# VARIATIONS IN RETAIL SALES BETWEEN CITIES FOR FURNITURE, HOME FURNISHINGS AND EQUIPMENT

by

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# CHAPTER I

# SCOPE OF THE STUDY

## Introduction

In the early nineteenth century, J. B. Say presented the idea that a product creates its own demand. With Say's idea in mind, business executives proceeded to orient their planning toward increasing production output; however, when supply drew closer to demand and inter- and intra- industry competition increased, these executives found themselves searching for new approaches to realize growth opportunities. The conviction of one author is that "it is all too easy in this day and age for a company or industry to let its sense of purpose become dominated by the economics of full production and to develop a dangerously lopsided product orientation."[1] In order to find other growth opportunities, many business executives today have found it necessary to scrutinize the business' external environment.

One investigative area concerning opportunity analysis is the market. A market can be defined as

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[1]Theodore Levitt, "Marketing Myopia," The Environment of Marketing Behavior, 2d ed., Robert J. Holloway and Robert S. Hancock (New York: John Wiley and Sons, Inc., 1964), p. 220.

"comprising all customer systems that purchase or may be induced to purchase an offering."[2] Market opportunity recognition begins with the segmentation, a product's aggregate market composition into homogeneous groupings based on buyer characteristics. Once the product market has been segmented, the homogeneous customer groupings can be measured for demand opportunity. The process of measuring demand opportunity is known as market measurement. Market measurement techniques include market potential analysis, market share analysis, market forecasts and company forecasts.

Market measurement is a distinct area of study in the field of marketing. The importance of such market measurement as a separate area of analysis is revealed by a study conducted under the direction of the American Marketing Association.[3] The survey showed that at least sixty percent of the 1660 respondent companies conducted studies on estimating market potentials, analyzing market shares, and projecting short-range forecasts. An analysis of territorial

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[2]Harry A. Lipson and John R. Darling, Introduction to Marketing: An Administrative Approach (New York: John Wiley and Sons, Inc., 1971), p. 160.

[3]Dik Warren Twedt (ed.), A Survey of Marketing Research (Chicago: American Marketing Association, 1963), pp. 41-44.

sales opportunities was the most important activity mentioned. The same study showed that the fifth ranked activity was measuring territorial variations in sales, market share, and sales effectiveness.

While this study will deal with market measurement, the proposed investigation will focus exclusively on the market measurement of retail sales.

## Problem Background

Marketing as well as non-marketing writers have been interested in analyzing retail sales for at least forty years for the purpose of determining trading areas and projecting sales for these trading areas. W. J. Reilly, Vera Russell, and Robert Ferber represent three authors who have analyzed the relationship between retail sales and independent variables that supposedly influence retail sales. In 1927, W. J. Reilly developed the "Law of Retail Gravitation" for explaining variations in retail sales between two cities.[4] Reilly concluded that variations in retail sales between two cities are explained by the variables, population and distance.

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[4]W. J. Reilly, The Law of Retail Gravitation, Bureau of Business Research, University of Texas (Austin: Bureau of Business Research, 1931).

Vera Russell, concerned with the value of income statistics as related to per capita retail sales, conducted a study to determine if there was an association between median income per family and retail sales per capita.[5] Seventy-eight communities with a population range of 25,000 to 49,999 were used. The conclusion reached from the study was that there was a virtual absence of correlation between retail sales per capita and median income per family. The results were interpreted to indicate that, in a community where individuals from outside the community cause retail per capita sales to be higher, a closed system is not approximated. The fact that a community does not approximate a closed system means that the retail per capita sales for that community do not vary with the average income of the local residents. A community was considered a closed system if its inhabitants do all their retail purchasing at the local stores, and the stores in turn serve only the market within the corporate bounds of the city or village.

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[5]Vera K. Russell, "The Relationship Between Income and Retail Sales in Local Areas," The Journal of Marketing, XXI (January, 1957), pp. 329-332.

Robert Ferber conducted a study of fifty-one Illinois cities with populations of 10,000 to 4,000,000.[6] The objective of this study was to determine which variables explained variations in retail sales between the fifty-one cities. Hypotheses were advanced regarding variables that were thought to influence variations in retail sales. Seven variables were finally selected because of their supposed influence on retail sales. The hypotheses were advanced without consideration of whether the variables related to either the demand or supply function as conceived in the field of economics. A multivariate regression equation was used with all variables being expressed in terms of logarithms. The analysis was carried out on two levels: (1) variables affecting variations in total retail sales between cities, and (2) variables influencing the variation in per capita retail sales between cities.

A number of regression equations were developed using the variables selected. The conclusion reached was that variations in total retail sales were accounted for by the variables, population and distance. Population was the most dominant of the two variables. Variations in per capita retail sales were accounted for

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[6]Robert Ferber, "Variations in Retail Sales Between Cities," The Journal of Marketing, XXII (January, 1958), pp. 295-303.

by per capita income, retail stores per 10,000 residents, and distance. Finally, the regression equation that had the highest coefficient of determination for the total sales and for the per capita sales was used to explain the variation in retail sales for particular types of products.

Although the studies of Reilly, Russell, and Ferber differ in the conclusions reached concerning which variables best explain variations in retail sales, the studies share a common research objective. The objective was to find variable(s) which best account for variations in retail sales between communities. Ferber and some students of Reilly have proceeded to use these developed equations to explain variations in particular types of retail sales. In conjunction with this last approach, Ferber states that "forces influencing intercity variations in per capita sales differ by type of sale, and a more or less individualistic approach is needed in each case."[7] Thus, it appears that these studies offer limited assistance to a market analyst interested in explaining variations between retail sales for different communities in regard to different types of consumer goods or services.

Since an individualistic approach is needed to explain retail sales variations between communities for

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[7] Ibid., p. 301.

different types of consumer goods, it becomes necessary that variables selected to account for retail sales be variables that are associated with the product under investigation. Variables used by Reilly and Ferber were selected based upon hypotheses regarding variations in total retail sales rather than particular types of retail sales such as clothing, food, and furniture. In measuring retail sales variations for a product, the market analyst needs to advance hypotheses concerning the size and characteristics of the target market, where size is indicated by population. This procedure is consistent with that advocated by most marketing authors as exemplified by the statement "once customer market segments have been identified, the market analyst is in a position to measure existing and potential demand for a particular offering and to forecast sales for the various market segments."[8]

Market analysts interested in market measurement will find that the studies of Reilly, Russell, and Ferber are useful but insufficient. For decision making purposes it is often necessary to go beyond just explaining variations in total sales. Managers are

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[8]Lipson and Darling, op. cit., p. 173.

often concerned with questions like: Who and where are likely buyers? Which market areas are most fertile for the product? How much can be sold in the coming period?[9]

## Purpose of the Study

Market forecasting is a difficult task. Unfortunately, this difficulty cannot be entirely removed by hard work and intelligence. Whether the market analyst is considering a market forecast for a product category or an individual product, he must deal with phenomena which have, or appear to have, a random nature about them. It is this very problem, however, that creates the necessity for scientific techniques. Market analysts cannot afford to substitute hunches and intuition for scientific analysis. One study showed that if sales are ten percent short of projections, profit could lag up to forty percent behind expectations.[10] It is hoped that this investigation will assist market analysts in conducting further research in the area of market or company forecasting.

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[9]David J. Luck, Hugh G. Wales, and Donald A. Taylor, Marketing Research (3d ed.; Englewood Cliffs: Prentice-Hall, Inc., 1970), p. 408.

[10]"Chains Sharpen Sales Estimates," Chain Store Age, XVI (October, 1968), p. 14.

The basic purpose of this study is to determine whether by empirical investigation a model can be developed for predicting the total rounded dollar retail sales for furniture, home furnishings and equipment for individual market areas.[11]

Specifically, this study is designed to answer the following questions:

1. How can independent variables which comprise the expected composition of the size and characteristics of the target market be identified using Census Data?

2. If a large number, say six or more, independent variables are identified, can these independent variables be reduced to a factor(s) which will account for the association among these independent variables?

3. Can an estimating model be designed based upon the independent variables and/or factor(s) obtained in questions one and two which will assist one in estimating the total dollar retail sales for furniture, home furnishings, and equipment for individual market areas?

The scope of this study is more specific than those conducted by Reilly, Russell and Ferber. First, this study will focus on variations in a type of retail sales

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[11]This classification involves establishments primarily selling merchandise used in furnishing the home, such as furniture, floor coverings, draperies, glass and chinaware, domestic stoves, refrigerators, and other household electrical and gas appliances, including radio and TV sets.

Source: U.S. Bureau of Census, County and City Data Book: 1967 (Washington, D.C.: Government Printing Office, 1967), p. App. -7.

instead of all retail sales. Secondly, the size and characteristics of the target market will serve as the basis for the selection of independent variables. Ferber's study was designed to study all city variations rather than variations in types of retail sales. As a result, variables were selected regardless of whether they were demand or supply variables. Finally, instead of just attempting to explain variations in sales, this investigation will attempt to predict retail sales, by type, for individual market sales areas; thus, allowing one to measure the fertility of different market areas.

The statistical approach followed in this study is more comprehensive than that used by Russell and Ferber. First, independent variables are selected based not only upon previous research, but each independent variable selected is correlated with the dependent variable, retail sales. Those independent variables which are not statistically significant are eliminated from future consideration. Russell's investigation ended statistically with the calculations of the simple correlations. Ferber proceeded to develop regression equations based upon the original variables.[12] The remaining independent variables, if six or more, are reduced to a common

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[12]Ferber, op. cit., pp. 329-332.

factor(s) that account for the association among the independent variables. These factors are then redefined and used as independent variables in a multiple regression equation. Partial coefficients, rather than beta coefficients, are used to develop the regression coefficients. Using partial coefficients allows for disentangling the separate effects of each independent variable. This procedure provides for determining the precise influence of any independent variable.

The analysis will be carried out on three bases. First, the values of the independent variables as obtained from Census Data will be tested against total rounded retail sales for furniture, home furnishings, and equipment. Census Data are reported by the number of individuals or units within classes of each variable. Secondly, each independent variable will be divided by population, giving a per capita independent variable. This was done because of the suspected overwhelming influence population exerts over the other variables. The values of these per capita independent variables will then be tested against total rounded retail sales for furniture, home furnishings, and equipment. Finally, the per capita independent variables will be tested against per capita retail sales for furniture, home furnishings, and equipment. Finally, the per capita

independent variables will be tested against per capita retail sales for furniture, home furnishings, and equipment.

There are other subjects of importance that could be analyzed in the area of market measurement, including the following:

1. a market share analysis involving the ratio of a company's sales to the total industry sales;

2. a company sales forecast involving an estimate of company sales for a specified future period under a proposed marketing program.

As interesting and important as these subjects are, they are beyond the defined scope of the research plan of this study.

## Hypotheses

The model that will be developed will be based upon a methodology which involves testing five hypotheses. The first two hypotheses are concerned with the selection of variables that will account for retail sales. The last three hypotheses are concerned with the predictive part of the model.

The first hypothesis of this study is: Simple correlation can be used to substantiate which original independent variables are associated with retail sales for furniture, home furnishings, and equipment. This hypothesis will be accepted if the simple correlation

coefficients are significant at the .01 level.

The second hypothesis is: Factor analysis can be used to explain the underlying forces of the independent variables which were proved significant when associated with retail sales. This hypothesis will be accepted if, (1) the independent variables selected have association, (2) the centroid factor loading account for most of the variance within the intercorrelations, and (3) the factor(s) obtained can be defined as specific independent variables.

The third hypothesis is: Partial correlation can be used to determine the association of the dependent variable (sales) as acted upon by an independent variable while the other independent variables are held constant.

The fourth hypothesis of this study is: Multiple correlation can be used to determine the total association between the dependent variable (sales) and the independent variables. This hypothesis will be accepted if the multiple correlation is significant at the .10 level.

The final hypothesis is: Product moment correlation coefficient can be used to substantiate the association between actual and predicted total rounded retail sales. This hypothesis will be accepted if the product moment

correlation coefficients are significant at the .01 level.

## Limitations of the Study

There are several limitations associated with the proposed methodology and data used. Some of the general limitations are enumerated in the following paragraphs. The others are given in Chapters IV and V.

One limitation is that the independent variables used must be measurable, for they are the predictors. If total rounded retail sales are to be predicted, it is necessary that these independent variables be subject to statistical testing.

A second limitation is that the data used for developing and projecting total rounded sales for furniture, home furnishings, and equipment were gathered from two basic geographical regions in the United States. These two regions are the East South Central and West South Central as defined by the Bureau of Census. The limitation is that the independent variables used as predictors may not be universal for projecting total rounded retail sales for furniture, home furnishings, and equipment for all individual market areas in the United States because the purchasing habits for different regions may be different. This limitation may be reduced

by redefining the statistical universe to include those geographical areas not considered.

A third limitation concerns the product category selected for investigation. Since the predictive model is based upon demand variables only, it is assumed that marketing effort has a minimum effect on shifting market demand. Changes in the magnitude and effectiveness of the marketing effort act primarily to change individual company's market shares.

Another limitation pertains to the assumption of stability. That is, simple relationships of the past are assumed to hold in the future. Accordingly, Paul Green states that

> any attempt to forecast the future assumes that past information is relevant and that the phenomenon under study possesses some regularity over space and time. Otherwise, the forecaster's task might be likened to the problem of attempting to guess the next number in a sequence of random digits; in this case knowledge of the entire past sequences provides no help in guessing the next number.
>
> By "stability," however, is not meant that the phenomenon is necessarily constant through time and space, but only that the rules (or super rules) for making the appropriate transformation are stable . . . . We are assuming, however, that the functional form is stable, i.e., that the trend equation does not suddenly change from a linear form to, say, a quadratic form.[13]

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[13]Paul E. Green and Donald S. Tull, Research for Marketing Decisions (Englewood Cliffs: Prentice-Hall, Inc., 1966), pp. 442-443.

Thus according to Green, it is possible to find a regular pattern of relationships between two or more sets of data over a period of time.

An additional discussion of this point can be found in Chapter II.

# CHAPTER II

# A REVIEW OF MARKET POTENTIAL

## Introduction

The primary objective of this study is to develop a model for estimating total rounded retail sales for furniture, home furnishings, and equipment. Predicting total sales for all retailers embraces the idea of market opportunity. The conceptual and traditional basis for explaining and measuring market opportunity has been the concept of "market potential." Market potential has been defined, measured, and used for at least the past four decades. D. R. G. Cowan's book provides an indication of the work accomplished by 1938.[14] Hummel's book gives evidence of the continuing concern up to 1961.[15]

This chapter is designed to review some of the literature on market potential. The review will explain the role market potential has played in developing the market measurements. First, the market potential concept will be examined. Secondly, existing methods used to

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[14]Donald R. G. Cowan, Sales Analysis from the Management Standpoint (Chicago: University of Chicago Press, 1938).

[15]Francis E. Hummel, Market and Sales Potential (New York: The Ronald Press Company, 1961).

determine market potential will be reviewed. Thirdly, several studies concerning the accuracy and use of several market potential measurement methods will be reviewed. Finally, market potential as a tool in marketing planning will be reviewed.

## The Market Potential Concept

Market potential as a concept has had a limited and repetitive exposure in marketing literature. The concept is not a simple one and a meaningful comprehension of it is difficult to formulate for investigative purposes. This section describes the various meanings associated with market potential, the formal definitions advocated for market potential, and a distinction between conceptual and actual market potential.

### Market Potential Meanings

The concept of market potential has been used to imply projections of gross national product for the economy, projections of industry opportunities, and projections of company opportunities. Donald R. G. Cowan summarizes this situation:

> First, market potentials may refer in a general way to the market provided by the whole economy as measured by total national income or total national expenditure. Gross National Product is often used for this purpose. Estimates of Gross National Product for various periods in the future relate to the nation's future market potential.

Second, market potentials may be regarded as one of numerous sectors of the economy such as consumer soft goods, consumer durable goods, capital equipment, or construction. These segments do not rise or decline either in unison or at the same rate, and in a broad sense are competing with each other.

Third, market potentials may mean a single industry's participation in, or share of, a major segment of the economy; such as the food industry's share of consumer's soft goods, or the refrigerator industry's share of consumer durable goods. Here again, there is competition between industries. The increased use of automobiles is said to have affected the character of the demand for clothing and housing . . .

Fourth, market potentials may refer to the size of the market for a particular product's classification, such as high-priced, medium-priced, and low-priced cars.

Fifth, market potentials may pertain to the sales volume and possibilities of a particular company.

Sixth, it very frequently applies to the individual products of a company.

Seventh, market potentials may be one of the previous concepts narrowed down to individual areas, such as regions, states, countries, cities, or other geographic areas . . .

Eighth, the concept of a market potential may apply to the amount of sales which might be made to particular customers . . .

Ninth, any market potential applies, either expressed or implied, to a period of time . . .[16]

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[16]Donald R. G. Cowan, "Market Potentials and Marketing Management," Market Potentials and Use of Census Data, ed. J. C. Halterman and T. W. Meloan (Chicago: American Marketing Association, 1958), pp. 1-3.

Market Potential Definitions

Just as there were several interpretations of market potential, there are various definitions which have been advocated for market potential. Definitions of market potential range from the sales opportunity of all sellers to the sales opportunity of an individual company. Several of these definitions and explanations of them are as follows:

1. A calculation of maximum possible sales opportunities for all sellers of a good or service during a stated period.[17] Ordinarily a company will determine the market potential for its product in a predetermined market and then from this figure determine its market share or sales potential.[18] Market share (or sales Potential) is the ratio of a company's sales to the total industry sales on either an actual or potential basis. The term market share is often used to designate the part of total industry sales a company hopes or expects to get. Since this concept usually has in it a considerable element of "blue sky," its usage is not encouraged.[19]

2. Potential is the market demand for a product in a given territory under given conditions of the controllable and uncontrollable

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[17]Committee on Definitions, Marketing Definitions (Chicago: American Marketing Association, 1970), p. 15.

[18]William J. Stanton, Fundamentals of Marketing (2d ed.; New York: McGraw-Hill Book Company, 1967), p. 648.

[19]Committee of Definitions, op. cit., p. 15.

determinants of demand.[20] Market potential is a relative measurement instead of an absolute measure of demand. It tells us that whatever the absolute volume of sales, about 5.0 per cent of this amount will occur in Illinois. Thus, market potential measures demand in one geographical area relative to another.[21]

3. It is the interrelated growth rate and factors that may accelerate or retard market growth. The potential for many products depends upon the number of automobiles on the road or the number of owner-occupied homes . . . Expressed graphically, potential is not a point on a line but a family of curves representing the way that buyers may be expected to behave under various combinations of price and promotion, at various stages of the innovation process in the case of a new product.[22] This definition may discourage its own use. However, in a general sense market or sales potential can be interpreted as meaning <u>total</u> opportunity--that "world" or "universe" that represents the total number of possible sales, customers, and so on. It is from this world that sales must be drawn.[23]

   The viewing of opportunity (the world or universe) must be restricted to the environmental phases of the decision making process, perhaps resulting in a consideration of two, three, or more marketing alternatives possibly derived from knowledge of this total opportunity. When the marketer obtains information

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[20] John A. Howard, <u>Marketing Management Analysis and Planning</u> (Rev. ed.; Homewood: Richard D. Irwin, Inc., 1963), p. 445.

[21] <u>Ibid</u>., p. 214.

[22] Wroe Alderson, "The Challenge of Marketing," <u>Cost and Profit Outlook</u> (Philadelphia: Alderson and Sessions, 1957), p. 5.

[23] William F. O'Dell, <u>The Marketing Decision</u> (New York: American Management Association, Inc., 1968), p. 222.

> which gives him a market potential of, for example, 20 million consumers, he then says to management: "Here is a large market which the company, may wish to consider entering." Or, if there are 2 million housing starts during a specified period of time, the marketing department of a particular building material manufacturer can construe their figure as a market potential for its product. However, these 2 million new homes that represent a potential do not in any sense assure the manufacturer of success if he decides to change his marketing strategy or to make any other marketing decisions relating to housing starts. What the housing starts information tells the manufacturer is that approximately X million windows, Y million bathrooms, and Z million kitchens will be installed. Nothing in this information tells the manufacturer what to do. It simply aids in posing various marketing alternatives.[24]

## Conceptual Versus Actual Market Potential

For investigative purposes, it is insufficient to make a distinction between whether market potential refers to the sales opportunity of all sellers or the sales potential of an individual company. Also needed is an interpretation of sales opportunity. Sales opportunity may refer to conceptual opportunity (undeveloped potential) or actual opportunity (developed potential). Richard M. Hill makes such a distinction when market potential refers to the capacity of the market to absorb products. First, his interpretation for conceptual opportunity will be presented and then his interpretation for actual opportunity will be presented.

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[24] Ibid., p. 222.

> One interpretation regards capacity to buy as being measured by the total amount of a commodity which could be used and purchased in a given market. Used in this sense, market opportunity represents a tangible possibility, a yardstick with which actual performance can be measured and appraised. In this sense, market opportunity represents a possibility, a norm measuring the level of demand if every consuming unit which could use the product were to purchase one.[25]

> Market opportunity may also be thought of as the total amount of a product which all suppliers might reasonably be expected to sell during a given period of time. Used in this sense, market opportunity represents a practical expectation of the sales performance by an industry. When referring to market opportunity as a practical and reasonable expectation, the term "industry sales" is used . . . It should be recognized that estimating market potential is a matter of predicting how the market should respond to a given product over a given period of time . . . Complete accuracy can neither be expected nor realized. Nevertheless, the need for such measurement is inherent in the management of the marketing activity.

> While there may be no way of constructing a measure of ultimate or possible demand with assumed accuracy, it is possible to remove the process from the realm of guesswork and intuition.[26]

Lyndon O. Brown mentions:

> While this is a purely conceptual notion, it is not used in its broadest literal sense. The ultimate total capacity of a market to absorb any given commodity, would be too far from any reasonable notion to be useful. The very poorest market might conceivably absorb unparalleled

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[25] Richard M. Hill, Techniques of Measuring Market Potential for Wholesalers, Bureau of Business Management, University of Illinois (Urbana: University of Illinois Press, 1962), p. 3.

[26] Ibid., p. 4.

> quantities of chewing gum. But an analysis which would entirely disregard habits and the general competition between various types of products would be of no practical significance . . . Thus the term "market potential" . . . must measure the power of markets to absorb commodities in the light of its customs and buying habits which affect its expression of that power . . . The problem with the conceptual definition is that it is beyond the power of measurement. Thus, it is necessary to consider the market customs and buying habits.[27]

The term "market potential" has many interpretations and definitions. Practical analysis requires that a distinction be made between undeveloped and developed potential with developed potential having the more practical application for investigative purposes. That is, market potential must measure the amount of sales that may be reasonably expected in light of customer buying habits. Customer buying habits can be explained by analyzing different market variables. Thus, developed potential "deals only with the basic characteristics of the market which measure its power to absorb a commodity."[28] Market potential analysis assumes that business conditions and competitive conditions are "normal."[29]

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[27] Lyndon O. Brown, Marketing Research and Analysis, (New York: The Ronald Press Company, 1937), p. 31.

[28] Ibid., p. 413.

[29] Ibid.

## Methods Used to Determine Market Potential

Numerous methods have been developed to estimate market potential. The designs range from largely non-quantitative to highly quantitative. Although many methods exist to estimate market potential, a large number of these methods have not been published. The methods selected for this review are those most frequently published in marketing literature. These include the consumer surveys, the direct data method, the corollary data method, the arbitrary factor method, the multiple correlation method, and the test market method. Each method will be reviewed in reference to its meaning, procedure for estimating market potential, and advocated advantages and disadvantages associated with its use.

### Consumer Surveys

Consumer surveys are surveys designed to project market potentials on the basis of consumer intentions or consumer current consumption rates. Market potentials are determined by taking a sample of customers and using the sample to project the entire market potential of the product. Consumer survey methods include the do-it-yourself survey, buyer intention survey, warranty card survey, and expenditure survey.

The do-it-yourself survey involves sampling consumers regarding their appraisal of the product, their attitude

toward competitor's product, and their future buying intentions for the product assuming it was to appear on the market.[30] The procedure involves taking a sample of possible customers, constructing a questionnaire, informing consumers about the product, and interpreting the results of the sample.[31] The sample results are projected to infer the universal potential by one of two methods:

> One of the most common is a sample projection to the entire universe on the basis of proportional analysis between the sample and the total universe. This may include a detailed subclassification of sample and market, and projection on the basis of market subclasses.
>
> Another common method is projection from sample to universe on the basis of similar existing products for which data are available and where there is substantial evidence of a similarity in market structure between the existing product and the new product.[32]

This method has been advocated because it is useful for both new and existing products that lack past sales histories and to products not adaptable to experimental market research. The problems mentioned for using this method are encountered in the process of collecting data and making projections. These problems are:

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[30] Hummel, op. cit., p. 209.

[31] Ibid.

[32] Ibid., p. 210.

1. Regarding data collection, accurate consumer reactions regarding new products suffer from a number of limitations, including bias injection into the survey and consumer attitudes may not accurately reflect their purchasing patterns.

2. Regarding data projections, the limitations are: the difficulty of interpreting which returns represent those that actually would purchase the product; the projection from the sample to the universe under assumptions of price, product availability, promotional success, competitor's reactions, etc.; and the time lag between the survey and product introduction, during which a basic market change may have occurred.[33]

Buying intention surveys are consumer surveys designed to measure future product market potentials based upon present consumer intentions. Potentials are developed on the basis of what consumers say they expect to buy during the forthcoming year or period. The procedure is identical to that stated for the do-it-yourself survey. These surveys are made annually by both private and public organizations, such as the University of Michigan Survey Research Center.

Buyer intention surveys have:

> indicated the general direction of future consumer spending but not always the specific quantitative amounts of change that would take place in consumer spending . . . Most of the published consumer buying intention surveys cover only household appliances and specialty goods. Such surveys are limited to those types of goods because respondents have difficulty estimating their purchases for many products purchased on

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[33] Ibid.

impulse, products of small dollar value, products that are of little emotional significance.[34]

The problems encountered through the use of this method are:

1. The major problem connected with an analysis of a consumer buying intention survey is . . . that the analyst does not know the full circumstances behind the respondent's answer . . . unexpressed contingencies regarding the future that color the consumer's reply.[35]

2. In addition, one must consider the time element--the longer the length of time between the survey data and the date of expected purchase, the greater the probability no action will be taken by the consumer.

3. Although buying intention surveys offer predictive value for some products, they can only be used with extreme care in estimating quantitatively market potentials for the future.[36]

Do-it-yourself surveys and buyer intention surveys are primarily distinguished from each other according to who initiates the survey. The do-it-yourself survey is conducted by the individual seller whereas, the buyer intention survey is conducted by a private or public organization independent of the seller. Both methods involve measuring anticipated consumer purchases by means of a sample group and projecting the sample results to obtain universe potentials for a product. The major limitations associated with both methods is that they

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[34] Ibid., p. 211. [35] Ibid. [36] Ibid., p. 212.

suffer from concurrent and predictive inaccuracies. Concurrent inaccuracy results from consumers replying contrary to their purchasing intentions when initially interviewed. Predictive inaccuracy results from consumers purchasing or not purchasing products which to the best of their knowledge they said they would when originally interviewed.

Warranty cards represent a third type of consumer survey. Warranty cards are cards provided to consumers to fill in and return to the manufacturer as evidence of purchase and eligibility for a product guarantee. The procedure involves delineating market characteristics (age, income, occupation, etc.) associated with sales. The market characteristics are then used to estimate the distribution of customers in the total universe (market). Also, these characteristics can be used in conjuntion with some market index to estimate market potential.

For estimating market potential:

> Warranty cards are limited in that they do not provide information regarding the total market size for the product or information on future buying intentions. They present merely a measure of past performance, and their use is based on the assumption that past relationships will hold under future market conditions.[37]

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[37] Ibid.

A fourth consumer survey is the expenditure survey. Expenditure surveys are also referred to as budget record surveys. Expenditure surveys consist of gathering records of consumer expenditures for various products or brands. These expenditure records are usually gathered by one of two methods:

> 1. The first is based on survey inquiries among groups of consumers who report their annual or monthly consumption of commodities. The groups usually represent members of a continuous panel.
>
> 2. The second method is based on an effort to use more scientific controls in gathering data. One plan calls for placing samples of the commodity in homes, checking on how long they have lasted, and calculating standard consumption rates from these data . . . Another plan uses the survey method, but shortens the period and removes generalizations from consumer data. Instead of asking the consumer to estimate his or her rate of consumption, data are obtained on (1) date he began using the last purchase, (2) amount of last purchase, and (3) amount remaining in the home.[38]

Regardless of the method used, a consumption rate is obtained. This consumption rate is then projected to estimate the potential for a market or segments of a market. The projection usually involves multiplying the family consumption rate times the number of families in the market territory being analyzed.

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[38]Brown, op. cit., p. 443.

The merits listed for using the expenditure survey are:

1. It obtains records on a variety of expenditures over a relatively long period of time.
2. It studies expenditures of one or a very few commodities.[39]
3. Data are gathered in a relatively short period of time.
4. It offers the advantage of working with facts regarding actual consumption.[40]

Limitations mentioned as militating against its actual use are:

1. Data received is not as specific as needed. Instead of gathering information on expenditures for food, clothing, the market analyst would require information on beef, coffee, overcoats, men's shoes, and collar buttons.
2. The need for more specific data would magnify the errors in reporting, even if it were possible to obtain cooperation of consumers.
3. The cost of securing such data, unless a by-product of some governmental survey, would be prohibitive.[41]

Consumer survey methods include the do-it-yourself survey, buyer intention survey, warranty card survey, and expenditure survey. Each method represents an approach to infer market potential by using a sample. The sample

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[39] Ibid., p. 442.

[40] Hummel, op. cit., p. 213.

[41] Brown, op. cit., p. 442.

represents a selected group of customers with market characteristics which hopefully are similar to those representing the total market for the product. The major advantage of consumer surveys is that they attempt to use current consumer intentions and facts to estimate market potentials. This advantage may also be the major disadvantage of their use. Intended or actual current rates of consumption are destined to change. Also, consumer surveys are costly and time consuming.

Direct Data Method

The direct data method uses actual sales figures of a product in each market area as a direct index of potential sales; that is, it relies upon past sales statistics for a commodity. If the sales for the whole industry are used, the market analyst must take his competitor's experience into consideration so that he is not misguided by the strengths and weaknesses peculiar to his own marketing program.[42] The industry sales become the index of potential business.

Sales potentials are determined as follows:

1. Obtain the most recent company sales figures available for the product market being measured.

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[42]David J. Luck, Hugh G. Wales, and Donald A. Taylor, Marketing Research (3d ed.; Englewood Cliffs: Prentice-Hall, Inc., 1970), p. 434.

2. Separate the company sales figures into units which correspond to the market territories which are to be analyzed.

3. Obtain and separate industrial sales according to the market areas previously selected.

4. Express the company sales as a percentage of the industry sales for each market territory.

5. Apply the percentages for each market territory to industry sales. The values obtained represent the company's sales potential for each territory of the total market.

The direct sales data employed to obtain total industry sales may be obtained from several sources:

1. Total industry sales data may be obtained as a by-product of some licensing or tax system, such as automobile licensing or gasoline taxes.

2. A second form of direct sales data is that in which the data are gathered by trade associations for the benefits of members, such as National Electrical Manufacturer's Association.

3. A third type of direct data are those provided by service organizations which maintain laboratory stores or dealer contacts for the purpose of reporting the flow of merchandise into various sections of the market, such as A. C. Neilsen Company.

4. A fourth source of direct data is government publications: Government sources present sales by commodity groupings, not by individual items,[43] such as the Standard Industrial Classification.

Advantages mentioned for using the direct data method are:

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[43]Brown, op. cit., p. 423.

1. Principle advantage of using total industry sales to measure market potential is that actual results (sales) are being used.

2. The method is straight forward and does not require as much clerical work as do some of the other methods.[44]

3. It requires relatively little statistical analysis.

4. Usually the factors selected are those for which detailed, reliable data are available.[45]

Limitations mentioned preventing this method from being used more often are:

1. The most important limitation of this method is that "past" sales are used to indicate market potentials; that is, no attention is given to the potentials except as revealed through past experience . . . Changes in these activities, as well as changes in price and product, may shift demand and redistribute total sales.

2. There are very few commodities on which total sales data are available. Even when data are available, they are usually furnished only at the state level, thereby precluding a break down by sales territories that do not follow state lines. Sometimes the data are ambiguous in that they cover several variations of the commodity.[46]

The direct data method is a method of projecting company sales potential by using actual sales. Actual

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[44]Harper W. Boyd and Ralph Westfall, Marketing Research: Text and Cases (rev. ed.; Homewood: Richard D. Irwin, Inc., 1964), p. 729.

[45]Brown, op. cit., p. 424.

[46]Boyd and Westfall, op. cit., p. 729.

company sales and total industry sales are segmented according to the company's market territories and each territory's potential is then determined. The principle advantage of this method is that actual sales figures are used. This advantage is also its fundamental limitation since the assumption is that past experience is the equivalent of present market potential.

Corollary Data Method

The corollary data method is a method used to estimate market potentials when sufficiently current or complete industry sales are not available. The corollary data method is an index method which is used to estimate the market area potential for a product or group of products. An index is developed by utilizing a complementary market factor(s) which is linked with the demand for the product under consideration. This method is based on the assumption that there is a causal relationship between the market factor(s) and the demand for the product; that is, two or more items parallel each other so closely that one item or a set of items gives the market potential for the other item. Therefore, if a corollary market factor(s) can be found, the market potential for a product can be developed. The success of the method depends upon selecting the market

factor(s) which will be used to represent the various market areas' purchasing ability.

> The selection of these factors, and the relative importance of each factor . . . varies with the type of consumer product and the demand for it. For example, the demand for most inexpensive convenience goods with wide appeal depends most on the number of consuming units, while at the other extreme the demand for luxury and specialty goods varies principally with the income status of the consumers. Thus, the market factors selected within the index should consider the differences in the type of consumer goods and the nature of the demand for them.[47]

Market factors may represent population, income, occupation, or even other commodities.

Corollary data methods include the single factor index and the multiple factor index. The single factor index is designed to measure the market potential of a number of market territories for a product. It is based on the assumption that a single market factor can be selected which reflects the relative buying power of the various market territories for the product being analyzed.

The procedure for calculating the single factor index is essentially the same as that used for the direct data method:

1. Select a single market factor which can be used to explain the relative buying power for the product market. A market factor may be population, income, or occupation.

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[47] Hummel, op. cit., p. 181.

2. Break down the product market into territories that correspond to the company's sales territories.

3. Collect the market factor values for each sales territory and sum these values.

4. Divide each sales territory market factor value by the total values of the market factor to obtain the relative percentage potential of each sales territory.

5. Multiply the percentage potential for each sales territory times the actual value of the market factor for that territory. The result represents the market potential for each sales territory and the sum of territory potentials represents the total market potential for the product under consideration.

Unlike the single factor index, the multiple factor index involves using more than one market factor. According to Boyd and Westfall, it involves:

> Combinations of several factors, occasionally as many as twenty . . . Many of these indexes are developed by particular companies or industries to measure market potentials for their products. Others are developed by independent organizations, frequently publishers, as indexes of market potential for consumer products in general.[48]

Multiple factor indexes suffer from subjective decisions:

> The individual preparing the index usually uses his judgment in selecting the factors combined. Whether his judgment is sound or not, cannot be proven. Furthermore, who is to say how many factors should be used, or, once the factors to use have been determined, how to combine them . . . Many such judgments are based on estimates of how close the indexes obtained

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[48] Boyd and Westfall, op. cit., p. 732.

> correspond to actual sales results. If this comparison is used to select an index, one can argue that sales themselves might as well be used as a direct index; that is, if sales are available for the purpose of consumption, they are available for use as a direct index . . . A multiple factor index, however, may correspond in general with the sales pattern, but may still show specific areas that do not correspond.[49]

Single factor and multiple factor indexes may be classified as specific or general indexes. A specific index is constructed to estimate the market potential for a particular product.[50] The potential for the product may be determined by the single factor or multiple factor index. A general index is designed to estimate the market potential for consumer goods in general.[51] Usually, this involves using a multiple factor index. Examples of the general index include: The Batten, Barton, Durstine and Osborn Index, the Crowell Index, the McCann Index, and Sales Management's Survey of Buying Power.

The two types of corollary methods are the single factor method and the multiple factor method. These two methods may be classified as specific indexes or general indexes depending upon whether the analyst is trying to estimate the market potential for a product or all consumer goods.

Advantages mentioned in connection with using the corollary method include:

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[49] Ibid., p. 733. [50] Ibid., p. 732. [51] Ibid., p. 733.

1. Theoretically valid. Theoretically, a general measure of purchasing power may be used as a basis for quantitative market analysis to measure consumption by the various areas, assuming the index contains the factors that make a market for the consumer product in question. It thus provides a measure of the area's relative market strength.

2. Understandable. The market index method is easy to understand, providing confidence in the method for the sales force.

3. Census data. The method utilizes published statistical data by areas. It is not done by guesswork. If the census data are accurate, the method should provide a reliable statistical portrayal of the various market's ability to purchase the product in question.

4. Averaging. The method is an averaging method with minor errors cancelling themselves out.[52]

5. Simplicity to use. The indexes are prepared and readily available.[53]

The fundamental limitations associated with using the corollary method are:

1. Failure to account for differences for individual commodities.

2. In most cases it is based on the assumption that the important element in quantitative analysis is general buying power. Such an assumption fails to recognize other elements which may be more important than buying power itself, chiefly, buying habits.[54]

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[52] Hummel, op. cit., p. 190.

[53] Brown, op. cit., p. 428.

[54] Brown, op. cit., p. 429.

3. It is hard to establish the relationship between the index series and the product at hand. To be sure the two have a relationship, it is necessary to compare the two series over a period of time. But, if total industry sales are available for this comparison, it would be wise to use the direct data method.

4. The obvious weakness of this approach is that the net result is to tend to establish sales potential for various markets in the same relative amounts that company sales have existed in the past--not in proportion to actual potential.

5. Judgment is used in selecting factors to be combined.[55]

Arbitrary Factor Method

There are a number of ways in which the index factors can be selected and weighted. One method by which the factors can be selected is the arbitrary factor method. This method attempts to account for factors uniquely affecting the demand for particular products which is a prime weakness of the corollary method.[56] Thus, the arbitrary factor method is designed to establish a tailor-made index for a particular product.

The index is determined as follows:

1. Isolate the important factors affecting the product's demand . . . These factors may be selected through the experience and good

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[55]Boyd and Westfall, op. cit., p. 731.

[56]Luck, Wales, and Taylor, op. cit., p. 439.

sense of marketers who have a realistic knowledge of the demand conditions for the product.[57] These factors might be population, retail sales or effective buying income.

2. Obtain the numerical values of these factors for the market area under consideration. Convert these values to percentages by dividing them by the national figures or total United States figures, thereby, obtaining a common denominator for all factors.

3. Assign a weight to each factor. If some factors are more important than others, they are given weights based on estimated importance.

4. The percentage for each factor is then multiplied by the assigned weight providing a weighted percentage.

5. The weighted percentages are then added and divided by the sum of the weights. The result is a single index for estimating market potential.

Thus, the arbitrary factor method is an aid to the construction of market potential indexes. Its primary purpose is designed for the selection and weighting of market factors when a sales history of the product is lacking and insufficient.[58]

The arbitrary-factor method has the following advantages advocated for its use:

1. Its chief advantage is that the conditions peculiar to each individual product are taken into account. Each analysis is constructed specifically for the commodity for which the market is being measured.

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[57] Ibid. [58] Ibid., p. 440.

2. It is also easy and inexpensive to apply. The method is simply to understand; hence it has had wide acceptance by businessmen.[59]

Limitations mentioned in connection with using the arbitrary factor method are:

1. The fundamental weakness of this method lies in its arbitrary nature. What is called judgment is usually guesswork. There is no scientific basis for the selection and weighting of the factors; all this is left to human intuition.

2. The only excuse for its use is as a stop-gap method to be employed in the absence of a better one.[60]

## Multiple Correlation Method

The multiple correlation method is closely related to the arbitrary factor and index method. Instead of using judgment to select the market factor(s), the market analyst uses statistical techniques. The multiple correlation method is based on the theory that:

> if certain factors are truly related to the demand for the product, this has been evidenced in the past. Thus, the best combination of these factors is that which most closely correlates with past sales of the industry. The relationship that has held true in the past should hold true in the present; markets shown to be relatively high or low by this multiple index are presumed to offer those relative potentials to the manufacturer at the present.[61]

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[59] Brown, op. cit., p. 440.

[60] Ibid., p. 441.

[61] Luck, Wales, and Taylor, op. cit., p. 440.

The method is based upon correlation and regression analysis. The procedure for estimating market potentials is:

1. Select factors which are suspected of accounting for sales; that is, identify independent variables which are believed to be associated with sales.

2. Correlate each factor (independent variable) with sales. This provides a correlation coefficient for each factor-sales relationship. If the correlation coefficient has a negative sign, this means that there is an indirect relationship between the factor and sales. If the correlation coefficient has a negative sign, this means that there is an indirect relationship between the factor and sales. If the correlation coefficient has a positive sign, there is a direct relationship between the factor and sales.

3. After the coefficient of correlations have been determined, the analyst must determine which factors should be used to establish the regression equation. This is done by analyzing the correlation coefficient. Those factors having a high correlation coefficient are selected.

4. The regression equation is then developed based upon the factors selected. The regression coefficients are then used to weight the factors and project the market potential for the product.

Multiple correlation represents the furthest advancement in projecting market potential.[62]

Multiple correlation has the following advantages mentioned for its use:

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[62]Luck, Wales, and Taylor, op. cit., p. 441.

1. Its final result is a seemingly accurate estimating equation into which the executive may insert an estimate of the market factor and obtain an apparently precise estimate of the product's demand.[63]

2. It allows the marketer to incorporate into one procedure several market factors.

3. It permits certain estimates to be made concerning the factors' degree of reliability.[64]

4. It provides a scientific basis for estimating market potential.

Limitations stated for this method are:

1. It is so complicated that businessmen are unlikely to understand or have faith in it.

2. The correlation found may be spurious--a mere coincidence rather than an actual cause-and-effect relationship.

3. The method assumes that the pattern of sales success realized in the past by the industry ought to be that of the future.

4. The data needed may be unobtainable.[65]

The multiple correlation method attempts to project market potential through the use of correlation and regression analysis. Correlation and regression analysis assist the market analyst in determining which market factors account for sales and what the relative weight of each

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[63]William J. Stanton and Richard H. Buskirk, Management of the Sales Force (rev. ed.; Homewood: Richard D. Irwin, Inc.), p. 535.

[64]Ibid., p. 558.

[65]Luck, Wales, and Taylor, op. cit., p. 441.

factor is in accounting for sales. The major merit of the method is that it provides a scientific equation for estimating market potential. Its major disadvantage is that it can be used only for products possessing a history of past sales.

## Test Marketing

Test marketing is defined as a "method of evaluating consumer reactions to a product through the actual marketing of the product in selected test areas."[66] A prime reason for test marketing is predicting what the market's reactions would be if the product were placed on sale. The selected marketing areas represent a sample of the total universe or market. By using a test market the analyst can tell actually how many people buy the product as opposed to how many say they would buy the product if they were interviewed. The sample results are then used to project the company's sales potential over the entire market. Also, the use of test markets provides a basis for choosing future market areas of significant importance.

The fundamental advantages of test marketing are:

1. Management estimates and judgments do not play a key role.

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[66]William R. King, Quantitative Analysis for Marketing Management (New York: McGraw-Hill Book Co., 1967), p. 175.

2. It is probably the most accurate method available for estimating the sales potential for a product. The reason is that a test market actually requires the buyers to spend their money, and this is the "acid test" of any marketing situation.

3. It directly results in a sales potential for a product under consideration.[67]

Disadvantages stated in conjunction with using test marketing are:

1. It takes considerable time and money and effort before its results are known.

2. Many factors are involved in the careful control of the test market situation, and it is assumed that management has properly controlled the situations surrounding the test market. However, this is not an easy task.

3. Many products which require extensive investment in fixed assets before any output is developed cannot be evaluated by this method since most of the risks have been taken before the answers are known.

4. Test markets can be unfair to products that require time to gain market acceptance or that have a low rate of consumption.[68]

Summary

There are basically six methods commonly advocated for estimating the market potential for consumer goods. These are consumer surveys, the direct-data method, the corollary-data method, the arbitrary-factor method, the

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[67] Stanton and Buskirk, op. cit., p. 538.

[68] Ibid., p. 538.

multiple-correlation method, and the test-market method.

Consumer surveys are surveys designed to project market potential by using consumer buying intentions or consumer current rates of consumption. Survey methods include the do-it-yourself method, published buyer intention surveys, warranty cards, and the expenditure method.

The direct-data method uses actual sales figures of a product in each market area as a direct index of sales potential. Its use depends upon whether sales statistics for the product can be obtained. If sales figures cannot be obtained, the direct-data method cannot be used.

The corollary-data method can be used when sales figures are insufficient or not available to project market potential. It is an index method based on complementary market factor(s) which are linked with the demand for the product under consideration. Market potentials may be computed by either a single factor index or a multiple factor index.

The arbitrary-factor method is used to select and weight market factors. Its prime purpose is to establish a tailor-made index for a particular product.

Multiple correlation is another method of projecting market potential. Potentials are determined through the use of correlation and regression techniques. It represents the furthest advancement in projecting market potential.

Test marketing represents the final most commonly used method to estimate market potential for consumer goods. Test marketing involves actually placing the product on the market to measure consumer reactions. These reations are then projected to the entire market to estimate market potential for the product.

## Previous Investigations Concerning Market Potential

### Accuracy of Methods

Based on a review of the literature, it appears that market analysts have devoted much time and effort to explaining market potential. This time and effort has been spent developing many methods to calculate market potentials as well as analyzing these calculated market potential values under different testing circumstances. This section is designed to review some of the analysis conducted with respect to the previously mentioned methods for determining market potentials.

Lyndon O. Brown's article in 1937 presented various methods of quantitative market analysis.[69] The article emphasized how these methods could be applied to establish market potentials. Since these methods have already been discussed, no attempt will be made to review them. In the Fall of 1937, Lyndon O. Brown wrote another article extending his coverage of quantitative methods to include multiple correlation; however, the primary objective of this second article was to compare quantitative methods for accuracy in market analysis.[70] Four methods were tested and compared to each other for predictive accuracy. These were the multiple-correlation method, the arbitrary-factors method, the single-index method, and the corollary-data method. Several forms of the single-index method were used.

The fact that correlation has been used in statistical problems in the areas of agriculture, finance, medical biometry, engineering, and in quantitative market analysis led Professor Brown to conclude that multiple correlation "has passed the experimental stage and has

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[69]Lyndon O. Brown, "Quantitative Market Analysis Methods," Harvard Business Review, III (September, 1937), pp. 321-336.

[70]Lyndon O. Brown, "Quantitative Market Analysis--Multiple Correlation; Accuracy of the Methods," Harvard Business Review, III (Autumn, 1937), pp. 62-63.

clearly demonstrated its advantages over the other methods."[71] To justify this comment, Brown proceeded to measure the accuracy of the ten methods. Accordingly, Brown mentions that:

> In market analysis . . . it appears that we have been so anxious to develop new methods that they have been put into use without adequate testing. The few tests which have been made were usually spasmodic, restricted, and of doubtful scientific validity. Of course, considerable testing of a sort has been going on steadily. Firms adopt one method of quantitative analysis and, after using it for a time, judge whether it has been successful or unsuccessful. Unfortunately, there is usually no objective basis for such judgments. The acceptance or rejection of a particular method is customarily based upon theoretical considerations and the extent to which it seems to produce results which agree with the company's latter performance . . . This analysis, however, provides no objective external standard. Such checking has no scientific basis, and has led to no standards of judgment as to either the value of all methods or the superiority of individual methods.[72]

To obtain objective tests for the accuracy of the ten methods, Brown selected eleven products and collected sales data on them from forty-eight states. Two statistical methods were used to analyze the errors of each method: (1) the mean weighted errors and (2) the frequency distribution of the individual errors. Referring to the measurement of errors, Brown comments:

> While the mean weighted errors provide a good basis for general statistical appraisal, they are not alone sufficient to reveal the accuracy of the

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[71] Ibid., p. 62. [72] Ibid., p. 69.

methods . . . Since a sales potential is an estimate of the potential power of a market to buy a commodity, it should not exactly equal sales. A certain amount of difference between expressed and potential power . . . It is impossible to know just how much variation of potential from sales in individual markets represents a true difference of potential from sales . . . On the other hand, it is not reasonable to assume that the extreme variations frequently encountered can generally represent merely the true difference between actual and potential market power.[73]

The results of these tests indicated that:

> In general, the multiple-correlation method is clearly more accurate than other methods, that the arbitrary factors may be more accurate but very dangerous, there is little difference between the various forms of the single-index method, and that the corollary-data method is slightly less accurate than most of the different forms of single indexes used.[74]

Cowan also appears to favor multiple correlation. His reasons are:

> The trained statistician prefers to use the more technical methods of multiple correlation. By so doing he reduces the labor involved in testing, measures more exactly the importance of different influences (especially those of a minor nature), estimates the sales possibilities of the respective areas based on the best combinations of these influences, and judges accordingly the performance of the regional salesman or sales force.[75]

H. R. Wellman, in 1939, when establishing a method for the distribution of selling effort among geographical areas, comments on the use of multiple correlation as a

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[73] Ibid., p. 62. [74] Ibid., p. 70.

[75] Cowan, op. cit., p. 26.

method for determining sales potential. He points out that multiple correlation has two difficulties:

1. that conditions may have changed between the period for which past sales were collected and the period for which the market potential is desired; and

2 past sales may have been affected by factors the influence of which should be eliminated in the determination of the market potential.[76]

Accordingly, he mentions:

> With regard to the first difficulty . . . the market potential based upon these estimated sales would not apply to any period except the average period for which the figures apply. If it is desired to estimate sales for other periods of time . . . from the multiple regression it would be necessary to know the values of the independent variables proper to the particular period of time under consideration . . . Since the values of each of these variables cannot be precisely known until the end of such future period, it is suggested that by the time the independent variable values are known, the actual sales . . . for the same period could also be known.[77]

> With regard to the empirical description of the relation between variables . . . correlation analysis makes use only of past sales and the factors which have affected sales in the past . . . Factors which are likely to affect sales in the future can be taken into account in multiple regression equation only if they also affected past sales . . . If such a factor were used in the correlation analysis, the net regression coefficient applicable to the factor would be zero. In any estimate made by means of the multiple

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[76] H. R. Wellman, "The Distribution of Selling Effort Among Geographic Areas," Journal of Marketing, III (January, 1939), p. 228.

[77] Ibid.

> regression equation either for the past period or the future period, this factor could have no influence on the estimate since the value of the factor would be multiplied by zero.[78]
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> The second difficulty . . . is that actual sales may be affected by factors the influence of which should be eliminated in the determination of the market potential. Here multiple correlation may be of some assistance, provided we know what factors should be taken into account and what factors should be left out of account. By means of multiple correlation analysis we can in effect eliminate the influence of specified factors.[79]

In a critique on Wellman's comments, L. D. H. Weld replied:

> To answer the first part . . . that the correlation method has to be based on past sales, that the independent variables selected apply to the same period of time as past sales . . . is that fundamental market factors (independent variables) which measure the market for past sales do not change so rapidly but that they can be used with a high degree of accuracy for estimating future sales. When I say "do not change," I mean relatively in one part of the country as compared with another . . . It is obvious that these things change so slowly (some of them not at all) that we do not need to worry about getting future data to layout a geographical pattern for future sales. It is true that some such factors do change in one part of the country as compared with another as the years roll along, and that where such factors are used, it is necessary to rework the correlation process every two or three years using the most up-to-date data.[80]

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[78] Ibid., p. 229. [79] Ibid., p. 230.

[80] L. D. H. Weld, "The Value of the Multiple Correlation Method in Determining Sales Potentials," Journal of Marketing, III (March, 1939), p. 389.

> As for the assumption . . . that the relationship between the dependent variables which prevailed in the past will also hold during the future period . . . it simply never happens that we can include in the correlation analysis all the variables that affect sales . . . there are such important factors as competition, which does not appear in the correlation factor. Adjustments for business conditions can also be made more or less scientifically. It is never possible to find . . . all the market factors . . . either because of lack of data or the existence of unsuspected factors . . . But suppose we find three or four factors, all of which show simple correlations with industry sales . . . Then we can be sure that we have most of the important factors, and we get near enough to yield results of real practical value.[81]

Lyndon O. Brown's tests measuring the accuracy of selected methods of determining market potential indicate that multiple correlation is more accurate compared to the other measures used. The other methods include variations of the single index, corollary data method, and the arbitrary factor method. Several problems were raised about using the multiple correlation method. The difficulty from which the problems come is whether past sales can be used to estimate market potential.

Studies Involving Different Methods

Market potential estimates are as important today as they were in the 1930's. Market analysts continue to estimate market potentials for particular commodities as well as for classes of commodities. Some of the

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[81] Ibid., p. 390.

estimates are made exclusively for the products of private organizations. Other estimates of market potentials are made for product classes which are published in periodicals such as Sales Management's Survey of Buying Power. As important as market potential is, current marketing literature has few articles designed to explore the concept. The latest research has been designed to explain variations in sales either within communities or between communities. The methods receiving the most attention have been multiple correlation and variations of the expenditure survey. This section is designed to review studies that have been published to explain variations in sales quantitatively.

Comparisons of geographical areas are often accomplished through the use of demographic characteristics; that is, demographic characteristics are often used to explain variations in sales between geographical areas. In 1957, Vera Kilduff Russell wrote an article to point out some limitations of using income statistics for the purpose of comparing geographical areas, particularly communities.[82] The question concerning the use of income statistics was whether they could be used as indicators of a market for goods and services. The hypothesis was

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[82]Vera Kilduff Russell, "The Relationship Between Income and Retail Sales in Local Areas," Journal of Marketing, XXII (January, 1957), pp. 329-332.

"there is a positive correlation between income per capita (or per family) and retail sales per capita only when areas under consideration are relatively 'closed systems.'"[83] A closed system was defined as a geographical area "where the inhabitants both earn their incomes and spend them within the area."[84]

Two samples were selected to determine correlations between retail sales per capita and income per capita. First, the state of New York was divided into incorporated communities with populations of 5,000 and over. Secondly, the total United States was divided into incorporated communities with populations of 25,000 and 49,999. Communities sampled were further divided into urban and non-urban areas. This was done because of the belief that proximity to a metropolitan area is an important factor in influencing the economy of a community.

The results were as follows:

1. The New York State communities lacked relationship between the two series applied to places of all sizes.

2. The coefficient of correlation between retail sales per capita and median income per capita in the 78 communities in the size group for the United States located in urbanized areas was found to be--.06. This figure indicates that the relationship is not significantly different from chance . . . Suburbs of this type are probably as far removed from being

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[83] Ibid., p. 329. [84] Ibid.

> "closed systems" as a community can be . . . This means that, while the central city is expected to be highly diversified, a suburb may be highly specialized for either residential or industrial purposes. Consequently, retail sales per capita vary widely from suburb to suburb within urbanized or metropolitan areas.
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> 3. The correlation for the 168 places of this size outside urbanized areas was .43 . . . with $r^2$=.18 . . . The low correlation between retail sales and income was not apparent in all regions when each community was analyzed individually . . . Why for places outside urbanized areas, is the relative variability of retail sales per capita greater than that of the median income per family? The answer is to be found again in the extent to which the given city or village approximates a closed system.[85]

Russell's conclusion was that there is a virtual absence of correlation between retail sales per capita and median income per capita when measures of these variables are made for cities. A factor which "tends to offset the influence of average local incomes is the community's ability to draw business from outside markets."[86]

In 1957, John Casparis wrote an article titled, "Metropolitan Retail Structure and Its Relation to Population."[87] His objective was to assess the functional relationship between retailing and population. The hypothesis was that "more than any other commercial function, retail trade is closely related to the distribu-

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[85] Ibid., p. 330. [86] Ibid., p. 331.

[87] John Casparis, "Metropolitan Retail Structure and Its Relation to Population," Land Economics, XXXXIII (May, 1967), pp. 212-218.

tion and composition of the population."[88] The study was concerned with answering two questions:

1. What is the effect of SMSA size on the distribution and redistribution of retail functions within the SMSA?

2. Can the redistribution of retail sales be explained by changes in the population composition of the SMSA?[89]

A sample of eighty-two SMSA areas was selected with populations over 100,000 which had information available on the dollar volume of retail sales in the Central Business District, the City, and the SMSA. The retail sales and population data were derived from the United States Census of Business and the United States Census of Population. Sales data was collected for the years 1948 and 1958. Population data was collected for the years 1950 and 1960. Coefficients of correlation were then computed between retail sales and changes in the population's composition, such as the percentage change between the age 65 years old and over. Seven retail categories were selected. The data were classified according to CBD, City, and Ring.

The results demonstrated that:

1. The explanation of the decentralization of retail trade in the metropolitan community lies in the changing characteristics of the

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[88] Ibid., p. 212. [89] Ibid.

> population . . . In the CBD the shopping goods are most closely related to population change. In the central city and the ring the convenience goods show the highest correlations. For eating and drinking places the correlations are high in all areas.
>
> 2. The best indicators of retail sales changes are the aged, 65 years old and over, and children under five. An absolute growth of the aged has a negative effect on sales in the CBD while a proportionate increase slows down the rate of decline in CBD sales. In the central city the exact opposite is the case: an aging city retards sales growth while absolute growth of the aged stimulates it. In the ring, a rapid increase in young children benefits ring retail stores . . . What is clearly demonstrated by our data, however, is that retailing does not only move out with a decentralizing population in a simple, arithmetic relationship but that it also responds selectively to changes in population composition.[90]

Troubled by the conclusion reached by Vera Russell, Robert Ferber, in 1958, proceeded to question what does influence variations in retail sales between cities.[91] Ferber's objective was to identify factors that influenced variations in retail sales between Illinois cities in 1954 and to measure the relative importance of each in affecting (1) total sales and (2) major types of retail sales. The analysis was conducted on two bases: (1) factors influencing the variation in total sales between cities,

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[90] Ibid., p. 215.

[91] Robert Ferber, "Variations in Retail Sales Between Cities," Journal of Marketing, XXII (January, 1958), pp. 295-303.

and (2) factors influencing the variation in per capita sales between cities.

A sample of fifty-one Illinois cities was selected. The cities included those with populations exceeding 25,000, plus a random systematic sample of one-half of cities having a population between 10,000 and 25,000 in 1950. Seven demographic variables were used. These variables included: (1) total 1954 incomes in a given city; (2) total population; (3) percentage of families earning over $4,000 in 1945; (4) percentage earning over $7,000; (5) distance to the nearest larger city; (6) ratio of number of stores in nearest larger city; and (7) the distance to St. Louis or Chicago, whichever is the nearest metropolitan area.[92] Nine product categories were selected. Multiple correlation and multiple regression were used to identify which factors accounted for variations in retail sales between cities using the seven factors selected. The correlations were computed in terms of logarithms.

The results indicated that:

> 1. In terms of total sales . . . it appeared that only population and distance between cities influenced the intercity variations in total retail sales. The other four variables, including income, were clearly not statistically significant either at the

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[92] Ibid., p. 297.

> .05 probability level, at the .10 level, or at various higher levels.[93]
>
> 2. In terms of per capita sales . . . Contrary to the previous findings, income turns out to be highly significant in every instance. The elasticity of sales with respect to income is in fact higher than the elasticity for any other variable . . . The income distribution variable--percent earning over $7,000--is statistically significant only when it does not appear in conjunction with income per capita. This phenomenon is clearly due to intercorrelations between these two variables . . . Distance remains a highly important variable. The number of retail stores in relation to a city's population is an important determinant of per capita sales, while the number of stores in a given city relative to those in the closest larger city is not.[94]

The author concludes that forces influencing intercity variations in per capita sales differ by type of sales, and that a more or less individualistic approach is needed to explain variations in area sales.

In 1964, in an attempt to overcome some of the limitations inherent in Reilly's formula for determining trading areas, David Huff developed a model for estimating retail sales potential.[95] The thesis of the model is that consumer spatial behavior can best be described as a probabilistic phenomenon. Instead of defining a

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[93] Ibid. [94] Ibid., p. 298.

[95] David L. Huff, "Defining and Estimating a Trading Area," Management Perspectives in Retailing, ed. Ronald R. Gist (New York: John Wiley and Sons, Inc., 1967), pp. 195-199.

trading area as having a singular or unique boundary, a trading area was defined as:

> containing potential customers for whom there exists a probability greater than zero of their purchasing a given class of products or services offered for sale by a particular firm or a particular agglomeration of firms.[96]

Huff's hypothesis is that "the probability of a consumer patronizing a shopping center is directly related to the size of a center and inversely related to some increasing function of time involved in traveling to a center."[97] The procedure to estimate retail sales potential is:

1. Divide the surrounding area into small statistical units.

2. Estimate the probability of consumers from each of these units going to a particular shopping center. The formula is:

$$P_{ij} = \frac{S_j / T_{ij}^{\lambda}}{\sum_{j=1}^{n} S_j / T_{ij}^{\lambda}}$$

where

$P_{ij}$ = the probability $P$ of a consumer originating at a given point $i$ shopping at a particular retail location $j$;

$S_j$ = the size of a retail location $j$ (measured in terms of square feet of selling or building area);

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[96] Ibid., p. 199. [97] Ibid., p. 198.

$T_{ij}$ = the distance T (expressed in terms of physical distance, time, cost, etc.) separating i and j;
$\lambda$ = a parameter which is to be estimated empirically to reflect the sensitivity of various kinds of shopping trips to distance; and
$\eta$ = the number of retail locations.

3. Draw a line connecting all statistical units having like probabilities. Thus the retail trade area becomes a series of zonal probability contours.

4. Multiply the total expected number of customers within the given region times the average dollar amount spent for the class of products being sold in the shopping center.[98]

Other studies have undoubtedly been conducted; however, their presentation is not possible because they have not been published. Other studies that have been published are similar to those presented in the above review. The above studies were selected because they represent the advancement of general thinking over time concerning market potential.

## Importance of Market Potential

Despite the lack of recent exposure in marketing literature, market potential remains an important concept. Market potential evaluations assist management in capitalzing on growth opportunities by reducing the uncertainty of future product opportunities in total or in various

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[98] Ibid.

market areas. While some executives probably prefer to ignore the possible effects of market risk in marketing planning, errors in the prediction of market opportunity are expensive. These errors are expensive because opportunity projections are fundamental to the entire business planning process, such as production, finance, and marketing planning. William Lazer has stated that "available opportunities must be related to the particular company's resources, including its personnel, financial, and physical resources."[99] Market potential neglect can and will in most instances lead to ineffective allocation of resources. From a company planning point of view, market potential estimates can be used for:

1. Determining corporate goals--potentials provide one important element in aiding the establishment of both long and short run corporate goals.

2. Determining new facilities--potentials provide one important element in considering whether additional plant and warehouse facilities are needed, and the location of such facilities with regard to the product's markets considering service and freight costs.[100]

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[99]William Lazer, "Competition, Innovation and Marketing Management," Competition in Marketing, ed. Taylor W. Meloan and Charles M. Whitto (Los Angeles: Citizen Print Shop, 1964), p. 18.

[100]American Marketing Association, Proceedings of the Forty-Fifth National Conference (Chicago, Ill., 1962), p. 18.

Market potential estimates are particularly valuable to the development of marketing programs. A marketing manager is continually searching for information in order to allocate the marketing decision variables. Market potentials offer a partial answer to this problem. For the purpose of marketing, market potentials can be used for:

1. Determining Market Entry--Potentials are one major factor in determining whether a new product should be produced and marketed. The final decision regarding market entry often hinges on the determination of the market potential for the product and the estimated share-of-market the firm expects to capture.

2. Determining Product Characteristics--Potential data estimated for a new industrial good with varying product features provide one valuable factor in determining engineering direction regarding the final characteristics and design of the product.[101]

3. The broadest and most fundamental aspect is that it provides business management with a basic understanding of its whole marketing operations, over and above the day-to-day applications of quota work and other specific uses.[102]

4. Setting sales quotas: (1) A basis for setting the total sales quotas for an individual firm, (2) A basis for setting territorial sales quotas, (3) A basis for setting sales quotas for individual salesmen and dealers.[103] Quotas are estimated on the basis of a careful

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[101] Ibid. [102] Brown, op. cit., p. 403.

[103] Ibid., p. 404.

market potential study of each area, and then modified in accordance with the particular circumstances affecting the territory.[104]

5. Determine sales territories and delineating their boundary lines.[105] However, volume and market potential considerations alone are not sufficient to settle this matter. The problem is twofold: (a) What is the market potential and its trend for the area?, and (b) What is the relation between anticipated volume and expected cost and future trend in each area?[106]

6. Determining Distribution of Sales Force--Comparisons of the distribution of the sales force against the number of salesmen is often greater or less than any given territory warrants.[107]

7. Distribution of Advertising--Market potentials are useful in determining the amount of emphasis to place, where to place it, and when to place it, assuming calculations over time are available.[108]

8. To achieve control over marketing effort. Complete market and sales potentials supply basic data upon which sound marketing plans can be built.[109]

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[104] Hummel, op. cit., p. 233.

[105] Ibid., p. 245.

[106] Brown, op. cit., p. 407.

[107] Hummel, op. cit., p. 255.

[108] Ibid., p. 262.

[109] Howard, op. cit., p. 457.

## Summary

This chapter has been designed to establish a review on measuring market opportunity. The conceptual and traditional basis for explaining and measuring market opportunity is the concept of "market potential." Market potential has been defined and measured for at least the past four decades. The first part of this chapter was devoted to market potential interpretations, market potential definitions, and a distinction between conceptual versus actual market potential. In connection with these topics, it was noted that the market potential concept is not a simple one, and a meaningful comprehension of it is difficult to formulate for investigative purposes.

The second part of the chapter involved a review of the different methods which have been used to estimate market potential. Although many methods exist to estimate market potential, a large number of these methods have not been published. The methods reviewed have been those most frequently appearing in marketing literature. These include the consumer-survey method, the direct-data method, the corollary-data method, the arbitrary-factor method, the multiple-correlation method, and the test-market method. Each method was examined in reference to its meaning, its procedure for estimating market potential, and its advocated advantages and disadvantages associated with its use.

The third section of the chapter reviewed some of the studies concerning the methods used to estimate market potential. This review included Lyndon Brown's tests involving the accuracy of some of the previously mentioned estimating methods and a discussion of several problems concerning the use of the multiple-correlation method. Also, particular studies were included which have been designed to explain variations in sales quantitatively.

Finally, section four discussed the importance of market potential as a planning tool for the development of business programs.

Chapter III is concerned with the methodology used to develop the model that will be used to estimate total retail sales for this investigation.

# CHAPTER III

# METHODOLOGY

## Introduction

This study is designed to develop through an empirical investigation a predictive model by using buyer independent variables which, for the time period and Standard Metropolitan Statistical Areas selected, appear to best represent and predict total rounded dollar retail sales for furniture, home furnishings, and equipment. This chapter is divided into three parts. Part I is concerned with the selection of independent variables which compose the size and characteristics of the target market. Part II is concerned with the statistical selection of the independent variables and factors which statistically appear to be the best predictors of the total rounded dollar retail sales for furniture, home furnishings, and equipment based on Census Data. Finally, Part III is concerned with the development of the predictive model and its statistical testing.

## Part I: Selection of the Size and Characteristics of the Target Market

The use of the methodology developed in this study requires first determining which independent variables best appear to compose the size and characteristics of

the target market. Since it is very possible that the independent variables composing the size and characteristics of the target market for furniture, home furnishings, and equipment are not the same as the independent variables affecting all types of retail sales, it was necessary to determine these variables. "The Kroehler Report" provided the initial basis.[110] "The Kroehler Report" is a comprehensive study of the furniture market. It includes such information as what women looked for in furniture, the attitudes that influenced their buying, and a summary that made some definite observations based upon the research conducted. The research was conducted by Social Research, Inc., a well-known organization in the motivation research field.

The research design for the Kroehler Report divided furniture buyers into five socioeconomic classes and analyzed their furniture-buying habits. The five socioeconomic classes were the upper and lower upper, the upper middle, the lower middle, the upper working, and the lower working. A few of the variables used to distinguish the five socioeconomic classes were given. These included occupation and income; however, it was decided that for purposes of estimating total retail sales in this study

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[110] The Kroehler Report: Why Isn't the Consumer spending More on Home Furnishings? (Chicago: Kroehler Manufacturing Company, 1958).

that these two variables were insufficient because they omitted the size of the target market and they were not comprehensive in explaining how families differed in furniture needs according to other characteristics of the furniture target market. The Kroehler Report survey summary showed that families differed in furniture needs according to social status, residential location, entertainment, and family status.

Identification of additional independent variables was accomplished with the aid of the Kroehler Report summary. Social status, entertainment, and family status were redefined as specific classifications consisting of independent variables which were measureable. Census classifications used to redefine the Kroehler classifications were "Class of Worker" and "Marital Status." Two additional independent variables and one classification were added because of their suspected influence on retail sales. The two independent variables were "Housing Units" and "Population," where "Population" was used to reflect the size of the target market. "Years Moved Into Present House" was the classification added. This resulted in five classifications--family income, class of worker, years moved into present house, occupation, and marital status--and two independent variables--housing units and population--being used to describe the size and character-

istics of the target market for furniture, home furnishings, and equipment. According to the Census of Population, 1960, the independent variables constituting these classifications along with the independent variables population and housing units are:

Population

Housing Units

Family Income-Median

Family Income-percent under three thousand dollars

Family Income-percent over ten thousand dollars

Family Income-percent between three thousand and ten thousand dollars

Class of Worker-private wage and salary

Class of Worker-government

Class of Worker-self-employed

Years Moved Into Present House-one

Years Moved Into Present House-two

Years Moved Into Present House-three

Years Moved Into Present House-four to six

Years Moved Into Present House-seven to ten

Occupation-professional, technical, and kindred

Occupation-farmers and farm managers

Occupation-managers office and proprietor executives

Occupation-clerical and kindred workers

Occupation-sales

Occupation-clerical, foreman, and kindred

Occupation-operatives and kindred

Occupation-laborers, except farm and mine

Marital Status-single

Marital Status-married

Marital Status-separated

Marital Status-divorced

The result was the selection of twenty-six independent variables.

Data for independent variables selected for this study were obtained from the Census of Population, 1960,[111] or from the Census of Housing, 1960.[112] The year 1960 was selected since it was the year for which the most current data were available. The decision to use Census data was based upon the availability of the data, the ease with which independent variables could be identified, and the fact that it is the most complete, consistent reporting source of population characteristics available.

Forty-eight Standard Metropolitan Statistical Areas (SMSAs) were used giving each independent variable

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[111] U.S. Bureau of the Census, U.S. Census of Population: 1960, Vol. I, Characteristics of the Population. Washington, D.C.: U.S. Government Printing Office, 1964.

[112] U.S. Bureau of the Census, U.S. Census of Housing: 1960, Vol. III, State and Small Areas. Washington, D.C.: U.S. Government Printing Office, 1963.

forty-eight observations.[113] SMSAs were selected from the East South Central and West South Central areas of the United States as defined by the Bureau of Census. Standard Metropolitan Statistical Areas were used because each SMSA is an integrated economic and social unit with a recognized population nucleus: Each area includes the county of the central city and the adjacent counties that are found to be metropolitan in character and economically and socially integrated with the county of the central city.[114] This data provided for greater homogeneity of economic and social activities.

## Part II: Statistical Selection of Independent Variables

The objective of Part I was to identify independent variables which composed the size and characteristics of the target market for furniture, home furnishings, and

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[113]The SMSAs are: Laredo, San Angelo, Midland, Lawton, Gadsden, Texarkana, Brownsville, Tyler, Lake Charles, Odessa, Tuscaloosa, Galveston, Wichita Falls, Fort Smith, Monroe, Waco, Abilene, Lexington, Huntsville, Jackson, Columbus, Corpus Christi, Baton Rouge, Montgomery, Evansville, Amarillo, Austin, Little Rock, Shreveport, Lubbock, Chattanooga, Beaumont-Port Arthur, Knoxville, Mobile, El Paso, Fort Worth, Tulsa, Nashville, San Antonio, Memphis, Oklahoma City, Birmingham, Louisville, New Orleans, Atlanta, Dallas, Cincinnati, and Houston.

[114]U.S. Bureau of Census, County and City Data Book: 1967 (Washington, D. C.: U.S. Government Printing Office, 1967), p. xiii.

equipment. Since this author planned to investigate the development of a predictive model, it was necessary to substantiate each of the twenty-six independent variables as possible predictors of sales.

Substantiating each of the twenty-six variables was carried out by analyzing these variables on three bases. First, the relationship between each variable as originally reported in the Census of Population and the Census of Housing and total rounded retail sales for furniture, home furnishings, and equipment was determined. The values of variables in Census data are reported according to the number of individuals or units that characterize that variable.[115] Secondly, the relationship between the per capita values of each variable and total rounded retail sales for furniture, home furnishings, and equipment were calculated. The per capita values for each variable were obtained by dividing the value of each variable by its corresponding population value. That is, the variable value for each SMSA was divided by the population value of that SMSA. For example, the per capita value for "Housing Units" for Laredo was obtained by dividing the number of "Housing Units," 17,000, in Laredo by the population, 65,000, of Laredo giving a per capita value

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[115]See Appendix A for the values of total retail sales and the values of the independent variables.

of .2615 or 26.15 percent of a "Housing Unit" belonging to one person. Per capita independent variable values were used to reduce the effect of population as a dominant or ruling variable due to the way the variable values were reported in the Census. Third, the relationship between each per capita variable and per capita retail sales for furniture, home furnishings, and equipment was determined. Per capita retail sales was obtained by dividing the total retail sales for a SMSA by the population for that SMSA.[116]

The relationship between each independent variable and sales was determined by correlation. Correlation is defined as "a measurement of the degree of association among two or more variables."[117] The association needed was that between each independent variable and sales for each of the three bases mentioned above; therefore, it was necessary to use simple correlation. Pearson's product moment formula was utilized in the computations.[118]

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[116]See Appendix B for the values of per capita retail sales and the values of the per capita independent variables.

[117]Howard L. Balsley, Introduction to Statistical Method (Totowa: Littlefield, Adams and Co., 1967), p. 167

[118]The formula used was:

$$r = \frac{n \cdot \Sigma XY - \Sigma X \cdot \Sigma Y}{\sqrt{[n \cdot \Sigma X^2 - (\Sigma X)^2][n \cdot \Sigma Y^2 - (\Sigma Y)^2]}}$$

Where:

A total of seventy-six product moment coefficients of correlation were computed. This involved calculating twenty-six correlation coefficients for the first basis of analysis, twenty-five for the second basis, and twenty-five for the third basis. The correlation coefficients were calculated on an IBM 1130 computer.

The product moment coefficient of correlation for each independent variable at each basis of analysis was tested for significance. The chief purpose of using the significance test was to establish the reliability of the simple correlation at a .01 critical probability. This correlation coefficient reliability level would allow one to logically screen independent variables for reliability as predictors of retail sales for furniture, home furnishings, and equipment.

At a .99 confidence level one is less likely to reject the null hypothesis when it is true than at the .95 level. To compute the simple correlation coefficient

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r = product moment coefficient correlation
X = the independent variable
Y = the dependent variable
n = sample size

Source: John R. Stockton, Business Statistics (Chicago: Southwestern Publishing Company, 1962), p. 552.

that would be significant at the .01 critical probability, the following formula was used.[119]

$$T = r\sqrt{N-1}$$

Where:

T = the t statistic
N = the population size
r = the simple correlation coefficient

The simple correlation coefficient (r) was computed to be .37. This meant that if an independent variable was going to be reliable at a .99 level of significance as predictor of retail sales for furniture, home furnishings, and equipment for the forty-eight SMSAs selected, it must have a correlation coefficient of .37 or greater; otherwise, the correlation coefficient could not be considered reliable, thus indicating that the independent variable should not be used as a reliable predictor of retail sales.[120]

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[119]Howard L. Balsley, Quantitative Research Methods for Business and Economics, (New York: Random House, 1970), p. 192.

[120]The calculations used were:

$$2.576 = r\sqrt{48-1}$$

$$r = \frac{2.576}{\sqrt{47}}$$

$$r = \frac{2.576}{6.856}$$

$$r = .37$$

The number of statistically significant independent variables remaining at each of the three bases of analysis was then determined. If a basis of analysis had six or more independent variables, an intercorrelation matrix was computed for that basis of analysis. The chief purpose for computing the intercorrelation matrix was to facilitate the use of factor analysis. Each independent variable was correlated with every other independent variable for that basis of analysis. Pearson's product moment formula was again utilized in the computations.

The purpose of factor analysis is to determine from among a large number of associated variables those factors which account for the intercorrelations among the variables. It is usually possible to use factor analysis to reduce a large number of associated variables to a much smaller number of factors which emerge from the underlying relationships operating among the variables and which are of primary interest to the investigator. The underlying postulate is that variables that are correlated can be explained by a single variable, called a factor. Factor analysis is utilized in the study to determine, from among the six or more independent variables considered, those factors which appear to represent best the size and characteristics of the target market for furniture, home furnishings, and equipment based on the data for the

forty-eight SMSAs. A separate factor analysis was computed for each basis of analysis with six or more signifcant independent variables.

Louis J. Thurstone's approach was used. The centroid method was utilized to calculate the factor loadings.[121] To gain a higher degree of information about the factors explaining the common variance among the six or more variables, the factors were rearranged by rotating the axis so that the underlying nature of each factor could more easily be identified. Oblique rotation was used for this purpose.[122] The centroid factor loadings were computed on an IBM 1130. Oblique rotation was done by hand. Using the centroid method, one will continue to extract factors until the residual correlations approach zero. This signified that nearly all the correlations from the original intercorrelations have been removed by the factor loadings.

The factors that were obtained for each bases of analysis were defined in terms of an independent variable(s) that appeared to explain best the relationship these variables had in common with each other. The factors were defined with recognition that the purpose

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[121] Louis J. Thurstone, Multiple Factor Analysis (Chicago: University of Chicago Press, 1947).

[122] Ibid.

of this study was to investigate the development of a predictive model for retail sales for furniture, home furnishings, and equipment.

## Part III: Development of Predictive Model

This section deals with the investigation to develop a predictive model to estimate the total dollar retail sales for furniture, home furnishings, and equipment. This objective was approached through an application of statistical techniques. The approach was to develop an estimating equation for each of the three bases of analysis stated earlier.

The technique of regression analysis was used to develop the estimating equation. The chief purpose of regression analysis is to predict the level of a dependent variable based on the level of some independent variable(s). Regression analysis is based on the idea that, if certain independent variables are truly "related" to the demand for a product, this is evidenced in correlation. Thus, the best variable or combination of these variables is that which most closely correlates with the sales of the product. Since there were three bases of analysis, it was necessary to develop three regression equations.

The factors or the significant independent variables (if five or less) as determined for each basis of

analysis were used to compute the regression equations. The regression coefficients were computed by utilizing the techniques of simple correlation, partial correlation, multiple correlation, and partial regression. If only one factor could be identified, simple regression analysis was used. The procedure utilized to compute the regression coefficients for each basis of analysis involving several factors or more than one significant independent variable is stated below.

First, product moment correlations were computed for each independent variable at each basis of analysis. This involved calculating the coefficient of correlation for each independent variable with the dependent variable (retail sales) and the coefficient of correlation between each pair of independent variables. The correlation coefficients were computed in order to calculate the partial correlation coefficients.

Second, partial correlation coefficients were then computed using the product moment correlation coefficients.[123] Partial correlation coefficients

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[123]The formula used was:

$$r_{12.345} = \frac{r_{12.345\ldots(n-1)} - (r_{1n.345\ldots(n-1)} \times r_{2n.345\ldots(n-1)})}{\sqrt{(1-r^2_{1n.345\ldots(n-1)})}\ \sqrt{(1-r^2_{2n.345\ldots(n-1)})}}$$

Source: Howard L. Balsley, op. cit., p. 179.

permit computing a coefficient of correlation for the dependent variable as acted upon by one independent variable while the remaining independent variables are held constant. Partial correlation measures the degree of association between two variables when the effects of the other variables have been removed. These correlation coefficients allow one to disentangle the separate effects of the independent variables. To use the simple correlation coefficients to determine the combined effect of the independent variables would require that the effect common to each independent variable be combined. This combined effect would result in effects common to all the variables being counted more than once. The actual number of times this common effect would be counted would depend upon the number of independent variables involved. Partial correlation coefficients were utilized in this study as a means of solving the problem of counting the common effect among the variables more than one. If the partial correlation coefficient for each variable was larger than zero and positive, a low interaction effect with the other variables was considered to prevail, thus, indicating that the relationship between the variables was not spurious. These partial correlation coefficients were then used to compute the multiple correlations and the partial regression coefficients for each basis of

analysis involving several factors or more than one independent variable.

Third, a multiple correlation coefficient was computed for each basis of analysis using the partial correlation coefficients.[124] Multiple correlation is a measure of the degree of linear association between a dependent variable and two or more independent variables. It "expresses the total association among the variables in one coefficient."[125] It is utilized in this study to determine to what extent the total retail sales for furniture, home furnishings, and equipment are influenced by the interaction of the independent variables. Each multiple correlation coefficient was tested for

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[124]The formula used was:

$$R1.234\ldots n = \sqrt{1[(1-r^2_{12})(1-r^2_{13.2})(1-r^2_{14.23})\ldots(1-r^2_{1n.23\ldots(n-1)})]}$$

Where:
R = multiple correlation coefficient
r = partial correlation coefficient
n = number of independent variables

Source: Howard L. Balsley, op. cit., p. 182.

[125]Ibid.

significance at the .90 level of significance.[126] The null hypothesis was: that the multiple correlation in the universe is zero. A computed F value greater than the F distribution table value for a .10 critical probability would indicate the multiple correlation is significant which would result in rejecting the null hypothesis and accepting the alternative hypothesis that the multiple correlation in the univers is not zero, allowing one to conclude that the independent variables are applicable for explaining the association of retail sales for furniture, home furnishings, and equipment. The partial correlations and the multiple correlations were computed by using a desk calculator.

The reasons for computing these various correlation measures were to compute directly the regression equation. Regression coefficients were determined by calculating

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[126]The formula used was:

$$F = \frac{R^2(N-m)}{(1-R^2)(m-1)}$$

Where:
F = F value for the F distribution
R = multiple correlation coefficient
N = number of observations
m = number of variables

Source: Ibid., p. 194.

the partial regression coefficients.[127] The primary purpose for calculating the partial regression coefficients is to substitute them into the regression equation for predicting the value of the dependent variable. Partial regression coefficients were computed through the use of partial correlation coefficients. These partial regression coefficients were then used in a multiple regression equation. The general multiple regression used was:[128]

$$X_{1i}=\bar{X}_1 + b_{12.34\ldots n}(X_{2i} - \bar{X}_2) + b_{13.24\ldots n}(X_{3i} - \bar{X}_3) + b_{14.23\ldots n}(X_{4i} - \bar{X}_4) + \ldots + b_{1n.23\ldots(n-1)}(X_{ni} - \bar{X}_n).$$

Where:

$X_{1i}$ = the dependent variable (retail sales).

$\bar{X}_1$ = the mean value of the dependent variable.

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[127] The formula used was:

$$b_{12.345\ldots n} = \frac{\delta x_1}{\delta_{x_2\ldots n}} \times \frac{r_{12.345\ldots(n-1)} - (r_{1n.345\ldots(n-1)} \times r_{2n.345\ldots(n-1)})}{\sqrt{1-r^2}_{1n.345\ldots(n-1)} \sqrt{1-r^2}_{2n.345\ldots(n-1)}}$$

Where:

b = partial regression coefficient

$\delta x_1$ = Standard deviation of the dependent variable

$\delta x_n$ = Standard deviation of the n independent variable

r = partial correlation coefficient

Source: Ibid., p. 186.

[128] Ibid., p. 187

$b_{1n.23}$ = the partial regression coefficient for the independent variable.

$X_n$ = the mean value of the independent variable n.

$X_{ni}$ = the known value of the independent variable n.

The regression equations were utilized to develop the estimating equation for the total rounded dollar retail sales for furniture, home furnishings, and equipment. Three final estimating equations were calculated; that is, there was a final estimating equation for each basis of analysis. These three equations were necessary since total rounded retail sales for furniture, home furnishings, and equipment was to be computed three ways. Since the first basis of analysis used undeflated independent variables, total rounded retail sales could be computed directly from the regression equation established. The second and third basis of analysis used deflated independent variables; therefore, to obtain total rounded retail sales it was necessary first to compute per capita retail sales. Regression equations were used to compute the per capita retail sales. Total rounded retail sales for the second and third basis of analysis were then obtained by multiplying each estimated per capita retail sales value for each SMSA by the population for that SMSA.

Since these final estimating equations were developed to predict the total rounded retail sales for furniture, home furnishings, and equipment, it was necessary to use a

statistical measure that would allow one to determine how well the estimated retail sales approximated the actual sales. In other words, the question to be answered is what relationship exists between predicted and actual sales. If the actual sales values are not closely related to the predicted sales values, it would be a mistake to accept the estimating equation as a predictor of actual sales; however, if the predicted sales values are closely related to the actual sales values, the estimating equation may prove to be a very good predictor of actual sales. The statistical measure selected to determine the relationship between actual and predicted sales was the product moment correlation coefficient.[129] A high product moment correlation coefficient would indicate that there is a real association between actual and predicted sales, whereas a low product moment correlation coefficient would indicate that there is virtually no relationship between actual and predicted sales. If a low product moment correlation coefficient was obtained, it would have to be concluded that the final estimating equation was a poor predictor of actual sales. The following test of significance of the sample correlation coefficient was conducted:

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[129]Refer to footnote number 9.

$$T = r\sqrt{N - 1}$$

Where:

T = t statistic
r = product moment correlation coefficient
N = sample size

The null hypothesis was posed: that the universe correlation coefficient is zero. A .01 critical probability was used in order to continue with maintaining a high level of significance.

This chapter was designed to establish a methodology which could be used to investigate the development of a predictive model to estimate the total rounded retail sales for furniture, home furnishings, and equipment. The methodology was divided into three parts: (1) the selection of the size and characteristics of the target market, (2) the statistical selection of independent variables, and (3) the development of a predictive model. Chapter IV will present the empirical results.

# CHAPTER IV

# EMPIRICAL RESULTS

## Introduction

In Chapter III, the methodology for predicting total retail sales for furniture, home furnishings, and equipment was covered. This chapter continues the discussion by presenting the statistical findings. The chapter is divided into three parts. Part I presents the findings concerning the statistical selection of independent variables and estimation of total rounded retail sales for furniture, home furnishings, and equipment based on the relationship between the undeflated variables as reported in the Census of Population and Census of Housing and total retail sales. Part II presents the findings concerning the statistical selection of independent variables and the prediction of total rounded retail sales for furniture, home furnishings, and equipment based on the relationship between deflated variables, variables deflated by population, and total rounded retail sales. Finally, Part III presents the findings concerning the statistical selection and estimation of total rounded retail sales for furniture, home furnishings, and equipment based upon the relationship between deflated variables and per capita retail sales.

## Part I: Results Concerning Total Sales and Undeflated Variables

One objective of Chapter III was to identify independent variables which composed the size and characteristics of the target market for furniture, home furnishings, and equipment. Twenty-six independent variables were selected because of their suspected association with total rounded retail sales. Since it was necessary to test their statistical relationship to total rounded retail sales, the coefficient of correlation, using Pearson's product moment formula, was computed for each independent variable. A total of twenty-six correlation coefficients were thus computed. The coefficients of correlations are shown in Table 1.

The coefficients of correlations were utilized in this study to screen independent variables not having a correlation coefficient of .37 or above as related to total rounded retail sales for furniture, home furnishings, and equipment. Twenty-four variables tested to be significant at the .01 critical probability, that is, had a coefficient of correlation of .37 or above.[130] The two variables not significant at the .01 critical probability were Income--% under 3,000 dollars and Income--% between

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[130]The formula for this correlation coefficient was given in Chapter III.

TABLE 1

CORRELATIONS WITH TOTAL ROUNDED RETAIL SALES OF FURNITURE, HOME FURNISHINGS, AND EQUIPMENT FOR 26 UNDEFLATED INDEPENDENT VARIABLES*

| Variable | r |
|---|---|
| Population | 98 |
| Housing Units | 98 |
| Income-Median | 48 |
| Income-% under 3,000 | -33 |
| Income-% over 10,000 | 48 |
| Income-% between 3,000 and 10,000 | -07 |
| Class of Worker-Private wage and salary | 98 |
| Class of Worker-Government | 86 |
| Class of Worker-Self-employed | 96 |
| Years Moved Into Present House-1 | 93 |
| Years Moved Into Present House-2 | 98 |
| Years Moved Into Present House-3 | 98 |
| Years Moved Into Present House-4 to 6 | 98 |
| Years Moved Into Present House-7 to 10 | 98 |
| Occupation-Professional, Technical, and Kindred | 98 |
| Occupation-Farmers and Farm Managers | 53 |
| Occupation-Managers, Office, and Proprietor Ex. | 97 |
| Occupation-Clerical and Kindred | 98 |
| Occupation-Sales | 98 |
| Occupation-Clerical, Foreman, and Kindred | 98 |
| Occupation-Operatives and Kindred | 97 |
| Occupation-Laborers, Except Farm and Mine | 94 |
| Marital Status-Single | 96 |
| Marital Status-Married | 98 |
| Marital Status-Separated | 87 |
| Marital Status-Divorced | 96 |

*Decimals omitted

3,000 and 10,000 dollars. Twenty-four independent variables were thus isolated from the twenty-six variables as best appearing to be significantly correlated with total rounded retail sales for furniture, home furnishings, and equipment for the time period and the SMSAs selected.

Due to the large number of variables which are associated with total rounded retail sales both directly and through interaction with one another, and because of the difficulty related to using this number of variables in a regression equation, it was necessary to determine the underlying order of these independent variables which, when found, will permit a simpler explanation of the phenomena which may seem to be the result of all the twenty-four variables. The centroid factor analytic technique was utilized to isolate the factors that appeared best to explain this underlying order. To compute the centroid factors, it was necessary to calculate a correlation matrix or a table of intercorrelations for the twenty-four independent variables. The correlation matrix is shown in Table 2.

The computations of the centroid method of factor analysis were performed on an IBM 1130 Computer. Factors were continued to be extracted until the residual correlations approached zero. This allowed extraction of the

TABLE 2

CORRELATION MATRIX FOR TWENTY-FOUR UNDEFLATED INDEPENDENT VARIABLES*

| Variable | r | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 1. Population | | | | | | | | | | | | | | | | | | | | | | | |
| 2. Housing Units | 99 | | | | | | | | | | | | | | | | | | | | | | |
| 3. Income-Median | 44 | 45 | | | | | | | | | | | | | | | | | | | | | |
| 4. Income-% over 10,000 | 48 | 47 | 57 | | | | | | | | | | | | | | | | | | | | |
| 5. Class of Worker-Private Wage and Salary | 99 | 99 | 46 | 52 | | | | | | | | | | | | | | | | | | | |
| 6. Class of Worker-Government | 89 | 88 | 37 | 47 | 84 | | | | | | | | | | | | | | | | | | |
| 7. Class of Worker-Self-employed | 96 | 97 | 44 | 45 | 97 | 85 | | | | | | | | | | | | | | | | | |
| 8. Years Moved Into Present House-1 | 96 | 95 | 43 | 47 | 94 | 90 | 96 | | | | | | | | | | | | | | | | |
| 9. Years Moved Into Present House-2 | 99 | 99 | 46 | 52 | 99 | 88 | 96 | 96 | | | | | | | | | | | | | | | |
| 10. Years Moved Into Present House-3 | 99 | 99 | 45 | 51 | 99 | 88 | 96 | 95 | 99 | | | | | | | | | | | | | | |
| 11. Years Moved Into Present House-4 to 6 | 99 | 99 | 45 | 49 | 99 | 87 | 96 | 95 | 99 | 99 | | | | | | | | | | | | | |
| 12. Years Moved Into Present House-7 to 10 | 99 | 99 | 42 | 48 | 99 | 89 | 96 | 94 | 99 | 99 | 99 | | | | | | | | | | | | |
| 13. Occupation-Professional, Technical, Kindred | 98 | 99 | 49 | 52 | 99 | 87 | 98 | 95 | 98 | 98 | 98 | 98 | | | | | | | | | | | |
| 14. Occupation-Farm and Farm Managers | 53 | 54 | 18 | 31 | 54 | 53 | 67 | 61 | 55 | 52 | 52 | 50 | 57 | | | | | | | | | | |
| 15. Occupation-Managers, Office, Proprietors | 98 | 99 | 46 | 54 | 99 | 87 | 98 | 96 | 98 | 98 | 98 | 98 | 99 | 60 | | | | | | | | | |
| 16. Occupation-Clerical and Kindred | 99 | 99 | 46 | 55 | 99 | 89 | 98 | 96 | 99 | 99 | 98 | 98 | 99 | 59 | 99 | | | | | | | | |
| 17. Occupation-Sales | 99 | 99 | 45 | 53 | 99 | 87 | 98 | 95 | 99 | 99 | 99 | 98 | 99 | 60 | 99 | 99 | | | | | | | |
| 18. Occupation-Clerical, Foreman, Kindred | 99 | 99 | 48 | 50 | 99 | 87 | 97 | 95 | 99 | 99 | 99 | 99 | 99 | 54 | 98 | 98 | 99 | | | | | | |
| 19. Occupation-Operatives and Kindred | 98 | 98 | 44 | 48 | 99 | 83 | 94 | 91 | 99 | 98 | 98 | 98 | 96 | 52 | 96 | 97 | 98 | 98 | | | | | |
| 20. Occupation-Laborers, Except Farm and Mine | 97 | 96 | 39 | 42 | 95 | 85 | 91 | 90 | 96 | 97 | 97 | 98 | 94 | 41 | 94 | 94 | 94 | 95 | 94 | | | | |
| 21. Marital Status-Single | 99 | 98 | 40 | 47 | 97 | 91 | 93 | 94 | 98 | 99 | 98 | 98 | 96 | 48 | 96 | 97 | 96 | 96 | 96 | 96 | | | |
| 22. Marital Status-Married | 99 | 99 | 45 | 39 | 98 | 87 | 97 | 95 | 98 | 99 | 99 | 99 | 98 | 53 | 97 | 97 | 98 | 99 | 97 | 96 | 97 | | |
| 23. Marital Status-Separated | 91 | 90 | 32 | 51 | 90 | 81 | 83 | 83 | 91 | 91 | 91 | 92 | 87 | 36 | 89 | 89 | 89 | 87 | 89 | 95 | 92 | 88 | |
| 24. Marital Status-Divorced | 96 | 97 | 45 | 34 | 95 | 86 | 98 | 95 | 96 | 95 | 96 | 96 | 96 | 57 | 96 | 95 | 95 | 97 | 93 | 92 | 93 | 98 | 80 |

*Decimals Omitted

maximum feasible amount of common variance from the intercorrelation matrix. The centroid factor loadings which indicate the correlation between each variable and that factor are shown in Table 3. These are the factor loadings prior to the Oblique Normalized Procedure. Table 3 also shows the proportion of the total variance in the correlations accounted for by each factor; that is, the proportion of the total variance existing in the original intercorrelation matrix accounted for by the factors. $h^2$ was computed by squaring the factor loading for each variable and adding the sum of the squared factor loading. Factor extraction of the first factor accounted for more than ninety percent of the variance in nineteen variables and seventy-nine and eighty-five percent of the variance in two other variables. The residual correlations were reduced to .08 after the extraction of the first factor. Since the extraction of only one factor accounted for forty-five percent or less of the proportion of the total variance in the correlations for three variables (Income-Median, Income-% over 10,000, and Occupation-Farm and Farm Managers), it was decided to extract a second factor. The extraction of the second factor reduced the residual correlation to .05; however, this only changed the proportion of the total variance by .18 for Income-% over 10,000 dollars,

TABLE 3

CENTROID FACTOR I AND FACTOR II LOADINGS OF 24 UNDEFLATED INDEPENDENT VARIABLES*

| | Factor I | Factor II | $h_1^2$ | $h_2^2$ |
|---|---|---|---|---|
| Population | 99 | 10 | 9801 | 9901 |
| Housing Units | 99 | 09 | 9801 | 9882 |
| Income-Median | 47 | -29 | 2209 | 3050 |
| Income-% over 10,000 | 53 | -42 | 2809 | 4573 |
| Private Wage and Salary | 99 | 06 | 9801 | 9837 |
| Government | 89 | -03 | 7921 | 7930 |
| Self-employed | 98 | -10 | 9604 | 9704 |
| Years in Present House-1 | 96 | -08 | 9216 | 9280 |
| Years in Present House-2 | 99 | 05 | 9801 | 9826 |
| Years in Present House-3 | 99 | 09 | 9801 | 9882 |
| Years in Present House-4 to 6 | 99 | 10 | 9801 | 9901 |
| Years in Present House-7 to 10 | 99 | 13 | 9801 | 9970 |
| Professional, Technical, Kindred | 99 | -03 | 9801 | 9810 |
| Farms and Farm Managers | 56 | -34 | 3136 | 4292 |
| Managers, Office Proprietor Executives | 99 | -05 | 9801 | 9826 |
| Clerical and Kindred | 99 | -06 | 9801 | 9837 |
| Sales | 99 | -03 | 9801 | 9810 |
| Clerical, Foreman, Kindred | 99 | 06 | 9801 | 9837 |
| Operatives and Kindred | 98 | 12 | 9604 | 9748 |
| Laborers, Except Farm and Mine | 95 | 25 | 9025 | 9650 |
| Marital Status-Single | 98 | 13 | 9604 | 9773 |
| Marital Status-Married | 98 | 15 | 9604 | 9829 |
| Marital Status-Separated | 90 | 21 | 8100 | 8541 |
| Marital Status-Divorced | 96 | 08 | 9216 | 9280 |

*Decimals omitted

.12 for Occupation-Farm and Farm Managers, and .08 for Income-Median. It was concluded that because of the small additional proportional total variance accounted for by the extraction of a second factor for the three variables, the use of a second factor would not appear to provide a simpler explanation of the phenomena. The centroid factor loading for the second factor and their $h^2$ values are shown in Table 3.

Since only one factor was to be used, it was not necessary to rotate the centroid factor loadings to obtain "simple structure." Simple structure refers "to finding the simplest structural relationship between factors so that the underlying nature of each may be more easily identified."[131]

The above computations make it apparent that only one factor accounts for the basic intercorrelations of the twenty-four undeflated independent variables. By studying the relationship between these variables, it was decided to rename Factor I "population." Factor I was renamed "population" since as the number of individuals under the classifications of "class worker," "years moved into present house," "occupation," and "marital status" increase, and as the number of "housing

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[131]Howard L. Balsley, op. cit., p. 268.

units" increase, the population for a SMSA is also increasing, which in turn, causes more individuals and housing units to be included under these classifications, thus creating larger SMSAs. These twenty-four variables were thus renamed as one factor which appeared best to explain the underlying force accounting for the inter-correlations among the independent variables.

Since only one independent variable, population, emerged as a possible predictor of the total rounded retail sales for furniture, home furnishings, and equipment, a simple regression analysis was utilized to estimate the total rounded retail sales for each of the forty-eight SMSAs. The estimating equation used was:[132]

$$Yc = a + b(X-\overline{X})$$

Where:

Yc = the predicted total rounded dollar retail sales
a = the arithmetic mean of the dependent variable, total rounded retail sales
b = the regression coefficient
X = the known value of the independent variable, population
$\overline{X}$ = the arithmetic mean of the independent variable, population

The computations were performed on an IBM 1130.

Substituting the actual values of "a" and "b" into the

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[132]Howard L. Balsley, op. cit., p. 183.

equation yielded the final estimating equation:

$$Yc = 21226 + 63(X-327.54)$$

The predicted total rounded retail sales for each of the forty-eight SMSAs based on population are shown in Table 4.

The product moment correlation coefficient between actual and predicted retail sales for furniture, home furnishings, and equipment was calculated to be .9809, therefore, indicating that there is a very high association between actual and predicted sales. A test of the significance of the product moment correlation coefficient provided a T value of 6.725. A standard normal deviate of 6.725 exceeds even the .999 level of confidence (3.29δ); therefore, the null hypothesis that the universe correlation coefficient is zero was rejected. The universe coefficient of correlation is not zero; the difference is significant at the .001 critical probability.

TABLE 4

PREDICTED TOTAL ROUNDED RETAIL SALES FOR FURNITURE, HOME FURNISHINGS, AND EQUIPMENT BASED UPON POPULATION*

| | SMSAs | Actual Total Sales | Predicted Total Sales |
|---|---|---|---|
| 1. | Laredo | 2930 | 4686 |
| 2. | San Angelo | 3651 | 4686 |
| 3. | Midland | 4666 | 4875 |
| 4. | Lawton | 4674 | 6324 |
| 5. | Gadsden | 4717 | 6702 |
| 6. | Texarkana | 4933 | 6387 |
| 7. | Brownsville | 5051 | 10104 |
| 8. | Tyler | 5058 | 6009 |
| 9. | Lake Charles | 5372 | 9726 |
| 10. | Odessa | 5476 | 6324 |
| 11. | Tuscaloosa | 5632 | 7458 |
| 12. | Galveston | 6474 | 9411 |
| 13. | Wichita Falls | 7559 | 8781 |
| 14. | Fort Smith | 8378 | 4812 |
| 15. | Monroe | 9320 | 7017 |
| 16. | Waco | 9896 | 10041 |
| 17. | Abilene | 9964 | 8151 |
| 18. | Lexington | 10854 | 8907 |
| 19. | Huntsville | 11585 | 7962 |
| 20. | Jackson | 12259 | 12372 |
| 21. | Columbus | 12573 | 14325 |
| 22. | Corpus Christi | 12786 | 14577 |
| 23. | Baton Rouge | 13565 | 15081 |
| 24. | Montgomery | 13683 | 11238 |
| 25. | Evansville | 13927 | 13128 |
| 26. | Amarillo | 14738 | 9978 |
| 27. | Austin | 15182 | 13947 |
| 28. | Little Rock | 17621 | 15900 |
| 29. | Shreveport | 18150 | 18294 |
| 30. | Lubbock | 18376 | 10419 |
| 31. | Chattanooga | 18788 | 18420 |
| 32. | Beaumont-Port Arthur | 21656 | 19869 |
| 33. | Knoxville | 22397 | 23775 |
| 34. | Mobile | 22698 | 20373 |
| 35. | El Paso | 22836 | 20373 |
| 36. | Fort Worth | 27628 | 36690 |
| 37. | Tulsa | 29159 | 26988 |
| 38. | Nashville | 30783 | 25791 |

TABLE 4--Continued

| | SMSAs | Actual Total Sales | Predicted Total Sales |
|---|---|---|---|
| 39. | San Antonio | 32824 | 43872 |
| 40. | Memphis | 35060 | 40092 |
| 41. | Oklahoma City | 37959 | 32847 |
| 42. | Birmingham | 39293 | 40596 |
| 43. | Louisville | 43609 | 46266 |
| 44. | New Orleans | 52113 | 55275 |
| 45. | Atlanta | 59552 | 64662 |
| 46. | Dallas | 72014 | 68883 |
| 47. | Cincinnati | 77981 | 68127 |
| 48. | Houston | 83469 | 78333 |

*All values are stated in thousands of dollars.

## Part II: Results Concerning Total Sales and Deflated Variables

Part I was designed to investigate the prediction of total rounded retail sales for furniture, home furnishings, and equipment using the relationship between undeflated independent variables and total rounded retail sales. This section deals with investigating the estimation of total rounded retail sales for furniture, home furnishings, and equipment based on the relationship between total rounded retail sales and independent variables that have been deflated for population; that is, each variable was divided by its corresponding SMSA population. All of the twenty-five original variables, except the income variables, were divided by population. The income variables

had already been adjusted for population as reported in the Census of Population.

The statistical selection of independent variables involved computing the coefficient of correlation, using Pearson's product moment formula, for the relationship between total rounded retail sales and each per capita variable. Twenty-five correlation coefficients were thus computed. Each correlation was again tested for significance at the .01 critical probability. Six independent variables had a correlation coefficient of .37 or above. These were Occupation-Clerical and Kindred; Occupation-Sales; Occupation-Clerical, Foreman, Kindred; Class of Worker-Private Wage and Salary; Years Moved Into Present House-4 to 6; and Income-Median. Therefore, nineteen independent variables had a correlation of less than .37. The coefficient of correlations are shown in Table 5.

Factor analysis was then employed in an attempt to isolate from among the six independent variables considered, those factors which appear to represent best the underlying order of these variables for the forty-eight SMSAs. The correlation matrix computed for factor analysis using the above six variables is shown in Table 6.

TABLE 5

CORRELATIONS WITH TOTAL ROUNDED RETAIL SALES OF FURNITURE, HOME FURNISHINGS, AND EQUIPMENT FOR 25 DEFLATED INDEPENDENT VARIABLES*

| Variable | r |
|---|---|
| Housing Units | 14 |
| Income-Median | 48 |
| Class of Worker-Private Wage and Salary | 56 |
| Class of Worker-Government | -16 |
| Class of Worker-Self-employed | -28 |
| Family Income-% under 3,000 | -35 |
| Family Income-% between 3,000 and 10,000 | 23 |
| Family Income-% over 10,000 | 26 |
| Occupation-Professional, Technical, Kindred | 23 |
| Occupation-Farm and Farm Managers | -36 |
| Occupation-Managers, Office, Proprietor Ex. | 03 |
| Occupation-Clerical and Kindred | 64 |
| Occupation-Sales | 47 |
| Occupation-Clerical, Foreman, Kindred | 37 |
| Occupation-Operatives, Kindred | 27 |
| Occupation-Laborers, Except Farm and Mine | 05 |
| Marital Status-Single | -16 |
| Marital Status-Married | -05 |
| Marital Status-Separated | 17 |
| Marital Status-Divorced | 28 |
| Years Moved Into Present House-1 | -29 |
| Years Moved Into Present House-2 | 19 |
| Years Moved Into Present House-3 | 34 |
| Years Moved Into Present House-4 to 6 | 58 |
| Years Moved Into Present House-7 to 10 | 03 |

*Decimals omitted

TABLE 6

CORRELATION MATRIX FOR 6 DEFLATED INDEPENDENT VARIABLES*

| Variable | r | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1. Income-Median | | | | | |
| 2. Class of Worker-Private Wage and Salary | 62 | | | | |
| 3. Occupation-Clerical and Kindred | 62 | 64 | | | |
| 4. Occupation-Sales | 46 | 67 | 70 | | |
| 5. Occupation-Clerical, Foreman, Kindred | 66 | 61 | 44 | 44 | |
| 6. Years MOved Into Present House-4 to 6 | 45 | 77 | 55 | 36 | 49 |

*Decimals omitted

Two factors were extracted using the centroid method. The first factor reduced the residual correlation to .27. Extracting a second factor reduced the residual correlation to .17. The proportion of the total variance existing in the original intercorrelation matrix accounted for by Factor I and II was at least .57. Since .17 of the residual correlation remained after the extraction of Factor II, a third factor was extracted. Extracting a third factor resulted in two factors, Factor I and Factor III, having loadings of a single variable, and it did not add any noticeable amount of explained variance to that existing after the extraction of two factors. The centroid factor loadings and the proportion of the total variance accounted for by the factors are shown in Table 7.

TABLE 7

CENTROID FACTOR I, FACTOR II, FACTOR III LOADING OF 6 DEFLATED INDEPENDENT VARIABLES*

| | Factor I | Factor II | Factor III | $h_2^2$ | $h_3^2$ |
|---|---|---|---|---|---|
| Income-Median | 77 | 10 | 41 | 6029 | 7710 |
| Private Wage and Salary | 91 | 13 | -30 | 8450 | 9350 |
| Clerical and Kindred | 81 | -34 | -09 | 7717 | 7798 |
| Sales | 75 | -46 | 11 | 7741 | 7861 |
| Clerical, Foreman, Kindred | 71 | 26 | 20 | 5717 | 6117 |
| Years in House-4 to 6 | 73 | 25 | -24 | 5954 | 6530 |

*Decimals omitted

To more easily identify the underlying nature of each factor, the centroid factor loadings were rotated by oblique rotation and normalized. The oblique normalized factor loadings showed that the variables, Occupation-Clerical and Kindred, and Occupation-Sales, were loaded on Factor I and that the variables, Years Moved Into Present House-4 to 6; Occupation-Clerical, Foreman and Kindred; Class of Worker-Private Wage and Salary; and Income-Median were loaded on Factor II. These two factors were defined as three variables. First, the variables Occupation-Clerical and Kindred, Occupation-Sales, Occupation-Clerical, Foreman and Kindred, and Class of Worker-Private Wage and Salary were interpreted to reflect "the percent of white collar

workers in the population." White collar workers are defined as all manufacturing workers less production workers. Secondly, Years Moved Into Present House-4 to 6, appears to indicate some stability of residence. The variable was renamed "percent of age group between the ages of thirty-five and fifty-four in the population." This was done based upon a study conducted by Fabian Linden, who discovered in probing buying behavior of different segments of a market based on selected family characteristics by age groups that the age group between the ages 35-54 had the lowest percent moving annually when compared to the age group under 25, 25-34, and 65+.[133] Finally, Income-Median was maintained as a separate variable. The six independent variables were thus reduced to two factors and the two factors were renamed three variables: "percent of white collar workers in the population," "percent of age group between the ages 35-54 in the population" and "income-median." These three variables appeared to be factorially purest and offered the most promise for estimating total retail sales. Oblique rotated and normalized factor loadings are presented in Table 8.

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[133]Fabian Linden, "Consumer Profiles: The Six Ages of Family," Managerial Marketing: Perspectives and Viewpoints, ed. William Lazer and Eugene Kelley (Homewood: Richard D. Irwin, Inc., 1962), p. 110.

TABLE 8

NORMALIZED FACTOR LOADING FOR THE 6 DEFLATED INDEPENDENT VARIABLES*

| | Factor I | Factor II |
|---|---|---|
| Occupation-Sales | 69 | 00 |
| Occupation-Clerical and Kindred | 60 | 14 |
| Years Moved Into Present House-4 to 6 | 00 | 59 |
| Occupation-Clerical, Foreman, Kindred | 00 | 59 |
| Class of Worker-Private Wage and Salary | 19 | 59 |
| Income-Median | 17 | 49 |

*Decimals omitted

With the identification and renaming of the underlying factors, the new variables were measured and tested for use as partial regression coefficients for predicting the per capita retail sales for furniture, home furnishings, and equipment. The measurement and testing involved collecting the SMSA values for "percent of white collar workers in population" and "percent of age group between the ages 35-54 in the population." The data for "percent of white collar workers in the population were collected from County and City Data Book: 1967.[134] Data for "percent

[134]U.S. Bureau of Census, County and City Data Book: 1967 (Washington, D.C.: U.S. Government Printing Office, 1967).

of age group between the ages 35-54 in the population" were collected from 1960 Census Data.[135] Since the data values were not deflated for population, it was necessary to divide the value of each variable for each SMSA by the corresponding population for that SMSA. Data on "income-median" had already been collected. These values are shown in Appendix C.[136] Two estimating equations were utilized to determine the total rounded retail sales. First, a multiple regression equation was used to predict the per capita retail sales. Secondly, per capita retail sales were multiplied by population to compute total rounded retail sales. It was necessary to compute per capita retail sales first since per capita independent variables were being used as predictors.

The regression coefficients for the per capita equation were computed by utilizing simple and partial correlation. Zero-order correlation coefficients were computed first for the three variables. These correlations are presented in Table 9. The zero-order correlations were then used to compute the first-order partial correlation coefficients. The first-order partial correlation

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[135] U.S. Bureau of the Census, U.S. Census of Population: 1960 Vol. I, Part I, "Characteristics of the Population" (Washington, D.C.: U.S. Government Printing Office, 1964).

[136] See Appendix C.

TABLE 9

PARTIAL CORRELATION COEFFICIENTS FOR INCOME-MEDIAN, PERCENT OF WHITE COLLAR WORKERS IN POPULATION, AND PERCENT OF AGE GROUP BETWEEN 35-54 IN POPULATION*

Zero-order Correlations

| | |
|---|---|
| $r_{12} = 35$ | $r_{23} = 40$ |
| $r_{13} = 05$ | $r_{24} = 45$ |
| $r_{14} = 01$ | $r_{34} = 56$ |

First-order Correlations

| | |
|---|---|
| $r_{12.3} = 3605$ | $r_{14.3} = -0218$ |
| $r_{12.4} = 3869$ | $r_{23.4} = 2000$ |
| $r_{13.2} = -1048$ | $r_{24.3} = 3054$ |
| $r_{13.4} = 0536$ | $r_{34.2} = 4642$ |
| $r_{14.2} = -1763$ | |

Second-order Correlations

$r_{12.34} = 3897$

$r_{13.24} = -0264$

$r_{14.23} = -1123$

Where:
1 = per capita retail sales for furniture, home furnishings, and equipment
2 = income-median
3 = % of white collar workers in population
4 = % of age group between 35-54 in population

*Decimals omitted

coefficients were then used to compute the second-order partial correlation coefficients. The partial correlations provided some interesting illumination on the relationships between the variables. The zero-order coefficients of correlation of per capita retail sales with "percent of white collar workers in the population" and "percent of age group between 35-54 in the population" had a direct relationship; however, the partial correlation coefficients for these two variables indicate that they have an indirect relationship with per capita retail sales. Income-Median turns out to have a more important relationship with per capita retail sales than originally indicated by the zero-order correlation coefficient.

The partial regression coefficients were computed by using the second-order partial correlation coefficients. The computations are as follows:

Income-Median:

$$b_{12.3} = \frac{\sigma_1}{\sigma_2} \times r_{12.34}$$

$$= \frac{18.99}{740.3} \times .3897$$

$$= .0100$$

$$= .01$$

Percent of White Collar Workers in Population:

$$b_{13.24} = \frac{\sigma_1}{\sigma_3} \times r_{13.24}$$

$$= \frac{18.99}{10.37} \times -.0264$$

$$= -.0483$$

$$= -.05$$

Percent of Age Group Between 35-54 in Population:

$$b_{14.23} = \frac{\sigma_1}{\sigma_4} \times r_{14.23}$$

$$= \frac{18.99}{1.778} \times -.1123$$

$$= -.1.1994$$

$$= -1.20$$

Substituting the partial regression coefficients into the regression equation yielded the following estimating equation for predicting per capita retail sales for furniture, home furnishings, and equipment:

$$X_{1i} = 62.37 + .01(X_{2i} - 5095.0009) -$$

$$.05(X_{3i} - 18.6918) - 1.20(X_{4i} - .2366)$$

where $X_{1i}$ equals the estimated per capita retail sales; 62.37 is the arithmetic of per capita retail sales in dollars; $X_{2i}$ is the known value of Income-Median:

5095.0009 is the arithmetic mean of Income-Median; $X_{3i}$ is the known value of Percent of White Collar Workers in Population; 18.6918 is the arithmetic mean of Percent of White Collar Workers in Population; $X_{4i}$ is the known value of Percent of Age Group Between 35-54 in Population; and .2366 is the arithmetic mean of Percent of Age Group Between 35-54 in Population. The multiple correlation was .3640. This did not prove to be significant at the .01 or .05 critical probabilities; however, the multiple correlation coefficient was significant at a .10 critical probability. The computed F value was determined to be 2.2423. It was computed by using the formula:[137]

$$F = \frac{R^2(N-m)}{(1-R^2)\ (m-1)}$$

Where:

$F_2$ = the computed F statistic
$R^2$ = the multiple correlation coefficient
N = number of observation
m = number of variables

Total rounded retail sales for furniture, home furnishings, and equipment were predicted by multiplying the estimated per capita retail sales by its corresponding population for each SMSA. The total predicted rounded retail sales are shown in Table 10.

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[137]Howard L. Balsley, op. cit., p. 194.

The product moment correlation coefficient between actual and predicted retail sales for furniture, home furnishings, and equipment was computed to be .9872; therefore, indicating that there is a very high relationship between actual and predicted sales. The T value obtained in testing the significance of the product moment correlation coefficient was 6.768. This exceeds even the .999 level of confidence (3.996); thus, the null hypothesis that the universe correlation coefficient is zero was rejected.

TABLE 10

PREDICTED TOTAL ROUNDED RETAIL SALES FOR FURNITURE, HOME FURNISHINGS, AND EQUIPMENT BASED UPON INCOME-MEDIAN, PERCENT WHITE COLLAR WORKERS IN POPULATION, AND PERCENT OF AGE GROUP BETWEEN 35-54 IN POPULATION*

| | SMSA | Actual Total Sales | Predicted Total Sales |
|---|---|---|---|
| 1. | Laredo | 2930 | 2716 |
| 2. | San Angelo | 3651 | 3785 |
| 3. | Midland | 4666 | 5534 |
| 4. | Lawton | 4674 | 5320 |
| 5. | Gadsden | 4717 | 5372 |
| 6. | Texarkana | 4933 | 4596 |
| 7. | Brownsville | 5051 | 6674 |
| 8. | Tyler | 5058 | 4945 |
| 9. | Lake Charles | 5372 | 9155 |
| 10. | Odessa | 5476 | 6667 |
| 11. | Tuscaloosa | 5632 | 5935 |
| 12. | Galveston | 6474 | 9122 |
| 13. | Wichita Falls | 7559 | 8422 |
| 14. | Fort Smith | 8378 | 3565 |

TABLE 10--Continued

| | SMSA | Actual Total Sales | Predicted Total Sales |
|---|---|---|---|
| 15. | Monroe | 9320 | 5642 |
| 16. | Waco | 9896 | 8761 |
| 17. | Abilene | 9964 | 7508 |
| 18. | Lexington | 10854 | 8551 |
| 19. | Huntsville | 11585 | 7583 |
| 20. | Jackson | 12259 | 11102 |
| 21. | Columbus | 12573 | 11919 |
| 22. | Corpus Christi | 12786 | 13488 |
| 23. | Baton Rouge | 13565 | 15970 |
| 24. | Montgomery | 13683 | 9958 |
| 25. | Evansville | 13927 | 12410 |
| 26. | Amarillo | 14738 | 10436 |
| 27. | Austin | 15182 | 13241 |
| 28. | Little Rock | 17621 | 14784 |
| 29. | Shreveport | 18150 | 17030 |
| 30. | Lubbock | 18376 | 10316 |
| 31. | Chattanooga | 18788 | 17118 |
| 32. | Beaumont-Port Arthur | 21656 | 21429 |
| 33. | Knoxville | 22397 | 22230 |
| 34. | Mobile | 22698 | 19808 |
| 35. | El Paso | 22836 | 19930 |
| 36. | Fort Worth | 27628 | 38393 |
| 37. | Tulsa | 29159 | 28684 |
| 38. | Nashville | 30783 | 25643 |
| 39. | San Antonio | 32824 | 40912 |
| 40. | Memphis | 35060 | 37826 |
| 41. | Oklahoma City | 37959 | 34521 |
| 42. | Birmingham | 39293 | 39591 |
| 43. | Louisville | 43609 | 49561 |
| 44. | New Orleans | 52113 | 55173 |
| 45. | Atlanta | 59552 | 69727 |
| 46. | Dallas | 72014 | 75774 |
| 47. | Cincinnati | 77981 | 78264 |
| 48. | Houston | 83469 | 87831 |

*All values are stated in thousands of dollars.

## Part III: Results Concerning Per Capita Sales and Deflated Variables

This section deals with the final basis of analysis, the statistical findings concerning the relationship between per capita retail sales and per capita independent variables. The correlation coefficients for each of the twenty-five original independent variables were computed by using Pearson's product moment formula. Two independent variables proved significant at the .01 critical probability, i.e., had a coefficient of correlation of .37 or above. These variables were Occupation-Sales and Years Moved Into Present House-2. As a result, it was possible to screen out twenty-three independent variables as not being significant at the .99 confidence level for predicting per capita retail sales. The correlation coefficients are shown in Table 11.

Since only two variables had a correlation of .37 or above, factor analysis was not needed; therefore, it was possible to proceed directly to the process of estimating total rounded retail sales for furniture, home furnishings, and equipment. Prediction of total rounded retail sales required developing two estimating equations, one for per capita sales and one for total rounded sales. Per capita sales were obtained by a multiple regression equation in which actual per capita sales were regressed on the independent variables Occupation-Sales and Years

TABLE 11

CORRELATIONS WITH PER CAPITA RETAIL SALES OF FURNITURE, HOME FURNISHINGS, AND EQUIPMENT FOR 25 DEFLATED INDEPENDENT VARIABLES

| Variable | r |
|---|---|
| Housing Units | 05 |
| Income-Median | 34 |
| Class of Worker-Private Wage and Salary | 18 |
| Class of Worker-Government | 11 |
| Class of Worker-Self-employed | 28 |
| Family Income-% under 3,000 | -36 |
| Family Income-% between 3,000 and 10,000 | 32 |
| Family Income-% over 10,000 | 25 |
| Occupation-Professional, Technical, Kindred | 31 |
| Occupation-Farm and Farm Managers | 28 |
| Occupation-Managers, Office, Proprietor Ex. | 17 |
| Occupation-Clerical and Kindred | 21 |
| Occupation-Sales | 46 |
| Occupation-Clerical, Foreman, Kindred | 28 |
| Occupation-Operatives and Kindred | -02 |
| Occupation-Laborers, Except Farm and Mine | -17 |
| Marital Status-Single | -12 |
| Marital Status-Married | 25 |
| Marital Status-Separated | -16 |
| Marital Status-Divorced | 21 |
| Years Moved Into Present House-1 | 24 |
| Years Moved Into Present House-2 | 47 |
| Years Moved Into Present House-3 | 29 |
| Years Moved Into Present House-4 to 6 | 01 |
| Years Moved Into Present House-7 to 10 | -11 |

Moved Into Present House-2. Estimated total rounded sales were obtained by multiplying predicted per capita sales for each SMSA by that SMSA corresponding population.

The partial regression coefficients utilized to predict per capita retail sales were again computed by determining the simple and partial correlation coefficients for each variable. Zero-order correlation coefficients originally calculated were used to compute the partial correlation coefficients. The partial correlation coefficient for Occupation-Sales was .3321, and the partial correlation coefficient for Years Moved Into Present House-2 was .3475. Zero-order correlations were somewhat misleading; however, the partial correlations revealed a low degree of interaction between the two independent variables. The calculations for the partial regression coefficients using the partial correlation coefficients are as follows:

Occupation-Sales:

$$b_{12.3} = \frac{\sigma_1}{\sigma_2} \times r_{12.3}$$

$$= \frac{18.99}{.4596} \times .3321$$

$$= 13.7219$$

$$= 13.72$$

Years Moved Into Present House-2:

$$b_{13.2} = \frac{\sigma_1}{\sigma_2} \text{ X } r_{13.2}$$

$$= \frac{18.99}{1..26} \text{ X } .3475$$

$$= 5.8606$$

$$= 5.86$$

The multiple regression equation used was:

$$X_{1i} = 62.37 + 13.72(X_{2i} - 2.6741) + 5.86(X_{3i} - 11.1172)$$

where $X_{1i}$ equals the estimated per capita retail sales for furniture, home furnishings, and equipment; 62.37 is the arithmetic mean of per capita retail sales in dollars; $X_{2i}$ is the known value for Occupation-Sales; 2.6741 is the arithmetic mean for Occupation-Sales; $X_{3i}$ is the known value for Years Moved Into Present House-2; and 11.1172 is the arithmetic mean for Years Moved Into Present House-2. The multiple correlation coefficient was calculated to be .5552, which was significant to both the .01 and .05 critical probabilities.

How well this final estimating equation appeared to describe the relationship between actual and predicted total rounded retail sales was determined by again calculating a product moment correlation coefficient for the two variables. The correlation coefficient was .9798 which indicates that a very high degree of association exists between actual and predicted total retail sales

for furniture, home furnishings, and equipment. The T value obtained in testing the significance of the product moment correlation coefficient was 6.718. This exceeds again the .999 level of confidence; thus, the null hypothesis that the universe correlation coefficient is zero was rejected, which indicates that a significant difference does exist.

TABLE 12

PREDICTED TOTAL ROUNDED RETAIL SALES FOR FURNITURE, HOME FURNISHINGS, AND EQUIPMENT BASED UPON OCCUPATION-SALES AND YEARS MOVED INTO PRESENT HOUSE-2*

| SMSAs | Actual Total Sales | Predicted Total Sales |
|---|---|---|
| 1. Laredo | 2930 | 3016 |
| 2. San Angelo | 3651 | 3531 |
| 3. Midland | 4666 | 4967 |
| 4. Lawton | 4674 | 4038 |
| 5. Gadsden | 4717 | 4344 |
| 6. Texarkana | 4933 | 4553 |
| 7. Brownsville | 5051 | 7113 |
| 8. Tyler | 5058 | 5653 |
| 9. Lake Charles | 5372 | 7906 |
| 10. Odessa | 5476 | 7812 |
| 11. Tuscaloosa | 5632 | 5240 |
| 12. Galveston | 6474 | 7053 |
| 13. Wichita Falls | 7559 | 7211 |
| 14. Fort Smith | 8378 | 2789 |
| 15. Monroe | 9320 | 5991 |
| 16. Waco | 9896 | 9757 |
| 17. Abilene | 9964 | 8635 |
| 18. Lexington | 10854 | 11056 |
| 19. Huntsville | 11585 | 7328 |
| 20. Jackson | 12259 | 11814 |
| 21. Columbus | 12573 | 14289 |
| 22. Corpus Christi | 12786 | 13180 |
| 23. Baton Rouge | 13565 | 12440 |

TABLE 12--Continued

| | SMSAs | Actual Total Sales | Predicted Total Sales |
|---|---|---|---|
| 24. | Montgomery | 13683 | 10316 |
| 25. | Evansville | 13927 | 9978 |
| 26. | Amarillo | 14738 | 10798 |
| 27. | Austin | 15182 | 14104 |
| 28. | Little Rock | 17621 | 17059 |
| 29. | Shreveport | 18150 | 17687 |
| 30. | Lubbock | 18376 | 12609 |
| 31. | Chattanooga | 18788 | 18031 |
| 32. | Beaumont-Port Arthur | 21656 | 17012 |
| 33. | Knoxville | 22397 | 21621 |
| 34. | Mobile | 22698 | 16235 |
| 35. | El Paso | 22836 | 19926 |
| 36. | Fort Worth | 27628 | 39987 |
| 37. | Tulsa | 29159 | 29408 |
| 38. | Nashville | 30783 | 28596 |
| 39. | San Antonio | 32824 | 36505 |
| 40. | Memphis | 35060 | 43585 |
| 41. | Oklahoma City | 37959 | 37488 |
| 42. | Birmingham | 39293 | 39435 |
| 43. | Louisville | 43609 | 50164 |
| 44. | New Orleans | 52113 | 50506 |
| 45. | Atlanta | 59552 | 79117 |
| 46. | Dallas | 72014 | 84973 |
| 47. | Cincinnati | 77981 | 75252 |
| 48. | Houston | 83469 | 83561 |

*All values are in thousands of dollars.

Chapter IV has presented the empirical results concerning the statistical selection and predictions of total rounded retail sales for furniture, home furnishings, and equipment based upon the relationship between total rounded retail sales and undeflated independent variables, total rounded retail sales and per capita independent variables, and per capita retail sales and per capita

independent variables. Chapter V will present a summary, a conclusion, and a recommendation concerning this investigation.

# CHAPTER V

# SUMMARY, CONCLUSIONS, RECOMMENDATION

## Summary

The purpose of this study was to determine if, by empirical investigation, a model could be developed for predicting the total rounded dollar retail sales for furniture, home furnishings, and equipment. To attain this objective, it was necessary to answer the following three questions:

1. How can independent variables which comprise the size and characteristics of the target market for furniture, home furnishings, and equipment be identified using Census Data?

2. If a large number, say six or more, independent variables are identified, can these independent variables be reduced to a factor(s) which will account for the association among these independent variables.

3. Can an estimating model be designed based upon the independent variables and/or factor(s) obtained in question one and two which will assist one in estimating the total rounded dollar retail sales for furniture, home furnishings, and equipment for individual market areas?

The statistical method employed was utilized because it is an objective and scientific method of analyzing the size and characteristics of the target market for furniture, home furnishings, and equipment and of estimating sales for individual market areas.

Product moment correlations were computed and employed to logically screen the twenty-six original independent variables for reliability of significance as a possible predictor of retail sales for furniture, home furnishings, and equipment. The hypothesis was advanced that independent variables would be accepted as probable individual predictors if their simple correlation coefficients were significant at the .01 critical probability; that is, if the variable had a coefficient of correlation of .37 or above. Correlation coefficients were also employed as a second tool of research because questions two and three above call specifically for their use.

Factor analysis was utilized to deal with question two. The purpose of actor analysis was to determine, if six or more independent variables could be identified, those factors that appear to represent best the size and characteristics of the target market. The underlying postulate was that independent variables which are correlated can be explained by a single variable, called a factor. The hypothesis was advanced that factor analysis would be accepted as a useful statistical technique if (1) the independent variables selected have association with each other, (2) the centroid factor loadings account for most of the proportional total variance within the

original intercorrelations, and (3) the factor(s) obtained could be renamed as specific variables which could be used as possible predictors for estimating retail sales for furniture, home furnishings and equipment.

Two estimating equations were employed to deal with question three. Regression analysis was first employed to predict the level of retail sales for furniture, home furnishings, and equipment based on the rounded level of the original independent variables or the factor(s) obtained in questions one and two. Regression analysis is based on the idea that if certain independent variables are truly "related" to the demand for a product, this is evidenced in correlation; therefore, the best variable or combination of these independent variables is that which most closely correlates with the sales of that product. In the case of the undeflated independent variables, i.e., variables not divided by population, total rounded retail sales were estimated directly from the regression equation; however, when deflated variables, i.e., variables divided by population, were employed to predict the total rounded retail sales, it was necessary to develop a second estimating equation. This involved multiplying the predicted per capita retail sales obtained from the regression equation times population. This was done to convert per capita retail sales to total rounded retail sales.

Partial correlation coefficients were utilized to compute the partial regression coefficients for the deflated independent variables. Partial correlation was employed because it permits computing the correlation coefficient for the dependent variable, retail sales, as acted upon by one independent variable while the remaining independent variables are held constant; therefore, it provides a measure of the degree of association between the dependent variable and an independent variable when the effects of the other independent variables have been removed. Partial correlations were also employed to calculate the multiple correlation coefficients and the partial regression coefficients. Multiple correlation was utilized to express the total association among the dependent and the independent variables in one coefficient. Partial regression coefficients were calculated by multiplying the value of the partial correlations by the ratio of the standard deviation of retail sales to the standard deviation of the independent variable. The partial regression coefficients were then incorporated into a multiple regression equation.

The critical point of this study was to determine how well the developed estimating equations predicted the total rounded retail sales for furniture, home furnishings, and equipment. Since historical data were used, actual rounded

retail sales were utilized to analyze the association between the actual and predicted total rounded retail sales for furniture, home furnishings, and equipment for each final estimating equation was the product moment correlation coefficient. A high correlation coefficient was interpreted to indicate that there was a high degree of relationship between actual and predicted total rounded retail sales.

## Conclusion

The data used were collected from four major sources: U.S. Census of Population: 1960, U.S. Census of Housing: 1960; County and City Data Book: 1967, and Census of Business, Retail Trade Area Statistics: 1963. The measures of total rounded retail sales estimates for furniture, home furnishings, and equipment were: (1) the relationship between total rounded retail sales and undeflated independent variables, (2) the relationship between total rounded retail sales and independent variables deflated for population, and (3) the association between per capita retail sales and independent variables deflated for population. The findings are summarized as follows by each measure of total rounded retail sales.

When this investigation was begun, twenty-six independent variables were identified because of their suspected

association to retail sales for furniture, home furnishings, and equipment. Of the twenty-six undeflated variables, twenty-four tested to be significant at the .01 critical probability, i.e., had a correlation coefficient of .37 or above. The two independent variables not significant were Income under 3,000 dollars and Income between 3,000 and 10,000 dollars. One factor was found to be sufficient to account for intercorrelations of the twenty-four remaining variables and most of the proportional variance in the intercorrelations. This factor was "population."

The failure to account for other factors may have been due to the failure to originally include other pertinent independent variables affecting total retail sales. This may have been due also to the overwhelming influence population exerts over the other variables. This latter reasoning is demonstrated by factor analysis. It is not uncommon to find "population" an important variable for explaining total retail sales. Reilly's "Law of Retail Gravitation" states that two cities attract trade from an intermediate town in proportion to the population of the two cities and in inverse proportion to the squares of the distance from the cities to the intermediate town. Also, Robert Ferber found "population" to be a dominant variable in explaining variations in "all"

retail sales between cities. According to Ferber "all this indicates is that variations within the range of the observed . . . data had little noticeable affect on sales."[138] Paraphrasing Ferber, this does not mean that variables, such as income, are of no importance to retail sales, for it is clear that if, for example, consumers had no income, retail sales would dwindle to a vanishing point.

With this idea in mind, it is necessary to recognize that there are several limitations involved in using regression analysis to estimate sales. First, regression analysis does not show cause and effect relations. Regression analysis is useful for estimating sales based on the variables used, but it is impossible, except through deductive logic, to determine whether $y=f(x)$ or $x=f(y)$; therefore, estimates resulting from the use of regression analysis should be considered only as approximations of sales. Secondly, findings from the regression equation hold only for the range of observations available in the data. Population was found to have a close relationship with total retail sales for furniture, home furnishings, and equipment, but the range in population was from 64,000 to 1,234,000. Finally, regression analysis involves essentially quantitative evaluations of data. Considering these limitations, however, regression analysis continues

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[138]Robert Ferber, op. cit., p. 298.

to provide a statistical method for dramatic advances in estimating efficiency. Also, for relatively little expenditure, a substantial amount of data can be collected and evaluated to give approximations of the relative importance of different independent variables.

When "population" was used as the only predictor of total rounded retail sales for furniture, home furnishings, and equipment, the final estimating equation obtained was:

$$Yc = 21226 + 63(X - 327.54)$$

where Yc equals the estimated total rounded retail sales; 21226 is the arithmetic mean of total rounded retail sales in dollars; 63 is the regression coefficient; and X is the known value of population; and 327.54 is the arithmetic mean for the rounded values of population. The product moment correlation coefficient between actual and predicted total rounded retail sales was .9809.

The "T" statistic obtained in testing the significance of the product moment correlation coefficient was 6.725 which exceeds the .999 level of confidence. It was possible to conclude, therefore, that the universe coefficient of correlation was not zero and that there was a high degree of association between actual and predicted sales because of the high correlation coefficient.

When the twenty-five deflated independent variables were associated with total rounded retail sales for furniture, home furnishings, and equipment, six variables were found to have correlation coefficients significant at the .01 critical probability. These variables were Income-Median; Class of Worker-Private Wage and Salary; Occupation-Clerical and Kindred; Occupation-Sales; Occupation-Clerical, Foreman, and Kindred; and Years Moved Into Present House-4 to 6. Two factors were found to be sufficient to account for the intercorrelations based on the six variables; however, the proportion of variance explained by the two factors was smaller than that obtained in the preceding basis of analysis. The two factors were redefined as three independent variables which were "income-median," "percent of white collar workers in population," and "percent of age group between the ages 35-54 in the population." These variables were selected because they seemed to explain best the underlying force in the intercorrelation matrix. The second-order partial correlation coefficients based upon per capita retail sales showed "income-median" to have a coefficient of .3897, "percent of white collar workers in the population" to have a coefficient of -.0264, and "percent of age group between 35-54 in the population" to have a coefficient of -.1123. Although the last two variables had an indirect

effect with per capita retail sales, the effect was positive since it increased the multiple correlation coefficient.

A multiple regression equation was then employed to estimate the per capita retail sales based on the three independent variables obtained. The regression equation was:

$$X_{1i} = 62.37 + .01(X_{2i} - 5095.0009) - .05(X_{3i} - 18.6918) - 1.20(X_{4i} - .2366)$$

Where $X_{1i}$ equals the estimated per capita retail sales; 62.37 is the arithmetic mean of per capita retail sales in dollars; .01 is the partial regression coefficient for "income-median;" $X_{2i}$ is the known value for "income-median"; 5095.0009 is the arithmetic mean for "income-median"; -.05 is the partial regression coefficient for "percent of white collar workers in the population"; $X_{3i}$ is the known value of "percent of white collar workers in the population"; 18.6918 is the arithmetic mean for "percent of white collar workers in the population"; -1.20 is the partial regression coefficient for "percent of age group between 35-54 in the population"; $X_{4i}$ is the known value for "percent of age group between 35-54 in the population"; and .2366 is the arithmetic mean for "percent of age group between 35-54 in the population." A multiple correlation coefficient of

.3640 was obtained between per capita retail sales and the three independent variables. The multiple correlation coefficient proved to be significant at the .90 significance level. The estimated per capita retail sales and the three independent variables. The multiple correlation coefficient proved to be significant at the .90 significance level. The estimated per capita retail sales for each SMSA was then multiplied by the population of that SMSA to obtain total rounded retail sales. The product moment correlation coefficient between actual and predicted total rounded retail sales was .9872. The T statistic obtained for the product moment correlation coefficient was 6.768 which exceeds the .999 level of confidence; therefore, it was concluded that the universe coefficient of correlation was not zero and that a high degree of relationship existed between actual and predicted sales because of the high correlation coefficient.

Finally, when the twenty-five deflated independent variables were correlated with per capita retail sales for furniture, home furnishings, and equipment, two variables were found to have correlation coefficients significant at the .01 critical probability. The two variables were Occupation-Sales with a simple correlation coefficient of .46 and Years Moved Into Present House-2 with a coefficient of .47. Partial correlation coefficients

were computed to be .3321 for Occupation-Sales and .3475 for Years Moved Into Present House-2," indicating that the two variables were not highly intercorrelated. Per capita retail sales were estimated again for each SMSA, using a multiple regression equation. The regression equation obtained was:

$$X_{1i} = 62.37 + 13.72(X_{2i} - 2.6741) + 5.86(X_{3i} - 11.1172)$$

where $X_{1i}$ equals the estimated per capita retail sales for furniture, home furnishings, and equipment; 62.37 is the arithmetic mean of per capita retail sales in dollars; 13.72 is the partial regression coefficient for Occupation-Sales; $X_{2i}$ is the known value of Occupation-Sales in percent of population; 2.6741 is the arithmetic mean for Occupation-Sales in percent of population; 5.86 is the partial regression coefficient for Years Moved Into Present House-2 as a percent of population; and 11.1172 is the arithmetic mean for Years Moved Into Present House-2 as a percent of population. The multiple correlation coefficient was .5552 and was significant at the .01 critical probability.

The estimated per capita retail sales for each SMSA were multiplied again by the population of that SMSA to obtain predicted total rounded retail sales. The product moment correlation coefficient between actual and predicted total rounded retail sales was .9798. A significant test

of the product moment correlation coefficient yielded a standard normal deviate of 6.718 which exceeds the .999 level of confidence, therefore, proving that the universe coefficient of correlation is not zero. The fact that the universe coefficient is not zero and that the product moment correlation coefficient is high leads to the conclusion that there is a high degree of association between actual and predicted sales.

The purpose of this study has been to determine if, by empirical investigation, a model could be developed for predicting the total rounded dollar retail sales for furniture, home furnishings, and equipment. Three final estimating equations were developed based upon three basis of analysis. The predicted total rounded retail sales for furniture, home furnishings, and equipment for each final estimating equation when correlated with the actual total rounded retail sales for furniture, home furnishings, and equipment proved to have correlation coefficients all highly statistically different from zero; they were .9809, .9872, and .9798. Using product moment correlation coefficients to compare the total predictions of all the SMSAs, it appears there is no basic difference between the different estimating equations. This might be interpreted to signify that the market for furniture, home furnishings, and equipment is as much a function of its

size, population, as it is the characteristic of its target market, recognizing that if consumers had no income, retail sales would dwindle to a vanishing point; therefore, for the purpose of explaining actual retail sales for all forty-eight SMSAs, the predicted sales from each estimating equation proved to be highly associated with actual sales. Of course, these results apply primarily to the geographical areas and the time period used in this investigation. Application to other areas would need to be investigated.

In reference to the predicted retail sales for the individual SMSAs, it is interesting to note that total rounded retail sales in some SMSAs tended to be over-predicted, such as Midland, Brownsville, Lake Charles, Odessa, Galveston, Corpus Christi, Fort Worth, Memphis, Birmingham, and Atlanta. On the other hand, Fort Smith, Monroe, Huntsville, Montgomery, Evansville, Amarillo, Austin, Lubbock, Chattanooga, Beaumont-Port Arthur, Mobile, El Paso, Nashville, and Oklahoma City tend to be under-predicted regardless of which estimating equation is used.

When the three sets of predicted rounded sales are compared with different levels of actual sales, it is interesting to note that for actual sales values between 2,930,000 and 7,559,000 dollars, the third basis of analysis provides an approximate equal number of over- and

under-predicted rounded sales.[139] The first and second basis of analysis tend to be dominated by more over-predicted than under-predicted sales values with the first basis of analysis giving all over-predicted sales values.[140] For actual sales between 8,378,000 and 13,683,000 dollars, the first basis of analysis provided an approximate equal number of over- and under-predicted sales values; however, the second and third basis of analysis tended to be dominated by more under-predicted than over-predicted sales values. When actual rounded sales are between 13,927,000 and 22,836,000, all three basis of analysis tend to provide more over-predicted than under-predicted sales values. Over- and under-predicted sales values for actual rounded sales between 27,628,000 and 37,959,000 dollars are about equal for all three basis of analysis. For actual rounded sales values between 39,293,000 and 83,469,000 dollars, the second basis of analysis provides all over-predicted sales values. The third basis of

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[139]The independent variables used to estimate sales for the third basis of analysis were Occupation-Sales, Years Moved Into Present House-2, and Population.

[140]The independent variable used to estimate sales for the first basis of analysis was Population. Independent variables used in the second basis of analysis were Income-Median, Percent of White Collar Workers in Population, and Percent of Age Group Between 35-54 in the Population.

analysis tends to have more over-predicted than under-predicted, with over- and under-predicted rounded sales being about equal for the first basis of analysis. Thus, it appears from the standpoint of estimating the total rounded retail sales for individual market areas that there tends to be more under-predicted total retail sales than over-predicted when over- and under-predicted sales are obtained by comparing all three estimating equations together. The under-predicted sales might be explained best by variables other than those classified as a demand, such as "promotion" and "percent of retail stores in the SMSA." Thus, more accurate sales predictions might be accomplished by incorporating both demand and supply variables in the estimating equation; however, the three basis of analysis employed consistently show that actual and predicted total rounded sales are highly associated. Finally, the statistical methodology employed in this study has proved to be useful and valid approach to providing an objective and scientific method of analyzing the expected composition of the size and characteristics of the target market for a product and finding the underlying factors which explain best the associated variables describing the size and characteristics of the target market.

## Recommendations

Research undertaken in this study suggests several topics that would be both challenging and interesting research projects in the area of market forecasting. These are as follows: (1) an estimate of total retail sales for furniture, home furnishings, and equipment based on both demand and supply variables with particular emphasis on increasing sales predictions by using supply variables. This approach would require gathering information on the type and amount of marketing expenditures used in different market areas. The project would lead one beyond the scope of Census data and probably require the assistance of a trade association; (2) a cross-sectional analysis to determine if different independent variables are more strongly associated with sales at different levels of sales. It is possible that discriminant analysis might prove to be a useful tool for this type of project; and (3) an investigation dealing with the selection of the size and characteristics of the target market for other product(s) based on the methodology developed in this study.

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# APPENDIX

A. Census Figures for Total Retail Sales of Furniture, Home Furnishings, and Equipment and for the Twenty-six Undeflated Independent Variables

B. Computed Figures Based upon Appendix A for Per Capita Retail Sales of Furniture, Home Furnishings, and Equipment and for the Twenty-five Deflated Independent Variables

C. Three Per Capita Independent Variables Computed to Obtain Per Capita Retail Sales for Furniture, Home Furnishings, and Equipment

APPENDIX A

CENSUS FIGURES FOR TOTAL RETAIL SALES OF FURNITURE, HOME FURNISHINGS, AND EQUIPMENT AND FOR THE TWENTY-SIX UNDEFLATED INDEPENDENT VARIABLES[a]

| SMSAs | Total Retail Sales (000)[b] | Population (000) | Housing Units: All Units (000) | Family Income | | | | Class of Worker[c] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Median | % under 3,000 | % over 10,000 | % between 3,000 and 10,000 | Private Wage and Salary Workers (000) | Government Workers (000) | Self-employed Workers (000) |
| Laredo | 2930 | 65 | 17 | 2952 | 50.7 | 5.6 | 43.7 | 12 | 3 | 2 |
| San Angelo | 3651 | 64 | 22 | 4634 | 22.4 | 10.4 | 6.2 | 16 | 3 | 4 |
| Midland | 4666 | 67 | 22 | 6936 | 13.1 | 24.6 | 62.3 | 20 | 2 | 3 |
| Lawton | 4674 | 91 | 25 | 4624 | 24.6 | 8.7 | 66.7 | 12 | 5 | 3 |
| Gadsden | 4717 | 97 | 30 | 4387 | 31.8 | 7.3 | 60.9 | 23 | 3 | 3 |
| Texarkana | 4933 | 92 | 32 | 3817 | 39.3 | 5.5 | 55.2 | 19 | 7 | 4 |
| Brownsville | 5051 | 151 | 42 | 3216 | 47.2 | 6.9 | 45.9 | 31 | 6 | 6 |
| Tyler | 5058 | 86 | 28 | 4603 | 31.1 | 10.9 | 58.0 | 24 | 3 | 4 |
| Lake Charles | 5372 | 145 | 43 | 5167 | 23.8 | 11.1 | 65.1 | 33 | 5 | 4 |
| Odessa | 5476 | 91 | 29 | 6128 | 14.2 | 14.6 | 71.2 | 26 | 3 | 4 |
| Tuscaloosa | 5632 | 109 | 30 | 4272 | 35.7 | 8.4 | 55.9 | 24 | 7 | 4 |
| Galveston | 6474 | 140 | 51 | 5375 | 23.2 | 11.8 | 65.0 | 38 | 7 | 4 |
| Wichita Falls | 7559 | 130 | 41 | 5276 | 19.9 | 11.9 | 68.2 | 30 | 6 | 6 |
| Fort Smith | 8378 | 67 | 25 | 4241 | 32.6 | 7.4 | 60.0 | 18 | 2 | 3 |
| Monroe | 9320 | 102 | 31 | 4367 | 33.7 | 8.9 | 57.4 | 26 | 4 | 3 |
| Waco | 9896 | 150 | 50 | 4684 | 29.8 | 9.3 | 60.9 | 38 | 7 | 7 |
| Abilene | 9964 | 120 | 40 | 5063 | 23.2 | 11.5 | 65.3 | 29 | 4 | 7 |
| Lexington | 10854 | 132 | 40 | 5377 | 23.6 | 13.5 | 62.9 | 36 | 8 | 5 |
| Huntsville | 11585 | 117 | 33 | 5426 | 27.1 | 17.2 | 55.7 | 23 | 11 | 4 |
| Jackson | 12259 | 187 | 41 | 4783 | 30.9 | 12.6 | 56.5 | 52 | 11 | 7 |
| Columbus | 12573 | 218 | 59 | 4292 | 31.0 | 7.5 | 61.5 | 46 | 9 | 5 |
| Corpus Christi | 12786 | 222 | 68 | 4908 | 28.0 | 12.0 | 59.6 | 53 | 9 | 7 |
| Baton Rouge | 13565 | 230 | 66 | 5830 | 21.9 | 17.2 | 60.9 | 58 | 14 | 6 |
| Montgomery | 13683 | 169 | 49 | 4777 | 31.1 | 12.8 | 56.1 | 41 | 11 | 5 |
| Evansville | 13927 | 199 | 66 | 5181 | 23.1 | 10.3 | 66.6 | 55 | 6 | 7 |

APPENDIX A--Continued

| SMSAs | Total Retail Sales (000)[b] | Population (000) | Housing Units: All Units (000) | Family Income | | | | Class of Worker[c] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Median | % under 3,000 | % over 10,000 | % between 3,000 and 10,000 | Private Wage and Salary Workers (000) | Government Workers (000) | Self-employed Workers (000) |
| Amarillo | 14738 | 149 | 47 | 5820 | 14.8 | 15.4 | 69.8 | 39 | 8 | 7 |
| Austin | 15182 | 212 | 65 | 5058 | 24.8 | 13.3 | 61.9 | 46 | 23 | 8 |
| Little Rock | 17621 | 243 | 76 | 4935 | 26.0 | 11.1 | 62.9 | 65 | 14 | 8 |
| Shreveport | 18150 | 281 | 90 | 4869 | 30.4 | 12.4 | 57.2 | 74 | 11 | 9 |
| Lubbock | 18376 | 156 | 49 | 5425 | 20.0 | 14.6 | 65.4 | 41 | 7 | 9 |
| Chattanooga | 18788 | 283 | 88 | 4958 | 26.0 | 10.7 | 63.3 | 84 | 10 | 9 |
| Beaumont-Port Arthur | 21656 | 306 | 98 | 5910 | 20.1 | 13.1 | 66.8 | 86 | 9 | 9 |
| Knoxville | 22397 | 368 | 113 | 4908 | 27.5 | 10.5 | 62.0 | 98 | 18 | 11 |
| Mobile | 22698 | 314 | 92 | 5132 | 25.4 | 11.7 | 62.9 | 74 | 24 | 8 |
| El Paso | 22836 | 314 | 86 | 5157 | 22.1 | 12.7 | 65.2 | 64 | 16 | 7 |
| Fort Worth | 27628 | 573 | 195 | 5617 | 19.3 | 13.5 | 67.2 | 170 | 23 | 20 |
| Tulsa | 29159 | 419 | 146 | 5729 | 19.7 | 15.1 | 65.2 | 124 | 13 | 17 |
| Nashville | 30783 | 400 | 121 | 5332 | 23.5 | 13.1 | 63.4 | 122 | 19 | 12 |
| San Antonio | 32824 | 687 | 197 | 4766 | 27.2 | 11.0 | 61.8 | 136 | 47 | 20 |
| Memphis | 35060 | 627 | 184 | 4903 | 27.5 | 11.1 | 61.4 | 174 | 29 | 18 |
| Oklahoma City | 37959 | 512 | 173 | 5601 | 18.6 | 14.2 | 67.2 | 130 | 43 | 21 |
| Birmingham | 39293 | 635 | 195 | 5103 | 25.8 | 12.4 | 61.8 | 182 | 20 | 15 |
| Louisville | 43609 | 725 | 224 | 5758 | 17.4 | 14.2 | 68.4 | 210 | 24 | 20 |
| New Orleans | 52113 | 868 | 272 | 5195 | 24.3 | 13.4 | 62.3 | 238 | 37 | 25 |
| Atlanta | 59552 | 1017 | 309 | 5758 | | | | 321 | 44 | 29 |
| Dallas | 72014 | 1084 | 362 | 5925 | 18.6 | 17.7 | 63.7 | 354 | 39 | 46 |
| Cincinnati | 77981 | 1072 | 344 | 6318 | 14.9 | 18.2 | 66.9 | 332 | 36 | 29 |
| Houston | 83469 | 1234 | 408 | 6040 | 18.1 | 17.6 | 64.3 | 386 | 38 | 43 |

APPENDIX A--Continued

| SMSAs | Years Moved into Present House[d] | | | | | Occupation[c] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 (00) | 2 (00) | 3 (00) | 4-6 (00) | 7-10 (00) | Professional, Technical and Kindred (0) | Farmers & Farm Managers (0) | Managers, Office & Proprietor Executives (0) | Clerical & Kindred Workers (0) | Sales (0) | Clerical Foreman & Kindred (0) | Operative & Kindred (0) | Laborers Except Farm and Mine (0) |
| Laredo | 175 | 63 | 43 | 85 | 72 | 135 | 20 | 185 | 217 | 138 | 195 | 213 | 109 |
| San Angelo | 222 | 60 | 46 | 91 | 81 | 246 | 79 | 294 | 301 | 181 | 251 | 273 | 114 |
| Midland | 293 | 85 | 61 | 107 | 72 | 465 | 21 | 343 | 437 | 186 | 305 | 276 | 109 |
| Lawton | 493 | 91 | 47 | 90 | 69 | 210 | 70 | 213 | 301 | 167 | 267 | 223 | 81 |
| Gadsden | 274 | 89 | 74 | 149 | 128 | 227 | 69 | 249 | 302 | 215 | 499 | 681 | 230 |
| Texarkana | 244 | 86 | 66 | 137 | 116 | 263 | 82 | 252 | 406 | 229 | 404 | 483 | 225 |
| Brownsville | 436 | 147 | 112 | 203 | 170 | 346 | 158 | 504 | 430 | 325 | 446 | 700 | 328 |
| Tyler | 242 | 97 | 66 | 149 | 108 | 358 | 89 | 276 | 414 | 245 | 396 | 529 | 161 |
| Lake Charles | 480 | 165 | 107 | 219 | 157 | 440 | 31 | 428 | 491 | 288 | 678 | 765 | 296 |
| Odessa | 399 | 130 | 74 | 137 | 83 | 314 | 7 | 434 | 385 | 276 | 522 | 690 | 148 |
| Tuscaloosa | 319 | 112 | 84 | 154 | 125 | 413 | 99 | 277 | 380 | 217 | 406 | 666 | 225 |
| Galveston | 391 | 152 | 126 | 272 | 174 | 619 | 20 | 490 | 709 | 267 | 674 | 710 | 444 |
| Wichita Falls | 549 | 133 | 87 | 172 | 132 | 504 | 59 | 556 | 591 | 332 | 629 | 587 | 182 |
| Fort Smith | 207 | 56 | 42 | 100 | 81 | 208 | 24 | 301 | 311 | 157 | 282 | 438 | 103 |
| Monroe | 307 | 106 | 78 | 174 | 120 | 344 | 31 | 357 | 395 | 277 | 447 | 559 | 220 |
| Waco | 501 | 159 | 116 | 209 | 175 | 553 | 153 | 507 | 723 | 463 | 651 | 823 | 249 |
| Abilene | 469 | 143 | 105 | 158 | 113 | 446 | 181 | 483 | 526 | 363 | 518 | 629 | 178 |
| Lexington | 440 | 170 | 123 | 217 | 139 | 730 | 86 | 440 | 728 | 460 | 554 | 587 | 210 |
| Huntsville | 490 | 149 | 97 | 150 | 92 | 692 | 163 | 291 | 545 | 234 | 544 | 476 | 166 |
| Jackson | 550 | 201 | 141 | 329 | 226 | 917 | 186 | 754 | 1110 | 540 | 739 | 863 | 331 |
| Columbus | 892 | 283 | 146 | 272 | 188 | 480 | 70 | 569 | 700 | 460 | 682 | 1421 | 316 |
| Corpus Christi | 709 | 247 | 183 | 413 | 267 | 807 | 102 | 682 | 971 | 544 | 894 | 982 | 454 |
| Baton Rouge | 664 | 245 | 182 | 368 | 267 | 1184 | 24 | 786 | 1178 | 522 | 1071 | 982 | 458 |
| Montgomery | 568 | 183 | 126 | 264 | 196 | 658 | 113 | 550 | 915 | 456 | 594 | 678 | 327 |
| Evansville | 489 | 199 | 154 | 364 | 258 | 534 | 8 | 439 | 740 | 450 | 675 | 1061 | 202 |

APPENDIX A--Continued

| SMSAs | Years Moved into Present House[d] 1 (00) | 2 (00) | 3 (00) | 4-6 (00) | 7-10 (00) | Occupation[c] Professional, Technical and Kindred (0) | Farmers & Farm Managers (0) | Managers, Office & Proprietor Executives (0) | Clerical & Kindred Workers (0) | Sales (0) | Clerical Foreman & Kindred (0) | Operative & Kindred (0) | Laborers Except Farm and Mine (0) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amarillo | 625 | 174 | 109 | 208 | 177 | 601 | 83 | 633 | 881 | 473 | 743 | 720 | 260 |
| Austin | 758 | 250 | 170 | 317 | 248 | 1282 | 94 | 745 | 1471 | 571 | 850 | 695 | 309 |
| Little Rock | 797 | 279 | 183 | 357 | 254 | 960 | 56 | 939 | 1334 | 750 | 1098 | 1364 | 413 |
| Shreveport | 922 | 330 | 203 | 439 | 310 | 1051 | 96 | 999 | 1314 | 689 | 1066 | 1265 | 517 |
| Lubbock | 670 | 192 | 122 | 233 | 145 | 620 | 218 | 688 | 766 | 548 | 767 | 682 | 297 |
| Chattanooga | 814 | 326 | 237 | 472 | 333 | 1026 | 97 | 863 | 1344 | 735 | 1400 | 2439 | 557 |
| Beaumont - Port Arthur | 876 | 328 | 257 | 511 | 366 | 1184 | 55 | 916 | 1247 | 719 | 1818 | 1871 | 802 |
| Knoxville | 940 | 392 | 304 | 609 | 482 | 1715 | 178 | 1001 | 1666 | 961 | 1880 | 2449 | 616 |
| Mobile | 941 | 323 | 243 | 514 | 338 | 1048 | 63 | 1024 | 1674 | 706 | 1622 | 1629 | 842 |
| El Paso | 1275 | 389 | 262 | 458 | 277 | 1094 | 48 | 969 | 1425 | 695 | 1150 | 1206 | 481 |
| Fort Worth | 1864 | 670 | 481 | 1035 | 702 | 2813 | 181 | 1914 | 3522 | 1702 | 3083 | 3368 | 909 |
| Tulsa | 1230 | 470 | 365 | 781 | 529 | 2026 | 163 | 1539 | 2635 | 1341 | 2363 | 2223 | 554 |
| Nashville | 1206 | 468 | 343 | 677 | 506 | 1757 | 70 | 1354 | 2694 | 1235 | 1987 | 2577 | 673 |
| San Antonio | 2771 | 693 | 533 | 1089 | 822 | 2215 | 154 | 1984 | 3579 | 1673 | 2954 | 2943 | 1271 |
| Memphis | 1975 | 724 | 493 | 1076 | 801 | 2056 | 164 | 1945 | 3498 | 1886 | 2550 | 3785 | 1294 |
| Oklahoma City | 1676 | 588 | 409 | 869 | 663 | 2539 | 239 | 1960 | 3557 | 1695 | 2827 | 2377 | 788 |
| Birmingham | 577 | 677 | 513 | 1066 | 827 | 2220 | 49 | 1913 | 3221 | 1808 | 3136 | 3877 | 1505 |
| Louisville | 1905 | 866 | 626 | 1395 | 864 | 2627 | 171 | 2089 | 3912 | 2041 | 3549 | 5207 | 1348 |
| New Orleans | 2179 | 908 | 784 | 1538 | 1190 | 3420 | 47 | 2920 | 5047 | 2297 | 3592 | 4358 | 2226 |
| Atlanta | 2928 | 1225 | 908 | 1843 | 1290 | 4436 | 242 | 3929 | 7358 | 3458 | 4741 | 6237 | 1776 |
| Dallas | 3657 | 1271 | 935 | 1947 | 1303 | 5136 | 525 | 4584 | 8032 | 3886 | 5526 | 6590 | 1770 |
| Cincinnati | 2761 | 1246 | 958 | 2021 | 1314 | 4755 | 121 | 3293 | 6651 | 3246 | 5369 | 7184 | 1792 |
| Houston | 3751 | 1393 | 1049 | 2382 | 1630 | 5898 | 151 | 4548 | 7517 | 3685 | 6514 | 6787 | 2596 |

| SMSAs | Marital Status Individuals 14 Years Old and Over[f] | | | |
|---|---|---|---|---|
| | Single (00) | Married (00) | Separated (00) | Divorced (00) |
| Laredo | 123 | 119 | 7 | 9 |
| San Angelo | 89 | 154 | 5 | 16 |
| Midland | 69 | 164 | 7 | 15 |
| Lawton | 170 | 218 | 7 | 18 |
| Gadsden | 126 | 233 | 12 | 17 |
| Texarkana | 120 | 221 | 12 | 19 |
| Brownsville | 249 | 291 | 17 | 20 |
| Tyler | 112 | 211 | 10 | 7 |
| Lake Charles | 187 | 336 | 20 | 18 |
| Odessa | 88 | 227 | 9 | 19 |
| Tuscaloosa | 217 | 231 | 21 | 19 |
| Galveston | 186 | 331 | 19 | 38 |
| Wichita Falls | 186 | 318 | 12 | 31 |
| Fort Smith | 87 | 164 | 6 | 13 |
| Monroe | 136 | 226 | 25 | 18 |
| Waco | 218 | 360 | 16 | 36 |
| Abilene | 177 | 296 | 10 | 22 |
| Lexington | 223 | 307 | 18 | 36 |
| Huntsville | 166 | 274 | 13 | 16 |
| Jackson | 282 | 407 | 40 | 32 |
| Columbus | 337 | 492 | 48 | 38 |
| Corpus Christi | 303 | 482 | 25 | 43 |
| Baton Rouge | 365 | 504 | 42 | 35 |
| Montgomery | 255 | 372 | 37 | 33 |
| Evansville | 267 | 480 | 16 | 47 |
| Amarillo | 213 | 364 | 14 | 34 |
| Austin | 423 | 458 | 22 | 54 |
| Little Rock | 327 | 580 | 32 | 63 |
| Shreveport | 357 | 642 | 70 | 50 |
| Lubbock | 217 | 368 | 13 | 29 |
| Chattanooga | 379 | 675 | 43 | 63 |
| Beaumont - Port Arthur | 383 | 738 | 34 | 67 |
| Knoxville | 567 | 874 | 32 | 75 |
| Mobile | 451 | 687 | 60 | 57 |
| El Paso | 491 | 671 | 30 | 62 |
| Fort Worth | 657 | 1430 | 56 | 144 |

| SMSAs | Marital Status Individuals 14 Years Old and Over[f] Single (00) | Married (00) | Separated (00) | Divorced (00) |
|---|---|---|---|---|
| Tulsa | 491 | 1041 | 31 | 116 |
| Nashville | 621 | 938 | 59 | 91 |
| San Antonio | 1132 | 1465 | 74 | 173 |
| Memphis | 882 | 1414 | 155 | 118 |
| Oklahoma City | 658 | 1250 | 43 | 152 |
| Birmingham | 859 | 1475 | 119 | 116 |
| Louisville | 974 | 1699 | 90 | 162 |
| New Orleans | 1319 | 1943 | 212 | 168 |
| Atlanta | 1411 | 1720 | 200 | 141 |
| Dallas | 1339 | 2650 | 130 | 291 |
| Cincinnati | 1612 | 2501 | 147 | 222 |
| Houston | 1504 | 2976 | 178 | 329 |

[a]Census figures were collected from U.S. Bureau of the Census, U.S. Census of Population: 1960. Vol. I, "Characteristics of Population," Parts 1, 2, 5, 12, 19, 20, 26, 37, 38, 44, and 45. U.S. Bureau of Census, U.S. Census of Housing: 1960. Vol. I. Unless otherwise indicated all figures are for the year 1960.

[b]Census of Business, Retail Trade Area Statistics: 1963. Vol. II, Parts 1, 2, 3. Total retail sales figures for furniture, home furnishings, and equipment are for 1963 dollar values.

[c]Class of worker figures include both male and female.

[d]As recorded in Census Data "1" is 1959-1960, "2" is 1958, "3" is 1957, "4-6" is 1954 to 1956, "7-10" is 1950 to 1953.

[e]Occupation of worker figures include both female and male.

[f]Marital Status figures included both male and female.

APPENDIX B

COMPUTED FIGURES BASED UPON APPENDIX A FOR PER CAPITA RETAIL SALES OF FURNITURE, HOME FURNISHINGS, AND EQUIPMENT AND FOR THE TWENTY-FIVE DEFLATED INDEPENDENT VARIABLES[a]

| SMSAs | Per Capita Retail Sales | Housing Units: All Housing | Family Income[b] Median | % under 3,000 | % over 10,000 | % between 3,000 and 10,000 | Class of Worker: Private Wage & Salary Wkrs. | Gov't Wkrs. | Self-Emp. Wkrs. | Years Moved into Present House: 1 | 2 | 3 | 4-6 | 7-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Laredo | 45.06 | 26.15 | 2952 | 50.7 | 5.6 | 43.7 | 18.46 | 4.62 | 3.08 | 26.92 | 9.69 | 6.62 | 13.08 | 11.08 |
| San Angelo | 57.04 | 34.38 | 4634 | 28.4 | 28.4 | 61.2 | 25.00 | 4.69 | 6.25 | 34.69 | 9.38 | 7.19 | 14.22 | 12.66 |
| Midland | 69.64 | 32.84 | 6936 | 13.1 | 24.6 | 62.3 | 29.85 | 2.99 | 4.48 | 43.73 | 12.69 | 9.10 | 15.97 | 10.75 |
| Lawton | 51.36 | 27.47 | 4624 | 24.6 | 8.7 | 66.7 | 13.19 | 5.49 | 3.30 | 54.18 | 10.00 | 5.16 | 9.09 | 7.58 |
| Gadsden | 48.63 | 30.93 | 4387 | 31.8 | 7.3 | 60.9 | 23.71 | 3.09 | 3.09 | 28.25 | 9.18 | 7.63 | 16.37 | 13.20 |
| Texarkana | 63.62 | 34.78 | 3817 | 39.3 | 5.5 | 55.2 | 20.65 | 7.61 | 4.35 | 26.52 | 9.35 | 7.17 | 14.89 | 12.61 |
| Brownsville | 33.45 | 27.81 | 3216 | 47.2 | 6.9 | 45.9 | 20.53 | 3.97 | 3.97 | 28.87 | 9.74 | 7.42 | 13.44 | 11.26 |
| Tyler | 58.81 | 32.57 | 4603 | 31.1 | 10.9 | 58.0 | 27.91 | 3.49 | 4.65 | 28.14 | 11.28 | 7.67 | 17.33 | 12.56 |
| Lake Charles | 37.05 | 29.66 | 5167 | 23.8 | 11.1 | 65.1 | 22.76 | 3.45 | 2.76 | 33.10 | 11.38 | 7.39 | 15.10 | 10.83 |
| Odessa | 60.18 | 31.87 | 6128 | 14.2 | 14.6 | 71.2 | 28.57 | 3.30 | 4.40 | 43.85 | 14.29 | 8.13 | 15.05 | 9.12 |
| Tuscaloosa | 51.67 | 27.52 | 4272 | 35.7 | 8.4 | 55.9 | 22.02 | 6.42 | 3.67 | 29.27 | 10.28 | 7.71 | 14.13 | 11.47 |
| Galveston | 46.24 | 36.48 | 5375 | 23.2 | 11.8 | 65.0 | 27.14 | 5.00 | 2.86 | 27.93 | 10.86 | 9.00 | 19.43 | 12.43 |
| Wichita Falls | 48.15 | 31.54 | 5276 | 19.9 | 11.9 | 68.2 | 23.08 | 4.62 | 4.62 | 42.23 | 10.23 | 6.69 | 13.23 | 38.77 |
| Fort Smith | 25.04 | 37.31 | 4241 | 32.6 | 7.4 | 60.0 | 26.87 | 2.99 | 4.48 | 30.90 | 8.36 | 6.27 | 14.93 | 12.09 |
| Monroe | 91.37 | 30.39 | 4367 | 33.7 | 8.9 | 57.4 | 25.49 | 3.92 | 2.94 | 30.10 | 10.39 | 7.65 | 17.06 | 11.76 |
| Waco | 65.97 | 33.33 | 4684 | 29.8 | 9.3 | 60.9 | 25.33 | 4.66 | 4.66 | 33.40 | 10.60 | 7.73 | 13.93 | 11.67 |
| Abilene | 83.03 | 33.33 | 5063 | 23.2 | 11.5 | 65.3 | 24.17 | 3.33 | 5.83 | 39.08 | 11.92 | 8.75 | 13.17 | 9.42 |
| Lexington | 82.23 | 30.30 | 5377 | 23.6 | 13.5 | 62.9 | 27.27 | 6.06 | 3.79 | 33.33 | 12.88 | 9.32 | 16.44 | 10.53 |
| Huntsville | 99.02 | 28.21 | 5426 | 27.1 | 17.2 | 55.7 | 19.66 | 9.40 | 3.42 | 41.88 | 12.74 | 8.29 | 12.82 | 7.86 |
| Jackson | 65.56 | 21.93 | 4783 | 30.9 | 12.6 | 56.5 | 27.81 | 5.88 | 3.74 | 29.41 | 10.75 | 7.54 | 17.59 | 12.09 |
| Columbus | 57.67 | 27.06 | 4292 | 31.0 | 7.5 | 61.5 | 21.10 | 4.13 | 2.29 | 40.92 | 12.98 | 6.70 | 12.48 | 8.62 |
| Corpus Christi | 57.59 | 30.63 | 4908 | 28.4 | 12.0 | 59.6 | 23.87 | 4.05 | 3.15 | 31.94 | 11.13 | 8.24 | 18.60 | 12.03 |
| Baton Rouge | 15.50 | 28.70 | 5830 | 21.9 | 17.2 | 60.9 | 25.22 | 6.09 | 2.61 | 28.87 | 10.65 | 7.91 | 16.00 | 11.61 |
| Montgomery | 21.79 | 28.99 | 4777 | 31.1 | 12.8 | 56.1 | 24.26 | 6.51 | 2.96 | 33.61 | 10.83 | 7.46 | 15.62 | 11.60 |
| Evansville | 69.98 | 33.17 | 5181 | 23.1 | 10.3 | 66.6 | 27.64 | 3.02 | 3.52 | 24.57 | 10.00 | 7.74 | 18.29 | 12.96 |

APPENDIX B--Continued

| SMSAs | Per Capita Retail Sales | Housing Units: All Housing | Family Income: Median | Family Income: % under 3,000 | Family Income: % over 10,000 | Family Income: % between 3,000 and 10,000 | Class of Worker: Private Wage & Salary Wkrs. | Class of Worker: Gov't Wkrs. | Class of Worker: Self-emp. Wkrs. | Years Moved into Present House: 1 | 2 | 3 | 4-6 | 7-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amarillo | 98.91 | 31.54 | 5820 | 14.8 | 15.4 | 69.8 | 26.17 | 5.37 | 4.70 | 41.95 | 11.68 | 7.32 | 13.96 | 11.88 |
| Austin | 71.61 | 30.66 | 5058 | 24.8 | 13.3 | 61.9 | 21.70 | 10.85 | 3.77 | 37.52 | 11.79 | 8.02 | 14.95 | 11.70 |
| Little Rock | 72.51 | 31.28 | 4935 | 26.0 | 11.9 | 62.9 | 26.75 | 5.76 | 3.29 | 32.80 | 11.48 | 12.80 | 14.69 | 10.45 |
| Shreveport | 64.59 | 32.03 | 4869 | 30.4 | 12.4 | 57.2 | 26.33 | 3.91 | 3.20 | 32.81 | 11.74 | 7.22 | 15.62 | 11.03 |
| Lubbock | 117.79 | 31.41 | 5425 | 20.0 | 14.6 | 65.4 | 26.28 | 4.49 | 5.77 | 42.95 | 12.31 | 7.82 | 14.94 | 9.29 |
| Chattanooga | 66.39 | 31.10 | 4958 | 26.0 | 10.7 | 63.3 | 29.68 | 3.53 | 3.18 | 28.76 | 11.52 | 8.37 | 16.68 | 11.37 |
| Beaumont - Port Arthur | 70.77 | 32.03 | 5910 | 20.1 | 13.1 | 66.8 | 28.10 | 2.94 | 2.94 | 28.63 | 10.72 | 8.40 | 16.70 | 11.96 |
| Knoxville | 60.86 | 30.71 | 4908 | 27.5 | 10.5 | 62.0 | 26.63 | 4.89 | 2.99 | 25.54 | 10.65 | 8.26 | 16.55 | 13.10 |
| Mobile | 72.29 | 29.30 | 5132 | 25.4 | 11.7 | 62.9 | 23.57 | 7.64 | 2.55 | 29.97 | 10.29 | 7.74 | 16.37 | 10.76 |
| El Paso | 72.73 | 27.39 | 5157 | 22.1 | 12.7 | 65.2 | 20.38 | 5.10 | 2.23 | 40.61 | 12.39 | 8.34 | 14.59 | 8.82 |
| Fort Worth | 48.22 | 34.03 | 5617 | 19.3 | 13.5 | 67.2 | 29.67 | 4.01 | 3.49 | 32.53 | 11.69 | 8.39 | 18.06 | 12.25 |
| Tulsa | 69.59 | 34.84 | 5729 | 19.7 | 15.1 | 65.2 | 29.59 | 3.10 | 4.06 | 29.36 | 11.22 | 8.71 | 18.64 | 12.63 |
| Nashville | 76.96 | 30.25 | 5332 | 23.5 | 13.1 | 63.4 | 30.50 | 4.75 | 3.00 | 30.15 | 11.70 | 8.58 | 16.93 | 12.65 |
| San Antonio | 47.78 | 28.68 | 4766 | 27.2 | 11.0 | 61.8 | 19.80 | 6.84 | 2.91 | 40.33 | 10.09 | 7.76 | 15.85 | 11.97 |
| Memphis | 55.92 | 29.35 | 4903 | 27.5 | 11.1 | 61.4 | 27.75 | 4.63 | 2.87 | 31.50 | 11.55 | 7.86 | 17.16 | 12.78 |
| Oklahoma City | 74.14 | 33.79 | 5601 | 18.6 | 14.2 | 67.2 | 25.39 | 8.40 | 4.10 | 32.73 | 11.48 | 7.99 | 16.97 | 12.95 |
| Birmingham | 61.88 | 30.71 | 5130 | 25.8 | 12.4 | 61.8 | 28.66 | 3.15 | 2.36 | 9.09 | 10.66 | 8.08 | 16.79 | 13.02 |
| Louisville | 60.15 | 30.90 | 5758 | 17.4 | 14.2 | 68.4 | 28.97 | 3.31 | 2.76 | 26.28 | 11.94 | 8.63 | 19.24 | 11.92 |
| New Orleans | 60.03 | 31.34 | 5195 | 24.3 | 13.4 | 62.3 | 27.42 | 4.26 | 2.88 | 25.10 | 10.46 | 9.03 | 17.72 | 13.71 |
| Atlanta | 58.56 | 30.38 | 5758 | 37.3 | 8.6 | 54.1 | 31.56 | 4.33 | 2.85 | 28.79 | 12.05 | 8.93 | 18.12 | 12.68 |
| Dallas | 66.43 | 33.39 | 5925 | 18.6 | 17.7 | 63.7 | 32.66 | 3.60 | 4.24 | 33.74 | 11.73 | 8.63 | 17.96 | 12.02 |
| Cincinnati | 72.74 | 32.09 | 6318 | 14.9 | 18.2 | 66.9 | 30.97 | 3.36 | 2.71 | 25.76 | 11.62 | 8.94 | 18.85 | 12.26 |
| Houston | 67.64 | 33.06 | 6040 | 18.1 | 17.6 | 64.3 | 31.28 | 3.08 | 3.48 | 30.40 | 11.29 | 8.50 | 19.30 | 13.21 |

APPENDIX B--Continued

| SMSAs | Occupation | | | | | | | | Marital Status - Individuals 14 Years Old and Over | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Professional, Technical, Kindred | Farmers & Farm Managers | Managers, Office & Proprietor Executives | Clerical and Kindred Workers | Sales | Clerical, Foreman, & Kindred | Operative & Kindred | Laborers, Except Farm & Mine | Single | Married | Separated | Divorced |
| Laredo | 2.08 | .31 | 2.85 | 3.34 | 2.12 | 3.00 | 3.28 | 1.68 | 18.92 | 18.31 | 1.08 | 1.38 |
| San Angelo | 3.84 | .12 | 4.59 | 4.70 | 2.83 | 3.92 | 4.27 | 1.78 | 13.91 | 24.06 | .78 | 2.50 |
| Midland | 6.94 | .31 | 5.12 | 6.52 | 2.78 | 4.55 | 4.12 | 1.63 | 10.30 | 24.48 | 1.04 | 2.24 |
| Lawton | 2.31 | .77 | 2.34 | 3.31 | 1.84 | 2.93 | 2.45 | .89 | 18.68 | 23.96 | .77 | 1.98 |
| Gadsden | 2.34 | .71 | 2.57 | 3.11 | 2.22 | 5.14 | 7.02 | 2.37 | 12.99 | 24.02 | 1.24 | 1.75 |
| Texarkana | 2.86 | .89 | 2.74 | 4.41 | 2.49 | 4.39 | 5.25 | 2.45 | 13.04 | 24.02 | 1.63 | 2.07 |
| Brownsville | 2.29 | 1.05 | 3.34 | 2.85 | 2.15 | 2.95 | 4.64 | 2.17 | 16.49 | 19.27 | 1.13 | 1.32 |
| Tyler | 4.16 | 1.03 | 3.21 | 4.81 | 2.85 | 4.60 | 6.15 | 1.87 | 13.02 | 24.53 | 1.16 | .81 |
| Lake Charles | 3.03 | .21 | 2.95 | 3.39 | 1.99 | 4.68 | 5.28 | 2.04 | 12.90 | 23.17 | 1.38 | 1.24 |
| Odessa | 3.45 | .08 | 4.77 | 4.23 | 3.03 | 5.74 | 7.58 | 1.63 | 9.67 | 24.95 | .99 | 2.09 |
| Tuscaloosa | 3.79 | .91 | 2.54 | 3.49 | 1.99 | 3.72 | 6.11 | 2.06 | 19.91 | 21.19 | 1.93 | 1.74 |
| Galveston | 4.42 | .14 | 3.50 | 5.06 | 1.91 | 4.81 | 5.07 | 3.17 | 13.29 | 23.64 | 1.36 | 2.71 |
| Wichita Falls | 3.88 | .45 | 4.28 | 4.55 | 2.55 | 4.84 | 4.52 | 1.40 | 14.31 | 24.46 | .92 | 2.38 |
| Fort Smith | 3.10 | .36 | 4.49 | 4.64 | 2.34 | 4.21 | 6.54 | 1.54 | 12.99 | 24.48 | .90 | 1.94 |
| Monroe | 3.37 | .30 | 3.50 | 3.87 | 2.72 | 4.38 | 5.48 | 2.16 | 13.33 | 22.16 | 2.45 | 1.76 |
| Waco | 3.69 | 1.02 | 3.38 | 4.82 | 3.09 | 4.34 | 5.49 | 1.66 | 14.53 | 24.00 | 1.07 | 2.40 |
| Abilene | 3.72 | 1.51 | 4.03 | 4.38 | 3.03 | 4.32 | 5.24 | 1.48 | 14.75 | 24.67 | .83 | 1.83 |
| Lexington | 5.53 | .65 | 3.33 | 5.52 | 3.48 | 4.20 | 4.45 | 1.59 | 16.89 | 23.26 | 1.36 | 2.73 |
| Huntsville | 5.91 | 1.39 | 2.49 | 4.66 | 2.00 | 4.65 | 4.07 | 1.42 | 14.19 | 23.42 | 1.11 | 1.37 |
| Jackson | 4.90 | .99 | 4.03 | 5.94 | 2.89 | 3.95 | 4.61 | 1.77 | 15.08 | 21.76 | 2.14 | 1.71 |
| Columbus | 2.20 | .32 | 2.61 | 3.21 | 2.11 | 3.13 | 6.52 | 1.45 | 15.46 | 22.57 | 2.20 | 1.74 |
| Corpus Christi | 3.64 | .46 | 3.07 | 4.37 | 2.45 | 4.03 | 4.42 | 2.05 | 13.65 | 21.71 | 1.13 | 1.94 |
| Baton Rouge | 5.15 | .10 | 3.42 | 5.12 | 2.27 | 4.66 | 4.27 | 1.99 | 15.87 | 21.91 | 1.83 | 1.52 |
| Montgomery | 3.89 | .67 | 3.25 | 5.41 | 2.70 | 3.51 | 4.01 | 1.93 | 15.09 | 22.01 | 2.19 | 1.95 |
| Evansville | 2.68 | .04 | 2.21 | 3.72 | 2.26 | 3.39 | 5.33 | 1.02 | 13.42 | 24.12 | .80 | 2.36 |
| Amarillo | 4.03 | .56 | 4.25 | 4.97 | 3.17 | 4.99 | 4.83 | 1.74 | 14.30 | 24.43 | .94 | 2.28 |
| Austin | 6.05 | .44 | 3.51 | 6.94 | 2.69 | 4.01 | 3.28 | 1.46 | 19.95 | 21.60 | 1.04 | 2.55 |
| Little Rock | 3.95 | .23 | 3.86 | 5.49 | 3.09 | 4.52 | 5.61 | 1.70 | 13.46 | 23.87 | 1.32 | 2.59 |
| Shreveport | 3.74 | .34 | 3.56 | 4.68 | 2.45 | 3.79 | 4.50 | 1.84 | 12.70 | 22.85 | 2.49 | 1.78 |

APPENDIX B--Continued

| SMSAs | Occupation | | | | | | | | Marital Status - Individuals 14 Years Old and Over | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Professional, Technical, Kindred | Farmers & Farm Managers | Managers, Office & Proprietor Executives | Clerical and Kindred Workers | Sales | Clerical, Foreman, & Kindred | Operative & Kindred | Laborers, Except Farm & Mine | Single | Married | Separated | Divorced |
| Lubbock | 3.97 | 1.40 | 4.41 | 4.91 | 3.51 | 4.92 | 4.37 | 1.90 | 13.91 | 23.59 | .83 | 1.86 |
| Chattanooga | 3.63 | .34 | 3.05 | 4.75 | 2.60 | 4.95 | 8.62 | 1.97 | 13.39 | 23.85 | 1.52 | 2.23 |
| Beaumont - Port Arthur | 3.87 | .18 | 2.99 | 4.08 | 2.35 | 5.94 | 6.11 | 2.62 | 12.52 | 24.12 | 1.11 | 2.19 |
| Knoxville | 4.66 | .48 | 2.72 | 4.53 | 2.61 | 5.11 | 6.65 | 1.67 | 15.41 | 23.75 | .87 | 2.04 |
| Mobile | 3.34 | .20 | 2.78 | 5.33 | 2.25 | 5.17 | 5.19 | 2.68 | 14.36 | 21.88 | 1.91 | 1.82 |
| El Paso | 3.48 | .15 | 3.09 | 4.54 | 2.21 | 3.66 | 3.84 | 1.53 | 15.64 | 21.37 | .96 | 1.97 |
| Fort Worth | 4.91 | .32 | 3.34 | 6.15 | 2.97 | 3.38 | 5.88 | 1.59 | 11.47 | 24.96 | .98 | 2.51 |
| Tulsa | 4.84 | .39 | 3.67 | 6.29 | 3.20 | 5.64 | 5.31 | 1.32 | 11.72 | 24.84 | .74 | 2.77 |
| Nashville | 4.39 | .18 | 3.39 | 6.74 | 3.09 | 4.97 | 6.44 | 1.68 | 15.53 | 23.45 | 1.48 | 2.28 |
| San Antonio | 3.22 | .22 | 2.89 | 5.21 | 2.44 | 4.30 | 4.28 | 1.85 | 16.48 | 21.32 | 1.08 | 2.52 |
| Memphis | 3.28 | .26 | 3.10 | 5.58 | 3.01 | 4.07 | 6.04 | 2.06 | 14.07 | 22.55 | 2.47 | 1.88 |
| Oklahoma City | 4.96 | .47 | 3.83 | 6.95 | 3.31 | 5.52 | 4.64 | 1.54 | 12.85 | 24.41 | .84 | 2.97 |
| Birmingham | 3.50 | .08 | 3.01 | 5.07 | 2.85 | 4.94 | 6.11 | 2.37 | 13.53 | 23.23 | 1.87 | 1.83 |
| Louisville | 3.62 | .25 | 2.88 | 5.40 | 2.82 | 4.90 | 7.18 | 1.86 | 13.43 | 23.43 | 1.24 | 2.23 |
| New Orleans | 3.94 | .05 | 3.36 | 5.81 | 2.65 | 4.14 | 5.02 | 2.56 | 15.20 | 22.38 | 2.44 | 1.94 |
| Atlanta | 4.36 | .24 | 3.86 | 7.24 | 3.40 | 4.66 | 6.13 | 1.75 | 13.87 | 16.91 | 1.97 | 1.39 |
| Dallas | 4.74 | .48 | 4.23 | 7.41 | 3.58 | 5.10 | 6.08 | 1.63 | 12.35 | 24.45 | 1.20 | 2.68 |
| Cincinnati | 4.44 | .11 | 3.07 | 6.21 | 3.03 | 5.01 | 6.70 | 1.67 | 15.04 | 23.33 | 1.37 | 2.07 |
| Houston | 4.78 | .12 | 3.69 | 6.09 | 2.99 | 5.28 | 5.50 | 2.10 | 12.19 | 24.12 | 1.44 | 2.67 |

[a]Per capita retail sales figures and deflated independent variable figures were obtained by dividing the values for these variables in Appendix A by their corresponding population values in Appendix A.

[b]These figures are listed as given in the Census Data. They were not divided by the population values given in Appendix A.

## APPENDIX C

### THREE PER CAPITA INDEPENDENT VARIABLES COMPUTED TO OBTAIN PER CAPITA RETAIL SALES FOR FURNITURE, HOME FURNISHINGS, AND EQUIPMENT

| SMSAs | Family Income Median[a] | % of White Collar Workers in the Population[b] | % of Age Group Between 35-54 in the Population[c] |
|---|---|---|---|
| Laredo | 2952 | 2.65 | .20 |
| San Angelo | 4634 | 9.59 | .23 |
| Midland | 6936 | 3.51 | .25 |
| Lawton | 4624 | 3.46 | .20 |
| Gadsden | 4387 | 16.39 | .26 |
| Texarkana | 3817 | 11.03 | .25 |
| Brownsville | 3216 | 7.46 | .19 |
| Tyler | 4603 | 17.70 | .24 |
| Lake Charles | 5167 | 18.16 | .22 |
| Odessa | 6128 | 7.30 | .24 |
| Tuscaloosa | 4272 | 12.92 | .22 |
| Galveston | 5375 | 18.45 | .26 |
| Wichita Falls | 5276 | 7.03 | .22 |
| Fort Smith | 4241 | 30.69 | .25 |
| Monroe | 4367 | 14.45 | .23 |
| Waco | 4684 | 15.43 | .25 |
| Abilene | 5063 | 8.50 | .23 |
| Lexington | 5377 | 26.82 | .24 |
| Huntsville | 5426 | 36.50 | .22 |

APPENDIX C--Continued

| SMSAs | Family Income Median[a] | % of White Collar Workers in the Population[b] | % of Age Group Between 35-54 in the Population[c] |
|---|---|---|---|
| Jackson | 4783 | 16.45 | .23 |
| Columbus | 4292 | 12.41 | .22 |
| Corpus Christi | 4908 | 13.72 | .23 |
| Baton Rouge | 5830 | 24.53 | .23 |
| Montgomery | 4777 | 24.00 | .24 |
| Evansville | 5181 | 35.70 | .25 |
| Amarillo | 5820 | 10.49 | .23 |
| Austin | 5058 | 9.91 | .22 |
| Little Rock | 4935 | 17.00 | .25 |
| Shreveport | 4869 | 8.98 | .23 |
| Lubbock | 5425 | 10.16 | .21 |
| Chattanooga | 4958 | 28.62 | .25 |
| Beaumont - Port Arthur | 5910 | 28.18 | .25 |
| Knoxville | 4908 | 19.99 | .26 |
| Mobile | 5132 | 11.77 | .24 |
| El Paso | 5157 | 9.92 | .20 |
| Fort Worth | 5617 | 30.10 | .25 |
| Tulsa | 5729 | 23.41 | .25 |
| Nashville | 5332 | 31.03 | .25 |
| San Antonio | 4766 | 9.65 | .22 |

APPENDIX C--Continued

| SMSAs | Family Income Median[a] | % of White Collar Workers in the Population[b] | % of Age Group Between 35-54 in the Population[c] |
|---|---|---|---|
| Memphis | 4903 | 21.05 | .24 |
| Oklahoma City | 5601 | 18.75 | .24 |
| Birmingham | 5130 | 25.82 | .25 |
| Louisville | 5758 | 30.92 | .26 |
| New Orleans | 5195 | 14.50 | .25 |
| Atlanta | 5758 | 27.15 | .25 |
| Dallas | 5925 | 33.72 | .25 |
| Cincinnati | 6318 | 50.23 | .25 |
| Houston | 6040 | 31.01 | .26 |

[a]Figures were obtained from Appendix A.

[b]Figures are 1963 figures obtained by subtracting "All employees" from "Production Workers" for manufacturers, 1963 and then dividing this value by its corresponding population for each SMSA. Source: U.S. Bureau of Census, County and City Data Book: 1967.

[c]Figures were obtained by adding the age groups 35-39, 40-44, 45-49, and 50-54. Source: U.S. Bureau of Census, U.S. Census of Population: 1960, Vol. I, Part I, Characteristics of the Population.