GROWTH VS. NONGROWTH TOWNS
IN WESTERN KANSAS

763

by

GEORGE DUANE JOHNSON

B.A., Fort Lewis College, 1965

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARTS

Department of Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1967

Approved by:

M Jarvin Emerson

Major Professor

PREFACE

This study was initiated as a pilot study designed to identify variables of sufficient reliability to use as indicators in predicting town growth using time series data. These long run projections still must be done.

However, some highly significant variables were found yet the multiple correlation coefficient remained very low--similar to previous studies using somewhat different variables.

This low multiple correlation coefficient can be improved in two ways. First, additional independent variables can be added to the model to try and increase the explained variation. The second possible approach, the one used in this study, is based on the hypothesis that two distinct town populations exist.

If a stratification is provided which produces the dichotomous population of towns suspected to exist, the stratification could be of great interest in and of itself. Therefore, determination and evaluation of the strata is the theme throughout this study.

I want to express my appreciation to Dr. Jarvin Emerson for the time and effort spent in helping formulate this paper into something presentable. Much encouragement and many hours were invested in the early stages of this paper by Dr. Donald Erickson who volunteered for the unfortunate task of reading the first draft and for which I am very grateful.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF ILLUSTRATIONS

CHAPTER I

INTRODUCTION

There has been a general rise of interest, especially over the last ten years, in the problems of space in relation to economic activities.[1] Some of this current interest arises from works that have dealt with spatial order in market and nonmarket systems.[2] The major source of this interest, however, is in the demand for solutions to problems related to spatial order. It is believed that certain actions by individuals and groups of individuals can influence the long run solution of the system of markets and distribution facilities in existence, i.e., man can and should attempt to control the social and economic system to his best advantage.

---

[1]See Donald R. Gilmore, "Developing the 'Little' Economies," (Supplementary Paper No. 10; New York: Committee for Economic Development, 1960), pp. 13-16.

[2]The Determination of land value (rent) was investigated by John Heinrich von Thünen, Der Isolierte Staat In Beziehung auf Landwirtschaft und National ökonomie (3rd ed.; Berlin: Schumacher-Zarchlin, 1875); location of business enterprises independent of the system of institutions was investigated by Alfred Weber, Über den Standort der Industrien, Part I, of Reine Theorie des Standorts (Tübingen, 1909); and the location of business enterprises within an expanded framework of costs and demands within a given set of institutional relationships is presented by Edgar M. Hoover The Location of Economic Activities (New York: McGraw-Hill Book Co. Inc., 1948).

Geographers such as Christaller in his Central Places in Southern Germany trans. by Carlisle W. Baskin from Die zentralen Orte in Süddeutschland (Jena, 1933) and August Lösch, The Economics of Location trans. by William Woglom and Wolfgang F. Stolper (New Haven: Yale University Press, 1964) from the second revised edition (1943) presented basic theses on the natural

Scale and Direction of Trade Center Change:

> If there is to be an adequate response to the problems of trade center decline by public authorities, there must be, at a minimum, some way of distinguishing the prospects for growth or decline--the viability--of trade centers.[3]

The purpose of this study is to help in this process of identification. The type and quantity of remedial action depends on the problem to be solved. Therefore, indicators of the scale and direction of the probable solution toward which the economic system is progressing need to be provided.

Two approaches are used. The first lends itself to the analysis of the individual town in relation to its effectiveness in the distribution of specific products and services. The second approach is directed toward the total economic landscape[4] in relation to the distribution of goods.

The Economic Base:

Throughout most if not all of the literature surveyed, it is consistently emphasized that a town must have some kind of economic base in order to, first become a town, and second become a member of the set of growth centers. When the definition of economic "base" is considered in the more general concept of

---

ordering of economic activities.

[3]Gerald Hodge, "The Prediction of Trade Center Viability in the Great Plains," The Regional Science Association Papers, Vol. 15 (1965) p. 88.

[4]August Lösch, The Economics of Location, trans. by William Woglom and Wolfgang F. Stolper (New Haven: Yale University Press, 1964), from the second revised edition (1943), p. 219.

"value added", exported services and retail trade in addition to manufacturing can be considered in this role.[5]

Agricultural Production and the Economic Base:

Agricultural production is a unique type of basic industry[6] in that dispersion may be considered a very important input. Current data on the size and number of these productive units indicate that the trend toward increased dispersion (increased spatial input) will continue. The attempt is made in this study to include the economic significance of this type of input for towns located within the dispersed farm population.[7] In addition to the dispersed farm population, the importance of the dispersed nonfarm population has been discussed by E. N. Thomas[8] and M. J. Emerson[9] among others.

---

[5]M. Jarvin Emerson, "Goal Specification and Analytical Models for Evaluating Regional Economic Growth," A paper presented at the Methodology Workshop in Regional Economic Development held in Denver, Colorado (May 4, 1966), pp. 32-33.

[6]For a discussion of a special kind of income distribution and allocation effects in relation to fixed and immobile capital in Agriculture see Roger W. Stohbehn, "Problems and Resource Fixities and Immobilities in Regional Analysis, "Paper presented at the Workshop of Regional Studies of Income Distribution held in Baton Rouge, Louisiana, March 17-18, 1966.

[7]Dependent variables and independent variables relating to density and distance are evaluated in relation to population movements and volume dollar flows.

[8]E. N. Thomas, et al., "The Spatial Behavior of Dispersed Non-Farm Population," Papers and Proceedings of the Regional Science Association, Vol. 9 (1962), pp. 107-133.

[9]Emerson, op. cit., pp. 30-31.

The important fact should be noted here that agricultural production can creat a "dual" industry problem depending on the choice of study units.

An area can have a basic industry of agricultural production, but because of the necessary spatial input none of this production takes place within the confines of towns. Therefore the second basic (town) industry exists in conjunction with and in support of the first (area) basic industry. This "secondary" basic industry is related to the towns as economic units and is composed of the distribution of products and services to the dispersed farm population.[10]

Trade Areas:

Retail trade and service shopping patterns involving the movement of consumers through a distance-time space is the subject of the majority of the available references.

One of the first confusing factors in relation to consumer behavior over distance-time is the difference between products and services. In reference to J.E. Brush and H.E. Bracey[11] the general conclusion is reached that, regardless of the great discrepency in population density, there exists similar distance structure between service centers of about 21,

---

[10]G. Rushton, "Spatial Competition for the Supply of Goods and Services to the Iowa Dispersed Population," Iowa Business Digest, Vol. 35 (1964), p. 3.

[11]J. E. Brush and H. E. Bracey, "Rural Service Centers in Southwestern Wisconsin and Southern England," The Geographical Review, Vol. 45 (1955), pp. 559-569.

8-10 and 4-6 miles. This and other studies[12] suggest, however, that for "shopping" goods, distances traveled for individual product groups can vary significantly. Average distance traveled for purchases varied from 30.3 miles for female clothing to 5.2 miles for food.[13] From this complex fact of life, a system of four basic economic landscapes can be differentiated;[14] (1) the simple market areas in relation to one product, product group or service (herein referred to as market areas), i.e., "on the one hand we have simple supply or market areas--very simple indeed, manifestly real, and wholly dependent upon trade. . .";[15] (2) the total trade area comprising the combined market areas for all products, product groups or services supplied in this center (herein referred to as trade areas);[16] (3) moving from the confines of one center, a "network" of market areas emerge from one product, group of products or services (herein referred

---

[12]R. G. Golledge, G. Rushton, and W. A. Clark, "Some implications for the Grouping of Central Place Function," Economic Geography, Vol. 42, No. 3 (July, 1966), pp. 261-272.

[13]Ibid.

[14]Lösch, op. cit., pp. 218-219.

[15]Ibid., p. 219. Also see Brian J. L. Berry, H. Gardiner Barnum and Robert J. Tennant, "Retail Location and Consumer Behavior," The Regional Science Association Papers, Vol. 9 (1962), pp. 64-106.

[16]This level of economic structure is not discussed in Lösch yet this is the structure one usually has reference to when "trade area" is used. See Lösch, op. cit. This system (#2) must be evaluated in relation to some norm for the area of interest and this is the economic landscape (#4). A large majority of the literature reviewed deals with this one concept of spatial economic systems.

to as network); and (4) a set of individual "networks"--one for each product--superimposed one upon the other to form the sometime simple, sometimes complex economic landscape (herein referred to as economic landscape.[17]

These four systems can be classified in relation to the number of centers and the number of products, product groups or services being included:

		Number of Products	
		One	Many
No. of Centers	One	#1	#2
	Many	#3	#4

The trade area (#2) is the major determinant of growth for the individual town and is the combination of all market areas (#1) for the products distributed by this center.

The economic landscape (#4) is the prime determinant of growth for towns within an area composed of dispersed farm population i.e., when the basic town industry is the distribution of products and services.

<u>Growth Associated with Highways</u>:

A certain segment of any town's business is associated with its proximity to a major highway. In this instance, traffic

---

[17]For a discussion concerning when the economic landscape tends to be simple--and therefore central place systems tend to dominate, see Lösch, op. cit., pp. 217-218.

flow rather than any other variable is the determinant of the distribution of these businesses.[18] However, this can be said of all accessibility concepts. In that accessibility can be included in the general framework of distance-time travel for shopping patterns and will generally be reflected in the survey data in the preference pattern, this type of additional economic activity is not specifically included.[19]

Labor Supply:

In the work by Borts and Stein[20] a very significant conclusion is reached. In relation to four assumptions about the model used--relating to the price of product, the price of capital goods, production functions and competetive behavior--the following conclusion is deduced.

> Interstate differences in the rates of growth of employment in a given manufacturing industry, from one long-run equilibrium to another, arise solely from interstate differences in the rate of growth of the labor-supply function.

---

[18] J. M. Roberts, et al., "The Small Highway Business on U.S. 30 in Nebraska," Economic Geography, Vol. 32 (1956), pp. 139-152 and Elizabeth Eiselen, "The Tourist Industry of a Modern Highway: U.S. 16 in South Dakota, "Economic Geography, Vol. 21, No. 3 (July, 1945).

[19] Hodge, op. cit., p. 105. The variables #30 and #31 Rail accessibility and Road accessibility respectively are important in relation to Urban size but neither is large enough for special consideration. Both factor loadings are below the lower limit of significance chosen by the author.

[20] George H. Borts and Jerome L. Stein, Economic Growth in a Free Market, (New York: Columbia University Press, 1964), pp. 208-209.

This labor supply function is affected by (1) the rate of migration (in and out) and (2) the size of the non-industrial labor sector.

> States with positive internal growth rates had more rapidly growing supplies of labor than did states with negative internal rates.[21]

One of the effects of in-migration is that the people tend to take their income with them. If low income families move into an area, per capita income tends to decline, and vice versa. Another effect is the capital forming ability of the newly arrived family, especially the new family. This capital formation takes place in new housing, durable consumer goods, the starting of families and therefore the support of local government expenditures on social overhead capital.

Easterlin, in discussing Kuznets cycle phenomena, quotes Abramovitz in the following passage:

> One common attribute of all these processes of resource development involving the movement of people from country to country and place to place, the formation of households and the birth of children, the foundations of business, and the investment of capital in highly durable forms is that they involve longterm decisions and commitments.[22]

Charles Tiebout discusses this long term effect in

---

[21]*Ibid.*, p. 210.

[22]R. A. Easterlin, "Economic-Demographic Interactions and Long Swings in Economic Growth," *The American Economic Review*, Vol. LVI (December, 1966), p. 1072, quoted from M. Abramovitz, "Historical and Comparative Rates of Production, Productivity and Prices," *Employment, Growth and Price Levels*, Hearing before the Joint Economic Committee, 86th Cong., 1st sess., Pt. 2, Washington 1959, p. 414.

distinguishing between short run and long run multipliers in relation to the economic base of a community.[23]

Similar Studies:

The first study of interest is one conducted by Ferber using towns of 10,000 population and larger in the State of Illinois.[24] Using per capita sales as the dependent variable, distance (a special distance to a certain dominating center) proved significant in relation to general merchandise, furniture, and drugs. The R^2 ranges from .21 for "Food" (using income and stores per 10,000 population as independent variables) to .64 for "Furniture" and "Apparel".

Using sales as the dependent variable and income, population and distance (distance to this large center) as the independent variables the R^2 ranges from .72 for automotive businesses to .95 for food purchases. Population and distance were significant in different amounts depending on the product of interest.

The general conclusion is "that a more or less individualistic approach is needed in each case."[25]

The second study having similar goals is one conducted by

---

[23]Charles M. Tiebout, "The Community Economic Base Study," Supplementary Paper No. 16 (New York: Committee for Economic Development, 1962), pp. 70-73.

[24]Robert Ferber, "Variations in Retail Sales Between Cities," Journal of Marketing, Vol. XXII, No. 3 (January, 1958), pp. 295-303.

[25]*Ibid.*, p. 301.

Gerald Hodge of the University of Toronto.[26] First, he ranks the "total" number of trade centers (473) according to "its numerical score on each of the thirty-five variables."[27] From this, rank correlation coefficients are computed and factor analysis is used to separate the significant variables from the less significant. The maximum contributor to the "variable" urban size is Utilities Quality. The maximum contributor to farm size (non-related) is Average Wheat Yield (negative) and Education Attained by Farm People. The maximum contributor to urban density (non-related) is Building Quality.[28]

These three variables, Urban Size, Farm Size and Urban Density--producing 28 per cent, 16 per cent and 13 per cent of the total factor contribution respectively--are regressed on two different dependent variables. Regression number One uses "Change in Number of Retail Firms" for the dependent variable and regression number Two uses "Change in Population" for the dependent variable. The "Coefficient of Determination" R^2 is .33 for regression One and .32 for regression Two.

One of the major results of this regression analysis is the relatively poor showing of Urban Size in relation to the very good results obtained with Urban Density.[29] This leads to

---

[26]Hodge, op. cit.

[27]*Ibid*., p. 104.

[28]*Ibid*., p. 105.

[29]Urban Size produces "T" values of 1.79 for regression One and -2.09 for regression Two both of which are significant at the five per cent level of confidence. On the other hand, Urban Density produces "T" values of 5.31 and 8.89 respectively.

the rejection of Urban Size as a method of classifying the viable from the nonviable towns.

> Indeed, the generally weaker relationship of the urban size scale to trade center change suggests that size of a trade center alone is not sufficient to guarantee its viability.[30]

This study by Hodge contributed substantially to the concept of integrating factor and regression analysis in relation to development problems dealt with in this study.

The Relationship of This Study to Current Literature:

Small towns in western Kansas are competing with each other for people, business firms, Federal and State recreational facilities and other job-creating, population-increasing locational decisions. Most of these small communities can make decisions only if they are furnished information that relates to the market system in which they must function. There must be developed, therefore, some objective method of analyzing the relative strength and weakness of each individual community and the economic landscape which they form. With the problem defined in a more specific manner this community can choose the course of action that lends itself to its potential and to its limitations.

People making long run decisions must have estimates of the future possibilities of the growth of an "individual" town before these decisions can be realistic. This paper presents

---

[30]Hodge, op. cit. p. 110.

two basic "methods for defining growth and nongrowth centers. The first method uses actual trade areas for the center derived from survey data. The second method makes use of factor analysis and uses the resulting component index as a means of classification.

The efficiency or practicality of these methods of classification are analyzed in relation to their ability to provide stratifications in which basically homogeneous groups of towns emerge.

Following the study of Borts and Stein[31] it is noted that none of the regression models tested in the rest of the current literature, either in the simple trade area surveys or in the elaborate and important viability study by Hodge,[32] used net migration as a variable.[33] Although no causal relationship can be imputed to this variable, regardless of what the works of Easterlin,[34] Tiebout,[35] and Borts and Stein[36] may imply, population "movements" may prove a very good lead or lag indicator

---

[31]Borts, _op. cit._ [32]Hodge, _op. cit._

[33]An important discussion of this variable is contained in Bernard Okun and Richard W. Richardson, "Regional Income Inequality and Internal Population Migration," _Economic Development and Cultural Change_, Vol. 9 (1961) reproduced in John Friedmann and William Alonso (ed.), _Regional Development and Planning: A Reader_, (Cambridge, Massachusetts: The M.I.T. Press, 1964), pp. 303-318.

[34]Easterlin, _op. cit._ [35]Tiebout, _op. cit._

[36]Borts, _op. cit._

of growth or decline of an area or individual center. In this study, it considered a lag variable with good results.

CHAPTER II

THE PROBLEM

The general problem posed by this study is not a new one but it is becoming a problem of increasing importance. It is the same problem as stated by Gerald Hodge:

> If there is to be an adequate response to the problem of trade center decline by public authorities, there must be, at a minimum, some way of distinguishing the prospects for growth or decline--the viability--of trade centers.[1]

The purpose of this study is to help in this process of identification. The type and quantity of remedial action depends on the problem to be solved. Therefore, a method for indicating the direction toward which the economic system is progressing needs to be provided.[2]

A second problem area to be considered in this study is the identification of the causally related variables that affect the growth or decline of trade centers which serve the dispersed farm population.

The causal relationships that thrust one group of towns down the path of growth and retard the other cannot be easily quantified. Yet, there are certain "indicators" that can be

---

[1]Gerald Hodge, "The Prediction of Trade Center Viability in the Great Plains," The Regional Science Association Papers, Vol. 15 (1965), p. 88.

[2]This is a re-statement of a previous position. See above, p. 2.

used to provide some insight into the probable growth or decline of a town.

From the review of the literature and especially in relation to the impressive list of variables tabulated by Hodge in his viability study[3] it is observed that very little attention is given to the causality of the variables considered. From numerous recent works[4] it became clear that migration of labor from one locality to another may affect the two areas involved in different ways. Although, perhaps, no causal relationship can be attributed to the movement of labor, it can reasonably be termed a causally related variable.

The emphasis placed on causally related variables may increase, to a reasonable degree, the explaination of the variation found between trade centers.

The final problem is one of obtaining efficiency in the identification of growing and declining trade centers. This requires the development of a framework for evaluating alternative methods of identification.[5]

Efficiency of estimates pertaining to the growth potential of trade centers can be evaluated in three general catagories.

First, consideration of the source of data should be taken into account. The data can be collected and used as

---

[3]Hodge, op. cit., p.105. [4]See above, p. 12.

[5]William G. Cochran, Sampling Techniques (2nd ed.; New York: John Wiley & Sons, inc., 1964), pp. 128-135. This is an analysis of a study or experiment design.

primary data which can provide a high degree of efficiency at large cost. Otherwise, the data source can be secondary in that it is an aggregate of many individual interactions. Secondary data usually produces less than desirable results in relation to projections dealing with individual units.

Second, the type of variable is important. Lag variables producing results in relation to growth and nongrowth trade centers in the current time period are more useful in this type of identification process than variables which follow the process of growth or decline.

Third, and probably most important, the nature of the population under study should be taken into account. In the study by Hodge[6] the explained variation in the town population was only approximately thirty-three per cent. The large amount of unexplained variation illustrates two compounding facts about a population of this nature. The size range of this population is greater than can be efficiently handled without stratification even if separate estimates are not desired for each stratum. This fact is illustrated by Berry and Cochran among others.[7] In addition to the variation introduced by the size range of towns, there is considerable variation within any given

---

[6]Hodge, op. cit., p. 105.

[7]Brian J. L. Berry, Gardiner H. Barnum and Robert J. Tennant, "Retail Location and Consumer Behavior," The Regional Science Association Papers, Vol. 9 (1962), pp. 64-106 and Cochran, op. cit., pp. 92-93.

stratum.

This study concentrates on two of the smaller size classes of towns and attempts identification of growth and nongrowth trade centers within these subpopulations.

Hypotheses:

Small towns located in a relatively homogeneous geographic area in which the "area" basic industry is agricultural production have as their main source of revenue the distribution of products and services to this "dispersed farm" population. In this sense, the external distribution of products and services can be considered the "basic" industry for these towns and is called the distribution function.[8]

Given this "town" basic industry assumption the major hypothesis is:

> Growth potential of town *i* in relation to all other towns in this given geographic area may be identified by the distribution function of town *i* in relation to all other distribution functions in this given geographic area.

That is, the growth potential of town *i* depends on the extent of the basic industry of town *i* in relation to the extent of all other basic industries of towns *n* minus *i* within a given geographic area.

The scale of this town's basic industry depends on, (1) the nature and therefore the quantity of the products or services

---

[8]The term "function" refers to the action or role performed and is not used in the mathematical sense.

demanded, and (2) the ability of the town to meet this distribution role in relation to other towns in the same geographic area. The ability of an individual town to meet this two fold criteria, reflecting the interaction of external supply and demand, suggests a consistent yet dynamic indicator of an individual town's growth potential.

The scale of this type of basic industry need not refer to geographic space only but can also be represented by simple economic indicators such as dollar flows. Therefore, this external distribution of products and services is referred to as the distribution function.

The first form of the distribution function, i.e., the scale or volume concept, can be represented by a measure of exported retail sales and revenue from selected services in relation to each town. In this study, however, "total" retail sales and "total" revenue from selected services are combined as a measure to differentiate one type of town from another.

The reason for this aggregate approach is, (1) no consistent import-export ratio can be ascribed to an individual town without first conducting an individual export base study and, (2) although there are variations in these ratios, it is probable that for the size range of towns in this study the import-export ratio is very close to unity. Therefore, this measure of the total distribution function is used and is labeled Y_1.

The second form of the total distribution function, i.e., the spatial concept, is represented by two measures; Y_2 being the trade area in square miles for each individual town and Y_3 representing the distance between towns within the given geographic area.

Given the major hypothesis, a minor hypothesis follows from it and is as follows:

> The direction and magnitude of the distribution function can be related to selected economic, demographic and geographic variables. Further, the direction and magnitude of the distribution function in relation to the economic, demographic and geographic variables may provide a criteria for the determination of strata and the evaluation of stratification procedures.

That is, the distribution function for town $\underline{i}$ may be affected by, (1) gross per capita tax load for town $\underline{i}$, (2) per capita income in town $\underline{i}$, (3) total town income, (4) distance between town $\underline{i}$ and other towns, (5) net migration for town $\underline{i}$, and (6) rural population density surrounding town $\underline{i}$.

Stratifications between growth and nongrowth towns are to be evaluated in relation to the homogeniety obtained within each subgroup as illustrated by the amount of explained variation between the distribution function and selected economic, demographic and geographic variables.

Also, if there are no significant differences between the growth and nongrowth regression coefficients it can be concluded that the towns are homogeneous in relation to these independent variables. If significantly different regression coefficients are obtained two different town populations are in existence simultaneously within a given geographic area in relation to these independent variables.

CHAPTER III

THE AREA

Geographic Characteristics:

Delineation.--This study is limited to the two areas of western Kansas designated as areas One and Two by the office of Area Development at Kansas State University.[1] The two areas include (see Fig. 1):

Area One:	(Counties)	8,006 Square Miles
Cheyenne		Thomas
Rawlins		Sheridan
Decatur		Wallace
Sherman		Logan

Area Two:	(Counties)	11,858 Square Miles	
Greeley		Wichita*	Scott*
Lane*		Hamilton	Kearny*
Finney*		Stanton	Grant*
Haskell*		Gray*	Morton
Stevens		Seward	Meade

Household survey data used in this study deals only with the counties in Area Two which are noted with an asterisk (see Fig. 1). This smaller area Two comprising eight counties and approximately 6,338 square miles is the area to be discussed under the name of the Southwest (-) area in all sections of the

---

[1]For a description of this delineation using ten criterion and the problems involved see Ralph E. Dakin, (ed.) "Area Development: and Interdisciplinary Approach to Area Research," Kansas State University Agricultural Experiment Station, Bulletin 440, (October, 1961), pp. 10 and 11.

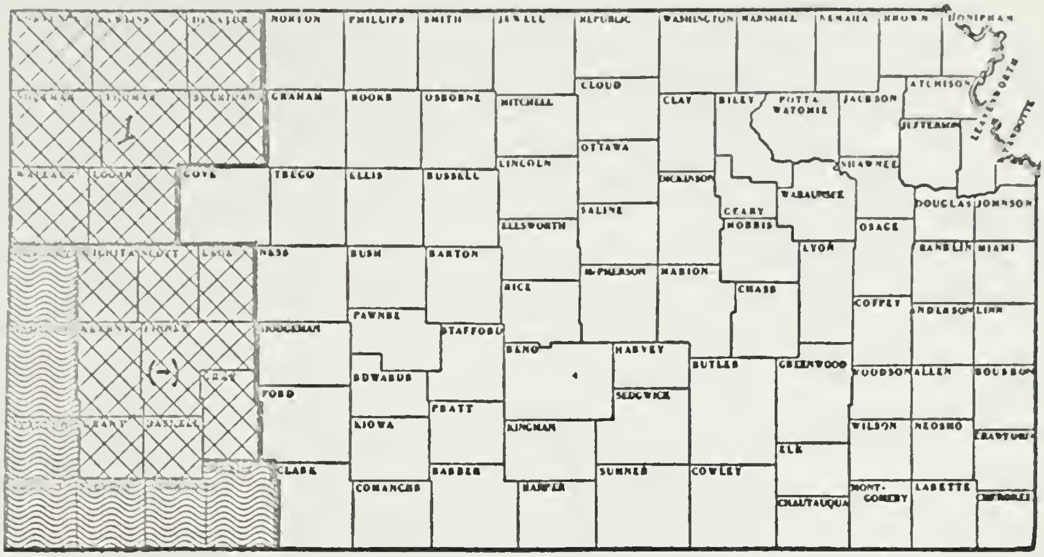


Fig. 1.--Areas of study.

Northwest area #1 and Southwest(-) area
Southwest area #2 <u>less</u> Southwest(-) area

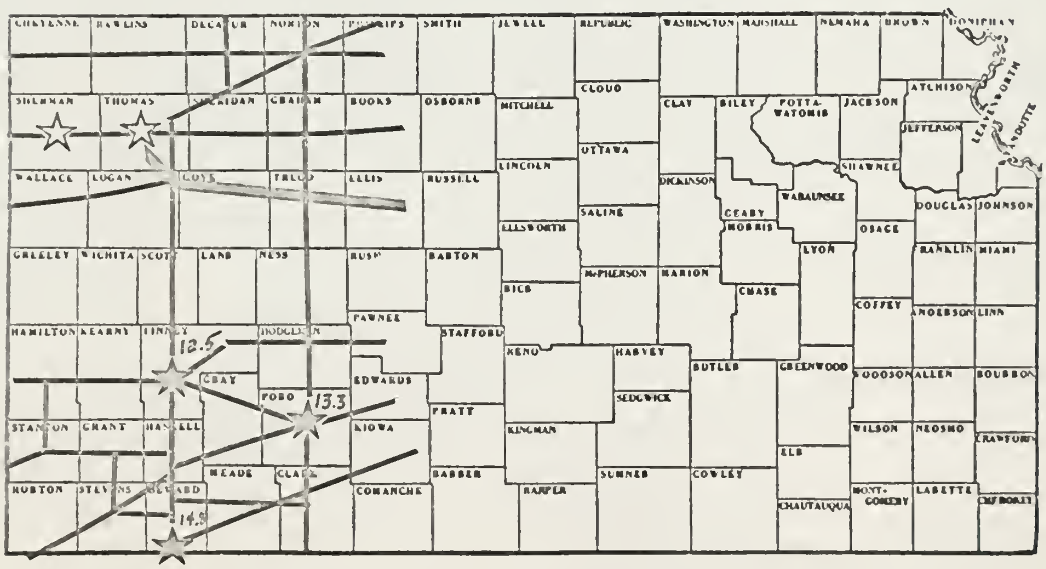


Fig. 2.--Major highways and towns over 4,000 population.

Major Highway
Freeway

Towns 4,000-9,999
Towns over 10,000

following study unless duly noted.

The Northwest area is referred to in its entirety.

Distribution of Towns.--The two areas are contrasted in the distribution of their towns. The Northwest area has two relatively small centers neither of which are above 5,000 population. The Southwest has one major center in the form of Garden City with an approximate population of 12,500 (see Fig.2).

The average distance between the towns for which yearly population estimates are available (incorporated) is 23.163 miles for the Southwest (-) area and 27.636 miles for the Northwest area.

Weather.--The sixteen counties included in this study are in what is usually termed far western Kansas. The significance of this location is that only, approximately, the western one fourth of the state of Kansas is in "the Great Plains". The first thing of interest about being a member of the great plains community is that it is considered semiarid, i.e., less than twenty inches of rainfall per year, on the average, is received in this area.[2]

The Great Plains, extending in a continuous belt 300

---

[2]Kansas Water Resources Board, "State Water Policy and Program Needs, "(A Report to the 1961 Kansas Legislature, Topeka: State of Kansas, 1960). Although the structure of the land types might tempt one to include more than one fourth of the state of Kansas in "the Great Plains", the average annual precipitation picture tends to place the land area approximately east of highway 283 into a buffer region between the eastern subhumid part of the state and the semiarid Great Plains.

> 400 miles wide from Mexico into Canada, comprise the largest uninterrupted area with semiarid climate in North America. For the most part they are high plains ranging from 3,000 feet above sea level along their eastern margin to more than 4,000 feet where they give way to the steep eastern slopes of the Rocky Mountains. Rainfall is scanty, averaging less than 20 inches annually except in the warmer southern portion, and only slightly more than 10 inches in the north. The variability of the rainfall is great; almost everywhere the driest year brings less than 10 inches and the rainiest more than three times as much.[3]

In the early days of settlement, this great variability of the weather created some of the great calamities of Kansas Agriculture. Much of far western Kansas was settled prior to 1890, during what is now considered an above average rainfall period. However, the drought of the 1890's stopped this surge of in-migration.

> Not only was further immigration stopped, but there was instead a considerable emigration of earlier settlers. In some of the western Kansas counties, two thirds of the farm population was forced to leave because of the drought.[4] . . .In 1934 nearly half of the area of the Great Plains experienced desert climate [my emphasis].[5]

The importance of the variability of the weather in this portion of kansas brought into play, shortly after 1890, dry farming techniques. Methods developed to retain a given

---

[3]C. Warren Thornthwaite, "Climate and Settlement in the Great Plains," Climate and Man: Yearbook of Agriculture, 1941 (Washington, D.C.: United States Department of Agriculture, 1941), p. 178. For a justification of the previous definition of what part of Kansas is in the Great Plains see this same reference. For a different view of theddelineation of the Great Plains in Western Kansas (without reference to rainfall patterns) see William F. Zornow, Kansas: A History of the Jayhawk State, (Norman, Okalhoma: University Press, 1957), p. 4.

[4]Ibid., p. 184. [5]Ibid., p. 183.

moisture supply can't greatly affect the outcome when there is little or no moisture to conserve as the 1930's pointed out quite drastically.

> In many respects the period from 1920 to 1940 resembled the earlier period between 1880 and 1900. In both a series of rainy years was followed by a disastrous drought. . . In both cases, the series of rainy years had been mistaken for normal climate.[6]

Within the last twenty years, other means have been employed in addition to improved dry farming techniques--namely irrigation. In the far western part of Kansas this means ground water irrigation since very few cubic feet of surface water are available, especially in relation to the rest of the state.

Natural Resources.--Two basic resources are discussed in relation to the areas under study. They are (1) ground water and (2) crude petroleum and natural gas products.

Ground water availability is widespread in the far western part of Kansas (see Fig. 3). However, the depletion rate in relation to the replenishment rate--the latter being rather slow--imposes some important restrictions on the long run availability of this resource.[7]

The other major resource is natural gas. The Hugoton gas field is the largest field of its kind in the State. In 1958 the value of the shipments for the mineral industries in

---

[6] Ibid., p. 186.

[7] Kansas Water Resources Board, op. cit.

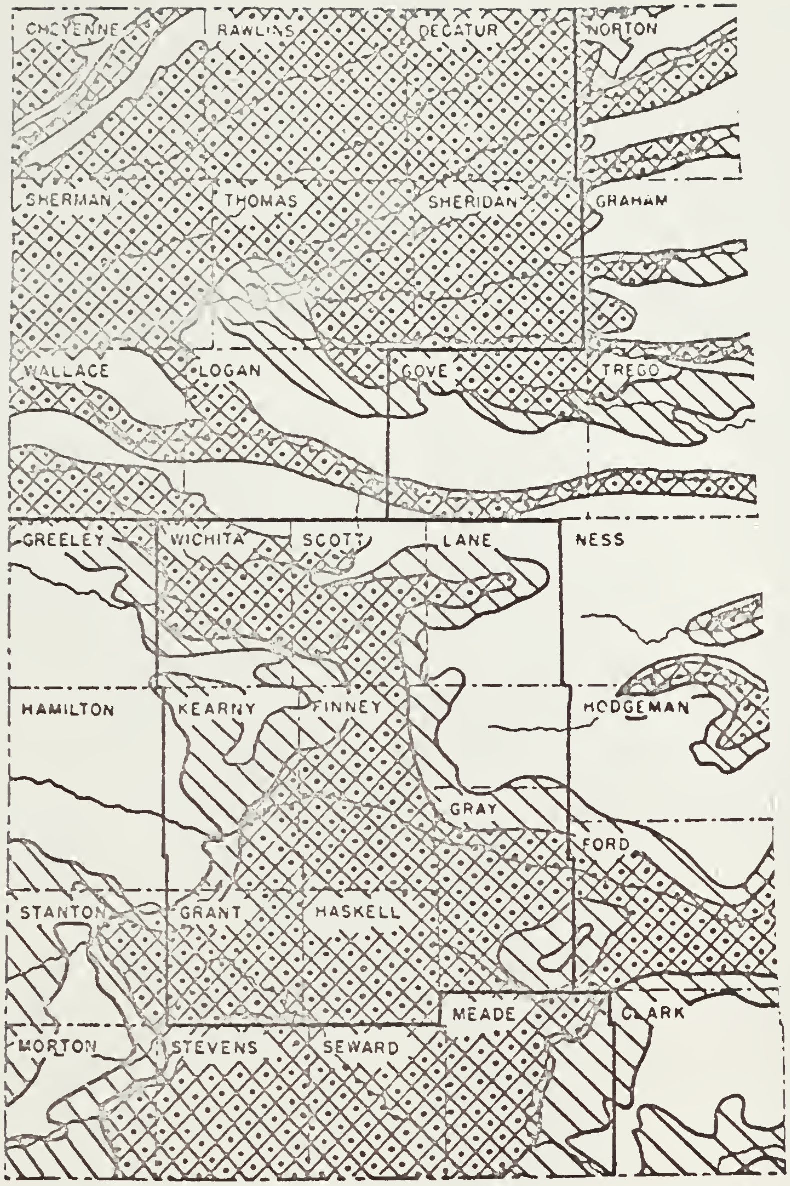


Fig. 3.--Generalized Ground Water Regions
In Areas 1 and 2

Generally Available Yields of Water per Minute

500 gal. 50 to 500 Below 50

the Northwest area was only 3.91 per cent of the total income of this area.[8] In the same year the value of the shipments for the mineral industries in the Southwest area was 65.05 per cent of the total area income.[9] This is a crude indicator of the difference between the two areas in relation to their mineral resource base.

Demographic Characteristics:

The southwest (-) area has about 79 per cent of the land area that is contained in the Northwest area, 78 per cent of the number of towns and yet has 129 per cent of the population that is contained in the Northwest area.

The Town Size.--The mean population of the total group of towns in 1962 is 1,630. The median population occurs between Oberlin and Ulysses (see Table 1).[10]

Age-Sex Distribution.--The age-sex distribution is the static account of the net migration over time. As an area experiences population growth from births exceeding deaths without population movements, the age sex distribution will approach the form of an isisceles triangle situated on a base

---

[8]U.S., Bureau of the Census, 1958 Census of Mineral Industries, pp. 13-9 to 13-12, and Darwin Daicoff, Kansas County Income: 1950-1964 (State of Kansas: Office of Economic Analysis, 1966).

[9]Ibid.

[10]U.S., Bureau of the Census, United States Census of Population: 1960, Population, Number of Inhabitants, pp. 14-15 and Kansas State Board of Agriculture, Population of Kansas: January 1, 1962 as reported by the County Assessors, Topeka, Ks.

slightly less in length than the two equal sides. As can be seen, none of the age-sex distributions fit this general pattern (see Fig. 4).

Net migration is a statement of the difference between all people moving in and all people moving out of an area with no indication as to age or sex composition. The age-sex distribution can lend some insight into which age group has left an area.

Two economically important observations are of interest. The Northwest area has a relatively large per cent of people over seventy years of age and a less than average share of the 0-5 year old population. This distribution is contrary to the desired long run population distribution. The Southwest area, in contrast, has relatively small percentages of people over seventy years of age and a large base population of 0-5 year olds. These divergences are large enough to produce significant differences in relation to the age-sex distributions and net migration variables.

The age-sex distribution of the Southwest area is significantly different from the age-sex distribution of the Northwest area and the state of Kansas (see Fig. 4). Using Klotz's Normal Scores Test[11] the following hypotheses are tested.

Ho_a (SW distribution = NW distribution) ; $m = 8$, $N = 16$

---

[11] H. C. Fryer, Concepts and Methods of Experimental Statistics (Boston: Allyn and Bacon, Inc., 1966), pp. 198-199.

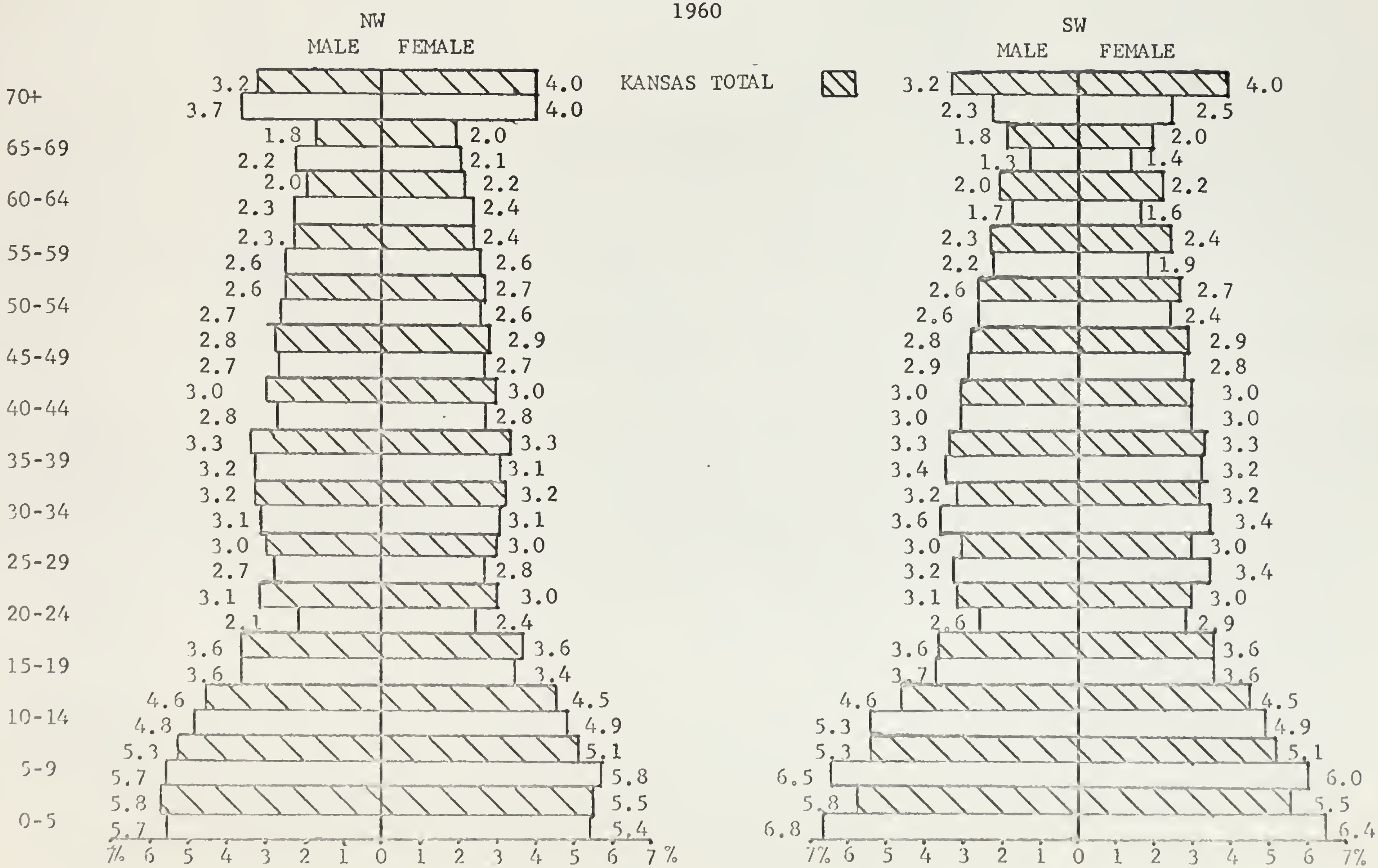
TABLE 1

TOWNS IN SURVEY AREA, IDENTIFICATION NUMBER AND POPULATION.

NORTHWEST		Pop. (63)	(62)	SOUTHWEST		Pop. (62)
Goodland	(2)	4,700	4,664	Garden City	(1)	12,575
Colby	(3)	4,113	4,122	Scott City	(4)	3,865
Oberlin	(6)	2,646	2,560	Ulysses	(5)	3,395
Oakley	(7)	2,441	2,379	Dighton	(10)	1,619
Atwood	(8)	1,801	1,781	Leoti	(11)	1,474
St. Francis	(9)	1,635	1,601	Lakin	(12)	1,455
Hoxie	(13)	1,276	1,282	Cimarron	(14)	1,176
Sharon Springs	(16)	1,049	1,004	Sublette	(15)	1,129
Bird City	(18)	702	696	Satanta	(17)	980
Winona	(21)	380	419	Montezuma	(19)	605
Seldon	(22)	329	347	Deerfield	(20)	423
Norcatur	(23)	323	311	Ensign	(28)	260
McDonald	(24)	311	320	Copeland	(29)	248
Brewster	(25)	309	325	Ingalls	(31)	190
Herndon	(26)	300	318			
Jennings	(27)	272	291			
Kanarado	(30)	200	216			
Dresden	(32)	134	135			
Total		22,921	22,771	Total		29,394

FIGURE 4

AGE-SEX DISTRIBUTION
1960



Normal score = 9.789*, i.e., it is rejected at the five per cent level of confidence.

Ho_b (SW distribution = Kansas distribution) m = 8, N = 16

Normal score = 9.650*, i.e., it is rejected at the five per cent level of confidence.

Ho_c (NW distribution = Kansas distribution) m = 8, N = 16

Normal score = 7.157ns, i.e., it is accepted at the five per cent confidence level.

Population Changes.--Figures 5,6 and 7 provide (1) the population of the counties in 1950, 1960 and 1962, (2) per cent change of population between 1950-1960, 1950-1962 and 1960-1962 and (3) net migration per county for 1961, 1962, and 1963.

There is a significant difference between the mean (net) migration (1961-1963) for the Northwest and the Southwest areas. Using a simple analysis of variance procedure, the following hypothesis is tested:

Ho_d [SW (-) X_5 = NW X_5] where X_5 is the mean (net) migration for 1961-1963. This resulted in an "F" of 5.6886* with one and sixteen degrees of freedom which is significant at the five per cent level of confidence.

In general;

> During the 20 years between 1940 and 1960 the population of the United States grew by one-third, that of Kansas by one fifth and southwestern Kansas population grew by one-half. . . . .In contrast Northwest Kansas, over those 20

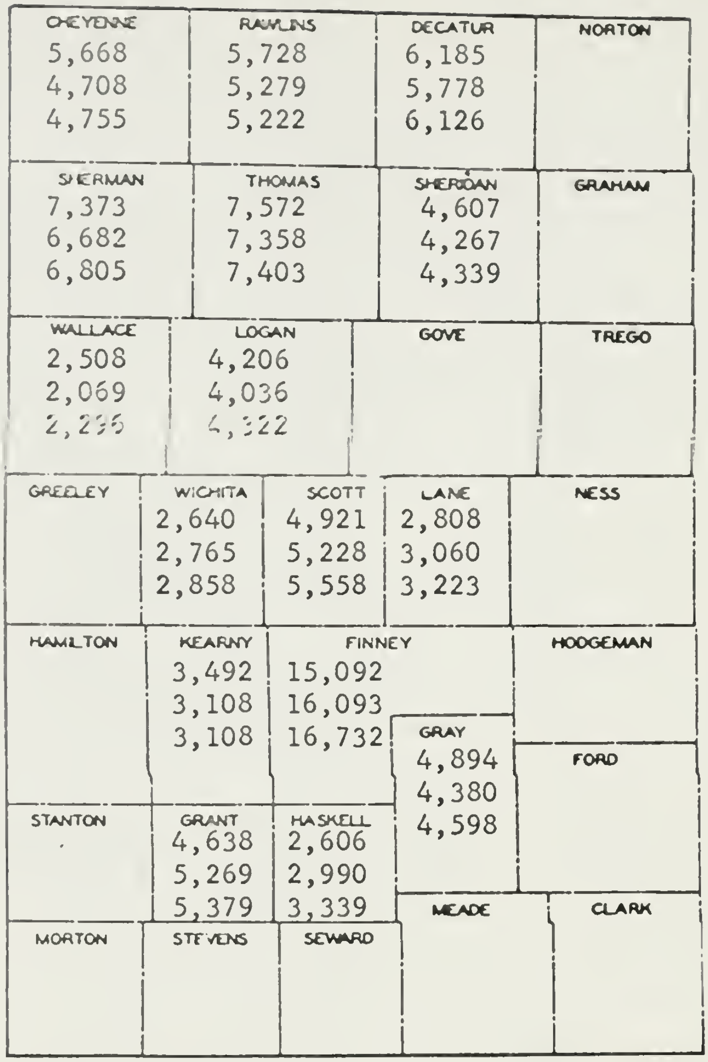


Fig. 5.--Population by county for NW and SW (-) areas.

1950
1960
1962

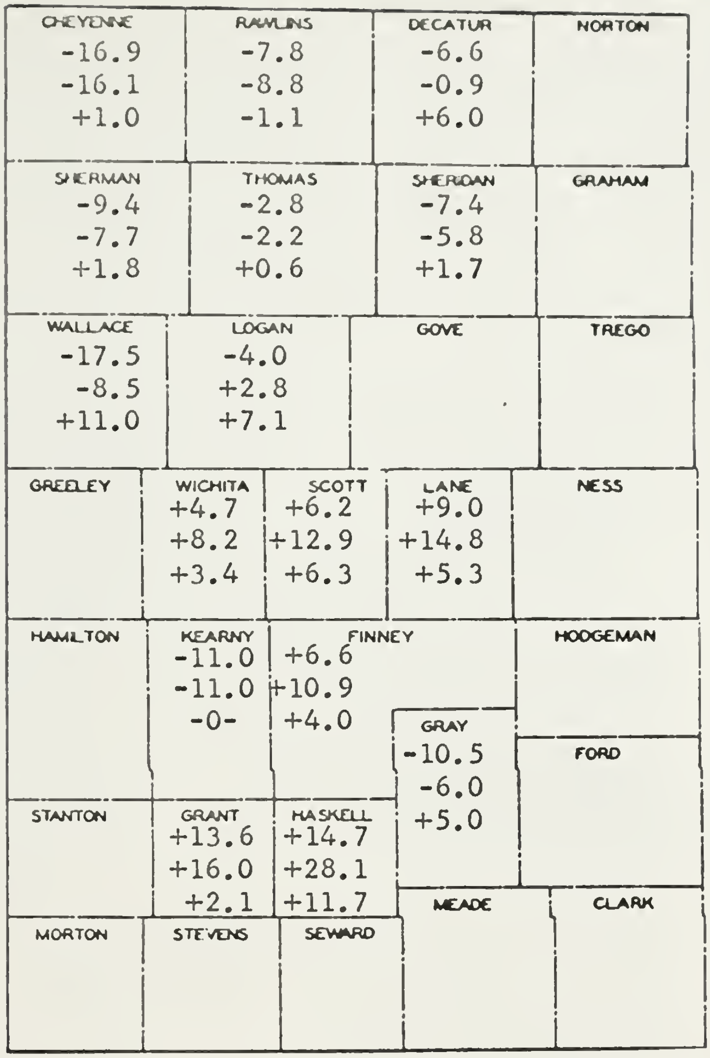


Fig. 6.--Percentage change in population for NW and SW (-) areas.

1950-1960
1950-1962
1960-1962

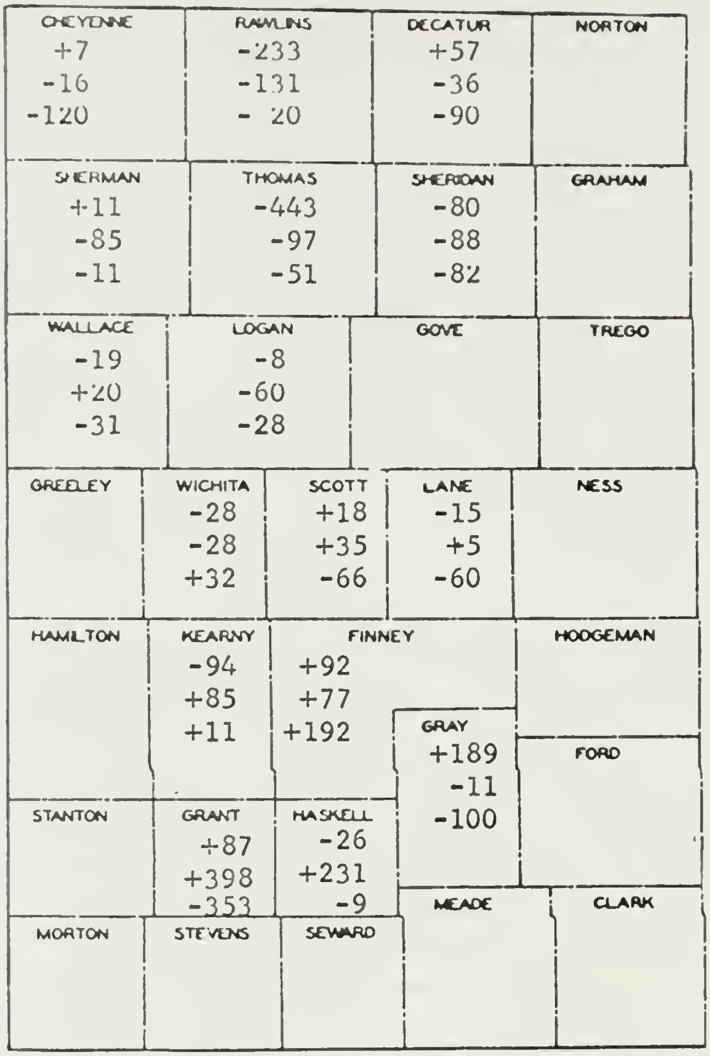


Fig. 7.--Net migration for NW and SW (-) areas.

1961-1962
1962-1963
1963-1964

years, suffered a nine per cent loss in population.[12]

Economic Characteristics:

Irrigation.--Irrigated acreage in the Northwest in 1959 was only 1.031 per cent of the total acreage. In 1964 the percentage had increased to 1.848 per cent--a move from 52,839 acres in 1959 to 94,724 acres in 1964, a large 79 per cent increase.

Irrigated acreage in the Southwest (-) in 1959 accounted for 9.457 per cent of the total acreage and in 1964 had advanced to 11.735 per cent. Actual acres increased from 383,618 in 1959 to 476,017 acres in 1964 or a 24 per cent increase.

Number of Farms.--The number of farms in the Northwest area continued the downward trend from a high number in 1930 of 7,351 to the present low number of 4,407. The average size of the farm--following the decrease in number--increased about eight per cent to an average size of 1,177 acres from the 1959 figure of 1,090 acres per farm.

The number of farms in the Southwest area continued the same downward trend from a high number in 1935 of 8,681 to the present low number of 5,302. The average size of the farm increased about nine per cent to an average size of 1,328 acres

---

[12] R. D. McKinney et al., Northwest Kansas Survey Highlights: October 1964, Extension Service, Kansas State University (Manhattan Kansas: Kansas State University, 1964), p. 41 and Louis H. Douglas et al., Southwest Kansas Survey Highlights: Jan. 1963, Extension Service, Kansas State University (Manhattan, Kansas: Kansas State University, 1963), p. 34.

from the 1959 figure of 1,216 acres per farm.[13]

The Importance of the Farm Sector.--The total farm income of the Northwest area averages about 71 per cent of all other private nonfarm income of this area in 1963. In three counties the farm income is larger than the private nonfarm income.

The total farm income of the Southwest (-) area averages about 54 per cent of all other private nonfarm income of this area in 1963. In two counties the farm income is larger than the private nonfarm income.

In summary, the Northwest area and the Southwest (-) area have similar total farm incomes of $32,538,000 and $34,307,000 respectively. The Southwest (-) has an additional 18.2 million dollars above that of the Northwest in private nonfarm income.[14] From this fact it is reasonable to conclude that the Northwest area is primarily agriculture with agriculture as its single basic industry; the Southwest (-) is primarily agriculture with a dual basic industry of agriculture and oil and gas extraction.[15]

---

[13]All of the above 1959 and 1964 data comes from U.S., Bureau of the Census, United States Census of Agriculture: 1964 Preliminary Report.

[14]All of the above income data refers to 1963 and comes from Darwin Daicoff, Kansas County Income: 1950-1964 (State of Kansas: Office of Economic Analysis, 1966), pp. 60-165.

[15]For the importance of the distinction between a single economic base and a multiple economic base area see the thoroughly complete synopsis in five and a half pages in Lösch, op. cit., pp. 215-220.

CHAPTER IV

NATURE OF THE DATA

Available Data:

The data available for this project is limited to the two areas of western Kansas designated as areas One and Two by the office of Area Development at Kansas State University (see Fig. 1, p. 21.).

The delineation of these areas was completed by a process of analyzing the similarities of the counties of Kansas from the 1950 Census data in relation to ten economic, social and political characteristics.[1] The Southwest area (area #2) necessitates a further breakdown into survey areas. In the Southwest area each questionnaire used in this study includes only eight of fifteen counties. These eight counties are referred to as the Southwest (-) area (see Fig. 1, p. 21).

In the Northwest area (area #1) all of the surveys were conducted over the entire area. Therefore, the survey areas and the Northwest area are the same for both purposes (see Fig. 1, p. 21).

The Survey as a Per Cent of the Population:

---

[1]Ralph E. Dakin, (ed.) "Area Development: An Interdisciplinary Approach to Area Research," Kansas State University Agricultural Experiment Station, Bulletin 440, (October, 1961), pp. 10-11.

The survey in the Northwest area represents a one per cent random sample of all households after the following adjustments. The Colby trade area is initially represented three times as heavily as the outer area.

The Colby Trade Area is composed of the following towns:

Colby	Brewster
Gem	Rexford
Menlo	Winona
Russell Springs	

The outer area emcompasses all the remaining towns in the Northwest survey area.

Since one of the methods of analysis used in this study is based heavily on the number of responses regarding which town serves as the supplier for certain products and services, the responses for the Colby Trade Area are adjusted so that the results of the two surveys are comparable for the entire area. That is, the responses for the Colby Trade Area are reduced by two thirds to make the results comparable.

In the Southwest (-) area the situation is similar yet somewhat more complex. The town Household survey was conducted in seven towns and the number of questionnaires represents different percentages of these town's populations. These range from 1.25 per cent for Garden City to 10.5 per cent for Copeland. The General Farm survey, on the other hand, consisted of seventy-seven interviews with forty-two of these given the Household questionnaire also. Forty-two General Farm Household interviews represent 2.18 per cent of the farmers in the area.

Therefore, to adjust the Town Household percentages to the General Farm percentages, ratios are constructed as follows:

TOWN	TOWN HH %	GEN. FARM %	RATIO	FACTOR
Sublette	4.	2.18	$\frac{.0218}{.04}$	.545
Satanta	5.	2.18	$\frac{.0218}{.05}$	.436
Ingalls	8.	2.18	$\frac{.0218}{.08}$	.272
Garden City	1.25	2.18	$\frac{.0218}{.0125}$	1.744
Lakin	4.	2.18	$\frac{.0218}{.04}$	.545
Deerfield	8.	2.18	$\frac{.0218}{.08}$	.272
Copeland	10.50	2.18	$\frac{.0218}{.1050}$	.208

These factors are used to adjust the Town Household percentage of coverage to conform to the General Farm percentage of coverage.

Also, three towns not included in the seven survey towns are affected by this method. These towns are (1) Ulysses, (2) Montezuma and (3) Cimarron. These three towns, together, received twenty four responses although the Town Household questionnaires were not concerned with them. These responses have been included in the computation of the market areas at their "full" value. To have excluded these responses would have biased the sample toward the seven towns chosen as survey towns.

Calculations:

The Market Areas.--[2]After arriving at the adjusted responses, using the percentage adjustment factors just described, another--yet different--percentage figure is determined. This is the percentage of adjusted responses per town to total adjusted responses. The "survey" area is multiplied by this percentage. The product is an unadjusted approximation of the relative market area in square miles for this one town--for this one product.

Ideal Distance.--[3]Using the market areas as determined above, the square miles are converted into the radius of a circle that circumscribes a hexagon of the desired area, i.e., the hexagon contains the same number of square miles as the market area. The area of a regular polygon with n-sides, each of length S is given as $\frac{1}{4} nS^2 \cot \frac{180°}{n}$. This yeilds the simple computation for the side of the hexagon--also the radius of the circle enclosing the hexagon--as $S = \sqrt{\frac{\text{area}}{2.5980765}}$. This simple concept of the side of the hexagonal market area is one value used in the ideal distance concept. In relation to the

---

[2]This area concept is referred to as the first--most basic--type of area discussed above, p. 6, i.e., area type #1.

[3]The ideal distance is an indicator of the first (#1) type of spatial organization--the market. It relates to the theoretical distance between one supplier of one given product. See above, p. 6. The relation between ideal distance and market areas is that one is a linear measure and the latter is an areal concept--the market area being approximately the ideal distance concept squared.

notation of Lösch, the ideal distance is exactly the same as his b where $b = a\sqrt{N}$ and a is the side of the hexagonal product market independently determined above. The N represents the dominance level of the market structure in question.[4]

The second value used in the ideal distance concept (N) is based on two factors. First, an assumption concerning the method for determining the value for N is used and is as follows:

The distance people travel for any one product, in relation to some indicator of the size of the town offering this product, will be the same--on the average--for all areas, other things being equal.

Second, both areas are assumed, initially, to contain the minimum dominance structure where N is equal to three.[5] From the preceding statements it is evident that the actual ideal distance cannot be estimated until the market structure is known for each area. This is done at a later point using previously described relationships.

The Product Coefficient.--The product coefficient (G_{ix}) relates to the above assumption concerning the distance people travel in relation to some specific product (x) and the size of town offering this product. It is defined as follows:

---

[4]Lösch, *op. cit.*, pp. 116-120.

[5]*Ibid.*

$$G_{ix} = \frac{\Sigma_{i=1}^{k} \; a_{ix} \sqrt{\text{appropriate dominance structure}}}{\Sigma_{i=1}^{k} \; \frac{P_{ix}}{100}}$$

where k is the number of towns furnishing the particular product x, P_{ix} is the population of town i[6] supplying product x and a_{ix} is again the side of the product market for town i and product x. The numerator of this coefficient is the summation of the ideal distances in relation to this one product, i.e., this coefficient is a behavioral coefficient based on a linear distance and population concept.[7]

Again, the only thing unknown in this coefficient is the appropriate dominance structure for the town and product in question.

Dominance Structure.--Starting from the position that the appropriate dominance structure is a minimum for both areas, i.e., using the square root of three for the initial minimum dominance structure, the "product coefficient" for the Northwest

---

[6]Kansas State Board of Agriculture, "Population of Kansas," January 1, 1962 and Ibid., January 1, 1963, as reported by the County Assessors; Topeka, Kansas. The population figures used in these coefficients correspond to the year of the survey in the respective areas, i.e., 1962 for the Southwest area and 1963 for the Northwest area.

[7]This is similar to Riley's law but more closely related to the work of Professor Robert Nunley as presented in his lecture "Distance, Barriers and Routeways: An Analog Field Plotter as a Tool in Geographic Teaching and Research," presented December 1, 1966, by the Department of Geography, Kansas State University.

is compared with the equivilant coefficient for the Southwest. If the dominance structure of the two areas are the same, other things remaining constant, the two coefficients should be equal. Stated another way, any movement from the initial position by changing the combination of N will increase the coefficient divergence. The numerator is adjusted by increasing the value of N in accordance with the specifications offered by Lösch[8] until the divergence between the two coefficients is a minimum.[9] The results of this adjustment process are illustrated for the Northwest and Southwest areas as follows:

TABLE 2

DOMINANCE STRUCTURE AND VALUES OF G_{ix} FOR NORTHWEST AND SOUTHWEST AREAS

PRODUCT	MARKET STRUCTURE NW#1	MARKET STRUCTURE SW#2	G_{ix} NW#1	G_{ix} SW#2	% DIVERGENCE
Food	$a\sqrt{3}$	$a\sqrt{12}$	1.483	1.560	4.9
Clothing	$a\sqrt{3}$	$a\sqrt{9}$	1.131	1.105	2.4
Recreation	$a\sqrt{3}$	$a\sqrt{12}$	1.280	1.331	3.8
Furniture and Appl.	$a\sqrt{3}$	$a\sqrt{13}$	1.414	1.398	1.1
Drugs	$a\sqrt{4}$	$a\sqrt{12}$	1.544	1.483	3.9
Medical and Dent.	$a\sqrt{3}$	$a\sqrt{9}$	1.204	1.213	0.7
Tractor Gas	$a\sqrt{3}$	$a\sqrt{7}$	1.261	1.240	1.7
Farm Machinery	$a\sqrt{3}$	$a\sqrt{7}$	1.353	1.394	2.9
Feed, Seed and Fertilizer	$a\sqrt{3}$	$a\sqrt{7}$	1.280	1.358	5.7
Livestock	$a\sqrt{3}$	$a\sqrt{12}$	1.014	1.021	0.7

Since $b = a\sqrt{N}$, this is by definition the ideal distance

---

[8]Lösch, *op. cit.*, p. 119.

[9]This process is crude in that these are local minimum divergences and no claim can be made for generality for all combinations of N. The linearity assumed for this coefficient over the range of populations under study is generally valid.

concept which is the distance between this one town supplying this specific product and an identical image of this same town selling the same product over the idealized plain of evenly dispersed population illustrated by Lösch.[10] The dominance structure found to exist in this procedure is used to adjust the preliminary estimates of the product coefficients (G_{ix}), ideal distance and market areas.

Figures 8 and 9 represent the effect of this adjustment in market structures. This is the only adjustment made in this study to produce comparable estimates for the two areas in question.

Market Coefficient.--The market coefficient (M_{ix}) relates to the individual town's ability to attract consumer dollars in relation to its size (population) and in relation to one product (x). That is, the definition of the market coefficient is as follows:

$$M_{ix} = \frac{a_{ix} \sqrt{\text{appropriate dominance structure}}}{\frac{P_{ix}}{100}}$$

$$= \frac{b_{ix}}{\frac{P_i}{100}}$$

where b is the "ideal" distance for town i and some given product x and P_i is the population of town i. A simple

[10] Lösch, op. cit., pp. 101-138.

Fig. 8.--Furniture and Appliances Before Market Structure Divergence Adjustment: Northwest and Southwest.

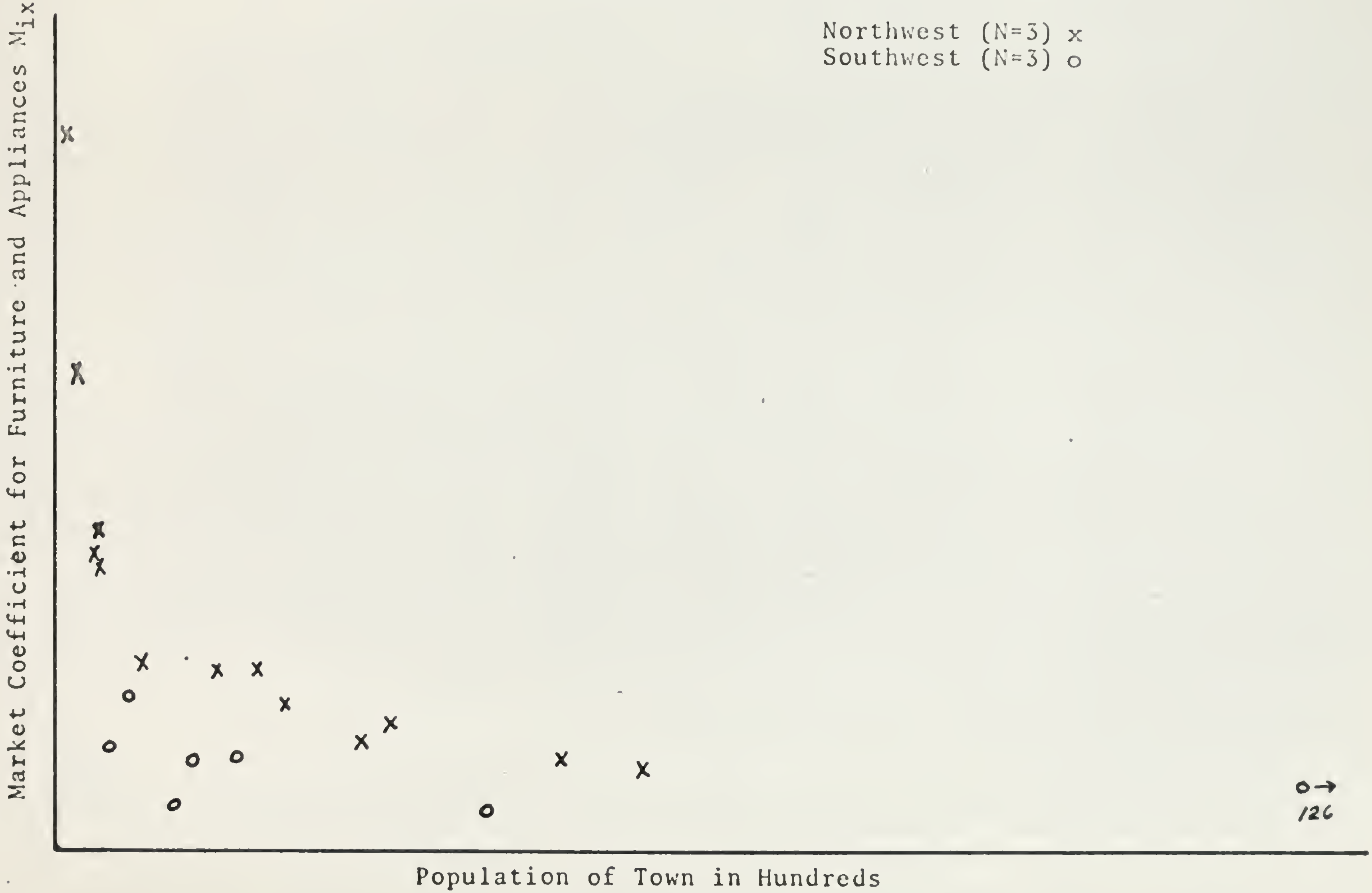
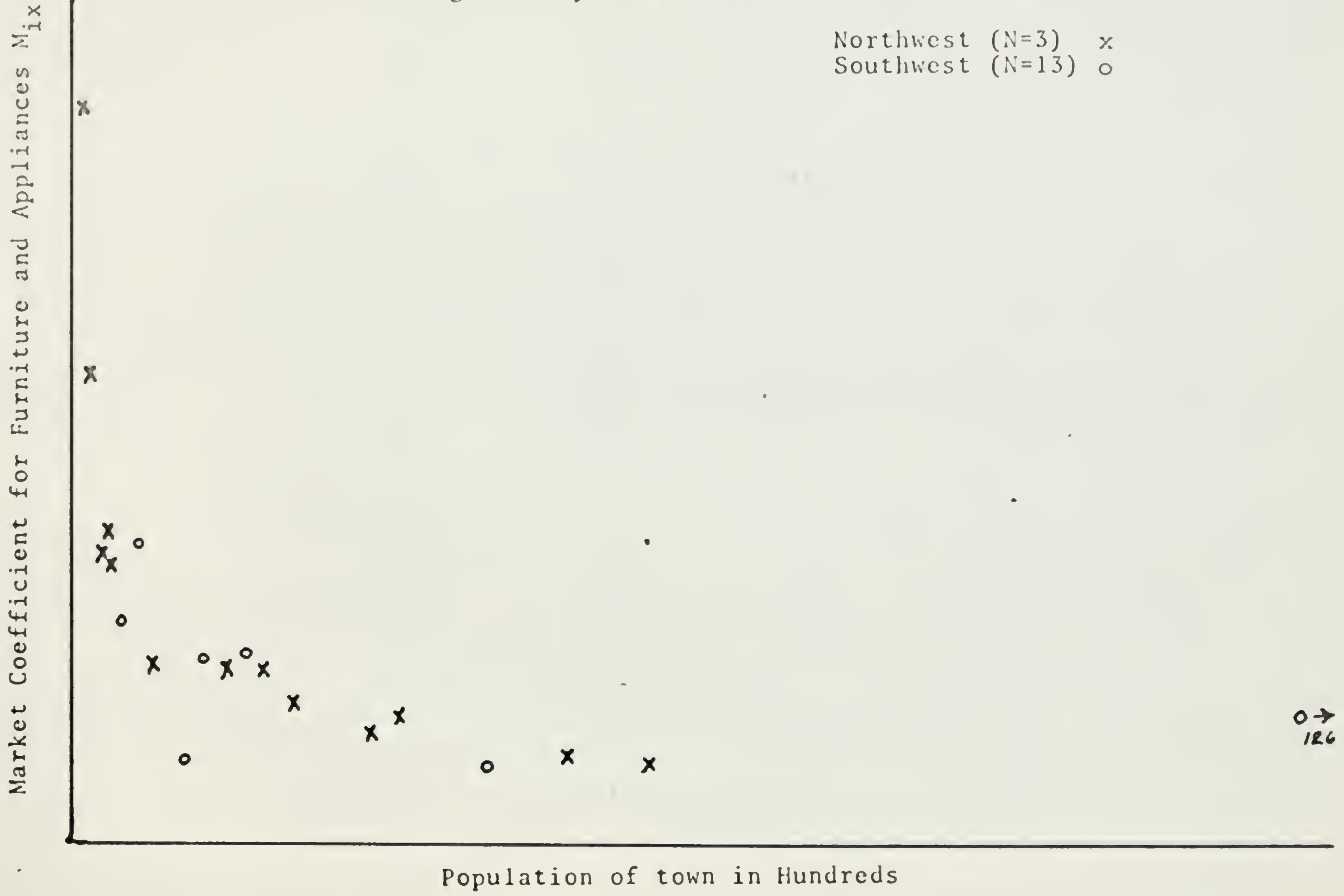


Fig. 9.--Furniture and Appliances After Market Structure Divergence Adjustment: Northwest and Southwest



comparison can now be made as to the value of the market coefficient (M_{ix}) in relation to the product coefficient (G_{ix}) for any town i. Constructing an array with the order of towns according to population along one axis and the market structure along the other axis and indicating whether the M_{ix} is above or below the G_{ix}, there appears a definate break in the nature of the shopping center between Oakley and Atwood. Therefore, three major groups emerge: (1) Garden City, which is in a group by itself due to its obvious size differential; (2) Goodland through Oakley (group 2-7), which are clearly seperated from the rest of the towns in regard to their shopping role; and (3) the remainder of the towns [group (-)], Atwood through Dresden.

Trade Area Coefficient.--The trade area coefficient averages out the total town performance in all ten product groups.[11] The definition of the town coefficient (T_{xj}) is as follows:

$$T_{xj} = \frac{\dfrac{\Sigma_{j=1}^{10} \; b_{xj}}{10}}{\dfrac{P_x}{100}} \qquad \text{for some specific}$$

town x and project j. Since this is an "average" concept, any products that are not shown to be purchased in this town affect the value of the coefficient. For instance, Brewster has coefficients for food of 3.112 and for furniture and appliances

---

[11]This concept relates to the second (#2) area above, p. 6, and indicates one town, many products.

of 3.263 yet it has a town coefficient of .637.

Group Coefficient.--The group coefficient is an average performance indicator within two basic groups of towns, i.e., group (2-7) and group (-). In this case there are three different sets of group coefficients, one set of two for the Northwest area, one set of two for the Southwest area and one set of two for the combined areas. The combined or total group coefficients are defined as follows:[12]

$$C_t^{(2-7)} = \frac{\dfrac{\Sigma_{i=2}^{7} \quad \Sigma_{j=1}^{10} \quad b_{ij}}{10}}{\Sigma_{i=2}^{7} \quad \dfrac{P_i}{100}}$$

$$C_t^{(-)} = \frac{\dfrac{\Sigma_{i=8}^{32} \quad \Sigma_{j=1}^{10} \quad b_{ij}}{10}}{\Sigma_{i=8}^{32} \quad \dfrac{P_i}{100}}$$

where the subscript t stands for the total group coefficient, and all other symbols have the same meaning for the town i and product j.

The group coefficients for the Northwest and Southwest areas are similar but only relate to the appropriate towns meeting the requirements of being in both a certain group and in a certain geographic area. For example, in group (2-7), i =

---

[12]The numerator is a representative measure of the fourth (#4) areal concept--the economic landscape--discussed above, p. 6. It involves many products and many towns.

2,3,6,7 for the Northwest area and i = 4 and 5 for the Southwest area. These two sets of "group" coefficients are indicated by the following notation:

Northwest	Southwest
$C_n^{(2-7)}$	$C_s^{(2-7)}$
$C_n^{(-)}$	$C_s^{(-)}$

CHAPTER V

METHODOLOGY

Choice of Tools:

Economic Base.--The small size and large number of towns under study preclude the use of many methods of analysis that could provide valuable information such as the economic base type proposed by Charles Tiebout.[1]

First, these types of investigations demand large amounts of specific data.[2]

Second, the relationships determined by these methods of analysis depend to a large degree on the choice of study area in square miles. This is true of most methods of analysis that rely on the import-export relationship. In fact, the very small geographic size of the unit of measure in this study may allow the import-export ratio to be considered very near unity.

A relative economic base concept is used in this study in the form of a simple ratio [market coefficients (M_{ix}) and trade area coefficients (T_{xj})] composed of a measure of the distribution function divided by a population size indicator. The

---

[1]Charles M. Tiebout, The Community Economic Base Study (Supplementary Paper No. 16; New York: Committee for Economic Development, 1962).

[2]One of the major reasons for economic base studies using input-output techniques is the determination of linkages and this requires not only the answer to the question of how much but also to whom and sometimes from whom.

resulting ratios are comparable to import-export ratios to the extent that the total distribution function divided by a crude measure of internal consumption can be related to the import-export ratio. As internal consumption increases, these ratios would tend to grow smaller while the import-export ratio would approach unity.

Regression Analysis.--Ordinary least squares is used in this study for a variety of reasons; some of which are:

1. Versatility and economy in the use of primary and secondary data sources.
2. Permits discrimination between reliable and unreliable relationships.
3. Allows for the stratification of towns within a given geographic area.
4. Provides criterion for the evaluation of stratification methods.
5. Lends itself to various well known statistical tests that allow the transition from descriptive to analytical research.

The variables used in this study are concentrated in the area of population movements and related indicators considered relevent to the prediction of growth or decline of small towns in western Kansas.

Three dependent variables are used in this study and are defined as follows:

Y_1 = Total sales (retail) and total revenue from selected services.

Y_2 = Ten product retail trade area in square miles.

Y_3 = Distance from town K to K's identical image town in miles for ten products, i.e., the ideal distance for town K.

The primary dependent variable (Y_1), total revenue from selected services and total sales, represents the total distribution function--with some service sectors missing--and is the total value in thousands of dollars.

The other two dependent variables, (Y_2) the ten product trade area in square miles and (Y_3) the ten product ideal distance, produce high simple correlation coefficients with (Y_1) of .870 and .888 for the total respectively, .997 and .966 for the growth subgroup respectively, and .906 and .942 for the nongrowth subgroup respectively (stratification G).

The major qualification for the dependent variable (Y_1) is the fact that where town data are available, county data are allocated to the towns in proportion to the population size of the towns. No consistent relationship between size of town and share of revenue from selected services and total sales could be established except that it was greater than proportional to the size of population for the larger towns for which data are available.[3] The shape and size of this function for the smaller towns is unknown.

---

[3]Central functions in relation to revenue from selected services and total sales produces a better relationship. However, it is exponential in form and the number of functions in the small towns in this study are not readily available. Brian J. L. Berry, H. Gardiner Barnum and Robert J. Tennant, "Retail Location and Consumer Behavior," The Regional Science Association Papers, Vol. 9 (1962), pp. 69-70. Figure 2 shows the relation between functional units and population so that the easier to obtain and largely equivalent units of population are used.

This data problem produces two effects. First, there is an omission of some service functions from the original data--producing a downward bias--and second, this type of allocation assumes a linear distribution.

Twelve different independent variables are evaluated in this study.

TABLE 3

INDEX OF INDEPENDENT VARIABLES

X_1 = Net migration (1962).

X_2 = Per capita tax load 1962 (gross).

X_3 = Three year migration <u>trend</u> (1961-1963).

$$\frac{(M_{t-1}-M_{t-2} + (M_t-M_{t-1})}{2}$$

X_4 = Per capita income (1963).

X_5 = Mean (net) migration (1961-1963).

$$\frac{M_{t-2} + M_{t-1} + M_t}{3}$$

X_6 = Net migration (1963).

X_{10} = Distance from town K to K's identical image town in miles for ten products adjusted for population density divergence (rural) between the two areas under study.

X_{11} = Net migration (1961).

X_{12} = Total town income.

X_{13} = Rural population density, i.e., net population density.

Preliminary Independent Variables:

X_7 = Ten product retail trade area in square miles (used as Y_2 in final regressions).

X_8 = Ideal distance for town K (used as Y_3 in final regressions).

Much of the town data is not readily available and must be allocated in accordance with some logical criteria from existing county data. The criterion used are:

1. Net migration per county is allocated to the individual towns on a basis proportional to the town population with the exception of some larger towns for which data are available.

2. Total income per county is allocated to the individual towns on a basis proportional to the town population.

3. Per capita town income is assumed to be the same as the county per capita income in which the town is located.

The implicit assumption in relation to number one above is that net migration originates uniformly throughout the urban and rural population (out-migration) and terminates uniformly throughout the urban and rural population (in-migration) for some counties.

The implicit assumption in relation to number two above is that income distribution is not significantly different between urban and rural residents in some counties.

The implicit assumption in relation to number three above is that the per capita distribution of income for the urban dweller is not significantly different from the rural dweller. This assumption results from the proportional allocation of county per capita incomes in relation to population size of the city which--due to the division of one ratio by another--equates the two per capita estimates.[4]

Factor Analysis.--Two modified and one standard factor analysis methods, used in relation to stratification within the given geographic area, proved to be efficient tools of analysis.

Procedure:

Stratification:

Stratification methods are numerous and in this study two basic methods are utilized. In addition, the towns are classed into a simple geographic stratification for comparison (Northwest and Southwest).

Stratification G.--The concept incorporated in the trade area coefficients (T_{xj})[5] is used in this stratification. Using the ten product average "Ideal" distance as a function of town population, a log-log least squares regression is applied to the data with the following results:

$M = 2.35 + p^{(.77336)}$ or $\log M = .37067 + .77336 \log. P.$

The dependent variable (M) is the mean "Ideal" distance concept and the independent variable (P) is the population of the town in 1962 or 1963 in hundreds--population in the year of survey.

---

[4]With the publication of Kansas County Income: 1950-1964 which seperates farm income from private non-farm income, independent per capita incomes could have been obtained. Proportional allocation still must be used but would have been based on more precise data. The income data used in this study are total county income figures extracted from this work prior to publication. Darwin Daicoff, Kansas County Income: 1950-1964 (State of Kansas: Office of Economic Analysis, 1966).

[5]See above, p. 46.

If the individual town's log $M \geq .3707 + .77336 \log P$, the town is considered a growth town. If the individual town's log $M < .3707 + .77336 \log P$, the town is considered a nongrowth town.

<u>Stratification</u> $\underline{B}_1$.--This stratification uses the town coefficients (T_{xj}) and the group coefficients for the Northwest and Southwest areas, i.e., $C_n^{(2-7)}$ and $C_n^{(-)}$ for the Northwest and $C_s^{(2-7)}$ and $C_s^{(-)}$ for the Southwest area.

Each town is evaluated as to its town coefficient (T_{xj}) being above or below the group coefficient for the area in question. Towns represented as being above their respective group coefficient are considered growth towns. Towns represented as being below their respective group coefficient are considered nongrowth towns.

<u>Stratification</u> $\underline{B}_2$.--This stratification is similar to stratification B_1. However, instead of evaluating the town coefficient (T_{xj}) in relation to Northwest and Southwest group coefficients, this method uses the total group coefficients $C_t^{(2-7)}$ and $C_t^{(-)}$.[6] Towns represented as being above their group coefficient are considered growth towns. Towns represented as being below their group coefficient are considered nongrowth towns.

<u>Stratification</u> <u>A</u>.--This stratification uses the component index (factor analysis) concept as illustrated by Hagood and

---

[6] See above, p. 47.

Bernert[7] with slight modification. The calculation of the factor loadings (a_j) is the same as illustrated by Hagood and Bernert. However, in applying the factor loading the standard form of each city rating is not used.[8] Stratification "A" uses this concept as follows:

$$I_i = a_1B_{i1} + a_2B_{i2} + \ldots + a_9B_{i9} = \sum_{j=1}^{9} a_jB_{ij} \quad \text{where}$$

$B_{ij} = \frac{Z_{ij}}{Z_{.j}}$ = the individual observation for town *i* in column *j* divided by the mean value of this column and a_j is the factor loading for this variable. The total town components (I_i) that are zero and above are considered growth towns while the town components less than zero are considered nongrowth towns.

Stratifications C and D.--These two stratifications use the component index method (factor analysis) in the following manner:

$$I'_i = \sum_{j=1}^{9} a_jB'_{ij} \quad \text{where } B'_{ij} = \frac{Z_{ij}}{\frac{\sum_{i=1}^{32} |Z_{ij}|}{n}} \quad = \text{the}$$

individual observation divided by the summation of the absolute values of column *j* divided by the number of observations. The

---

[7]M. J. Hagood and E. H. Bernert, "Component Indexes as a Basis for Stratification in Sampling," *Journal of the American Statistical Association*, Vol. 40 (September 1945) pp. 330-341.

[8]Walter Isard, *et al.*, *Methods of Regional Analysis: An Introduction to Regional Science* (Cambridge, Massachusetts: The MIT Press, 1960), pp. 298-299.

only difference between this and stratification "A" (above) is that the migration figures (Z_{ij}) which have negative values are considered in their absolute values to compute the mean instead of using the simple arithmetic mean.

The determination of growth and nongrowth towns is accomplished by the use of exponential least square regressions applied to the individual size groups. When the component (I'_i) is graphed as a function of population on semi-log graph paper the individual groups become apparent. Towns represented as being above their respective group regression line are termed growth and the towns represented as being below their respective group regression line are termed nongrowth (see Fig. 10).

Stratification "C" uses 1,500 population as the dividing line between the two groups of towns. This defines three groups composed of (1) Garden City, (2) towns 2-10 and (3) towns below 10.

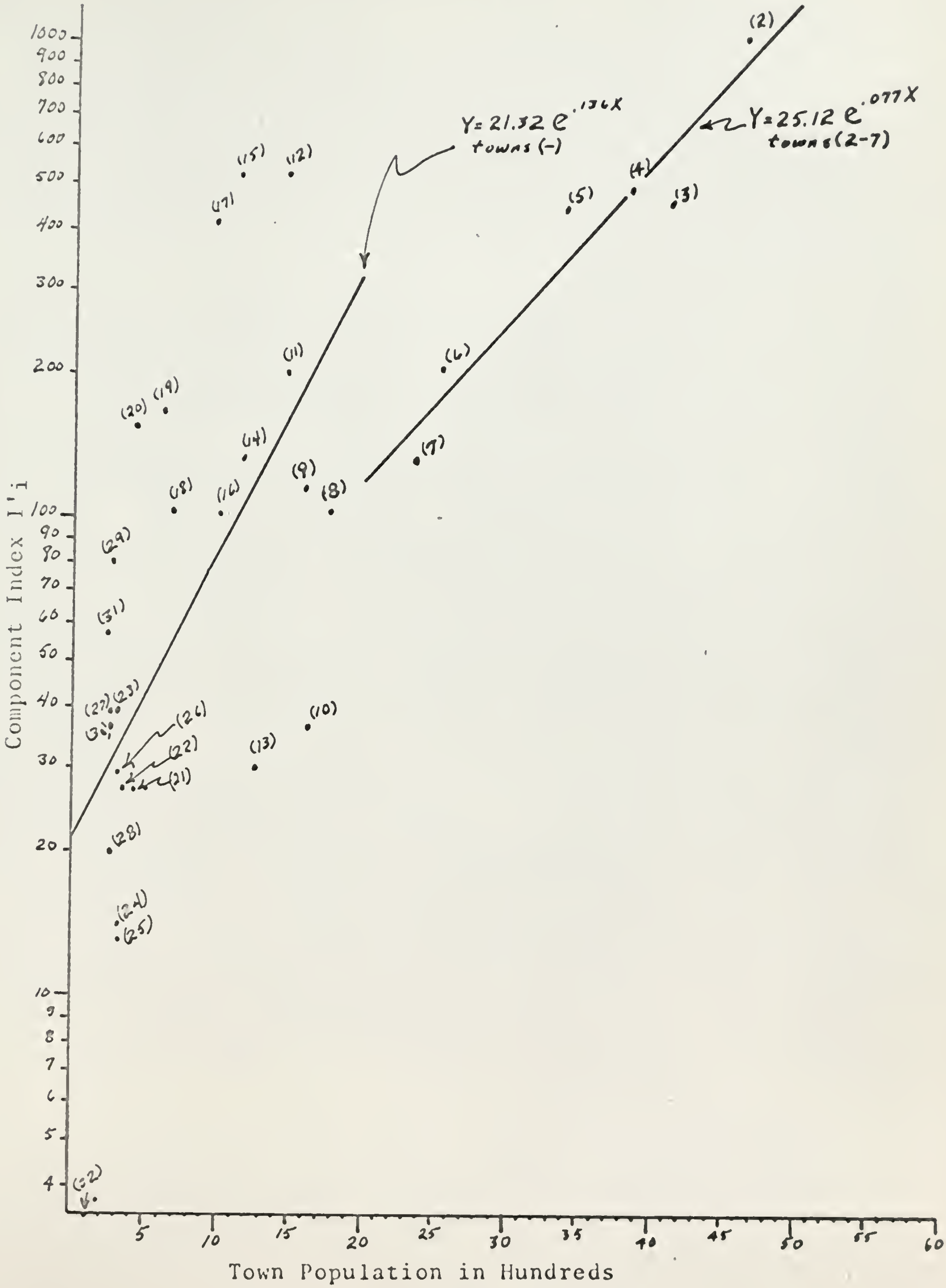
Stratification "D" uses 2,000 population as the dividing line between the last two groups of towns with Garden City comprising the first group. The last two groups are composed of towns 2-7 and towns below 7.

Stratification E.--This stratification uses the component index method (factor analysis) in the manner prescribed by most writers, i.e., the use of standard form for each rating (Z_{ij}).[9] Therefore, the following definition:

---

[9]*Ibid*., pp. 298-299.

Fig.10.--Stratification "D".



$$I''_i = \sum_{j=1}^{9} a_j B''_{ij} \quad \text{where } B''_{ij} = \frac{Z_{ij} - Z_{.j}}{s_j} = \text{the}$$

individual observation less the mean of column j divided by the standard deviation of column j.

Where $I''_i \geq 0$, town i is considered a growth town and where $I''_i < 0$, town i is considered a nongrowth town.

Regression:

The regression results are presented in two basic levels. Data groups I, II and III are the preliminary investigations and data group IV is the final regression results.

Three models are used in data group I, three in data group II and four in data group III. Five basic models are used in data group IV with each basic model being regressed on three different dependent variables producing fifteen different models.

Data Group I.--Three models are used in data group I and are:[10]

#1 $Y_1 = a + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12}$

#2 $Y_1 = a + b_{10}X_{10} + b_{11}X_{11}$

#3 $Y_1 = a + b_{11}X_{11} + b_{12}X_{12}$

All independent variables in this data group are thought to be positively related to the dependent variable.

Data Group II.--This data group has three models and they are:

---

[10]Variable identifications are indexed above, pp. 50 and 52.

#1 $Y_1 = a + b_7X_7 + b_1X_1 + b_4X_4$

#2 $Y_1 = a + b_7X_7 + b_1X_1$

#3 $Y_1 = a + b_7X_7 + b_4X_4$

All independent variables in this data group are thought to be positively related to the dependent variable.

Data Group III.--This data group has four models and they are:

#1 $Y_1 = a + b_{13}X_{13} + b_5X_5 + b_4X_4$

#2 $Y_1 = a + b_{13}X_{13} + b_5X_5$

#3 $Y_1 = a + b_{13}X_{13} + b_4X_4$

#4 $Y_1 = a + b_5X_5 + b_4X_4$

All independent variables in this data group are thought to be positively related to the dependent variable.

Data Group IV.--This data group has fifteen different models--five basic models regressed upon three different dependent variables. They are:

#1 Y_1, Y_2 or $Y_3 = a + b_2X_2 + b_4X_4 + b_5X_5$

#2 Y_1, Y_2 or $Y_3 = a + b_2X_2 + b_4X_4 + b_3X_3$

#3 Y_1, Y_2 or $Y_3 = a + b_2X_2 + b_4X_4 + b_1X_1$

#4 Y_1, Y_2 or $Y_3 = a + b_2X_2 + b_4X_4 + b_6X_6$

#5 Y_1, Y_2 or $Y_3 = a + b_2X_2 + b_5X_5$

All independent variables are thought to be positively related to all three dependent variables with the exception of X_2 (per capita government revenue, i.e., gross per capita tax load) for which no a-priori assumptions are made.[11]

Variables:

Data Group I.--The dependent variable used in this data group is (Y_1) revenue from selected services and total sales (1963) in thousands of dollars. This is county data allocated proportionally to the population of the town with the exception of Garden City, Ulysses, and Scott City for which data are available.

The independent variables for data group I are; (1) (X_{10}) the ten product ideal distance from town K to K's identical image town in miles adjusted for the net population density divergence between the two areas; (2) (X_{11}) net migration (1961) using county data allocated proportionally to the population of the town with the exception of Garden City, Ulysses, Scott City, Goodland and Colby for which city data are available; and (3) (X_{12}) total town income using County data and allocating this proportionally to the town's population.

---

[11] Net migration variable--X_5, X_1, and X_6--may have negative relationships with the dependent variables based upon an hypothesis presented by Bernard Okum and Richard W. Richardson, "Regional Income Inequality and Internal Population Migration," Economic Development and Cultural Change, Vol. 9 (1961) reproduced in John Friedmann and William Alonso (ed.), Regional Development and Planning: A Reader, (Cambridge, Massachusetts: The M.I.T. Press, 1964), p. 317.

Data Group II.--The dependent variable used in this data group is again (Y_1) revenue from selected services and total sales (1963) in thousands of dollars. This is county data allocated proportionally to the population of the town with the exception of Garden City, Ulysses, and Scott City for which data are available.

The independent variables for data group II are; (1) (X_7) retail trade and service area for ten products in square miles; (2) (X_1) net migration (1962) using county data allocated proportionally to the population of the town with the exception of Garden City, Ulysses, Scott City, Goodland, and Colby for which data are available; and (3) (X_4) per capita income (1963) and is the per capita income of the county in which the town is located.

Data Group III.--The dependent variable used in this data group is (Y_1) revenue from selected services and total sales (1963) in thousands of dollars. This is county data allocated proportionally to the population of the town with the exception of Garden City, Ulysses, and Scott City for which data are available.

The independent variables for data group III are; (1) (X_{13}) net population density of the county in which the town is located--this being the total county population less the population in incorporated towns within this county divided by the square miles of this county; (2) (X_5) mean (net) migration (1961-1963)--this being the summation of net migration for the three inclusive years allocated proportionally to the population of the town, divided by three with the exception of Garden City, Ulysses, Scott City, Goodland, and Colby for which data are available; and (3) (X_4) per capita income (1963) using the county per capita income in which the town is located.

Data Group IV.--This data group has three dependent variables. All three of these dependent variables are alternative statements of a town's relative position in the distribution of goods and services. They are; (1) (Y_2) retail trade and service area for ten products in square miles; (2) (Y_3) the ten product "Ideal" distance from town K to K's identical image town in miles; and (3) (Y_1) total revenue from selected services and total retail sales (1963) in thousands of dollars--county data allocated proportionally to the population of the town with the exception of Garden City, Ulysses, and Scott City for which data are available.

The independent variables for data group IV are; (1) (X_1) net migration (1962) using county data allocated proportionally to the population of the town with the exception of Garden City, Ulysses, Scott City, Goodland, and Colby for which data are available; (2) (X_2) per capita government revenue (gross) of the county in which the town is located; (3) (X_3) three year net migration trend (1961-1963) using county data applied proportionally to the population of the town with the exception of Garden City, Ulysses, Scott City, Goodland, and Colby for which city data are available--this being the change in net migration from 1961 to 1962 added to the change in net migration from 1962 to 1963 divided by two; (4) (X_4) per capita income (1963) and is the per capita income of the county in which the town is located; (5) (X_5) mean (net) migration (1961-1963)--this being the summation of net migration for the three inclusive years allocated proportionally to the population of the town and divided by three with the exception of Garden City, Ulysses, Scott City, Goodland, and Colby for which data are available; and (6) (X_6) net migration (1963) using county data applied proportionally to the town population with the exception of Garden City, Ulysses, Scott City, Goodland, and Colby for which city data are available.

CHAPTER VI

THE RESULTS

Stratification Methods:

The criterion devised to test the stratification methods for efficiency is composed of two parts. The first part is completed by inspection of the regression results in relation to the multiple correlation coefficient squared (R^2) and the model "F" value. The second part is the actual test as to whether the acceptances are significantly different from zero.

The first two hypotheses are as follows:

Ho_1 : R^2_t = both R^2_g and R^2_n for a given model.

Ho_2 : F_t = both F_g and F_n for a given model.

Where g = growth subgroup.
n = nongrowth subgroup.
t = total population

These hypotheses are evaluated by inspection in relation to each model in data group IV and a simple count is made within each stratum as to how many models indicate rejection of Ho_1 and how many models indicate rejection of Ho_2.

The chi-square test is performed in relation to an hypothesis concerning the relation of these regression models and their cumulative performance within each stratum.

The hypothesis tested is:

$Ho_{st',\ 1\ or\ 2}$: sum of models rejecting Ho_1 or Ho_2 = 0

TABLE 4

DATA GROUP IV: THE FREQUENCY OF MODELS REJECTING Ho_1 OR Ho_2 IN RELATION TO THE STRATIFICATION METHOD USED--EFFICIENCY OF STRATIFICATION METHODS

Model No.	G		B_1		B_2		A		C		D		E		NW-SW		Total		
	F	R[a]	F	R[a]	F	R[a]	F	R[a]	F	R[a]	F	R[a]	F	R[a]	F	R[a]	F	R[a]	
1		1		3		1		1	1	2		3		1			1	12	13
2	2	3	1	2		3	2	2	2	3	1	3	1	1	1	3	10	20	30[a]
3		2								1		3		2		3	0	11	11
4														1		1	0	2	2
5				3		1		1	1	2	2	2		1			3	10	13
Total	2	6	1	8	0	5	2	4	4	8	3	11**	1	6	1	7			

This null hypothesis is tested with a simple count of the number of models rejecting Ho_1 or Ho_2. Using a corrected chi-square test (Yates' correction for continuity) only stratification "D" in data group IV rejected Ho_{st} (see Table 4). In all cases the Ho_{st} relating to the model "F" value is accepted. Stratification "D" rejected Ho_{st} in relation to the R^2 with a corrected chi-square value of 7.350**.[1]

The null hypothesis tested above emphasizes the balanced nature of stratification "D". But stratification "A", in relation to the growth subgroup, is more efficient in both model "F" value and R^2 for all models (see Table 5).

TABLE 5

STRATIFICATION PERFORMANCE INDEPENDENT OF THE MODEL
DATA GROUP IV

	Number of Models in which Growth F & R^2 = Total F & R^2	Number of Models in which Nongrowth F & R^2 = Total F & R^2
Strat A	30	7
Strat D	22	17
Strat C	23	14
Strat G	29	8
NW vs SW	23	12
Strat B_1	18	9
Strat B_2	24	6
Strat E	17	7

[1]The corrected chi-square value in relation to the null hypothesis, Ho: Sum of models rejecting = sum of models accepting Ho_1 is 3.266 which is significant at the ten per cent level of confidence.

TABLE 6

STRATIFICATION PERFORMANCE INDEPENDENT OF THE MODEL: DATA GROUP III

	Number of Models in which Growth F & R^2 = Total F & R^2.	Number of models in which Nongrowth F & R^2 = Total F & R^2.
Strat A	8	6
Strat D	7	4
Strat C	7	4
Strat G	8	1
NW vs SW	7	2

As can be seen, both stratification "A" and "G" emphasize the efficiency of the growth subgroup to the neglect of the nongrowth subgroup in Data Group IV. Stratification "A" in Data Group III proves to be most efficient in growth and nongrowth subgroups.

From the preceding results, three stratifications will be termed efficient. Stratification "D" will be classified as a balanced stratification. Stratifications "A" and "G" will be classified as growth stratifications.

Multiple Regression:

Growth vs. Nongrowth Populations.--Using the first step in the concept of analysis of covariance,[2] the following null hypotheses are tested:

Ho_3 : Variance of growth stratum = Variance of nongrowth stratum

Ho_4 : $(B_{gi} = B = B_{ni} \quad Var_g = Var_n)$

---

[2]H. C. Fryer, Concepts and Methods of Experimental Statistics (Boston: Allyn and Bacon, Inc., 1966), pp. 397-404.

where var_g is the variance of the growth subgroup, Var_n is the variance of the nongrowth subgroup, B_{gi} is the regression coefficient i of the growth subgroup and B_{ni} is the regression coefficient i of the nongrowth subgroup.

Null hypothesis number three (Ho_3) is tested using Hartley's maximum-F test (Fmax).[3] The fourth null hypothesis tested (Ho_4) is only valid if Ho_3 is accepted and is tested with the first step of the analysis of covariance which results in a typical "F" ratio.

The following table presents the results of these tests in relation to dependent variable Y_1, i.e., revenue from selected services (total) and total retail sales.

Population Size and Growth Potential:

Using Spearman's rank correlation coefficient (r_s) the following relationships between the ordering on the basis of population size and the various growth potential measurements are presented.[4]

Stratification G.--The Spearman rank correlation coefficient is .85227**. This r_s is calculated by listing the towns

---

[3]Ibid., p. 246.

[4]Fryer, op. cit., pp. 236-237. The significance of this coefficient is tested with the hypothesis that it is equal to zero. One asterisk indicates a significant value at the five per cent level of confidence, two asterisks indicate a significant value at the one per cent level of confidence and "ns" indicates a value not significantly different from zero.

TABLE 7

RESULTS OF TESTING HO_3 AND HO_4 IN RELATION TO DEPENDENT VARIABLE Y_1: DIFFERENCES BETWEEN STRATA

Independent variable	Stratification A		Stratification D	
	Fmax	F	Fmax	F
$X_{1,1}$	4.783**	-------	2.951*	-------
$X_{2,1}$	4.614**	-------	3.535*	-------
$X_{3,1}$	7.265**	-------	5.570**	-------
$X_{4,1}$	10.992**	-------	6.249**	-------
$X_{5,1}$	1.036ns	87.254**	1.731ns	79.122**
$X_{6,1}$	1.397ns	31.748**	2.977*	-------
$X_{10,1}$	1.493ns[a]	.578ns	-------	-------
$X_{11,1}$	1.315ns[a]	18.987**	-------	-------
$X_{12,1}$	1.380ns[a]	4.063ns	-------	-------
$X_{13,1}$	5.774**	--------	3.642*	-------

[a]Stratification "G", data group I is the only data group using these specific variables.

*Rejected Ho at the five per cent confidence level.

**Rejected Ho at the one per cent confidence level.

in order of the 1962 population for the Southwest and the 1963 population for the Northwest (year of the survey for the respective areas) and then again in order of the size of the adjusted ideal distance for town _i_ in relation to the ten products, i.e., the numerator for the town coefficient.

Stratification B_1 and B_2.--The Spearman rank correlation coefficient for these two stratifications is .99902**. This r_s is calculated by listing the towns in order of their populations as before and then again in order of the size of their town coefficient within their respective groups.

Stratification _A_.--The Spearman rank correlation coefficient for this stratification is -.04069ns. This r_s is calculated by listing the towns in order of their population as before and then again in order of the size of their individual component index (I_i). Although this stratification is one of the most efficient stratifications, the ranking of growth towns with this method is shown to have no relationship to town population.

Stratification _C_ and _D_.--The Spearman rank correlation coefficient for these two stratifications is .74872**. This r_s is calculated by listing the towns in order of their population as before and then again in order of the size of their component index (I'_i).

Stratification _E_.--The Spearman rank correlation coefficient for this stratification is .81048**. This r_s is calculated by listing the towns in order of their population as before and then again in order of the size of their individual component index (I''_i).

In the following table the stratifications are listed in an ordered array in relation to the largest model R^2 achieved for the growth subgroup. The Spearman rank correlation coefficient for the respective group is listed in the last column. The general relationship between the size of the Spearman rank correlation coefficient and the size of the model R^2 can be seen to be negative.

TABLE 8

RELATIONSHIP BETWEEN EFFICIENCY OF STRATIFICATIONS AND THE SPEARMAN RANK CORRELATION COEFFICIENT INDICATING THE RELATIONSHIP BETWEEN POPULATION SIZE AND THE DISTRIBUTION FUNCTION

Stratum	Largest R^2 Data Gp. I			Largest R^2 Data Gp. II			Largest R^2 Data Gp. III			Largest R^2 Data Gp. IV			r_s
	Total	Growth	Nongrowth	Total	Growth	Nongrowth	Total	Growth (SW)	Nongrowth (NW)	Total	Growth (SW)	Nongrowth (NW)	
A	----	----	----	----	----	----	.475	.922	.635	.517	.960	.596	-.041ns
NW--SW	----	----	----	----	----	----	.475	.941	.403	.517	.954	.644	-------
D[a]	----	----	----	----	----	----	.475	.906	.543	.517	.927	.707	.749**
G	.989	.998	.978	.818	.996	.916	.475	.892	.358	.517	.920	.472	.852**
C[a]	----	----	----	----	----	----	.475	.836	.486	.517	.903	.734	.749**
B_2[b]	----	----	----	----	----	----	----	----	----	.517	.885	.619	.999**
E	----	----	----	----	----	----	----	----	----	.517	.849	.448	.810**
B_1[b]	----	----	----	----	----	----	----	----	----	.517	.650	.700	.999**

[a]These two stratification methods have the same r_s.

[b]These two stratification methods have the same r_s.

CHAPTER VII

THE CONCLUSIONS

One of the major purposes of this study is to provide and evaluate some way of distinguishing the prospects for growth or decline of trade centers of western Kansas. The type and quantity of remedial action by public authorities depends on the nature and size of the problem to be solved. Therefore, a method for indicating the direction toward which the economic system is progressing needs to be provided and evaluated.

The framework for identifying growth from nongrowth towns presented in this study is based on one major assumption. This assumption is as follows:

> Small towns located in a relatively homogeneous geographic area in which the "area" basic industry is agricultural production have as their main source of revenue the distribution of products and services to this "dispersed farm" population. In this sense, the external distribution of products and services can be considered the "basic" industry for these towns.[1]

The first method of identification uses trade areas in relation to ten product-groups. Using this direct stratification procedure, stratifications "G", "B_1", and "B_2" are produced. Of these three stratifications, only stratification "G" proved to be efficient in producing relatively homogeneous

---

[1] Above, p. 17.

strata. Some of the advantages of this approach are:

1. The trade area coefficient (T_{xj}) and stratification "G"--which is based on this concept--utilizes a simplified relative export position of the small towns.

2. This concept is capable of disaggregation to the individual town level and, in conjunction with a display of the market coefficients (M_{ix}), can illustrate the strengths and weaknesses of the individual town, (see Tables 11 and 12).

3. Evaluating the trade area as an ideal distance concept provides a method for comparison and evaluation of the actual distances between towns and the distance people travel to suppliers (see Tables 9 and 10).

Some major disadvantages of this approach are:

1. The dependence upon agricultural production as the area major economic base is much more valid for the Northwest area than in the Southwest area. That is, the validity of the town base industry assumption will vary from one area to another depending on the homogeniety of the area's economic base.

2. This approach requires primary data in the form of trade area surveys.

3. As towns become less dependent upon the external area base industry, the critical position of the distribution function becomes less important. Therefore, the relation between growth potential and the distribution function may be invalidated for towns located in mixed base areas.

Note should be made here that due to the primary nature of this data, effecient coefficients are produced without stratification for the total population.

This is due to the fact, however, that both dependent and independent variables are essentially different measurements of the same variable, i.e., the distribution function.

The second method, using factor analysis techniques, relies on this basic industry concept as stated above and, in

TABLE 9

COMPARISON BETWEEN PREDICTED DISTANCE BETWEEN SUPPLIERS AND ACTUAL DISTANCE BETWEEN CENTERS NORTHWEST AREA #1

Product	Min. Avg. Dist.(Actual)	Max. Avg. Dist. (Act.)	Predicted Dist.
Food	19.000	19.000	20.849
Clothing	31.125	38.000	27.791
Recreation	25.500	30.400	26.047
Furniture and Appliances	19.384	23.384	22.384
Drugs	26.700	30.400	31.871
Medical and Dental	27.666	33.777	27.240
Livestock	29.666	50.666	27.328
Tractor Gas	20.857	21.714	19.722
Farm Machinery	22.636	27.636	25.838
Feed, Seed and Fertilizer	22.461	23.384	21.266
Total	23.518	27.636	24.291
First 7 products	24.518	29.555	25.489
Last 3 products	21.921	24.000	22.021
1,4,8,9,10	20.731	22.686	21.811
2,3,5,6,7	27.860	35.348	28.154

TABLE 10

COMPARISON BETWEEN PREDICTED DISTANCE BETWEEN SUPPLIERS AND ACTUAL DISTANCE BETWEEN CENTERS SOUTHWEST AREA #2

Product	Min. Avg. Dist. (Actual)	Max. Avg. Dist. (Act.)	Predicted Dist.
Food	17.000	17.461	34.950
Clothing	18.200	45.400	43.156
Recreation	20.091	20.636	34.280
Furniture and Appliances	16.286	32.428	41.062
Drugs	19.000	25.222	42.189
Medical and Dental	21.375	28.375	38.182
Livestock	26.166	37.833	36.733
Tractor Gas	18.416	18.916	30.848
Farm Machinery	16.214	16.214	29.278
Feed, Seed and Fertilizer	17.000	17.461	30.424
Total	18.520	23.163	34.855
First 7 products	19.423	26.932	37.969
Last 3 products	17.153	17.461	30.143
1,4,8,9,10	17.016	19.237	32.498
2,3,5,6,7	20.794	29.102	38.421

TABLE 11

INDIVIDUAL TOWN MARKET COEFFICIENTS (M_{ix}) AND TRADE AREA COEFFICIENT (T_{xj}) FOR TEN PRODUCT-GROUPS
NORTHWEST AREA #1

Town	T_{ij}	M_{i1}	M_{i2}	M_{i3}	M_{i4}	M_{i5}	M_{i6}	M_{i7}	M_{i8}	M_{i9}	M_{i10}
Colby	.916	1.045	.992	1.051	.964	1.249	1.180	.623	.905	.732	.425
Goodland	.762	.843	.915	.798	.870	.954	.774	.545	.723	.553	.647
Oakley	.872	1.182	1.114	1.086	1.148	1.380	.973	.610	.623	.610	
Oberlin	1.206	1.205	1.310	1.227	1.300	1.466	1.305	.968	1.149	.982	1.149
Hoxie	1.782	1.994	1.305	1.191	1.906	2.318	2.008	1.167	2.383	1.167	2.383
St. Francis	1.677	1.663	1.176	1.986	1.914	2.060	1.684	1.567	1.610	1.589	1.522
Bird City	1.896	2.739			1.985	3.202	1.937	3.001	3.063	3.032	
Mc Donald	1.277	3.092						4.790	4.888		
Atwood	1.645	1.688	1.510	1.802	1.556	1.870	1.422	1.170	2.068	1.671	1.688
Norcatur	1.541	4.210						4.612		6.589	
Winona	.542	2.530		2.885							
Jennings	1.857	3.535				4.082		5.476		5.476	
Selden	2.348	2.922			3.065			6.403	4.621	6.469	
Brewster	.638	3.112			3.263						
Kanarado	.985	4.808			5.042						
Sharon Springs	1.234	1.588	1.296	1.787		1.863	.916	1.420	2.050	1.420	
Herndon	1.900			3.654	3.361			7.022		4.965	
Dresden	.752				7.525						
NW M_{ix}		1.483	1.131	1.280	1.414	1.544	1.204	1.261	1.353	1.280	1.014
Total M_{ix}		1.526	1.118	1.310	1.406	1.510	1.209	1.249	1.377	1.324	1.018

M_{i1} = Food; M_{i2} = Clothing; M_{i3} = Recreation; M_{i4} = Furniture and Appliances; M_{i5} = Drugs; M_{i6} = Medical and Dental; M_{i7} = Tractor Gas; M_{i8} = Farm Machinery; M_{i9} = Feed, Seed and Fertilizer and M_{i10} = Livestock.

$C_t^{(2-7)} = .7954$; $C_t^{(-)} = 1.7055$; $C_n^{(2-7)} = .9117$; $C_n^{(-)} = 1.5571$

TABLE 12

INDIVIDUAL TOWN MARKET COEFFICIENTS (M_{ix}) AND TRADE AREA COEFFICIENT (T_{xj}) FOR TEN PRODUCT-GROUPS SOUTHWEST AREA #2

Town	T_{ij}	M_{i1}	M_{i2}	M_{i3}	M_{i4}	M_{i5}	M_{i6}	M_{i7}	M_{i8}	M_{i9}	M_{i10}
Ulysses	.702	.812	.647	.812	.813	1.008	1.095	.439	.621	.770	
Sublette	2.443	4.313	2.116	2.668	1.996	3.354	2.420	2.974	1.320	3.274	
Satanta	2.025	3.219	1.069	3.123	.813	2.761	2.293	2.633	2.150	2.191	
Ingalls	3.584	8.543							7.843	19.45	
Garden City	.957	1.102	1.139	1.212	1.354	1.174	1.029	.572	.608	.588	.792
Lakin	2.425	3.547	1.116	2.681	2.048	3.044	2.807	2.524	1.774	2.540	2.168
Deerfield	2.934	4.242		4.045	2.306	3.133		4.981	7.112	3.523	
Copeland	4.578	7.558		6.545					13.54	6.008	
Montezuma	3.638	5.137			3.225	4.289	1.897	5.549	6.999	5.591	3.687
Cimarron	1.747	2.057		1.127		2.682	2.146	3.461	2.855	3.143	
Leoti	.831	.971		.899				1.430	2.041	1.457	1.513
Scott City	.459	.505		.626		.464	.297	.668	.779	.676	.577
Dighton	.622	.884		.818				.920	1.301	.920	1.378
Ensign	.573								5.731		
SW M_{ix}		1.560	1.105	1.331	1.398	1.483	1.213	1.240	1.394	1.358	1.021
Total M_{ix}		1.526	1.118	1.310	1.406	1.510	1.209	1.249	1.377	1.324	1.018

M_{i1} = Food; M_{i2} = Clothing; M_{i3} = Recreation; M_{i4} = Furniture and Appliance M_{i5} = Drugs; M_{i6} = Medical and Dental; M_{i7} = Tractor Gas; M_{i8} = Farm Machinery; M_{i9} = Feed, Seed and Fertilizer and M_{i10} = Livestock.

$C_t^{(2-7)} = .7954$; $C_t^{(-)} = 1.7055$; $C_s^{(2-7)} = .5727$; $C_s^{(-)} = 1.8428$

addition, it relies on the validity of the relationship the independent variables display in relation to the distribution function.

Factor analysis techniques produce stratification "A", "C", "D", and "E". Stratification "E" is the only stratification using the standard factor analysis techniques. Stratifications "C" and "D" use one method for evaluating the individual town observations and stratification "A" uses weighted town observations in relation to specific migration variables.

This weighted factor analysis technique (stratification "A") produces the most efficient stratification obtained in this study in relation to growth towns. Stratification "D" produces subpopulations of towns with more equal amounts of explained variation.

This approach to stratification has the following advantages.

1. It is the most efficient method of stratification in relation to the variables used.

2. It can include many causally related variables which affect the distribution function of a given town and allocate appropriate weights in relation to the effect these variables have on the distribution function.

3. It provides efficient results within a given geographic area using <u>secondary</u> data sources.

Some of the major limitations of this method are:

1. As towns become less dependent upon the external area base industry, the critical position of the distribution function becomes less important. Therefore, the relation between growth potential and the distribution function may be invalidated for towns located in mixed base areas.

2. This method is not capable of disaggregation into individual market areas for individual towns due to the secondary nature of the data source.

3. There is no empirical equivilent relationship between the resulting component index and a real world measure of the town since the relationship between population size and the component index seems to move in the opposite direction in relation to efficiency of stratification achieved (see Table 8).

<u>Growth Towns in Western Kansas</u>:

Using three stratifications--A, D, and G--the growth towns of the Northwest and Southwest areas are presented.

TABLE 13

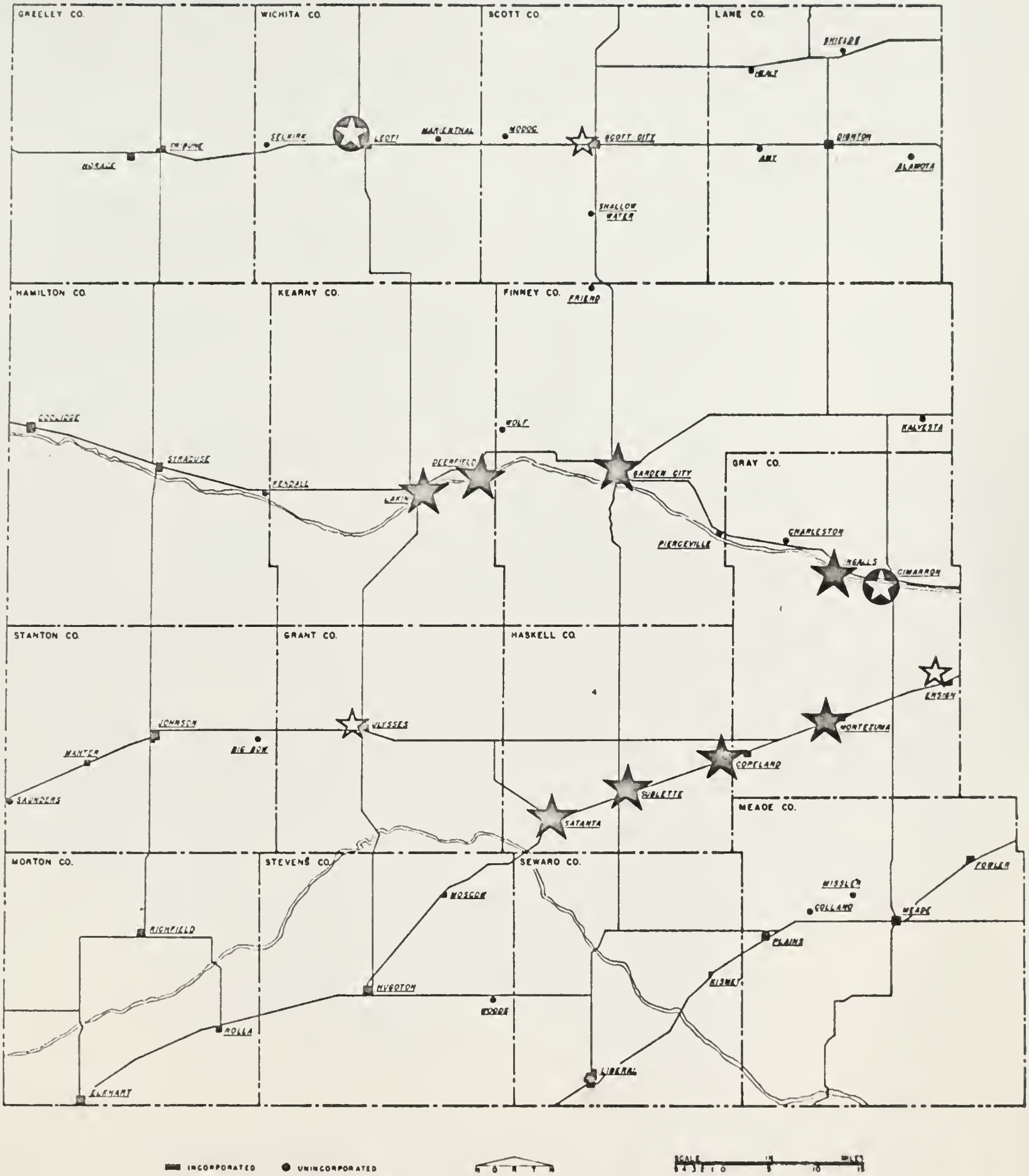
SHORT RUN IDENTIFICATION OF GROWTH TOWNS IN WESTERN KANSAS BY THE FREQUENCY OF INCLUSION IN STRATIFICATIONS A, D AND G

Included in all three			Excluded from one				Included in one only			
Garden City	(1)	SW	Goodland	(2)	NW	[G]	Scott City	(4)	[A]	SW
Lakin	(12)	SW	Oberlin	(6)	NW	[A]	Ulysses	(5)	[D]	SW
Sublette	(15)	SW	Leoti	(11)	SW	[G]	Atwood	(8)	[G]	NW
Satanta	(17)	SW	Cimarron	(14)	SW	[A]	St. Francis	(9)	[G]	NW
Bird City	(18)	NW					Hoxie	(13)	[G]	NW
Montezuma	(19)	SW					Sharon Spgs.	(16)	[D]	NW
Deerfield	(20)	SW					Seldon	(22)	[G]	NW
Copeland	(29)	SW					Norcatur	(23)	[D]	NW
Ingalls	(31)	SW					Herndon	(26)	[G]	NW
							Jennings	(27)	[D]	NW
							Ensign	(28)	[A]	SW
							Kanarado	(30)	[D]	NW

<u>Suggestions for Further Research</u>:

The nature of some of the data used and the arbitrary manner in which it is allocated to the individual towns provide one of the most important needs for additional verification of the relationships found in the regression coefficients. Also,

Fig. 11.--Short run identification of Growth Towns in the Southwest (-) Area.

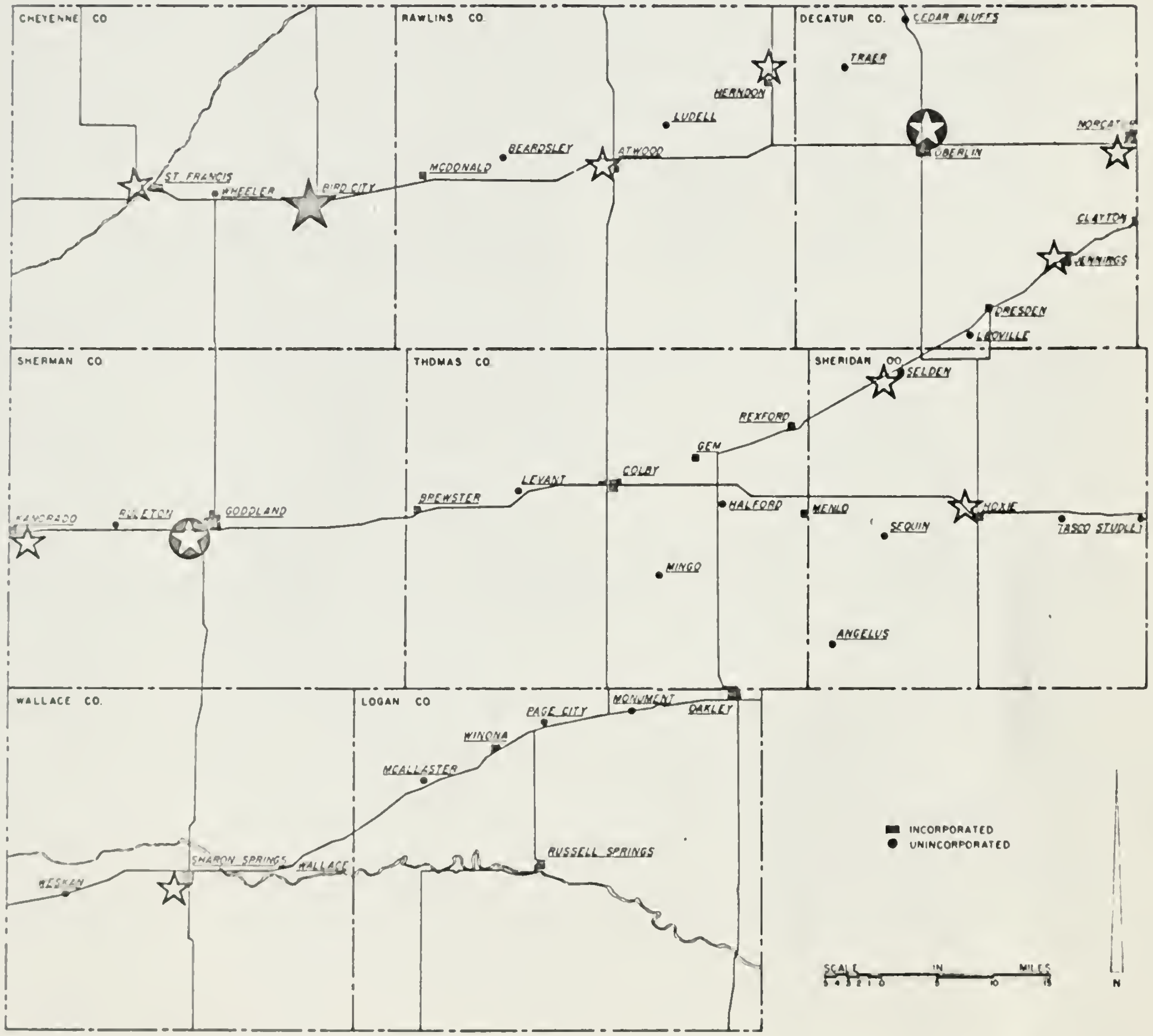


Excluded from one ✪

Included in only one ☆

Included in Stratifications A, D and G ★

Fig. 12.--Short run identification of Growth Towns in the Northwest Area



Included in Stratifications A, D and G ★

Excluded from one stratification ✪

Included in one stratification only ☆

the number of observations in much too small to allow the placing of much emphasis on the coefficients.

Still many of these relationships are highly significant and have very different directions and intensities when comparisons between growth and nongrowth subpopulations are made.

The identification of growth and nongrowth towns rests very heavily on an assumption concerning the basic industry of small towns serving a dispersed farm population. Should this assumption prove generally valid, however, the short run growth town identifications have no forseeable limitations on validity except the short run time span itself. In relation to the long run effects of population movements some doubt may exist as to whether these are short or long run identifications. This leads to the next major area of suggested additional investigation.

Time series data would enable long run predictions of a relatively precise nature. This approach would provide coefficients that would enable the evaluation of similar studies using time series and cross sectional time lag coefficients.

Simple linear relations are used. This intuitively--although not necessairly--does great discredit to some independent variables which may exhibit curvelinear relationships. Additional investigation into the nature of the relationships as well as into additional data sources needs to be conducted.

Concluding Remarks:

As is the case with most studies of this nature, it opens up many different avenues of analysis. However, two general methods for the identification of growth and declining trade centers have been presented along with the identification of some important causally related variables. The results strongly suggest that stratification of towns by the use of relevent variables, as stratification "A" and "D" have shown, is feasable and efficient. In addition, the side product of regression coefficients for quantative estimates lends utility to this approach.

Finally, the estimates of growth and nongrowth towns presented in figures eleven and twelve and table thirteen are very tenative due to the short time period covered by the data. The presentation is generally valid, however, in relation to the years 1961-1963. Other factors, however, have entered since this time such as the completion of a new interstate highway system into the Northwest area.

BIBLIOGRAPHY

BIBLIOGRAPHY

Public Documents

Kansas State Board of Agriculture, "Population of Kansas," January 1, 1961, as reported by the County Assessors, Topeka, Kansas. (Mimeographed)

_______. "Population of Kansas," January 1, 1962 as reported by the County Assessors, Topeka, Kansas. (Mimeographed)

_______. "Population of Kansas," January 1, 1963 as reported by the County Assessors, Topeka, Kansas. (Mimeographed)

_______. "Population of Kansas," January 1, 1964 as reported by the County Assessors, Topeka, Kansas. (Mimeographed)

U.S. Bureau of the Census. United States Census of Agriculture: 1964, (Preliminary Report).

_______. United States Census of Governments: Government in Kansas, 1962.

_______. United States Census of Population: 1960.

_______. 1963 Census of Business: Retail Trade, Kansas.

_______. 1963 Census of Business: Selected Services, Kansas.

_______. 1958 Census of Mineral Industries, Kansas.

Books

Borts, George H. and Stein, Jerome L. Economic Growth in a Free Market. New York: Columbia University Press, 1964.

Christaller, Walter. Central Places in Southern Germany. Translated from Die Zentralen Orte in Süddeutschland by Carlisle W. Baskin. Englewood Cliffs, New Jersey: Prentice-Hall, 1966.

Cochran, William G. Sampling Techniques. New York: John Wiley & Sons, Inc., 1964.

Fryer, H. C. Concepts and Methods of Experimental Statistics. Boston: Allyn and Bacon, Inc., 1966.

Isard, Walter, et al. Methods of Regional Analysis: An Introduction to Regional Science. Cambridge, Massachusetts: The M.I.T. Press, 1960.

Lösch, August. The Economics of Location. Translated from the second revised edition by William H. Woglom with the assistance of Wolfgang F. Stolper. New Haven: Yale University Press, 1964.

Perloff, Harvey S., et al. Regions Resources, and Economic Growth. Lincoln: University of Nebraska Press, 1960.

Articles and Periodicals

Berry, Brian J. L., Barnum, H. Gardiner and Tennant, Robert J. "Retail Location and Consumer Behavior," The Regional Science Association Papers, 9 (1962), 64-106.

Bratcher, A. S. "A Method of Delineating Retail Trade Zones," Journal of Marketing, 3 (1939), 262-264.

Brush, J. E. and Bracey, H. E. "Rural Service Centers in Southwestern Wisconsin and Southern England," The Geographical Review, 45 (1955), 559-569.

Converse, P. D. "Retail Trade Areas in Illinois," University of Illinois, "Bureau of Economic and Business Research Business Studies." (1946), 2.

Douglas, Edna. "Measuring the General Retail Trading Area--A Case Study," Journal of Marketing, XIII, No. 4 (April, 1949), 481-497 and XIV, No. 1 (July, 1949), 46-60.

Easterlin, R. A. "Economic-Demographic Interactions and Long Swings in Economic Growth, "The American Economic Review, LVI (December, 1966), 1063-1104.

Eiselen, Elizabeth. "The Tourist Industry of a Modern Highway: U.S. 16 in South Dakota," Economic Geography, 21, No. 3 (July, 1945).

Ferber, Robert. "Variations in Retail Sales Between Cities," Journal of Marketing, XXII, No. 3 (January, 1958), 295-303.

Fox, Karl A. and Kumar, Krishna T. "Delineating Functional Economic Areas," Research and Education for Regional and Area Development, Ames, Iowa: Iowa State University Press, 1966.

Golledge, R. G., Rushton, G., and Clark, W.A.V. "Some Spatial Characteristics of Iowa's Dispersed Farm Population and Their Implications for the Grouping of Central Place Functions," Economic Geography, 42, No. 3 (July, 1966), 261-272.

Hagood, M. J. and Bernert, E. H. "Component Indexes as a Basis for Stratification in Sampling," Journal of the American Statistical Association, 40 (September, 1945), 330-341.

Hassinger, Edward. "The Relationship of Retail-Service Patterns to Trade Center Population Change," Rural Sociology, XXII, No. 3 (September, 1957).

Hodge, Gerald. "The Prediction of Trade Center Viability in the Great Plains," The Regional Science Association Papers, 15 (1965), 87-115.

Hodges, J. L. Jr. and Delenius, T. "Minimum Variance Stratification," Journal American Statistical Association, 54 (1959), 88-101.

Huff, D. L. "A Probabilistic Analysis of Shopping Center Trade Areas," Land Economics, 39 (1963), 81-89.

Hutchinson, Ruth Gillette, et al. "A Study in Business Mortality," American Economic Review, XXVIII, No. 3. (September, 1938), 497-514.

Inkle, F. C. "Sociological Relationship of Traffic to Population and Distance," Traffic Quarterly, 8 (1954), 123-136.

Isard, Walter and Peck, M. J. "Location Theory and International and Interregional Trade Theory," Quarterly Journal of Economics, 68 (February, 1954), 97-114.

_______. "Location Theory and Trade Theory, Short Run Analysis," Quarterly Journal of Economics, 68 (May 1954), 305-320.

Nelson, Lowry and Jacobson, Ernst T. "Recent Changes in Farm Trade Centers of Minnesota," Rural Sociology, 6, No. 2 (June, 1941), 99-106.

Nesmith, Dwight A. "The Smaller Rural Town," Yearbook of Agriculture, (1963).

Northam, R. M. "Declining Urban Centers in the United States: 1940-1960," Annals of the Association of American Geographers, 53 (1963), 50-59.

Okun, Bernard and Richardson, Richard W. "Regional Income Inequality and Internal Population Migration," Economic Development and Cultural Change, 9 (1961).

Olsen, Bernard M. "An Application of Factor Analysis to Regional Economic Growth," Journal of Regional Science,6, No. 1 (Summer, 1965), 51-56.

Perloff, Harvey S. "Problems of Assessing Regional Economic Progress," in Studies in Income and Wealth, 21 ("Regional Income," National Bureau of Economic Research), Princeton: Princeton University Press, 1957, 35-62.

Roberts, J. M., et al. "The Small Highway Business on U.S. 30 in Nebraska," Economic Geography, 32 (1956), 139-152.

Ross, H. L. "The Local Community: A Survey Approach," American Sociological Review, 27 (1962), 75-84.

Rowe, J. B. "The Form and Function of the Rural Township," The Australian Geographer, 4 (1964), 217-225.

Rushton, G. "Spatial Competition for the Supply of Goods and Services to the Iowa Dispersed Population," Iowa Business Digest, 35 (1964), 3-8.

Stafford, H. A. "The functional Basis of Small Towns," Economic Geography, 39 (1963), 165-175.

Thomas, Edwin N. "Some Comments on the Functional Bases for Small Iowa Towns," Iowa Business Digest, (Winter, 1960), 10-16

Thomas, E. N., Mitchell, R. A. and Blome, D. A. "The Spatial Behavior of Dispersed Non-Farm Population," Papers and Proceedings of the Regional Science Association, 9 (1962), 107-133.

Thornthwaite, C. Warren. "Climate and Settlement in the Great Plains," Climate and Man: Yearbook of Agriculture, 1941, Washington, D.C.: United States Department of Agriculture, 1941.

Reports

"Agricultural Growth and the Rural Economy," Monthly Review, Federal Reserve Board of Kansas City, (June, 1960), 3-8.

Daicoff, Darwin. Kansas County Income: 1950-1964. State of Kansas: Office of Economic Analysis, 1966.

Emerson, M. Jarvin. _Third Annual Economic Report of the Governor: State of Kansas_. A Report Prepared by the Office of Economic Analysis. Topeka: State of Kansas, 1966.

Gilmore, Donald R. "Developing the 'Little' Economies," (Supplementary Paper No. 10) New York: Committee for Economic Development, 1960.

Kansas Water Resources Board. _State Water Policy and Program Needs_. A Report to the 1961 Kansas Legislature. Topeka: State of Kansas, 1960.

Tiebout, Charles M. "The Community Economic Base Study," (Supplementary Paper No. 16) New York: Committee for Economic Development, 1962.

Unpublished Material

Buzenberg, Mildred E. "The Interrelationships of Regions, Population Change, and Change in Number of Retail Firms in Selected Areas of Nonmetropolitan Kansas," Contribution No. 8, Department of Economics and Sociology, Kansas Agricultural Experiment Station. Manhattan, Kansas: Kansas State University, 1963.

Choguill, C. L. "A County Economic Base Study: An Input-Output Approach." Unpublished Master's Thesis, Department of Economics and Sociology, Kansas State University, 1964.

Dakin, Ralph E. (ed.) "Area Development: An Interdisciplinary Approach to Research," Kansas Agricultural Experiment Station Bulletin 440. Manhattan, Kansas: Kansas State University, 1961.

Douglas, Louis H. "The Agrarian Polity in an Era of Development." A paper presented to the Inter-University Seminar on Urbanization, Boulder, Colorado. October 19, 1962.

________. _et al_. "Southwest Kansas Survey Highlights: January 1963," Extension Service Publication No. MF-114. Manhattan, Kansas: Kansas State University, 1963.

Emerson, M. Jarvin. "Goal Specification and Analytical Models for Evaluating Regional Economic Growth," A paper presented at the Methodology Workshop in Regional Economic Development held in Denver, Colorado, May 4, 1966.

Knox, John W. "Survey of Trade Areas in Northwest Kansas," Extension Service Publication No. MF-113. Manhattan, Kansas: Kansas State University, 1962.

Knox, John W. "Survey of Trade Areas in Southwest Kansas," Extension Service Publication No. MF-112. Manhattan, Kansas: Kansas State University, 1962.

McKinney, R. D. and Dawe, Sandra. "Changes in a South central Kansas Trade Area: 1937-1960," Kansas Agricultural Experiment Station Technical Bulletin 143. Manhattan, Kansas: Kansas State University, 1965.

McKinney, R.D., et al. "Northwest Kansas Survey Highlights: October 1964," Extension Service Publication No. MF-114. Manhattan, Kansas: Kansas State University, 1964.

Sears, J. L. "The Effect of Population Change on Selected Types of Businesses in Southeast Kansas by 1972." Unpublished Master's Thesis, Department of Economics and Sociology, Kansas State University, 1964.

Scotton, Donald W. "Trends in Rural Retailing in Two Illinois Districts: 1938-1950," Bulletin No. 76, College of Commerce and Business Administration, Bureau of Economic and Business Research. Urbana, Illinois: University of Illinois, 1953.

Strohbehn, Roger W. "Problems of Resource Fixities and Immobilities in Regional Analysis," Paper presented at the Workshop on Regional Studies of Income Distribution held in Baton Rouge, Louisiana, March 17-18, 1966.

Tobkin, Leonard and Palver, Edgar Z. "Types of Business in Nebraska Towns," Business Research Bulletin No. 57, College of Business Administration. Lincoln, Nebraska: University of Nebraska, 1954.

Other Sources

Division of Vital Statistics. "Live Births and Deaths by Place of Residence," Furnished by a letter received from Kenneth N. Johnson; Chief, Research and Analysis Section, Division of Vital Statistics, Topeka, Kansas (October 5, 1966).

APPENDIXES

APPENDIX A

STRATIFICATION RESULTS

In this study, eight different methods of delineating growth from nongrowth towns are presented and evaluated.

These eight stratifications are produced by two basic procedures. The first procedure is based on the "ideal distance" concept.[1] The stratifications that result from this concept are stratification "G", stratification "B_1" and stratification "B_2".

The second procedure is based on factor analysis. The stratifications that result from this concept are stratification "A", "C", "D", and "E".

---

[1]See above, p. 37.

TABLE 1

STRATIFICATION G: DATA GROUPS I, II, III, and IV

Growth			Nongrowth		
Town	I.D.#	Area	Town	I.D.#	Area
Garden City	(1)	SW	Goodland	(2)	NW
Oberlin	(6)	NW	Colby	(3)	NW
Atwood	(8)	NW	Scott City	(4)	SW
St. Francis	(9)	NW	Ulysses	(5)	SW
Laking	(12)	SW	Oakley	(7)	NW
Hoxie	(13)	NW	Dighton	(10)	SW
Cimarron	(14)	SW	Leoti	(11)	SW
Sublette	(15)	SW	Sharon Springs	(16)	NW
Satanta	(17)	SW	Winona	(21)	NW
Bird City	(18)	NW	Norcatur	(23)	NW
Montezuma	(19)	SW	McDonald	(24)	NW
Deerfield	(20)	SW	Brewster	(25)	NW
Seldon	(22)	NW	Jennings	(27)	NW
Herndon	(26)	NW	Ensign	(28)	SW
Copeland	(29)	SW	Kanarado	(30)	NW
Ingalls	(31)	SW	Dresden	(32)	NW

TABLE 2

STRATIFICATION B_1: DATA GROUP IV

Growth			Nongrowth		
Town	I.D.#	Area	Town	I.D.#	Area
Garden City	(1)	SW	Goodland	(2)	NW
Colby	(3)	NW	Scott City	(4)	SW
Ulysses	(5)	SW	Oakley	(7)	NW
Oberlin	(6)	NW	Dighton	(10)	SW
Atwood	(8)	NW	Leoti	(11)	SW
St. Francis	(9)	NW	Cimarron	(14)	SW
Lakin	(12)	SW	Sharon Springs	(16)	NW
Hoxie	(13)	NW	Winona	(21)	NW
Sublette	(15)	SW	Norcatur	(23)	NW
Satanta	(17)	SW	McDonald	(24)	NW
Bird City	(18)	NW	Brewster	(25)	NW
Montezuma	(19)	SW	Ensign	(28)	SW
Deerfield	(20)	SW	Kanarado	(30)	NW
Seldon	(22)	NW	Dresden	(32)	NW
Herndon	(26)	NW			
Jennings	(27)	NW			
Copeland	(29)	SW			
Ingalls	(31)	SW			

TABLE 3

STRATIFICATION B_2: DATA GROUP IV

Growth			Nongrowth		
Towns	I.D.#	Area	Towns	I.D.#	Area
Garden City	(1)	SW	Goodland	(2)	NW
Colby	(3)	NW	Scott City	(4)	SW
Oberlin	(6)	NW	Ulysses	(5)	SW
Oakley	(7)	NW	Atwood	(8)	NW
Lakin	(12)	SW	St. Francis	(9)	NW
Hoxie	(13)	NW	Dighton	(10)	SW
Cimarron	(14)	SW	Leoti	(11)	SW
Sublette	(15)	SW	Sharon Springs	(16)	NW
Satanta	(17)	SW	Winona	(21)	NW
Bird City	(18)	NW	Norcatur	(23)	NW
Montezuma	(19)	SW	McDonald	(24)	NW
Deerfield	(20)	SW	Brewster	(25)	NW
Seldon	(22)	NW	Ensign	(28)	SW
Herndon	(26)	NW	Kanarado	(30)	NW
Jennings	(27)	NW	Dresden	(32)	NW
Copeland	(29)	SW			
Ingalls	(31)	SW			

TABLE 4

STRATIFICATION A: DATA GROUPS III and IV

Growth			Nongrowth		
Town	I.D.#	Area	Towns	I.D.#	Area
Garden City	(1)	SW	Colby	(3)	NW
Goodland	(2)	NW	Ulysses	(5)	SW
Scott City	(4)	SW	Oberlin	(6)	NW
Leoti	(11)	SW	Oakley	(7)	NW
Lakin	(12)	SW	Atwood	(8)	NW
Sublette	(15)	SW	St. Francis	(9)	NW
Satanta	(17)	SW	Dighton	(10)	SW
Bird City	(18)	NW	Hoxie	(13)	NW
Montezuma	(19)	SW	Cimarron	(14)	NW
Deerfield	(20)	SW	Sharon Springs	(16)	NW
Ensign	(28)	SW	Winona	(21)	NW
Copeland	(29)	SW	Seldon	(22)	NW
Ingalls	(31)	SW	Norcatur	(23)	NW
			McDonald	(24)	NW
			Brewster	(25)	NW
			Herndon	(26)	NW
			Jennings	(27)	NW
			Kanarado	(30)	NW
			Dresden	(32)	NW

TABLE 5

STRATIFICATION C: DATA GROUPS III and IV

Growth			Nongrowth		
Towns	I.D.#	Area	Towns	I.D.#	Area
Garden City	(1)	SW	Colby	(3)	NW
Goodland	(2)	NW	Scott City	(4)	SW
Ulysses	(5)	SW	Oakley	(7)	NW
Oberlin	(6)	NW	Dighton	(10)	SW
Atwood	(8)	NW	Leoti	(11)	SW
St. Francis	(9)	NW	Hoxie	(13)	NW
Lakin	(12)	SW	Cimarron	(14)	SW
Sublette	(15)	SW	Sharon Springs	(16)	NW
Satanta	(17)	SW	Winona	(21)	NW
Bird City	(18)	NW	Seldon	(22)	NW
Montezuma	(19)	SW	McDonald	(24)	NW
Deerfield	(20)	SW	Brewster	(25)	NW
Norcatur	(23)	NW	Herndon	(26)	NW
Jennings	(27)	NW	Ensign	(28)	SW
Copeland	(29)	SW	Dresden	(32)	NW
Kanarado	(30)	NW			
Ingalls	(31)	SW			

TABLE 6

STRATIFICATION D: DATA GROUPS III and IV

Growth			Nongrowth		
Towns	I.D.#	Area	Towns	I.D.#	Area
Garden City	(1)	SW	Colby	(3)	NW
Goodland	(2)	NW	Scott City	(4)	SW
Ulysses	(5)	SW	Oakley	(7)	NW
Oberlin	(6)	NW	Atwood	(8)	NW
Leoti	(11)	SW	St. Francis	(9)	NW
Lakin	(12)	SW	Dighton	(10)	SW
Cimarron	(14)	SW	Hoxie	(13)	NW
Sublette	(15)	SW	Winona	(21)	NW
Sharon Springs	(16)	NW	Seldon	(22)	NW
Satanta	(17)	SW	McDonald	(24)	NW
Bird City	(18)	NW	Brewster	(25)	NW
Montezuma	(19)	SW	Herndon	(26)	NW
Deerfield	(20)	SW	Ensign	(28)	SW
Norcatur	(23)	NW	Dresden	(32)	NW
Jennings	(27)	NW			
Copeland	(29)	SW			
Kanarado	(30)	NW			
Ingalls	(31)	SW			

TABLE 7

STRATIFICATION E: DATA GROUP IV

Growth			Nongrowth		
Towns	I.D.#	Area	Towns	I.D.#	Area
Garden City	(1)	SW	Oberlin	(6)	NW
Goodland	(2)	NW	Oakley	(7)	NW
Colby	(3)	NW	Atwood	(8)	NW
Scott City	(4)	SW	St. Francis	(9)	NW
Ulysses	(5)	SW	Dighton	(10)	SW
Lakin	(12)	SW	Leoti	(11)	SW
Sublette	(15)	SW	Hoxie	(13)	NW
Satanta	(17)	SW	Cimarron	(14)	SW
			Sharon Springs	(16)	NW
			Bird City	(18)	NW
			Montezuma	(19)	SW
			Deerfield	(20)	SW
			Winona	(21)	NW
			Seldon	(22)	NW
			Norcatur	(23)	NW
			McDonald	(24)	NW
			Brewster	(25)	NW
			Herndon	(26)	NW
			Jennings	(27)	NW
			Ensign	(28)	SW
			Copeland	(29)	SW
			Kanarado	(30)	NW
			Ingalls	(31)	SW
			Dresden	(32)	NW

APPENDIX B

REGRESSION RESULTS

Preliminary Regression Analyses:

Initially a comparison is made between the previously conducted post card survey trade areas and the questionnaire trade areas which are developed in this study. Using only the shopping good "clothing" for comparison and a third variable, migration 1963-64, the results are as follows.[1]

Preliminary Model I.--(Postcard survey trade areas).

Y' = Retail sales (1963) in thousands of dollars.[2]
X_2' = Market area for clothing in square miles.[3]
X_3' = Net migration (1963-64.[4]

---

[1]The five per cent significance level is represented by one asterisk and the one per cent level of significance is represented by two asterisks.

[2]U.S., Bureau of the Census, 1963 Census of Business: Retail Trade. Kansas, RA1B, pp. 32-33. City data is used where available and county data is allocated proportional to the size of the town when town data is unavailable.

[3]The square miles included in the clothing trade areas (post card survey) are estimated from John W. Knox, Survey of Trade Areas in Southwest Kansas, (Extension Service; Manhattan Kansas: Kansas State University, 1962), p. 6, and John W. Knox Survey of Trade Areas in Northwest Kansas, (Extension Service; Manhattan Kansas: Kansas State University, 1963), p. 6.

[4]M. Jarvin Emerson, Third Annual Economic Report of the Governor: State of Kansas, (Topeka, Kansas: State of Kansas, 1966), p. 28. Net migration per county is given and then allocated proportional to population of the individual town.

$$Y' = 358 + \underset{(.370)}{6.448^{**}} X_2' + \underset{(7.826)}{20.332^{*}} X_3'$$

$r_{12.3} = .958$ $R^2_{1.23} = .9238$

$r_{13.2} = .688$

The confidence intervals for the above coefficients at the five per cent level ($CI_{.05}$) are:

X'_2 : $5.72282 \leq B \leq 7.17318$

X'_3 : $4.99335 \leq B \leq 35.67065$

<u>Preliminary Model I_a</u>.--(Questionnaire Trade Areas)

Y' = Retail Sales (1963) in thousands of dollars.[5]

X''_2 = Market area for clothing in square miles.[6]

X'_3 = Net migration (1963-64).[7]

$$Y' = 1{,}276 + \underset{(.453)}{4.975^{**}} X''_2 + \underset{(12.34)}{5.594} X'_3$$

$r_{12.3} = .910$ $R^2_{1.23} = .8330$

$r_{13.2} = .318$

The confidence interval for this coefficient ($CI_{.05}$) is:

X''_2 : $4.08714 \leq B \leq 5.86286$

The partial correlation coefficient ($r_{12.3}$) for these two regression problems illustrates the similarity of results obtained by the two different methods of trade area delineation

---

[5]U.S., Bureau of the Census, <u>1963 Census of Business</u>. . ., <u>loc. cit</u>.

[6]See above p. 37.

[7]Emerson, <u>loc cit</u>.

which is also indicated by individual inspection. These questionnaire market areas are used to develop the "Ideal Distance" concept and stratification "G".

<u>Data Group I: Stratification G</u>.--This data group utilizes one primary data source (X_{10}) and three secondary data sources. The high simple correlation coefficient between (X_{10})[8], adjusted "Ideal" distance (adj. D_{xj}) and (X_{12}), total town income[9] indicates that model #1 which includes both of these independent variables has high degree of multicolinearity. This results in a large variation in the X_{10} coefficient while, in contrast, the X_{12} coefficient remains comparatively stable. Therefore, X_{10} will not be discussed in relation to Model #1.

The dependent variable is (Y_1) total retail sales and total revenue from selected services.[10] The simple correlation coefficient ($r_{1,11}$) changes from .078 for the total to .730 for the growth subgroup and -.302 for the nongrowth subgroup. The X_{11} coefficient--1961 net migration--in the growth subgroup indicates that for every net migrant gained for the year by one

---

[8]See above, p.37. The adjustment is made on this distance concept by correcting the individual town distances by a factor based on the difference in population density which exists between the Northwest area and the Southwest area.

[9]Darwin Daicoff, <u>Kansas County Income: 1950-1964</u> (State of Kansas: Office of Economic Analysis, 1966). pp. 60-165. County data is used and allocated to the individual town in proportion to the population of the town.

[10]U.S., Bureau of Census, 1963 Census of Business. . ., <u>loc. cit.</u> and U.S., Bureau of Census, <u>1963 Census of Business: Selected Services</u>, Kansas, SA18, pp. 8-12.

town, the total sales and total revenue from selected services (Y_1) increases from between \$3,540 in the first model to a maximum of \$67,740 with the second model using the five per cent confidence limits.[11] However, the first model appears the most efficient with its high R^2 and has an estimate of between \$3,540 and \$17,500. In view of the double counting involved in the dependent variable (Y_1), this coefficient isn't as extreme as it first appears. The following are the five per cent confidence intervals for the X_{11} coefficient.

+++Growth Model	#1--X_{11}	:	3.542	≤	B	≤	17.499
Growth Model	#2--X_{11}	:	11.568	≤	B	≤	67.740
Growth Model	#3--X_{11}	:	6.471	≤	B	≤	24.565

The size and sign of the X_{12} coefficient is consistent with the census data in that one unit change in total town income (X_{12}) is associated with a "slightly" more than unitary change in total sales and revenue from selected services (Y_1). The list of the five per cent confidence intervals for X_{12} are:

++Total, Model	#1--X_{12}	:	1.199	≤	B	≤	1.442
+Total, Model	#3--X_{12}	:	1.087	≤	B	≤	1.196
+++Growth, Model	#1--X_{12}	:	1.171	≤	B	≤	1.516

---

[11] Much needed additional data pertaining to live births and deaths, in relation to residence, for County and City, was provided by Kenneth N. Johnson, Chief, Research and Analysis Section, Division of Vital Statistics, Topeka, Kansas, Oct. 5, 1966.

+Best Model using Model F Criterion
++Best Model using R^2 Criterion

Growth, Model #3--X_{12} : $.994 \leq B \leq 1.102$

++Nongrowth, Model #1--X_{12} : $.735 \leq B \leq 1.457$

+Nongrowth, Model #3--X_{12} : $1.092 \leq B \leq 1.324$

The size and sign of the X_{10} coefficient, which is one measure of the size of the trade area for the individual town, proves to be a very efficient coefficient and changes considerably between growth and nongrowth subgroups. That is, as each "Ideal" mile is lost (gained) by the nongrowth town, the town experiences a loss (gain) of total sales and revenue from selected services (Y_1) of between $32,040 and $49,280. The confidence intervals ($CI_{.05}$) for X_{10} follow (this variable is unstable in model #1):

Total, Model #2--X_{10} : $21.355 \leq B \leq 31.810$

Growth, Model #2--X_{10} : $20.192 \leq B \leq 28.983$

Nongrowth, Model #2--X_{10} : $32.039 \leq B \leq 49.285$

<u>Data Group II: Stratification G</u>.--This data group uses one primary data source in the form of the ten product trade area (X_7).[12] The 1962 net migration (X_1),[13] the per capita income in 1963 (X_4)[14] and the dependent variable composed of

---

[12]See above p. 6.

[13]Division of Vital Statistics, <u>loc</u>. <u>cit</u>.

[14]Daicoff, <u>loc</u>. <u>cit</u>. and Kansas State Board of Agriculture, <u>Population of Kansas</u>: January 1, 1962 and 1963.

revenue from selected services and total sales (Y_1)[15] are from secondary data sources.

The main independent variable for this model is the trade area (X_7) as indicated by the high simple correlation coefficient ($r_{1,7}$) of .870 for the total, .997 for the growth subgroup and .906 for the nongrowth subgroup. This same variable yields stable and highly significant coefficients. In the total sample the coefficient indicates that for every square mile change in the trade area of a town, the total sales and revenue from selected services change from between $2,520 to $4,160. For the growth subgroup each unit change in square miles of trade area changes revenue from selected services and total sales by between $3,230 to $3,720. Where as in the nongrowth subgroup the effect is larger with each loss (gain) of a square miles of trade area losing (gaining) the town between $9,350 and $19,170.

The five per cent confidence intervals for the variable X_7 are:

++Total,	Model	#1--X_7	:	$2.592 \leq B \leq 4.047$
+Total,	Model	#2--X_7	:	$2.519 \leq B \leq 4.160$
Total,	Model	#3--X_7	:	$2.613 \leq B \leq 3.925$
++Growth,	Model	#1--X_7	:	$3.233 \leq B \leq 3.672$
Growth,	Model	#2--X_7	:	$3.288 \leq B \leq 3.718$
+Growth,	Model	#3--X_7	:	$3.353 \leq B \leq 3.651$

---

[15] U.S., Bureau of Census, 1963 Census of Business. . ., loc. cit.

++Nongrowth, Model #1--X_7 : $11.736 \leq B \leq 18.116$

+Nongrowth, Model #2--X_7 : $13.074 \leq B \leq 19.168$

Nongrowth, Model #3--X_7 : $9.353 \leq B \leq 18.160$

The net migration variable for this model (X_1) changes radically for the different subgroups but it does not change sign. The simple correlation coefficient ($r_{1,1}$) changes from .433 for the total subgroup to .708 for the growth subgroup and finally to .161 for the nongrowth subgroup. It is in this last subgroup, however, that this independent variable becomes significant. While maintaining approximately the same error term, the influence increases sufficiently to produce a significant "t" value although it is still a relatively inefficient estimator. This net migration figure indicates that for each net migrant any nongrowth town loses (gains), there is a loss (gain) of between $6,710 and $42,330 in revenue from selected services and total sales. The five per cent confidence intervals for net migration in 1962 are:

++Nongrowth, Model #1--X_1 : $6.713 \leq B \leq 41.698$

+Nongrowth, Model #2--X_1 : $10.933 \leq B \leq 32.329$

Per capita income in 1963, independent variable (X_4), is significantly different from zero only in the total subgroup. The simple correlation coefficient ($r_{1,4}$) changes from .407 for the total subgroup to .324 for the growth subgroup and to .579 for the nongrowth subgroup. It indicates that for each one dollar change in the per capita income figure for the total sample the revenue from selected services and total sales change from between \$2,320 to \$12,425. The five per cent confidence intervals for this coefficient are:

++Total, Model #1--X_4 : $2.318 \leq B \leq 12.425$

Total, Model #3--X_4 : $2.417 \leq B \leq 11.698$

Data Group III: Stratification A.--This data group contains data from secondary sources, only.

Mean migration (net) 1961-1963 (X_5)[16] is the principle independent variable of the total and growth subgroups. The simple correlation coefficient ($r_{1,5}$) changes from .955 for the growth subgroup to -.546 for the nongrowth subgroup. This compares with .499 for the total data group III. This net migration coefficient indicates that for each unitary change, the revenue from selected services and total sales change from between \$22,076 to \$136,112 for the total sample, \$109,878 to \$303,437 for the growth subgroup and -\$104,348 to -\$9,968 for the nongrowth subgroup. The negative sign of the nongrowth subgroup coefficients indicates that the nongrowth towns experience "increases" in retail sales and revenue from selected services when they have "out-migration"!

The five per cent confidence intervals for this coefficient are:

++Total, Model #1--X_5 : $22.076 \leq B \leq 118.188$

---

[16]Division of Vital Statistics, loc. cit.

Total,	Model	#2--X_5	:	26.728	≦ B ≦	136.112
+Total,	Model	#4--X_5	:	26.976	≦ B ≦	128.732
++Growth,	Model	#1--X_5	:	109.878	≦ B ≦	303.437
Growth,	Model	#2--X_5	:	175.422	≦ B ≦	293.805
+Growth,	Model	#4--X_5	:	170.396	≦ B ≦	265.273
+++Nongrowth,	Model	#1--X_5	:	-83.132	≦ B ≦	-11.625
Nongrowth,	Model	#2--X_5	:	-104.348	≦ B ≦	-12.162
+Nongrowth,	Model	#4--X_5	:	-84.996	≦ B ≦	-9.968

Per capita income 1963 (X_4)[17] is a significant coefficient for the total, growth, and nongrowth subgroups. The simple correlation coefficient ($r_{1,4}$) changes from .406 for the total sample to .311 for the growth subgroup and to .610 for the nongrowth subgroup. The coefficients indicate that for every one dollar change in the per capita income, revenue from selected services and total sales increase from $1,579 to $24,684 for the total sample, from $15,449 to $53,187 for the growth subgroup and from $2,509 to $15,519 for the nongrowth subgroup. The five per cent confidence intervals are:

++Total,	Model	#1--X_4	:	4.944	≦ B ≦	21.882
Total,	Model	#3--X_4	:	5.808	≦ B ≦	24.684
+Total,	Model	#4--X_4	:	1.579	≦ B ≦	18.531
Growth,	Model	#3--X_4	:	15.449	≦ B ≦	53.187
++Nongrowth,	Model	#1--X_4	:	3.403	≦ B ≦	13.447

---

[17] Daicoff, and Kansas State Board of Agriculture, loc. cit.

Nongrowth, Model #3--X_4	:	3.745	≤	B	≤	15.519
+Nongrowth, Model #4--X_4	:	2.509	≤	B	≤	12.859

Net population density 1962 (X_{13})[18] is significant in model #3 in both total and growth subgroups. The values of these coefficients are very large indicating that a small change in the density of population within an area changes the revenue from selected services and total sales by a large amount. In fact, a unit change in the net population density changes the revenue from selected services and total sales by a minimum of $408,050 to a maximum of $8,150,591 for the total sample. For the growth subgroup the effect is even greater with a "minimum effect of $9,688,134. The five per cent confidence intervals are:

++Total, Model #1--X_{13}	:	408.050	≤	B	≤	7,070,652
Total, Model #3--X_{13}	:	720.054	≤	B	≤	8,150,591
Growth,Model #3--X_{13}	:	9,688.134	≤	B	≤	27,029,848

<u>Data Group III: Stratification D</u>.--Mean (net) migration 1961-1963 (X_5)[19] is the principle independent variable of the total and growth subgroups. The simple correlation coefficient

---

[18] U.S., Bureau of the Census, <u>United States Census of Population: 1960</u>. Population, Number of Inhabitants, pp. 14-15 and Kansas State Board of Agriculture, <u>Population of Kansas: January 1, 1962</u>. This is the total population of the County less the population of incorporated towns divided by the square miles of the County.

[19] Division of Vital Statistics, <u>loc. cit.</u>

$(r_{1,5})$ changes from .903 for the growth subgroup to -.559 for the nongrowth subgroup. This compares with .499 for the total sample. This net migration variable indicates that for each unitary change in mean (net) migrants a town experiences, the revenue from selected services and total sales change from between $157,645 to $256,693 for the growth subgroup and between -$1,862 to -$118,321 for the nongrowth subgroup. Again, the negative sign of the nongrowth migration coefficients shows an increase of sales by this amount as each unitary (net) out migration occurs. The total data group results are the same as indicated in relation to stratification "A" of Data Group III. The five per cent confidence intervals for this coefficient are:

++Growth,	Model #1--X_5	:	$157.645 \leq B \leq 253.359$
Growth,	Model #2--X_5	:	$171.843 \leq B \leq 256.693$
+Growth,	Model #4--X_5	:	$172.243 \leq B \leq 255.294$
Nongrowth,	Model #2--X_5	:	$-118.321 \leq B \leq -1.862$

Per capita income 1963 (X_4)[20] is a significant coefficient for the total and nongrowth subgroups. The simple correlation coefficient $(r_{1,4})$ changes from .406 for the total sample to .334 for the growth subgroup and to .647 for the nongrowth subgroup. The coefficients indicate that for every "one dollar" change in the per capita income, revenue from selected services and total sales increase from a minimum of $80 to a maximum of

---

[20]Daicoff, and Kansas State Board of Agriculture, *loc. cit.*

$29,661 for the growth subgroup and from a minimum of $1,153 to $24,318 for the nongrowth subgroup.

The strength of this coefficient in both this stratification and stratification "A", especially in relation to nongrowth towns, provides an adequate explanation for the negative sign for the net migration variable. The simple correlation coefficient ($r_{4,5}$), indicating the relationship between per capita income and (net) mean migration, changes from a positive relationship for the growth subgroup to a negative relationship for the nongrowth subgroup for all of the stratification methods applied to data group III. In growth towns, both relations reinforce each other while in nongrowth towns they "act in the opposite direction".

The five per cent confidence intervals for this coefficient are:

Growth,	Model	#3--X_4	:	$.080 \leq B \leq 29.661$
Nongrowth,	Model	#3--X_4	:	$3.114 \leq B \leq 24.318$
+Nongrowth,	Model	#4--X_4	:	$1.153 \leq B \leq 19.269$

Net population density 1962 (X_{13})[21] is significant in the total sample and in the growth subgroup. The values of these coefficients are very large with large standard errors. A unit change in net population density in this stratification changes the revenue from selected services and total sales by a

[21] Kansas State Board of Agriculture, loc. cit.

minimum of $311,136 to a maximum of $12,093,511 for the growth subgroup. The total sample values are the same as presented for stratification "A". The five per cent confidence interval for this variable is:

$$\text{Growth, Model \#3--}X_{13} : 311.136 \leq B \leq 12,093.511$$

Final Regression Analyses:

Data Group IV: Stratification A.--This data group uses only secondary data sources. Of the six independent variables, four are migration variables so that only one migration variable is used in each model. The remaining two variables are per capita government revenue (1962) (X_2) and per capita income (1963) (X_4). There are five basic models used with this data group in conjunction with three different dependent variables.

All three dependent variables are alternative measurements of the distribution function for the towns of interest. Total revenue from selected services and total retail sales (Y_1)[22] is the first dependent variable used. The second dependent variable is the ten product trade area in square miles (Y_2).[23] The third dependent variable is the "Ideal" distance averaged over the ten products used in this study (Y_3), i.e, the numerator of the "Trade Area Coefficient".[24]

---

[22]U.S. Bureau of the Census, 1963 Census of Business. . ., loc. cit.

[23]These trade areas are calculated using the adjusted market areas. See above, p. 37.

[24]See above, p. 44.

The first independent variable discussed is (net) migration (1962) (X_1).[25] This migration variable is significant in the total and growth subgroups.

The simple correlation coefficient ($r_{1,1}$) changes from .433 for the total to .629 for the growth subgroups and to .187 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,1}$) (dependent variable Y_3) changes from .401 for the total to .753 for the growth and to -.118 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,1}$) changes from .434 for the total to .727 for the growth to -.217 for the nongrowth subgroup. This variable produced no significant coefficients for the nongrowth subgroup.

The five per cent confidence intervals for 1962 (net) migration are:

Total,	Model	#3--$X_{1,1}$	:	$9.281 \leq B \leq 96.177$
Total,	Model	#3--$X_{3,1}$	:	$.013 \leq B \leq .334$
Total,	Model	#3--$X_{2,1}$	:	$4.153 \leq B \leq 27.964$
Growth,	Model	#3--$X_{1,1}$	:	$38.410 \leq B \leq 203.045$
Growth,	Model	#3--$X_{3,1}$	:	$.197 \leq B \leq .773$
Growth,	Model	#3--$X_{2,1}$	:	$15.955 \leq B \leq 66.718$

Gross per capita government revenue (X_2)[26] is used as an indication of tax "load" placed on individuals and the relation

---

[25]Division of Vital Statistics, loc. cit.

[26]U.S., Bureau of the Census, U.S. Census of Governments: Government in Kansas, 1962, pp. 41-50. This is County data

this has on the trade or trade area of a town. This variable produces significant regression coefficients in the total and growth subgroups mainly in relation to the dependent variable Y_1, i.e., revenue from services and total sales in thousands.

The simple correlation coefficient ($r_{1,2}$) changes from -.224 for the total to -.630 for the growth subgroup and to .122 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,2}$) changes from -.121 for the total to -.416 for the growth subgroup and to -.043 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,2}$) changes from -.166 for the total to -.423 for the growth subgroup and to -.155 for the nongrowth subgroup.

The five per cent confidence intervals for gross per capita government revenue (1962) are:

Total,	Model	#1--$X_{1,2}$:	-78.051	≤	B	≤	-9.984
Total,	Model	#3--$X_{1,2}$:	-84.583	≤	B	≤	-8.158
Total,	Model	#1--$X_{2,2}$:	-17.273	≤	B	≤	-.158
++Growth,	Model	#1--$X_{1,2}$:	-66.747	≤	B	≤	-7.355
Growth,	Model	#2--$X_{1,2}$:	-196.518	≤	B	≤	-24.256
Growth,	Model	#3--$X_{1,2}$:	-166.924	≤	B	≤	-35.390
Growth,	Model	#4--$X_{1,2}$:	-97.351	≤	B	≤	-4.186
+Growth,	Model	#5--$X_{1,2}$:	-69.673	≤	B	≤	-7.189

---

allocated proportionally in relation to the size of the town population.

The three year migration trend (1961-1963) variable (X_3)[27] is an attempt to evaluate the effect of an out migration town reducing its rate of out migration on the local trade pattern and vice versa. This coefficient produced significant regression coefficients in this stratification only in the growth subgroup.

The simple correlation coefficient $(r_{1,3})$ changes from .228 for the total to .407 for the growth subgroup and to .349 for the nongrowth subgroup. The simple correlation coefficient $(r_{3,3})$ changes from .244 for the total to .590 for the growth subgroup and to .272 for the nongrowth subgroup. The simple correlation coefficient $(r_{2,3})$ changes from .192 for the total to .550 for the growth subgroup and to .431 for the nongrowth subgroup.

The five per cent confidence intervals for (net) migration trend (1961-1963) are:

Growth, Model #2--$X_{3,3}$: $.042 \leq B \leq .989$

Growth, Model #2--$X_{2,3}$: $4.529 \leq B \leq 85.608$

This is the only significant variable in these two models and the "F" value in relation to the model is not significant in either case at the five per cent confidence level. That is, explained variation produced by this model in relation to the dependent variable is not significantly different from zero.

Per capita income (1963) (X_4)[28] is a significant

---

[27]See above, p. .

[28]Daicoff, and Kansas State Board of Agriculture. loc. cit.

independent variable in the total and nongrowth subgroups and only in relation to the dependent variable (Y_1), i.e., revenue from selected services and total sales in thousands of dollars.

The simple correlation coefficient ($r_{1,4}$) changes from .406 for the total to .311 for the growth subgroup and to .610 for nongrowth subgroup. The simple correlation coefficient ($r_{3,4}$) changes from .268 for the total to .304 for the growth subgroup and to .139 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,4}$) changes from .189 for the total to .198 for the growth subgroup and to .176 for the nongrowth subgroup.

The five per cent confidence intervals for per capita income (1963) are:

Total,	Model	#1--$X_{1,4}$	:	3.836	$\leq$	B	$\leq$	19.505
Total,	Model	#2--$X_{1,4}$	:	2.591	$\leq$	B	$\leq$	21.965
+++Total,	Model	#4--$X_{1,4}$	:	3.152	$\leq$	B	$\leq$	18.621
+++Nongrowth,	Model	#1--$X_{1,4}$	:	1.428	$\leq$	B	$\leq$	12.319
Nongrowth,	Model	#2--$X_{1,4}$	:	1.768	$\leq$	B	$\leq$	14.123
Nongrowth,	Model	#3--$X_{1,4}$	:	2.241	$\leq$	B	$\leq$	16.007
Nongrowth,	Model	#4--$X_{1,4}$	:	2.316	$\leq$	B	$\leq$	15.493

Mean (net) migration (1961-1963) (X_5)[29] is a significant variable in total, growth, and nongrowth stratifications and in every model in which it appears.

---

[29]Division of Vital Statistics, loc. cit.

The simple correlation coefficient ($r_{1,5}$) changes from .499 for the total to .955 for the growth subgroup and to -.546 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,5}$) changes from .493 for the total to .956 for the growth subgroup and to -.551 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,5}$) changes from .637 for the total to .967 for the growth subgroup and to -.677 for the nongrowth subgroup.

The five per cent confidence intervals for mean (net) migration (1961-1963) are:

Total,	Model	#1--$X_{1,5}$	:	37.927	≤	B	≤	131.531
Total,	Model	#5--$X_{1,5}$	:	37.530	≤	B	≤	143.341
Total,	Model	#1--$X_{3,5}$	:	.101	≤	B	≤	.456
Total,	Model	#5--$X_{3,5}$	:	.108	≤	B	≤	.472
Total,	Model	#1--$X_{2,5}$	:	16.201	≤	B	≤	39.736
++Total,	Model	#5--$X_{2,5}$	:	16.715	≤	B	≤	40.388
++Growth,	Model	#1--$X_{1,5}$	:	155.099	≤	B	≤	237.697
+Growth,	Model	#5--$X_{1,5}$	:	157.454	≤	B	≤	243.539
++Growth,	Model	#1--$X_{3,5}$	:	.558	≤	B	≤	.914
+Growth,	Model	#5--$X_{3,5}$	:	.571	≤	B	≤	.931
Growth,	Model	#1--$X_{2,5}$	:	50.143	≤	B	≤	78.144
+++Growth,	Model	#5--$X_{2,5}$	:	50.978	≤	B	≤	77.228
+++Nongrowth,	Model	#1--$X_{1,5}$	:	-95.992	≤	B	≤	-14.426
Nongrowth,	Model	#5--$X_{1,5}$	:	-115.747	≤	B	≤	-23.416
Nongrowth,	Model	#1--$X_{3,5}$	:	-.406	≤	B	≤	-.039
+++Nongrowth,	Model	#5--$X_{3,5}$	:	-.393	≤	B	≤	-.051

++Nongrowth, Model #1--$X_{2,5}$: $-9.613 \leq B \leq -2.102$

+Nongrowth, Model #5--$X_{2,5}$: $-9.435 \leq B \leq -2.445$

Migration (net) (1963) (X_6)[30] is a significant variable in the total and in the growth subgroup.

The simple correlation coefficient ($r_{1,6}$) changes from .600 for the total to .906 for the growth subgroup and to -.132 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,6}$) changes from .613 for the total to .919 for the growth subgroup and to -.101 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,6}$) changes from .703 for the total to .926 for the growth subgroup and to .053 for the nongrowth subgroup.

The five per cent confidence intervals for (net) migration (1963) are:

Total, Model #4--$X_{1,6}$: $32.998 \leq B \leq 105.562$

Total, Model #4--$X_{3,6}$: $.122 \leq B \leq .385$

Total, Model #4--$X_{2,6}$: $13.257 \leq B \leq 31.589$

Growth, Model #4--$X_{1,6}$: $81.120 \leq B \leq 174.031$

Growth, Model #4--$X_{3,6}$: $.300 \leq B \leq .662$

Growth, Model #4--$X_{2,6}$: $27.948 \leq B \leq 56.672$

Data Group IV: Stratification D.--This stratification is termed the "balanced" stratification as a result of the rejection of Ho_1[31], and the data group is the same selection of

---

[30] *Ibid.*

[31] See above, p. 65.

dependent and independent variables as previously defined in relation to stratification "A". The values for the total group are the same as presented previously in relation to stratification "A" and therefore will not be duplicated in this section.

Migration (net) (1962) (X_1) is significant in the growth subgroup and in the nongrowth subgroup in relation to dependent variable (Y_2), i.e., ten product trade area in square miles.

The simple correlation coefficient ($r_{1,1}$) changes from .433 for the total to .557 for the growth subgroup and to -.212 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,1}$) changes from .401 for the total to .533 for the growth subgroup and to -.563 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,1}$) changes from .434 for the total to .490 for the growth subgroup and to -.693 for the nongrowth subgroup.

The five per cent confidence intervals for (1962) (net) migration are:

Growth,	Model	#3--$X_{1,1}$	:	$12.988 \leq B \leq 147.334$
Growth,	Model	#3--$X_{3,1}$	:	$.017 \leq B \leq .519$
Growth,	Model	#3--$X_{2,1}$	:	$1.462 \leq B \leq 42.575$
Nongrowth,	Model	#3--$X_{2,1}$	:	$-9.712 \leq B \leq -1.759$

Gross per capita government revenue (X_2) produces significant regression coefficients in the growth subgroup only.

The simple correlation coefficient ($r_{1,2}$) changes from -.224 for the total to -.377 for the growth subgroup and to

-.089 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,2}$) changes from -.121 for the total to -.216 for the growth subgroup and to -.328 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,2}$) changes from -.166 for the total to -.303 for the growth subgroup and to -.326 for the nongrowth subgroup.

The five per cent confidence intervals for gross per capita government revenue (1962) are:

Growth, Model #1--$X_{1,2}$: $-51.381 \leq B \leq -1.035$

Growth, Model #3--$X_{1,2}$: $-131.792 \leq B \leq -8.587$

The three year migration trend variable (X_3) produced only one significant regression coefficient. This coefficient occured in relation to the nongrowth subgroup and dependent variable (Y_2), i.e., the ten product retail trade area in square miles.

The simple correlation coefficient ($r_{1,3}$) changes from .228 for the total to .171 for the growth subgroup and to .536 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,3}$) changes from .244 for the total to .286 for the growth subgroup and to .535 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,3}$) changes from .192 for the total to .346 for the growth subgroup and to .711 for the nongrowth subgroup.

The five per cent confidence interval for (net) migration trend (1961-1963) is:

Nongrowth, Model #2--$X_{2,3}$: $.228 \leq B \leq 2.879$

Per capita income (1963) (X_4) is a significant independent variable in the nongrowth subgroup and only in relation to dependent variable (Y_1), i.e., revenue from selected services and total sales in thousands of dollars.

The simple correlation coefficient ($r_{1,4}$) changes from .406 for the total to .334 for the growth subgroup and to .647 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,4}$) changes from .268 for the total to .253 for the growth subgroup and to .261 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,4}$) changes from .189 for the total to .187 for the growth subgroup and to .291 for the nongrowth subgroup.

The five per cent confidence intervals for per capita income (1963) are:

+++Nongrowth, Model #1--$X_{1,4}$: $.664 \leq B \leq 20.316$

Nongrowth, Model #2--$X_{1,4}$: $.520 \leq B \leq 20.393$

Nongrowth, Model #3--$X_{1,4}$: $2.639 \leq B \leq 22.510$

Nongrowth, Model #4--$X_{1,4}$: $1.350 \leq B \leq 21.616$

Mean (net) migration (1961-1963) is a significant variable in total, growth and nongrowth stratifications.

The simple correlation coefficient ($r_{1,5}$) changes to .499 for the total to .947 for the growth subgroup and to -.534 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,5}$) changes from .493 for the total to .930 for the growth subgroup and to -.694 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,5}$) changes from .637 for the total to .954 for the growth subgroup and to -.831 for the nongrowth subgroup.

The five per cent confidence intervals for the mean (net) migration (1961-1963) variable are:

++Growth,	Model	#1--$X_{1,5}$	:	162.961	$\leq$	B	$\leq$	241.832
+Growth,	Model	#5--$X_{1,5}$	:	172.556	$\leq$	B	$\leq$	247.961
++Growth,	Model	#1--$X_{3,5}$	:	.539	$\leq$	B	$\leq$	.888
+Growth,	Model	#5--$X_{3,5}$	:	.547	$\leq$	B	$\leq$	.864
++Growth,	Model	#1--$X_{2,5}$	:	49.428	$\leq$	B	$\leq$	71.370
+Growth,	Model	#5--$X_{2,5}$	:	47.908	$\leq$	B	$\leq$	68.768
++Nongrowth,	Model	#1--$X_{3,5}$	:	-.391	$\leq$	B	$\leq$	-.024
+Nongrowth,	Model	#5--$X_{3,5}$	:	-.393	$\leq$	B	$\leq$	-.054
++Nongrowth,	Model	#1--$X_{2,5}$	:	-9.187	$\leq$	B	$\leq$	-2.700
+Nongrowth,	Model	#5--$X_{2,5}$	:	-9.036	$\leq$	B	$\leq$	-3.224

Net migration (1963) (X_6) is a significant variable in the growth subgroup.

The simple correlation coefficient ($r_{1,6}$) changes from .600 for the total to .630 for the growth subgroup and to .415 for the nongrowth subgroup. The simple correlation coefficient ($r_{3,6}$) changes from .613 for the total to .679 for the growth subgroup and to .252 for the nongrowth subgroup. The simple correlation coefficient ($r_{2,6}$) changes from .703 for the total to .745 for the growth subgroup and to .462 for the nongrowth subgroup.

The five per cent confidence intervals for (net) migration (1963) are:

Growth, Model #4--$X_{1,6}$: $19.686 \leq B \leq 121.519$

Growth, Model #4--$X_{1,6}$: $.100 \leq B \leq .451$

Growth, Model #4--$X_{1,6}$: $11.343 \leq B \leq 37.717$

The following tables indicate the regression coefficients in relation to their standard errors in parenthesis. The significance of the coefficients are indicated with asterisks, one for the five per cent level of confidence and two for a confidence level of one per cent. The model "F" and its degrees of freedom are provided with asterisks where one asterisk indicates a five per cent level of confidence and two asterisks indicate a one per cent level of confidence. The R^2 value is followed by the value of R for each model and the squared value indicates the approximate percentage of explained variation provided by the model in relation to the total variation in the dependent variable.

Dependent variable Y_1 in the text--total revenue from selected services and total retail sales--is discussed in the following tables as Y_9. Dependent variable Y_2 in the text--ten product retail trade area in square miles--is discussed in the following tables as Y_7. Dependent variable Y_3 in the text--ideal distance for town K--is discussed in the following tables as Y_8.

That is:

Y_1 in text = Y_9 in tables

Y_2 in text = Y_7 in tables

Y_3 in text = Y_8 in tables

TABLE 1

REGRESSION RESULTS FOR DATA GROUP 1, STRATIFICATION G: COEFFICIENTS AND STANDARD ERRORS

Model No. & Dep. Var.	Adj. Ideal Dist. X10	Mig. (net) 1961 X11	Total Town Income X12	Constant	Std. Error	"F" (d.f.)	R^2 R
#1-Y Total	-5.0** (1.5)	-2.6 (1.7)	1.3** (.06)	-389	728.4	820.5** (3,28)	.988 ++ .994
#2-Y "	26.6** (2.5)	.321 (7.1)		-1,386.4	3,094	54.5** (2,29)	.790 .889
#3-Y "		-2.4 (1.9)	1.14** (.03)	-672.3	842	917.4** (2,29)	.984 + .992
#1-Y Growth	-7.4** (1.9)	10.5** (3.2)	1.34** (.08)	123	348	2,608** (3,12)	.998 +++ .999
#2-Y "	24.5** (2.0)	39.6** (13.0)		-3,025	1,672	163.0** (2,13)	.962 .981
#3-Y "		15.5** (4.2)	1.05** (.02)	-659.	498	1,904** (2,13)	.997 .998
#1-Y Nongrowth	4.2 (5.8)	-1.1 (2.6)	1.1** (.16)	-680	819	180.1** (3,12)	.978 ++ .989
#2-Y "	40.7** (3.9)	7.1 (4.7)		-883	1,699	57.7** (2,13)	.899 .948
#3-Y "		-2.2 (2.0)	1.2** (.05)	-609	804	280.6** (2,13)	.977 + .989

TABLE 2

REGRESSION RESULTS FOR DATA GROUP II, STRATIFICATION G : COEFFICIENTS AND STANDARD ERRORS

Model No. & Dep. Var.	Adj. Trade Area X_7	Migration 1962 X_1	P. C. Income 1963 X_4	Constant	Std. Error	"F" (d.f.)	R^2 R
#1-Y9 Total	3.3** (.35)	-4.4 (12.3)	7.4** (2.5)	-13,752	2,927	42.1** (3,28)	.818 ++ .905
#2-Y9 "	3.3** (.4)	8.8 (12.9)	[illegible]	1,821	3,303	46.05** (2,29)	.760 .872
#3-Y9 "	3.3** (.32)		7.0** (2.3)	-13,094	2,882	64.9** (2,29)	.818 + .904
#1-Y9 Growth	3.45** (.1)	4.7 (6.8)	-1.8 (1.2)	3,992	586	916.2** (3,12)	.996 ++ .999
#2-Y9 "	3.5** (.09)	-2.7 (5.0)		385	615	1,247** (2,13)	.995 .997
#3-Y9 "	3.5** (.07)		-1.2 (.8)	2,837	574	1,432** (2,13)	.995 + .998
#1-Y9 Nongrowth	15.4** (1.7)	24.2** (8.0)	1.5 (2.0)	-2,402	1,611	43.6** (3,12)	.916 ++ .957
#2-Y9 "	16.1** (1.4)	26.6** (7.3)		837	1,586	67.2** (2,13)	.912 + .955
#3-Y9 "	13.7** (2.0)		3.9 (2.3)	-7,177	2,052	37.5** (2,13)	.852 .923

TABLE 3

REGRESSION RESULTS FOR DATA GROUP III, STRATIFICATION G: COEFFICIENTS AND STANDARD ERRORS

Model No. & Dep. Var.	Net. Pop. Dens. X_{13}	Mean Mig. '61-63 X_5	P.C. Income 1963 X_4	Constant	Std. Error	"F"	R^2 / R
#1-Y_9 Total	3,739.3*	70.1**	13.4**	-33,696	4,976	8.45**	.475 ++
	(1,627)	(23.5)	(4.1)			(3,28)	.689
#2-Y_9 "	1,875.8	81.4**		-695	5,735	5.58**	.278
	(1,753)	(26.7)				(2,29)	.527
#3-Y_9 "	4,453.3*		15.25**	-39,324	5,616	6.44**	.308
	(1,817)		(4.61)			(2,29)	.555
#4-Y_9 "		77.8**	10.0*	-17,669	5,331	8.74**	.376
		(24.9)	(4.1)			(2,29)	.613 +
#1-Y_9 Growth	6,947.5*	134.8**	11.5	-38,043	2,925	32.93**	.892 ++
	(2,854.5)	(31.2)	(8.1)			(3,12)	.944
#2-Y_9 "	3,539.5	169.7**		-6,130	3,035	44.97**	.874
	(1,580)	(19.8)				(2,13)	.935 +
#3-Y_9 "	16,009.2**		39.245**	-116,979	4,489	17.02**	.724
	(2,967)		(7.626)			(2,13)	.851
#4-Y_9 "		190.7**	-5.2	13,294	3,435	33.68**	.838
		(24.8)	(5.0)			(2,13)	.915
#1-Y_9 Nongrowth	916.2	-11.7	11.4*	-23,309	4,453	2.23ns	.358 ++
	(1,727)	(31.1)	(4.6)			(3,12)	.599
#2-Y_9 "	318.6	-19.9		3,046	5,276	.16ns	.024
	(2,027)	(36.7)				(2,13)	.156
#3-Y_9 "	938.9		11.6*	-23,673	4,303	3.51ns	.351 +
	(1,668)		(4.4)			(2,13)	.592
#4-Y_9 "		-12.3	11.1*	-20,473	4,328	3.40ns	.343
		(30.2)	(4.4)			(2,13)	.586

TABLE 4

REGRESSION RESULTS FOR DATA GROUP III, STRATIFICATION A: COEFFICIENTS AND STANDARD ERRORS

Model No. & Dep. Var.	Net. Pop. Dens. X_{13}	Mean Mig. '61-63 X_5	P.C. Income 1963 X_4	Constant	Std. Error	"F" (d.f.)	R^2 R
#1-Y_9 Growth	1,270.2 (4,147)	206.7** (42.8)	6.289 (7,474)	-15,096	3,009	35.5** (3,9)	.922 ++ .960
#2-Y_9 "	-1,642.2 (2,252.3)	234.6** (26.6)		4,634	2,965	54.4** (2,10)	.916 .957
#3-Y_9 "	18,359** (3,892)		34.318** (8.47)	-110,522	5,411	12.8** (2,10)	.720 .848
#4-Y_9 "		217.83** (21.29)	4.380 (3.93)	-8,308	2,870	58.4** (2,10)	.921 + .960
#1-Y_9 Nongrowth	1,416 (846)	-47.38* (16.78)	8.425** (2.357)	-19,238	2,268	8.7** (3,15)	.635 ++ .797
#2-Y_9 "	846.5 (1,095)	-58.25* (21.74)		-451	2,989	3.8* (2,16)	.323 .569
#3-Y_9 "	1,424 (1,014)		9.63** (2.78)	-21,087	2,718	6.3** (2,16)	.441 .664
#4-Y_9 "		-47.5* (17.69)	7.68** (2.44)	-14,169	2,392	10.5** (2,16)	.567 + .753

TABLE 5

REGRESSION RESULTS FOR DATA GROUP III, STRATIFICATION D: COEFFICIENTS AND STANDARD ERRORS

Model No. & Dep. Var.	Net. Pop. Dens. X_{13}	Mean Mig. '61-63 X_5	P.C. Income 1963 X_4	Constant	Std. Error	"F" (d.f.)	R^2 R
#1-Y_9 Growth	966.65 (1,218)	205.50** (22.31)	2.691 (3.01)	-6,343	2,723	44.9** (3,14)	.906 ++ .952
#2-Y_9 "	505.7 (1,096)	214.27** (19.91)		417	2,705	67.8** (2,15)	.900 .949
#3-Y_9 "	6,202.3* (2,765)		14.871* (6.941)	-42,122	6,989	3.7* (2,15)	.335 .579
#4-Y_9 "		213.77** (19.49)	1.680 (2.69)	-2,026	2,689	68.7** (2,15)	.901 + .949
#1-Y_9 Nongrowth	298.9 (1,829)	-38.11 (25.24)	10.62 (5.00)	-20,891	3,040	3.9* (3,10)	.543 ++ .737
#2-Y_9 "	-1,669 (1,812)	-60.09* (26.45)		5,781	3,492	2.8ns (2,11)	.336 .580
#3-Y_9 "	1,145 (1,839)		13.716* (4.82)	-28,722	3,212	4.3* (2,11)	.438 .662
#4-Y_9 "		-39.37 (22.94)	10.211* (4.11)	-19,318	2,902	6.5* (2,11)	.541 + .736

TABLE 6

REGRESSION RESULTS FOR TOTAL SAMPLE, DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		-44.0*		11.7**	84.7**		-8,455	4,862	9.29**	.49884	
		(16.6)		(3.8)	(22.8)				(3,28)	.70628	
#2-Y_9		-33.4	7.2	12.3*			-12,880	5,903	3.30*	.26130	
		(20.7)	(12.7)	(4.7)					(3,28)	.51118	
#3-Y_9	52.7*	-46.4*		8.6			-1,813	5,374	5.91**	.38785	
	(21.2)	(18.6)		(4.5)					(3,28)	.62277	
#4-Y_9		-23.4		10.9**		69.3**	-12,573	4,775	9.98**	.51673	+++
		(16.5)		(3.8)		(17.7)			(3,28)	.71884	
#5-Y_9		-36.1			90.4**		14,143	5,515	7.21**	.33225	
		(18.6)			(25.8)				(2,29)	.57641	
#1-Y_8		-.093		.024	.278**		-4.50	18.44	4.86**	.34252	
		(.063)		(.014)	(.087)				(3,28)	.58525	
#2-Y_8		-.05	.04	.02			-18.29	21.24	1.367	.12775	
		(.07)	(.04)	(.017)					(3,28)	.35743	
#3-Y_8	.173**	-.101		.0137			17.39	19.91	2.846	.23369	
	(.078)	(.069)		(.017)					(3,28)	.48341	
#4-Y_8		-.021		.020		.253**	-17.81	17.28	6.83**	.42263	+++
		(.059)		(.014)		(.064)			(3,28)	.65010	
#5-Y_8		-.077			.290**		41.52	18.96	5.62**	.27949	
		(.064)			(.089)				(2,29)	.52867	
#1-Y_7		-8.715*		1.193	27.97**		517.87	1,223	9.31**	.49947	
		(4.178)		(.962)	(5.746)				(3,28)	.70673	
#2-Y_7		-5.257	2.294	1.400			-946.54	1,649	.9172	.08948	
		(5.789	(3.554)	(1.321)					(3,28)	.29913	
#3-Y_7	16.06**	-9.238		.294			2,421	1,473	3.519*	.27382	
	(5.8)	(5.113)		(1.24)					(3,28)	.52328	
#4-Y_7		-1.988		.946		22.42**	-845.21	1,206	9.82**	.51273	+
		(4.178)		(.954)		(4.475)			(3,28)	.71605	
#5-Y_7		-7.911			28.55**		2,827	1,234	12.9**	.47198	++
		(4.166)			(5.779)				(2,29)	.68701	

TABLE 7

REGRESSION RESULTS FOR GROWTH SUBGROUP, STRATIFICATION "G", DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		-38.2**		.199	181.7**		13,178	2,687	39.76**	.90858	++
		(12.10)		(4.344)	(19.70)				(3,12)	.95319	
#2-Y_9		-46.562	33.501	15.144			-14,150	7,537	1.563	.28092	
		(36.05)	(57.81)	(13.11)					(3,12)	.53002	
#3-Y_9	182.3**	-63.2**		-9.157			38,502	4,174	14.14**	.77945	
	(34.31)	(18.68)		(8.007)					(3,12)	.88286	
#4-Y_9		-18.145		-1.481		145.67**	11,844	2,887	33.92**	.89451	
		(13.54)		(4.778)		(17.157)			(3,12)	.94578	
#5-Y_9		-38.2**			182.1**		13,523	2,582	64.59**	.90856	+
		(10.67)			(16.57)				(2,13)	.95318	
#1-Y_8		-.1257		.016	.5297**		26.66	14.35	13.40**	,77007	
		(.0645)		(.023)					(3,12)	.87754	
#2-Y_8		-.143	.128	.055			46.67	24.85	1.80	.31030	
		(.119)	(.191)	(.043)					(3,12)	.55704	
#3-Y_8	.555**	-.1997*		-.015			108.24	16.15	9.73**	.70871	
	(.133)	(.072)		(.031)					(3,12)	.84185	
#4-Y_8		-.065		.010		.432**	24.44	14.16	13.87**	.77617	++
		(.066)		(.023)		(.084)			(3,12)	.88100	
#5-Y_8		-.108			.565**		54.34	14.05	20.69**	.76098	+
		(.058)			(.090)				(2,13)	.87234	
#1-Y_7		-10.78*		.428	51.4**		2,856.7	810.	35.86**	.89966	
		(3.647)		(1.309)	(5.940)				(3,12)	.94850	
#2-Y_7		-12.394	12.761	4.225			-4,195	2,127	1.784	.30844	
		(10.17)	(16.32)	(3.699)					(3,12)	.55537	
#3-Y_7	51.35**	-17.8**		-2.182			9,946.8	1,226	13.41**	.77032	
	(10.08)	(5.485)		(2.352)					(3,12)	.87763	
#4-Y_7		-4.819		-.209		42.35**	2,733,3	724	45.92**	.91987	++
		(3.398)		(1.198)		(4.303)			(3,12)	.95910	
#5-Y_7		-10.3**			52.36**		3,599	782	57.71**	.89876	+
		(3.232)			(5.019)				(2,13)	.94803	

TABLE 8

REGRESSION RESULTS FOR NONGROWTH SUBGROUP, STRATIFICATION "G", DATA GROUP IV

Model No. and Depdendent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		-20.78 (26.30)		11.336* (4.477)	-6.893 (31.45)		-15,101	4,392	2.41ns (3,12)	.37592 .61312	
#2-Y_9		-16.511 (27.13)	5.855 (10.15)	11.229* (4.413)			-16.071	4,341	2.56ns (3,12)	.39033 .62476	+++
#3-Y_9	3.652 (21.04)	-22.853 (26.14)		11.231* (4.623)			-14,254	4,395	2.40ns (3,12)	.37499 .61236	
#4-Y_9		-16.935 (27.00)		11.775* (4.439)		13.494 (24.19)	-17,013	4,344	2.55ns (3,12)	.38925 .62390	
#5-Y_9		-16.333 (31.2)			-15.959 (37.18)		8,404.9	5,227	.289ns (2,13)	.04255 .20628	
#1-Y_8		-.0165 (.0653)		.0242 (.0111)	-.0846 (.078)		-36.76	10.90	2.23ns (3,12)	.35772 .59809	
#2-Y_8		.002 (.066)	.036 (.025)	.024* (.011)			-41.76	10.53	2.68ns (3,12)	.40148 .63362	+++
#3-Y_8	-.032 (.054)	-.025 (.067)		.027* (.012)			-40.87	11.26	1.84ns (3,12)	.31472 .56100	
#4-Y_8		-.005 (.067)		.027* (.011)		.069 (.060)	-45.51	10.84	2.30ns (3,12)	.36504 .60419	
#5-Y_8		-.007 (.074)			-.104 (.088)		13.35	12.37	.761ns (2,13)	.10476 .32367	
#1-Y_7		-1.042 (1.546)		.503 (.263)	-2.73 (1.848)		-643.30	258	2.474ns (3,12)	.38211 .61815	
#2-Y_7		-.409 (1.491)	1.195 (.558)	.502 (.243)			-811.20	239	3.572* (3,12)	.47173 .68683	+++
#3-Y_7	-1.367 (1.284)	-1.226 (1.595)		.628* (.282)			-839.89	268	1.99ns (3,12)	.33276 .57686	
#4-Y_7		-.595 (1.547		.607* (.254)		2.495 (1.387)	-963.51	249	2.95ns (3,12)	.42458 .65159	
#5-Y_7		-.845 (1.692			-3.132 (2.014)		399.20	283	1.57ns (2,13)	.19411 .44059	

TABLE 9

REGRESSION RESULTS FOR GROWTH SUBGROUP, STRATIFICATION "A", DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		-37.05*		4.31	196.4**		3,781.1	2,163.0	71.49**	.960	++
		(13.13)		(2.96)	(18.26)				(3,9)	.980	
#2-Y_9		-110.4*	105.1	-.486			41,247	7,016	4.07*	.576	
		(38.11)	(62.2)	(11.09)					(3,9)	.759	
#3-Y_9	120.73**	-101.2**		-1.48			30.869	5,400	8.950**	.749	
	(36.39)	(29.07)		(7.66)					(3,9)	.865	
#4-Y_9		-50.77**		1.78		127.57**	15,639	3,502	25.42**	.894	
		(20.59)		(4.88)		(20.54)			(3,9)	.946	
#5-Y_9		-38.43*			200.5**		13,646	2,282	95.43**	.950	+
		(13.81)			(19.03)				(2,10)	.975	
#1-Y_8		.036		.015	.736**		-34.0	9.33	38.78**	.928	++
		(.057)		(.013)	(.079)				(3,9)	.963	
#2-Y_8		-.248	.515*	-.014			134.0	23,60	3.527ns	.540	
		(.128)	(.209)	(.037)					(3,9)	.735	
#3-Y_8	.485**	-.204		.003			71.1	18.90	7.179**	.705	
	(.127)	(.102)		(.027)					(3,9)	.840	
#4-Y_8		-.015		.006		.481**	10.40	13.64	16.53**	.846	
		(.080		(.019)		(.080)			(3,9)	.920	
#5-Y_8		.031			.751**		1.366	9.54	54.86**	.916	+
		(.058)			(.080)				(2.10)	.957	
#1-Y_7		2.516		-.043	64.14**		-970.3	733.3	45.24**	.938	
		(4.45)		(1.00)	(6.19)				(3,9)	.968	
#2-Y_7		-22.26	45.07*	-2.60			13,701	2,021	3.35ns	.527	
		(10.97)	(17.92)	(3.19)					(3,9)	.726	
#3-Y_7	41.34**	-18.40		-1.09			8,088.5	1,665	6.354*	.679	
	(11.22)	(8.96)		(2.36)					(3,9)	.824	
#4-Y_7		-1.704		-.908		42.3**	2,894	1,083	19.133**	.864	
		(6.37		(1.509)		(6.35)			(3,9)	.930	
#5-Y_7		2,530			64,103**		-1,068	695.7	75.383**	.938	+++
		(4.212)			(5.802)				(2,10)	.968	

TABLE 10

REGRESSION RESULTS FOR NONGROWTH SUBGROUP, STRATIFICATION "A" DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		14.565 (13.96)		6.873* (2.555)	-55.21* (19.138)		-16,506	2,386	7.375** (3,15)	.596 .772	+++
#2-Y_9		9.198 (16.19)	10.231 (6.453)	7.946* (2.899)			-16,547	2,753	4.293* (3,15)	.462 .680	
#3-Y_9	-2.750 (14.95)	-.296 (16.51)		9.124* (3.230)			-16,410	2,971	2.977ns (3,15)	.373 .611	
#4-Y_9		-1.308 (16.73)		8.904* (3.091)		-1.079 17.811	-15,689	2,975	2.961ns (3,15)	.372 .610	
#5-Y_9		25.98 (15.68			-69.58* (21.66)		-5,481	2,813	5.357* (2,16)	.401 .633	
#1-Y_8		.042 (.063)		-.0003 (.011)	-.223* (.086)		.574	10.7	2.411ns (3,15)	.325 .570	
#2-Y_8		.009 (.073)	.029 (.029)	.005 (.013)			1.26	12.5	.474ns (3,15)	.087 .294	
#3-Y_8	-.043 (.064)	-.009 (.071)		.011 (.014)			-6.024	12.7	.282ns (3,15)	.053 .231	
#4-Y_8		-.029 (.072)		.007 (.013)		-.030 (.077)	6.66	12.854	.181ns (3,15)	.035 .187	
#5-Y_8		.042 (.058)			-.222* (.080)		-.009	10.407	3.858ns (2,16)	.325 .570	+++
#1-Y_7		.405 (1.285)		.040 (.235)	-5.857** (1.762)		-54.5	219.69	4.342* (3,15)	.465 .682	++
#2-Y_7		-.255 (1.58)	.995 (.628)	.162 (.282)			-52.3	267.96	1.279ns (3,15)	.204 .451	
#3-Y_7	-1.541 (1.401)	-.842 (1.55)		.366 (.303)			-318.8	278.5	.814ns (3,15)	.140 .374	
#4-Y_7		-1.182 (1.627)		.264 (.301)		.250 (1.732)	-7.117	289.3	.387ns (3,15)	.072 .268	
#5-Y_7		.471 (1.19)			-5.94** (1.64)		9.05	212.9	6.919* (2,16)	.464 .681	+

TABLE 11

REGRESSION RESULTS FOR GROWTH SUBGROUP, STRATIFICATION "D", DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		-26.21*		3.06	202.4**		3.035.6	2,401.6	59.00**	.927	++
		(11.73)		(2.46)	(18.38)				(3.14)	.963	
#2-Y_9		-64.70	18.46	12.09			-1,660.	7,374.2	2.087ns	.309	
		(34.35)	(31.68)	(7.12)					(3,14)	.556	
#3-Y_9	80.16*	-70.19*		2.79			17,714	6,159.6	5.013*	.518	
	(31.32)	(28.72)		(7.02)					(3,14)	.720	
#4-Y_9		-43.42		11.08		70.60*	-6,209	5,842.1	6.093**	.566	
		(28.19)		(5.64)		(23.74)			(3,14)	.752	
#5-Y_9		-22.95			210.2**		8,537.9	2,445.1	84.65**	.919	+
		(11.65)			(17.58)				(2,15)	.958	
#1-Y_8		.012		-.003	.714**		16.83	10.63	30.08**	.866	++
		(.052)		(.011)	(.081)				(3,14)	.930	
#2-Y_8		-.121	.120	.028			2.077	26.04	1.124ns	.194	
		(.121)	(.112)	(.025)					(3,14)	.441	
#3-Y_8	.269*	-.142		-.002			65.13	23.12	2.679ns	.365	
	(.117)	(.108)		.026					(3,14)	.604	
#4-Y_8		-.040		.024		.275**	-17.25	20.15	5.005*	.517	
		(.097)		(.019)		(.082)			(3,14)	.719	
#5-Y_8		.008			.706**		11.11	10.30	48.01**	.865	+
		(.049)			(.074)				(2,15)	.930	
#1-Y_7		-1.998		-.803	60.399**		2,312.7	668.13	55.117**	.922	++
		(3.265)		(.685)	(5.115)				(3,14)	.960	
#2-Y_7		-13.143	12.288	1.779			1,132.9	2,075.7	1.527ns	.246	
		(9.670)	(8.918)	(2.005)					(3,14)	.496	
#3-Y_7	22.018*	-15.015		-.656			6,218.9	1,885.0	2.844ns	.379	
	(9.583)	(8.789)		(2.148)					(3,14)	.615	
#4-Y_7		-6.047		1.524		24.530**	-639.5	1,513.1	6.990**	.600	
		(7.302)		(1.462)		(6.148)			(3,14)	.774	
#5-Y_7		-2.852			58.338**		870.3	676.4	79.994**	.914	+
		(3.222)			(4.862)				(2,15)	.956	

TABLE 12

REGRESSION RESULTS FOR NONGROWTH SUBGROUP, STRATIFICATION "D", DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R2 and R	Comments
#1-Y_9		-5.429		10.490*	-37.076		-18,425	3,031.8	3,995*	.545	+++
		(19.181)		(4.410)	(25.30)				(3,10)	.738	
#2-Y_9		-5.643	11.637	10.407*			-17,786	3,052.7	3.895*	.539	
		(19.332)	(8.267)	(4.482)					(3,10)	.734	
#3-Y_9	-19.026	-12.565		12.575*			-20,468	3,272.9	2.955ns	.470	
	(29.233)	(19.824)		(4.459)					(3,10)	.685	
#4-Y_9		-10.712		11.483*		31.370	-18,224	3,194.7	3.267ns	.495	
		(19.528)		(4.548)		(32.353)			(3,10)	.703	
#5-Y_9		4.749			-58.612		485.8	3,617.1	2.223ns	.288	
		(22.307)			(28.185)				(2,11)	.536	
#1-Y_8		-.046		.005	-.208*		10.68	9.86	3.483ns	.511	++
		(.062)		(.014)	(.082)				(3,10)	.715	
#2-Y_8		-.062	.046	.009			10.23	11.43	1.740ns	.343	
		(.072)	(.031)	(.017)					(3,10)	.586	
#3-Y_8	-.199	-.077		.016			-2.04	10.45	2.729ns	.450	
	(.093)	(.063)		(.014)					(3,10)	.671	
#4-Y_8		-.090		.016		.053	4.11	12.50	.905ns	.213	
		(.076)		(.018)		(.127)			(3,10)	.462	
#5-Y_8		-.041			-.219*		20.42	9.46	5.589*	.504	+
		(.058)			(.074)				(2,11)	.710	
#1-Y_7		-.783		.091	-5.943**		116.6	174.4	8.031**	.707	++
		(1.104)		(.254)	(1.456)				(3,10)	.841	
#2-Y_7		-1.053	1.554*	.142			154.4	219.6	3.836*	.535	
		(1.391)	(.595)	(.322)					(3,10)	.731	
#3-Y_7	-5.735**	-1.663		.393			-248.1	199.8	5.329*	.615	
	(1.785)	(1.210)		(.272)					(3,10)	.784	
#4-Y_7		-1.820		.317		3,430	48.1	264.0	1.630ns	.328	
		(1.613)		(.376)		(2.673)			(3,10)	.573	
#5-Y_7		-.695			-6.130**		280.3	167.4	13.014**	.703	+
		(1.032)			(1.304)				(2,11)	.838	

TABLE 13

REGRESSION RESULTS FOR SOUTHWEST SUBGROUP, DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		-32.9*		4.0	194.9**		3,164.6	2,138	68.9**	.95384	++
		(13.2)		(2.5)	(16.7)				(3,10)	.97664	
#2-Y_9		-90.8	13.5	9.1			13,373	8,115	1.68ns	.33546	
		(46.4)	(34.7)	(9.5)					(3,10)	.57919	
#3-Y_9	94.6*	-82.8*		-3.5			35,183	5,958	5.97	.64176	
	(31.8)	(34.2)		(8.1)					(3,10)	.80110	
#4-Y_9		-65.34		11.15		64.5*	894.67	6,642	4.15	.55478	
		(39.6)		(7.8)		(28.4)			(3,10)	.74483	
#5-Y_9		-32.5*			199.3**		11,988	2,283	89.6**	.94215	+
		(14.1)			(17.6)				(2,11)	.97064	
#1-Y_8		.084		.001	.754**		-18.10	9.06	41.7**	.92605	++
		(.056)		(.011)	(.071)				(3,10)	.96231	
#2-Y_8		-.142	.146	.023			20.72	29.96	.785ns	.19063	
		(.171)	(.128)	(.035)					(3,10)	.43661	
#3-Y_8	.308	-.114		-.020			92.61	26.09	2.10	.38630	
	(.139)	(.150)		(.035)					(3,10)	.62153	
#4-Y_8		-.016		.031		.315**	-39.62	21.74	4.49	.57385	
		(.129)		(.026)		(.093)			(3,10)	.75752	
#5-Y_8		.084			.756**		-14.82	8.64	68.7**	.92590	+
		(.053)			(.066)				(2,11)	.96224	
#1-Y_7		-2.159		-.536	60.30**		1,794.1	764	41.6**	.92587	++
		(4.709)		(.903)	(5.965)				(3,10)	.96222	
#2-Y_7		-20.35	14.6	1.20			4,878.1	2,320	1.54ns	.31588	
		(13.27)	(9.93)	(2.71)					(3,10)	.56203	
#3-Y_7	22.03	-18.18		-1.91			10,040	2,201	2.08	.38457	
	(11.75)	(12.62)		(2.99)					(3,10)	.62014	
#4-Y_7		-9.276		1.927		27.47**	-373.40	1,556	7.50	.69239	
		(9.27)		(1.83)		(6.65)			(3,10)	.83210	
#5-Y_7		-2.2			59.70**		617.87	741	66.2**	.92325	+
		(4.57)			(5.70)				(2,11)	.96086	

TABLE 14

REGRESSION RESULTS FOR NORTHWEST SUBGROUP, DATA GROUP IV

Model No. and Dependent Var.	X-1 Migration (net) 1962	X-2 Per. Cap. Gov. Revenue	X-3 3 Yr. Migration Trend (net)	X-4 Per. Cap. Income (1963)	X-5 Mean (net) Migration	X-6 Migration (net) 1963	Constant	Standard Error	"F" & Degrees of Freedom	R^2 and R	Comments
#1-Y_9		-8.155 (17.89)		11.78* (4.577)	-19.6 (27.05)		-19,537	3,475	3.31 (3,14)	.41482 .64406	
#2-Y_9		-4.28 (16.89)	14.96 (9.48)	9.032 (4.73)			-14,973	3,262	4.38 (3,14)	.48449 .69605	
#3-Y_9	-82.06* (37.44)	-1.46 (15.89)		8.78 (4.23)			-16,105	3,054	5.66 (3,14)	.54796 .74024	
#4-Y_9		-6.41 (13.6)		5.18 (4.16)		82.66** (26.27)	-6,071	2,709	8.46 (3,14)	.64440 .80274	+
#5-Y_9		-4.39 (20.9)			-43.07 (29.9)		3,247.7	4,075	1.20 (2,15)	.13797 .37144	
#1-Y_8		-.060 (.062)		.012 (.016)	-.128 (.093)		5.71	11.98	1.80 (3,14)	.27796 .52721	
#2-Y_8		-.064 (.063)	.038 (.036)	.009 (.018)			12.71	12.28	1.49 (3,14)	.24224 .49218	
#3-Y_8	-.354* (.124)	-.039 (.053)		.001 (.014)			17.98	10.16	4.32 (3,14)	.48087 .69345	+++
#4-Y_8		-.077 (.063)		.011 (.019)		.080 (.122)	12.39	12.57	1.21 (3,14)	.20550 .45332	
#5-Y_8		-.057 (.060)			-.151 (.086)		28.26	11.80	2.50 (2,15)	.24983 .49983	
#1-Y_7		-1.45 (1.44)		.412 (.368)	-3.28 (2.176)		-254.13	279	2.43 (3,14)	.34272 .58543	
#2-Y_7		-1.43 (1.454)	1.18 (.818)	.294 (.408)			3.61	281	2.351 (3,14)	.33505 .57883	
#3-Y_7	-8.789** (2.85)	-.924 (1.21)		.158 (.322)			44.04	232.59	5.59 (3,14)	.54504 .73827	+++
#4-Y_7		-1.784 (1.439)		.284 (.440)		3.375 (2.78)	149.72	286.65	2.09 (3,14)	.30900 .55587	
#5-Y_7		-1.316 (1.447)			-4.099 (2.066)		542.95	281.91	2.97 (2,15)	.28391 .53284	

TABLE 15a

SIMPLE CORRELATION COEFFICIENTS FOR TOTAL: DATA GROUPS I, II, III, AND IV

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
X_1 Migration (net) 1962	-----	.260	-.502	.398	.727	-.151	.434	.401	.433	-----	-----	-----	-----
X_2 Per. Capita Gov. Rev.		-----	-.224	.167	.137	-.182	-.166	-.121	-.224	-----	-----	-----	-----
X_3 Three Year Migration Trend			-----	.160	-.513	.657	.192	.244	.228	-----	-----	-----	-----
X_4 Per. Cap. Income (1963)				-----	.105	.097	.189	.268	.406	-----	-----	-----	-.339
X_5 Mean (net) Migration 1961-1963					-----	.254	.637	.493	.499	-----	-----	-----	.098
X_6 Migration (net) 1963						-----	.703	.613	.600	-----	-----	-----	-----
X_7 (Y_7) Ten Prod. Trade in Square Miles							-----	.924	.870	-----	-----	-----	-----
X_8 (Y_8) Ten Prod. Ideal Distance								-----	.888	-----	-----	-----	-----
X_9 (Y_9) Revenue from Selected Services and Total Sales									-----	.889	.078	.992	.217
X_{10} Ten Product Ideal Distance--Density adjusted										-----	.084	.921	-----
X_{11} Migration (net) 1961											-----	.108	-----
X_{12} Total Town Income												-----	-----
X_{13} Net Population Density													-----

TABLE 15b

SIMPLE CORRELATION COEFFICIENTS FOR GROWTH SUBGROUP; DATA GROUPS I, II, III, AND IV STRATIFICATION G

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
X_1 Migration (net) 1962	-----	.329	.367	.714	.884	.764	.717	.702	.708	-----	-----	-----	-----
X_2 Per. Capita Gov. Rev.		-----	-.106	.377	.060	-.093	-.226	-.201	-.245	-----	-----	-----	-----
X_3 Three Year Migration Trend			-----	.495	.290	.598	.448	.437	.400	-----	-----	-----	-----
X_4 Per. Cap. Income (1963)				-----	.468	.443	.351	.381	.324	-----	-----	-----	-.636
X_5 Mean (net) Migration 1961-1963					-----	.914	.905	.835	.905	-----	-----	-----	.203
X_6 Migration (net) 1963						-----	.949	.871	.932	-----	-----	-----	-----
X_7 (Y_7) Ten Prod. Trade Area in Square Miles							-----	.968	.997	-----	-----	-----	-----
X_8 (Y_8) Ten Prod. Ideal Distance								-----	.966	-----	-----	-----	-----
X_9 (Y_9) Revenue from Selected Services and Total Sales									-----	.966	.730	.996	.401
X_{10} Ten Product Ideal Distance--Density Adjusted										-----	.620	.982	-----
X_{11} Migration (net) 1961											-----	.689	-----
X_{12} Total Town Income												-----	-----
X_{13} Net Population Density													-----

TABLE 15c

SIMPLE CORRELATION COEFFICIENTS FOR NONGROWTH SUBGROUP; DATA GROUPS I, II, III, AND IV
STRATIFICATION G

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
X_1 Migration (net) 1962	-----	.187	-.777	.273	.605	-.909	-.151	-.009	.161	-----	-----	-----	-----
X_2 Per. Capita Gov. Rev.		-----	-.349	.043	.210	-.341	-.210	-.092	-.170	-----	-----	-----	-----
X_3 Three Year Migration Trend			-----	.065	-.910	.791	.531	.380	.228	-----	-----	-----	-----
X_4 Per. Cap. Income (1963)				-----	-.102	-.139	.465	.530	.579	-----	-----	-----	-.135
X_5 Mean (net) Migration 1961-1963					-----	-.494	-.423	-.323	-.150	-----	-----	-----	-.021
X_6 Migration (net) 1963						-----	.379	.212	.102	-----	-----	-----	-----
X_7 (Y_7) Ten Prod. Trade Area in Square Miles							-----	.961	.906	-----	-----	-----	-----
X_8 (Y_8) Ten Prod. Ideal Distance								-----	.942	-----	-----	-----	-----
X_9 (Y_9) Revenue from Selected Services and Total Sales									-----	.939	-.302	.987	.046
X_{10} Ten Product Ideal Distance--Density Adjusted										-----	-.449	.932	-----
X_{11} Migration (net) 1961											-----	-.262	-----
X_{12} Total Town Income												-----	-----
X_{13} Net Population Density													-----

TABLE 16a

SIMPLE CORRELATION COEFFICIENTS FOR GROWTH SUBGROUP, STRATIFICATION A: DATA GROUP III

Variable	13	5	4	9
X_{13} Net Population Density	----	.591	-.523	.510
X_5 Mean (net) Migration 1961-1963		----	.225	.955
X_4 Per. Cap. Income (1963)			----	.311
X_9 (Y_9) Revenue from Selected Services and Total Sales				----

TABLE 16b

SIMPLE CORRELATION COEFFICIENTS FOR NONGROWTH SUBGROUP, STRATIFICATION A: DATA GROUP III

Variable	13	5	4	9
X_{13} Net Population Density	----	.031	-.191	.142
X_5 Mean (net) Migration 1961-1963		----	-.184	-.546
X_4 Per. Cap. Income (1963)			----	.610
X_9 (Y_9) Revenue from Selected Services and Total Sales.				----

TABLE 17a

SIMPLE CORRELATION COEFFICIENTS FOR GROWTH SUBGROUP, STRATIFICATION D: DATA GROUP III.

Variable	13	5	4	9
X_{13} Net Population Density	----	.345	-.275	.362
X_5 Mean (net) Migration 1961-1963		----	.302	.948
X_4 Per. Cap. Income (1963)			----	.334
X_9 (Y_9) Revenue from Selected Services and Total Sales				----

TABLE 17b

SIMPLE CORRELATION COEFFICIENTS FOR NONGROWTH SUBGROUP, STRATIFICATION D: DATA GROUP III

Variable	13	5	4	9
X_{13} Net Population Density	----	-.126	-.438	-.157
X_5 Mean (net) Migration 1961-1963		----	-.310	-.534
X_4 Per. Cap. Income (1963)			----	.647
X_9 (Y_9) Revenue from Selected Services and Total Sales				----

TABLE 18a

SIMPLE CORRELATION COEFFICIENTS FOR GROWTH SUBGROUP, STRATIFICATION A: DATA GROUP IV.

Variable	1	2	3	4	5	6	7	8	9
X_1 Migration (net) 1962	----	.260	-.502	.398	.727	-.151	.434	.401	.433
X_2 Per. Capita Gov. Revenue		----	.024	-.163	-.480	-.427	-.423	-.416	-.630
X_3 Three Year Migration Trend			----	.507	.445	.705	.550	.590	.407
X_4 Per Cap. Income (1963)				----	.212	.288	.198	.304	.311
X_5 Mean (net) Migration 1961-1963					----	.907	.967	.956	.955
X_6 Migration (net) 1963						----	.026	.919	.906
X_7 (Y_7) Ten Prod. Trade Area in Sq. Miles							----	.969	.910
X_8 (Y_8) Ten Prod. Ideal Distance								----	.917
X_9 (Y_9) Revenue from Selected Services and Total Sales									----

TABLE 18b

SIMPLE CORRELATION COEFFICIENTS FOR NONGROWTH SUBGROUP, STRATIFICATION A: DATA GROUP IV

Variable	1	2	3	4	5	6	7	8	9
X_1 Migration (net) 1962	----	.298	-.723	.367	.656	-.897	-.217	-.118	.187
X_2 Per. Capita Gov. Revenue		----	-.360	.221	.330	-.314	-.155	-.043	.122
X_3 Three Year Migration Trend			----	.115	-.947	.853	.431	.272	.349
X_4 Per. Cap. Income (1963)				----	-.184	-.203	.176	.139	.610
X_5 Mean (net) Migration 1961-1963					----	-.689	-.677	-.551	-.546
X_6 Migration (net) 1963						----	.053	-.101	-.132
X_7 (Y_7) Ten Prod. Trade Area in Square Miles							----	.969	.753
X_8 (Y_8) Ten Prod. Ideal Distance								----	.724
X_9 (Y_9) Revenue from Selected Services and Total Sales									----

TABLE 19a

SIMPLE CORRELATION COEFFICIENTS FOR GROWTH SUBGROUP, STRATIFICATION D: DATA GROUP IV

Variable	1	2	3	4	5	6	7	8	9
X_1 Migration (net) 1962	----	.123	-.334	.541	.615	-.081	.490	.533	.557
X_2 Per. Capita Gov. Revenue		----	-.037	.132	-.249	-.257	-.303	-.216	-.377
X_3 Three Year Migration Trend			----	.067	.259	.830	.346	.286	.171
X_4 Per. Cap. Income (1963)				----	.297	.041	.187	.253	.334
X_5 Mean (net) Migration 1961-1963					----	.685	.954	.930	.947
X_6 Migration (net) 1963						----	.745	.679	.630
X_7 (Y_7) Ten Prod. Trade Area in Square Miles							----	.959	.918
X_8 (Y_8) Ten Prod. Ideal Distance								----	.928
X_9 (Y_9) Revenue from Selected Services and Total Sales									----

TABLE 19b

SIMPLE CORRELATION COEFFICIENTS FOR NONGROWTH SUBGROUP, STRATIFICATION D: DATA GROUP IV

Variable	1	2	3	4	5	6	7	8	9
X_1 Migration (net) 1962	----	.136	-.834	-.061	.905	-.732	-.693	-.563	-.212
X_2 Per. Capita Gov. Revenue		----	-.262	.122	.264	-.154	-.326	-.328	-.089
X_3 Three Year Migration Trend			----	.332	-.963	.934	.711	.535	.536
X_4 Per Cap. Income (1963)				----	-.310	.275	.291	.261	.647
X_5 Mean (net) Migration 1961-1963					----	-.819	-.831	-.694	-.534
X_6 Migration (net) 1963						----	.462	.252	.415
X_7 (Y_7) Ten Prod. Trade in Square Miles							----	.963	.684
X_8 (Y_8) Ten Prod. Ideal Distance								----	.677
X_9 (Y_9) Revenue from Selected Services and Total Sales									----

TABLE 20a

SIMPLE CORRELATION COEFFICIENTS FOR SOUTHWEST AREA: DATA GROUP III AND IV.

Variable	1	2	3	4	5	6	7	8	9	13
X_1 Migration (net) 1962	----	-.091	-.383	.518	.644	-.074	.482	.576	.652	----
X_2 Per. Capita Gov. Revenue		----	.022	-.051	-.377	-.272	-.399	-.239	-.516	----
X_3 Three Year Migration Trend			----	-.055	.197	.818	.369	.309	.076	----
X_4 Per. Cap. Income (1963)				----	.174	-.106	.116	.179	.270	-.200
X_5 Mean (net) Migration 1961-1963					----	.668	.960	.953	.956	.500
X_6 Migration (net) 1963						----	.788	.712	.568	----
X_7 (Y_7) Ten Prod. Trade Area in Square Miles							----	.970	.927	----
X_8 (Y_8) Ten Prod. Ideal Distance								----	.912	----
X_9 (Y_9) Revenue from Selected Services and Total Sales									----	.549
X_{13} Net Population Density										----

TABLE 20b

SIMPLE CORRELATION COEFFICIENTS FOR NORTHWEST AREA: DATA GROUP III AND IV

Variable	1	2	3	4	5	6	7	8	9	13
X_1 Migration (net) 1962	----	.258	-.858	-.430	.886	-.565	-.722	-.679	-.639	----
X_2 Per. Capita Gov. Revenue		----	-.232	-.002	.236	-.096	-.310	-.311	-.136	----
X_3 Three Year Migration Trend			----	.505	-.886	.767	.522	.424	.592	----
X_4 Per. Cap. Income (1963)				----	-.328	.587	.375	.290	.612	-.464
X_5 Mean (net) Migration 1961-1963					----	-.402	-.494	-.453	-.363	-.169
X_6 Migration (net) 1963						-----	.466	.326	.775	----
X_7 (Y_7) Ten Prod. Trade in Square Miles							----	.975	.856	----
X_8 (Y_8) Ten Prod. Ideal Distance								----	.782	----
X_9 (Y_9) Revenue from Selected Services and Total Sales									----	-.230
X_{13} Net Population Density										----

APPENDIX C

DISTANCES TRAVELED FOR TEN, SEVEN AND THREE PRODUCT CLASSIFICATIONS

People travel different distances for different products and travel different distances for the same products within two sharply contrasting areas such as Northwest Area #1 and Southwest Area #2. The following tables illustrate:[1]

TABLE 1

NORTHWEST AREA #1

Product	Suppliers Avg. Dist.	Customer's Max. Dist.	Customer's Avg. Dist.
Food	20.849	10.424	5.212
Clothing	27.791	13.986	6.948
Recreation	26.047	13.024	6.512
Furniture and Appliances	22.384	11.192	5.596
Drugs	31.871	15.935	7.968
Medical and Dental	27.270	13.620	6.810
Livestock	27.328	13.664	6.832
Tractor Gas	19.722	9.861	4.930
Farm Machinery	25.838	12.919	6.460
Feed, Seed and Fertilizer	21.266	10.633	5.316
Total	24.291	12.146	6.073
First 7 products	25.489	12.745	6.372
Last 3 products	22.021	11.010	5.505
1,4,8,9,10	21.811	10.905	5.453
2,3,5,6,7	28.154	14.077	7.038

---

[1] Also see Golledge, *op. cit.*

TABLE 2

SOUTHWEST AREA #2

Product	Suppliers Avg. Dist.	Customer's Max. Dist.	Customer's Avg. Dist.
Food	34.950	17.475	8.737
Clothing	43.156	21.578	10.789
Recreation	34.280	17.140	8.570
Furniture and Appliances	41.062	20.531	10.266
Drugs	42.189	21.094	10.547
Medical and Dental	38.182	19.091	9.545
Livestock	36.733	18.366	9.183
Tractor Gas	30.848	15.424	7.712
Farm Machinery	29.278	14.639	7.319
Feed, Seed and Fertilizer	30.424	15.212	7.606
Total	34.855	17.427	8.714
First 7 products	37.969	18.985	9.492
Last 3 products	30.143	15.072	7.356
1,4,8,9,10	32.498	16.249	8.124
2,3,5,6,7	38.421	19.210	9.605

APPENDIX D

THE SURVEY

The survey used in this study was conducted in 1962 in the Southwest Area #2 and in 1963 for the Northwest Area #1.

Southwest Survey:

Town Household.--This is a random sample of the households in all incorporated towns in the Garden City trade area. The towns where interviews were taken, with the number of interviews and the per cent of households sampled are:

Town	Number Taken	% of Households
Garden City	50	1.25
Lakin	18	4.00
Deerfield	11	8.00
Copeland	8	10.50
Ingalls	5	8.00
Sublette	15	4.00
Satanta	15	5.00
TOTAL	122	

General Farm.--This is a four per cent random sample of all farmers in the Garden City trade area. Approximately half (chosen randomly) were given household schedules.

TOTAL:	General Farm	77
	Household	42

Northwest Survey:

Town Household.--The Colby trade area will be represented three times as heavily as the outer area.

There are 1,976 town households in the Colby trade area and 6,276 outside the Colby area. A three per cent sample of the households in the Colby area and a one per cent sample of the households in the outer area gives 59 interviews in the Colby area and 63 in the outer area. This produces a total household interview for the Town Household of 122.

The towns in the Colby trade area are:

Colby	Brewster
Gem	Rexford
Menlo	Winona
Russell Springs	

General Farm.--The Colby trade area will be represented three times as heavily as the outer area.

There are 1,065 rural households in the Colby trade area and 3,318 in the outer area. A three per cent sample of the rural households in the Colby area and a one per cent sample in the outer area gives 32 interviews in the Colby area and 33 in the outer area for a total of 65.

The townships in the Colby trade area are:

Thomas Co.	Rawlins Co.	Logan Co.
Barrett	Grant	McAllaster
West Hale	Arbor	Winona
East Hale	Clinton	Monument
Kingery	Jefferson	Western
Rovohl		Russell Springs
Morgan	Decatur Co.	
Summers		Sherman Co.
Wendall	Cook	
Lacey	Prairie Dog	Llanos
Smith		Union
North Randall	Sheridan Co.	Iowa
Menlo		
	Prarie Dog	
	Logan	

Town Household Schedule:

57. We would like to know where you buy most of each of the listed items. W also would like to know where you buy some or only a little bit of these same items. Could you also tell us where you made these purchases ten years ago? Where did you last purchase the amounts of each item listed under column 3 since living at your present address?

	(1) NOW	(2) 10 YEARS AGO*	(3) TOWN WHERE LAST PURCHA ITEM OR SERVICE **	
	Town (s)	Town (s)	Amount	Town (s
1. Food Most			Over $20.00	
			Under $20.00	
Some				
2. Clothing Most			Over $50.00	
			Under $50.00	
Some				
3. Medical & Dental Care Most			Last Doctor	
			Last Dentist	
			Last Hospital	
Some				
4. Drugs Most			Over $5.00	
			Under $5.00	
Some				

Town Household Schedule (continued).--

5. Furniture and Appliances			Over$100.00
Most			Under $100.00
↓			
Some			
6. Recreation (Bowling movies, etc)			Last Bowling
Most			Last Movie
↓			Last Sport
Some			

* If moved in last 10 years, or if did not have a household 10 years ago, omit column 2.

**Answer only if purchase was made by your household while living at present residence

General Farm Schedule:

GF 56. We would like to know where you buy most of each of the listed items. We also would like to know where you buy some or only a little bit of these same items. Could you also tell us where you made these purchases ten years ago? Where did you last purchase the amounts of each item listed under column 3?

	(1) NOW	(2) 10 YEARS AGO*	(3) TOWN WHERE LAST PURCHASE ITEM OR SERVICE **	
	Town (s)	Town (s)	Amount	Town (s)
Farm machinery Most			Over $500	
↓			Under $500	
Some				
Feed, seed & fertilizer Most			XXXXXXXXXX	
↓				
Some				
Tractor gas Most			XXXXXXXXXX	
↓				
Some				
Livestock Most			Over $1000	
↓			Under $1000	
Some				

* IF MOVED IN LAST 10 YEARS, OR IF DID NOT HAVE A HOUSEHOLD 10 YEARS AGO, OMIT (2)

** ANSWER ONLY IF PURCHASE WAS MADE BY YOUR HOUSEHOLD WHILE LIVING AT PRESENT RESIDENCE.

APPENDIX E

FACTOR ANALYSIS

The method for determining the factor loadings in this study follows the proceedure in the Hagood and Bernert article.[1] The steps are:

1. A matrix of simple correlations with the major diagonal trace of ones is provided. Call this Matrix "B".

2. Sum over all columns and call this $\Sigma 1$.(Forms a row)

3. Divide each sum shown in $\Sigma 1$ by the largest single sum. Enter the row of quotients in the first column of another matrix. Call this new column (W_1) and the new matrix, Matrix "C".

4. Produce a sum of products for each element in column W_1 with its equivilent element in Matrix B. Enter this sum as the first element of the $\Sigma 2$ row under column one of Matrix B. Do the same with W_1 with all other columns in Matrix B to form the complete row of $\Sigma 2$.

5. Go back to (3) only use $\Sigma 2$ and call the results W_2.

6. Continue until no change occures in the W's.

7. Multiply each weight by: (final nonchanging weight)

$$W_{Li}\sqrt{\frac{\text{largest sum in last } \Sigma \text{ row}}{\text{sum of squares of the weights in last W column}}} = a_{si}$$

8. $$\frac{\Sigma (a_{si}{}^2)}{n} = R^2_{1.2} \text{ for the first factor.}$$

Where W_{Li} is the ith element in the last column of W's

---

[1]M.J. Hagood and E.H. Bernert, "Component Indexes as a Basis for Stratification in Sampling," Journal of the American Statistical Association, Vol. 40 (September, 1945), pp. 330-341.

GROWTH VS. NONGROWTH TOWNS
IN WESTERN KANSAS

by

GEORGE DUANE JOHNSON

B.A., Fort Lewis College, 1965

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARTS

Department of Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1967

ABSTRACT

Adequate and appropriate response by public authorities to the problem of declining trade centers requires an efficient method of identifying probable growth and nongrowth centers.

The objective of this study is to provide and evaluate different methods of identifying growth and nongrowth trade centers and to provide estimates of growth trade centers for western Kansas.

Two general methods of identification are presented. Both methods are based upon an a-priori assumption about the major source of funds for small towns serving a dispersed farm population. That is, small towns located in a relatively homogeneous geographic area in which the "area" basic industry is agricultural production have as their main source of revenue the distribution of products and services to this dispersed farm population. Therefore, the external distribution of products and services can be considered the "basic" industry for these towns in contrast to the area basic industry which is agricultural production.

The first method of identification used relative individual town performance in the distribution of ten products and services as the criteria for identification. Performance in this method of identification is measured by the trade area of the individual town in square miles and an alternative statement

of the trade area in linear miles, both in relation to ten products and services.

The second method uses nine economic, geographic and demographic variables in conjunction with a factor analysis approach to identify growth and nongrowth trade centers.

Both methods of identification are evaluated using multiple regression techniques. Three dependent variables are used which indicate the size or scale of the individual town's distribution of products and services. These dependent variables are, (1) total retail sales and total revenue from selected services, (2) ten product trade area in square miles, and (3) an alternative statement of the trade area in linear miles in relation to ten products. In the final regression problems three basic independent variables are used. They are, (1) gross per capita government revenue--individual tax load, (2) per capita income, and (3) four different net migration variables.

Using the multiple correlation coefficient squared (R^2) and the "F" value for each model--both measurements indicating the amount of variation in the dependent variable explained by the independent variables in the model--the homogeniety of the growth and nongrowth subpopulations are evaluated using the following hypothesis. An efficient identification procedure will produce a higher percentage of explained variation in both subpopulations than in the total population in relation to the same model. Only one identification procedure met this criteria at a significant level of confidence using a corrected chi-square test.

Also, it is found that certain net migration coefficients are significantly different at the one per cent level of confidence in relation to the growth and nongrowth subpopulations. That is, two distinct town populations exist within a given geographic area in relation to certain net migration variables.

Finally, short run designations are made of the probable growth towns in the two study areas of western Kansas based upon their inclusion in three relatively efficient identification procedures.