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THE REGIONAL STRUCTURE OF THE KANSAS ECONOMY

by

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A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

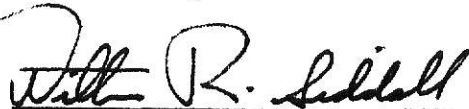
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Chapter I

INTRODUCTION

With a few minor exceptions the county lines of the state of Kansas were permanently defined by the early 1890's (see Fig. 1). This was a period when a majority of Kansans were settled in rural environments and, considering the transportation facilities of the day, were rather immobile. There were very few non-agricultural activities and urban areas were few in number. In such a setting the rural county served a very definite and valuable purpose. It provided a self-contained political and socio-economic unit, the size and configuration of which made it easily available to all of its residents.

Increased population in concert with new technological innovations in transport and production systems led to a reorganization of the landscape in the twentieth century. Urban-oriented activity began to extend over multi-county areas, gradually claiming more and more of the civilian labor force, concentrating the population in urban centers, and in general led to the breakdown of the county as a meaningful functional unit.

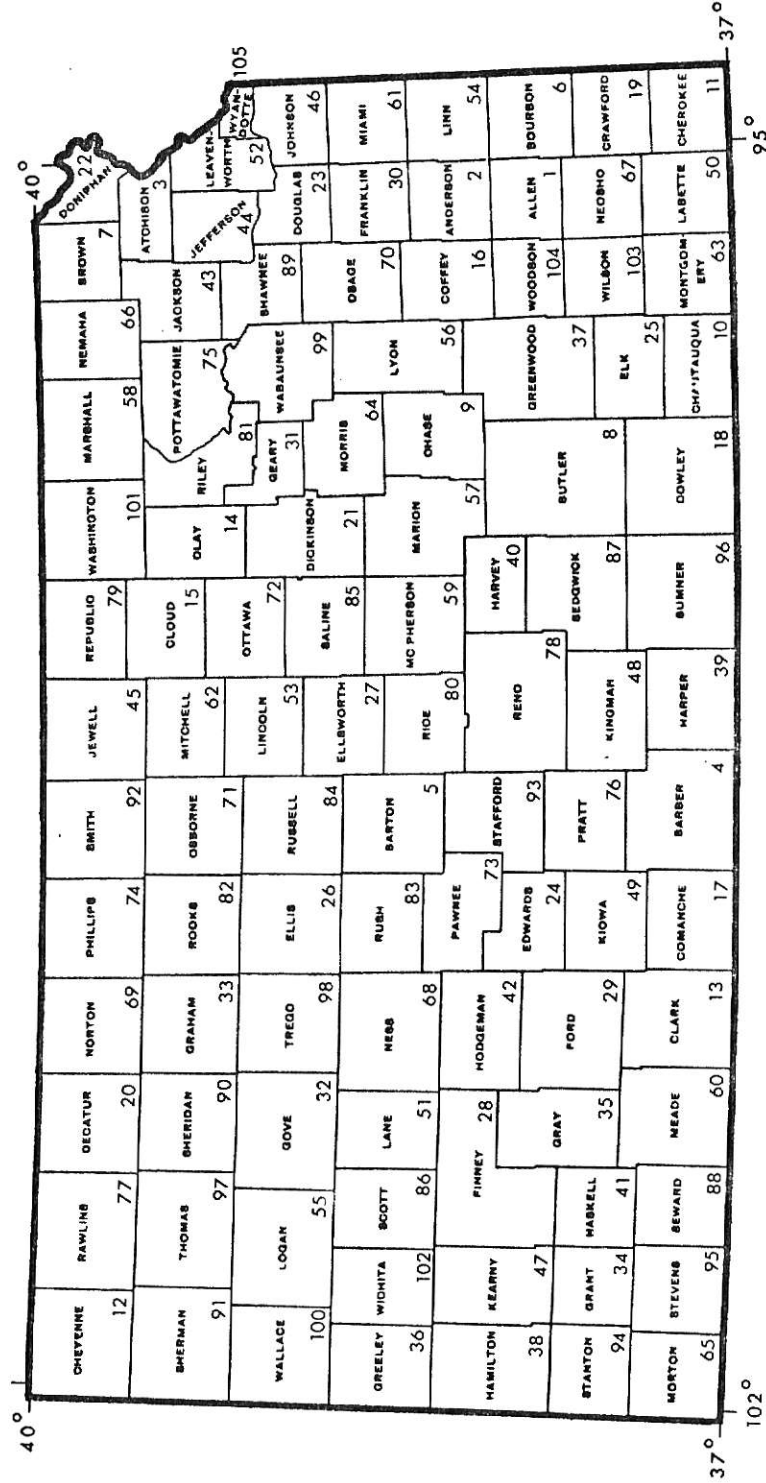
Today, except for political purposes, the county is a unit of very little significance. The agricultural sector, which originally constituted a county's economic development, proceeds without much regard to county lines. Modern transport and communications networks disregard county lines almost completely. As a result, the typical rural county, which may have been well adapted to the mid-nineteenth century, today appears to be too small and too confining to comprise a self-contained economic area.

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FIGURE 1

THE 105 COUNTIES OF KANSAS



THE NUMBERS REPRESENT THE ALPHABETICAL

ORDER OF THE COUNTY UNITS

SCALE



THE PROBLEM

Even though most private concerns have rendered the county economically and socially obsolete, it still remains as one of the official political sub-units of the state. Consequently, most governmental decisions, concerning private and governmental economic development, are made by a political body that, by force of structure, continues to regard the county as an independent, self-contained, socio-economic unit. The possibility that many counties are different only to a degree and that there is actually a great deal of economic similarity among certain contiguous counties, has only recently been considered.

Harmful effects of such a gross disregard of reality are many. The continued use of the county as a political decision-making unit can seriously hamper the ability of man to recognize the true spatial ordering of economic activity within the state's landscape. It also obscures the dynamic interrelationships present within and between these spatial orderings. Tacit acceptance of the county as a meaningful socio-economic unit certainly does not encourage inter-county cooperation on large-scale development projects. The efficient operation, planning and development of the Kansas economy may be retarded if this extremely distorted description of the existing and functioning Kansas economy is not replaced.

PURPOSE OF THE STUDY

Given the many problems created by the awkwardness of the county as a significant areal unit, it seems appropriate to declare the purpose of this research effort to be:

1. The objective determination of the true character of the Kansas economic landscape to better describe the present spatial ordering.

2. The derivation of a meaningful set of homogeneous economic regions using the true character of the landscape as a guiding reference.

PREVIOUS REGIONALIZATIONS

The derivation of a meaningful set of homogeneous economic regions is not something that has never been attempted for the State of Kansas. However, previous efforts are largely subjective and lack a convincing rationale.

State Economic Areas

In 1950 Donald J. Bogue and Calvin L. Beale, in conjunction with the Bureau of the Census, devised a system of economic areas for the State of Kansas. Using the more than 3100 counties and county equivalents as building blocks, they constructed a system of Economic Areas which they felt minimized economic variation within the areas, while maximizing variation between regions. In the authors' words:

"The Economic Areas were delimited by stages. The first stage consisted of subdividing each of the states into State Economic Areas, by grouping together counties with similar traits. The succeeding stages consisted of grouping similar State Economic Areas into Economic sub-regions, and finally of grouping similar Economic Regions into Economic Provinces."¹

This delimitation of the economic areas used previous research and delimitations, and supplemented it with statistical tests in which as many as sixty-four statistical indices were used simultaneously. Although variation in roughly sixty-four indices were used as surrogates for economic activity, a great majority of these were indicators of agricultural economy. However, Bogue and Beale repudiated this bias by stating

¹D. J. Bogue and C. L. Beale, Economic Areas of the United States (New York: The Free Press of Glencoe, Inc., 1961), p. 1142.

that for major nonagricultural activities, such as forestry, mining, or manufacturing, only one or two series of statistics were usually required to detect and delimit the nonagricultural activity.

Because some of the raw data used in the delimitation was informal or subjective, and because the authors themselves were forced to make informal and subjective evaluations of the wide assortment of information about each area, Bogue and Beale stated in their study, "that it would be impossible for them to specify exactly a process that could be carried out mechanically or by the use of arithmetic to duplicate and check the boundaries of the regions."² They verified the objectivity of their results in quite a different way; the validity of the results rested upon objective tests that were made concerning the results, rather than upon an evaluation of the objectivity and reproducibility of the various steps.

"701" Regions

The Regional Delineation Study for Kansas (commonly referred to as the "701" project)³ was the result of research commissioned by the State Planning Division of the Kansas Department of Economic Development. With the aid of a Federal grant from the Urban Renewal Administration of the United States Department of Housing and Urban Development, research was performed as an interdepartmental project at Kansas State University. The results were published as a multi-volume series in July of 1966. The objective of the project was to provide statistical regions for analytic purposes, planning regions within which state-wide planning might proceed,

²Ibid., p. 1143.

³The preparation of the delineation was financially aided through a Federal grant from the Urban Renewal Administration of HUD, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954.

political regions within which various state and federal government agencies might conduct dialogue with local governments to assure proper recognition of the needs of the citizenry, and administrative areas for various governmental programs.

A statistical procedure was designed to accomplish the formidable task of deriving regions which would meet the requirements and conditions essential for good planning. The procedure consisted of determining thirty-six factors or surrogates of economic character and mapping these factors on thirty-six uniform outline maps of the state. However, after deliberating on the thirty-six factor maps, the Development Commission determined that a significant percentage of the county variation could be accounted for by only twelve of the factor maps. These twelve maps were then combined in order that areas with the most intensive economic activity might be recognized. These areas were then used as the core or centers of the planning regions.

Subsequent bands of low intensity activity, low homogeneity among factors and low dominance by any single core area were then identified and provided possible regional boundaries. Subjective procedures, employed consequent to the above, determined all questionable county memberships and delineated the final regional boundary lines. The process generally exhibits elements of a "magic lantern" technique.

METHOD OF APPROACH

In recent years many scholars have begun to seriously question the apparent subjectivity of the methods used by geographers and social scientists to derive descriptive regionalization schemes. Criticism has been directed toward the descriptive regionalization procedures which employ

the traditional map overlay, and the good judgement and common sense of the regional specialist involved. To combat this subjectivity, geographers have increasingly employed statistical methods developed in other disciplines in an attempt to make the regionalization process more objective. While a perfectly objective set of regions could never be developed, there seems to be general feeling among geographers that "statistical methods have greatly improved the validity of regional systems and hence of the generalizations that can be made from them."⁴

Ideally, descriptive regionalizations of economic activity have no given statistical data base, but should be derived from the observed inter-relationship of economic activity irregardless of political boundaries. However, any description is limited by practical considerations and no matter how precise the description, perfection, i.e., reality, is never attained. The degree to which description does approach reality depends primarily upon how skillfully surrogates of reality are selected and manipulated. And when considering the possible surrogates of economic activity, it soon becomes clear that, short of an errorless personal survey, usable data are only available for the county-base units which this paper has previously criticized. As a result, a departure from the ideal regional description to a less accurate but operational regionalization based upon statistical analysis of existing data units has to be made.

The statistical regionalization scheme used in this research is an aggregation procedure involving three statistical analyses: (1) principal components analysis, (2) distance scaling of similarities, and (3) contiguity grouping. The originality of this procedure is not in the statistical

⁴Richard Chorley and Peter Haggett (eds.), Models in Geography (London: Methuen and Co. LTD, 1967), p. 464.

methods themselves nor their application, for they have been used at all levels of regionalization by many reputable research groups. The originality is in the application of the procedure to the task of describing spatially the ordering of economic activity in Kansas.

3. The surrogates of economic activity used by previous studies were biased or inappropriate indicators of the general economic situation in Kansas.

4. The previous regionalizations did not provide methods that could be easily duplicated for periodical updating of the regions.

EXPECTED RESULTS

The final result of this study is a set of homogeneous economic regions which are significantly superior to the regions delineated by previous research. The expected results of the specific analyses were:

1. Factor analysis: as a result of factor analyzing sixty-two variable indices of economic character, ten (r) statistically independent factors can be recognized as adequate representatives of the original sixty-two variables. In addition, a table of factor scores would be calculated to indicate how each county scored on each factor.

2. Distance scaling of similarities: continued statistical analysis of the new factors would result in a matrix of distances between the sixty-two variables plotted in (r) dimensional space.

3. Contiguity grouping: by grouping counties with similar factor scores a set of internally homogeneous economic regions should emerge.

Chapter II

ANTECEDENT RESEARCH USING FACTOR ANALYSIS

Factor analytic methods have been employed by regional specialists for some time. M. G. Kendall in 1939 and M. J. Hagood (et al.) in 1941 were probably among the first to use factor analytic methods for purposes of regional taxonomy.¹ Since they were first unveiled as useful research tools for regional scientists, factor analytic methods have been called upon by many individuals to disentangle unknown variable interdependencies at all levels of regional delineation. A few of the more common examples of their past usage are outlined in the following paragraphs.

WORLD LEVEL

Brian J. L. Berry demonstrated the use of factor analytic methods at the world level with his 1960 publication of "An Inductive Approach to the Regionalization of Economic Development."²

The approach that Berry followed in his article was,

"to take forty-three variables thought to be significant in the analysis of economic development and, by manipulating them, attempt to identify and differentiate the so-called underdeveloped nations, to inquire whether there were any regional types of underdevelopment, and to suggest answers to some simple hypotheses concerning the characteristics of underdeveloped countries."³

¹M. G. Kendall, "The Geographical Distribution of Crop Productivity in England," Journal of Royal Statistical Society, 102, (1939), 21-62: See also M. J. Hagood et al., "An Examination of the Use of Factor Analysis in the Problem of Sub-Regional Delineation," Rural Sociology, 6, (1941), 216-33.

²Brian J. L. Berry, "An Inductive Approach to the Regionalization of Economic Development," Essays on Geography and Economic Development, ed. Norton Ginsburg (Chicago: The University of Chicago Press, 1960), pp. 78-107.

³Ibid., p. 78.

Berry used forty-three socio-economic variable indices for ninety-five countries. Using a rank-correlation method, he arranged the forty-three indices into a table of correlation coefficients upon which he performed a factor analysis. Subsequent to his use of factor analytic methods he was able to identify five principal patterns of variation which were capable of explaining a majority of the variation present in the original forty-three variables.

NATIONAL LEVEL

"Cross-Sectional Analysis of Canadian Urban Dimensions: 1951 and 1952" was published by Leslie J. King in 1966.⁴ King's work explained how factor analytic methods were used to successfully determine the character of 106 Canadian cities. Intending to group cities by regional type (e.g. plains cities, etc.), King derived fifty-two economic, demographic, social and locational variable indices which he considered to best indicate the character of 106 Canadian cities. Arranging the fifty-two indices in a (52 x 52) correlation matrix and performing a principal components analysis upon the matrix he was able to isolate twelve components of variation, and therefore reduce fifty-two indices to twelve factors without a significant loss in accuracy.

STATE LEVEL

J. H. Thompson, Sidney C. Sufrin, Peter R. Gould and Marion A. Buck published, "Toward a Geography of Economic Health: The Case of New York

⁴Leslie J. King, "Cross-Sectional Analysis of Canadian Urban Dimensions: 1951 and 1961," Canadian Geographer, X, No. 4 (December, 1966), 205-24.

State," in March of 1962.⁵ The paper considered the meaning of economic health by analyzing various facets or variables of economic character in the fifty-eight counties of New York State. The analysis performed was a factor analysis of nine indices of levels and trends in economic conditions during the period 1947 to 1958. Using a rank-correlation method, a (9 x 9) intercorrelation matrix was derived. By factor analysing the (9 x 9) matrix it was possible to summarize a large percentage of the total variation in three statistically independent factors.

LOCAL LEVEL

An example of the use of factor analysis on the local level was Brian J. L. Berry's and Robert J. Tennant's, "Commercial Structure."⁶ The purpose of the study was to provide a socio-economic framework within which the commercial structure of the northeastern Illinois Metropolitan Area could be analyzed.

Using 147 observational units (municipalities with populations exceeding 2,500 in 1960, but excluding the city of Chicago) and fifty variable indices, a principal axes factor analysis of the (50 x 50) correlation matrix was performed. The result was seven significant patterns

⁵ J. H. Thompson et. al., "Toward a Geography of Economic Health: The Case of New York State," Annals of the Association of American Geographers, LIII, No. 1 (March, 1962), 1-20.

⁶ Brian J. L. Berry and Frank E. Horton (eds.), Geographic Perspectives on Urban Systems (Englewood Cliffs: Prentice-Hall, Inc., 1970), pp. 321-23, citing Brian J. L. Berry and Robert J. Tennant, "Commercial Structure," (Chicago: Northeastern Illinois Planning Commission, 1965), Appendix A, "Socio-Economic Classification of Municipalities in the Northeastern Illinois Metropolitan Area," Table A2, pp. 124-27.

of variation. Therefore, from a series of fifty variable indices the use of factor analysis enabled seven orthogonal components of variation to be identified.

SUMMARY

The above examples have been used to demonstrate how principal components analysis can be employed to obtain a parsimonious description of variation from a complex of interdependent variable observations. However, principal components analysis is a valuable research tool which has many additional geographical applications not demonstrated by the above examples. A few of the more common applications are outlined below.

1. Assuming a set of interdependent variable indices, principal components analysis can be employed to determine the basic structure of the set.
2. Principal components analysis can be used as a tool for developing an empirical typology, either of variables or areal units.
3. Principal components analysis can be used to transform data to meet the assumptions of other analytical procedures. An example is multiple regression analysis which assumes that the independent variables are statistically independent. If the independent variables are not orthogonal, principal components analysis can be used to reduce them to a smaller set of statistically independent factors.⁷

⁷Harold McConnel, "On the Use of Principal Components Analysis" (University of Iowa), pp. 14-17. (Mimeographed.)

Chapter III

OPERATIONALIZING THE FACTORIAL MODEL

Most economists and geographers agree that the economic character of a landscape is determined by a complex of highly interrelated and interdependent variables operating within the spatial extent of the area. Approaching the Kansas landscape in this context, a complex of (m) variable indices and (n) county observational units were amassed and placed in an (n x m) data matrix. In order to partition the state into economic regions this data matrix had to be so reduced that the regional aggregates maintained a high level of internal homogeneity while exhibiting a large amount of external heterogeneity. The procedure outlined in Chapter I was used to accomplish these ends.

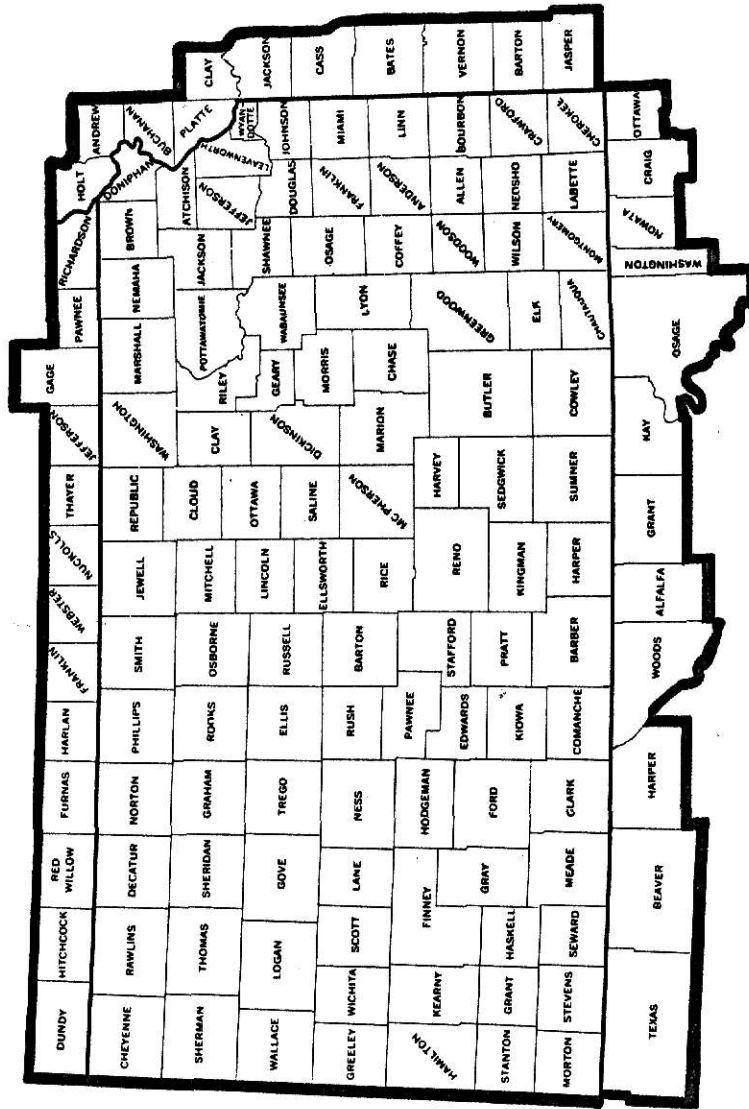
COUNTY OBSERVATIONAL UNITS

The observational units that were utilized in the aggregation procedure were the 105 counties of Kansas and the thirty-six adjoining counties of Oklahoma, Missouri, and Nebraska (see Fig. 2). The reason for the inclusion of the thirty-six adjoining counties arose from the belief that regions; economic, social, or physical usually do not begin or end with a political boundary. Therefore, a one county tier from each of the adjoining states excepting Colorado, was included in the analysis.¹ The addition of the

¹The General Social and Economic Characteristics of the U.S. Bureau of the Census for Colorado were not available at the time of this research. Consequently, it was impossible to obtain suitable data for the state of Colorado.

FIGURE 2

THE 141 COUNTIES USED IN THE ANALYSIS



thirty-six observations did not complicate the analysis to any significant degree but it did aid in explaining the nature of the border counties of Kansas.

VARIABLE INDICES OF ECONOMIC CHARACTER

Appendix A lists the sixty-two variable indices that were used in the analysis. Great care was taken to select surrogates which provided as much socio-economic diversity as possible, while retaining enough depth to indicate the direct and indirect aspects of the Kansas economy.

Because of the difference in the areal expanse of the 141 county observational units, it was necessary to put the variables in a form that would not be affected by size difference. To accomplish this, most of the raw data was manipulated into percentage, per capita, or coefficient form.

Nine general themes were recognized as influential in the selection of the variable indices. It was felt that the economy of Kansas could be best characterized by considering the economic implications of these nine general themes and their specific members.

The first theme was demographic in nature; demographic in the sense that it pertained to the populace of the State of Kansas. Specific indices indicated the age structure, settlement type, population size and density. These were characteristics which were considered to determine, and also to be determined by, the economy of the state.

The backgrounds of the people that make up an economy are considered important when attempting to characterize that economy. Therefore, in order to differentiate the background of Kansas' inhabitants, specific indices such as per cent negro population, percentage of population foreign or

mixed parentage were included under a second general theme, namely ethnic status.

A direct cause and effect of economic character is income; income in the form of wages and rents paid by business or government to households. General theme number three was concerned with income and, specifically, with such aspects of income as: per capita income of persons, county income potentials,² percentage of households with over \$10,000 income per year, and average taxable payrolls in manufacturing, transportation and construction.

Directly related to the amount of income received is the method by which income is generated. In order that this aspect of the economy might be considered, general theme number four included such specific indices as percentage of the working force employed in manufacturing, mining, trade, government, and other occupational categories.

In any economy the individuals employed by firms in manufacturing, mining, trade, government, and other occupations constitute the economy's labor force. Theme five considered the general and specific nature of the labor force of Kansas. Specific surrogates were non-worker/worker ratio, percent of the civilian labor force unemployed, and county employment potentials.³

Value added per capita by manufacturing, value of farm products per capita and retail sales per capita were three variable indices used to represent, value of production, the sixth theme. Theme six was con-

²A Gravity Potential Program was used to calculate the employment, population, and income potentials.

³Ibid.

sidered important because the amount of county product greatly influences the economy both directly, by increasing the amount of purchasable products available and indirectly, by producing jobs and income for the counties' citizens.

The vitality of an area can often times be surmized by observing the population dynamics of an area over time. It was this relationship that necessitated the inclusion of a set of indices under the title, Population Growth. Three indices were used; per cent change in rural population (1960-1970); per cent change in urban population (1960-1970) and per cent population growth (1960-1970).

The eighth general theme focused on the Economic Base of the county unit. The justification for inclusion of such a group of indices stemmed from the realization that concentrations of industrial and service activity vary spatially. To fully consider this fact a series of location quotients⁴ for various sectors of the economy were calculated and presented under the theme, Economic Base Index.

The ninth and final theme reflected the strong effect that education tends to have upon an economy. Realizing that a positive correlation between educational attainment and economic level appears to exist, it seemed essential to include a group of indicators to represent the educational achievements of the Kansas populace. Variable indices included were; per cent of the population that were high school graduates, persons twenty-five years of age and over; median school years completed, percent of persons twenty-five years old and over with four years of college or more.

⁴For a mathematical account of the location quotient see Appendix B.

FACTOR ANALYSIS OF THE VARIABLE MATRIX

When considering the set of sixty-two variables there was reason to suspect redundancies in the variable set, i.e., it was felt that some of the variables told the same things about the variation in the observations. Therefore, in the interest of efficiency it was considered desirable to eliminate the redundancies.

Transforming the sixty-two variable indices to common logarithms for normalization, and arranging them in a (62 x 62) correlation matrix (see Appendix C), a factor analytic method, referred to as principal components analysis, was performed upon the matrix.⁵ By means of this analytical process, orthogonal patterns of variation (principal components) of the variable matrix were objectively isolated. Therefore, instead of having to explain the variation of 141 observations with sixty-two variables, it was possible to explain most of the variation with a smaller number of (r), super variables or principal components; and thus, eliminate a large percentage of the inefficiency.

Despite the fact that (r) orthogonal patterns were known to exist, the nature of the patterns remained vague. That is to say, it was not known which of the sixty-two original variables were combined to produce each of the (r) principal components. Therefore, the (r) factors and the sixty-two variables were placed in a (62 x r) factor matrix and rotated to the normal varimax position. This process achieved simple structure

⁵The IBM 360 computer at Kansas State University performed the actual analysis. The computer program used was a "Political Science Multi-Set Factor Analysis (POLFAC)" written by Lon Mackelprang, Department of Political Science, University of Iowa, and revised by Fred Gampper, IV, Kansas State University.

by allocating variables mutually exclusively to factors and summarized the results in a table of factor loadings. The individual loadings helped identify which variables were included in what factor pattern, and to what degree.

By multiplying the product of the $(62 \times r)$ factor matrix and an inverted $(r \times r)$ matrix of eigenvalues by the (141×62) observational matrix, factor scores were arrived at for each factorial observation. The factor scores were important because they designated the rank of each observation with respect to each principal component.

DISTANCE SCALING OF SIMILARITIES

By graphically representing the new factors or principal components with a set of (r) orthogonal axes in (r) dimensional space, and plotting the previously determined factor scores in relation to these axes, it was possible, at least conceptually, to observe an array of points. Points lying close together in (r) dimensional space were, by nature of their factor scores, more alike than points lying further away. This suggested that similarity was measured as distance, and that distance between points in the orthogonal r -dimensional space was a meaningful index of the degree of observational similarity.

Actual measurement of the distance was simple. The space was orthogonal, so the distance between any two points (a) and (b) was the square root of the sum of squares of differences of the scores of the two points on each of the axes. The distance between each pair of

observations was measured in this manner, and the set of distances were arranged in a square (141 x 141) distance matrix.⁶

CONTIGUITY GROUPING

By employing a contiguity grouping and the distance matrix just mentioned, it was possible, in a succession of steps, to group the 141 observational units in such a manner that, at each step, maximum uniformity of the groups was maintained.⁷

The procedure grouped observations using the criterion of Euclidean proximity in a (r) dimensional vector space. The original 141 observations were initially considered to consist of (141) dimensional groups, each containing one element. The grouping procedure examined all of the 141 observations and joined the two groups separated by the minimum distance. Each step of the grouping procedure decreased by one the number of groups still to be consolidated. Each grouping replaced two joined groups by a new group located at the center of mass of the pair. Thus, the first step reduced the (141 x 141) distance matrix to a (141-1) x (141-1) by combining two observations that were most alike, and replacing them in the matrix by their centroid. Before a new step was initiated,

⁶Brian J. L. Berry, "Grouping and Regionalizing: An Approach to the Problem Using Multivariate Analysis," Quantitative Geography, Part I: Economic and Cultural Topics, eds. W. L. Garrison and D. F. Marble (Evanston: Northwestern University, 1967), p. 233.

⁷A GNGRP program written by Neely and Mazukelli at the University of Chicago and modified by Dierk Rhynsbarger, University of Michigan, was used to group the squared distances. The IBM 360 computer at Kansas State University performed the actual grouping.

the distances from each of the remaining groups to the new group was calculated. They replaced the distances to both of the component groups, with a consequent reduction by one of the distances to be examined at the next step. Repetition of the process resulted in a $(141-2) \times (141-2)$ matrix and continued until there was a (2×2) matrix and finally a single cell. The result of this procedure was a series of 141 groupings and the combinations undertaken to produce them.

Any grouping procedure involves generalization which in turn implies gains in generality and manageability, but losses in detail. Loss of detail in the grouping was observed by comparing the between-region distance squared at each stage of the grouping procedure. The between-region variation measured detail or differentiation between regions. When the regions were grouped, a certain percentage of the differentiation was sacrificed by treating the regions as undifferentiated members of a group. The amount of detail lost was given by the within-region variation. The smaller the variation, the more homogeneous the region.

Chapter IV

RESULTS OF THE FACTORIAL MODEL

Chapter III outlined the aggregation procedure that was used to delineate homogeneous economic regions for the State of Kansas. The results of the analysis are presented below.

PRINCIPAL COMPONENTS ANALYSIS

The ultimate result of the analysis was rewarding. After performing the principal components analysis on the (62 x 62) variable correlation matrix, ten orthogonal factors (principal components) were recognized. Arranging the ten new factors and the sixty-two original variables in a (62 x 10) factor loading matrix (see Table 1) and rotating the factors to the normal varimax position¹ a table of rotated factor loadings was obtained (see Table 2). The loadings in tables one and two are interpretable as correlation coefficients, therefore any particular loading a_{ij} is interpreted as the correlation of variable (i) with factor (j).

Included in Table 1 is a column labelled h^2 . The h^2 (communality) indicates the proportion of a particular variable's total variation that is explained by the ten factors in total.² For example: Variable one of

¹The factors were rotated to the normal varimax position in order to obtain simple structure. See Harry H. Harmon, Modern Factor Analysis (Chicago: The University of Chicago Press, 1960), p. 301.

²In a principal components analysis a variable is assumed to have total variation equal to one.

TABLE I
FACTOR LOADING MATRIX

	1	2	3	4	5	6	7	8	9	10	H2
VAR. 1 0.699		0.216	0.461	0.223	0.334	-0.063	-0.039	0.025	-0.011	0.072	0.921
VAR. 2 -0.194		-0.312	-0.169	0.156	0.075	-0.117	0.037	0.195	-0.032	0.289	0.331
VAR. 3 -0.629		0.478	-0.031	-0.135	0.303	0.100	0.386	-0.053	-0.092	0.001	0.906
VAR. 4 0.709		-0.301	-0.203	-0.351	0.004	-0.353	0.067	-0.056	-0.048	0.021	0.893
VAR. 5 0.682		0.173	0.474	0.179	0.338	-0.010	0.017	0.033	-0.001	0.015	0.868
VAR. 6 -0.659		0.518	-0.009	-0.053	0.272	0.113	0.364	-0.023	-0.069	0.028	0.932
VAR. 7 -0.852		0.093	0.341	-0.033	-0.077	0.012	-0.006	-0.083	0.044	-0.120	0.882
VAR. 8 -0.685		-0.049	0.205	0.092	-0.134	-0.093	0.283	-0.212	0.005	-0.077	0.680
VAR. 9 0.818		-0.000	-0.278	-0.049	0.120	0.063	-0.202	0.181	-0.021	0.102	0.852
VAR. 10 0.156		-0.495	0.242	0.506	-0.353	0.124	-0.358	-0.030	0.167	0.007	0.881
VAR. 11 0.559		-0.230	-0.141	-0.520	-0.021	-0.338	-0.115	0.061	-0.047	-0.116	0.802

TABLE I (cont)

VAR. 27 0.442	-0.704	0.110	0.244	-0.007	0.095	0.063	0.015	0.172	0.075	0.811
VAR. 28 -0.527	0.415	-0.017	-0.111	-0.063	-0.340	-0.278	-0.147	0.067	0.011	0.685
VAR. 29 -0.576	0.671	-0.071	-0.128	0.217	0.132	0.121	0.087	-0.094	-0.007	0.899
VAR. 30 0.840	-0.248	-0.115	-0.191	0.154	0.161	0.081	0.067	0.002	0.097	0.887
VAR. 31 0.057	-0.157	0.096	-0.609	-0.052	-0.461	0.095	0.157	-0.065	0.038	0.663
VAR. 32 0.643	0.459	-0.341	0.157	-0.073	0.255	-0.186	-0.117	-0.077	-0.113	0.902
VAR. 33 0.728	-0.285	-0.090	-0.261	0.171	0.090	0.237	-0.072	-0.011	-0.002	0.787
VAR. 34 -0.069	0.367	0.054	-0.027	-0.487	0.019	0.154	0.690	-0.040	0.184	0.916
VAR. 35 -0.004	-0.209	-0.439	0.447	0.065	-0.297	0.395	-0.046	0.434	0.138	0.893
VAR. 36 -0.850	-0.187	0.390	0.010	0.007	-0.081	0.007	-0.153	-0.046	-0.055	0.944
VAR. 37 -0.027	-0.342	0.070	0.438	-0.218	-0.475	0.210	0.168	-0.310	-0.251	0.819
VAR. 38 -0.547	-0.214	0.505	-0.301	-0.042	0.014	-0.156	-0.071	0.141	0.328	0.850
VAR. 39 -0.526	0.190	-0.024	0.198	-0.222	-0.008	-0.184	-0.170	0.114	-0.068	0.598
VAR. 40 0.547	0.172	-0.471	-0.072	0.124	-0.089	-0.180	0.017	-0.101	0.017	0.623
VAR. 41 -0.325	-0.340	-0.141	0.093	0.568	-0.033	-0.210	0.097	-0.280	-0.015	0.706

TABLE 1 (cont)

VAR. 42 -0.315	-0.410	0.232	-0.092	0.019	0.002	-0.030	-0.005	-0.329	0.099	0.506
VAR. 43 0.638	0.676	0.164	-0.029	-0.187	0.040	0.117	-0.099	-0.013	-0.017	0.953
VAR. 44 0.686	0.476	0.427	0.036	-0.210	0.021	0.067	-0.088	0.060	0.000	0.941
VAR. 45 0.561	0.701	0.084	-0.043	-0.133	-0.032	0.135	-0.068	-0.042	-0.030	0.859
VAR. 46 0.701	0.492	0.397	0.044	-0.189	0.027	0.088	-0.091	0.053	-0.012	0.948
VAR. 47 0.523	0.280	0.430	0.315	0.440	-0.127	-0.078	0.091	-0.047	0.019	0.862
VAR. 48 -0.694	-0.374	0.372	0.067	0.028	-0.029	-0.026	-0.181	-0.140	-0.048	0.821
VAR. 49 0.103	-0.387	0.042	0.088	0.306	0.240	-0.411	0.183	-0.050	0.310	0.621
VAR. 50 -0.029	-0.236	-0.101	0.358	-0.284	0.194	-0.338	-0.038	-0.146	-0.158	0.475
VAR. 51 0.375	-0.135	0.153	-0.270	-0.393	0.097	0.173	-0.220	0.055	-0.050	0.503
VAR. 52 0.658	-0.283	0.124	-0.117	-0.460	0.092	-0.149	-0.071	-0.072	-0.033	0.796
VAR. 53 0.591	0.432	-0.412	0.122	-0.037	0.255	-0.194	-0.110	-0.053	-0.129	0.857
VAR. 54 -0.514	-0.185	0.519	-0.279	-0.090	-0.012	-0.139	-0.105	0.104	0.381	0.839
VAR. 55 0.736	-0.263	-0.069	-0.260	0.171	0.105	0.233	-0.086	-0.007	0.001	0.786
VAR. 56 -0.071	0.362	0.093	-0.038	-0.480	0.063	0.138	0.714	-0.028	0.143	0.931

TABLE II
ROTATED FACTOR LOADING MATRIX

	1	2	3	4	5	6	7	8	9	10	H2
VAR. 1											
0.897	-0.199	-0.187	-0.039	-0.159	-0.014	-0.094	-0.051	-0.044	0.027	0.921	
VAR. 2											
-0.112	-0.048	0.118	0.049	0.432	-0.025	-0.066	0.144	0.222	0.196	0.331	
VAR. 3											
-0.132	0.295	0.229	-0.056	0.014	0.184	0.844	-0.012	0.012	0.016	0.906	
VAR. 4											
0.080	-0.452	-0.367	0.062	-0.090	-0.674	-0.219	-0.138	0.053	0.104	0.893	
VAR. 5											
0.853	-0.271	-0.160	-0.031	-0.173	-0.001	-0.058	-0.056	-0.051	-0.036	0.868	
VAR. 6											
-0.105	0.353	0.243	-0.057	0.013	0.254	0.816	0.040	0.035	0.030	0.932	
VAR. 7											
-0.241	0.443	0.691	0.022	0.017	0.215	0.232	-0.000	-0.101	-0.200	0.882	
VAR. 8											
-0.278	0.228	0.632	0.205	-0.070	0.173	0.223	-0.083	0.131	0.012	0.680	
VAR. 9											
0.291	-0.332	-0.717	-0.154	0.040	-0.203	-0.253	0.060	-0.056	0.071	0.852	
VAR. 10											
0.068	-0.116	0.169	0.083	0.041	0.331	-0.842	0.007	0.077	-0.031	0.881	
VAR. 11											
0.010	-0.296	-0.323	0.021	-0.056	-0.727	-0.201	-0.068	-0.142	-0.112	0.802	

TABLE II (cont)

VAR. 27 0.134	-0.632	0.050	0.047	0.136	0.043	-0.538	-0.071	0.270	-0.016	0.811
VAR. 28 -0.133	0.757	0.186	-0.080	-0.030	-0.149	0.150	-0.068	-0.058	0.001	0.685
VAR. 29 -0.087	0.479	0.045	-0.130	0.012	0.209	0.737	0.131	-0.137	-0.036	0.899
VAR. 30 0.246	-0.690	-0.480	-0.168	-0.044	-0.239	-0.175	-0.030	-0.008	0.041	0.887
VAR. 31 -0.067	-0.109	0.172	0.036	-0.017	-0.758	0.083	0.137	-0.105	-0.068	0.663
VAR. 32 0.175	0.012	-0.016	-0.074	-0.329	0.198	-0.097	-0.083	-0.147	0.125	0.902
VAR. 33 0.160	-0.711	-0.346	-0.078	-0.117	-0.293	-0.048	-0.162	0.034	0.019	0.787
VAR. 34 -0.043	0.158	-0.045	0.069	-0.173	0.012	0.088	0.916	-0.059	0.045	0.916
VAR. 35 -0.106	-0.031	-0.112	0.153	0.119	0.025	-0.035	-0.063	0.894	0.160	0.893
VAR. 36 -0.219	0.297	0.832	0.105	0.183	0.143	0.133	-0.125	-0.073	-0.110	0.944
VAR. 37 0.041	-0.038	0.175	0.823	0.104	-0.065	-0.226	0.090	0.154	0.097	0.819
VAR. 38 -0.092	0.122	0.750	-0.386	0.125	-0.095	-0.054	0.061	-0.145	-0.044	0.850
VAR. 39 -0.205	0.648	0.155	-0.020	-0.143	0.296	0.051	-0.019	0.014	-0.003	0.598
VAR. 40 0.095	-0.040	-0.721	-0.048	0.032	-0.238	-0.051	-0.091	-0.039	0.143	0.623
VAR. 41 -0.003	0.003	0.083	0.112	0.768	0.042	0.129	-0.256	-0.105	-0.041	0.706

TABLE 11 (cont)

VAR. 42	-0.159	0.540	0.114	0.276	-0.030	-0.056	-0.027	-0.289	0.084	0.506
-0.069										
VAR. 43	0.024	-0.423	-0.078	-0.711	-0.023	0.094	0.120	-0.138	0.133	0.953
0.449										
VAR. 44	-0.085	-0.212	-0.076	-0.699	-0.019	-0.114	0.124	-0.125	0.061	0.941
0.588										
VAR. 45	0.089	-0.442	-0.033	-0.637	-0.069	0.178	0.117	-0.111	0.137	0.859
0.403										
VAR. 46	-0.093	-0.248	-0.064	-0.699	-0.011	-0.087	0.112	-0.114	0.065	0.948
0.590										
VAR. 47	-0.044	-0.163	0.045	-0.017	0.042	0.000	-0.053	-0.028	-0.015	0.862
0.909										
VAR. 48	0.111	0.775	0.156	0.258	0.160	-0.005	-0.197	-0.117	-0.053	0.821
-0.191										
VAR. 49	-0.218	-0.014	-0.296	0.570	0.108	-0.311	0.005	-0.146	0.033	0.621
0.174										
VAR. 50	0.050	-0.082	0.202	0.104	0.355	-0.472	-0.053	-0.160	0.017	0.475
-0.193										
VAR. 51	-0.176	0.027	-0.054	-0.516	-0.168	-0.211	-0.020	-0.088	0.023	0.503
-0.102										
VAR. 52	-0.430	-0.190	0.017	-0.360	-0.168	-0.595	0.051	-0.239	0.061	0.796
0.030										
VAR. 53	0.024	-0.831	-0.092	-0.270	0.180	-0.068	-0.106	-0.124	0.092	0.857
0.108										
VAR. 54	0.129	0.792	-0.374	0.075	-0.104	-0.071	0.071	-0.151	0.043	0.839
-0.070										
VAR. 55	-0.706	-0.343	-0.094	-0.139	-0.280	-0.045	-0.167	0.023	0.020	0.786
0.178										
VAR. 56	0.142	-0.033	0.060	-0.176	0.040	0.084	0.925	-0.091	-0.017	0.931
-0.033										

TABLE 11 (cont)

[illegible]

Table 1 has an h^2 of .921. This indicates that 92.1 per cent of the total areal variation of variable one as measured for the 141 counties can be predicted from a knowledge of county values on the ten factors.

The total variation in the (62 x 62) correlation matrix is given by (m equals sixty-two) the number of variables. The contribution of each factor in explaining this variation is given by its corresponding eigenvalue or latent root. Table 1 lists the eigenvalues for the ten factors that were obtained by the analysis. The analysis was limited so that only factors with eigenvalues greater than or equal to one were accepted.

Row two at the bottom of Table 1 lists the percentage of total variance explained by each factor. Thirty-one per cent of the total variation in the variable matrix is accounted for by factor one. If two factors are employed, another fifteen per cent of the variation is explained. Employing ten factors explains 78.9 per cent of the total variation in the variable correlation matrix. That is, 78.9 per cent of the data for the 141 county units on the sixty-two variable indices can be reproduced by knowing the county-unit factor scores on the ten factors.

Row three at the bottom of Table 1 lists accumulated percentages of common variance found in each of the ten factors. Observance of factor one reveals that it accounts for thirty-nine per cent of the total variation explained by the ten factors or 30.42 per cent of the total variation of the (62 x 62) correlation matrix. Factor two accounts for another 18.5 per cent of the total variation explained by the ten factors, etc. Noting factor six it is observed that eighty-five per cent of the total variation explained by the ten factors is accounted for by only six factors. That is, 66.3 per cent of the total variation in the variable correlation matrix is explained by just six factors. By employing ten factors one hundred

per cent of the total variance explained by the ten factors is accounted for and seventy-eight per cent of the total variance of the matrix is explained.

Table 2 represents the result of rotating the factors of Table 1 to a varimax position. The table is read in the same manner as Table 1, the only major difference being that the factor patterns are not ordered according to the amount of data variation they account for. All subsequent analysis which required the results of the factor loading matrix utilized the rotated factor matrix.

IDENTIFYING THE PRINCIPAL PATTERNS OF VARIATION

By taking into account the rotated factor loadings (Table 2) and the factor scores (Table 3) of the 141 counties it was possible to identify the nature of each principal component and identify the observational units that loaded on each factor (see Appendix D).

The first pattern or factor was clearly an indicator of population size, and by extension, an index of urban development. County units having highly positive factor scores tended to have large populations (Variable 1; loading .897), were densely populated (Variable 5; loading .853), employed large numbers (in absolute terms) of manufacturing workers (Variable 47; loading .909) who made relatively high wages (Variable 22; loading .863), many of whom were likely to be non-white or negro (Variable 14; loading .671 and Variable 13; loading .563). In addition, the counties in general were characterized by having high local and regional income, employment and population potentials (Variable 24; loading .427, Variable 25; loading .600, Variable 43; loading .449, Variable 44; .588, Variable 45; loading .409, and Variable 46; loading .590). Conversely, counties scoring negatively on

TABLE III
FACTOR SCORES

1	-0.063	0.711	-1.255	0.340	-0.102	0.574	0.489	-0.728	-0.413	0.070
2	-0.046	1.081	-0.006	-0.130	-0.628	0.391	-0.021	0.886	-0.388	0.275
3	0.320	0.442	-1.352	0.281	-0.746	-0.301	-0.177	-0.905	-0.534	-0.433
4	0.038	-0.072	0.215	-0.479	0.956	0.700	0.565	1.234	0.790	0.979
5	0.022	-0.611	-0.964	-0.450	1.048	1.205	-1.056	0.443	2.307	-0.964
6	-0.043	-0.385	-1.137	0.208	0.157	-0.007	1.374	0.134	-0.734	0.682
7	-0.119	0.667	-0.082	0.626	-0.769	0.412	0.568	-0.367	-0.280	-0.559
8	-0.324	-0.128	-1.448	0.018	-0.128	0.801	-0.717	-0.059	0.493	0.369
9	0.021	0.156	0.727	0.627	-0.176	-0.443	1.342	2.450	-0.367	0.434
10	0.124	1.037	0.172	0.344	-0.194	-0.502	1.759	-1.303	1.477	1.473
11	-0.589	2.223	-2.334	0.327	-0.595	0.228	-0.546	-0.812	0.072	0.300
12	0.040	0.608	1.009	-0.651	0.437	-0.417	-0.181	-0.740	0.013	-1.214
13	-0.250	-1.517	1.325	-0.386	0.143	-0.036	1.331	-0.080	0.630	0.914
14	0.032	-0.177	-0.095	-0.298	0.557	0.206	1.008	0.962	-0.639	-0.570
15	-0.018	-0.650	-0.360	-0.143	0.788	0.125	0.862	0.740	-0.525	-0.647
16	0.146	0.454	0.153	-0.157	-0.437	-0.012	1.043	0.923	-0.466	0.009
17	-0.070	-0.458	1.044	0.686	0.271	-0.139	1.152	-2.087	-0.675	1.393
18	0.070	-0.169	-1.406	-0.416	0.702	-0.063	0.348	-0.331	-0.058	0.529
19	-0.339	0.226	-1.512	-0.034	-0.227	-1.512	0.752	-0.407	-0.213	-2.001
20	-0.065	-0.033	0.871	0.151	0.361	0.176	0.579	-1.049	0.776	-0.232
21	-0.016	-0.284	-0.336	-0.008	0.516	0.415	0.201	0.645	-0.556	-0.492
22	0.015	1.368	0.650	-1.234	-1.952	0.015	-0.871	-0.259	-0.263	0.752
23	-0.337	-2.055	-0.868	0.341	-1.537	-3.537	0.297	-0.331	-1.234	-0.722
24	-0.887	-1.643	-0.895	2.373	0.250	1.576	1.727	-2.515	-2.422	-0.183
25	3.081	0.446	0.455	-0.324	-0.038	-0.068	2.213	0.690	-0.024	1.071
26	-0.744	-0.942	-0.838	-0.148	0.788	-1.411	-0.955	-0.997	0.495	-1.152
27	-0.255	0.171	-0.162	0.217	-0.047	0.423	1.105	-0.005	1.224	-2.072
28	-0.131	-0.375	-0.473	-0.837	1.631	0.064	-2.283	1.031	-0.475	0.228
29	-0.078	-0.823	-0.678	-0.054	1.659	0.339	-1.166	0.892	-0.960	0.119
30	-0.156	0.124	-0.879	-0.079	-0.725	0.259	-0.112	0.836	-0.734	0.443
31	0.326	0.134	-0.457	-0.264	-0.497	-5.515	-0.931	0.592	0.804	-1.384
32	0.030	0.787	1.331	1.731	0.458	-0.008	-1.507	1.437	-0.005	-1.169
33	-0.040	-0.143	0.629	-0.133	0.475	0.161	-0.447	0.098	1.815	-0.067
34	-0.355	-0.367	-0.488	0.128	0.960	0.667	-2.260	0.912	1.162	-0.075
35	-0.621	-1.054	0.670	-0.536	0.584	0.691	-0.269	-0.403	-0.384	0.358
36	0.106	-0.442	2.260	-2.115	0.647	0.090	-1.212	-1.609	-0.043	1.379

TABLE III (cont)

37	-0.010	0.152	-0.462	0.046	0.410	-0.100	1.494	1.430	1.113	0.864
38	-0.183	-0.690	1.572	-1.088	0.734	-0.430	-0.213	-0.745	0.056	0.958
39	0.033	-0.922	0.477	-0.674	0.233	0.113	1.282	0.689	0.468	0.807
40	-0.300	-0.081	-1.425	0.334	-0.323	0.967	-0.320	-0.817	-0.725	-1.534
41	-0.357	0.294	1.251	2.957	0.010	0.449	-2.500	-1.243	-0.839	-0.307
42	-0.199	0.583	1.327	0.497	-0.148	-0.192	-0.308	-2.698	-0.255	-0.257
43	-0.195	0.461	-0.358	0.458	-1.014	0.982	-0.342	1.256	-0.826	-0.171
44	-0.651	-0.100	-0.320	0.375	-2.467	1.171	-0.506	1.894	-0.075	-0.521
45	-0.137	0.062	1.249	-0.022	-0.194	0.456	0.883	0.152	0.060	-0.007
46	1.082	-6.753	0.419	-1.454	-3.105	1.241	-0.782	-0.007	0.030	0.858
47	-0.073	0.317	0.344	3.345	0.476	-0.349	-1.267	-0.205	0.780	-0.170
48	-0.210	0.447	0.013	-0.569	0.453	0.246	-0.449	1.076	0.024	-0.124
49	-0.033	-1.037	0.323	2.682	0.767	0.025	1.144	-0.344	-0.300	1.043
50	-0.313	0.928	-2.173	0.208	0.329	0.164	-0.057	-0.638	-0.728	0.247
51	0.077	0.114	1.760	1.132	0.165	-0.222	-0.634	-1.563	-0.108	-0.041
52	0.599	-0.033	-0.465	-0.286	-2.592	-1.907	-0.601	0.102	0.412	-0.563
53	-0.103	0.405	0.558	-1.039	-0.028	0.247	1.241	-0.415	0.440	-1.123
54	-0.110	0.657	-0.300	1.530	-0.989	0.219	0.984	2.623	-0.515	0.500
55	-0.109	-0.289	0.641	-1.651	1.270	-0.269	-0.822	1.852	-0.092	0.267
56	-0.434	-1.171	-1.279	0.262	0.503	-1.770	0.162	-0.034	-1.537	-0.172
57	0.106	0.272	-0.311	-0.032	-0.348	0.134	0.579	-0.890	0.832	-3.225
58	0.170	0.204	0.274	-0.236	0.246	0.376	0.691	1.609	0.044	-0.895
59	-0.245	-1.057	-1.003	0.441	0.104	0.639	0.256	0.099	-0.101	-1.239
60	-0.264	-0.277	0.442	0.334	0.282	-0.097	-0.071	-0.071	0.486	0.254
61	0.012	0.391	-0.875	1.074	-1.032	0.305	-0.024	1.865	-0.360	0.146
62	-0.028	-0.483	-0.033	-1.001	1.010	0.145	0.678	0.319	-0.182	0.044
63	0.335	0.826	-2.012	0.228	0.709	0.148	0.174	-0.935	-0.202	0.574
64	0.140	0.094	0.237	1.643	0.313	0.715	0.818	0.411	-1.030	-0.271
65	-0.471	-0.916	0.806	0.617	-0.069	0.672	-1.457	-0.933	3.900	0.420
66	0.216	1.525	0.442	-0.021	-0.478	0.541	-0.561	0.272	-0.485	-0.721
67	-0.378	0.414	-1.634	-0.306	0.137	0.656	0.151	0.141	-0.346	0.063
68	-0.198	0.754	0.740	-0.486	0.220	-0.108	-0.083	-0.905	0.614	-2.379
69	0.036	-0.634	0.206	1.342	-1.383	-0.432	0.784	2.572	-0.353	-0.003
70	-0.425	0.169	-0.079	-0.720	-1.114	0.330	0.041	2.466	-0.097	-0.117
71	-0.040	-0.058	0.787	-0.447	0.568	0.605	1.188	0.332	-0.347	0.474
72	-0.463	-0.077	-0.068	0.622	-0.116	0.536	1.038	1.130	-0.428	-0.773
73	0.011	-0.893	0.168	-0.686	0.917	-1.000	0.891	-0.195	0.042	0.196
74	0.014	0.455	-0.162	0.977	0.813	0.288	0.138	0.320	-0.124	-0.512
75	-0.115	-0.301	0.459	-0.214	-0.423	-0.274	0.281	2.776	0.313	-0.351
76	0.075	-1.142	-0.292	-0.706	1.153	0.166	0.648	-0.392	0.423	0.494
77	-0.035	0.237	1.158	-0.468	0.662	-0.229	-0.087	0.413	-0.283	-0.580
78	0.120	-0.632	-1.295	-0.256	0.940	0.717	-0.470	0.155	-0.485	0.223
79	0.031	-0.041	0.634	-0.186	0.067	0.090	1.064	0.022	-0.130	-0.856
80	-0.157	-0.369	-0.529	1.344	-0.087	0.381	0.618	-0.421	2.259	-0.920
81	-0.689	-2.207	-0.128	-0.168	-0.540	-6.144	0.193	-0.123	-0.455	-0.783

TABLE III (cont)

82	-0.173	0.043	-0.055	-0.549	0.552	0.481	0.003	0.887	3.083	-0.581
83	-0.054	0.345	0.356	0.868	0.282	-0.389	0.849	-0.171	-0.094	-1.963
84	-0.013	-0.351	-0.591	0.085	0.516	-0.146	0.516	-0.061	3.919	-2.289
85	0.317	-0.574	-1.063	-0.704	1.297	-0.387	-0.972	1.149	-0.339	-0.378
86	-0.210	-0.252	0.271	0.781	0.946	0.323	-1.593	-0.857	-0.657	0.383
87	2.371	-0.816	-1.667	-0.280	0.626	0.144	-0.783	-0.929	-0.469	0.651
88	0.171	-0.453	-0.896	0.095	1.749	0.091	-1.842	-0.046	1.612	1.015
89	1.290	-1.513	-0.961	-0.307	0.111	-0.480	-0.422	0.041	-0.051	-0.322
90	-0.179	1.173	1.159	-0.576	0.319	-0.082	-1.286	-0.746	-0.301	-1.010
91	-0.216	-0.113	0.154	-0.915	1.577	0.143	-1.808	0.981	-0.535	0.754
92	0.072	-0.178	0.941	-0.921	0.476	0.533	1.807	-0.905	-0.266	0.556
93	-0.176	-1.408	0.677	0.071	-0.048	0.542	1.896	-0.468	0.691	0.046
94	-0.085	0.134	2.438	-1.279	0.654	-0.488	-2.521	-1.086	-1.154	1.403
95	-0.065	-1.211	0.690	2.844	0.796	-0.079	-0.096	-0.096	2.236	1.173
96	-0.197	0.253	-0.866	-0.102	-0.080	0.723	-0.205	-0.896	-0.172	0.326
97	-0.225	-1.164	0.401	-0.076	1.317	-0.160	-0.343	-0.265	-0.252	0.401
98	-0.173	0.635	0.893	0.031	0.452	0.819	-1.313	-0.051	-0.647	-2.063
99	-0.315	0.461	0.614	-0.879	-1.257	0.795	0.063	1.392	0.418	-0.808
100	0.374	0.820	1.260	-1.850	1.714	0.142	-1.955	-1.050	-0.827	0.103
101	0.343	1.513	1.146	0.634	0.021	-0.229	0.220	0.658	0.117	-0.237
102	-0.196	0.707	1.188	3.347	0.400	-0.411	-2.608	0.371	-0.809	-0.806
103	-0.255	0.760	-1.824	-0.139	0.333	0.894	1.010	-0.106	-0.687	0.482
104	-0.046	1.487	0.032	-0.717	-0.544	-0.016	1.035	-0.059	1.160	0.279
105	2.927	1.392	-0.974	-0.588	-3.263	-0.905	-1.477	-0.436	0.646	0.034
106	-0.475	-0.358	0.268	-0.174	1.294	-0.796	-1.616	1.112	1.017	1.825
107	-0.251	-0.084	0.730	2.129	0.508	-0.659	-0.267	-0.112	1.348	1.359
108	-0.335	0.286	0.295	1.617	0.487	-1.011	0.120	1.528	1.544	1.314
109	-0.348	-0.568	0.369	0.317	0.810	-2.560	0.984	-0.421	-0.595	1.342
110	-0.169	-0.232	0.892	0.230	-0.030	-0.068	1.300	-0.681	-0.120	1.205
111	-0.138	0.396	1.310	-0.942	-0.302	-0.416	0.596	0.367	0.455	1.295
112	-0.163	-0.898	-1.879	-0.505	0.561	0.497	0.428	-1.130	-0.228	0.844
113	-0.160	1.079	-1.321	0.153	-0.420	-0.548	-0.244	0.116	2.275	1.916
114	-0.563	-2.412	-2.051	-0.658	-0.624	0.684	0.707	-1.630	1.069	0.621
115	-0.064	2.996	-1.108	-0.565	-0.885	-0.902	-0.119	-0.945	2.061	1.957
116	0.149	1.985	-0.372	0.136	0.033	-1.872	0.167	-0.070	-0.165	2.061
117	-0.518	1.613	-2.254	0.020	0.048	-0.130	-0.643	-1.723	-0.820	1.640
118	0.175	0.573	-1.744	0.212	0.721	0.501	-0.372	-0.756	-0.871	0.834
119	-0.334	1.394	-0.876	-0.474	-0.326	0.196	0.865	-0.777	-0.263	0.932
120	-0.103	1.365	-0.408	-0.838	-0.244	-1.209	0.613	0.491	-0.344	1.532
121	0.276	2.079	0.233	-0.038	-0.932	-0.210	-0.239	0.589	-0.628	2.237
122	-0.574	-0.152	-0.270	-0.206	-2.847	0.657	-1.867	1.412	-0.656	0.668
123	10.533	-0.329	0.424	0.872	0.129	0.174	0.593	-0.002	0.127	-0.347
124	0.635	-1.905	-0.690	-1.213	-1.732	1.460	-1.705	-0.147	-0.530	0.456
125	-1.458	-2.721	0.525	0.414	-5.104	0.796	-1.174	-0.438	-0.038	0.395
126	0.863	0.290	-1.780	-0.130	-0.305	0.709	-0.426	-0.139	-0.774	-0.444

TABLE III (cont)

127	-0.391	0.589	0.500	-0.194	-1.813	0.346	-0.424	0.955	-0.679	0.675
128	0.219	0.482	1.095	-0.009	-0.709	0.460	0.894	-0.790	-0.274	1.516
129	-0.060	0.314	-0.337	-1.002	0.020	0.564	0.440	-0.135	-0.432	-0.332
130	-0.108	0.748	0.730	-0.933	-0.642	-0.224	1.111	-0.763	0.112	-0.980
131	-0.394	0.017	-0.925	-0.004	0.157	0.252	0.050	-0.557	-0.339	-1.534
132	-0.015	0.728	-0.239	-0.198	0.568	0.014	0.165	0.325	-0.419	-1.283
133	-0.047	0.352	0.638	-0.517	0.142	0.452	0.446	-0.150	-0.311	-1.253
134	0.019	0.715	0.237	-1.550	0.681	0.669	-0.449	-0.654	-0.326	-0.771
135	-0.434	1.131	0.452	-0.856	-0.085	0.176	0.120	-0.348	-0.158	-1.205
136	0.111	0.653	0.968	-1.706	0.601	-0.423	0.871	-0.049	0.126	-0.312
137	-0.317	0.242	0.680	-0.521	0.087	-0.082	0.359	-0.198	-0.181	-1.317
138	-0.307	0.493	0.258	-0.551	0.402	0.549	0.678	0.165	-0.086	-0.418
139	-0.146	-0.491	-0.479	-1.647	1.635	0.249	-0.671	1.371	-0.010	-0.384
140	-0.412	1.351	0.692	-0.451	-0.210	-0.323	-0.373	-1.490	0.161	-1.554
141	-0.263	-0.573	1.251	-1.508	0.274	-0.310	0.895	-0.636	1.038	-0.007

factor one were typified by being, to varying degrees, non-urban and possessing attributes not associated with urban threshold characteristics.

Factor two was determined to be a general index of rural (or non-urban) socio-economic character. The populations of counties which scored highly positive on factor two were relatively poor (Variable 28; loading .757 and Variable 26; loading .448), older (Variable 12; loading .428, Variable 39; loading .648 and Variable 29; loading .499) and rural farm in nature (Variable 7; loading .443).

Counties scoring highly negative on factor two had relatively young (Variable 4; loading -.452), well educated (Variable 60; loading -.743, Variable 61; loading -.823 and Variable 62; loading -.764), and growing populations (Variable 52; loading -.430), with high incomes (Variable 19; loading -.726, Variable 20; loading -.748 and Variable 27; loading -.632) earned mainly in white collar and service occupations (Variable 30; loading -.690, Variable 33; loading -.711 and Variable 55; loading -.706).

A Rural Occupational Index was the essence of factor three. County units scoring highly positive on factor three tended to be rural (Variable 7; loading .691), or rural non-farm (Variable 8; loading .632) in nature with much of the active labor force employed in agricultural and retail trade activities (Variable 36; loading .832, Variable 48; loading .775, Variable 57; loading .771, Variable 54; loading .792 and Variable 38, loading .790). Many members of the labor force were senior citizens (Variable 42; loading .540).

County units scoring highly negative on factor three were basically urban counties (Variable 9; loading -.717), with large population or income potentials (Variable 43; loading -.423, Variable 45; loading -.422 and Variable 24; loading -.444). Unemployment among the members of the

civilian labor force was high (Variable 40; loading $-.721$). Most members of the labor force were employed in white collar and manufacturing related jobs (Variable 30; loading $-.480$, Variable 32; loading $-.816$ and Variable 53; loading $-.831$).

Factor four indicated the influence of transportation services upon the economy of Kansas. More specifically, factor four accounted for the many transportation employees that are needed to man the many miles of pipeline and railroad property that cross the Kansas plains. Counties having highly positive factor scores on factor four had relatively large numbers of railroad or pipeline installations (Variable 59; loading $.812$), which employed large percentages of the civilian labor force (Variable 37; loading $.823$).

Rural isolation or remoteness was suggested by factor five. It could be properly labeled as an index of relative inaccessibility. Observational units which rated highly positive on this factor were counties that employed a large percentage of their residents in the counties themselves (Variable 41; loading $.768$), many of them in businesses which had the immediate county as the range of their goods (Variable 49; loading $.570$). In general, counties characterized by positive factor five scores were isolated units which were distant (in terms of miles) from any large urban agglomeration.

Counties scoring highly negative on factor five were characterized by having close contacts with the larger urban masses. They were very affected by the outside influence of the economic masses (Variable 25; loading $-.693$, Variable 24; loading $-.703$), employment masses (Variable 44; loading $-.699$ and Variable 43; loading $-.711$), and population masses (Variable 46; loading $-.699$ and Variable 45; loading $-.637$).

Factor six was determined to be an index of rural demography or socio-economic backwardness. Many residents of counties that scored highly negative on factor six were young (Variable 11; loading $-.727$ and Variable 4; loading $-.674$), well educated (Variable 62; loading $-.415$), and employed in government jobs (Variable 31; loading $-.758$). Individuals from minority groups (Variable 13; loading $-.437$), other states (Variable 17; loading $-.406$), and other countries (Variable 16; loading $-.448$), were disproportionately represented in the counties scoring highly negative on factor six.

The seventh factor derived from the analysis was an index of the influence of age upon income and growth. County units placing highly positive on factor seven had high percentages of older people (Variable 3; loading $.844$ and Variable 6; loading $.807$), many of whom were over sixty-five (Variable 12; loading $.807$ and Variable 29; loading $.737$).

Many residents of the counties with highly negative factor seven scores were young, many of them under eighteen years of age (Variable 10; loading $-.842$). The youthful nature of the area was reflected in the rapid change of the population (Variable 50; loading $-.472$ and Variable 52; loading $-.595$), and the high incomes of the residents (Variable 19; loading $-.477$ and Variable 27; loading $-.538$).

Factor eight tended to summarize the level of construction activity within county and regional units. Counties scoring highly positive on factor eight had relatively large percentages of their working forces engaged in construction activity (Variable 34; loading $.916$), and possessed extra-ordinarily large construction industries (Variable 56; loading $.925$). Counties scoring negatively had relatively low construction activity and few construction employees.

Mining Activity Index was surmized to be the best label that could be placed on factor nine. County and regional units placing highly positive on pattern nine showed above average levels of mining activity (Variable 58; loading .882) and employed above average percentages of mining employees (Variable 35; loading .894). Negative scores on factor nine indicated the counties that possessed varying degrees of mining deficiency.

Factor ten displayed signs of being a nativity index. A nativity index in the sense that counties scoring highly negative on the factor had high numbers of people who were foreign born or natives of foreign or mixed parentage (Variable 16; loading -.665 and Variable 15; loading -.822). County units scoring highly positive on factor ten had large numbers of inhabitants from states other than Kansas (Variable 17; loading .411), and many families receiving public assistance (Variable 26; loading .436).

DISTANCE SCALING OF SIMILARITIES

The second step of the three part aggregation procedure was a distance scaling of similarities. The result of the step was a distance squared matrix of the squared Euclidean distances between individual plottings of county factor scores in ten-dimensional vector space. Counties with similar characteristics had similar squared distances.

CONTIGUITY GROUPING

By employing the Euclidean distance measurements listed in the distance matrix and the contiguity grouping referred to in Chapter three, it was possible, through a series of steps, to group county units into homogeneous regions. Table 4 lists the step by step grouping.

TABLE IV

GROUPING STEPS

STEP 1	SUM =	C.385830E 00	MIN DIST =	0.385830E 00	FOR ITEMS	133	AND	137	WITH	1	1	MEMBERS
STEP 2	SUM =	C.870155E 00	MIN DIST =	0.484326E 00	FOR ITEMS	14	AND	15	WITH	1	1	MEMBERS
STEP 3	SUM =	0.162676E 01	MIN DIST =	0.756609E 00	FOR ITEMS	14	AND	21	WITH	2	1	MEMBERS
STEP 4	SUM =	0.259159E 01	MIN DIST =	0.964821E 00	FOR ITEMS	79	AND	133	WITH	1	2	MEMBERS
STEP 5	SUM =	0.361092E 01	MIN DIST =	0.101933E 01	FOR ITEMS	28	AND	91	WITH	1	1	MEMBERS
STEP 6	SUM =	0.463429E 01	MIN DIST =	0.102337E 01	FOR ITEMS	53	AND	130	WITH	1	1	MEMBERS
STEP 7	SUM =	0.570467E 01	MIN DIST =	0.107038E 01	FOR ITEMS	129	AND	138	WITH	1	1	MEMBERS
STEP 8	SUM =	0.680467E 01	MIN DIST =	0.110000E 01	FOR ITEMS	63	AND	118	WITH	1	1	MEMBERS
STEP 9	SUM =	0.771060E 01	MIN DIST =	0.905935E 00	FOR ITEMS	50	AND	63	WITH	1	2	MEMBERS
STEP 10	SUM =	0.892255E 01	MIN DIST =	0.121194E 01	FOR ITEMS	1	AND	96	WITH	1	1	MEMBERS
STEP 11	SUM =	0.103072E 02	MIN DIST =	0.138462E 01	FOR ITEMS	67	AND	103	WITH	1	1	MEMBERS
STEP 12	SUM =	0.117563E 02	MIN DIST =	0.144916E 01	FOR ITEMS	79	AND	129	WITH	3	2	MEMBERS
STEP 13	SUM =	0.131968E 02	MIN DIST =	0.144046E 01	FOR ITEMS	79	AND	135	WITH	5	1	MEMBERS
STEP 14	SUM =	0.146455E 02	MIN DIST =	0.144867E 01	FOR ITEMS	53	AND	79	WITH	2	6	MEMBERS
STEP 15	SUM =	0.162422E 02	MIN DIST =	0.159672E 01	FOR ITEMS	35	AND	97	WITH	1	1	MEMBERS
STEP 16	SUM =	0.178966E 02	MIN DIST =	0.165442E 01	FOR ITEMS	16	AND	45	WITH	1	1	MEMBERS
STEP 17	SUM =	0.195240E 02	MIN DIST =	0.162742E 01	FOR ITEMS	16	AND	71	WITH	2	1	MEMBERS

TABLE IV (cont)

STEP 18	SUM =	0.212218E 02	MIN DIST =	0.169783E 01	FOR ITEMS	14	AND	62	WITH	3	1	MEMBERS
STEP 19	SUM =	0.229488E 02	MIN DIST =	0.172697E 01	FOR ITEMS	1	AND	67	WITH	2	2	MEMBERS
STEP 20	SUM =	0.245223E 02	MIN DIST =	0.157353E 01	FOR ITEMS	1	AND	50	WITH	4	3	MEMBERS
STEP 21	SUM =	0.263013E 02	MIN DIST =	0.177859E 01	FOR ITEMS	110	AND	128	WITH	1	1	MEMBERS
STEP 22	SUM =	0.280955E 02	MIN DIST =	0.179427E 01	FOR ITEMS	1	AND	18	WITH	7	1	MEMBERS
STEP 23	SUM =	0.299332E 02	MIN DIST =	0.183771E 01	FOR ITEMS	4	AND	39	WITH	1	1	MEMBERS
STEP 24	SUM =	0.317783E 02	MIN DIST =	0.184503E 01	FOR ITEMS	43	AND	61	WITH	1	1	MEMBERS
STEP 25	SUM =	0.336417E 02	MIN DIST =	0.186347E 01	FOR ITEMS	70	AND	75	WITH	1	1	MEMBERS
STEP 26	SUM =	0.355514E 02	MIN DIST =	0.190965E 01	FOR ITEMS	12	AND	90	WITH	1	1	MEMBERS
STEP 27	SUM =	0.374037E 02	MIN DIST =	0.185235E 01	FOR ITEMS	12	AND	140	WITH	2	1	MEMBERS
STEP 28	SUM =	0.393271E 02	MIN DIST =	0.192335E 01	FOR ITEMS	2	AND	30	WITH	1	1	MEMBERS
STEP 29	SUM =	0.410559E 02	MIN DIST =	0.172887E 01	FOR ITEMS	2	AND	43	WITH	2	2	MEMBERS
STEP 30	SUM =	0.430227E 02	MIN DIST =	0.196682E 01	FOR ITEMS	40	AND	59	WITH	1	1	MEMBERS
STEP 31	SUM =	0.447903E 02	MIN DIST =	0.176757E 01	FOR ITEMS	40	AND	131	WITH	2	1	MEMBERS
STEP 32	SUM =	0.467902E 02	MIN DIST =	0.199988E 01	FOR ITEMS	53	AND	132	WITH	8	1	MEMBERS
STEP 33	SUM =	0.489024E 02	MIN DIST =	0.211226E 01	FOR ITEMS	58	AND	72	WITH	1	1	MEMBERS
STEP 34	SUM =	0.508081E 02	MIN DIST =	0.190567E 01	FOR ITEMS	14	AND	58	WITH	4	2	MEMBERS
STEP 35	SUM =	0.529581E 02	MIN DIST =	0.215001E 01	FOR ITEMS	12	AND	68	WITH	3	1	MEMBERS
STEP 36	SUM =	0.551170E 02	MIN DIST =	0.215895E 01	FOR ITEMS	14	AND	16	WITH	6	3	MEMBERS
STEP 37	SUM =	0.572828E 02	MIN DIST =	0.216580E 01	FOR ITEMS	13	AND	93	WITH	1	1	MEMBERS
STEP 38	SUM =	0.594654E 02	MIN DIST =	0.218263E 01	FOR ITEMS	14	AND	53	WITH	9	9	MEMBERS
STEP 39	SUM =	0.613359E 02	MIN DIST =	0.187046E 01	FOR ITEMS	14	AND	77	WITH	18	1	MEMBERS
STEP 40	SUM =	0.635237E 02	MIN DIST =	0.218781E 01	FOR ITEMS	29	AND	85	WITH	1	1	MEMBERS

TABLE IV (cont)

STEP 41	SUM =	0.658165E 02	MIN DIST =	0.229282E 01	FOR ITEMS	29	AND	78	WITH	2	1	MEMBERS
STEP 42	SUM =	0.681997E 02	MIN DIST =	0.238323E 01	FOR ITEMS	55	AND	139	WITH	1	1	MEMBERS
STEP 43	SUM =	0.706573E 02	MIN DIST =	0.245755E 01	FOR ITEMS	42	AND	51	WITH	1	1	MEMBERS
STEP 44	SUM =	0.731181E 02	MIN DIST =	0.246081E 01	FOR ITEMS	14	AND	48	WITH	19	1	MEMBERS
STEP 45	SUM =	0.756489E 02	MIN DIST =	0.253088E 01	FOR ITEMS	64	AND	74	WITH	1	1	MEMBERS
STEP 46	SUM =	0.781834E 02	MIN DIST =	0.253453E 01	FOR ITEMS	73	AND	76	WITH	1	1	MEMBERS
STEP 47	SUM =	0.806346E 02	MIN DIST =	0.245121E 01	FOR ITEMS	35	AND	73	WITH	2	2	MEMBERS
STEP 48	SUM =	0.833375E 02	MIN DIST =	0.270291E 01	FOR ITEMS	92	AND	110	WITH	1	2	MEMBERS
STEP 49	SUM =	0.860412E 02	MIN DIST =	0.270369E 01	FOR ITEMS	20	AND	60	WITH	1	1	MEMBERS
STEP 50	SUM =	0.887617E 02	MIN DIST =	0.272047E 01	FOR ITEMS	20	AND	33	WITH	2	1	MEMBERS
STEP 51	SUM =	0.915014E 02	MIN DIST =	0.273969E 01	FOR ITEMS	116	AND	120	WITH	1	1	MEMBERS
STEP 52	SUM =	0.942556E 02	MIN DIST =	0.275426E 01	FOR ITEMS	2	AND	127	WITH	4	1	MEMBERS
STEP 53	SUM =	0.970590E 02	MIN DIST =	0.280334E 01	FOR ITEMS	1	AND	8	WITH	8	1	MEMBERS
STEP 54	SUM =	0.999001E 02	MIN DIST =	0.284114E 01	FOR ITEMS	1	AND	126	WITH	9	1	MEMBERS
STEP 55	SUM =	0.102654E 03	MIN DIST =	0.275411E 01	FOR ITEMS	1	AND	3	WITH	10	1	MEMBERS
STEP 56	SUM =	0.105597E 03	MIN DIST =	0.294254E 01	FOR ITEMS	27	AND	57	WITH	1	1	MEMBERS
STEP 57	SUM =	0.108735E 03	MIN DIST =	0.313843E 01	FOR ITEMS	66	AND	101	WITH	1	1	MEMBERS
STEP 58	SUM =	0.111888E 03	MIN DIST =	0.315331E 01	FOR ITEMS	28	AND	29	WITH	2	3	MEMBERS
STEP 59	SUM =	0.114989E 03	MIN DIST =	0.310072E 01	FOR ITEMS	28	AND	55	WITH	5	2	MEMBERS
STEP 60	SUM =	0.118144E 03	MIN DIST =	0.315484E 01	FOR ITEMS	4	AND	35	WITH	2	4	MEMBERS
STEP 61	SUM =	0.121367E 03	MIN DIST =	0.322328E 01	FOR ITEMS	4	AND	13	WITH	6	2	MEMBERS
STEP 62	SUM =	0.124518E 03	MIN DIST =	0.315061E 01	FOR ITEMS	4	AND	20	WITH	8	3	MEMBERS

TABLE IV (cont)

STEP 63	SUM =	0.127582E 03	MIN DIST =	0.306455E 01	FOR ITEMS	4	AND	14	WITH	11	20	MEMBERS
STEP 64	SUM =	0.130893E 03	MIN DIST =	0.331014E 01	FOR ITEMS	1	AND	112	WITH	11	1	MEMBERS
STEP 65	SUM =	0.134213E 03	MIN DIST =	0.332026E 01	FOR ITEMS	17	AND	92	WITH	1	3	MEMBERS
STEP 66	SUM =	0.137614E 03	MIN DIST =	0.340089E 01	FOR ITEMS	95	AND	107	WITH	1	1	MEMBERS
STEP 67	SUM =	0.141063E 03	MIN DIST =	0.344896E 01	FOR ITEMS	27	AND	83	WITH	2	1	MEMBERS
STEP 68	SUM =	0.144549E 03	MIN DIST =	0.348671E 01	FOR ITEMS	1	AND	119	WITH	12	1	MEMBERS
STEP 69	SUM =	0.148037E 03	MIN DIST =	0.348772E 01	FOR ITEMS	1	AND	6	WITH	13	1	MEMBERS
STEP 70	SUM =	0.151526E 03	MIN DIST =	0.348897E 01	FOR ITEMS	12	AND	134	WITH	4	1	MEMBERS
STEP 71	SUM =	0.155165E 03	MIN DIST =	0.363891E 01	FOR ITEMS	70	AND	99	WITH	2	1	MEMBERS
STEP 72	SUM =	0.15880CE 03	MIN DIST =	0.363542E 01	FOR ITEMS	2	AND	70	WITH	5	3	MEMBERS
STEP 73	SUM =	0.162510E 03	MIN DIST =	0.370946E 01	FOR ITEMS	4	AND	64	WITH	31	2	MEMBERS
STEP 74	SUM =	0.166284E 03	MIN DIST =	0.377384E 01	FOR ITEMS	38	AND	141	WITH	1	1	MEMBERS
STEP 75	SUM =	0.170079E 03	MIN DIST =	0.379569E 01	FOR ITEMS	38	AND	111	WITH	2	1	MEMBERS
STEP 76	SUM =	0.173652E 03	MIN DIST =	0.357290E 01	FOR ITEMS	38	AND	136	WITH	3	1	MEMBERS
STEP 77	SUM =	0.176987E 03	MIN DIST =	0.333467E 01	FOR ITEMS	4	AND	38	WITH	33	4	MEMBERS
STEP 78	SUM =	0.180810E 03	MIN DIST =	0.382277E 01	FOR ITEMS	25	AND	37	WITH	1	1	MEMBERS
STEP 79	SUM =	0.184638E 03	MIN DIST =	0.382869E 01	FOR ITEMS	12	AND	98	WITH	5	1	MEMBERS
STEP 80	SUM =	0.188516E 03	MIN DIST =	0.387772E 01	FOR ITEMS	9	AND	54	WITH	1	1	MEMBERS
STEP 81	SUM =	0.192413E 03	MIN DIST =	0.389727E 01	FOR ITEMS	34	AND	88	WITH	1	1	MEMBERS
STEP 82	SUM =	0.196486E 03	MIN DIST =	0.407243E 01	FOR ITEMS	2	AND	44	WITH	8	1	MEMBERS
STEP 83	SUM =	0.200594E 03	MIN DIST =	0.410791E 01	FOR ITEMS	116	AND	121	WITH	2	1	MEMBERS
STEP 84	SUM =	0.204706E 03	MIN DIST =	0.411247E 01	FOR ITEMS	41	AND	102	WITH	1	1	MEMBERS
STEP 85	SUM =	0.208911E 03	MIN DIST =	0.420477E 01	FOR ITEMS	5	AND	82	WITH	1	1	MEMBERS

TABLE IV (cont)

STEP 86	SUM =	0.213225E 03	MIN DIST =	0.431401E 01	FOR ITEMS	7 AND	66 WITH	1	2 MEMBERS
STEP 87	SUM =	0.216872E 03	MIN DIST =	0.364734E 01	FOR ITEMS	4 AND	7 WITH	37	3 MEMBERS
STEP 88	SUM =	0.221300E 03	MIN DIST =	0.442781E 01	FOR ITEMS	4 AND	17 WITH	40	4 MEMBERS
STEP 89	SUM =	0.225810E 03	MIN DIST =	0.451039E 01	FOR ITEMS	11 AND	117 WITH	1	1 MEMBERS
STEP 90	SUM =	0.230408E 03	MIN DIST =	0.459737E 01	FOR ITEMS	4 AND	25 WITH	44	2 MEMBERS
STEP 91	SUM =	0.235063E 03	MIN DIST =	0.465511E 01	FOR ITEMS	36 AND	94 WITH	1	1 MEMBERS
STEP 92	SUM =	0.239725E 03	MIN DIST =	0.466185E 01	FOR ITEMS	10 AND	104 WITH	1	1 MEMBERS
STEP 93	SUM =	0.244501E 03	MIN DIST =	0.477589E 01	FOR ITEMS	1 AND	40 WITH	14	3 MEMBERS
STEP 94	SUM =	0.249355E 03	MIN DIST =	0.485433E 01	FOR ITEMS	1 AND	4 WITH	17	46 MEMBERS
STEP 95	SUM =	0.254399E 03	MIN DIST =	0.504444E 01	FOR ITEMS	87 AND	89 WITH	1	1 MEMBERS
STEP 96	SUM =	0.259488E 03	MIN DIST =	0.508861E 01	FOR ITEMS	2 AND	9 WITH	9	2 MEMBERS
STEP 97	SUM =	0.264685E 03	MIN DIST =	0.519742E 01	FOR ITEMS	34 AND	106 WITH	2	1 MEMBERS
STEP 98	SUM =	0.269746E 03	MIN DIST =	0.506108E 01	FOR ITEMS	28 AND	34 WITH	7	3 MEMBERS
STEP 99	SUM =	0.275080E 03	MIN DIST =	0.533432E 01	FOR ITEMS	36 AND	100 WITH	2	1 MEMBERS
STEP 100	SUM =	0.280541E 03	MIN DIST =	0.546088E 01	FOR ITEMS	95 AND	108 WITH	2	1 MEMBERS
STEP 101	SUM =	0.286057E 03	MIN DIST =	0.551605E 01	FOR ITEMS	1 AND	2 WITH	63	11 MEMBERS
STEP 102	SUM =	0.291832E 03	MIN DIST =	0.577536E 01	FOR ITEMS	113 AND	115 WITH	1	1 MEMBERS
STEP 103	SUM =	0.297642E 03	MIN DIST =	0.581043E 01	FOR ITEMS	19 AND	27 WITH	1	3 MEMBERS
STEP 104	SUM =	0.303583E 03	MIN DIST =	0.554037E 01	FOR ITEMS	1 AND	12 WITH	74	6 MEMBERS
STEP 105	SUM =	0.309759E 03	MIN DIST =	0.617663E 01	FOR ITEMS	41 AND	47 WITH	2	1 MEMBERS
STEP 106	SUM =	0.316044E 03	MIN DIST =	0.628475E 01	FOR ITEMS	1 AND	10 WITH	80	2 MEMBERS
STEP 107	SUM =	0.322368E 03	MIN DIST =	0.632469E 01	FOR ITEMS	1 AND	19 WITH	82	4 MEMBERS

TABLE IV (cont)

STEP 108	SUM =	C.328908E 03	MIN DIST =	0.654006E 01	FOR ITEMS	28	AND	86	WITH	10	1	MEMBERS
STEP 109	SUM =	0.335410E 03	MIN DIST =	0.650219E 01	FOR ITEMS	1	AND	28	WITH	86	11	MEMBERS
STEP 110	SUM =	0.342165E 03	MIN DIST =	0.675529E 01	FOR ITEMS	5	AND	84	WITH	2	1	MEMBERS
STEP 111	SUM =	0.348475E 03	MIN DIST =	0.631024E 01	FOR ITEMS	5	AND	80	WITH	3	1	MEMBERS
STEP 112	SUM =	0.355538E 03	MIN DIST =	0.706230E 01	FOR ITEMS	26	AND	56	WITH	1	1	MEMBERS
STEP 113	SUM =	0.362530E 03	MIN DIST =	0.659251E 01	FOR ITEMS	1	AND	26	WITH	97	2	MEMBERS
STEP 114	SUM =	0.370063E 03	MIN DIST =	0.753271E 01	FOR ITEMS	32	AND	41	WITH	1	3	MEMBERS
STEP 115	SUM =	0.378254E 03	MIN DIST =	0.819163E 01	FOR ITEMS	1	AND	87	WITH	99	2	MEMBERS
STEP 116	SUM =	0.386463E 03	MIN DIST =	0.820904E 01	FOR ITEMS	49	AND	95	WITH	1	3	MEMBERS
STEP 117	SUM =	0.394950E 03	MIN DIST =	0.848676E 01	FOR ITEMS	22	AND	116	WITH	1	3	MEMBERS
STEP 118	SUM =	0.403076E 03	MIN DIST =	0.812625E 01	FOR ITEMS	1	AND	22	WITH	101	4	MEMBERS
STEP 119	SUM =	0.412540E 03	MIN DIST =	0.946381E 01	FOR ITEMS	1	AND	42	WITH	105	2	MEMBERS
STEP 120	SUM =	0.422302E 03	MIN DIST =	0.976279E 01	FOR ITEMS	5	AND	65	WITH	4	1	MEMBERS
STEP 121	SUM =	0.432068E 03	MIN DIST =	0.976548E 01	FOR ITEMS	23	AND	81	WITH	1	1	MEMBERS
STEP 122	SUM =	0.441940E 03	MIN DIST =	0.987250E 01	FOR ITEMS	122	AND	124	WITH	1	1	MEMBERS
STEP 123	SUM =	0.452510E 03	MIN DIST =	0.105702E 02	FOR ITEMS	11	AND	113	WITH	2	2	MEMBERS
STEP 124	SUM =	0.463263E 03	MIN DIST =	0.107528E 02	FOR ITEMS	52	AND	105	WITH	1	1	MEMBERS
STEP 125	SUM =	0.474160E 03	MIN DIST =	0.108975E 02	FOR ITEMS	1	AND	49	WITH	107	4	MEMBERS
STEP 126	SUM =	0.484833E 03	MIN DIST =	0.106725E 02	FOR ITEMS	1	AND	69	WITH	111	1	MEMBERS
STEP 127	SUM =	0.496175E 03	MIN DIST =	0.113429E 02	FOR ITEMS	1	AND	109	WITH	112	1	MEMBERS
STEP 128	SUM =	0.507680E 03	MIN DIST =	0.115047E 02	FOR ITEMS	1	AND	5	WITH	113	5	MEMBERS
STEP 129	SUM =	0.519157E 03	MIN DIST =	0.114777E 02	FOR ITEMS	1	AND	11	WITH	118	4	MEMBERS
STEP 130	SUM =	0.532066E 03	MIN DIST =	0.129091E 02	FOR ITEMS	23	AND	31	WITH	2	1	MEMBERS

TABLE IV (cont)

STEP 131	SUM =	0.545973E 03	MIN DIST =	0.139072E 02	FOR ITEMS	1	AND	122	WITH	122	2	MEMBERS
STEP 132	SUM =	0.561230E 03	MIN DIST =	0.152570E 02	FOR ITEMS	1	AND	36	WITH	124	3	MEMBERS
STEP 133	SUM =	0.576961E 03	MIN DIST =	0.157310E 02	FOR ITEMS	1	AND	32	WITH	127	4	MEMBERS
STEP 134	SUM =	0.593936E 03	MIN DIST =	0.169749E 02	FOR ITEMS	1	AND	114	WITH	131	1	MEMBERS
STEP 135	SUM =	0.611472E 03	MIN DIST =	0.175360E 02	FOR ITEMS	1	AND	52	WITH	132	2	MEMBERS
STEP 136	SUM =	0.630315E 03	MIN DIST =	0.188430E 02	FOR ITEMS	46	AND	125	WITH	1	1	MEMBERS
STEP 137	SUM =	0.658323E 03	MIN DIST =	0.280081E 02	FOR ITEMS	1	AND	24	WITH	134	1	MEMBERS
STEP 138	SUM =	0.689190E 03	MIN DIST =	0.308672E 02	FOR ITEMS	1	AND	23	WITH	135	3	MEMBERS
STEP 139	SUM =	0.724399E 03	MIN DIST =	0.352087E 02	FOR ITEMS	1	AND	46	WITH	138	2	MEMBERS
STEP 140	SUM =	0.838267E 03	MIN DIST =	0.113868E 03	FOR ITEMS	1	AND	123	WITH	140	1	MEMBERS

The first grouping step combined the two most similar county units, namely, county unit 133 (Thayer county, Nebraska) and county unit 137 (Harlan county, Nebraska). Step two grouped county fourteen (Clay county, Kansas) and fifteen (Cloud county, Kansas). In step three county unit fourteen which, as a result of step two contained two members (counties 14 and 15) was grouped with county twenty-one (Dickinson county, Kansas). The step by step grouping continued through step 140 and until there was but one group. Thus, the grouping began with complete detail and 141 regions and ended with one region and complete generality. At each step in the grouping uniformity was maximized, and the whole series facilitated in the selection of the uniform economic regions which best combined the detail and generality required of any meaningful regionalization procedure.

Detail Loss

When county units were grouped, a certain amount of detail was sacrificed by treating the divisions as undifferentiated members of a group. The amount of detail lost was equivalent to the within-group distance squared.

Table 5 provides a step-wise listing of the county groupings plus the between-group distance squared and within-group distance squared measurements. It was interesting to note the per cent of detail loss at various step intervals of the grouping. After ten steps only 1.06 per cent detail loss occurred. After twenty steps another 1.87 per cent detail was lost. Proceeding at ten step intervals it was easy to see that the per cent detail loss accelerated at an increasing rate until 36.53 per cent detail was lost in the interval between step 130 and step 140. Thus, a pattern of interval detail loss was recognized.

TABLE V
MEASURES OF DETAIL LOSS BY
GROUPING

STEP	I	J		WITHIN DSC	BETW DSC
C			C.00	0.00000E 00	0.83827E 03
1	133	137	C.05	0.38583E 00	0.83788E 03
2	14	15	C.10	0.87016E 00	0.83740E 03
3	14	21	C.19	0.16268E 01	0.83664E 03
4	79	133	C.31	0.25916E 01	0.83567E 03
5	28	91	C.43	0.36107E 01	0.83466E 03
6	53	130	C.55	0.46343E 01	0.83363E 03
7	129	138	C.68	0.57047E 01	0.83256E 03
8	63	118	C.81	0.68047E 01	0.83146E 03
9	50	63	C.92	0.77106E 01	0.83056E 03
10	1	96	1.06	0.89225E 01	0.82934E 03
11	67	103	1.23	0.10307E 02	0.82796E 03
12	79	129	1.40	0.11756E 02	0.82651E 03
13	79	135	1.57	0.13197E 02	0.82507E 03
14	53	79	1.75	0.14645E 02	0.82362E 03
15	35	97	1.94	0.16242E 02	0.82202E 03
16	16	45	2.13	0.17897E 02	0.82037E 03
17	16	71	2.33	0.19524E 02	0.81874E 03
18	14	62	2.53	0.21222E 02	0.81704E 03
19	1	67	2.74	0.22949E 02	0.81532E 03
20	1	50	2.93	0.24522E 02	0.81374E 03
21	110	128	3.14	0.26301E 02	0.81197E 03
22	1	18	3.35	0.28096E 02	0.81017E 03
23	4	39	3.57	0.29933E 02	0.80833E 03
24	43	61	3.79	0.31778E 02	0.80649E 03
25	70	75	4.01	0.33642E 02	0.80462E 03
26	12	90	4.24	0.35551E 02	0.80272E 03
27	12	140	4.46	0.37404E 02	0.80086E 03
28	2	30	4.69	0.39327E 02	0.79894E 03
29	2	43	4.90	0.41056E 02	0.79721E 03
30	40	59	5.13	0.43023E 02	0.79524E 03
31	40	131	5.34	0.44790E 02	0.79348E 03
32	53	132	5.58	0.46790E 02	0.79148E 03
33	58	72	5.83	0.48902E 02	0.78936E 03
34	14	58	6.06	0.50808E 02	0.78746E 03
35	12	68	6.32	0.52958E 02	0.78531E 03
36	14	16	6.58	0.55117E 02	0.78315E 03
37	13	93	6.83	0.57283E 02	0.78098E 03
38	14	53	7.09	0.59465E 02	0.77880E 03
39	14	77	7.32	0.61336E 02	0.77693E 03
40	29	85	7.58	0.63524E 02	0.77474E 03
41	29	78	7.85	0.65816E 02	0.77245E 03
42	55	139	8.14	0.68200E 02	0.77007E 03
43	42	51	8.43	0.70657E 02	0.76761E 03
44	14	48	8.72	0.73118E 02	0.76515E 03
45	64	74	9.02	0.75649E 02	0.76262E 03
46	73	76	9.33	0.78183E 02	0.76008E 03
47	35	73	9.62	0.80635E 02	0.75763E 03
48	92	110	9.94	0.83338E 02	0.75493E 03
49	20	60	10.26	0.86041E 02	0.75223E 03
50	20	33	10.59	0.88762E 02	0.74950E 03
51	116	120	10.92	0.91501E 02	0.74677E 03
52	2	127	11.24	0.94256E 02	0.74401E 03
53	1	8	11.58	0.97059E 02	0.74121E 03
54	1	126	11.92	0.99900E 02	0.73837E 03
55	1	3	12.25	0.10265E 03	0.73561E 03
56	27	57	12.60	0.10560E 03	0.73267E 03
57	66	101	12.97	0.10874E 03	0.72953E 03
58	28	29	13.35	0.11189E 03	0.72638E 03

TABLE V (cont)

59	28	55	13.72	0.11490E 03	C.72328E 03
60	4	35	14.09	0.11814E 03	C.72012E 03
61	4	13	14.48	0.12137E 03	C.71670E 03
62	4	20	14.85	0.12452E 03	C.71375E 03
63	4	14	15.22	0.1275PE 03	C.71068E 03
64	1	112	15.61	0.13089E 03	C.70737E 03
65	17	92	16.01	0.13421E 03	C.70405E 03
66	95	107	16.42	0.13761E 03	C.70065E 03
67	27	83	16.83	0.14106E 03	C.69720E 03
68	1	119	17.24	0.14455E 03	C.69372E 03
69	1	6	17.66	0.14804E 03	C.69023E 03
70	12	134	18.09	0.15153E 03	C.68674E 03
71	70	99	18.51	0.15516E 03	C.68310E 03
72	2	70	18.94	0.15880E 03	C.67947E 03
73	4	64	19.39	0.16251E 03	C.67576E 03
74	38	141	19.84	0.16629E 03	C.67198E 03
75	38	111	20.29	0.1700PE 03	C.66819E 03
76	38	136	20.72	0.17365E 03	C.66461E 03
77	4	38	21.11	0.17699E 03	C.66128E 03
78	25	37	21.57	0.18081E 03	C.65746E 03
79	12	98	22.03	0.18464E 03	C.65361E 03
80	9	54	22.49	0.18852E 03	C.64975E 03
81	34	88	22.95	0.19241E 03	C.64585E 03
82	2	44	23.44	0.19649E 03	C.64178E 03
83	116	121	23.93	0.20059E 03	C.63767E 03
84	41	102	24.42	0.20471E 03	C.63356E 03
85	5	82	24.92	0.20891E 03	C.62936E 03
86	7	66	25.44	0.21322E 03	C.62504E 03
87	4	7	25.87	0.21687E 03	C.62139E 03
88	4	17	26.40	0.22130E 03	C.61697E 03
89	11	117	26.94	0.22591E 03	C.61246E 03
90	4	25	27.49	0.23041E 03	C.60786E 03
91	36	94	28.04	0.23507E 03	C.60320E 03
92	10	104	28.60	0.23972E 03	C.59854E 03
93	1	40	29.17	0.24450E 03	C.59377E 03
94	1	4	29.75	0.24935E 03	C.58891E 03
95	87	89	30.35	0.25440E 03	C.58387E 03
96	2	9	30.96	0.25940E 03	C.57878E 03
97	34	106	31.58	0.26460E 03	C.57358E 03
98	28	34	32.18	0.26975E 03	C.56852E 03
99	36	100	32.82	0.2750PE 03	C.56319E 03
100	95	108	33.47	0.28054E 03	C.55773E 03
101	1	2	34.12	0.28606E 03	C.55221E 03
102	113	115	34.81	0.29183E 03	C.54643E 03
103	19	27	35.51	0.29764E 03	C.54062E 03
104	1	12	36.22	0.3035PE 03	C.53468E 03
105	41	47	36.95	0.30976E 03	C.52851E 03
106	1	10	37.70	0.31604E 03	C.52222E 03
107	1	19	38.46	0.32237E 03	C.51590E 03
108	28	86	39.24	0.32891E 03	C.50936E 03
109	1	28	40.01	0.33541E 03	C.50286E 03
110	5	84	40.82	0.34217E 03	C.49610E 03
111	5	80	41.57	0.3484PE 03	C.48979E 03
112	26	56	42.41	0.35554E 03	C.48273E 03
113	1	26	43.25	0.36253E 03	C.47574E 03
114	32	41	44.15	0.37006E 03	C.46820E 03
115	1	87	45.12	0.37825E 03	C.46001E 03
116	49	95	46.10	0.38646E 03	C.45180E 03

TABLE V (cont)

117	22	116	47.12	0.39495E 03	0.44332E 03
118	1	22	48.08	0.4030PE 03	C.43519E 03
119	1	42	49.21	0.41254E 03	0.42573E 03
120	5	65	50.38	0.42230E 03	0.41596E 03
121	23	81	51.54	0.43207E 03	C.40620E 03
122	122	124	52.72	0.44194E 03	C.39633E 03
123	11	113	53.98	0.45251E 03	0.38576E 03
124	52	105	55.26	0.46326E 03	C.37500E 03
125	1	49	56.56	0.47416E 03	C.36411E 03
126	1	69	57.84	0.48483E 03	0.35343E 03
127	1	109	59.19	0.4961PE 03	0.34209E 03
128	1	5	60.56	0.5076PE 03	C.33059E 03
129	1	11	61.93	0.51916E 03	0.31911E 03
130	23	31	63.47	0.53207E 03	0.30620E 03
131	1	122	65.13	0.54597E 03	C.29229E 03
132	1	36	66.95	0.56123E 03	0.27704E 03
133	1	32	68.83	0.57696E 03	0.26131E 03
134	1	114	70.85	0.59394E 03	C.24433E 03
135	1	52	72.94	0.61147E 03	C.22679E 03
136	46	125	75.19	0.63031E 03	0.20795E 03
137	1	24	78.53	0.65832E 03	C.17994E 03
138	1	23	82.22	0.68919E 03	C.14908E 03
139	1	46	86.42	0.72440E 03	0.11387E 03
140	1	123	100.00	0.83827E 03	0.0

Recognizing Regional Types

Deciding at which step to limit further grouping was facilitated by this pattern. It was reasoned that grouping should continue until detail loss from each additional step became exceedingly large. Following this line of thought, the grouping was continued through step ninety-three. As can be seen from Table 5 detail loss at step ninety-three was approximately thirty per cent.

According to traditional geographical thought, an area such as Kansas would necessarily be inherently divided into contiguous regional types. Noting Fig. 3, which presents a graphic representation of the regional types that emerged from grouping through step ninety-three, it appears that the traditional concept of regional delineation does not apply. Instead of neat contiguous regions many of the regional types are individual county units or have non-contiguous county membership. What Fig. 3 does provide is a regional set that reflects as accurately as possible, though somewhat idealistically, the true spatial character of the Kansas economy.

REFINEMENT OF THE REGIONAL SET

Except in the most idealistic instances of regional delineation it is important that a regional set be operational. The importance of the operationability lies in the main objective of a regionalization, that being to determine a simpler and more manageable form of accurately representing reality.

The operationability of a region depends greatly upon its areal scope or size, population factors, space efficiency, internal homogeneity and dimensional attributes. Other factors are also, important but in most cases they can be indirectly or directly associated with the major factors listed above.

Size and Population Factors

Area and population are both indicators of regional size. A region can be large in areal extent or large in terms of the number of inhabitants living within its boundaries. Both indicators of size are significant when determining if a particular region can be viable with respect to the area and population served.

If the areal extent of a region is very small and the inhabitants of the region few, the viability of the region would be doubtful. However, a region with a small population dispersed over a large area would most likely be determined viable simply because of the sheer size of the regional area. In similar fashion, a region with a large population but a small area would be viable because of the large economic potential of the people within the region.

Space Efficiency

Using Central Place Theory as a source of guidance, it may be recalled that the most efficient market area configuration is circular in form.³ Because regional types are in fact small, internally homogeneous economies with only a minimum of external interaction, it would follow that the most efficient regional configuration would also be circular. However, because of the polygonal shape of most Kansas counties a circular region would be impossible. Realizing this and perceiving the perpendicular alignment of the county boundary lines, the most efficient regional form was determined to be a square polygon. Thus, the closer a regional configuration approaches a square form the more

³ Edgar M. Hoover, An Introduction To Regional Economics (New York: Alfred A. Knopf, Inc., 1971), p. 126-131.

efficient is its use of space, and the more efficient a region is in terms of space usage the easier and more economical it is to implement public and private business within that region.

Internal Homogeneity

The internal homogeneity of a region is an important element when attempting to implement regional projects. The more homogeneous a region is in terms of social status, economy, demography, etc., the more general a specific project may be and thus, the lower the cost. Specifically designed projects for individual regional county members are expensive and decrease the total efficiency of the region as a whole. Therefore, the more internally homogeneous a region the more efficient and operational it will be.

Dimensional Attributes

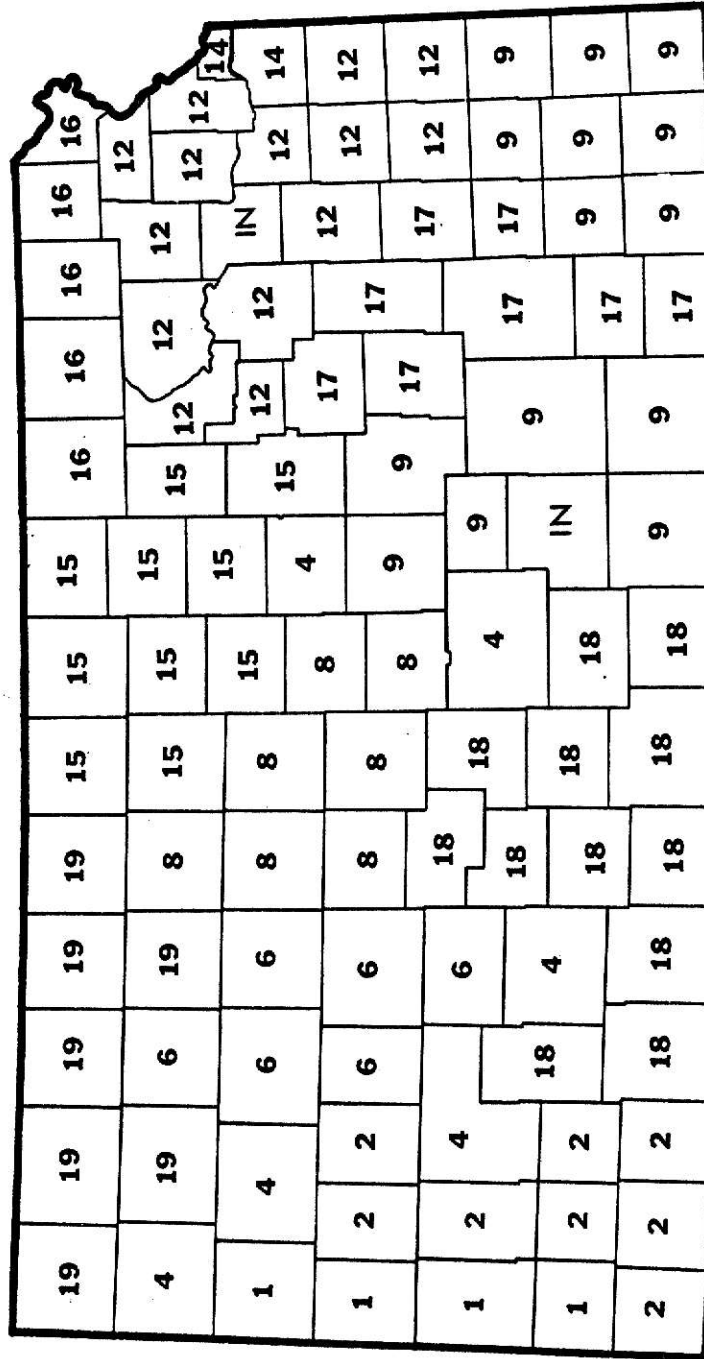
As mentioned above, internal homogeneity is important when considering regional operationability. However, internal homogeneity implies maximum similarity with respect to a defined number of dimensional attributes. The greater the number of attributes considered the closer a region will approximate reality. Thus, a region which is internally homogeneous with respect to only two or three dimensional attributes approaches reality to a lesser degree than a region that is internally homogeneous with respect to a larger number of attributes.

Major Refinements

In order that the operationability of the regional set of Fig. 3 might be increased, steps were taken to make the regions larger, more compact and more internally alike. Figs. 4, 5, and 6 represent the results

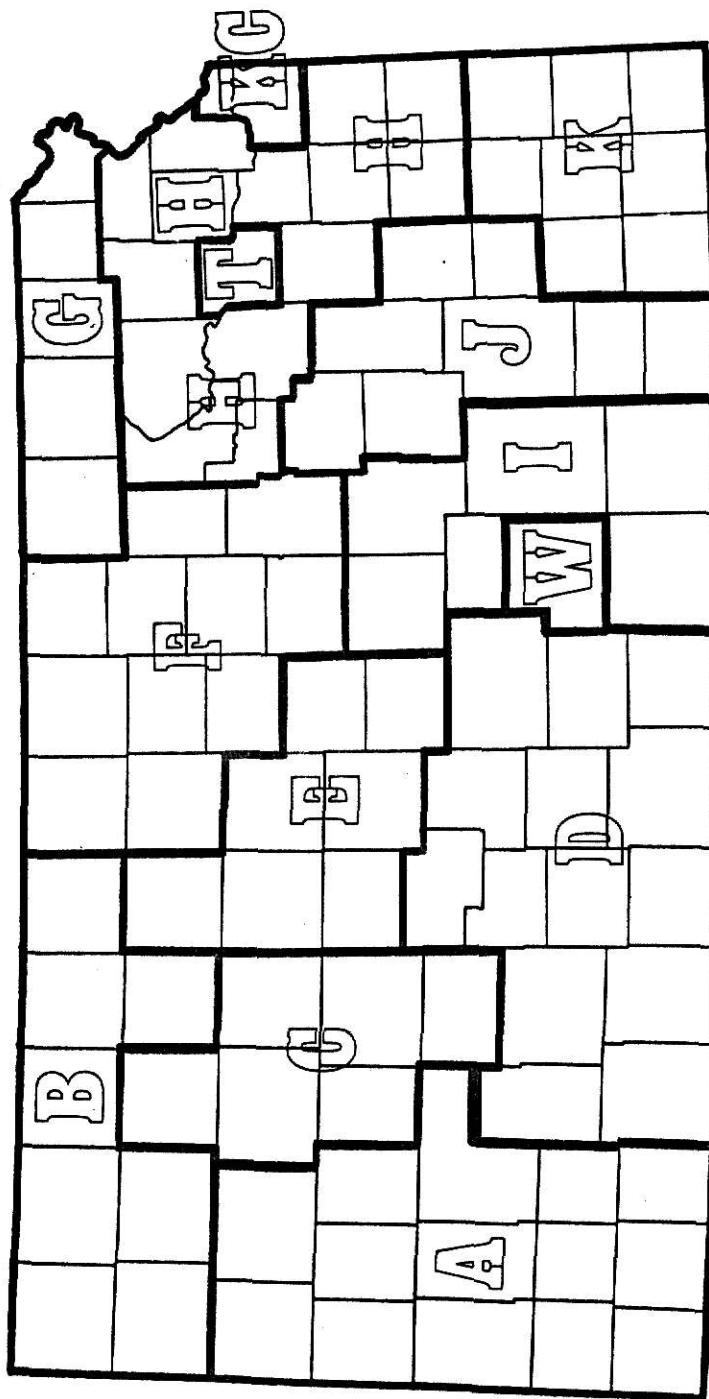
FIGURE 5

REFINEMENT TWO



(IN) REPRESENTS AN INDEPENDENT COUNTY REGION

FIGURE 6
THE KANSAS ECONOMIC REGIONS



of the steps that were taken to increase the cohesiveness and operationability of the regional set outlined in Fig. 1.

The first step taken was the placing of individual county regions into nearby regional types.⁴ The counties were assigned according to the results of an interpolative process.⁵ In some instances two county regions lying adjacent to each other were combined with each other rather than with an adjacent multi-county region. Johnson and Wyandotte counties were combined in this manner. Fig. 4 provides a graphical representation of the regions that prevailed consequent to the above alterations.

Fig. 5 expresses the product of combining the outlying member(s) of non-contiguous regions with the members of a nearby region (the county regions of Saline, Reno, Ford, Finney, Logan, and Sherman were not combined at this point). Again the counties were assigned according to the results of an interpolative process.

In addition to the parceling of outlying regional members another refinement was the division of region one into five sectoral regions. This was accomplished by observing where in the grouping procedure (see Table 4) each sector had been joined to region one. It was at these junctures that the divisions were made. Figure 5 depicts this division.

The regions outlined by Fig. 6 are the results of refinements made upon the regions of Fig. 5. Again the increased operationability of the

⁴Due primarily to their urban attributes, the counties containing the Wichita and Topeka metropolitan areas were considered to be individual urban regions.

⁵The interpolative process used in this analysis entailed a comparison of the factor scores of the county in question with the factor scores of the counties surrounding it. The county was assigned to the region containing the county unit which possessed the most similar factor scores.

regional set was the motive. The first refinement resulted in the combination of regions 1 and 2. It was felt that although the two regions were different, they were enough alike that the desire for operationability outweighed the need for their independence.

The assignment of the county retailing regions of Saline, Ford, Finney, Reno, Logan, and Sherman to nearby regional types comprised the second refinement made on Fig. 5. An interpolative process⁶ was used to parcel the individual county regions.

Aside from representing the cumulative result of changes made on the regions of Fig. 3, it was felt that Fig. 6 illustrated a set of economic regions that combined the degree of technical accuracy, internal homogeneity, cohesiveness, and operationability required to make a regional set have both meaning and usefulness.

MAJOR FACTORIAL TRENDS OF THE REGIONAL TYPES

Having settled upon a set of operational regions that best embodied a balance between the too general and the too detailed, the economic character of the individual regions became a primary point of concern. In order to determine the economic character of each regional type, the sign and magnitude of each county's factor scores were observed (see Table 3). The factor scores most commonly and highly scored upon ($\pm .700$ or above) by a region's county members determined major regional trends.

The members of region A scored highly positive most commonly on factor three and negatively most often on factor seven. In addition, the

⁶Ibid.

counties in the eastern one-half of the region scored highly positive on factor four while the western counties scored highly negative on factor four.

From these figures the nature of region A was determined to be typically rural or non-urban with a relatively low age profile. The young populace earned relatively high incomes, primarily from agricultural activities.

As indicated by the highly positive scores on factor four, the eastern one-half of the region possessed above average transportation service while the highly negative factor four scores of the western one-half implied below average transportation service. The discrepancy in factor four scoring was accounted for by the presence of natural gas fields in the eastern one-half of region A.

The county members of region B scored highly positive most often on factors three and five. There were no outstanding negative factor scores. The major trends implied by the positive scores were ones of rural remoteness dominated by an agrarian economy of senior citizens.

A highly positive factor score on factor three revealed the aged, non-urban, agrarian character of region C. The highly negative scores on factors eight and ten emphasized the relatively small amount of construction activity taking place in a region populated by a sizeable number of recent immigrants and first generation natives of immigrant parents.

The major trends of region D were determined by the highly positive scores on factor seven and the highly negative scores on factor two. These two factors illustrated the high income and age profiles of the region. The high incomes were earned by well educated persons, many of who were employed in white collar and service activities.

Highly positive scores on factor nine determined the mining trend of region E. Petroleum was the mineral being mined and most of the mining was located in the central and southeastern parts of the region.

The outstanding trend of region F was its high age profile. As the highly positive scores on factor seven indicated, many of the residents of region F were over sixty-five and receiving their social security incomes.

Positive factor two scores established the major trend of region G. The trend was one of an agrarian economy with a high age profile and a low income profile.

Increasing urbanization was determined to be the major trend of region H. Highly negative factor five scores indicated high income, population and employment potentials in an area of rapid urban population growth.

The major grouping trend of region I was one that revolved around highly negative factor scores on factor three. Such scores suggested an area with a great number of urban inhabitants living and working in urban environments that offered diversified employment opportunities in manufacturing related white collar and blue collar jobs. Poverty tended to be above average with many people unemployed and an abnormally large number receiving public welfare assistance.

Positive factor seven scores indicated that the major grouping trend of counties in region J was one of an agriculturally based economy populated by many senior citizens.

The major trend of region K was outlined by the highly negative scores on factor three. The trend emphasized the influence of urban areas within the region along with the disproportionately large industrial

base of the region. Poverty and hardship were highlighted by the high unemployment rate and the high percentage of inhabitants receiving public welfare assistance.

A large, densely populated urban industrial environment was the trend suggested for the Wichita-Sedgwick county region (region W). Factors that were negatively scored upon were two, three, seven, and nine. Factor one was the lone factor with a positive factor score.

The Topeka-Shawnee county region (region T) scored highly positive on factor one and highly negative on factors two and three. The major trend suggested was one of densely populated urban development with an above average industrial base. The inhabitants of the region were typically young and well educated.

A positive score on factor one and negative scores on factors five and seven determined the major grouping trend of the two county region containing the Kansas portion of the metropolitan Kansas City area (region KC). The trend indicated an urban environment populated by a large, wealthy and well educated populace. Above average manufacturing activity was also implied as was high unemployment.

SUMMARY

The aggregation procedure noted above provided for ten principal patterns of variation from sixty-two variable indices and identified the nature of each. The 141 county units were scaled in relation to these factors and were grouped into homogeneous economic regions. The operationability of the regions was then increased through a series of regional refinements, the ultimate result being a series of maps which graphically displayed the step-wise refinements that led to the Kansas Economic Regions.

Chapter V

SUMMARY AND CONCLUSION

As is the situation with most valuable research, an important concluding step involves a comparative evaluation of the newly determined information plus a summary of the possible implications that the research might have in the future. The remainder of this chapter will deal with these issues.

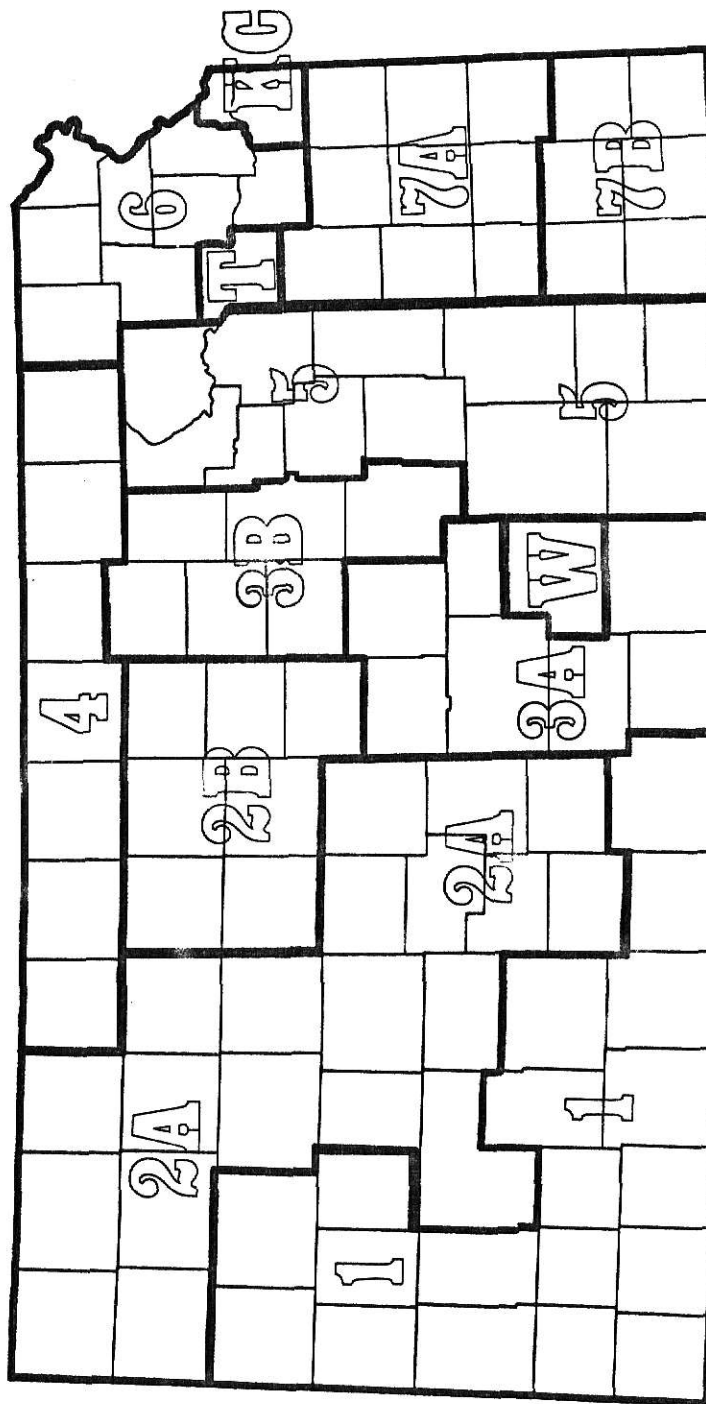
COMPARATIVE EVALUATION OF THE REGIONAL SYSTEMS

Operationability was the primary concern when Donald J. Bogue and Calvin L. Beale developed their State Economic Areas and when the Kansas Economic Development Commission delineated their "701" regions. Both groups wanted a regional system that would give them an accurate picture of the Kansas economy, but be of such a form and nature that the individual regions' internal homogeneity could be used as a base for implementing public and private programs.

The rationale for such a system was good, however, unlike the Kansas Economic Regions derived in this study, the "701" regions and the State Economic Regions never achieved the internal homogeneity required to make them operational. As a result both regionalizations failed to provide the accurate economic picture for which they were designed.

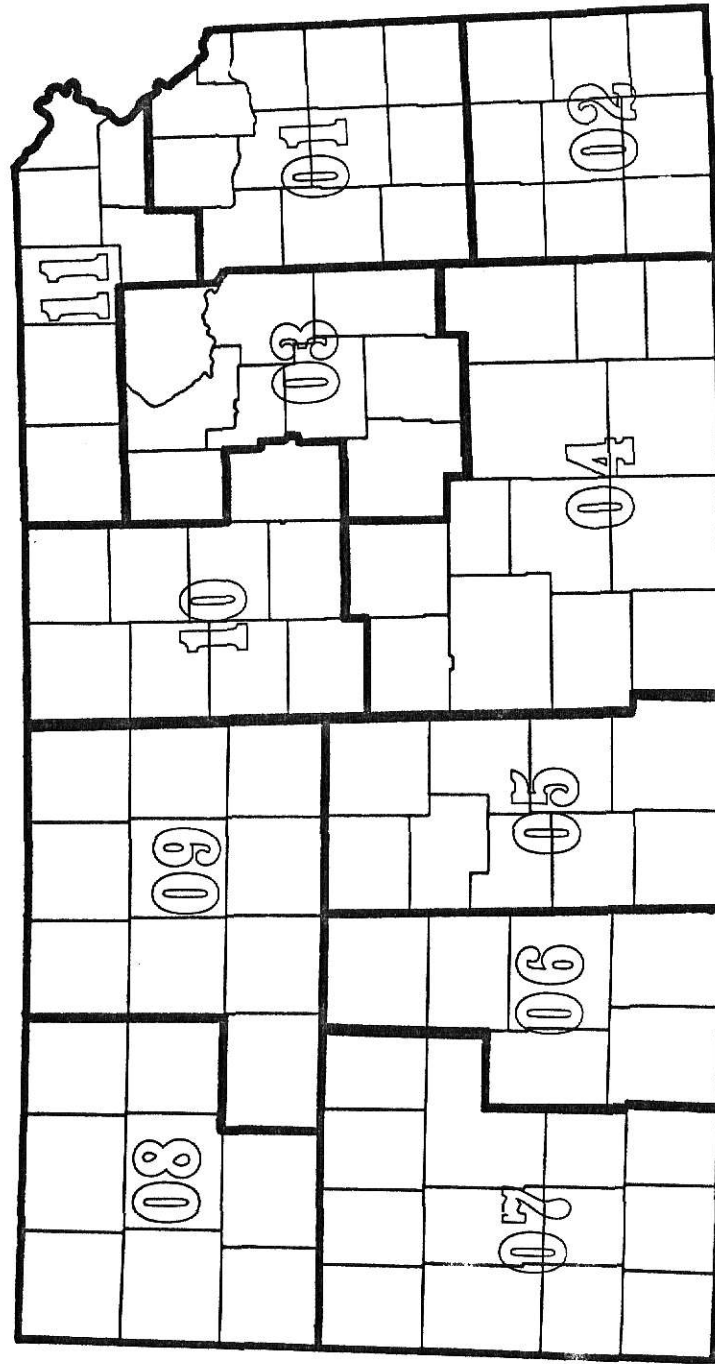
Comparing the Kansas Economic Regions (see Fig. 6) with the State Economic Areas of Bogue and Beale (see Fig. 7) and with the "701" regions of the Kansas Economic Development Commission (see Fig. 8), it is clear that only minimal resemblance exists among the three schemes. The area of greatest similarity common to the three regionalizations obtains in

FIGURE 7
STATE ECONOMIC AREAS



Source: Donald J. Bogue, and Calvin L. Beale, Economic Areas of the United States (New York: The Free Press of Glencoe, Inc., 1961), p. 1142.

FIGURE 8
"701" REGIONS



Source: Kansas Department of Economic Development, Regional Review for Planning in Kansas. 701 Project, Kansas P-43, 11 Vols. 1968.

the southeastern most corner of the state. Noting Table 4 carefully, it can be seen that this particular region was one of the earliest to emerge from the grouping procedure and was therefore one of the more salient regional types. Other areas of less prominent mutual similarity occur in the northeastern and southwestern corners of the state, but the degree of similarity is not as great as in the southeastern corner.

In summary, there is very little similarity among the regional schemes. However, from the beginning, the State Economic Areas and "701" regions have proven to be riddled with subjective value judgements and incalculable inaccuracies. Such characteristics have made their use as tools for detailed research very questionable.

In contrast, the Kansas Economic Regions were objectively derived by use of relatively sophisticated and proven statistical procedures. Only after the true economic character of the state had been determined were subjective modifications attempted. The modifications were made in full view of the reader and were employed in order to increase the operationability of the regions. Furthermore, all of the procedures employed can be replicated and assessed for legitimacy.

IMPLICATIONS OF THE REGIONALIZATION FOR FUNCTIONING OF THE KANSAS ECONOMY

Kansas has been characterized by a sizeable out-migration of young and talented people and the state's share of the nation's new capital investment is decreasing. Many rural areas within the state are economically depressed and are becoming more so every year. The social services in these and most other areas of the state are not improving and in many cases are deteriorating.

Problems such as these are only the visible signs of the much more basic problems of economic viability and governmental inadequacy. The governmental jurisdictions that exist to handle these difficulties were born in a different era and have neither the breadth or resources to deal with current problems. Surely, the first step in ameliorating areal disparities in well-being involves the acquisition of a meaningful picture of how the spatial economic landscape is ordered. Given an accurate window on the spatial structure of activity, programs can then be implemented to produce desirable economic changes, and perhaps even objectively reorder the governmental jurisdictions.

Significant social and economic implications of the Kansas Economic Regions make them valuable areas in which to implement planned remedies for these and other social and economic problems. These are implications that could favorably affect private business, state and federal government, and more importantly, the Kansas citizen.

Because of their economic, social and geographic homogeneity, the Kansas Economic Regions are logical base-units for the formation of a system of economic development districts. The purpose of the districts would be to provide a homogeneous realm in which the human and economic resources of the region could be used to plan and develop a prosperous and expanding regional economy. Such development would require careful planning and recruiting but it could provide increased employment opportunities and greater market potential. Moreover, it would bolster the general economic environment of the individual regions.

The Kansas Economic Regions are logical units for implementing inter-governmental development of important infrastructure. Adequate sewage disposal facilities, airports, water treatment projects, utility

services, etc., are often financial impossibilities for small rural counties. Planned within the framework of the Kansas Economic Regions, the economies of larger scale projects would reduce the per capita fixed costs of the projects, and the intensity of use afforded by the increased areal dimension would decrease the per capita variable costs of operating and maintaining such capital intensive services. The lower, fixed and variable costs would allow these services to be provided for members of all regions.

The high degree of internal homogeneity within the Kansas Economic Regions makes them logical units for coordinating state, federal, and private remedial programs. Pollution control projects, conservation programs, land reclamation, etc., could be carried out more efficiently when operating within the individual homogeneous regions.

The Kansas Economic Regions would be of service to private business. Because of the internal homogeneity and external heterogeneity of the regions the location of market areas, employment pools, and wealth would be more apparent. Knowing the location of market areas would greatly assist the location and planning of plant facilities, warehouse terminals, district offices, and other installations.

The Kansas Economic Regions are the obvious units for economical and efficient government in the state of Kansas. They are blocks of territory that unlike the counties from which they were formed, have the size, homogeneity and financial, physical and human resources to constitute viable governmental units.

In summary, if the Kansas Economic Regions were adopted as the official economic planning regions for Kansas the impact on the economic development of Kansas could be favorable. Government and business would be able to plan their development activities with full knowledge of the true

character of the Kansas economy. Such a favorable decision-making situation would provide the possibility for an efficiently run and well planned public and private economy which would be able to provide the necessary social and service activities needed by a developing region.

CONCLUSION

The initial purpose of this research was to determine the true character of the Kansas economy and in light of this knowledge derive a more accurate set of operational economic regions for the state. In satisfying these ends the analysis has provided for:

1. Ten statistically independent patterns of variation for the 141 county observational units when sixty-two differentiating characteristics of the observations were known.
2. Single measurements of the similarity of each of the 141 multivariate observation and every other observation.
3. A grouping of the observational units into mutually exclusive regional subsets, such that each subset was as uniform as possible.
4. Measures of the detail lost with increased generalization.
5. A graphical representation of the true spatial character of the Kansas economy.
6. A set of operational economic regions for the State of Kansas and the steps used to obtain them.

When utilizing the regional types delineated by this research, it is important to keep in mind that they are representative of but one instant in time, and because of the dynamic everchanging nature of the Kansas landscape, the usefulness of these regions as representatives of reality decrease with the passage of time. However, this instantaneous

picture of the Kansas landscape has definite value, the value being that for one instant an objective view of the Kansas economy is provided. For one instant the true interdependencies of socio-economic factors can be explicitly noted. And for one instant it is possible to observe the socio-economic character of Kansas as the direct result of processes active over the Kansas landscape.

In conclusion, the comprehensive picture derived by this research should be of extreme merit if the decision to reorganize the socio-economic space of Kansas were to come about. The instantaneous picture would provide for an objective awareness of the organization of the contemporary Kansas landscape, which would allow for a more accurate altering of processes so necessary for the successful reorganization of this space.

**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH MULTIPLE
PENCIL AND/OR
PEN MARKS
THROUGHOUT THE
TEXT.**

**THIS IS THE BEST
IMAGE AVAILABLE.**

APPENDIX A

SIXTY-TWO VARIABLES OF ECONOMIC CHARACTER

A. Demographic Characteristics

1. 1970 Population
2. Land Area in Square Miles
3. Median Age of Rural Population
4. Percent of Population Between 18 and 64 Years Old
5. Gross Population Density
6. Median Age of Total Population
7. Percent of Population that is Rural Farm
8. Percent of Population that is Rural Non-Farm
9. Percent of Population that is Urban
10. Percent of Population Under 18 Years of Age
11. Percent of Population Between 18 and 25 Years Old
12. Percent of Population Over 65 Years Old

B. Ethnic Characteristics

13. Percent of Population that is Non-White
14. Percent of Population that is Negro
15. Percent of Population that is Native of Foreign or Mixed Parentage
16. Percent of Population that is Foreign Born
17. Percent of Population that was Born in a State Other than Kansas

C. Income Characteristics

18. Buying Power Index
19. Median Income of Families
20. Per Capita Income of Persons
21. Average Taxable Payrolls (Construction)

APPENDIX A (continued)

C. Income Characteristics (cont'd.)

- 22. Average Taxable Payrolls (Manufacturing)
- 23. Average Taxable Payrolls (Transportation)
- 24. Income Potential (Total)
- 25. Income Potential (Local)
- 26. Percent of Families Receiving Public Assistance
- 27. Percent of Households With Over \$10,000 Income
- 28. Percent With Under \$3,000 Income
- 29. Percent of Families Receiving Social Security Income

D. Occupational Characteristics

- 30. Percent of Working Force that are White Collar
- 31. Percent of Working Force in Government
- 32. Percent of Working Force in Manufacturing
- 33. Percent of Working Force in Services
- 34. Percent of Working Force in Construction
- 35. Percent of Working Force in Mining
- 36. Percent of Working Force in Agriculture
- 37. Percent of Working Force in Transportation
- 38. Percent of Working Force in Trade

E. Nature of Labor Force

- 39. Non-Worker/Worker Ratio
- 40. Percent of Labor Force Unemployed
- 41. Percent of All Workers Working in County of Residence
- 42. People 65 Years and Over: Percent in Labor Force
- 43. Employment Potential (Total)
- 44. Employment Potential (Local)

APPENDIX A (continued)

E. Nature of Labor Force (cont'd.)

- 45. Population Potential (Total)
- 46. Population Potential (Local)

F. Value of Production

- 47. Value Added Per Capita By Manufacturing
- 48. Value of Farm Products Per Capita
- 49. Retail Sales Per Capita

G. Growth Characteristics

- 50. Percent Change in Rural Population (1960-1970)
- 51. Percent Change in Urban Population (1960-1970)
- 52. Percent Population Growth (1960-1970)

H. Economic Base

- 53. Location Quotient (Manufacturing)
- 54. Location Quotient (Trade)
- 55. Location Quotient (Services)
- 56. Location Quotient (Construction)
- 57. Location Quotient (Agriculture)
- 58. Location Quotient (Mining)
- 59. Location Quotient (Transportation and Public Utilities)

I. Educational Characteristics

- 60. Persons 25 Years Old and Over (Median School Years)
- 61. Percent of Population Who are High School Graduates
- 62. Percent of Persons 25 Years Old and Over With 4 Years of College or More

APPENDIX B

MATHEMATICAL ACCOUNT OF THE LOCATION QUOTIENT

The location quotient for each industry was constructed as follows:

$$\begin{array}{rcl}
 \text{Location Quotient} & & \text{Employment in Industry A} \\
 \text{for Industry A} & & \text{in County X} \\
 \text{in County X} & = & \frac{\text{Total Employment in County X}}{\text{Employment in Industry A in Kansas}} \\
 & & \frac{\text{Total Employment in Kansas}}{\text{Total Employment in Kansas}}
 \end{array}$$

APPENDIX C

CORRELATION MATRIX (62 X 62)

	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)	(1, 7)	(1, 8)	(1, 9)	(1, 10)	(1, 11)	(1, 12)	(1, 13)	(1, 14)	(1, 15)
R(2, J)	-0.131														
R(3, J)	-0.306	-C.C13													
R(4, J)	0.293	C.C08	-0.517												
R(5, J)	0.939	-0.172	-0.279	0.300											
R(6, J)	-0.297	-C.C45	0.948	-0.604	-0.271										
R(7, J)	-0.445	C.C93	0.525	-0.700	-0.425	0.564									
R(8, J)	-0.402	0.145	0.430	-0.483	-0.388	0.455	C.634								
R(9, J)	0.458	-C.142	-0.512	0.613	0.441	-0.545	-0.838	-0.953							
R(10, J)	0.110	C.C96	-0.700	-0.128	C.085	-0.637	-0.051	-0.019	0.037						
R(11, J)	0.189	-0.C62	-0.498	0.823	C.190	-0.593	-0.492	-C.462	0.518	-0.144					
R(12, J)	-0.304	-C.C80	0.921	-0.653	-0.289	0.938	0.564	0.375	-0.488	-0.669	-0.506				
R(13, J)	0.591	-C.172	-0.366	0.495	C.490	-0.360	-0.546	-0.429	0.517	-0.019	0.403	-0.356			
R(14, J)	0.672	-C.254	-0.365	0.433	C.556	-0.360	-0.520	-0.434	0.511	0.022	0.385	-0.341	0.929		
R(15, J)	-0.109	-C.C14	0.212	-0.251	-0.066	0.208	0.419	0.140	-0.265	-0.067	-0.102	0.240	-0.265	-0.170	
R(16, J)	0.216	-C.116	-0.305	0.400	0.269	-0.342	-0.183	-0.181	0.196	0.035	0.449	-0.325	0.275	0.325	0.484
R(17, J)	0.287	-C.C21	-0.476	0.674	C.283	-0.493	-0.600	-C.321	0.465	0.125	0.415	-0.601	0.471	0.413	-0.470
R(18, J)	0.992	-0.118	-0.296	0.279	C.954	-0.283	-0.437	-0.395	0.451	0.118	0.168	-0.299	0.561	0.643	-0.092
R(19, J)	0.473	-C.C34	-C.669	0.505	C.490	-0.691	-0.647	-0.409	0.543	0.506	0.266	-0.767	0.249	0.319	-0.258
R(20, J)	0.422	-0.005	-0.372	0.415	C.448	-0.385	-0.513	-C.283	0.399	0.254	0.162	-0.507	0.196	0.219	-0.270
R(21, J)	0.444	-C.127	-0.378	0.410	0.423	-0.401	-C.480	-0.423	0.486	0.103	0.342	-0.387	0.404	0.436	-0.186
R(22, J)	0.789	-C.C74	-0.212	0.142	C.400	-0.701	-0.293	-0.265	0.302	0.102	0.126	-0.183	0.414	0.519	-0.045

APPENDIX C (cont)

R(23,J)	0.053	-0.043	-0.040	0.019	C.049	-0.038	-0.120	C.074	-0.006	0.067	-0.025	-0.066	0.025	0.016	-0.060
R(24,J)	0.551	-0.400	-0.052	0.233	C.528	-0.045	-0.403	-0.396	0.438	-0.227	0.178	-0.001	0.548	0.549	-0.288
R(25,J)	0.703	-0.383	-0.230	0.246	C.658	-0.238	-0.384	-0.376	0.417	0.036	0.184	-0.211	0.577	0.647	-0.183
R(26,J)	0.149	-0.069	0.066	0.122	C.084	0.080	-0.277	-0.137	0.204	-0.251	0.032	0.100	0.416	0.302	-0.338
R(27,J)	0.236	0.151	-0.617	0.361	0.252	-0.626	-0.421	-0.244	0.336	0.609	0.159	-0.736	0.076	0.133	-0.041
R(28,J)	-0.271	-0.093	0.380	-0.385	-0.284	0.405	0.533	0.283	-0.408	-0.216	-0.171	0.454	-0.108	-0.161	0.087
R(29,J)	-0.263	-0.113	0.825	-0.611	-0.263	0.846	C.511	C.300	-0.414	-0.621	-0.426	0.931	-0.265	-0.269	0.185
R(30,J)	0.487	-0.090	-0.514	0.675	0.508	-0.571	-0.803	-0.635	0.760	0.077	0.526	-0.565	0.445	0.441	-0.195
R(31,J)	-0.074	C.030	-0.079	0.407	-0.049	-0.141	-0.017	0.031	-0.019	-0.210	0.475	-0.143	0.187	0.176	0.016
R(32,J)	0.397	-0.245	-0.255	0.258	0.370	-0.250	-0.580	-0.528	0.604	-0.018	0.167	-0.179	0.427	0.358	-0.371
R(33,J)	0.401	-0.061	-0.436	0.657	0.428	-0.484	-0.629	-0.440	0.556	0.023	0.514	-0.510	0.392	0.365	-0.151
R(34,J)	-0.064	C.039	0.082	-0.193	-0.074	0.151	0.076	0.054	-0.064	-0.073	-0.121	0.200	-0.050	-0.046	-0.028
R(35,J)	-0.110	0.306	-0.045	0.129	-0.113	-0.036	-0.171	C.099	-0.005	0.086	-0.073	-0.162	0.028	-0.053	-0.202
R(36,J)	-0.446	C.129	0.429	-0.594	-0.426	0.462	0.892	0.690	-0.836	0.053	-0.446	0.404	-0.559	-0.520	0.351
R(37,J)	-0.046	C.086	-0.168	0.090	-0.043	-0.171	-0.011	0.102	-0.069	0.247	-0.029	-0.258	-0.043	-0.033	-0.136
R(38,J)	-0.247	0.031	0.209	-0.319	-0.249	0.219	0.570	C.402	-0.507	0.054	-0.224	0.178	-0.349	-0.288	0.320
R(39,J)	-0.310	-0.061	0.341	-0.605	-0.317	0.392	0.529	C.360	-0.459	0.030	-0.483	0.430	-0.223	-0.278	-0.001
R(40,J)	0.291	C.017	-0.268	0.459	0.232	-0.288	-0.619	-0.522	0.610	-0.115	0.398	-0.255	0.428	C.373	-0.296
R(41,J)	-0.149	0.189	0.142	-0.141	-0.161	0.122	C.126	C.067	-0.078	-0.036	-0.093	0.131	-0.243	-0.217	0.112
R(42,J)	-0.173	C.167	0.019	-0.122	-0.171	0.010	0.334	0.219	-0.286	0.149	-0.047	-0.024	-0.293	-0.261	0.141
R(43,J)	0.569	-0.405	-0.074	0.235	0.545	-0.067	-0.404	-0.397	0.440	-0.199	0.179	-0.025	0.558	0.565	-0.283
R(44,J)	0.681	-0.392	-0.245	0.244	C.643	-0.248	-0.376	-0.370	0.410	0.050	0.182	-0.218	0.571	0.643	-0.197
R(45,J)	0.510	-0.343	-0.023	0.196	0.455	0.000	-0.359	-0.345	0.385	-0.270	0.166	0.059	0.565	0.561	-0.277
R(46,J)	0.697	-0.177	-0.233	0.249	0.631	-0.235	-0.397	-0.381	0.426	0.026	0.144	-0.207	0.584	0.651	-0.205
R(47,J)	0.842	-0.008	-0.174	0.171	0.854	-0.147	-0.393	-0.302	0.341	0.033	0.045	-0.162	0.504	0.674	-0.087

APPENDIX C (cont)

R(48,J)	-0.481	0.189	0.232	-0.464	-0.371	0.255	0.695	0.597	-0.692	0.188	-0.390	0.203	-0.502	-0.463	0.247
R(49,J)	0.092	0.027	-0.254	0.039	0.104	-0.268	-0.243	-0.284	0.297	0.269	0.014	-0.235	-0.041	0.009	0.054
R(50,J)	-0.100	0.131	-0.275	-0.060	-0.124	-0.262	0.011	0.091	-0.065	0.375	-0.064	-0.244	-0.159	-0.217	-0.042
R(51,J)	0.108	-0.155	-0.274	0.361	0.154	-0.321	-0.241	-0.146	0.198	0.117	0.296	-0.360	0.053	0.070	-0.083
R(52,J)	0.303	-0.131	-0.691	0.571	0.355	-0.738	-0.507	-0.384	0.473	0.372	0.539	-0.712	0.195	0.177	-0.236
R(53,J)	0.326	-0.218	-0.227	0.239	0.286	-0.221	-0.550	-0.509	0.579	-0.044	0.161	-0.145	0.426	0.333	-0.330
R(54,J)	-0.219	0.045	0.197	-0.286	-0.215	0.204	0.542	0.389	-0.487	0.055	-0.220	0.172	-0.330	-0.276	0.246
R(55,J)	0.422	-0.080	-0.425	0.650	0.453	-0.473	-0.629	-0.445	0.559	0.018	0.500	-0.500	0.393	0.369	-0.146
R(56,J)	-0.059	-0.015	0.076	-0.223	-0.067	0.147	0.092	0.044	-0.063	-0.056	-0.120	0.209	-0.080	-0.048	0.010
R(57,J)	-0.414	0.236	0.402	-0.464	-0.397	0.422	0.783	0.651	-0.766	0.011	-0.403	0.338	-0.485	-0.477	0.116
R(58,J)	-0.120	0.116	-0.018	0.041	-0.120	-0.011	-0.125	0.081	-0.011	0.102	-0.078	-0.109	-0.101	-0.099	-0.068
R(59,J)	-0.059	0.070	-0.212	0.083	-0.059	-0.206	-0.018	0.084	-0.053	0.284	-0.002	-0.280	-0.069	-0.046	-0.097
R(60,J)	0.119	0.069	-0.360	0.295	0.148	-0.414	-0.275	-0.138	0.203	0.273	0.279	-0.429	-0.071	0.005	0.052
R(61,J)	0.176	-0.002	-0.517	0.461	0.218	-0.552	-0.386	-0.209	0.296	0.340	0.389	-0.606	0.024	0.064	-0.105
R(62,J)	0.247	-0.013	-0.496	0.713	0.296	-0.583	-0.518	-0.317	0.424	0.100	0.651	-0.610	0.225	0.206	-0.118

APPENDIX C (cont)

(1,16)	(1,17)	(1,18)	(1,19)	(1,20)	(1,21)	(1,22)	(1,23)	(1,24)	(1,25)	(1,26)	(1,27)	(1,28)	(1,29)	(1,30)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

R(17,J)	0.183			
R(18,J)	0.213	0.281		
R(19,J)	0.162	0.537	0.485	
R(20,J)	0.029	0.451	0.446	0.835
R(21,J)	0.219	0.303	0.435	0.499
R(22,J)	0.177	0.071	0.808	0.422
				0.218

APPENDIX C (cont)

R(48,J)	-0.076	-0.347	-0.363	-0.308	-0.151	-0.449	-0.234	0.004	-0.638	-0.498	-0.377	-0.026	0.193	0.087	-0.576
R(49,J)	0.047	0.089	0.125	0.220	0.121	0.024	0.078	0.021	-0.286	-0.145	-0.191	0.328	-0.263	-0.230	0.280
R(50,J)	-0.072	-0.029	-0.108	0.156	0.046	-0.017	-0.115	0.034	-0.146	-0.131	-0.046	0.133	-0.081	-0.211	-0.050
R(51,J)	0.181	0.333	0.103	0.397	0.318	0.295	-0.004	0.055	0.240	0.329	-0.091	0.217	-0.220	-0.354	0.328
R(52,J)	0.284	0.531	0.305	0.669	0.446	0.437	0.134	0.043	0.311	0.440	-0.062	0.420	-0.383	-0.636	0.545
R(53,J)	-0.003	0.283	0.294	0.284	0.149	0.302	0.164	0.069	0.614	0.428	0.415	-0.063	-0.148	-0.053	0.384
R(54,J)	-0.025	-0.238	-0.219	-0.309	-0.244	-0.337	-0.243	-0.191	-0.352	-0.225	-0.304	-0.091	0.242	0.105	-0.374
R(55,J)	0.249	0.495	0.429	0.625	0.555	0.404	0.225	0.095	0.284	0.340	-0.053	0.444	-0.480	-0.486	0.863
R(56,J)	-0.132	-0.170	-0.063	-0.160	-0.201	0.076	0.032	-0.094	0.233	0.159	0.035	-0.742	0.083	0.251	-0.145
R(57,J)	-0.240	-0.353	-0.397	-0.486	-0.313	-0.406	-0.301	-0.010	-0.461	-0.422	-0.178	-0.225	0.435	0.257	-0.709
R(58,J)	-0.117	0.060	-0.110	0.073	0.132	-0.155	-0.021	-0.022	-0.247	-0.237	-0.126	0.290	-0.113	-0.149	-0.012
R(59,J)	0.023	0.131	-0.044	0.163	0.155	-0.044	0.091	-0.004	-0.233	-0.139	-0.105	0.270	-0.135	-0.316	-0.073
R(60,J)	0.195	0.132	0.134	0.531	0.464	0.174	0.160	0.084	-0.183	-0.041	-0.488	0.552	-0.541	-0.525	0.431
R(61,J)	0.205	0.341	0.199	0.682	0.629	0.188	0.160	0.106	-0.125	0.032	-0.406	0.691	-0.592	-0.663	0.569
R(62,J)	0.335	0.486	0.261	0.625	0.539	0.288	0.139	0.141	0.045	0.145	-0.217	0.573	-0.480	-0.609	0.739

APPENDIX C (cont)

(1.31) (1.32) (1.33) (1.34) (1.35) (1.36) (1.37) (1.38) (1.39) (1.40) (1.41) (1.42) (1.43) (1.44) (1.45)

APPENDIX C (cont)

(1,46) (1,47) (1,48) (1,49) (1,50) (1,51) (1,52) (1,53) (1,54) (1,55) (1,56) (1,57) (1,58) (1,59) (1,60)

APPENDIX C (cont)

R155,J)	0.169	0.314	0.996	-0.205	0.040	-0.572	-0.072	-0.353	-0.536	0.321	-0.086	-0.152	0.289	0.323	0.253
R156,J)	0.100	0.020	-0.207	0.990	-0.141	-0.071	0.009	0.004	0.156	-0.076	-0.319	-0.097	0.232	0.189	0.249
R157,J)	0.006	-0.673	-0.553	-0.015	0.014	0.874	0.211	0.523	0.368	-0.572	0.220	0.444	-0.460	-0.414	-0.415
R158,J)	-0.148	-0.136	0.024	-0.166	0.865	-0.048	0.203	-0.174	-0.022	-0.032	0.084	-0.148	-0.250	-0.245	-0.220
R159,J)	0.001	-0.259	-0.058	0.009	0.204	0.144	0.983	-0.071	-0.085	-0.147	0.138	0.150	-0.226	-0.130	-0.213
R160,J)	0.155	-0.049	0.425	-0.179	-0.057	-0.131	0.077	0.006	-0.415	0.013	0.108	0.171	-0.174	-0.047	-0.203
R161,J)	0.186	-0.035	0.556	-0.218	-0.014	-0.200	0.138	0.015	-0.510	0.071	0.016	0.176	-0.114	0.025	-0.160
R162,J)	0.355	0.066	0.800	-0.244	0.000	-0.360	0.050	-0.154	-0.572	0.201	0.024	0.115	0.053	0.138	0.036

APPENDIX C (cont)

(1,61) (1,62) (1,63) (1,64) (1,65) (1,66) (1,67) (1,68) (1,69) (1,70) (1,71) (1,72) (1,73) (1,74) (1,75)

R(62,J) 0.746

APPENDIX D
VARIABLE ORIGIN OF THE PRINCIPAL
PATTERNS OF VARIATION¹

FACTOR	VARIABLES LOADING ON FACTOR ²	DEGREE OF CORRELATION ³	IDENTITY OF FACTOR
ONE	1	*	
	5	*	
	13		
	14	*	
	18	*	
	22	*	
	24		
	25		
	43		
	44		
	45		
	46		
	47	*	
			Urban Threshold Index
TWO	-4		
	7		
	12		
	-19	*	
	-20	*	
	26		
	-27		
	28	*	

APPENDIX D (continued)

FACTOR	VARIABLES LOADING ON FACTOR	DEGREE OF CORRELATION	IDENTITY OF FACTOR
TWO	29		
	-30	*	
	-33	*	
	39		
	-52		
	-55	*	
	-60	*	
	-61	*	
	-62	*	
			Rural Socio-Economic Index
THREE	7	*	
	8		
	-9	*	
	-24		
	-26		
	-30		
	-32	*	
	-36	*	
	-38	*	
	-40	*	
	42		
	-43		
	-45		
	48	*	

APPENDIX D (continued)

FACTOR	VARIABLES LOADING ON FACTOR	DEGREE OF CORRELATION	IDENTITY OF FACTOR
THREE	-53		
	54	*	
	57	*	
			Rural Occupational and Employment Index
FOUR	37	*	
	59	*	
			Transportation Services Index
FIVE	2		
	-24	*	
	-25	*	
	41	*	
	-43	*	
	-44	*	
	-45		
	-46	*	
	49		
	-51		
			Rural Remoteness Index
SIX	- 4	*	
	-11	*	
	-13		
	-16		
	-17		

APPENDIX D (continued)

FACTOR	VARIABLES LOADING ON FACTOR	DEGREE OF CORRELATION	IDENTITY OF FACTOR
SIX	-31	*	
	-62		
			Rural Demography Index
SEVEN	3	*	
	6	*	
	-10	*	
	12	*	
	-19		
	-27		
	29	*	
	-50		
	-52		
			Age Structure Index
EIGHT	34	*	
	56	*	
			Construction Activity Index
NINE	35	*	
	58	*	
			Mining Index
TEN	-15	*	
	-16	*	
	17		
	26		
			Nativity Index

APPENDIX D (continued)

¹All variables and factor loading were taken from the rotated factor loading matrix (Table 2).

²See Appendix A for a list of variable number equivalents.

³* equals a correlation of plus or minus .65 and above.

BIBLIOGRAPHY

1. Single Volume Works

Berry, Brian J. L., and Frank E. Horton (eds.). Geographic Perspectives on Urban Systems. Englewood Cliffs: Prentice-Hall, Inc., 1970.

_____, and Duane F. Marble (eds.). Spatial Analysis. Englewood Cliffs: Prentice-Hall, Inc., 1968.

Blalock, Hubert M. Social Statistics. New York: McGraw-Hill Book Company, 1960.

Bogue, Donald J., and Calvin L. Beale. Economic Areas of the United States. New York: The Free Press of Glencoe, Inc., 1961.

Chorley, Richard J., and Peter Haggett (eds.). Models in Geography. London: Methuen and Co. LTD, 1967.

Dickinson, Robert E. City and Region. London: Routledge and Kegan Paul LTD, 1964.

Friedman, John, and William Alonso (eds.). Regional Development and Planning. Cambridge: The M.I.T. Press, 1964.

Ginsburg, Norton (ed.). Essays on Geography and Economic Development. Department of Geography Research Paper, No. 62. Chicago: University of Chicago Press, 1960.

_____. Atlas of Economic Development. Chicago: The University of Chicago Press, 1961.

Harman, Harry H. Modern Factor Analysis. Chicago: The University of Chicago Press, 1960.

Hoover, Edgar M. An Introduction to Regional Economics. New York: Alfred A. Knopf, 1971.

2. Multivolume Works

Board, Christopher, and others (eds.). Progress in Geography. Vol. 2, International Reviews of Current Research. London: Edward Arnold (Publishers) LTD, 1970.

Garrison, William, and D. F. Marble (eds.). Quantitative Geography. Vol. I, Economic and Cultural Topics. Evanston: Northwestern University, 1967.

Kansas Department of Economic Development. Regional Review for Planning in Kansas. 701 Project, Kansas P-43, 11 Vols. 1968.

3. Periodicals

- Amedeo, Douglas. "An Optimization Approach to the Identification of A System of Regions," The Regional Science Association Papers, XXIII (1969), 23-44.
- Berry, Brian J. L. "A Method for Deriving Multi-Factor Uniform Regions," PRZEGLAD GEOGRAFICZNY, XXXIII, (ZESZYT, 1961), 263-79.
- Hagood, J. J. et al. "An Examination of the Use of Factor Analysis in the Problem of Sub-Regional Delineation," Rural Sociology, 6, (1941), 216-33.
- Kendall, M. G. "The Geographical Distribution of Crop Productivity in England," Journal of Royal Statistical Society, 102, (1939), 21-62.
- King, Leslie J. "Cross-Sectional Analysis of Canadian Urban Dimensions: 1951 and 1961," Canadian Geographer, X, No. 4, (December, 1966), 205-24.
- Thompson, J. H. et al. "Toward a Geography of Economic Health: The Case of New York State," Annals of the Association of American Geographers, LIII, No. 1, (March, 1962), 1-20.

4. Government Documents

- U.S. Department of Commerce. Bureau of the Census. Metropolitan Area Definition: A Re-Evaluation of Concept and Statistical Practice. Bureau of the Census Working Paper No. 28. Washington, D.C., 1968.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. Number of Inhabitants. Final Report PC(1)-A 18 Kansas. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. Number of Inhabitants. Final Report PC(1)-A 27 Missouri. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. Number of Inhabitants. Final Report PC(1)-A 29 Nebraska. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. Number of Inhabitants. Final Report PC(1)-A 38 Oklahoma. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Population Characteristics. Final Report PC(1)-B 18 Kansas. Washington, D.C.: U.S. Government Printing Office, 1971.

- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Population Characteristics. Final Report PC(1)-B 27 Missouri. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Population Characteristics. Final Report PC(1)-B 29 Nebraska. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Population Characteristics. Final Report PC(1)-B 38 Oklahoma. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Social and Economic Characteristics. Final Report PC(1)-C 18 Kansas. Washington, D.C.: U.S. Government Printing Office, 1972.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Social and Economic Characteristics. Final Report PC(1)-27 Missouri. Washington, D.C.: Government Printing Office, 1972.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Social and Economic Characteristics. Final Report PC(1)-B 29 Nebraska. Washington, D.C.: Government Printing Office, 1972.
- U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. General Social and Economic Characteristics. Final Report PC(1)-C 38 Oklahoma. Washington, D.C.: Government Printing Office, 1972.
- U.S. Department of Commerce. U. S. Bureau of the Census: 1970. County Business Patterns. CBP-70-18 Kansas. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. U.S. Bureau of the Census: 1970. County Business Patterns. CBP-70-27 Missouri. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. U.S. Bureau of the Census: 1970. County Business Patterns. CBP-70-29 Nebraska. Washington, D.C.: U.S. Government Printing Office, 1971.
- U.S. Department of Commerce. U.S. Bureau of the Census: 1970. County Business Patterns. CBP-70-38 Oklahoma. Washington, D.C.: U.S. Government Printing Office, 1971.

5. Unpublished Works

McConnell, Harold. "On the Use of Principal Components Analysis,"
(University of Iowa), pp. 14-17. (Mimeographed).

THE REGIONAL STRUCTURE OF THE KANSAS ECONOMY

by

JAMES FREDRICK BOCK

B.S., Kansas State University, 1970

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARTS

Department of Geography

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1973

The Kansas economic landscape exhibits a rich variety in types and intensity of human activity. Portions of the state are highly urban and industrialized while other parts remain rural and agrarian. Growth and change in modes of livelihood and levels of welfare have varied widely over the state in concert with the general social and economic transformation experienced in the United States. An understanding of the general socio-economic character of the state requires an objective ordering system to distill the observed locational complexity.

The state is divided into one-hundred-and-five county units, each possessing a range of economic characteristics which differentiate it from other counties. However, these are differences of degree. Close analysis indicates there are economic similarities among certain groups of counties. Furthermore, these shared attributes suggest the presence of a spatial ordering of economic activity. In an effort to clarify this hypothesized regularity in the landscape, this study employs a three-step quantitative procedure to develop and assess state economic regions. The procedure involves (1) a factor analysis of sixty-two variable indices of county socio-economic character; (2) a distance scaling of county similarities; and (3) a contiguity grouping of counties with similar characteristics.

Beginning with the one-hundred-and-five county units of Kansas, sixty-two variable indices of economic character were collected for each. The indices were carefully selected and were thought to be best surrogates for representing variability in the economic landscape.

Realizing that in any variable set there is a certain amount of redundancy, a factor analysis was performed upon a matrix of variable correlations in order to increase the parsimony of the variable set. The

result of the analysis was a reduction from the sixty-two interdependent variables to ten orthogonal patterns of variation. The patterns were labeled by correlating the sixty-two variables and the ten factors and observing which variables loaded on which factors.

Utilizing the ten orthogonal patterns, a set of factor scores were determined for each county. These scores indicated the degree of association of each county on the derived factors. It then followed that counties with similar factor scores had similar economies.

Plotting the factor scores in multi-dimensional space and observing the distance between each plot and every other plot, a matrix of distances was produced. Since points lying near one another were alike, it was conceptually possible to distinguish clusterings of plotted points. Such clusterings were identifiable as county groups.

The determination of which counties were the most similar was accomplished by using a contiguity grouping. The grouping procedure joined county observations using the criterion of Euclidean proximity in a multi-dimensional vector space. The observations were initially considered to consist of one-hundred-and-five (r) dimensional groups, each containing one element. The grouping procedure examined all of the observations and joined the two counties separated by the minimum distance. Each step of the grouping procedure decreased by one the number of groups still to be consolidated. Each grouping replaced two joined groups by a new group located at the center of mass of the pair, and this group then contained all the elements of the pair. The end result of this grouping was a set of homogeneous economic regions for the state of Kansas.

The derived regions are considered to represent the basic spatial structure of the Kansas economy. In addition, the results of this analysis

clearly indicates that past attempts to compartmentalize the state were inaccurate. Future private and public planning in the state should benefit from the objectively based regionalization articulated in this study.