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ABSTRACT

Eleven indexes of rurality and their effect on the classification of Michigan's 83 counties were investigated. The indexes were based on different concepts of rurality: (1) percent of employment in agriculture, fishing, and forestry; (2) population density and distance to urban centers; and (3) economic conditions. Index rankings were compared to determine if a county's rank varied from one index to another. The two indexes most frequently associated with extreme ranks were then eliminated and a similar analysis performed. The average county still had adifference of 31 between its highest and lowest rank. Further classification into four discrete quartile groupings also revealed substantial difference in county classification depending on the index selected. Rank correlation analysis revealed that 55 pairs of correlations between indexes were significantly different from 0 at the .01 probability level. Index choice, then, did make a difference, since in selecting a particular index, rurality was explicitly or implicity defined. It was concluded that no one index could satisfy the needs of all potential users, since policy is usually problem specific and the rurality index used should also, therefore, be problem specific. (JC)

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A COMPARATIVE EVALUATION OF INDEXES OF RURALITY—THEIR POLICY IMPLICATIONS AND DISTRIBUTIONAL IMPACTS

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PREFACE

Under U.S. Department of Labor grant number 21-26-73-52 the Department of Agricultural Economics agreed to investigate indexes of rurality and to identify the "best" or superior indexes. Eleven potential indexes were identified in this study and compared for the 83 Michigan counties. Our conclusions are found in this paper.

We express gratitude to our colleagues for their help: to Professor Karl Wright who shared his thinking with us in the early stages of the project; to Professor James Bonnen who reviewed drafts and helped clarify our thoughts; and to Professor Collette Moser, Project Director, for her interest and assistance. We also thank Professors Blair Smith and David Parvin, Agricultural Economists at Georgia Experiment Station, Georgia for allowing us to use some of their unpublished data for the ranking of Michigan counties.

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Introduction

For many years, "what is rural" has been an implicit question of policy-makers and researchers. Yet, seldom has the question been dealt with explicitly. Rather it is often assumed that everyone knows what the term means. The counties containing Detroit and Cincinnati are obviously "urban" while many counties in Appalachia and the Upper Peninsula of Michigan are obviously "rural." But when one attempts to distinguish counties between the extremes of obviously "urban" and obviously "rural," difficulty is encountered.

Differentiating rural from urban is more difficult today than 75 years ago when agriculture and rural were more synonymous. Hathaway, Beegle, and Bryant, in their book entitled PEOPLE OF RURAL AMERICA, account for this change in the following passage:

> Due to numerous causal phenomena, among them technological innovation, the ease of access to urban centers, and firmly fixed channels of farm-to-city migration, the styles of life of farm people in the 1960s appear to have merged with those of society at large. The entities described by the terms "rural" and "urban" have become confused and obscured. Where one resides no longer carries with it an unchanged connotation of attributes that it once may have had. The functions of rural areas as well as the roles associated with them are multiple and it could be a serious error to assume that the sole or even primary function of many rural areas today is agriculturally oriented.1/

Developing a working definition of "rural" and an accompanying measure is not a futile exercise. It conditions one's ability to procure public

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funds and programs for "rural" areas. As Bonnen notes, ..."if rural people desire major access to many of the new programs, they will have to convince the decision-makers .... that there are dimensions of these social problems in rural life."[2] Not only must rural residents show that similar needs and problems exist in their area but that rural areas have some unique needs and problems. In 1968 the Advisory Commission on Intergovernmental Relations followed Bonnen's suggestion and contrasted rural and urban poverty in the following paragraph:

> Rural poverty is greater proportionately. It has a much wider geographic distribution. It is somewhat more insulated from the main thoroughfare of economic activity. Finally, it is less visible, largely because of the foregoing traits. Its basic causes stem from a long-term secular, structural change that has reduced employment in farming and in relatively stable or even declining non-agricultural jobs. High birth rates, limited occupational experience along with other obstacles to mobility, and shrinking local population and tax base all combine to perpetuate this condition in numerous enclaves, large and small, in rural America.[3]

In 1966 it was reported that 45 percent of all low-income families lived in rural areas. Yet only 28 percent of the dollars went to the rural needy for such programs as Neighborhood Youth Corps, Community Action, Adult Basic Education, and Small Business Loans while approximately 40 percent of funds for Summer Head Start and Work Experience Programs were allocated to rural areas.[4] Evidence of this type was used to argue that residents, and especially the rural poor, were victims of discrimination. Critical to this argument is the definition of rural and urban as well as the careful delineation of the proper relationship between residence and program cost effectiveness.

Whether allocating Rural Development Act funds, Department of Labor services, or Cooperative Extension Service resources, elected and bureaucratic decision-makers need some sort of decision rule. If a certain

percentage of the resources are intended to reach rural residents, then the decision rule needs to discriminate between rural and urban. In addition, researchers often need variables which reflect rurality for such investigations as rural to urban migration.

The intrinsic distinctions between rural and urban contained in one's definition of rural should be embedded in the index used to measure ruralness. Thus, researchers must agree on the concept of rural before they can prove that one index measures ruralness better than another.

Since different indexes often have different implicit definitions of "rural," it cannot be concluded that one index is "better" at distinguishing ruralness than another. What can be tested, however, is whether or not the county's classification changes according to the index used. Thus the central question of this paper becomes, "Does the choice of the rurality index differentially affect the classification of counties?"

Some Potential Measures of Rurality

Hathaway, et.al.[5/] contend that if a distinction is to be made between rural and urban there must be something inherently different between the two populations which can be observed and measured. They state that ...

> Given persistent migration from rural to urban areas for many years, selectivity in the migration process, and the functional specialization of urban places, it is not unexpected that rural and urban population groups have different age, educational, and occupational composition. The question is taking all of these things into account does the proximity of a rural area to an urban area of a given size have an influence on the rural area apart from these observed differences in population characteristics? Is there support for the assertion that the degree of rurality in itself is a factor that explains some of the observed differences in such items as family income, personal income, and fertility rates?

In the literature and practice of economic policy formulation many different measures have been used either explicitly or implicitly to

identify rurality. The 11 indexes discussed and compared in this paper are identified in Table 1.

TABLE 1

Index Number	Index Name	Index Description
Index 1	Percent of Employed Labor in Agriculture, Fisheries, and Forestry	Uses 1960 Census data on occupational classifications of those employed.
Index 2	Population Density	A county's total population divided by its geographic area in square miles.
Index 3	Percent of County's Population Classified as Rural	Uses 1960 Census definition of urban places. Residents of all other places are classified as rural and are related to total county population.
Index 4	Bluestone Index	Bluestone has a two-way classification using percent population classified as rural and population density. Bluestone constructs six groups of counties based on these two dimensions.
Index 5	Clifton Index	Clifton has the same two-way classification as Bluestone but uses different criteria to categorize all counties into four groups.
Index 6	Hathaway, Beegle, Bryant Index	These three authors construct an index based on a county's distance from the nearest SMSA and the size of the dominant county within the SMSA.
Index 7	Smith-Parvin Index	Smith and Parvin construct an index of rurality based on population density, percent of employed labor force not employed in agriculture, fisheries, and forestry, and a population proximity to SMSA variable.

(continued)

TABLE 1 (continued)

Index Number	Index Name	Index Description
Index 8	Agglomeration Index	Edwards, Coltrane, and Daberkow use principle component analysis on twelve demographic and economic variables to construct indexes 8, 9, and 10. Index 8 reflects the clustering of people and economic activity.
Index 9	General Business Activity Index	Index 9 focuses on the gross domestic product of an area.
Index 10	Economic Development Index	Index 10 reflects income and other measures of economic welfare and progress including change variables such as willingness to change production patterns and institutional relationships.
Index 11	Earnings Gap	This is an index constructed by John Nixon measuring the difference between the actual and potential earnings of an area and is an indicator of how well the labor market is operating.

Each of the 11 indexes in Table 1 will be discussed briefly in the next section. Each index will be used to rank Michigan's 83 counties; the rankings will then be compared. If major position changes are noticed, then choice of index makes an important difference.

Conceptual Basis for Indexes of Rurality

Reviewing the literature, one can identify three major approaches used to define and measure rurality. The first is the equating of rural with agriculture, or more recently, agriculture and other spatially oriented

industries such as forestry. A second approach, the most common one, is the interaction among demographic and geographic variables. Indexes numbered 2 through 6 have this orientation.

Finally, an approach implicit in much policy discussion of the 1960s, is the association of economic underdevelopment with rurality. While it was never stated that rural meant underdeveloped, policy-makers behaved as if this were the case. The approach is not without its merits. Rural-oriented industries, such as agriculture, mining and forestry, have as an aggregate declined relative to other industries over the past three decades. This decline led to low labor earnings and associated migration of the best part of the labor force to more urban areas. Thus, relative underdevelopment correctly characterizes many traditionally rural communities. Indexes 7 through 11 tend to focus on relative development. Each major approach and its respective index will now be reviewed.

Agriculture and Rurality

For many years, the words agriculture and rurality were used interchangeably. With the growth of rural-nonfarm dwellers, as defined by the Census Bureau, and other changes mentioned in Hathaway, et.al., this identification is no longer as prevalent. Index 1 considered in this paper is the percent of employed labor force employed in agriculture, forestry, and fisheries. This primary sector of the economy requires extensive use of land; wide expanses of land are easily associated with rurality.

Professor Karl Wright, Michigan State University, in a study of work off-farm in Michigan, took agricultural employment, farmers plus farm laborers, as a percentage of total employment and ranked the 83 Michigan counties.[6] Using 1970 data, he observed that of the ten counties with

the lowest percentage agricultural employment and therefore considered the most urban: a) six were in the top ten in value added in manufacturing; b) six were in the top ten in population density; c) two were Upper Peninsula counties; and d) one was in the northern Lower Peninsula county. The latter three had low population density and low value added by manufacturing.[7]

Demographic and Geographic Characteristics and Rurality

Another group of rurality indexes focuses on demo-geographic variables such as population, area, distance from urban centers, etc. One of the easiest indexes to construct is Index 2, population density. The fewer the number of people per square mile, the more rural the county. This measure is sensitive to variability in size of counties. For instance, Denver, Colorado is a densely populated urban center situated in a very large county which includes a large sparsely settled mountainous area. The population density index classifies this county near the rural end of the scale even though most of its residents are clearly urban dwellers. Since county size is not uniform within most states, let alone throughout the entire country, many similar problems can be expected.

Index 3 is probably the most widely used index of rurality and builds on the Census Bureau's definition of urban residents since those not classified as urban are by Census definition, rural. The following definition of urban was used in 1960:

> ...all persons living in (a) places of 2,500 or more incorporated as cities, boroughs, villages, and towns (except towns in New England, New York, and Wisconsin); (b) the densely settled urban fringe, whether incorporated or unincorporated, of urbanized areas....; (c) towns in New England and townships in New Jersey and Pennsylvania which contain no incorporated municipalities as subdivisions and have either 25,000 inhabitants or more or a population of 2,500 to 25,000 and a density of 1,500 persons or

more per square mile; (d) counties in states other than the New England states, New Jersey and Pennsylvania that have no incorporated municipalities within their boundaries and have a density of 1,500 persons per square mile; and (e) unincorporated places of 2,500 inhabitants or more.[8]

Index 3 utilized in this paper is percent of population classified as rural or 100 minus the percent classified as urban. Variations of this index have been used by Government agencies. The Rural Development Act of 1972 defines rural as villages, small cities and towns with a population of 10,000 or less and the open countryside. For industrialization loar and the placement of Government offices, the maximum city jumps to 50,000 population, the minimum size of a SMSA. According to Blair Smith, the Farmers Home Administration ..."defines rural areas to include open country and those places with a population of not more than 5,500 and not closely associated with urban areas."[9] These variations will not be used in this report.

Indexes 4 and 5 combine the conceptual bases of the previous two indexes since they are based on percent of population classified as urban and population density. Bluestone, in his work for the U.S. Department of Agriculture, used the following six categories and their accompanying criteria:[10]

Group 1. Metropolitan--if percent urban population is greater than 85 percent and the density is greater than 100 per square mile or if the percent urban is greater than 50 percent and the density is greater than 500 people per square mile.

Group 2. Urban--if the urban population is less than 85 percent and the density is between 100 and 500 people per square mile.

Group 3. Semi-isolated Urban--if the percent urban is greater than 50 and the density is less than 100 people per square mile.

Group 4. Densely Settled Rural--if the percent urban population is less than 50 and the density is between 50 and 100 people per square mile.

Group 5. Sparsely Settled Rural with Some Urban Population--if the percent urban population is less than 50 and the density is less than 50 people per square mile.

Group 6. Sparsely Settled Rural with No Urban Population--zero percent urban population and a density less than 50 people per square mile.

Groups 1 and 2 tend to contain large cities and densely settled areas. Group 3 has smaller urban centers and are somewhat isolated from the surrounding counties. Group 4 tends to contain counties with less urban population internally and which tend to cluster around the counties found in Groups 1 and 2. Groups 5 and 6 are progressively more isolated.

Clifton[11/] in his study "Classification and Analysis of Purportedly Homogeneous Farm Real Estate Market Areas" in the U.S. used a modified version of the county classification procedure developed by Bluestone. He used the following groups:

Group 1. Urban--where the density is equal or greater than 200 per square mile and percent population classified as urban equal to 50 percent or greater.

Group 2. Semi-Urban--population density is between 30 and 200 square miles and percent classified as urban equal to 50 percent or greater.

Group 3. Densely Settled Rural--density is greater than 30 people per square mile and percent population classified as urban is less than 50 percent.

Group 4. Rural--density is less than 30 per square mile and percent classified as urban less than 100 percent.

The discrete classifications of Bluestone and Clifton as modified become our fourth and fifth indexes of rurality. Within each of their respective groups, counties of Michigan are ranked according to population density to increase the comparability with the more continuous indexes.

Hathaway, Beegle, and Bryant suggest two measures of rurality that depart from population density by considering instead the distance from,

and thus the impact of a Standard Metropolitan Statistical Area (SMSA), as defined by the Census Bureau, on the surrounding counties. Their first index is simply county distance from a SMSA with a value of one being assigned for each 50 miles. The index range was from 0 (counties within a SMSA) to six (no county was further than 300 miles from a SMSA). Their other measure incorporated both distance from SMSA and size of the SMSA, asserting that the larger the SMSA, the greater the influence on surrounding counties.[12/] Since the size-distance index is more continuous than the index based solely on distance, it will be incorporated into our analysis as Index 6.

Economic Characteristics and Rurality

A third set of rurality indexes centers around economic and social dimensions such as types and levels of economic activity. While these indexes were not designed with the sole purpose of delineating rural areas, they are often used to identify counties which have relative need of public transfers or have potential for growth and development. During the 1960s, there was a strong tendency to imply that rural was synonymous with underdevelopment. Relative to the demo-geographic indexes, the economic and social characteristic based indexes are more problem-oriented and rooted in development theory thus enhancing their analytical explanatory powers.[13/]

Index 7 is based on the work of Smith and Parvin who initially constructed an index containing nine factors and applied it to the counties of Georgia. Their motivation for classifying counties according to their rurality was to highlight the rural-to-urban migration which had allegedly hurt both rural and urban places. The nine factors which they used are:

(1) Population density (persons per square mile)
(2) Percent of persons living in rural areas
(3) Percent of persons living on farms
(4) Average annual percentage change in population, 1940-1970
(5) Percent employment in medical and dental professions
(6) Percent employment in entertainment and recreational services
(7) Percent employment in service work (except private households)
(8) Percent employment in agriculture, forestry, fisheries, and mining
(9) Total population (1,000 persons)

Principal component analysis was used to assign weights to each factor such that the variance of the resulting index is maximized.

The most important factor, i.e., the most heavily weighted, in their index is population density and the least important is service work employment. The resulting index, according to Smith and Parvin, discriminates well between those counties which are "obviously" rural and those "obviously" urban; but a great deal of arbitrariness is required to sort out the bulk of Georgia counties which fall in the middle range.

Later Smith and Parvin extended their work to a factor analysis of 19 variables for the counties of five states. The following three factors, of the original nineteen, are given the largest weights:

(1) Number of persons not employed in agriculture, forestry, or fisheries
(2) Population density
(3) Population-proximity, which is "the sum of the total population in the reference county and the sum of the ratios of the number of persons in all counties within 125 miles of the reference county divided by the distance in miles between the county seat in the reference county and the county seat in each county within the specified distance[14]

The index used in our analysis will be the latter index. It should be noted that Michigan rankings for this index are based on 1970 data while the other indexes of this paper use 1960 data.

The remaining indexes related rurality to the relative lack of economic health. This association is embedded in much U.S. rural policy-making. For

instance, in the early and middle 1960s, the following acts carried the bulk of U.S. attention toward rural areas: Area Redevelopment Act, Accelerated Public Works Act, Appalachian Regional Developmental Act, and the Public Works and Economic Development Act. The criteria used for the allocation of funds was level of economic activity as indicated by level of unemployment and/or percent of low-income families.

Edwards, Coltrane, and Daberkow concentrate on regional variation in economic growth and development.[15/] Their objective was to rank multi-county units according to past development accomplishments and present development needs rather than to rank counties according to their relative rurality. They constructed three indexes which we are identifying as follows:

Index 8 Agglomeration
Index 9 General Business Activity
Index 10 Economic Development

To construct these three indexes, they generate relative weights for the following 12 variables by principal component analysis:

(1) Percentage of the population that is urban
(2) Percentage of the population that is farm
(3) Percentage white collar
(4) Percentage employed in finance, insurance, and real estate
(5) Per capita income
(6) Percentage families with less than $3,000
(7) Percentage housing units sound
(8) Percentage of persons age 25 or over with a high school degree
(9) Percentage of commercial farms with sales greater than $10,000
(10) Retail sales per capita
(11) Bank deposits per capita
(12) Local governmental expenditures per capita

The agglomeration index reflects the clustering of population and economic activities. They state: "Agglomeration economies develop when people and economic activity cluster in urban places."[16/]

The general business activity index focuses on the gross domestic product of an area by giving major weight to such variables as population, income, and employment in a single index.

The economic development index reflects the process of changing the way things are done. As they point out, "Economic development is a process of changing the way of doing things....Discovering resources, inventing techniques, changing the inputs mix, creating products, innovating organizational arrangements, and tapping markets are associated more with new ways of doing things than with expanding the volume of things done; more with development than with growth."[17/]

Our final rurality index is a proxy for the amount of local labor market maladjustment. Index 11 measures the gap between the potential and actual earnings of a county given its population composition. If a local labor market is operating efficiently, then average earnings will be close to the potential which could be earned given full utilization of its human resources.

The index is based on the work of John Nixon who used multiple regression to relate socioeconomic variables to individual earnings and construct an "earnings capacity equation."[18/] Thus for each U.S. county he was able to estimate potential earnings for an "average" citizen and compare it to the actual income per capita for each county. The earnings gaps reflect apparent labor market deficiencies in demand; however, such factors as imperfect knowledge, nonpecuniary income, etc. were not analyzed.

In using this index several observations are needed. First, according to Nixon, "...an 'earnings gap' reflects the amount by which the estimated dollar amount of earnings for an average individual in a county deviates from the national average earnings for individuals with the same socioeconomic characteristics."[19/] Thus, the norm being used is a national one

rather than a state or regional one. Second, there is a strong correlation between size of labor maladjustment and distance of a county from major industrial activity. Also, earnings gaps in counties surrounding urban centers appear positively related to size of urban areas. Both of these observations are consistent with the Hathaway, Beegle, and Bryant approach which used distance and size of SMSA as determinants of rurality.

Index Characteristics

The eleven indexes have additional differentiating characteristics. Some of the indexes are discrete while others are continuous; some are uni-dimensional while others are multi-dimensional.

Discrete Versus Continuous Measures

Some of the indexes assign each county a separate and usually unique value. Other indexes group counties and disregard intra-group variation as in the case of population density. A county can be assigned the actual density in persons per square mile or categorized into high density or low density based on its population density being above or below the national average.

Continuous indexes are preferable to discrete classifications for at least two reasons. First, when variation within a group is greater than between groups, discrete classification becomes meaningless. The Census Bureau in 1960 defined urban places as being communities with a population of 2,500 or more. If a place was not urban, then by default it was rural. One wonders what communities with a population of 2,500 to 5,000 have in common with cities of several hundred thousand. Is its urban commonality greater than that of the small urban community with its rural neighbors?

Second, with continuous indexes, the user has the opportunity, according to the problem under consideration, to decide which counties will be in the urban group and which will be in the rural group. With a discrete index, the user is confined to the grouping of a researcher or of attempting disaggregation which if possible, may require great effort. The Bluestone and Clifton Indexes, Indexes 4 and 5, were discrete as constructed but were made continuous by ranking counties within each of the respective groups according to population density. This modification was designed to facilitate comparison with the continuous indexes.

Even indexes that are essentially continuous may assign the same value to different counties. For instance, Index 3, Percent of County's Population Classified as Rural, has 22 Michigan counties classified as 100-percent rural. Of the indexes reviewed, the Hathaway, Beegle, and Bryant Index, Index 6, has the most Michigan counties involved in a tie with at least one other county.

Dimensionality

Some of the indexes are based on a single variable. One example is Index 2, population density. Others are based on a large number of variables, e.g., Index 10.

The dimensionality of an index is a function of the conceptual simplicity or complexity of the concept of rural and of the availability of direct measures of the concept. A simple concept, such as population density, is easily measured by a single variable. A complex concept, such as the average person's quality of life, may involve several variables or measures. With more complex concepts, one needs to specify carefully the weighting to be used for various components, e.g., should income have equal weight with availability of medical care? If not, what should the relative weights be?

Lack of data may require use of proxy measures and thus introduce complexity into what otherwise would be a simple concept. In this case it is also important to specify carefully the weights so that the weighted-proxy measures closely approximate the desired measure.

In summary, the dimensionality of an index may reflect either the complexity of the definition of rural or the lack of a direct measurement of a simple concept. In any case where multiple variables are used the weights attached to the variables are important.

Index Comparison

Because of definitional uniqueness which lies behind each rurality indicator, it is impossible to say that one indicator reflects rurality better than another. However, it is possible to determine agreement in measuring the degree of rurality among the 11 indexes considered in this study.[20/] All 83 Michigan counties have been ranked from 1-83 for each of the 11 indexes with a rank of 1 for the most urban county and a rank of 83 for the most rural county.[21/] Use of ranks permits comparisons of the indexes without conversion to standardized index scales.[22/] Table 2 displays these rankings for all 11 indexes.

Some simple calculations were made to highlight the rank position changes for different counties. First, the maximum and minimum rankings were identified across all 11 indexes and a rank difference calculated. For instance, Alcona County has its highest rank (77) according to the Agglomeration Index and its lowest rank (47.5) according to the Hathaway, Beegle, Bryant Index. The rank difference or the maximum difference in rank position among indexes for this county is 29.5. Table 3 contains these maximums, minimums, and rank differentials for each county.

TABLE 2

Ranking of Michigan Counties According to Different Indexes of Rurality

County	Percent Agr., For. & Fish. 1	Pop. Dens. 2	Percent Pop. Class. Rural 3	Modified Bluestone 4	Modified Clifton 5	Hathaway, Beegle & Bryant 6	Smith-Parvin 7	Agglomeration 8	Gen. Bus. Act. 9	Econ. Dev'l. 10	Earnings Gap 11
Alcona	75	73	72.5	75	73	47.5	73	77	71	76.5	74
Alger	31	72	27.5	60	72	73.5	79	60	79	72	58
Allegan	61	27	48	35	30	32.5	22	52	37	46.5	25.5
Alpena	29	37.5	23	21	16	60.5	48	26	24	27	21
Antrim	70.5	60	72.5	69	60	60.5	65.5	67	65	68	79
Arenac	69	54	72.5	65	54	32.5	43	72	56	65.5	53
Baraga	45	79	72.5	80	79	80.5	77	65	68	70	61
Barry	59.5	34.5	54	42	37.5	32.5	32	49.5	53	50	25.5
Bay	17	11	12	11	10	23.5	16	16	22	17	19
Benzie	50	56	72.5	67	56	60.5	64	54	45	48	75
Berrien	37	9	24	9	20	16.5	10	17	17	15	8
Branch	55.5	28	49	36	31	32.5	30.5	49.5	32	41.5	29.5
Calhoun	19.5	13	14	13	12	32.5	14	8	8	8	6
Cass	48.5	24	56	33	28	32.5	25	56	59	57	28
Charlevoix	44	47	35.5	52	47	60.5	60	38	43	38	78
Cheboygan	40	64.5	37	55.5	64	68	68	32	62	44.5	69
Chippewa	30	62	18	27	62	73.5	57	25	41	33	50
Clare	42.5	63	72.5	71	63	47.5	50.5	63	62	62	64
Clinton	67	30	51.5	38	33	6	28	51	42	46.5	33
Crawford	4	75	72.5	77	75	47.5	71	37	55	44.5	55.5
Delta	31	52	16	25	52	73.5	50.5	20	31	25	39
Dickinson	15.5	48	7	23	19	73.5	55	18	23	21	43
Eaton	47	21	38	30	25	6	20	31	27	29	37
Emmet	35	43	39	50	44	68	59	19	18	16	73
Genesee	3	4	6	4	4	2.5	4	9	9	10	7
Gladwin	77	61	72.5	70	61	32.5	49	79	81	80	49
Gogebic	9.5	59	11	26	59	78	62	27	48	36	55.5
Gr. Traverse	33	26	19	20	15	60.5	40	13	13	13	31
Gratiot	63	31	34	39	34	32.5	34	40	21	28	34
Hillsdale	70.5	34.5	50	43	37.5	16.5	29	61	44	52	45
Houghton	23.5	42	45	49	43	80.5	54	45	74.5	60	67
Huron	82	40	61	47	41	32.5	53	74	51	61	44
Ingham	11	6	4	6	6	6	6	2	1	1	23
Ionia	57.5	25	42	34	29	32.5	30.5	48	36	43	42
Iosco	36	51	72.5	64	49	47.5	45	33	29	32	40.5
Iron	14	67	51.5	57	67	73.5	59	41	48	39.5	32
Isabella	53	33	32	41	36	32.5	35	39	33	37	48
Jackson	19.5	14	17	14	13	10	13	11	12	11	10
Kalamazoo	12.5	7	9	7	7	16.5	8	7	6	6	13.5
Kalkaska	62	60	72.5	81	80	60.5	74	69	70	71	81
Kent	9.5	5	5	5	5	3.5	5	4	5	5	12
Keweenaw	23.5	83	72.5	83	83	83	83	80	83	83	65
Lake	54	74	72.5	76	74	47.5	61	81	82	82	62
Lapeer	73	32	57	40	35	16.5	24	62	38.5	53	27
Leelanau	79	55	72.5	66	55	60.5	65.5	66	60	64	77
Lenawee	42.5	18	33	18	23	16.5	18	29	16	22	24
Livingston	46	29	60	37	32	16.5	19	34	28	31	13.5
Luce	8	76	44	61	76	73.5	82	55	76	65.5	36
Mackinac	26.5	71	46	59	71	73.5	78	46	54	49	68
Macomb	7	2	3	2	2	2.5	3	6	10	7	2
Manistee	32	44	29	51	45	60.5	47	35	35	35	52
Marquette	5	50	15	24	17	80.5	39	24	38.5	30	35
Mason	48.5	39	31	46	40	47.5	44	44	48	39.5	66
Mecosta	55.5	41	35.5	48	42	47.5	42	47	61	56	80
Menominee	57.5	57	27.5	53	57	68	56	53	64	58	59
Midland	15.5	20	22	19	14	32.5	27	10	7	9	4
Missaukee	81	70	72.5	74	70	47.5	67	83	77	81	76
Monroe	26.5	15	47	15	50	16.5	12	43	52	41.5	5
Montcalm	59.5	37.5	53	45	51	32.5	36	58	46	54	40.5
Montmorency	67	77.5	72.5	78.5	77.5	60.5	80	71	78	75	83
Muskegon	6	8	13	8	8	23.5	11	14	15	14	18
Newaygo	72	53	59	54	53	47.5	41	64	67	67	46
Oakland	2	3	2	3	3	2.5	2	1	2	2	1
Oceana	80	49	72.5	63	48	47.5	46	75	57.5	69	57
Ogemaw	65	66	72.5	72	66	47.5	58	76	73	76.5	70
Ontonagon	52	77.5	72.5	78.5	77.5	80.5	76	73	80	79	62.5
Osceola	76	58	72.5	68	58	47.5	53	78	72	78	54
Oscoda	64	82	72.5	82	82	47.5	75	70	74.5	73	60
Otsego	41	68	43	56	68	60.5	70	36	34	34	71
Ottawa	34	16	26	16	21	32.5	15	23	20	19	11
Presque Isle	74	64.5	41	55.5	65	60.5	72	57	69	63	15
Roscommon	12.5	69	72.5	73	69	47.5	63	15	25	18	72
Saginaw	19.5	12	10	12	11	16.5	9	12	11	12	9
St. Clair	25	17	25	17	22	16.5	17	22	26	24	17
St. Joseph	39	22	40	31	26	32.5	26	30	14	20	22
Sanilac	83	45	72.5	62	46	16.5	37	82	57.5	74	47
Schoolcraft	28	81	21	28	81	73.5	81	42	66	55	62.5
Shiawassee	38	19	30	29	24	16.5	21	28	19	23	20
Tuscola	78	36	58	44	39	16.5	33	68	50	59	29.5
Van Buren	67	23	55	32	27	32.5	23	59	40	51	38
Washtenaw	19.5	10	8	10	9	8.5	7	5	3	4	16
Wayne	1	1	1	1	1	2.5	1	3	4	3	3
Wexford	22	46	20	22	18	60.5	52	21	30	26	51

TABLE 3

Maximum and Minimum Ranking Positions and Differentials

County	Based on 11 Indexes			Based on 9 Indexes (Excludes Indexes 1 and 6)		
	Maximum	Minimum	Rank Difference	Maximum	Minimum	Rank Difference
Alcona	77	47.5	29.5	77	71	6
Alger	79	27.5	51.5	79	27.5	51.5
Allegan	61	22	39	52	22	30
Alpena	60.5	16	44.5	48	16	32
Antrim	79	60	19	79	60	19
Arenac	72.5	32.5	40	72.5	43	29.5
Baraga	80.5	45	35.5	80	61	19
Barry	59.5	25.5	34	54	25.5	28.5
Bay	23.5	10	13.5	22	10	12
Benzie	75	45	30	75	45	30
Berrien	37	8	29	24	8	16
Branch	55.5	28	27.5	49.5	28	21.5
Calhoun	32.5	6	26.5	14	6	8
Cass	59	24	35	59	24	35
Charlevoix	78	35.5	42.5	78	35.5	42.5
Cheboygan	69	32	37	69	32	37
Chippewa	73.5	18	55.5	62	18	44
Clare	72.5	42.5	30	72.5	50.5	22
Clinton	67	6	61	51.5	28	23.5
Crawford	77	4	73	77	37	40
Delta	73.5	16	57.5	52	16	36
Dickinson	73.5	7	66.5	55	7	48
Eaton	47	6	41	38	20	18
Emmet	73	16	57	73	16	57
Genesee	10	2.5	7.5	10	4	6
Gladwin	81	32.5	48.5	81	49	32
Gogebic	78	9.5	68.5	62	11	51
Grand Traverse	60.5	13	47.5	40	13	27
Gratiot	63	21	42	40	21	19
Hillsdale	70.5	16.5	54	61	29	32
Houghton	80.5	23.5	57	74.5	42	32.5
Huron	82	32.5	49.5	74	38	36
Ingham	23	1	22	23	1	22
Ionia	57.5	25	32.5	48	25	23
Iosco	72.5	29	43.5	72.5	29	43.5
Iron	73.5	14	59.5	69	32	37
Isabella	53	32	21	48	32	16
Jackson	19.5	10	9.5	17	10	7
Kalamazoo	16.5	6	10.5	13.5	6	7.5
Kalkaska	81	60.5	20.5	81	70	11
Kent	12	4	8	12	4	8
Keweenaw	83	23.5	59.5	83	65	18
Lake	82	47.5	34.5	82	61	21
Lapeer	73	16.5	56.5	62	24	38
Leelanau	79	55	24	77	55	22
Lenawee	42.5	16	26.5	33	16	17
Livingston	60	13.5	46.5	60	13.5	46.5
Luce	82	8	74	82	36	46
Mackinac	78	26.5	51.5	78	46	32
Macomb	10	2	8	10	2	8
Manistee	60.5	9	31.5	52	29	23
Marquette	80.5	5	75.5	50	15	35
Mason	66	31	35	66	31	35
Mecosta	80	35.5	44.5	80	35.5	44.5
Menominee	68	27.5	40.5	64	27.5	36.5
Midland	32.5	4	28.5	27	4	23
Missaukee	83	47.5	35.5	83	67	16
Monroe	52	5	47	52	5	47
Montcalm	59.5	32.5	27	58	36	22
Montmorency	83	60.5	22.5	83	71	12
Muskegon	23.5	6	17.5	18	8	10
Newaygo	72	41	31	67	41	26
Oakland	3	1	2	3	1	2
Oceana	80	46	34	72.5	46	26.5
Ogemaw	76.5	47.5	29	76.5	58	18.5
Ontonagon	80.5	52	28.5	80.5	62.5	18
Osceola	78	47.5	30.5	78	53	25
Oscoda	82	47.5	34.5	82	60	22
Otsego	71	34	37	71	34	37
Ottawa	34	11	23	26	11	15
Presque Isle	74	15	59	72	15	57
Roscommon	73	12.5	60.5	73	15	58
Saginaw	19.5	9	10.5	12	9	3
St. Clair	26	16.5	9.5	26	17	9
St. Joseph	40	14	26	40	14	26
Sanilac	83	16.5	66.5	82	37	45
Schoolcraft	81	21	60	81	21	60
Shiawassee	38	16.5	21.5	30	19	11
Tuscola	78	16.5	61.5	68	29.5	38.5
Van Buren	67	23	44	59	23	36
Washtenaw	19.5	3	16.5	16	3	13
Wayne	4	1	3	4	1	3
Wexford	60.5	18	42.5	52	18	34
Average			37.27			27.14

Two of the 11 indexes, the Hathaway, Beegle, Bryant Index and the index of percent employed in agriculture, fisheries, and forestry, accounted for most of the extreme rankings. These two indexes were omitted and maximums, minimums, and ranking differentials were again calculated for each county. These results are also found in Table 2. The average ranking change between the maximum and minimum ranking for each county across all 11 indexes is 37 positions, while the average for 9 indexes is 31. Even with the two extreme indicators omitted, there is still substantial position alteration.

To obtain a better feel of how a county's rank might change according to which index is chosen, we can look at Table 4 which shows the number of counties falling within different ranges of maximum possible rank changes. Across all 11 indexes, 32 of the 83 counties change by 41 ranks or more. When the two indexes producing the most maximums and minimums are eliminated, 13 counties change by 41 ranks or more. More than half the counties, 48, change by 31 positions or more when 11 indexes are used; 34 counties change by at least that amount when the 9 indexes are used.

TABLE 4

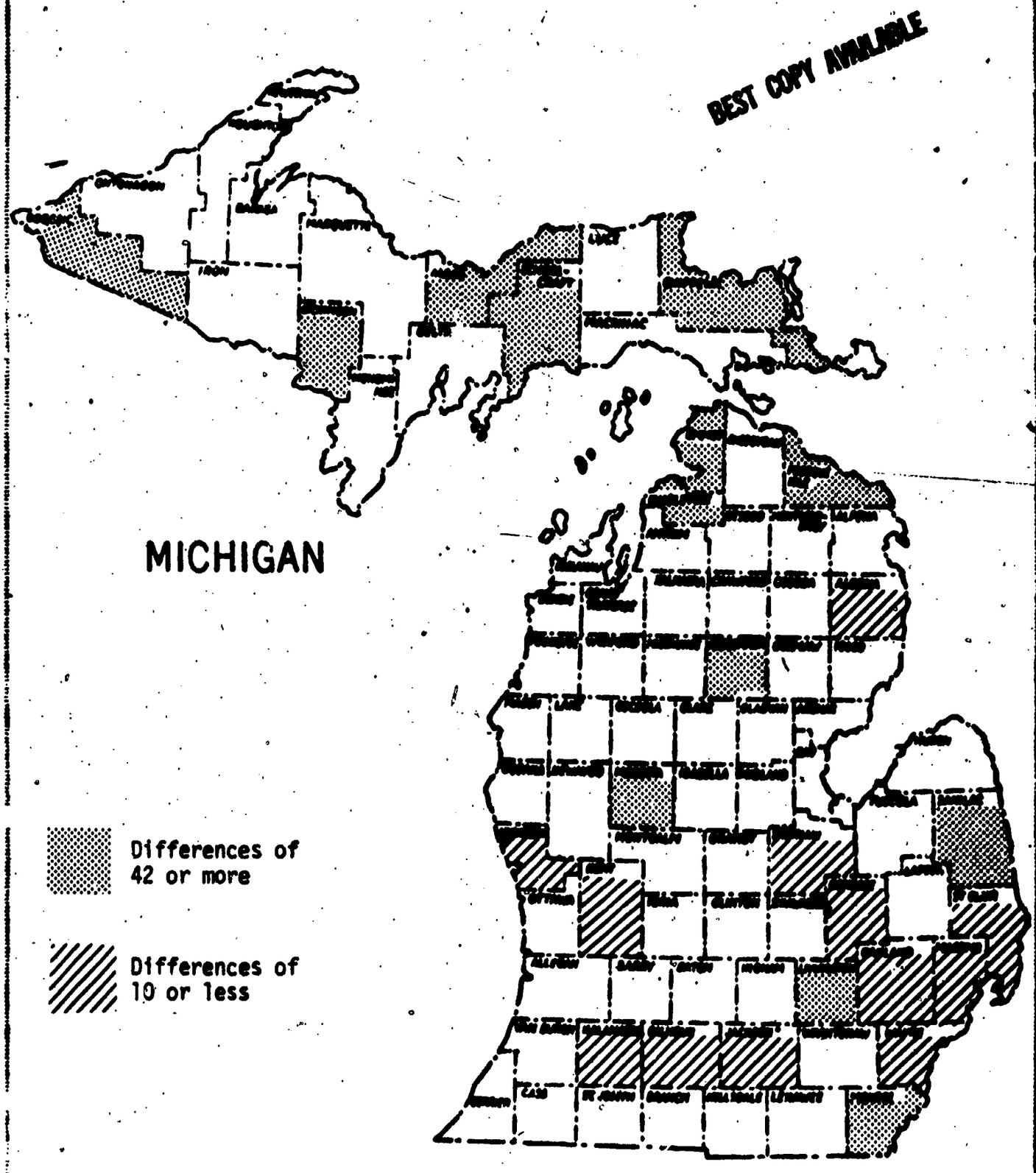
Number of Counties Falling Within Different Ranges of Maximum Rank Change

Difference Between Minimum and Maximum Rank Change Between Any Pair of Indexes	Number of Counties in Category Using:	
	Eleven Indexes	Nine Indexes
0-10	7	12
11-20	9	18
21-30	19	19
31-40	16	21
41-50	11	7
51-60	13	6
61-83	8	0
	83	83

Which counties have the larger ranges between their maximum and minimum rankings? The counties shaded in the following map have a spread between their maximum and minimum rankings of 42 or greater and those with slanted lines are those with a difference of 10 or less. It is interesting to note that those counties which have the greatest variation are those counties which most people would think of as obviously rural. Most of the counties with the least variation are those around Detroit, Grand Rapids, and Jackson; except for Jackson County, these are "obviously urban" counties. It is ironic that indexes which have been constructed to reflect either rurality or used to delineate rural regions, should show the greatest possible variation in the more remote parts of the state.

Some users may prefer a discrete index that merely groups counties without ranking within groups. It is then relevant to ask if choice of an index affects a county's placement into a particular group. For simplicity, assume categorization into four groups of approximately equal size. For each index, 21 counties are placed in the most urban group (Group 1) and 20 are placed in the most rural group (Group 4). The two middle groupings also include 21 counties.[23] How many different quartiles will counties occupy when the 11 indexes are used to group counties? Seventeen counties were placed in all four quartiles, 24 counties were placed in three quartiles, 33 counties were in two different quartiles and only nine counties, all Group 1 or urban counties, were place in one quartile. Table A-1 in the Appendix displays the number of indexes which place a particular county into one of the four arbitrary groups.

In our earlier discussion, we broke the 11 indexes into the following three groups: 1) indexes which focused on agriculture or extensive land use type economic activity; 2) indexes which dealt with demographic and



Map 1. Comparison of Rurality Ranks for Michigan Counties

geographic dimensions; 3) indexes which reflect something about the type and level of economic activity. Table A-2 takes the indexes concerned with the demo-geographic dimensions and identifies the maximum and minimum ranking and the difference between the two. The average rank change between the two extremes is 25. Again the greatest differences between the maximum and minimum rankings are found in the more rural counties.

Also in Table A-2, the maximums and minimums and the differentials are constructed for indexes which deal with economic variables. The average position change is 24. Table 5 indicates for both sets of indexes the number of rank changes possible between maximums and minimums rankings. While there are 15 counties with a rank change of 41 or more for the demo-geographic group and only 8 counties with that much rank change for the economic group, there is little reason to prefer one group to the other. Thus, it is clear that even when one narrows the range of possible indexes by specifying a type of variable to emphasize, one still encounters a marked difference among indexes within the group.

TABLE 5

Number of Counties Falling Within Different Ranges of Maximum Rank Changes

Range of Maximum Rank Changes	Rurality Indexes Using Primarily Demo-Geographic Variables	Rurality Indexes Using Primarily Economic Variables
0-10	17	15
11-20	15	24
21-30	24	18
31-40	12	18
41-50	8	3
51-60	4	4
61-70	3	0
71-80	0	1
	83	83

Some of the indexes tend to account for more maximums and minimums. Table 6 shows the number of maximums and minimums which can be attributed to each index (based on both the 11 indexes and the 9 indexes). As indicated earlier, the index of percent employed in agriculture, fisheries, and forestry, and the Hathaway, Beegle, Bryant Index account for most of the minimums and maximums. It should also be noted that the economic development index accounts for the fewest number of maximum and minimum rankings with the modified Bluestone Index a fairly close second.

TABLE 6

Maximum and Minimum Rankings Generated by the Different Indexes

Index Number and Name	Eleven Indexes		Nine Indexes	
	Maximum	Minimum	Maximum	Minimum
1 Percent Agriculture	24	9	Excluded	
2 Percent Rural	3	12	14	11
3 Population Density	5	10	9	10
4 Bluestone	6	3	7	4
5 Clifton	5	7	7	8
6 Hathaway	20	15	Excluded	
7 Smith-Parvin	5	4	13	18
8 Agglomeration	6	3	13	6
9 General Business Activity	8	11	14	9
10 Economic Development	4	4	7	2
11 Earnings Gap	13	8	20	16
Total*	99	86	104	84

*Totals do not add up to 83 because of ties for the maximum or minimum.

Table 7 displays the rank correlations among the various indexes. Only 1 of the 55 correlations is near zero--that between the modified Clifton and the Earnings Gap indexes. These two indexes have different purposes. Clifton constructed an index to study land prices while Nixon developed the earnings gap to measure labor market efficiency. In general

the rank correlations among indexes are large. All but the one mentioned above are significantly different from zero at a .01 probability level.

TABLE 7

Rank Correlation Among the Eleven Indexes of Rurality*

Index Number	Index Number										
	1	2	3	4	5	6	7	8	9	10	11
1		.4261	.5932	.5191	.6526	.2058	.8548	.4300	.6840	.7699	.7090
2			.7207	.8707	.4542	.6491	.4905	.7149	.6503	.5568	.2324
3				.8513	.5349	.4186	.6471	.5681	.6628	.6870	.4377
4					.5084	.5496	.5842	.6631	.6870	.6299	.3354
5						.3006	.6295	.4575	.6217	.5946	.4964
6							.2610	.5479	.4343	.3240	.0154
7								.5062	.7991	.8974	.6244
8									.7132	.5893	.2168
9										.8121	.4305
10											.5330
11											

*Computed from ranks reported in Table 1. Correlations below diagonal are equal to those above since correlations are symmetric.

The statistical test of significance on the correlation coefficients investigated the hypothesis of zero correlation among indexes. The analysis of rank changes, while not pursued to a statistical significance test, implicitly investigated the hypothesis of perfect correlation among all the indexes--or of zero rank change. It is obvious that a statistical test would also reject that hypothesis at any reasonable probability level. Thus we can reject both the hypothesis of zero and the hypothesis of perfect correlation.

On a pair-wise basis there are high (greater than 0.8) correlations between:

a) Smith-Parvin Index and the Economic Development Index

b) Population Density Index and the Hathaway, Beegle, and Bryant Index

c) Smith-Parvin Index and the Percent Employed in Agriculture, Forestry, and Fisheries Index.

The previous descriptions of these indexes indicates that these pairs are all related with each other in terms of their conceptual basis.

In summary the analysis suggests that while the 11 indexes are correlated with each other, that correlation is far from perfect. There are major rank or quartile group changes depending on one's implicit definition of rural; and these changes are least important for counties that are most clearly urban. Choice of index does make a difference.

Summary and Conclusions

The purpose of this study was to investigate alternative measures or indexes of rurality and their effect on the classification of Michigan counties as more or less rural. Eleven indexes were studied. These were indexes that either have been or might be used as measures of rurality.

Different indexes are associated with different concepts of rurality. Some concepts have their base in agriculture and use percent of employment in agriculture or in agriculture, forestry, and fishing as a measure. Others are based on considerations of population density and distance to urban centers. A third group is based primarily on economic conditions. Indexes based on the latter two conceptual bases are usually multi-dimensional, i.e., there are two or more measures weighted into the index. Indeed, one index considered 19 different variables.

The basic analysis ranked all 83 Michigan counties by each index. These rankings were then compared to determine if a county's rank varied from one index to another. When all 11 indexes were studied, the average county had a difference of 37 between its highest and lowest rank (Table 3). Or, to state it in another way, 32 counties had a rank difference of

41 or more (Table 4). The two indexes most frequently associated with extreme ranks were then eliminated and a similar analysis performed. The average county still had a difference of 31 between its highest and lowest rank (Table 3) and 34 had a rank difference of 31 or more (Table 4).

While an argument for use of continuous indexes was presented, a classification into four discrete quartile groupings was analyzed. Only nine counties remained in the same quartile for all indexes; 33 were placed in two quartiles; 24 in three different quartiles; and 17 in all four quartiles (Table A-1). Therefore, use of discrete groupings also reflects substantial difference in classification of a county depending on the index selected.

In general, those counties considered most urban were those least affected by choice of index. This is consistent with the belief that less urban counties are more heterogeneous than the more urban counties.

Another analytical device was a rank correlation analysis. All but one of 55 pairs of correlations between indexes were significantly different from zero at the .01 probability level. This does not, however, contradict the preceding analysis. Moreover, since only three of the 55 correlations were greater than 0.8 and most were significantly different from one in a statistical sense, the hypothesis that index choice made no difference (an expected correlation of +1.0) was rejected.

Thus we conclude that the index chosen does make a difference. In selecting a particular index, one explicitly or implicitly is defining rurality. That definition of rurality affects the classification of a county and, therefore, affects any benefits or costs imposed on residents of the county.

Our analysis has focused on the definition and measurement of rurality. In the introduction several different uses for such an index were mentioned. Can any one index satisfy the needs of all potential users? Our answer is no. The answer is negative because policy is usually problem specific. And if a policy is designed to solve or alleviate a specific problem, then the index used in the decision rule to allocate funds or services should also be problem specific. One of the rurality concepts highlighted the relation between population and land area (population density index) while another reflected some degree of economic activity (general business activity and economic development indexes). If the problem being addressed is labor market deficiency, then the choice of index needs to be made between population density, which reflects labor supply or economic activity which reflects labor demand or a joint product of the two. The conceptual basis of the other rurality indexes discussed also needs to be related to the conceptual basis underlying the problem of labor market deficiency if the most appropriate index is to be used.

One further comment is in order. The analysis has focused on one state--Michigan. While the analysis may not be valid for each and every state, we expect that the conclusions are valid for the United States as a whole and for most large and/or heterogeneous states. Analyses for other states would provide useful confirmatory or refutory evidence.

FOOTNOTLS

1. Dale E. Hathaway; J. Allan Beegle; and W. Keith Bryant, People of Rural America, U.S. Bureau of the Census (A 1960 Census Monograph) (U.S. Government Printing Office, Washington, D.C., 1968), p. 1.

2. James T. Bonnen, "Emerging Public Policy Orientation and New Programs on Rural Life," Politics Affecting Rural People (Raleigh, Agricultural Policy Institute, North Carolina State University, April 1966).

3. Urban and Rural America: Policies for Future Growth (Washington, D.C.: Advisory Commission on Intergovernmental Relations, April 1968), A-32.

4. Intergovernmental Relations in the Poverty Program, a commission report by the Advisory Commission on Intergovernmental Relations (U.S. Government Printing Office, Washington, D.C., April 1966), p. 137.

5. Dale E. Hathaway, et.al., op.cit., pp. 2-3.

6. For the comparative analysis of indexes, which is the last section of this paper, we shall use percent of employed labor force employed in agriculture, fisheries, and forestry instead of percent employed only in agriculture for two reasons. First, another index, the Smith-Parvin Index, has as one of its factors percent of employed labor force not employed in agriculture, forestry, and fisheries. Second, when the rankings of Michigan counties for the two variations of this index were compared, few differences were observed.

7. A county may be quite remote and have very marginal soil for agricultural purposes. There is reason to believe that as different territories were settled during the 1700s and 1800s people tended to locate in areas with high soil fertility. Many of these developed into urban centers.

8. U.S. Census of Population: 1960, Vol. 1, "Characteristics of the Population, Part 1," U.S. Summary (U.S. Government Printing Office, Washington, D.C., 1964).

9. Blair J. Smith and David W. Parvin, Jr., "Defining and Measuring Rurality," Southern Journal of Agricultural Economics, Vol. 5, No. 1 (July 1973), p. 110.

10. Herman Bluestone, "Focus for Area Development Analysis: Urban Orientation of Counties," Economic Development Division, Economic Research Service, USDA.

11. Ivery Clifton, Agricultural Economist, Economic Research Service, USDA, unpublished manuscript.

12. Dale E. Hathaway, et.al., op.cit., pp. 7-12.

13. Clark Edwards and Robert Coltrane, "Economic and Social Indicators of Rural Development from an Economic Viewpoint," Southern Journal of Agricultural Economics, Vol. 4 (July 1972), p. 244.

14. Blair J. Smith and David W. Parvin, Jr., "Comparative Levels of Rurality Among Georgia Counties," Faculty Series, Agricultural Economics, University of Georgia.

15. Clark Edwards; Robert Coltrane; and Stan Daberkow, Economic Variations in Economic Growth and Development, U.S. Department of Agriculture, Economic Research Service, Agricultural Economics Report No. 205.

16. Ibid., p. 45.

17. Ibid., p. 6.

18. John Wayne Nixon, "An Analysis of Apparent Maladjustment in Local Labor Markets of the U.S.," unpublished Ph.D. thesis, Michigan State University, (1967).

19. Ibid., p. 102.

20. Some are interested in distributional consequences resulting from choice of a rurality index. Assume public decision-makers desire an allocative formula which discriminates between urban and rural counties. Assume further that the following linear relationship exists between the rank position of a county (RP_i) according to some index of rurality and the level of subsidy (SUB_i) it receives:

$$SUB_i = A + B(RP_i)$$

where A and B are parameters of the allocative formula. If there are major rank position changes according to which rurality index is used to rank the counties, then major distributional consequences will result. Other decision rules, such as a quadratic relationship, can be suggested, but the same conclusion is valid that if there are major position changes, significant subsidy level changes will result.

The rationale for using rank position of the county in the decision rule rather than the actual index level is to facilitate our indicator comparison. If the decision rule is constructed such that the magnitude of the index were inserted rather than the rank position, the distributional consequences will likely be different than if rank position were used. For instance, assume that we have two counties (A and B) ranking 63 and 64 according to Index 1 and Index 2; the difference is one and according to our allocation the county will receive B amount more for Index 1 than Index 2. If the absolute differences between the actual index values is very small, say .05, then the distributional consequences of using actual values will be less than if rank position were used. Conversely if the difference between the actual index values is greater than the average difference in the actual values, the distributional consequence is greater.

21. If two counties have the same index value, they are assigned a rank which is an average of the next two successive ranks. For instance, if two counties had the same population density and if the next two ranks to be assigned were 63 and 64, then each of the two counties would be ranked 63.5 ([63 + 64] ÷ 2).

22. An example of a standardized scale would be one where the state average equals 100 and the standard deviation across counties is 10. Since any such scale is, in a sense, arbitrary, the ranks should give almost as much information.

23. This is equivalent to assigning ranks 1 through 21 to Group 1, ranks 22 through 42 to Group 2, ranks 43 through 63 to Group 3, and ranks 64 through 83 to Group 4.

APPENDIX

Table A-1 NUMBER OF TIMES A COUNTY IS RANKED WITHIN DIFFERENT RANKING RANGES

COUNTY	RANKING RANGES 1-21	22-42	43-63	64-83
Alcona			1 (H) *	10 (%Ag) *
Alger		1	4 (%Ag)	6 (H)
Allegan		7 (H)	4 (%Ag)	
Alpena	3	6 (%Ag)	2 (H)	
Antrim			3 (H)	8 (%Ag)
Arenac		1 (H)	5	5 (%Ag)
Baraga			2 (%Ag)	9 (H)
Barry		6 (H)	5 (%Ag)	
Bay	9 (%Ag)	2 (H)		
Benzie			7 (H-%Ag)	4
Berrien	9 (H)	2 (%Ag)		
Branch		8 (H)	3 (%Ag)	
Calhoun	10 (%Ag)	1 (H)		
Cass		6 (H)	5 (%Ag)	
Charlevoix		3	7 (H-%Ag)	
Cheboygan		3 (%Ag)	3	5 (H)
Chippewa	1	5 (%Ag)	4	1 (H)
Clare		1 (%Ag)	7 (H)	3
Clinton	1 (H)	6	3	1 (%Ag)
Crawford	1 (%Ag)	1	4 (H)	5
Delta	2	5 (%Ag)	3	1 (H)
Dickinson	5 (%Ag)	2	3	1 (H)
Eaton	3 (H)	7	1 (%Ag)	
Emmet	3	2 (%Ag)	4	2 (H)
Genesee	11 (H-%Ag)			
Gladwin		1 (H)	4	6 (%Ag)
Gogebic	2 (%Ag)	3	5	1 (H)
Grand Traverse	6	4 (%Ag)	1 (H)	
Gratiot	1	9 (H)	1 (%Ag)	
Hillsdale	1 (H)	3	6	1 (%Ag)
Houghton		1 (%Ag)	6	3 (H)
Huron	4 (H)	5	2 (%Ag)	
Ingham	10 (H-%Ag)	1		
Ionia		8 (H)	3 (%Ag)	
Iosco		5 (%Ag)	4 (H)	2
Iron	1 (%Ag)	3	3	4 (H)
Isabella		9 (H)	2 (%Ag)	
Jackson	11 (H-%Ag)			
Kalamazoo	11 (H-%Ag)			
Kalkaska			2	9
Kent	2 (H-%Ag)			
Keweenaw		1 (%Ag)		10 (H)
Lake			3 (H-%Ag)	8
Lapeer	1 (H)	6	3	1 (%Ag)
Leelanau			4 (H)	7 (%Ag)
Lenawee	5 (H)	5	1 (%Ag)	
Livingston	3 (H)	6	2 (%Ag)	
Luce	1 (%Ag)	1	3	6 (H)
Mackinac		1 (%Ag)	5	5 (H)
Macomb	2 (H-%Ag)			
Manistee		5 (%Ag)	6 (H)	
Marquette	3 (%Ag)	6	1	1 (H)
Mason		4	6 (H-%Ag)	1
Mecosta		4	6 (H-%Ag)	1
Menominee		1	8 (%Ag)	2 (H)
Midland	8 (%Ag)	3 (H)		
Missaukee			1 (H)	10 (%Ag)
Monroe	5 (H)	2 (%Ag)	4	
Montcalm		4 (H)	7 (%Ag)	
Montmorency			1 (H)	10 (%Ag)
Muskegon	10 (%Ag)	1 (H)		
Newaygo		1	6 (H)	4 (%Ag)
Oakland	2 (H-%Ag)			
Oceana			7 (H)	4 (%Ag)
Ogemaw			2 (H)	9 (%Ag)
Ontonagon			2 (%Ag)	9 (H)
Osceola			5 (H)	6 (%Ag)
Oscoda			2 (H)	9 (%Ag)
Otsego		4 (%Ag)	3 (H)	4
Ottawa	7	4 (H-%Ag)		
Presque Isle	1	1	4 (H)	5 (%Ag)
Roscommon	3 (%Ag)	1	2 (H)	5
Saginaw	2 (H-%Ag)			
St Clair	5 (H)	6 (%Ag)		
St. Joe	2	9 (H-%Ag)		
Sanilac	1 (H)	1	5	4 (%Ag)
Schoolcraft	1	3 (%Ag)	2	5 (H)
Shiawassee	5 (H)	6 (%Ag)		
Tuscola	1 (H)	3	5	2 (%Ag)
Van Buren		7	3	1 (%Ag)
Washtenaw	2 (H-%Ag)			
Wayne	2 (H-%Ag)			
Wexford	3	4 (%Ag)	4 (H)	

* The (H) refers to Hathaway, Beegle, and Bryant Index while (Ag) refers to the Percent Employed in Agriculture, Fisheries and Forestry Index. For Alcona County, the Hathaway Index placed it in the 43-63 ranking range while Percent Agriculture put Alcona in the 64-83 ranking range.

TABLE A-2

Maximum and Minimum Ranking Positions and Differentials
For the Following Two Sets of Indexes

County	Indexes Dealing With Demographic and Geographic Dimensions (#2,3,4,5, & 6)			Indexes Reflecting Type and/or Level of Economic Activity (#7,8,9,10, & 11)		
	Maximum	Minimum	Rank Difference	Maximum	Minimum	Rank Difference
Alcona	75	47.5	27.5	77	71	6
Alger	73.5	27.5	46	79	58	21
Allegan	48	27	21	52	22	30
Alpena	60.5	37.5	23	48	21	27
Antrim	72.5	60	12.5	79	65	14
Arenac	72.5	32.5	40	72	43	29
Baraga	80.5	72.5	8	77	61	16
Barry	54	32.5	21.5	53	25.5	27.5
Bay	23.5	10	13.5	22	16	6
Benzie	72.5	56	16.5	75	45	30
Berrien	24	9	15	17	8	9
Branch	49	28	21	49.5	29.5	20
Calhoun	32.5	12	20.5	14	6	8
Cass	56	24	32	59	25	34
Charlevoix	60.5	35.5	25	78	38	40
Cheboygan	68	37	31	69	32	37
Chippewa	73.5	18	55.5	57	25	32
Clare	72.5	47.5	25	64	50.5	13.5
Clinton	51.5	6	45.5	51	28	23
Crawford	77	47.5	29.5	71	37	34
Delta	73.5	16	57.5	50.5	20	30.5
Dickinson	73.5	7	66.5	55	18	37
Eaton	38	6	32	37	20	17
Emmet	68	39	29	73	16	57
Genesee	6	2.5	3.5	10	4	6
Gladwin	72.5	32.5	40	81	49	32
Gogebic	78	11	67	62	27	35
Grand Traverse	60.5	15	45.5	40	13	27
Gratiot	39	31	8	40	21	19
Hillsdale	50	16.5	33.5	61	29	32
Houghton	80.5	42	38.5	74.5	45	29.5
Huron	61	32.5	28.5	74	38	36
Ingham	6	4	2	23	1	22
Ionia	42	25	17	48	30.5	17.5
Iosco	72.5	47.5	25	45	29	16
Iron	73.5	51.5	22	69	32	37
Isabella	41	32	9	48	33	15
Jackson	17	10	7	13	10	3
Kalamazoo	16.5	7	9.5	13.5	6	7.5
Kalkaska	81	60.5	20.5	81	69	12
Kent	8.5	5	3.5	12	5	7
Keweenaw	83	72.5	10.5	83	65	18
Lake	76	47.5	28.5	82	61	21
Lapeer	57	16.5	40.5	62	24	38
Leelanau	72.5	55	17.5	77	60	17
Lenawee	33	16.5	16.5	29	16	13
Livingston	60	16.5	43.5	34	13.5	20.5
Luce	76	44	32	82	36	46
Mackinac	73.5	46	27.5	78	46	32
Macomb	3	2	1	10	2	8
Manistee	60.5	29	31.5	52	35	17
Marquette	80.5	15	65.5	39	24	15
Mason	47.5	31	16.5	66	39.5	26.5
Mecosta	48	35.5	12.5	80	42	38
Menominee	68	27.5	40.5	64	53	11
Midland	32.5	14	18.5	27	4	23
Missaukee	74	47.5	26.5	83	67	16
Monroe	50	15	35	52	5	47
Montcalm	53	32.5	20.5	58	36	22
Montmorency	78.5	60.5	18	83	71	12
Muskegon	23.5	8	15.5	18	11	7
Newaygo	59	47.5	11.5	67	41	26
Oakland	3	2	1	2	1	1
Oceana	72.5	47.5	25	75	46	29
Ogemaw	72.5	47.5	25	76.5	58	18.5
Ontonagon	80.5	72.5	8	80	62.5	17.5
Osceola	72.5	47.5	25	78	53	25
Oscoda	82	47.5	34.5	75	60	15
Otsego	68	43	25	71	34	37
Ottawa	32.5	16	16.5	23	11	12
Presque Isle	65	41	24	72	15	57
Roscommon	73	47.5	25.5	72	15	57
Saginaw	16.5	10	6.5	12	9	3
St. Clair	25	16.5	8.5	26	17	9
St. Joseph	40	22	18	30	14	16
Sanilac	72.5	16.5	56	82	37	45
Schoolcraft	81	21	60	81	42	39
Shiawassee	30	16.5	13.5	28	19	9
Tuscola	58	16.5	41.5	68	29.5	38.5
Van Buren	55	23	32	59	23	36
Washtenaw	10	8	2	16	3	13
Wayne	2.5	1	1.5	4	1	3
Wexford	60.6	18	42.5	52	21	31
Average			28.48			23.34