DOCUMENT RESUME

ED 091 142 RC 007 906

AUTHOR Gouin, Ellen Ammerman
TITLE A Development Index for Sixty Counties in Central Appalachia.
PUB DATE Aug 72
NOTE 112p.; M.S. Thesis, University of Tennessee
AVAILABLE FROM Inter-Library Loan, University of Tennessee, Knoxville

EDRS PRICE MF-$0.75 HC-$5.40 PLUS POSTAGE
DESCRIPTORS Agency Role; Area Studies; *Comparative Analysis; *County Programs; Futures (of Society); Individual Differences; Industrialization; *Information Needs; Measurement Goals; Population Trends; Relationship; *Rural Areas; Social Change; *Socioeconomic Status; Surveys; Values
IDENTIFIERS *Central Appalachia; Commission on Religion in Appalachia; CORA

ABSTRACT

The study was undertaken at the suggestion of the Commission on Religion in Appalachia, a private development agency in Central Appalachia. Given limited resources and the difficulty of obtaining firsthand knowledge of the circumstances in the area, the commission wanted to measure socioeconomic status in the 60 Central Appalachian counties to facilitate recognition of critical need areas. The primary goal of the study was to scale the 60 counties in relation to each other for individual levels of development. To measure developmental status, a composite index was prepared which included 14 socioeconomic indicators. These were chosen on the basis of subjective analysis of the components which affect the social and economic well-being of a geographic area. Only secondary data sources were utilized, with emphasis on the "1970 Census of the Population." The counties were initially scaled for each development indicator. Both observed values and ranked results were reported. The technique of common factor analysis, coupled with oblique rotation, was then employed to detect patterned relationships in the data. Three salient factors were identified: level of development; immobility; and level of industrial activity. A reduced-scale development index utilizing four variables was devised as a working index of developmental change. The report also noted that, in future evaluations of relative changes in status among the 60 counties, the ranking results, rather than factor scores, should be compared. (Author/KM)

A DEVELOPMENT INDEX FOR SIXTY COUNTIES IN CENTRAL APPALACHIA

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Ellen Ammerman Gouin

August 1972

July 28, 1972

To the Graduate Council:

I am submitting herewith a thesis written by Ellen Ammerman Gouin entitled "A Development Index for Sixty Counties in Central Appalachia." I recommend that it be accepted for nine quarter hours in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:

Vice Chancellor for
Graduate Studies and Research

ACKNOWLEDGMENTS

The helpful assistance of a number of people made this thesis project a most enjoyable learning experience. Dr. Frank Goode launched the endeavor in the right direction by matching my desire to do relevant research with an existing research need. Mr. Max Glenn and Mr. Ben Poage of the Commission on Religion in Appalachia proposed the topic of study and provided an excellent incentive to the effort by actually wanting the research results. The Commission graciously paid the expenses associated with the thesis.

Dr. Charles Cleland, who chaired the thesis committee, displayed a remarkable amount of cooperation and courtesy. In spite of his many other academic responsibilities, he always found time to satisfy my need for an impromptu discussion. The other members of the thesis committee, Dr. Charles Sappington and Dr. David Brown, carefully read the thesis and made numerous suggestions which significantly improved its content.

Since I gave birth to a daughter midway through my studies, and nevertheless completed the degree, it is evident that the person who helped me most was my husband. In addition to assuming full-time supervision of the household, he took an active part in performing the factor analysis and in feeding the data to the computer.

To all of these individuals, as well as to the National Science Foundation which supported my graduate studies, I am truly grateful. Sincere thanks to you all!

ABSTRACT

The study was undertaken at the suggestion of the Commission on Religion in Appalachia, a private development agency with programs in Central Appalachia. Given limited resources, and the difficulty of knowing firsthand the circumstances in such a large area, the Commission desired that a measurement of socio-economic status be devised and applied to the sixty Central Appalachian counties, facilitating recognition of areas of more critical need.

The primary goal of the study was to scale the sixty counties in relation to each other as regards their individual levels of development. To measure developmental status, a composite index of development was proposed, which included fourteen socio-economic indicators. The indicators were chosen on the basis of subjective analysis of the components which affect the social and economic well-being of a geographic area. Only secondary data sources were utilized, with emphasis placed on the <u>1970 Census of the Population</u>.

The counties were initially scaled in respect to each development indicator. Both observed values and ranked results were reported. The technique of common factor analysis, coupled with oblique rotation, was then employed to detect patterned relationships in the data. Three salient factors were identified, descriptively named "level of development," "immobility," and "level of industrial activity." Rankings for each county for each factor were reported.

A reduced-scale development index utilizing four variables was devised as a working index of developmental change. It was found to yield results closely correlated with those of the fourteen-variable reference index.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION: AN EXPANDED CONCEPT OF DEVELOPMENT

Until quite recently, the prevalent concept of development focussed primarily on the level of economic activity. A gross national product of impressive magnitude, an adequate rate of economic growth, a high per capita income and similar measures were proffered as evidence of a satisfactory status of national development. Developmental theories dealt with the analysis of impediments to economic activity--such as a lack of infrastructure or the persistence of traditional values--and ways to remove such obstacles. Data collection by governmental agencies was principally designed to diagnose the state of the nation's economy, and fluctuations in key economic indicators attracted great attention. "Well-being" and "economic activity" seemed largely synonymous.

Though these indicators continue to excite general interest, three recent concerns have begun to chip away at the monopoly previously exercised by economic activity on the national consciousness. These three concerns are, namely, (1) the concern over the existence of poverty within the U. S.; (2) the concern over social unrest; and (3) the concern over environmental abuse.

The realization that considerable numbers of Americans live in poverty conditions has prompted legislative and civic action aimed at improving their situation. Such action initially sought to enhance the economic position of the poor, through such channels as welfare payments. Yet, to the dismay of those who established antipoverty programs, the poverty problem seems to persist even in the face of money transfers. There has been a gradual realization that low income is only one dimension of the circumstances denoted as "poverty":

> That low income is only one facet of the poverty problem is indicated by the fact that simple money transfers are not likely to solve the poverty problem.[1]

The quality of life, or developmental status, of many Americans, then is seen to be inadequately summarized by a rising GNP and a high average income.

As the United States moved into the post-industrial era, unforeseen social disturbances began to arise. General criticism of established values, and specific opposition to the U. S. political role abroad; increasing boredom among blue-collar and white-collar workers alike; the challenge to conventional mores and the resultant "generation gap"; apparent increases in crime, divorce, and mental illness rates -- such evidence of discontent with the quality of life appeared despite a high level of economic activity:

> It seems paradoxical that the economic indicators are generally registering continuing progress (January 1969)--rising income, low unemployment--while the streets and newspapers are full of evidence of growing discontent.[2]

---

[1] President's National Advisory Commission on Rural Poverty, The People Left Behind, (U. S. Government Printing Office, Washington, D. C., 1967), p. 7.

[2] U. S. Department of Health, Education, and Welfare, Toward A Social Report, (The University of Michigan Press, Ann Arbor, Michigan, 1970), p. xxxi.

A further challenge to the "New Philistinism"[3] mentality arose with the growing awareness of environmental abuse. Americans became conscious of the fact that certain communal goods such as scenic vistas, clear-running rivers, and clean air, had no dollar-and-cents value in the marketplace. Though of obvious worth, environmental quality seemed to have been omitted from the economic accounts. Even more amazingly, environmental deterioration could be included as a positive factor in the economic accounts. For example, if soot deposits coming from a nearby factory chimney required homeowners in the vicinity to repaint their homes at frequent intervals, both the produce of the factory and the paint purchased out of necessity by the homeowners would act to augment the GNP. Once again, the economic accounts seemed to inaccurately reflect the real quality of life.

These concerns culminated in a disillusionment with solely economic accounting as a description of societal status. Frederick Andrews writing in the Wall Street Journal of December 16, 1971, voiced this disillusionment:

> How do you measure a society?
>
> You can count the number of people, of course, and the numbers of television sets and automobiles and indoor toilets. And you can get some idea what people do with themselves by totting up the gross national product, the crime rate, the per-capita income, the housing starts and the consumer loan volume.
>
> But when you're all done, does it add up to anything worthwhile? Can you tell whether all those things the people

---

[3] A term coined by Bertram Gross meaning "an approach to life based on the principle of using monetary units as the common denominator of all that is important in human life." See Gross, The State of the Nation, (Tavistock Publications Limited; London, 1966), p. 19.

> produce are worth producing? Can you tell whether the cost, in terms of resources and energy expended, is really worth it? Do higher income and lower unemployment necessarily add up to satisfaction and security? Is happiness an ever-rising GNP?
>
> To an increasingly vocal group of doubters, the answer to all those questions is no.[4]

A conviction seems to have evolved, then, that the full evaluation of the status of development cannot be entirely couched in economic terms. While a higher income level may be a means to a higher quality of life, improvements in such things as environmental quality and health status also enhance the level of living. Economic activity is thus viewed as one dimension of an enlarged notion of development. To describe the status of development of a domain, economic accounting must be subsumed by an expanded system of social accounting.

---

[4] "Is the GNP an Accurate Measurement?", Current, March 1972, No. 138, p. 31, taken from an article originally appearing in the Wall Street Journal.

CHAPTER II

MEASURING DEVELOPMENTAL STATUS

I. IDENTIFYING THE RELEVANT VARIABLES

Social Accounting: The State of the Art

In order to develop a system of social accounting comparable in credibility to the existing economic accounts, there must be agreement upon the elements that determine the quality of life. Should artistic achievement be included along with housing and health status? Should recreational as well as educational facilities be itemized? Can key variables be identified which succintly indicate social progress or retrogression? Certainly there is a need to be able to assess the level of development over time, for policy planning and policy evaluation purposes.

Though the art of social accounting has not yet attained a degree of perfection similar to that attained by economic accounting, as typified by the annual Economic Report of the President, the movement does indeed boast a history of increasing momentum. The Committee on Social Trends appointed by Hoover in 1929 produced a two-volume report entitled Recent Social Trends in the United States. Though the report excited some interest in social accounting, it was not until 1959 that the federal government again presented systematic social data in the form of two periodic publications by the Department of Health, Education and Welfare, titled HEW Indicators and HEW Trends.

In the early sixties, work on social accounting in symposium form was produced by private foundations.[1] President Johnson gave the movement renewed impetus when he expressed to Congress in 1966 a desire for a Social Report equivalent to the Economic Report. The Department of Health, Education and Welfare, on the advice of a panel of social scientists, offered in 1969, at the end of the Johnson administration, a report called Toward a Social Report which contained suggestions as to what should be measured in a national social accounts system.

These various contributions to the field of social reporting did not, however, yield a consensus concerning the choice of key social variables. While social scientists lament the dearth of social statistics amid the wealth of economic statistics, they nevertheless dispute the issue of *which* statistics would be most worthwhile:

> . . . our problem is at least as much that we do not know what we *ought* to be measuring (and, therefore, how we ought to go about measuring) as that we are failing to accumulate the kinds of information we do know how to collect. For all the number of words that have gone into the discussion of what "social accounts" might be or what "social indicators" really are for, there is clearly an uneasy feeling that we do not, in fact, have sufficient warrant for proposing these as valid analogies to economic accounting and economic indicators.[2]

In the absence of a consensus on the specific content of a social account, this study proposes to use the HEW construct contained in

---

[1] See Bauer, *Social Indicators* (MIT Press; Cambridge, Mass., 1966); Sheldon, *Indicators of Social Change* (Russell Sage Foundation, New York; 1968); and the *Annals of the American Academy of Political and Social Science*, Numbers 371 and 373, for material which resulted from this work.

[2] Duncan, Otis Dudley, "Social Forecasting: The State of the Art," *The Public Interest*, No. 17, Fall 1969, p. 111.

Toward a Social Report as a point of departure in deriving a level-of-development index. A brief description of the nature of the report follows.

Social Accounting: The HEW Approach

The HEW report maintains that the areas listed below must be included in an analysis of societal conditions which attempts to be comprehensive. A short explanatory note following each item suggests the intended thrust within each major area:

Health and Illness. Mortality, morbidity, and life expectancy rates provide pertinent indication of health status, as does the quantity, quality and accessibility of medical services.

Social Mobility. Equal opportunity for education and vocational training determine in part the quality of the society.

Physical Environment. Such things as housing conditions, conservation efforts, pollution levels and recreational facilities bear on the level of living.

Income and Poverty. Changes in aggregate income levels, income distribution and total assets are associated with changes in development levels.

Public Order and Safety. The prevalence of crime and the nature of law enforcement are important societal characteristics.

Learning, Science, and Art. The availability of enrichment opportunities--such as cultural events, libraries and adult education programs--as well as the status of scientific investigation reflect the level of development.

Participation and Alienation. The degree of societal participation, whether in an election or a classroom discussion, as well as the general cohesiveness or integration of societal members are relevant quality-of-life components.

II. DERIVING APPROPRIATE MEASURES FOR SOCIAL CONCEPTS

The Problem of Establishing Social Indicators

While the HEW document puts forth the above general framework for analyzing social development, or progress, it contains little discussion of the means by which one measures fluctuations in particular key variables. The need is for identification of reliable social indicators, defined as,

> quantitative data that serve as indexes to socially important conditions in the society.[3]

The need to produce quantitative data again proves to be the bête noire of social analysis. How does one statistically measure accessibility to medical care? In terms of time: distance to the hospital; waiting room delay? In terms of cost? In terms of a hospital bed/inhabitant ratio? Or how does one assess the degree of alienation in the society? In terms of riot occurrence? Of voter apathy? Of suicide

---

[3]Biderman, Albert D., "Social Indicators and Goals," in Bauer, ed., Social Indicators (MIT Press, Cambridge, Mass., 1966), p. 69.

rates? The problem seems to be that frequently no direct measure exists for specific social concepts:

> The key problem of a system of social indicators . . . is that we can never measure the variables that interest us directly, but we must select surrogates that stand in the place of such variables. Thus, we may be interested in whether or not a person is "ambitious." But we cannot observe ambition per se. We can ask a person questions and listen to his answers, or we can observe how hard he will work, and for what rewards. From such observations we can then make an inference that he is or is not ambitious.[4]

The social scientist who ultimately decides what he would like to measure must then attempt to decide how to measure it with the maximum degree of accuracy. This decision, apart from involving issues of practicality, also involves judgment quandaries:

> Is it better to have a crude measure of the variable you are really interested in, or a precise measure of a variable which is only an approximation of what you are interested in?[5]

The Need for a Pragmatic Solution

Until established social accounting needs effect transformations in the governmental data-collecting apparatus, the surrogates chosen to measure indirectly developmental status will be primarily determined not by hypothetical considerations, but by available statistics. It could be argued that social analysis has been long enough deferred by arguments of a lack of vital data. Tentative analyses based on existing data may be desirable, even if their only value is to thrust the social accounting issue before the public eye. Some social scientists argue

---

[4]Bauer, *op. cit.*, p. 45.

[5]*Ibid.*, p. 37.

that the spell cast by statistics is such that numbers alone inspire confidence:

> The minimum statement of the nature of number magic is that things that have been counted attract more concern than things which cannot or have not been counted.[6]

This study thus attempts to use existing, available data in the derivation of a development index for Central Appalachia to meet the needs of policy-making agencies in the area.

III. TAILORING THE INDICATORS TO THE CLIENTS' NEEDS

Appalachian Development Agencies As Prospective Clients

Numerous public and private agencies are seeking to promote development in the Appalachian region. Special interest exists in improving the quality of life in the sixty counties which comprise Central Appalachia, a mountainous rural area with pronounced poverty problems. (An enumeration of these counties appears in Table I on the following page. Figure 1, on page 12, maps the Central Appalachian region.) While such agencies possess both manpower skills and financial assets to devote to grass-roots development projects, such resources are of course limited. Broad knowledge of existing conditions in the area is needed to achieve maximum effectiveness in the use of available resources.

Acquiring such knowledge firsthand in a sixty-county area would have proved an unwieldy task. It was thought that an analysis of

---

[6] Ibid., p. 25.

TABLE I

CENTRAL APPALACHIAN COUNTIES

Counties in Kentucky	Counties in Tennessee	Counties in Virginia	Counties in West Virginia
Bell	Anderson	Buchanan	Fayette
Breathitt	Campbell	Dickenson	Logan
Clay	Claiborne	Lee	McDowell
Clinton	Clay	Russell	Mercer
Floyd	Cumberland	Scott	Mingo
Harlan	DeKalb	Tazewell	Monroe
Jackson	Fentress	Wise	Raleigh
Johnson	Hancock		Summers
Knott	Jackson		Wyoming
Knox	Macon		
Laurel	Morgan		
Lawrence	Overton		
Lee	Pickett		
Leslie	Putnam		
Letcher	Scott		
Magoffin	Smith		
Martin	Union		
McCreary	White		
Owsley			
Perry			
Pike			
Pulaski			
Rockcastle			
Wayne			
Whitley			
Wolfe			

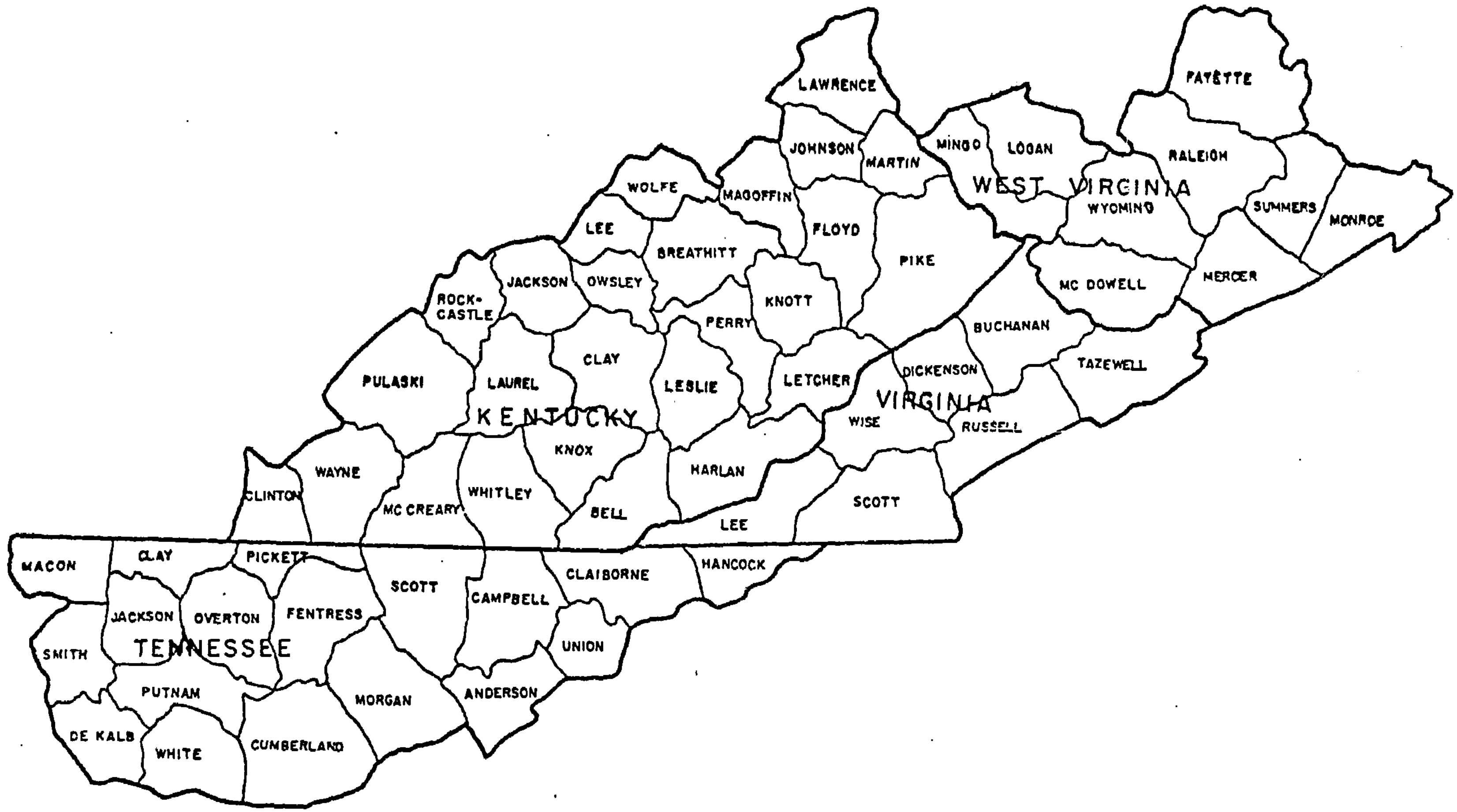

Figure 1. The sixty counties comprising Central Appalachia.

available data concerning social conditions in the counties would enable development agencies to better orient their supportive policies. An index of development would be substituted for immediate experience.

> With the growth of the complexity of society, immediate experience with its events plays an increasingly smaller role as a source of information and basis of judgment in contrast to symbolically mediated information about these events. The vast amount of information that must be digested places a premium on the selectivity, rapidity, condensation, and generalization of knowledge. Numerical indexes of phenomena are peculiarly fitted to these needs.[7]

An index of development for the sixty Central Appalachian counties would not only facilitate initial program planning. Periodic recalculation of the index would provide a basis for gauging changes in the level of living within the counties; that is, the index would also provide a basis for program evaluation.

The Objectives of the Study

Specifically, then, the objectives of the study were the following:

1. To derive a development index for sixty counties comprising Central Appalachia;
2. To scale the counties in relation to each other in terms of the individual development indicators, and in terms of the overall index;
3. To identify, if possible, a select few development indicators, highly correlated with the reference index, which could serve as working measures of social change.

---

[7] Biderman, *op. cit.*, p. 97.

CHAPTER III

PROPOSED INDICATORS FOR MEASURING DEVELOPMENTAL STATUS IN CENTRAL APPALACHIA

Organizations which seek to promote development in Central Appalachia are concerned with two questions when deciding on policy alternatives: first, who needs help? and second, who can be helped? In general, agencies seeking developmental change desire to direct their efforts toward those areas where the possibility of change is greatest. The Appalachian Regional Development Act instructs that "public investment made in the region under this Act shall be concentrated in areas where there is a significant potential for future growth, and where the expected return on public dollars invested will be the greatest."

It is important to note the distinction between a need for improvement in the level of development and the potential to effect such an improvement. A low index of development does not necessarily indicate a high capacity for change. "Level of development" should not be construed to mean "capacity for development."

This study seeks to measure, through selected socioeconomic indicators, the level of development (and hence is related to the question of relative need); it does not attempt to measure the potential for development within each county. Measuring developmental potential would require the inclusion of indicators to measure such elements as (1) the existence of a dynamic local leadership, (2) the availability of credit, (3) the receptivity of local residents to outside aid, and (4) the amount of outside aid already invested in the area.

As has been emphasized earlier, there exists no unique, recognized theory which clearly defines the essential elements involved in measuring the status of a society. Delineation of these elements, as well as the selection of appropriate indicators for them, remains largely a matter of subjective judgment. Consequently, the choice of the fourteen indicators included in the development index described here may appear arbitrary. Certainly, indexes composed of entirely different indicators could have been devised, with sound arguments to justify their composition. This degree of latitude does not imply, however, that a subjectively-derived index is meaningless. Rather, the validity of a particular index should be judged, in the absence of universal criteria, on the basis of the intended use of the index.

While the choice of indicators was influenced by subjective notions on the nature of development as well as the particular needs which the index was designed to fulfill, the availability of data on a county basis was also a determining factor. In most cases, more than one indicator was included to measure a single dimension of development, each indicator measuring a different facet of the same concept. This was regarded as an advisable precaution, rather than an unnecessary redundancy.

> We suggest that, as a general rule, any measurement of a social science concept that relies on a single indicator should be viewed as dubious . . . drawing on two or more indicators of different dimensions provides at least partial insurance against fractional coverage and its dysfunctions.[1]

---

[1]Etzioni, Amitai, and Lehman, Edward W., "Some Dangers in 'Valid' Social Measurement," The Annals, v. 373, September 1967, p. 4.

With these general remarks stated, what then were thought to be basic dimensions of the level of development, and what indicators were included to measure these dimensions? The indicators are listed in Table II, grouped as well as possible into specific categories. An elaboration of the reasons for their inclusion is contained below.

I. ECONOMIC STATUS

It was noted in the Introduction to this study that the term "development" as utilized here involves social dimensions beyond purely economic considerations. While it was argued that economic accounting should be superseded by social accounting for the purposes of evaluating societal status, there was no implication that economic status is irrelevant in determining the level of development. Information regarding the economic situation should be included in the social accounts:

> Yet the distinction between economic and social--while having many uses--cannot be carried too far. Although economic information deals completely with nothing, it tends to touch everything, often significantly.[2]

Four indicators were chosen to reflect economic status within each county:

1. The per capita personal income;
2. The percentage of families having an income below the poverty level;

---

[2]Gross, Bertram, "Preface: A Historical Note on Social Indicators," p. xv, in Bauer, op. cit.

TABLE II

LEVEL OF DEVELOPMENT INDICATORS FOR CENTRAL APPALACHIA

Dimension of Development		Indicator
Economic Status	1	Annual per capita income of persons
	2	Percentage total families having income below poverty level
	3	Percentage occupied housing units having no automobile available
	4	Percentage total employed aged sixteen and over employed twenty-six weeks or less per year
Health Status	5	Infant mortality rate
	6	Number of hospital beds per one thousand inhabitants
	7	Number of physicians per one thousand inhabitants
Educational Status	8	Percentage population aged twenty-five years and over who are high school graduates
	9	Percentage sixteen and seventeen year-olds enrolled in school
	10	Percentage employed persons sixteen years and over working in unskilled occupations
Physical Environment	11	Percentage total employed sixteen years and over employed in mining and manufacturing
Participation	12	Miles of nonmunicipal roads per square mile county area
Miscellaneous Characteristics	13	Dependency ratio
	14	Percent change in population 1960-70

3. The percentage of occupied housing units having no automobile available; and
4. The percentage of total employed persons sixteen years and over employed less than twenty-six weeks per year.

<u>Per Capita Personal Income</u>

Total personal wealth within a county would consist of total current income plus total personal assets. Since accurate information on income exists, while data on total community assets is not readily available, personal income was selected as an indicator of economic status for this study. Such a choice would appear not only pragmatic but also logical in low-income areas, where it may be assumed that the accumulation of assets other than income is restricted.

An aggregate income figure would have been meaningless in view of population differentials among counties. The per capita calculation was thus introduced to allow for population size.

It should be remembered that per capita personal income is a conceptual tool that may not be at all indicative of real income patterns. Income distribution in a given county will not be egalitarian in actuality. For example, the lowest fifth of the population will tend to receive much less than 20 percent of the total income, while the upper fifth will tend to receive much more than 20 percent of the total community income. Thus, per capita income figures contain information regarding aggregate income adjusted for population size, but relate no information regarding income distribution. Given this clarification, it is maintained that a high average income generally indicates a high economic status.

Percentage of Families Having Incomes Below the Poverty Level

The information provided by this indicator complements that contained in the per capita income figures, since it conveys some knowledge of income distribution within the county. While data on average income give a notion of the aggregate level of income, data on the percentage of families living below the poverty level give an indication of the distribution of wealth. The greater the percentage of families living below the poverty line, the lower the overall economic status of the region. Both aggregate wealth and wealth distribution are important in evaluating the economic aspects of the level-of-living.[3]

Percentage Occupied Housing Units Having No Automobile Available

Attempts have been made to wholly describe the level-of-living in terms of possessions. While that is not the approach taken in this study, one particular material asset--the automobile--has been included. This singular attention is paid the automobile because it is felt that it is a singularly meaningful possession in the rural context of Central Appalachia.

Its inclusion in the index is based primarily on its role as an indicator of material economic wealth: use of an automobile is a positive item in assessing economic status. But moreover, the automobile represents a certain degree of labor mobility as well, an important asset in underdeveloped regions. Lack of availability of an automobile may also increase societal alienation by limiting exchange (i.e.,

---

[3]Income distribution thus appears as an indicator of economic status in this study. However, it could feasibly be included in other

participation) among residents of different localities. For these reasons, then, the availability of an automobile may give a more significant indication of societal conditions than, does, for instance, indoor plumbing or a television set.

<u>Percentage Total Employed Aged Sixteen Years and Over Employed Twenty-Six Weeks or Less Per Year</u>

A further indication of economic conditions in an area is provided by employment characteristics. High rates of unemployment generally typify low-income areas,[4] and vice versa. While unemployment rates have historically been used as economic indicators, a newer notion of "underemployment" now figures in economic development theory. Underemployment refers to the use of human resources at a level short of full capacity. It is thought that many workers in underdeveloped areas operate at less than their maximum output level. Limited possibilities of employment prevent them from achieving full productivity.

While underemployment would seem to be a more crucial measure of economic status than unemployment, it is a concept which frequently defies measurement. The above indicator has been proposed as a possible means of gauging, albeit imperfectly, the degree of underemployment.

---

ways in other indexes. The distribution of wealth, as it relates to social conscience and social philosophy, might be included in some other index of development as a relevant societal dimension, rather than an indicator. From another point of view, wealth distribution, as it pertains to saving versus dissaving rates and capital accumulation, might be employed as an indicator of development potential.

[4] Low wages, rather than high unemployment, may sometimes be the cause of low income. Indicator 10, percentage labor force employed in unskilled occupations, which appears as an education status measure, also represents an attempt to make allowances for this possibility.

The normal working year consists of fifty to fifty-two weeks, including paid vacations. A working year of half this amount or less evidences underutilization of human resources.

II. HEALTH STATUS

High morbidity rates and general poor health are so closely associated with inadequate standards of living that there is debate as to whether they are causes or effects of poverty. Any assessment of the level of development must take into account, not only the wealth of the people, but also the health of the people. Historically, the rise of living standards has been manifested to a large degree by improvements in the health status of the population. It is a tenet of the development index presented here that the availability of health services is a key element in determining the level of living. Three indicators were included in the index which seek to measure the health dimension of development.

Infant Mortality Rate

Reflected in the infant mortality rate are numerous elements; notably, these include (1) the availability of prenatal care, (2) the quality of this care, (3) sanitation conditions, and (4) the general health status of a significant portion of the population. (Health status of infants under one year is reflected in a direct way, and that of women in the child-bearing age group in an indirect way.)

While the infant mortality rate was once the most widely accepted measure of the level of living and sanitation conditions, it should be noted that the adequacy of this measure is now questioned. Mortality figures do not fully describe health status in that they contain no information on morbidity rates. Recent analysis of health conditions emphasizes the length of "healthy-life" expectancy, along with morbidity rates, as opposed to simple life expectancy and mortality rates. It is argued that mortality is merely one extreme on a health spectrum spanning all conditions between it and optimal total health.[5]

Though these criticisms are well founded, it should be noted that vital statistics relating to mortality leave far less margin for definitional inaccuracy than do vital statistics relating to morbidity. While few controversies arise in deciding which cases to register on the mortality figures, there is a considerable latitude of opinion when deciding which cases should be enumerated in, for example, the heart disease morbidity figures.

Despite certain inadequacies in the measure, the infant mortality rate is retained as a valid indicator in view of its dual role as an indicator of the general health status <u>and</u> the availability and quality of health services. It is highly suitable as an indicator of health status in scaling populations, given the availability, accuracy and comparability of the data.

<u>Number of Hospital Beds Per 1,000 Inhabitants</u>

An important measure of the health services at the disposition of county residents would be the ratio of hospital beds to inhabitants.

---

[5]The interested reader may wish to pursue the current thinking on health measurement by reading Moriyama, Iwac M., "Problems in the Measurement of Health Status," in Sheldon, <u>op</u>. <u>cit</u>.

Such a ratio is considered an acceptable indicator of the availability of a critical health service--hospital care--though not a perfect indicator.

The existence of hospital beds in a specific ratio to inhabitants may not indicate service "availability" in a real sense, since the high cost of such service may effectively prevent its utilization by residents in low-income brackets. Hospital care may, in fact, be out of the realm of possibility for a portion of the population, since they cannot pay the necessary costs. For these people, the hospital bed/inhabitant ratio overstates availability.

On the other hand, such a ratio may on occasion understate the availability of hospital care to county residents. For example, in counties where there are no hospitals, care can nevertheless be obtained by traveling to adjacent counties where facilities are available. Inconvenience and additional costs are incurred in such circumstances, but hospital care is, in the strict sense of the word, available. One must also consider the fact that, in seeking hospital services elsewhere, residents of counties without hospitals effectively decrease the real ratio of beds to inhabitants in the areas to which they travel. This effect, however, does not appear in the computed ratio.

In noting the limitations inherent in the bed-inhabitant ratio, suffice it to add that sheer numbers indicate only something of the quantity, and virtually nothing of the quality of available services. While the kinds of specialists practicing within the hospital and the kind of equipment owned by the hospital are relevant considerations to the quality of care offered, these elements are ignored in a count of hospital beds.

Number of Physicians Per 1,000 Inhabitants

As a final indicator of health status in the county, the ratio of physicians to residents was included in the index. Though this indicator is subject to the disadvantages enumerated in the case of the hospital bed/inhabitant ratio, it remains a useful measure for which data are available on the county level.

III. EDUCATIONAL STATUS

The educational status of the population represents an important dimension of the level of living. The consecration of resources to educational endeavor shows a level of development sufficient to support mental as well as physical activity. It evidences the ability of the society to maintain nonproductive members. It gives some information regarding the values of the society. It provides clues about the degree of social mobility present in the society. Three measures, each attempting to reflect different aspects of the educational dimension of development, are included in the index.

Percentage of Population Aged Twenty-Five Years or Over Who Are High School Graduates

The proportion of the population completing high school is a classic measure of educational status. Like all other indicators included in the index described here, it contains information regarding a situation at a given point in time; it contains no trend information. Completion of twelve years of schooling was selected as an educational standard since it represents the basic American educational diploma; the completion of high school indicates a voluntary, rather than legally minimum, commitment to educational attainment.

It is known, of course, that equal time spent in the classroom does not result in equal actual learning; the knowledge derived varies from one individual to another. Data in terms of school years do not reflect these individual differences.

Nor do data in terms of school years reflect differences in educational attainment due to the wide variation from one school to another in the quality of educational instruction offered. Differences in instructional quality result from such things as variations in the caliber of the instructors, variations in the adequacy of plant facilities, and availability of supplementary materials. It was originally thought that government expenditures per pupil on education might provide an indication of qualitative differences in educational status from one county to another. Unfortunately, no data source could be identified which expressed per pupil expenditures on a county basis. Consequently, while no measure of this aspect of education was included in the index, it can be hypothesized that the quality of educational instruction offered affects the level of educational status.

<u>Percentage of Sixteen and Seventeen Year-Olds Enrolled in School</u>

The preceding indicator relates information regarding the educational status of the adult population. It tells something about the past situation. It does not, however, describe the current trend in educational attainment. The educational patterns of the younger segments of the population indicate the current situation. Can the younger members of the population be expected to achieve a higher educational status than did their elders?

The present indicator seeks to measure the current trend in educational attainment. It focuses on the sixteen and seventeen year-old age group, since at these ages school enrollment is on a voluntary basis while the high school diploma has usually not yet been attained. From the enrollment level, one may deduce the value which the community places on education, as well as its effectiveness in communicating this emphasis to the young. A high percentage of enrollment suggests a trend to high educational status, and hence, is positively associated with the level of development.

Percentage Employed Persons Aged Sixteen and Over Working in Unskilled Occupations

One final aspect of the education dimension must be taken into account. Certainly, all learning does not occur within the confines of the formal school system. Learning takes place on the job, in extra-school training programs, and through self-instruction. Persons who profit from these types of instruction are able to acquire skills making them more readily employable. As a means of including these forms of learning when measuring educational status, the above indicator was included. The fewer the number of persons working in unskilled positions, the greater one may infer the overall educational status of the population to be and the higher the level of development of the area.

IV. PHYSICAL ENVIRONMENT

In the introduction to this thesis, the growing concern with environmental abuse was credited with playing a role in enlarging the prevailing concept of development to include noneconomic considerations. If this is true, measures of the status of the environment must be included in the social accounts. But the environmental concern is both so broad and so recent that it is difficult to select indicators in the field and even more difficult to find existing data series which are applicable. As a tentative indicator of the environmental situation, this study proposed to utilize the ratio of persons employed in mining and manufacturing to total persons employed aged sixteen and over.

Percentage Total Persons Employed Aged Sixteen and Over Employed in Mining and Manufacturing

One has only to follow a county road through Central Appalachia to perceive a difference in environmental quality between valleys where agricultural pursuits predominate and valleys where extractive industries predominate. The agricultural valleys evidence only modest means but nevertheless pleasant surroundings; the mining valleys are characterized by deteriorated dwellings and unsightly surface scars. Slag heaps, piles of rubble, stripped earth surfaces, and dingy buildings have been by-products of the mining industry in Central Appalachia.

The transformation industries, as well as the extractive industries, often yield by-products which are detrimental to the environment. Among these are wastes discharged into local waterways, chemical fumes, and deforested hillsides. The recent concern with control of manufacturing wastes has apparently not yet reversed this long association between manufacturing and environmental pollution.

It should be stressed that this indicator is proposed as a measure of environmental status in the particular context of Central Appalachia. It does not have the quality of universal applicability. For example, a barren desert would obtain a high ranking in environmental quality when judged by the mining and manufacturing criterion. Obviously, the indicator is subject to geographical limitations.

One should also emphasize the fact that the indicator may be of use in the Central Appalachian context only within certain time limits. While the history of mining and manufacturing has been one of environmental abuse, this trend may be reversed in the future, through legislation and the force of public opinion. It was felt, however, that to the present time, mining may be justifiably linked to surface disfiguration and manufacturing associated with pollution.

Given the posited negative correlation between the quality of the physical environment and the amount of mining and manufacturing activity, the above indicator was included to describe the environmental dimension of the level of development. Persons employed were assumed to indicate the level of activity of these industries. A high percentage of persons employed in mining and manufacturing is taken to denote a low environmental quality ranking, and a low level of development as regards this dimension of development.

V. PARTICIPATION AND ALIENATION

An important dimension of the level of development is the degree of participation experienced by the members of the society in the stream of activities which links one locale with another. Do residents have adequate access to centers of activity within their own domain, and to hubs of activity in other geographic areas? Are they involved in the mainstreams of growth and change, or are they isolated? The present indicator was included as a measure of the participation dimension of development.

Miles of Nonmunicipal Surfaced Roads Per Square Mile County Area

Isolation, from economic activity and social services, decreases the level of development. In mountainous Central Appalachia, the degree of access to an adequate road system affects the degree of isolation experienced by county residents. The more extensive the available road network, the less the effective isolation, and therefore the higher the level of development.

VI. MISCELLANEOUS CHARACTERISTICS

Though difficult to classify in any of the above categories, two other indicators were considered useful in describing societal conditions in the Central Appalachian counties. They were therefore included in the index, under a miscellaneous rubric.

Dependency Ratio

The dependency ratio is defined as the ratio of persons less than eighteen years old or sixty-five years old and over to persons aged eighteen to sixty-four years.

The proportionate distribution of age groups within a society relates important information about the viability of the community. If the age distribution is skewed in favor of those portions of the population which do not exercise full social responsibility (who do not vote, or who cannot work, for example), the vitality of the whole unit is diminished. An abnormally high dependency ratio evidences an insufficient number of those elements of the population who are capable of initiative and productive activity. A high dependency ratio tends to indicate an exodus of the independent segment of the population as a result of a lack of opportunity within the area. This may be associated with a low level of development.

Percent Change in Population 1960-70

The direction and degree of population change also contain information pertaining to the level of living. An increase in population which exceeds the natural rate of increase over the decade indicates the existence of attractive opportunities in the area, be they economic, educational, recreational, or whatever. A decline in population would indicate an absence of these same attractive advantages. Positive change in population tends to reflect, in the Appalachian context, progressive prospects for the level of development, whereas negative population change suggests poor developmental status.

VII. INTERACTION AMONG INDICATORS

These fourteen indicators, then, comprise the development index constructed for the sixty counties in Central Appalachia. Given the appropriate data for each indicator, it is possible to scale the counties in relation to each other as regards their overall level of development, and as regards each dimension of development delineated above. The results of such data collection appear in the succeeding two chapters.

While each indicator was chosen to represent distinct aspects of each dimension of development, it cannot be assumed that there are no interrelationships among the various indicators. On the contrary, there may be high degrees of correlation among the individual indicators. This kind of overlapping is a characteristic trait of socio-economic analysis. In attempting to measure a particular social dimension, one may be indirectly measuring other pehnomena as well.

CHAPTER IV

DATA SOURCES AND OBSERVATIONS FOR FOURTEEN VARIABLES

The observed values for each of the fourteen variables (indicators) are reported in Tables III and IV, located on pages 33-38, for each of the sixty cases (counties). Also reported is the rank assigned to each county in respect to each indicator. To facilitate the presentation of the data in tabular form, the following capitalized mnemonics have been used to identify the variables: (1) INCOME, (2) POVERTY, (3) NOCAR, (4) UNDEREMP, (5) INFDEATH, (6) HOSBEDS, (7) DOCTORS, (8) HSGRADS, (9) ENROLL, (10) UNSKILL, (11) MNGMFG, (12) ROADS, (13) DEPENDCY, and (14) POPCHAN. This listing is consistent with the order of presentation of the variables found in Table II, page 17.

Table III contains data pertaining to variables 1 through 7; Table IV completes the data presentation with variables 8 through 14. In each of the two tables, two rows are devoted to each county. At the intersection of the variable column and the case row will be found, on the first row, the observed value for that particular variable for that county. In parentheses, on the second row, will be found the rank of the county in relation to all the other counties as regards that particular indicator. These rankings, from 1 through 60, denote a progressively <u>decreasing</u> level of development as measured by the specific indicator.

TABLE III

OBSERVATIONS AND RANKINGS: VARIABLES 1 - 7

County	INCOME	POVERTY	NOCAR	UNDEREMP	INFDEATH	HOSBEDS	DOCTORS
Bell Ky	1507	39.2	32.18	15.47	28.30	7.270	.965
	(36)	(38)	(54)	(20)	(42)	(6)	(8)
Breathitt Ky	1119	54.9	41.70	20.43	16.70	0.000	.211
	(55)	(54)	(60)	(52)	(6)	(45)	(48)
Clay Ky	1025	39.3	28.98	18.95	35.90	4.378	.271
	(59)	(39)	(45)	(46)	(58)	(19)	(45)
Clinton Ky	1477	40.0	21.36	22.46	31.57	3.181	.245
	(41)	(42)	(13)	(58)	(53)	(35)	(46)
Floyd Ky	1632	34.9	26.34	18.51	21.70	3.873	.613
	(24)	(28)	(31)	(44)	(20)	(27)	(19)
Harlan Ky	1593	36.2	30.33	18.10	26.87	6.262	1.338
	(29)	(32)	(49)	(39)	(36)	(7)	(3)
Jackson Ky	1184	49.9	27.26	17.73	20.93	0.000	.100
	(52)	(50)	(35)	(36)	(19)	(45)	(57)
Johnson Ky	1615	38.3	29.30	17.40	18.37	4.105	.741
	(25)	(35)	(46)	(34)	(10)	(24)	(14)
Knott Ky	1161	56.4	28.17	18.40	27.33	0.000	.204
	(53)	(57)	(37)	(43)	(37)	(45)	(49)
Knox Ky	1386	48.4	30.76	18.83	21.93	1.689	.422
	(46)	(47)	(51)	(45)	(22)	(43)	(31)
Laurel Ky	1675	34.4	20.87	16.75	27.67	5.441	.438
	(23)	(27)	(11)	(27)	(39)	(12)	(30)
Lawrence Ky	1605	40.0	29.33	16.15	29.33	4.195	1.026
	(27)	(43)	(47)	(25)	(48)	(22)	(7)
Lee Ky	1282	48.4	35.39	23.04	28.83	0.000	.304
	(47)	(48)	(58)	(60)	(45)	(45)	(43)
Leslie Ky	1057	55.3	36.56	10.86	31.00	1.377	.172
	(57)	(55)	(59)	(1)	(52)	(44)	(53)
Letcher Ky	1496	40.0	28.50	11.27	27.60	7.814	.777
	(37)	(44)	(41)	(2)	(38)	(4)	(12)
Magoffin Ky	1266	48.9	28.66	17.74	11.27	0.000	.192
	(49)	(49)	(43)	(37)	(2)	(45)	(51)
Martin Ky	1190	52.7	32.98	21.45	30.87	0.000	.213
	(51)	(53)	(55)	(55)	(51)	(45)	(47)
McCreary Ky	1136	52.2	27.95	19.28	24.43	0.000	.000
	(54)	(52)	(36)	(47)	(29)	(45)	(60)
Owsley Ky	979	61.6	30.14	21.82	28.70	0.000	.199
	(60)	(60)	(48)	(56)	(44)	(45)	(50)
Perry Ky	1495	39.1	34.61	15.67	18.80	4.239	.739
	(38)	(37)	(56)	(21)	(13)	(20)	(15)
Pike Ky	1706	31.8	25.49	14.97	20.00	5.405	.524
	(22)	(22)	(29)	(16)	(16)	(13)	(25)

TABLE III (continued)

County	INCOME	POVERTY	NOCAR	UNDEREMP	INFDEATH	HOSBEDS	DOCTORS
Pulaski Ky	1971	29.2	19.79	15.18	26.40	3.207	.823
	(8)	(20)	(10)	(18)	(35)	(34)	(11)
Rockcastle Ky	1534	35.9	23.29	17.64	27.77	2.123	.163
	(33)	(30)	(22)	(35)	(41)	(41)	(54)
Wayne Ky	1281	50.1	23.25	14.57	18.33	0.000	.421
	(48)	(51)	(20)	(12)	(9)	(45)	(32)
Whitley Ky	1598	39.7	28.79	20.11	26.37	3.479	.828
	(28)	(41)	(44)	(51)	(34)	(31)	(10)
Wolfe Ky	1083	59.0	35.22	19.47	29.03	0.000	.176
	(56)	(59)	(57)	(50)	(46)	(45)	(52)
Anderson Tn	2783	15.1	11.78	14.24	16.57	3.980	1.343
	(1)	(1)	(1)	(8)	(5)	(26)	(2)
Campbell Tn	1521	36.2	28.45	17.77	32.17	4.031	.384
	(35)	(31)	(39)	(38)	(54)	(25)	(36)
Claiborne Tn	1537	38.7	25.46	19.45	17.60	3.141	.309
	(32)	(36)	(28)	(48)	(8)	(36)	(42)
Clay Tn	1025	39.3	28.66	21.17	19.73	4.378	.604
	(59)	(39)	(42)	(53)	(15)	(19)	(21)
Cumberland Tn	1749	29.0	16.44	17.25	29.93	6.077	.772
	(19)	(17)	(4)	(33)	(49)	(8)	(13)
DeKalb Tn	1994	21.6	15.96	15.39	19.37	6.008	.538
	(7)	(6)	(2)	(19)	(14)	(9)	(24)
Fentress Tn	1264	42.4	26.83	21.30	25.00	5.559	.318
	(50)	(46)	(33)	(54)	(32)	(10)	(40)
Hancock Tn	1045	55.5	21.64	22.74	20.10	4.614	.149
	(58)	(56)	(15)	(59)	(17)	(18)	(55)
Jackson Tn	1443	38.0	24.21	17.14	12.40	4.668	.491
	(43)	(34)	(25)	(31)	(3)	(17)	(26)
Macon Tn	1755	29.1	17.94	18.38	21.83	2.517	.325
	(17)	(18)	(7)	(42)	(21)	(40)	(39)
Morgan Tn	1573	27.3	21.31	13.89	18.77	0.000	.073
	(30)	(16)	(12)	(6)	(12)	(45)	(58)
Overton Tn	1441	35.9	32.13	16.96	27.67	3.700	.404
	(44)	(29)	(53)	(28)	(40)	(28)	(34)
Pickett Tn	1475	33.9	22.59	16.99	18.57	0.000	.000
	(42)	(25)	(19)	(29)	(11)	(45)	(59)
Putnam Tn	2143	23.3	17.06	22.27	7.50	2.931	.564
	(4)	(10)	(6)	(57)	(1)	(37)	(22)
Scott Tn	1481	42.1	24.17	17.21	24.17	4.132	.406
	(39)	(45)	(24)	(32)	(27)	(23)	(33)
Smith Tn	2126	20.0	16.92	24.62	30.27	5.196	.480
	(5)	(4)	(5)	(14)	(50)	(15)	(27)

TABLE III (continued)

County	INCOME	POVERTY	NOCAR	UNDEREMP	INFDEATH	HOSBEDS	DOCTORS
Union Tn	1548	34.1	16.28	14.96	15.00	0.000	.110
	(31)	(26)	(3)	(15)	(4)	(45)	(56)
White Tn	1922	23.1	18.10	14.59	20.37	3.336	.469
	(9)	(9)	(8)	(13)	(18)	(32)	(28)
Buchanan Va	1714	27.2	23.29	11.68	32.73	2.713	.343
	(21)	(15)	(21)	(3)	(55)	(39)	(37)
Dickenson Va	1527	33.9	25.74	15.73	28.40	0.000	.311
	(34)	(24)	(30)	(22)	(43)	(45)	(41)
Lee Va	1480	39.5	31.23	16.46	24.67	3.642	.394
	(40)	(40)	(52)	(26)	(30)	(29)	(35)
Russell Va	1805	25.3	21.94	14.36	22.97	3.539	.285
	(14)	(12)	(17)	(9)	(26)	(30)	(44)
Scott Va	1847	26.9	21.36	13.36	17.43	0.000	.328
	(12)	(13)	(14)	(5)	(7)	(45)	(38)
Tazewell Va	2187	21.5	23.50	14.46	25.50	5.535	.628
	(3)	(5)	(23)	(10)	(33)	(11)	(18)
Wise Va	1828	27.1	26.53	15.99	24.40	7.289	1.224
	(13)	(14)	(32)	(24)	(48)	(5)	(5)
Fayette W Va	1908	23.6	26.90	18.14	22.43	4.237	.547
	(11)	(11)	(34)	(41)	(45)	(21)	(23)
Logan W Va	2004	23.0	25.20	14.19	29.20	5.382	.865
	(6)	(8)	(27)	(7)	(47)	(14)	(9)
McDowell W Va	1754	29.3	28.47	15.84	33.67	5.132	.711
	(18)	(21)	(40)	(23)	(56)	(16)	(16)
Mercer W Va	2340	18.0	21.79	17.12	22.07	8.053	1.297
	(2)	(2)	(16)	(30)	(23)	(3)	(4)
Mingo W Va	1606	36.5	30.72	14.54	37.00	2.898	1.098
	(26)	(33)	(50)	(11)	(59)	(38)	(6)
Monroe W Va	1726	29.2	22.07	18.10	42.57	0.000	.710
	(20)	(19)	(18)	(40)	(60)	(45)	(17)
Raleigh W Va	1790	19.6	24.23	15.12	22.33	14.826	1.512
	(15)	(3)	(26)	(17)	(24)	(1)	(1)
Summers W Va	1763	33.7	28.17	18.47	34.17	12.715	.605
	(16)	(23)	(38)	(49)	(57)	(2)	(20)
Wyoming W Va	1908	21.9	19.60	12.72	24.77	1.861	.465
	(10)	(7)	(9)	(4)	(31)	(42)	(29)

TABLE IV

OBSERVATIONS AND RANKINGS: VARIABLES 8 - 14

County	HSGRADS	ENROLL	UNSKILL	MNGMFG	ROADS	DEPENDCY	POPCHAN
Bell Ky	25.22	75.2	30.64	25.59	1.395	94	-12.0
	(20)	(33)	(24)	(21)	(34)	(41)	(42)
Breathitt Ky	21.24	70.1	38.96	13.21	1.247	105	- 8.2
	(34)	(47)	(53)	(3)	(40)	(53)	(32)
Clay Ky	17.26	63.9	36.74	23.06	1.506	108	-10.4
	(51)	(54)	(45)	(13)	(30)	(56)	(35)
Clinton Ky	33.59	84.2	36.87	31.56	1.774	85	- 8.0
	(5)	(11)	(46)	(28)	(16)	(19)	(30)
Floyd Ky	24.48	82.1	27.82	29.87	1.589	88	-13.8
	(23)	(16)	(17)	(24)	(25)	(28)	(47)
Harlan Ky	23.87	81.4	27.28	32.18	.996	93	-26.9
	(29)	(17)	(12)	(30)	(54)	(38)	(59)
Jackson Ky	13.58	61.4	49.57	16.64	2.178	98	- 6.3
	(59)	(56)	(59)	(4)	(3)	(48)	(23)
Johnson Ky	25.19	78.6	31.72	22.45	1.974	86	-11.2
	(21)	(26)	(30)	(11)	(6)	(22)	(38)
Knott Ky	18.81	68.2	33.30	23.34	1.374	101	-15.3
	(45)	(48)	(37)	(14)	(36)	(51)	(49)
Knox Ky	21.94	71.8	35.00	22.06	1.622	94	- 6.2
	(32)	(43)	(40)	(10)	(22)	(42)	(22)
Laurel Ky	26.81	73.7	36.39	19.55	2.630	93	+10.0
	(16)	(37)	(43)	(5)	(1)	(39)	(2)
Lawrence Ky	23.19	82.7	31.91	24.48	1.297	97	-11.6
	(31)	(14)	(31)	(18)	(38)	(47)	(40)
Lee Ky	16.56	71.9	31.51	27.34	1.929	104	-11.2
	(53)	(42)	(27)	(22)	(7)	(52)	(39)
Leslie Ky	16.03	71.3	31.67	33.43	1.085	108	+ 6.2
	(55)	(44)	(29)	(33)	(52)	(57)	(6)
Letcher Ky	19.29	78.6	30.76	45.97	1.384	94	-23.0
	(43)	(27)	(25)	(54)	(35)	(43)	(56)
Magoffin Ky	17.51	67.7	32.67	20.56	1.601	108	- 6.4
	(50)	(50)	(36)	(6)	(23)	(58)	(24)
Martin Ky	13.84	75.4	36.04	24.73	1.091	109	- 8.1
	(58)	(32)	(42)	(19)	(51)	(60)	(31)
McCreary Ky	14.82	65.8	31.54	34.51	1.519	107	+ 0.7
	(56)	(53)	(28)	(36)	(29)	(54)	(13)
Owsley Ky	12.69	60.9	52.81	4.64	1.985	108	- 6.4
	(60)	(57)	(60)	(1)	(5)	(59)	(25)
Perry Ky	24.15	61.5	30.06	23.69	1.592	100	-26.4
	(26)	(55)	(21)	(16)	(24)	(50)	(58)
Pike Ky	23.44	79.9	27.74	38.57	1.415	89	-10.6
	(30)	(18)	(16)	(45)	(33)	(31)	(36)

TABLE IV (continued)

County	HSGRADS	ENROLL	UNSKILL	MNGMFG	ROADS	DEPENDCY	POPCHAN
Pulaski Ky	28.81	73.6	35.77	24.22	1.924	86	+ 2.4
	(9)	(38)	(41)	(17)	(8)	(24)	(9)
Rockcastle Ky	19.76	86.9	37.60	23.66	2.103	96	- 0.2
	(41)	(6)	(49)	(15)	(4)	(46)	(15)
Wayne Ky	18.18	73.1	43.88	25.11	1.268	94	- 2.9
	(49)	(39)	(57)	(20)	(39)	(45)	(17)
Whitley Ky	26.92	67.0	29.11	21.49	1.852	88	- 6.5
	(15)	(51)	(20)	(9)	(12)	(29)	(26)
Wolfe Ky	16.61	58.3	44.79	20.74	1.586	107	-13.2
	(52)	(59)	(58)	(7)	(27)	(55)	(44)
Anderson Tn	54.72	88.8	20.08	38.33	1.564	74	+ 0.4
	(1)	(3)	(1)	(4)	(28)	(2)	(14)
Campbell Tn	21.44	75.4	31.31	34.39	1.424	87	- 6.8
	(33)	(31)	(26)	(34)	(32)	(26)	(28)
Claiborne Tn	24.01	85.7	32.45	29.45	1.588	81	+ 1.9
	(27)	(8)	(34)	(23)	(26)	(10)	(10)
Clay Tn	18.27	76.6	40.03	34.47	1.728	81	- 9.1
	(48)	(30)	(54)	(35)	(18)	(11)	(33)
Cumberland Tn	26.58	78.0	27.73	36.45	1.155	90	+ 8.0
	(17)	(28)	(15)	(39)	(47)	(32)	(4)
DeKalb Tn	26.42	53.4	28.70	37.58	1.907	78	+ 3.5
	(18)	(60)	(19)	(43)	(10)	(5)	(8)
Fentress Tn	18.80	75.2	36.91	36.50	1.104	93	- 5.2
	(46)	(34)	(47)	(40)	(49)	(37)	(20)
Hancock Tn	16.03	70.2	42.88	31.26	1.713	83	-13.4
	(54)	(46)	(55)	(27)	(19)	(16)	(45)
Jackson Tn	14.29	84.5	32.04	40.23	1.836	81	-11.8
	(57)	(10)	(32)	(51)	(13)	(12)	(41)
Macon Tn	18.36	70.9	36.54	39.45	2.194	80	+ 1.0
	(47)	(45)	(44)	(38)	(2)	(9)	(12)
Morgan Tn	28.52	87.1	28.25	46.67	1.102	86	- 4.8
	(12)	(5)	(18)	(55)	(50)	(23)	(19)
Overton Tn	19.24	59.8	30.37	44.81	1.658	82	+ 1.4
	(44)	(58)	(23)	(53)	(21)	(15)	(11)
Pickett Tn	20.11	66.4	30.12	44.53	1.772	81	-14.8
	(37)	(52)	(22)	(52)	(17)	(13)	(48)
Putnam Tn	32.28	74.7	25.27	31.02	1.921	65	+21.4
	(6)	(36)	(5)	(26)	(9)	(1)	(1)
Scott Tn	21.21	72.8	33.78	36.28	1.018	94	- 4.2
	(35)	(41)	(39)	(38)	(53)	(44)	(18)
Smith Tn	27.37	91.9	37.52	33.09	1.681	81	+ 3.7
	(14)	(1)	(48)	(32)	(20)	(14)	(7)

TABLE IV (continued)

County	HSGRADS	ENROLL	UNSKILL	MNGMFG	ROADS	DEPENDCY	POPCHAN
Union Tn	19.42	68.2	33.66	39.72	1.896	86	+ 6.8
	(42)	(49)	(38)	(49)	(11)	(25)	(5)
White Tn	25.93	79.3	25.43	49.67	1.778	78	+ 9.7
	(19)	(24)	(6)	(58)	(15)	(7)	(3)
Buchanan Va	19.92	73.0	38.26	55.98	.980	92	-12.7
	(39)	(40)	(50)	(60)	(55)	(36)	(43)
Dickenson Va	20.06	85.9	27.66	47.48	1.242	91	-20.5
	(38)	(7)	(14)	(57)	(41)	(34)	(54)
Lee Va	19.80	84.1	42.94	21.49	1.336	85	-21.3
	(40)	(12)	(56)	(8)	(37)	(20)	(55)
Russell Va	20.77	79.6	32.30	39.00	1.195	83	- 6.7
	(36)	(22)	(33)	(47)	(43)	(18)	(27)
Scott Va	24.71	79.4	32.49	38.89	1.158	76	- 5.6
	(22)	(23)	(35)	(46)	(46)	(3)	(21)
Tazewell Va	28.81	83.2	25.99	36.53	.967	78	-11.1
	(10)	(13)	(8)	(41)	(56)	(6)	(37)
Wise Va	23.90	79.9	27.55	34.84	1.168	85	-17.5
	(28)	(19)	(13)	(37)	(45)	(21)	(52)
Fayette W Va	29.22	87.8	26.22	36.68	1.145	87	-20.1
	(8)	(4)	(10)	(42)	(48)	(27)	(53)
Logan W Va	28.75	78.8	22.62	39.89	.708	90	-24.9
	(11)	(25)	(2)	(50)	(60)	(33)	(57)
McDowell W Va	24.40	79.7	25.88	47.30	.893	93	-29.0
	(24)	(21)	(7)	(56)	(57)	(40)	(60)
Mercer W Va	43.35	85.1	26.10	22.67	1.787	77	- 7.3
	(2)	(9)	(9)	(12)	(14)	(4)	(29)
Mingo W Va	24.35	75.1	26.93	30.89	.849	100	-17.5
	(25)	(35)	(11)	(25)	(58)	(44)	(51)
Monroe W Va	38.62	89.7	38.28	31.70	1.190	79	- 2.7
	(3)	(2)	(51)	(29)	(44)	(8)	(16)
Raleigh W Va	35.75	78.0	25.27	32.89	1.222	83	-10.0
	(4)	(29)	(4)	(31)	(42)	(17)	(34)
Summers W Va	30.57	79.8	38.58	11.71	1.506	91	-15.5
	(7)	(20)	(52)	(2)	(31)	(35)	(50)
Wyoming W Va	27.47	82.2	24.38	51.42	.818	88	-13.6
	(13)	(15)	(3)	(59)	(59)	(30)	(46)

Following the presentation of the tables, the chapter treats in turn each of the fourteen variables which comprise the development index. In each case, a formal statement concerning the method of computing the county values for the indicator is presented, along with a specific reference to the source of the data for that indicator. In addition, brief comments related to the ranked results are included, to draw attention to the more salient features of the ranked results.

I. INDICATOR 1: ANNUAL PER CAPITA INCOME OF PERSONS

Formal Definition of the Indicator

Per capita income for a particular group was derived by dividing total income for the group by the total population of that group. The population count included all men, women and children, as well as patients or inmates in institutional quarters.

Source of the Data

Per capita personal income figures in 1969 for each Central Appalachian county were obtained from Table 124, "Income and Poverty Status in 1969 for Counties," of the U. S. Bureau of the Census, 1970 Census of the Population, General Social and Economic Characteristics, Series PC(1)-C, Kentucky, Tennessee, Virginia and West Virginia volumes, (U. S. Government Printing Office, Washington, D. C., 1972).

Income data were estimated from a twenty percent sample of the entire population. The Census Bureau cautions that the data are subject to reporting errors, resulting in both cases of overestimation and cases of underestimation. For example, while some persons may forget to note irregular sources of income, others may erroneously record gross income in place of net income. The former error under-reports income, while the latter over-reports it. The Census employed procedures of computer editing and telephone callback to eliminate those reporting errors which were detected.

It should be noted that reporting concerns money income only. Income "in kind", such as auto-consumption on a farm or business expense accounts, does not appear on the accounts.

Comments on the Ranking Results

Per capita income in 1969 averaged $1591 in the sixty-county area, with a standard deviation of $349. The Central Appalachian portion of West Virginia exhibited the highest average income ($1867) among the state-groups. The Virginia state-group average ($1770) followed in second place, succeeded by the Central Appalachian sector of Tennessee ($1679) and finally, the Kentucky state-group ($1387).

The per capita income in the Central Appalachian portion of each state was considerably lower than the per capita income of the state as a whole. The state of Virginia boasted the highest total state average of $3013, as contrasted to the Appalachian Virginia average of $1770 quoted above. The Tennessee state average was $2469, closely similar to the Kentucky state average of $2437. West Virginia, which showed the highest Central Appalachian state-group per capita income average, displayed the lowest per capita income figure ($2338) when computed on a state-wide basis.

Only two counties (Anderson, Tennessee, and Mercer, West Virginia) desplayed per capita income figures greater than or equal to their respective state averages. All other counties exhibited per capita income levels below that of the state as a whole. The income levels spanned a wide range from a high of $2783 in Anderson County, Tennessee, to a low of $979 in Owsley County, Kentucky, a difference of slightly more than five standard deviations.

II. INDICATOR 2: PERCENTAGE TOTAL FAMILIES HAVING INCOME BELOW POVERTY LEVEL

Formal Definition of the Indicator

The county poverty figure was derived by dividing the total number of families whose family income in 1969 was less than the appropriate poverty threshold for that family by the total number of families in the county, then multiplying by 100.

The poverty threshold applicable in each case was drawn from a table of poverty income cutoffs which adjusts for such things as family size, age of children, farm versus nonfarm residence, and age of household head. Originally devised by the Social Security Administration, the table of threshold figures, reduced to a weighted average scale from a set of 124 thresholds, is presented in Table V. Such a scale, adjusted to suit family size and situation, reduces the error of oversimplification inherent in any single-figure definition of the poverty level.

TABLE V

WEIGHTED AVERAGE THRESHOLDS AT POVERTY LEVEL IN 1969

Size of Family	Total	Nonfarm			Farm		
		Total	Male Head	Female Head	Total	Male Head	Female Head
All unrelated individuals	$1,834	$1,840	$1,923	$1,792	$1,569	$1,607	$1,512
Under 65 years	1,888	1,893	1,974	1,826	1,641	1,678	1,552
65 years and over	1,749	1,757	1,773	1,751	1,498	1,508	1,487
All families	3,388	3,410	3,451	3,082	2,954	2,965	2,757
2 persons	2,364	2,383	2,394	2,320	2,012	2,017	1,931
Head under 65 years	2,441	2,458	2,473	2,373	2,093	2,100	1,984
Head 65 years and over	2,194	2,215	2,217	2,202	1,882	1,883	1,861
3 persons	2,905	2,924	2,937	2,830	2,480	2,485	2,395
4 persons	3,721	3,743	3,745	3,725	3,195	3,197	3,159
5 persons	4,386	4,415	4,418	4,377	3,769	3,770	3,761
6 persons	4,921	4,958	4,962	4,917	4,244	4,245	4,205
7 or more persons	6,034	6,101	6,116	5,952	5,182	5,185	5,129

Source: U. S. Bureau of the Census, 1970 Census of the Population, *General Social and Economic Characteristics*, (U. S. Government Printing Office, Washington, D. C., 1972), p. App-30.

The threshold figures are adjusted annually to allow for changes in the consumer price index; no allowances, however, are made for geographical variations in the cost of living.

Family income is defined as income of family members or principal individuals, while income of persons in the household who are not family members is excluded.

Source of the Data

Data were obtained from the U. S. Bureau of the Census, 1970 Census of the Population, *General Social and Economic Characteristics*, Series PC(1)-C, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, Table 44, "Summary of Economic Characteristics by Counties: 1970," (U. S. Government Printing Office, Washington, D. C., 1972).

Census figures are estimates based on a 20 percent sample of the population.

Comments on the Ranking Results

The West Virginia state-group displayed the lowest average percentage of poverty-level families (26.1 percent), while Kentucky's Central Appalachian counties yielded the highest average percentage (45.2 percent). Between these two figures lay the Virginia state-group average (28.8 percent) and the Appalachian Tennessee average (32.5 percent).

Individual county values ranged from a low percentage of 15.1 percent in Anderson County, Tennessee, to a high percentage of 61.6 in Owsley County, Kentucky. The sixty-county average showed that 36.6 percent of all families in the Central Appalachian region had an income below the poverty level, with a standard deviation of 11.6 percentage points.

III. INDICATOR 3: PERCENTAGE OCCUPIED HOUSING UNITS HAVING NO AUTOMOBILE AVAILABLE

Formal Definition of the Indicator

The figures presented for each county were calculated by dividing the total number of housing units having no available automobile by the total number of housing units in the county, then multiplying by 100.

Source of the Data

The data were derived from the U. S. Bureau of the Census, 1970 Census of the Population, Detailed Housing Characteristics, Series HC(1)-B, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, (U. S. Government Printing Office, Washington, D. C., 1972). Specifically, information on automobile availability was contained in Table 62, "Structural, Plumbing, Equipment, and Financial Characteristics for Counties: 1970."

The Census Bureau defines the concept "housing unit" to consist of "houses, apartments, groups of rooms, or single rooms, which are occupied, or vacant but intended for occupancy, as separate living quarters."[1] A housing unit is characterized by either direct access or complete kitchen facilities or both. The persons occupying a housing unit are termed a household.

The Census classified households by the number of "passenger automobiles owned or regularly used." Company cars kept at home were included in the enumeration, while taxis, pickup trucks, larger trucks and cars permanently out-of-order were excluded. The enumeration was based on a 15 percent sample of all housing units.

Comments on the Ranking Results

It should be noted that the exclusion of pickup trucks from enumeration results in an understatement of economic status, and an overstatement of the isolation situation.

---

[1]U. S. Bureau of the Census, 1970 Census Users' Guide, Part I, (U. S. Government Printing Office, Washington, D. C., 1970), p. 113.

The ranking was characterized by a wide range in values, of almost 30 percentage points, from a low percentage of 11.78 (Anderson, Tennessee) to a high of 41.71 percent (Breathitt, Kentucky). Among state-groups, Tennessee ranked highest in terms of development with a low of 21.44 percent occupied housing units having no automobile available, while Kentucky ranked lowest with a high ratio of 29.12 percent. Virginia (24.80 percent) and West Virginia (25.24 percent) ranked second and third, respectively, in state groupings.

The regional average was determined to be 25.73 percent with a standard deviation of 5.81 percent.

IV. INDICATOR 4: PERCENTAGE TOTAL EMPLOYED AGED SIXTEEN YEARS AND OVER EMPLOYED TWENTY-SIX WEEKS OR LESS PER YEAR

Formal Definition of the Indicator

To obtain an estimation of the extent of underemployment in each county, the total number of persons aged sixteen years and over (both male and female) who were employed twenty-six weeks or less in 1969 was divided by the total number of persons aged sixteen years and over who were classified as employed in 1969, then multiplied by 100.

Civilians sixteen years and over were classified in the employed groups if (1) they were engaged in any paid work during the Census reference week, or (2) they had performed at least fifteen hours of unpaid work in a family enterprise during the reference week, or (3) they were temporarily absent from their jobs during the reference week due to illness, strikes, inclimate weather, or the like. Weeks worked included paid vacation and sick leave, work without pay on a family farm or in a family business, and military service.

Source of the Data

The data were derived from the U. S. Bureau of the Census, 1970 Census of the Population, General Social and Economic Characteristics, Series PC(1)-C, Table 121, "Employment Characteristics for Counties: 1970," (U. S. Government Printing Office, Washington, D. C., 1972), volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia.

Census figures are estimates based on a 20 percent sample of the population.

Comments on the Ranking Results

Several considerations are relevant to interpretation of the ranking results. On the one hand, the degree of underemployment may be overstated since there is a tendency among interviewed persons to forget weeks worked without pay (in a family enterprise, for example) as well as irregular or brief periods of employment. A further bias toward overstatement of underemployment arises from the fact that people who were not in fact seeking full-time employment were enumerated in the twenty-six or less weeks worked category. For example, students who intentionally worked only during the summer months would be classified as underemployed, although their underemployment was voluntary.

On the other hand, the indicator may understate underemployment since persons may be working more than twenty-six weeks and nevertheless be working considerably less than the forty-eight or fifty weeks which constitute full employment. The cutoff level of twenty-six weeks was largely necessitated by the presentation of the Census data, and is not necessarily the ideal definition of underemployment. A cutoff level of forty weeks or less might be preferable.

The sixty-county average percentage total employed aged sixteen and over employed twenty-six weeks or less per year was 17.10 percent, with a standard deviation of 2.88 percent. The Virginia and West Virginia state-group averages were lower than the Central Appalachian average as a whole, at 14.58 percent and 16.14 percent, respectively. Both Kentucky and Tennessee displayed state-group averages which exceeded the regional average; these were 17.78 percent and 17.57 percent respectively.

V. INDICATOR 5: INFANT MORTALITY RATE

Formal Definition of the Indicator

Normally, the infant mortality rate for any one year is calculated by dividing the total number of live births into the number of deaths of infants less than one year of age, and then multiplying by 1,000. However, in view of the small magnitude of the numbers of deaths and births on the county level, this annual rate is subject to wide variation due solely to chance. To reduce the role played by chance, it was decided that an average mortality rate, computed over a period of years, was preferable to a simple annual figure. Consequently, a three-year average infant mortality rate was calculated for each county. For each of the four states, data for the three most recent years available were utilized.

Sources of the Data

The specific source for data regarding each Central Appalachian state is enumerated below:

Kentucky Department of Health, Kentucky Vital Statistics 1967, 1968, 1969; Frankfort: 1969, 1970, 1971; Tables 9;

State of Tennessee Department of Public Health, Annual Bulletin of Vital Statistics 1968, 1969, 1970; Nashville: 1969, 1970, 1971;

Commonwealth of Virginia Department of Health, Annual Report 1968, 1969, 1970; Richmond: 1969, 1970, 1971; and

State of West Virginia Department of Health, Division of Vital Statistics, Public Health Statistics of West Virginia 1968, 1969, 1970; Charleston: 1969, 1970, 1971.

In each of these publications, deaths and births were recorded by county of residence.

Comments on Ranking Results

Fifteen counties, representing Tennessee, Kentucky and Virginia, exhibited infant mortality rates lower than the total U. S. 1970 rate. The sixty-county rate of 24.62 deaths per 1,000 live births exceeded the national rate of 19.8 deaths per 1,000 live births. Tennessee boasted the lowest rate of the state-groups with 20.95 infant deaths per thousand live births, followed by Virginia (25.16), Kentucky (25.23), and West Virginia (29.80).

The infant mortality rate, in contrast to the succeeding two health indicators, may be viewed as an indicator of the accessibility, as opposed to the availability, of health services. The rate reflects to some degree the extent to which existing health facilities are utilized to improve living conditions.

It should be reemphasized, however, that chance variations may yield large differences in the calculated mortality rate:

> There are variations in all statistics which are the result of chance. This characteristic is of particular importance in classifications with small numbers of events where small variations are proportionately large in relation to the base figure. As an example, small changes in the number of deaths or births in small population areas . . . could result in large changes in these rates. For this reason, rates for counties with small populations or other small bases should be used cautiously.[2]

VI. INDICATOR 6: NUMBER OF HOSPITAL BEDS PER 1,000 INHABITANTS

Formal Definition of the Indicator

The data presented for this indicator were computed by dividing the total number of general purpose hospital beds in existence in the county by the total county population, and then multiplying by 1,000.

Source of the Data

Letters of inquiry addressed to the respective Departments of Health of the four states resulted in individual data sources for each of the states, each of which is listed below:

Commonwealth of Kentucky Department of Health, "Facilities Licensed as Hospitals by the Kentucky State Board of Health, 1971-72," a mimeographed publication;

State of Tennessee Department of Public Health, Annual Report of Hospitals and Related Facilities in Tennessee, 1970, Nashville, 1970;

Virginia State Department of Health, Bureau of Medical and Nursing Facilities Services, Virginia Hospitals, January 1, 1972; and

---

[2] Kentucky Department of Health, Kentucky Vital Statistics 1968, Frankfort, 1969, p. 1.

West Virginia Department of Health, Hospital and Medical Facilities, personal letter.

Data on hospital beds were origianlly derived from the Journal of the American Hospital Association, v. 45, no. 15, Guide Issue, Part II, Hospitals, August 1, 1971. However, a comparison of the data contained in the Journal and those presented by the individual states evidenced a high degree of incompatability in the two data series. It was decided that the latter series was likely to be the more accurate; therefore, the state publications were used as sources for the data.

Population data for each of the sixty counties were derived from the 1970 Census of the Population.

Comments on the Ranking Results

The ranking was characterized by a wide range of variation from high to low county ratios. Twenty-seven of the sixty counties had hospital bed/inhabitant ratios greater than the total U. S. ratio of 3.81 beds per 1,000 inhabitants.[3] The sixty-county ratio of 3.48 beds per 1,000 inhabitants (standard deviation = 3.04) approached the national ratio, and divided the ranking into two parts, with half the counties lying above this ratio and half below. Yet, the range of the ratios ran from a high of 14.826 hospital beds per 1,000 inhabitants (Raleigh, West Virginia) to a low of 0.000 beds per 1,000 inhabitants. Not only did the ratio fall to a low of zero, but it did so in sixteen separate counties representing all four states. (Each of these counties received a rank of 45, the lowest rank assigned for this particular indicator.)

---

[3]The overall U. S. ratio, derived for the year 1966, was quoted in U.S.D.A., E.R.S., "Medical Problems in Rural Areas," Agricultural Economics Report Number 172, 1970, page 6.

In state-group ratios, West Virginia ranked substantially higher than the other state groups, with a nine-county ratio of 6.122 hospital beds per 1,000 inhabitants. In fact, three of the nine counties (Raleigh, Summers and Mercer) exhibited ratios equal to at least twice the total U. S. ratio, while only one county (Monroe) had a ratio of zero.

The three other state-groups exhibited ratios below the national rate. In descending order, these ratios were 3.571 for Tennessee; 3.243 for Virginia; and 2.573 for Kentucky. While West Virginia seemed to maintain an especially advantaged position in terms of hospital beds, Kentucky appeared particularly disadvantaged with a low state-group ratio and ten counties having ratios of zero.

VII. INDICATOR 7: NUMBER OF PHYSICIANS PER 1,000 INHABITANTS

Formal Definition of the Indicator

The physician/inhabitant ratio was calculated in the following manner: the total number of resident physicians in 1969 was divided by the total county population as of 1970, and the result was then multiplied by 1,000.

Source of the Data

An enumeration of physicians by county of residence was contained in the 1969 American Medical Directory, Parts II and III, Geographical Register of Physicians, Twenty-Fifth Edition, published by the American Medical Association. The AMA listing did not specify whether the individuals listed were engaged actively in medical practice or not; physicians in retirement or involved in research were included on the list. Consequently, the figures derived from the Directory tend to overstate the availability of physician services to county residents.

Data on county populations were derived from the 1970 Census of the Population.

Comments on Ranking Results

Physicians appear to be in shorter supply in Central Appalachia than do hospital facilities. Only four of the sixty counties exhibited a ratio of physicians to inhabitants higher than the overall U. S. ratio of 1.25 physicians per 1,000 inhabitants.[4] The Central Appalachian regional ratio was far below the national ratio at .519 physicians per 1,000 inhabitants, with a standard deviation of .36. This discrepancy appears all the more glaring in view of the fact that even the national ratio is considered far short of ideal. The national doctor shortage shows up acutely in Central Appalachia.

While a high degree of correlation between number of hospital beds and number of physicians in the county might be hypothesized, the relationship was not a strict one. The nine counties of West Virginia exhibited the highest physician/inhabitant ratio for a state group (.868). This appears consistent with a high hospital bed/inhabitant ratio for the same county group. Two West Virginia counties (Raleigh and Mercer) boasted a ratio greater than the national ratio, while only one West Virginia county (Wyoming) fell below the regional ratio. The seven-county group of Virginia, third in state-group rankings for

[4]This figure, derived for the year 1966, was quoted on page 6 of U.S.D.A., E.R.S., op. cit.

hospital beds, had the second-highest physician ratio of .502. However, no Virginia county had a ratio exceeding the total U. S. ratio. The Kentucky group, with a twenty-six county ratio of .465, ranked higher than the Tennessee group, with an eighteen county ratio of .430. While both Kentucky and Tennessee had one county each with a county ratio greater than the national ratio (Harlan and Anderson, respectively), both also had one county each with no resident physicians and no hospital facilities (McCreary and Pickett, respectively).

VIII. INDICATOR 8: PERCENTAGE POPULATION AGED TWENTY-FIVE YEARS AND OVER WHO ARE HIGH SCHOOL GRADUATES

Formal Definition of the Indicator

To obtain this indicator, the total number of persons in each county aged twenty-five years and over (both male and female) who had completed a high school education was divided by the total number of persons in the county aged twenty-five years and over, then multiplied by 100.

Source of the Data

The data were drawn from the U. S. Bureau of the Census, 1970 Census of the Population, General Social and Economic Characteristics, Series PC(1)-C, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, Table 120, "Educational and Family Characteristics for Counties: 1970," (U. S. Government Printing Office, Washington, D. C., 1972).

The Census figures are estimates based on a 20 percent sample of the population.

Comments on the Ranking Results

The Central Appalachian average was computed to be 23.62 percent of the aged twenty-five years and over population, with a standard deviation of 7.39 percent. The West Virginia state-group exhibited a nine-county average of 31.39 percent, which was substantially higher than the other state-group averages. The Tennessee, Virginia and Kentucky state-group averages were 24.06 percent, 22.60 percent and 20.92 percent, respectively.

The ranked results displayed a wide range in values. The highest-ranked county (Anderson, Tennessee) with a ratio of 54.72 percent differed from the lowest-ranked county (Owsley, Kentucky) with a ratio of 12.69 percent by almost six standard deviations.

IX. INDICATOR 9: PERCENTAGE SIXTEEN AND SEVENTEEN YEAR-OLDS ENROLLED IN SCHOOL

Formal Definition of the Indicator

The county figures were calculated by dividing the number of sixteen and seventeen year-olds enrolled in school by the total population aged sixteen and seventeen in the county, then multiplying by 100.

Source of the Data

The data were taken from the U. S. Bureau of the Census, 1970 Census of the Population, General Social and Economic Characteristics, Series PC(1)-C, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, (U. S. Government Printing Office, Washington, D. C., 1972).

Comments on the Ranking Results

Averages for the Central Appalachian portions of each state yielded the following state-group rankings: West Virginia, 81.80 percent; Virginia, 80.73 percent; Tennessee, 75.45 percent; and Kentucky, 72.51 percent. The Central Appalachian regional average was calculated to be 75.74 percent, with a standard deviation of 8.55 percentage points.

X. INDICATOR 10: PERCENTAGE EMPLOYED PERSONS SIXTEEN YEARS AND OVER WORKING IN UNSKILLED OCCUPATIONS

Formal Definition of the Indicator

To obtain the value of this indicator for each county, the total number of persons aged sixteen and over who were employed in unskilled occupations was divided by the total number of employed persons in the county aged sixteen and over, then multiplied by 100.

An attempt was made by the author to divide the occupations listed in the 1970 Census into two groups, one classified as unskilled, and the other as skilled. The unskilled classification grouped together the following occupations as categorized by the Census:

1. Transport equipment operatives;
2. Laborers, including construction, freight, and farm laborers;
3. Farmers and farm managers; and
4. Service workers, including private household workers.

The remaining categories, designated as skilled, included professional, technical, and kindred workers; managers and administrators, except farms; sales workers; clerical and kindred workers; craftsmen, foremen, and kindred workers; and operatives, except transport.

Source of the Data

The data were derived from the U. S. Bureau of the Census, 1970 Census of the Population, General Social and Economic Characteristics, Series PC(1)-C, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, Table 122, "Occupations and Earnings for Counties: 1970," (U. S. Government Printing Office, Washington, D. C., 1972).

The Census data represent estimates based on a 20 percent sample of the population.

Comments on the Ranking Results

Prior to consideration of the rankings, a word of caution regarding the unskilled classification of occupations appears in order. Specific occupational groups labelled unskilled sometimes contain subgroups which cannot be described as unskilled. For example, the service worker group, categorized as unskilled, contains practical nurses, dental assistants and hairdressers, all of whom could more appropriately be described as skilled. The contrary is likely to hold also; specific positions grouped in the skilled occupational category may in reality be best described as unskilled. While these anomalies exist, data availability constraints prevent their elimination.

The sixty-county average proved to be 32.78 percent employed in unskilled occupations, with a standard deviation of 6.45 percentage points. The West Virginia state-group had the lowest average percentage of unskilled workers (28.25 percent) and therefore the highest level of development among the state-groups as regards this indicator, followed by Tennessee (31.84 percent), Virginia (32.46 percent), and Kentucky (35.08 percent).

XI. INDICATOR 11: PERCENTAGE TOTAL EMPLOYED AGED SIXTEEN YEARS AND OVER EMPLOYED IN MINING AND MANUFACTURING

Formal Definition of the Indicator

Data for the indicator were derived by dividing the total number of persons aged sixteen and over employed in mining and manufacturing enterprises by the total number of employed persons aged sixteen and over in the county, then multiplying by 100. The mining and manufacturing categories represent two of the twelve major industry groups included in the industry classification system of the 1970 Census. Included in the mining category are also quarrying and petroleum and gas extraction. Included in the manufacturing category are such things as lumber production, primary metal industries, textile products and chemical products.

Source of the Data

The data were drawn from the U. S. Bureau of the Census, 1970 Census of the Population, General Social and Economic Characteristics, Series PC(1)-C, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, Table 123, "Industry of Employed Persons and Occupation of Experienced Unemployed Persons for Counties: 1970," (U. S. Government Printing Office, Washington, D. C., 1972).

The data represent estimates based on a 20 percent sample of the population. Individual responses pertained to the situation prevailing during the reference week.

Comments on the Ranking Results

The sixty-county average was computed to be 31.93 percent of the total employed in mining and manufacturing. The standard deviation was found to be 10.34 percentage points. State-group averages were calculated to be the following: Kentucky, 25.10 percent; West Virginia, 33.91 percent; Tennessee, 37.99 percent; and Virginia, 39.17 percent.

It is of interest to note that Owsley County, Kentucky, which has the highest developmental ranking in terms of the mining and manufacturing indicator, was contrastingly ranked lowest in terms of the per capita income indicator. This is precisely the kind of contrast which the developmental index was designed to illuminate. Economic activity involves social costs; conversely, an agreeable social environment entails economic costs. It was the intention of the development index to weigh both economic an˙ social considerations.

XII. INDICATOR 12: MILES OF NONMUNICIPAL SURFACED ROADS PER SQUARE MILE COUNTY AREA

Formal Definition of the Indicator

Data for the indicator were derived by dividing the total number of miles of nonmunicipal surfaced roads by the total county land area in square miles.

Source of the Data

Data were obtained through letters of inquiry addressed to the Highway Commissioner of each state. Statistics for each state-group were contained in the following specific sources:

Personal letter, dated May 23, 1972, from Mr. James W. Fehr, Director, Division of Planning, Kentucky Department of Highways;

Personal letter, dated May 19, 1972, from Mr. James G. Daves, Assistant Director of Planning Statistics, Research and Planning Division, Tennessee Department of Highways;

"Mileage Tables: The State Highway System," Division of Traffic and Safety, Commonwealth of Virginia Department of Highways; and

"Annual Inventory Tables," Advanced Planning Division, West Virginia Department of Highways.

In each case, mileage statistics pertained to the period ending December 31, 1971.

Statistics concerning county land area expressed in square miles were derived from the Rand McNally and Company _1971 Commercial Atlas and Marketing Guide_, (Chicago, 1971).

Comments on the Ranking Results

The Central Appalachian regional average was found to be 1.49 miles of nonmunicipal paved roads per square mile county area, with a standard deviation of .40 miles. The Central Appalachian counties of Kentucky and Tennessee exhibited similar mileage ratios of 1.612 and 1.613, respectively. The Virginia state-group boasted the third highest ratio of 1.149, while West Virginia ranked last among the state-groups with a ratio of 1.124.

XIII. INDICATOR 13: DEPENDENCY RATIO

Formal Definition of the Indicator

To obtain the dependency ratio for each county, the total number of persons under 18 years of age or 65 years and over was divided by the number of persons aged 18 to 64 years. The resulting figure was multiplied by 100, to conform to general convention, thereby yielding the number of "dependents" per hundred "independents."

Source of the Data

The data were derived from the U. S. Bureau of the Census, 1970 Census of the Population, General Population Characteristics, Series PC(1)-B, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, Table 16, "Summary of General Characteristics" (U. S. Government Printing Office, Washington, D. C., 1971).

Comments on the Ranking Results

Only eight of the sixty Central Appalachian counties exhibited dependency ratios equal to or lower (i.e., better) than that of the nation as a whole. While the overall U. S. ratio was found to be 79 dependent persons per hundred independent persons, the sixty county regional average was computed to be 90 dependents per hundred independents. The standard deviation was computed to be 10.0.

The Central Appalachian counties of Tennessee displayed the most favorable state-group average (82 per 100), followed by Virginia (84 per 100) and West Virginia (88 per 100). The twenty-six counties of Kentucky yielded an average which was substantially disadvantaged compared to other state-groups (98 per 100). In fact, Kentucky counties comprised eighteen of the twenty lowest-ranked counties.

XIV. INDICATOR 14: PERCENT CHANGE IN POPULATION 1960-70

Formal Definition of the Indicator

To obtain the appropriate county figure, the difference between the countv population in 1970 and the county population in 1960, as established by the respective decennial census, was divided by the 1960 county population, then multiplied by 100.

Source of the Data

The data were obtained from the U. S. Bureau of the Census, 1970 Census of the Population, General Population Characteristics, Series PC(1)-B, volumes pertaining to Kentucky, Tennessee, Virginia and West Virginia, Table 16, "Summary of General Characteristics, 1970," (U. S. Government Printing Office, Washington, D. C., 1971).

Comments on the Ranking Results

Central Appalachia, as a region, decreased in population during the ten-year period from 1960 to 1970. The average degree of population reduction in the sixty-county region was -7.9 percent. Tennessee experienced the most limited degree of population change among the state-groups, the 1970 population of its eighteen Central Appalachian counties being .7 percent less than the 1960 population. The twenty-six Kentucky counties exhibited a 1970 population 8.7 percent smaller than that of 1960, while Virginia displayed a 13.6 percent drop in population and West Virginia, a 15.6 percent decrease in population.

While all four state-groups experienced negative population change, fourteen individual counties in Kentucky and Tennessee displayed population gains during the decade. However, all Central Appalachian counties in Virginia and West Virginia showed population losses.

Population change should not be confused with migration figures. Data concerning migration are adjusted for population change due to births and deaths, while population change expresses the net effect of changes resulting from three distinct sources: births, deaths, and migration. However, dramatic changes in population are more likely to stem from migratory movements than from vital statistics effects.

CHAPTER V

DERIVATION OF A COMPOSITE INDEX AND RESULTANT COUNTY RANKINGS

A primary goal of this study, as stated in Chapter II, was to describe the level-of-living status within each Central Appalachian county in terms of a developmental score which would enable one to scale the sixty counties in relation to each other. Toward this end, data were collected on fourteen variables comprising elements of the theoretical set of all those elements which determine the level of living.

The question may then be posed, do variations in the variables reflect, in fact, a relationship to some common component, which might be given a name such as "level of development"? Are there patterns in the observed data variations which can be discerned? Can these patterns, once discerned, be given meaningful labels?

To answer such questions, the mathematical technique of factor analysis lends itself. Through factor analysis, one may reduce data to its common patterns, if such exist. Thus, regularity in the data may be detected. Each pattern discerned in the data appears as a _factor_, locating a cluster of interrelated variables.

It is not possible to know, prior to the analysis, how many significant patterns exist in the data. Though the aim of this study was to discern a pattern which might be described as the level of development, it will be seen below that three interesting patterns emerged from the factor-analyzed data, only one of which was the level of development pattern initially sought. All three patterns are presented and described, though the emphasis of the present thesis remains centered on the "level of development" factor.

While this chapter does not aim to serve as a text explanation of the factor analytic technique,[1] an attempt will be made to present both the results as computed according to the technique and the methodological commentary vital to the understanding of these results. It will be recalled that developmental agencies working in Central Appalachia were designated as the client of this study. Bearing the needs of the client in mind, it was thought that a careful, albeit selective, description of the several steps which culminate in the composite index would yield a report with a higher informational content and a greater usability.

The process by which the composite index is derived may be viewed essentially as involving four successive steps. First, the matrix of correlation coefficients expressing relationships between every pair of variables is obtained. Second, the initial factors are extracted to yield an unrotated factor solution. Third, terminal factors are obtained through rotation. Fourth, factor scores, which can subsequently be ordered to yield a ranking, are computed. The results of each of these steps will be presented and examined in turn in this chapter.

I. THE MATRIX OF CORRELATION COEFFICIENTS

The point of departure in the procedure of factor analysis is the calculation of a matrix of correlation coefficients, which shows the

[1]For such, see Rummel, R. J., Applied Factor Analysis, (Northwestern University Press, Evanston, Illinois, 1970).

direction and degree of linear relationship which exists between any two variables.[2] This matrix is presented in Table VI.[3]

The relationship of any one variable to any other variable may be found by reading down the specific variable column, or across the specific variable row. As the correlation coefficient approaches an absolute value of 1, a progressively stronger linear relationship is indicated. Contrarily, correlation coefficients close to zero indicate weak, or nonexistent, relationships. The matrix diagonal contains only 1's, indicating the identity relationship between a variable and itself. A negative correlation coefficient indicates an inverse relationship. To ascertain the percent variation in common for data on two variables, one may simply square the correlation coefficient and multiply by 100.

For example, reading down the INCOME column, one may note that INCOME has a strong negative relationship with POVERTY (the correlation coefficient is -.93). That is, in examining data on the sixty counties, a distinct relationship in the variations of INCOME and POVERTY figures could be perceived; namely, as per capita income rose, the percentage of families having income below the poverty level tended to decline. From the correlation coefficient, one may calculate that 86 percent of the

---

[2]Analysis of interrelationships among characteristics (variables) is categorized in the literature as R-type analysis; Q-type analysis, on the other hand, deals with interrelationships among cases.

[3]All computations performed in the factor analysis were carried out to five decimal places. However, for display purposes, the results presented in tabular form have been rounded-off to two, or three, decimal places in all cases but one. The table of factor score coefficients exhibits the computed coefficients with five decimal places.

TABLE VI

MATRIX OF CORRELATION COEFFICIENTS FOR FOURTEEN VARIABLES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. INCOME	1.00	-0.93	-0.66	-0.40	-0.13	0.42	0.59	0.82	0.52	-0.62	0.36	-0.07	-0.73	0.15
2. POVERTY	-0.93	1.00	0.67	0.47	0.11	-0.45	-0.51	-0.71	-0.54	0.64	-0.55	0.14	0.77	-0.10
3. NOCAR	-0.66	0.67	1.00	0.25	0.24	-0.13	-0.10	-0.49	-0.31	0.25	-0.43	-0.19	0.70	-0.48
4. UNDEREMP	-0.40	0.47	0.25	1.00	-0.04	-0.14	-0.24	-0.19	-0.21	0.38	-0.52	0.38	0.15	0.08
5. INFDEATH	-0.13	0.11	0.24	-0.04	1.00	0.11	0.11	-0.01	0.09	0.14	-0.04	-0.31	0.35	-0.26
6. HOSBEDS	0.42	-0.45	-0.13	-0.14	0.11	1.00	0.68	0.41	0.25	-0.33	0.03	-0.09	-0.32	-0.18
7. DOCTORS	0.59	-0.51	-0.10	-0.24	0.11	0.68	1.00	0.64	0.34	-0.52	0.01	-0.23	-0.30	-0.24
8. HSGRADS	0.82	-0.71	-0.49	-0.19	-0.01	0.41	0.64	1.00	0.51	-0.53	0.11	-0.08	-0.57	0.12
9. ENROLL	0.52	-0.54	-0.31	-0.21	0.09	0.25	0.34	0.51	1.00	-0.35	0.27	-0.31	-0.42	-0.11
10. UNSKILL	-0.62	0.64	0.25	0.38	0.14	-0.33	-0.52	-0.53	-0.35	1.00	-0.54	0.35	0.37	0.08
11. MNGMFG	0.36	-0.55	-0.43	-0.52	-0.04	0.03	0.01	0.11	0.27	-0.54	1.00	-0.39	-0.44	-0.04
12. ROADS	-0.07	0.14	-0.19	0.38	-0.31	-0.09	-0.23	-0.08	-0.31	0.35	-0.39	1.00	-0.13	0.47
13. DEPENDCY	-0.73	0.77	0.70	0.15	0.35	-0.32	-0.30	-0.57	-0.42	0.37	-0.44	-0.13	1.00	-0.27
14. POPCHAN	0.15	-0.10	-0.48	0.08	-0.26	-0.18	-0.24	0.12	-0.11	0.08	-0.04	0.47	-0.27	1.00

variation in the data on INCOME and POVERTY was in common ($-.93^2 \times 100 = 86.49\%$).

Similarly, a strong positive relationship exists between INCOME and HSGRADS (correlation coefficient of .82), while there seems to be little variation in common between the data on INCOME and ROADS (the correlation coefficient was -0.07). This means that, on the basis of the observed data, one may assert that a high per capita income was generally associated with a high percentage of high school graduates, whereas data on income within the county did not contain much information about the miles of nonmunicipal paved roads within the county.

Careful perusal of the correlation matrix will provide the reader with considerable information regarding the interrelationships among the variables. Intuitive ideas concerning these relationships may be confirmed in some cases, but refuted in others. For instance, one might have hypothesized a strong inverse relationship between INFDEATH and DOCTORS or HOSBEDS, based on a notion that infant mortality rates should decline as the ratio of doctors or hospital beds to inhabitants increases. However, the observed data did not substantiate such a hypothesis. The correlations between INFDEATH and DOCTORS and between INFDEATH and HOSBEDS were weak ones having little predictive value. (The correlation coefficients were 0.11 in both cases.) In both cases, scarcely more than 1 percent of the observed variation in the pair of variables was in common. Apparently, the number of doctors, or hospital beds, accounted for little of the variation in the infant mortality rate. Surprisingly, the variation in infant mortality rates seemed to have more in common (negatively) with variation in miles of pave roads ($-.31^2 \times 100 = 9.61\%$) and (positively) with variation in the dependency ratio ($.35^2 \times 100 = 12.25\%$) than with either doctors or hospital beds.

II. EXTRACTION OF THE INITIAL FACTORS

Following the computation of the matrix of correlation coefficients, the data were factor analyzed. The patterns of interrelationships among the variables were extracted through the technique of classical, or common, factor analysis. Common factor analysis is premised on the assumption that, while part of the variation in each variable may result from a source common to all the variables, some proportion of the total variation of a particular variable is unique to that variable. Only that part of the variation which is common to all the variables is factor analyzed in the common factor method.

An algebraic description of the factor model may clarify the special properties of the common factor method. Each variable may be expressed as a linear function of the (unknown) common factors and the (unknown) unique sources of variation. A series of n equations would result (where the number of variables = n), such that,

$$
\begin{aligned}
V_1 &= a_{11}F_1 + a_{12}F_2 + a_{13}F_3 + \cdots + a_{1m}F_m + d_1U_1 \\
V_2 &= a_{21}F_1 + a_{22}F_2 + a_{23}F_3 + \cdots + a_{2m}F_m + \quad + d_2U_2 \\
V_3 &= a_{31}F_1 + a_{32}F_2 + a_{33}F_3 + \cdots + a_{3m}F_m + \quad\quad + d_3U_3 \\
&\vdots \\
V_n &= a_{n1}F_1 + a_{n2}F_2 + a_{n3}F_3 + \cdots + a_{nm}F_m + \quad\quad\quad + d_nU_n
\end{aligned}
$$

where

V = a variable with known data,

a, d = constants,

F, U = functions of unknown variables, and

$m < n$.

The series of equations is presented in such a way to emphasize the distinction between the common sources of variation (the F functions) and the unique sources (the U functions). Note that F_1 through F_m are the <u>same</u> in each equation. These are the sources of variation which are common to all the variables. On the other hand, U_1 through U_n represent a <u>different</u> function for each variable. There is no correlation between any two U functions; nor is there any correlation between any one U function and any one F function. The U functions are the unique sources of variation for each variable. Only the common sources of variation will be included in the analysis; the unique sources of variation will not be accounted for.[4]

While only common variance will be analyzed, the degree of communality among the variables is not internally determined by the factor model. The degree of communality must be exogenously specified. However, there exists no fixed standard concerning the best method of estimating communality. A frequently employed estimate of communality is the squared multiple correlation coefficient, the sum of the squared factor loadings for each variable. This was the method of estimation

---

[4]The common factor method should be distinguished from the principal component method, which analyzes all sources of variation, whether common or unique.

utilized here. Prior to further computation, the estimates of communality are used to replace the 1's in the diagonal of the correlation coefficient matrix. One might view these estimates somewhat intuitively as "deflaters."

The common factor method of analysis will define the F functions; these will appear as factors describing the salient patterns in the data. There will be fewer factors than there are variables (m<n). The analysis will also define the "a" constants, termed loadings. As a final step, the analysis will reverse the format of the series of equations, to express each factor as a function of the n variables, such that

$$F_i = b_{i1}V_1 + b_{i2}V_2 + b_{i3}V_3 + \ldots\ldots + b_{in}V_n.$$

The "b" constants, termed weights, will be defined as factor score coefficients, permitting the computation of a terminal factor score for each county.

The initial extraction of factors, obtained through the principal axes technique, yielded the results displayed in Table VII. The Kaiser test for factor saliency was used, specifying the extraction of only those factors with an eigenvalue greater than or equal to 1.0. Given these specifications, three meaningful patterns of relationship among the variables were identified, labelled as Factor 1, Factor 2, and Factor 3. These factors may be interpreted as three distinct independent sources of data variation; conversely, variations in the data may be thought of as reflecting differences from one case to another in the domain delineated by the factor.

The figures appearing at the intersection of the factor columns and variable rows are the loadings, or the "a" constants of the model

TABLE VII

FACTOR ANALYSIS OF FOURTEEN VARIABLES FOR SIXTY COUNTIES: UNROTATED FACTOR MATRIX

Variables	Factor 1	Factor 2	Factor 3	Communality
INCOME	0.949	-0.105	-0.123	0.926
POVERTY	-0.967	0.067	-0.064	0.943
NOCAR	-0.650	0.542	-0.155	0.741
UNDEREMP	-0.439	-0.233	-0.335	0.359
INFDEATH	-0.108	0.416	-0.051	0.187
HOSBEDS	0.474	0.254	-0.373	0.428
DOCTORS	0.625	0.425	-0.505	0.826
HSGRADS	0.780	-0.014	-0.339	0.723
ENROLL	0.552	0.155	-0.004	0.329
UNSKILL	-0.679	-0.233	-0.123	0.530
MNGMFG	0.537	0.092	0.756	0.869
ROADS	-0.199	-0.716	-0.329	0.661
DEPENDCY	-0.755	0.397	-0.005	0.728
POPCHAN	0.075	-0.679	0.012	0.466
Percent Total Variance	38.25	14.30	9.73	62.28
Percent Common Variance	61.4	23.0	15.6	
Eigenvalues	5.355	2.001	1.362	

(Principal axes technique. Factoring stopped at eigenvalues less than 1.0.)

set of equations, as determined by the unrotated solution. In the case of the unrotated solution, these loadings are also correlation coefficients, showing the degree and direction of the relationship between each variable and each factor pattern. A high loading (approaching an absolute value of 1) thus suggests a high involvement of the variable in the cluster associated with the factor pattern, whereas a low loading (approaching 0) indicates little involvement. Though no universal criterion exists for evaluating a loading as high, a loading equal to or greater than .4 will be considered as moderate-to-high for the purposes of this discussion. The loading squared and multiplied by 100 yields the percent of variation in the variable involved in the specific factor pattern. Thus a loading of .4 indicates that $.4^2 \times 100 = 16\%$ of the total variation in the variable is accounted for by the factor.

Note that all the variables load greater than .4 on at least one factor. Eleven of fourteen variables load heavily on Factor 1; five of fourteen variables load heavily on Factor 2; and two of fourteen variables load heavily on Factor 3. It is characteristic of the unrotated solution that the first factor accounts for the greatest amount of patterned variation in the data, while the second factor accounts for the second greatest amount, and so on.

The column labelled "Communality" shows the proportion of total variation of each variable which is patterned (where total variation of each variable equals 1). It is derived by summing the squared factor loadings over all the factors for each variable. Equivalently, one might state that the communality figure expresses the percent of total variation that can be explained for one variable from data on all the other variables. The complement of the communality figure yields the proportion of total variance in each variable which is unique, or unpatterned.

For instance, the communality figures indicate that a high proportion (94 percent) of the total variance in the POVERTY data is patterned, while only 19 percent of the total variance in the INFDEATH data results from a common source of variation. Evidently, 81 percent of the variation in infant mortality rates results from a source unique to it.

By summing the communality column (to obtain the amount of total variation which is patterned), and dividing by 14 (the total amount of variation), then multiplying by 100, one obtains the percent of total variation which is patterned. From the table, it can be seen that 62.28 percent of the total variation in all variables can be accounted for by the factor patterns as a group.

One may also determine the amount of total variance in all variables accounted for by any one particular factor. This is done by summing the squared factor loadings for any factor, dividing by total variance for all factors (14), and multiplying by 100. The "Percent Total Variance" row exhibits these percentages. Factor 1 accounts for 38.25 percent of the total variation; Factor 2, 14.30 percent; and Factor 3, 9.73 percent.

The "Percent Common Variance" row indicates how much of the patterned variation is involved in each particular pattern. The figures were obtained by dividing the sum of the squared factor loadings for the given factor by the sum of the communality figures, then multiplying by 100. It will be seen from the table that 61.4 percent of the patterned variation in all the variables is explained by Factor 1, 23.0 percent by Factor 2 and 15.6 percent by Factor 3.

The eigenvalue is defined as the sum of the squared factor loadings for a particular factor. As seen above, the percent total variance and the percent common variance may be computed from the eigenvalue.

III. ROTATION TO TERMINAL FACTORS

The factors identified in the unrotated solution may be thought of as axes defining a space in which the groups of interrelated variables form clusters. To better locate these clusters of variables, the axes may be rotated to a position more closely associated with the center of the cluster. Prior to this rotation, one may specify whether the axes (or factors) must remain at right angles to each other (orthogonal rotation) or whether the axes may deviate from the fixed right-angles position (oblique rotation).

In an orthogonally-rotated solution, the terminal factors are independent, or uncorrelated. In a solution obtained through oblique rotation, the terminal factors may be correlated. While the first method is characterized by greater mathematical simplicity, the latter method more nearly approximates empirical reality. In the real world, factors, just as variables, may be related. The oblique rotational method was employed here, thus allowing the factors to freely locate clusters of variables.

The Factor Pattern

The factor pattern presented in Table VIII displays the terminal solution following the rotation. At the intersections of the factor columns and the variable rows are found the factor loadings, as determined by the rotated solution. These loadings are the "a" constants of the factor model. One may now replace the unknown "a" constants in the original set of equation with the loadings, such that,

$$\text{INCOME} = 0.733F_1 - 0.371F_2 + 0.242F_3 + d_1U_1;$$

$$\text{POVERTY} = -0.605F_1 + 0.350F_2 - 0.440F_3 + d_2U_2;$$

and so on for the fourteen variables.

The factor loadings indicate which variables are highly involved in which clusters. A high loading suggests a close association with the cluster located by the factor; a low loading indicates little or no association. Analysis of which variables load highly on which factors, and in which direction, gives insight into the meaning of the factor.

Interpretation of the Factors

Table IX is intended to facilitate this analysis. The table displays a simplified version of the factor pattern matrix. In it are noted only those loadings greater than .50, and the highest loading for each variable, though this was in three instances less than .50.

It can be seen that Factor 1, the factor which accounted for the greatest amount of common variation in the data, was characterized by high positive loadings for DOCTORS, HOSBEDS, HSGRADS, ENROLL, and INCOME, and a high negative loading for POVERTY. This indicates that, (1) an increase in the number of doctors per inhabitant is associated with

TABLE VIII

FACTOR ANALYSIS OF FOURTEEN VARIABLES FOR SIXTY COUNTIES: FACTOR PATTERN

Variables	Factor 1	Factor 2	Factor 3
INCOME	0.733	-0.371	0.242
POVERTY	-0.605	0.350	-0.440
NOCAR	-0.204	0.718	-0.286
UNDEREMP	-0.090	-0.079	-0.561
INFDEATH	0.061	0.433	0.006
HOSBEDS	0.685	0.126	-0.109
DOCTORS	0.934	0.252	-0.135
HSGRADS	0.809	-0.223	-0.016
ENROLL	0.422	-0.011	0.258
UNSKILL	-0.426	-0.020	-0.452
MNGMFG	-0.209	-0.107	0.977
ROADS	-0.038	-0.613	-0.574
DEPENDCY	-0.430	0.602	-0.217
POPCHAN	-0.112	-0.674	-0.121

(Common factor analysis. Oblique rotation.)

TABLE IX

FACTOR ANALYSIS OF FOURTEEN VARIABLES FOR SIXTY COUNTIES: SIMPLIFIED FACTOR PATTERN

Variables	Factor 1	Factor 2	Factor 3
DOCTORS	.93		
HSGRADS	.81		
INCOME	.73		
HOSBEDS	.69		
ENROLL	.42		
POVERTY	-.61		
NOCAR		.72	
DEPENDCY		.60	
INFDEATH		.43	
POPCHAN		-.67	
RAODS		-.61	
MNGMFG			-.57
UNDEREMP			.98
UNSKILL			-.56
			-.45

(All loadings greater than .50, or the highest loading for the variable if less than .50, were noted.)

Factor 1; (2) an increase in the number of hospital beds per inhabitant is associated with Factor 1; (3) an increase in the percentage of the over-25 population who are high school graduates is associated with Factor 1; (4) an increase in the percentage of sixteen and seventeen year olds enrolled in school is associated with Factor 1; (5) an increase in the per capita income is associated with Factor 1; and (6) a decrease in the percentage of families having income below the poverty line is associated with Factor 1. Factor 1 is characterized by a favorable status concerning health facilities, a favorable educational status, and a favorable income level and distribution. Factor 1 is related to health, wealth and education variables. As such, it would seem appropriate to label it "level of development" in the broad sense outlined in the Introduction.

Factor 2, on the other hand, gives a heavy positive loading to NOCAR, DEPENDCY, AND INFDEATH, while POPCHAN and ROADS are loaded heavily in a negative direction. An increase in the percentage of households having no car; an increase in the dependent segments of the population; an increase in the infant mortality rate; a decrease in the miles of paved roads; and a decrease in the degree of population change are all associated with Factor 2. The relative absence of cars, roads and population change, coupled with a high infant mortality rate and a high proportion of dependent persons suggests that Factor 2 indicates a pattern tentatively described as "immobility."

In examining the loadings for Factor 3, one is struck by the high degree of association between MNGMFG and the factor. The MNGMFG variable carries a positive loading of .98. Three other indicators display loadings, all of which are negative, which associate them with the Factor 3 pattern; these are ROADS, UNDEREMP, UNSKILL. The pattern thus involves a high degree of mining and manufacturing activity, a low degree of underemployment and a low proportion of unskilled workers, suggesting that the domain delineated might aptly be termed "level of industrial activity." The involvement of low road mileage is somewhat confusing, however. It might be noted that, contrary to expectations, the ROADS indicator seemed to indicate, rather than a participation element, a "ruralism" element. From the correlation coefficients matrix, it may be seen that ROADS was negatively correlated with such variables as ENROLL and MNGMFG, while being positively correlated with UNDEREMP and UNSKILL. A high ratio of roads to land area may in fact suggest a decentralized, primarily rural county as opposed to a more centralized, urbanized county. Such an interpretation could explain its negative association with the "level of industrial activity" factor.

Correlations Between Factors

Since there was no orthogonality constraint imposed on the oblique rotation, it was possible for the terminal factors to exhibit some degree of correlation. Despite the absence of such a constraint, the factors were, in fact, only moderately oblique. The correlation coefficient of -0.08004 between Factor 1 and Factor 2 ("level of development" and "immobility") showed the two factors to be virtually uncorrelated. A similar lack of correlation appeared between Factor 2 and Factor 3 ("immobility" and "level of industrial activity") with a correlation coefficient of -0.08286. A moderate degree of positive correlation was found between Factor 1 and Factor 3 ("level of development" and "level of industrial activity") with a coefficient of 0.37985.

The Factor Structure

In the unrotated solution, the factor loadings were identical with the correlation coefficients showing the relationship between each factor and each variable. Following oblique rotation, however, this is no longer true. The square of the factor loadings, displayed in the factor pattern matrix, indicate the amount of variance in the variable directly accounted for by a factor. A given factor may, however, contribute indirectly to the variance in a variable through its relationship (correlation) with other factors. For this reason, the oblique rotational method yields two separate matrices, one (the factor pattern) displaying factor loadings, and the other (factor structure) displaying correlation coefficients.

The factor structure matrix is presented in Table X. It shows the correlations between variables and factors. By squaring the structure coefficient and multiplying by 100, one may compute the total variation in each variable which is explained by the respective factor. The total variation in each variable explained by all the factors combined--the communality of the variable--is given by the sum of the squared structure coefficients along the row.

Factor Score Coefficients

The final output of the procedure of rotation to the terminal factor solution is the matrix of factor score coefficients, presented in

TABLE X

FACTOR ANALYSIS OF FOURTEEN VARIABLES FOR SIXTY COUNTIES:
FACTOR STRUCTURE

Variables	Factor 1	Factor 2	Factor 3
INCOME	0.854	-0.450	0.551
POVERTY	-0.800	0.434	-0.699
NOCAR	-0.370	0.758	-0.423
UNDEREMP	-0.297	-0.025	-0.589
INFDEATH	0.028	0.428	-0.007
HOSBEDS	0.633	0.080	0.140
DOCTORS	0.863	0.188	0.199
HSGRADS	0.821	-0.287	0.310
ENROLL	0.521	-0.067	0.419
UNSKILL	-0.596	0.051	-0.613
MNGMFG	0.170	-0.171	0.906
ROADS	-0.207	-0.563	-0.538
DEPENDCY	-0.561	0.654	-0.430
POPCHAN	-0.104	-0.655	-0.108

(Common factor analysis; oblique rotation.)

Table XI. The factor score coefficients represent the weights required to estimate the factors from the variables. These weights are the "b" constants defined in the second series of equations depicting the factor model. The factor score coefficients permit the computation of a factor score for each of the Central Appalachian counties in terms of each factor. Computation of these scores, the fourth and final step of the analysis, is treated in the section below.

IV. FACTOR SCORES FOR THE SIXTY COUNTIES

Factor Scores

Given the factor score coeffici .s, a score on each factor may now be computed for each Central Appalachian county from the observed data. The score coefficients and the data values replace the unknown elements of the equation

$$F_i = b_{i1}V_1 + b_{i2}V_2 + b_{i3}V_3 + \ldots\ldots + b_{in}V_n.$$

In the actual calculation, the data appear in standardized form; that is, the mean of the values observed for the variables over the sixty cases is substracted from the observed variable value for the specific county, then divided by the standard deviation. Given the standardized form of the data, the mean of the score distribution is known to be zero, with a standard deviation of 1. The sum of the fourteen standardized variables multiplied by their respective factor score coefficients yields the factor score.

For example, the Factor 1 score for County J would be computed in the following fashion:

TABLE XI

FACTOR ANALYSIS OF FOURTEEN VARIABLES FOR SIXTY COUNTIES: FACTOR SCORE COEFFICIENTS

Variables	Factor 1	Factor 2	Factor 3
INCOME	0.23316	-0.23322	0.21941
POVERTY	-0.42791	0.00318	-0.42893
NOCAR	0.06335	0.35186	0.11447
UNDEREMP	0.08144	0.00031	0.06728
INFDEATH	-0.00856	0.00910	-0.12695
HOSBEDS	0.02082	0.04669	-0.01485
DOCTORS	0.45698	0.34117	-0.00089
HSGRADS	0.12151	0.04702	0.08932
ENROLL	0.02027	0.06139	0.02714
UNSKILL	0.05974	0.10679	0.21927
MNGMFG	-0.08294	0.13790	0.84215
ROADS	-0.06887	-0.27742	-0.21005
DEPENDCY	0.03635	0.35025	0.34018
POPCHAL	-0.02261	-0.13706	0.02583

(Common factor analysis; oblique rotation.)

$$
\begin{aligned}
\text{Factor 1 Score} = {} & (0.23316)[(V_1 - \bar{X}_1)/s_1] + (-0.42791)[(V_2 - \bar{X}_2)/s_2] \\
& + (0.06335)[(V_3 - \bar{X}_3)/s_3] + (\ 0.08144)[(V_4 - \bar{X}_4)/s_4] \\
& +(-0.00856)[(V_5 - \bar{X}_5)/s_5] + (\ 0.02082)[(V_6 - \bar{X}_6)/s_6] \\
& + (0.45698)[(V_7 - \bar{X}_7)/s_7] + (\ 0.12151)[(V_8 - \bar{X}_8)/s_8] \\
& + (0.02027)[(V_9 - \bar{X}_9)/s_9] + (\ 0.05974)[(V_{10} - \bar{X}_{10})/s_{10}] \\
& +(-0.08294)[(V_{11} - \bar{X}_{11})/s_{11}] + (-0.06887)[(V_{12} - \bar{X}_{12})/s_{12}] \\
& + (0.03635)[(V_{13} - \bar{X}_{13})/s_{13}] + (-0.02261)[(V_{14} - \bar{X}_{14})/s_{14}]
\end{aligned}
$$

where V_i = observed value for the i^{th} indicator for County J;

$\bar{X}_i$ = mean of the sixty observed values for indicator i;

s_i = standard deviation of the sixty observed values for indicator i.

The constants are the factor score coefficients for Factor 1 as presented in Table XI.

Note that a score pertains to only the factor specified. It is not possible to score a county in terms of the three factors simultaneously. Rather, three separate scores may be derived for each county: a score for Factor 1 ("level of development"), a score for Factor 2 ("immobility"), and a score for Factor 3 ("level of industrial activity"). Although the initial interest which prompted this study concerned the level of development, a factor score for each of the three factors was calculated for each county. These scores, rounded to two decimal places, are presented in Table XII. It was felt that information on all three factors would serve to increase general knowledge about the Appalachian region.

County Rankings Derived from Factor Scores

Table XIII presents, in tabular form, for each factor, the rank assigned to each county on the basis of its factor score. The county

TABLE XII

FACTOR ANALYSIS OF FOURTEEN VARIABLES FOR SIXTY COUNTIES: FACTOR SCORES

County	Factor 1 "Level of Development"	Factor 2 "Immobility"	Factor 3 "Level of Industrial Activity"
Ball Ky	.56	1.08	- .55
Breathitt Ky	- .88	1.42	-1.14
Clay Ky	-1.34	.83	-1.34
Clinton Ky	- .30	- .63	- .36
Floyd Ky	.25	- .02	- .26
Harlan Ky	1.26	1.77	.24
Jackson Ky	-1.30	- .41	-1.55
Johnson Ky	.30	- .14	-1.04
Knott Ky	-1.33	.46	-1.31
Knox Ky	- .55	.21	-1.06
Laurel Ky	- .07	-1.44	-1.35
Lawrence Ky	.67	1.07	- .46
Lee Ky	- .79	.61	- .65
Leslie Ky	-1.63	1.29	- .23
Letcher Ky	- .10	1.11	.84
Magoffin Ky	-1.03	.29	- .79
Martin Ky	-1.02	1.21	- .45
McCreary Ky	-1.64	.23	- .13
Owsley Ky	-1.42	.38	-2.54
Perry Ky	.27	1.09	- .47
Pike Ky	.14	.02	.65
Pulaski Ky	.85	- .95	- .50
Rockcastle Ky	- .52	- .77	- .72
Wayne Ky	- .84	.17	- .65
Whitley Ky	.41	- .11	-1.23
Wolfe Ky	-1.36	1.02	-1.10
Anderson Tn	2.70	-1.43	1.29
Campbell Tn	- .24	.02	- .05
Claiborne Tn	- .34	- .68	- .44
Clay Tn	- .06	.04	- .01
Cumberland Tn	.61	- .36	.54
DeKalb Tn	.48	-1.82	.35
Fentress Tn	- .55	.56	.45
Hancock Tn	-1.50	- .48	-1.10
Jackson Tn	- .47	- .42	.12
Macon Tn	- .22	-1.66	.28
Morgan Tn	- .41	- .43	1.52
Overton Tn	- .48	- .15	.52
Pickett Tn	- .97	-1.06	.49
Putnam Tn	.83	-2.56	- .11
Scott Tn	- .42	.34	.45
Smith Tn	.79	-1.28	.57
Union Tn	- .90	-1.59	.31
White Tn	.20	-1.46	1.30
Buchanan Va	- .10	.46	2.51
Dickenson Va	- .41	.35	1.18
Lee Va	- .13	.47	- .74
Russell Va	.06	- .56	.90
Scott Va	.08	- .86	.79
Tazewell Va	1.06	- .38	.89
Wise Va	1.41	.78	.52
Fayette W Va	.87	.27	1.08
Logan W Va	1.24	.82	1.33
McDowell W Va	.61	1.21	1.61
Mercer W Va	2.43	- .65	- .21
Mongo W Va	.85	1.67	.19
Monroe W Va	.88	- .13	.17
Raleigh W Va	2.19	.84	.53
Summers W Va	.83	.29	-1.26
Wyoming W Va	.45	.00	2.16

TABLE XIII

FACTOR ANALYSIS OF FOURTEEN VARIABLES FOR SIXTY COUNTIES:
COUNTY RANKINGS BASED ON FACTOR SCORES

County	Factor 1 "Level of Development"	Factor 2 "Immobility"	Factor 3 "Level of Industrial Activity"
Bell Ky	18	9	43
Breathitt Ky	48	3	53
Clay Ky	55	13	57
Clinton Ky	36	46	37
Floyd Ky	24	34	36
Harlan Ky	5	1	26
Jackson Ky	53	41	59
Johnson Ky	22	37	49
Knott Ky	54	19	56
Knox Ky	44	28	50
Laurel Ky	30	55	58
Lawrence Ky	15	10	40
Lee Ky	46	16	44
Leslie Ky	59	4	35
Letcher Ky	31	7	12
Magoffin Ky	52	25	48
Martin Ky	51	5	39
McCreary Ky	60	27	33
Owsley Ky	57	21	60
Perry Ky	23	8	41
Pike Ky	26	31	14
Pulaski Ky	11	51	42
Rockcastle Ky	43	49	46
Wayne Ky	47	29	45
Whitley Ky	21	35	54
Wolfe Ky	56	11	52
Anderson Tn	1	54	7
Campbell Tn	35	32	31
Claiborne Tn	37	48	38
Clay Tn	29	30	30
Cumberland Tn	16	39	16
DeKalb Tn	19	59	23
Fentress Tn	45	17	22
Hancock Tn	58	44	51
Jackson Tn	41	42	29
Macon Tn	34	58	25
Morgan Tn	38	43	4
Overton Tn	42	38	19
Pickett Tn	50	52	20
Putnam Tn	13	60	32
Scott Tn	40	23	21
Smith Tn	14	53	15
Union Tn	49	57	24
White Tn	25	56	6
Buchanan Va	32	20	1
Dickenson Va	39	22	8
Lee Va	33	18	47
Russell Va	28	45	10
Scott Va	27	50	13
Tazewell Va	7	40	11
Wise Va	4	15	18
Fayette W Va	9	26	9
Logan W Va	6	14	5
McDowell W Va	17	6	3
Mercer W Va	2	47	34
Mingo W Va	10	2	27
Monroe W Va	8	36	28
Raleigh W Va	3	12	17
Summers W Va	12	24	55
Wyoming W Va	20	33	2

scores were scaled in descending order; that is, a rank of 1 indicates the highest numerical score for the factor, while a rank of 60 represents the lowest numerical factor score. Thus, Anderson County, Tennessee, was found to have the highest level of development (Factor 1 rank = 1), while McCreary County, Kentucky, rated lowest in terms of the level of development (Factor 1 rank = 60). Harlan County, Kentucky, exhibited the highest degree of immobility (Factor 2 rank = 1), while Putnam County, Tennessee, had the lowest immobility score (Factor 2 rank = 60). Similarly, Buchanan County, Virginia, displayed the greatest level of industrial activity (Factor 3 rank = 1), with Owsley County, Kentucky, rated last in terms of industrial activity (Factor 3 rank = 60). The county rank in respect to each of three factors may be found by reading across the county row.

Mapping of the Ranked Results

Figures 2, 3 and 4 display the ranked results in map form. Each figure indicates four county groups: those comprising the top 25 percent of the ranked scale (ranks 1-15); the second-highest 25 percent (ranks 16-30); the second-lowest 25 percent (ranks 31-45); and the lowest 25 percent (ranks 46-60). In viewing the maps, it must be remembered that inclusion in the first quartile of the ranked results (ranks 1-15) may not automatically be interpreted as indicating an "advantaged" position. While a rank of 1 is preferable to a lower rank in the case of Factor 1 ("level of development"), the reverse may be true in the case of Factor 2 ("immobility"). Interpretation of advantaged versus disadvantaged groups

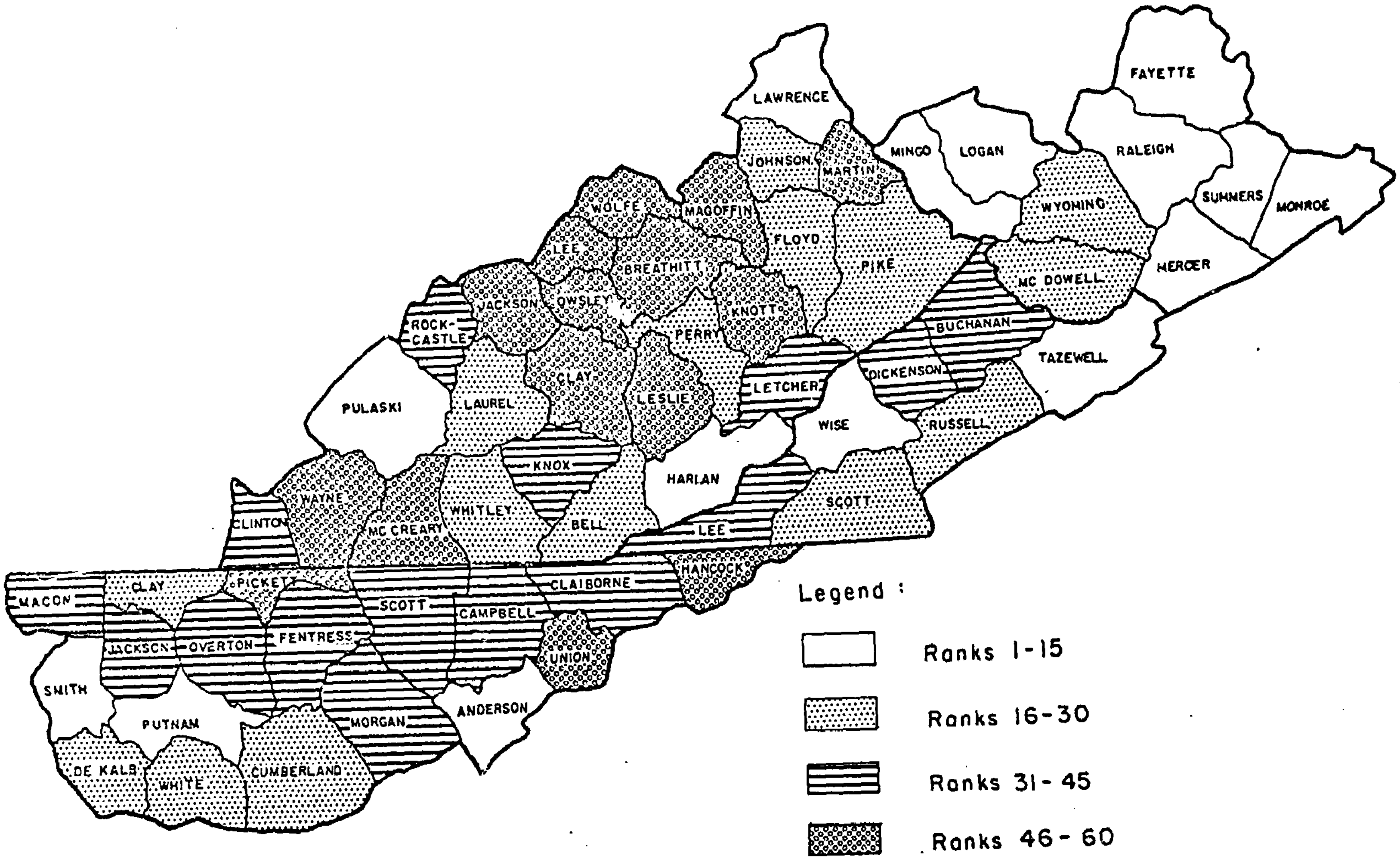

Figure 2. Factor I ranking results: "Level of Development."

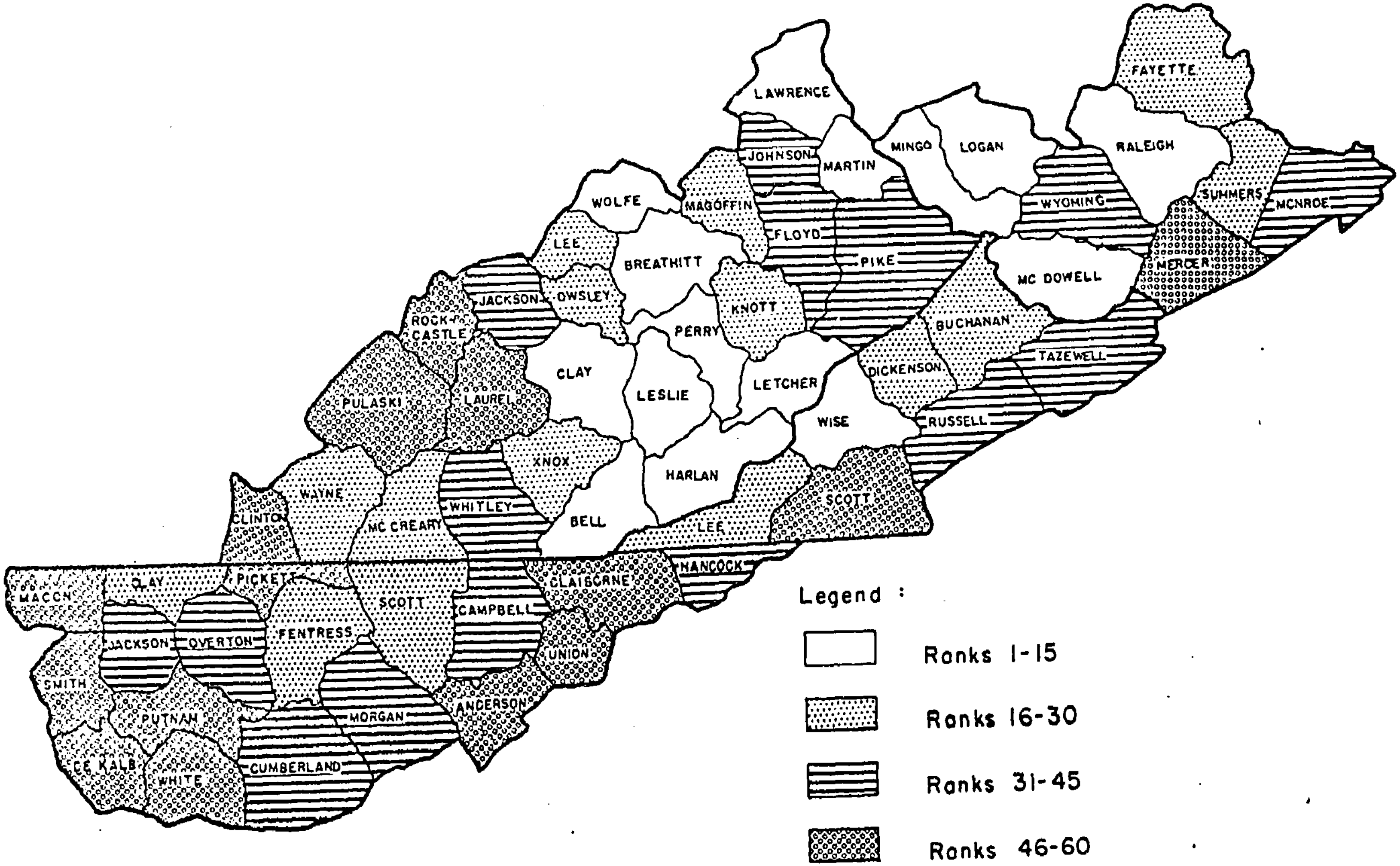

Figure 3. Factor 2 ranking results: "Immobility."

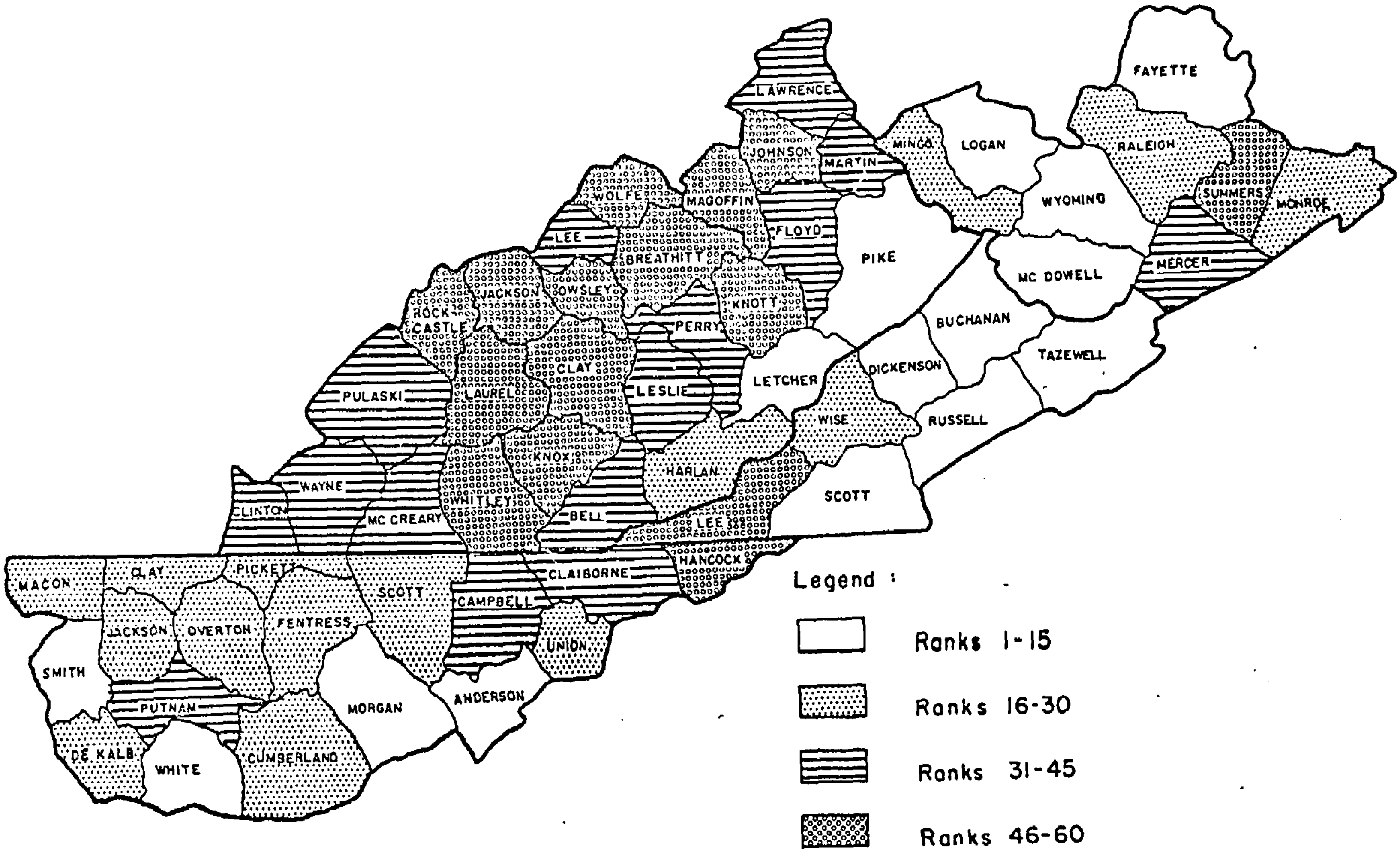

Figure 4. Factor 3 ranking results: "Level of Industrial Activity."

for Factor 3 ("level of industrial activity") may depend on the perspective of the analyst. An economist might consider the highest quartile to be the best, while an environmentalist might evaluate a ranking in the lowest quartile as "best."

Figure 2 displays the quartile divisions of the "level of development" scale. The most salient point emerging from its pattern concerns the West Virginia and Kentucky state-groups. The West Virginia state-group appeared substantially advantaged compared to the other state-groups in terms of the general level of development. Seven of the nine West Virginia counties ranked in the highest quartile; the remaining two counties ranked in the second-highest quartile. Contrastingly, the Kentucky state-group appeared characterized by the most pervasive developmental problems. Twelve of the twenty-six Kentucky counties ranked in the lowest development quartile, while only three counties were included in the highest quartile. Breathitt County, Kentucky, appeared to form the nucleus of a low level-of-living area.

Figure 3 represents the scale derived from Factor 2, named "immobility." The pattern evidences a high degree of immobility in the heart of the Central Appalachian counties of Kentucky. One might thus be tempted to conclude that a high degree of immobility could be associated with a low level of development. But interestingly, six of the fifteen counties which ranked in the highest developmental quartile also ranked in the highest immobility quartile. A possible explanation may be that immobility may be viewed as the result of one of two opposing forces: the inability to relocate, and the absence of need to relocate.

Ambiguous variations in the data, which prevent any linear correlation between Factors 1 and 2, may be a result of two opposing causes of immobility, such as these. While the Kentucky state-group appeared the most immobile, the Tennessee state-group exhibited the lowest degree of immobility.

Figure 4, which maps the ranking results of the "level of industrial activity" factor, delineates two distinct groups of activity. One extends along the Kentucky-Virginia border, including counties in those two states and West Virginia. This suggests an axis of mining activity. The other group, involving the western portion of the Central Appalachian counties of Tennessee, probably indicates varied manufacturing activity, other than mining. While Tennessee, Virginia and West Virginia state-groups all evidence significant amounts of industrial activity, twenty-three of the twenty-six Kentucky counties ranked in the lower half of the ranking distribution.

V. A COMPACT DEVELOPMENT INDEX USING SELECTED VARIABLES

Data on fourteen variables were required to derive the level of development index, identified with the Factor 1 pattern. Collection of fourteen data series for sixty cases entailed considerable time and effort; the number of variables also acted to increase the complexity of the actual computation of the factor score. In an effort to increase the usability of the development scale as a tool for periodic reassessment of the Appalachian situation, a means of reducing the index's complexity, without diminishing its ranking accuracy, was sought.

Study of the factor structure (see Table X, p. 83) evidenced a high degree of correlation between Factor 1 and both INCOME and DOCTORS (the respective correlation coefficients were .854 and .863). A scaling of the sixty counties based on one of these two indicators alone would yield a reasonably good approximation of the scale obtained from data on all fourteen indicators. Such a gain in simplicity could in many circumstances justify the loss in accuracy incurred when the number of indicators is reduced from fourteen to one.

Examination of the factor score coefficients (see Table XI, p.85) suggested another approach to the goal of simplification of the index. It will be recalled that the factor scores, which determine the county rankings, are obtained by summing the fourteen products of the factor score coefficient and the observed value for the variable (in standardized form). The final score is thus affected relatively little by the product of an observed value and a small score coefficient. It would therefore appear feasible to eliminate all those variables associated with small score coefficients, to obtain a compact index yielding results similar to those of the full-scale index.

Such a reduced index was computed, retaining four of the original fourteen variables, listed with their respective score coefficients: INCOME, .23316; POVERTY, -.42791; DOCTORS, .45698; and HSGRADS, .12151. The factor scores computed from the four-variable index were then compared with the scores calculated for the fourteen-variable index. The

Pearson correlation coefficient between the two series of scores was calculated and determined to be .9811. This value was significant at the .001 level. The nearness of the coefficient to 1 indicates a near-perfect correlation between the scores derived from the fourteen-variable index and those derived from the four-variable index. The compact index thus permits one to measure development status in the counties with a great gain in facility and little accompanying loss in accuracy.

CHAPTER VI

CONCLUSION

The sixty-county region known as Central Appalachia is the target area for a considerable investment in human and material resources by development agencies, both public and private. Effective policy-making within the region should be based on a comprehensive assessment of the existing development situation in the individual counties. Following initial policy orientation, continued program effectiveness might be aided by a periodic reassessment of the development situation with its implications for program evaluation. This study sought to provide (1) an assessment of the current development status of the Central Appalachian counties, and (2) a framework for measuring development status periodically.

The fourteen socio-economic variables included in the analysis of development status were selected to indicate various dimensions of the level of living. The selection of the variables was guided not only by considerations of desirability (which indicators best measure the dimension), but also by questions of practicality (what data series are available). Often a compromise had to be struck between the two.

For example, a health status indicator to reliably reflect the quantity, quality and availability of medical services was desired. However, data availability constraints resulted in the use of indicators measuring the numerical ratio of physicians and hospital beds to inhabitants, though these surrogate measures were poor approximations of anything but quantity in terms of health care.

Data limitations were most keenly felt when selecting indicators for the environmental quality dimension of development (where the MNGMFG surrogate was used) and for the participation/alienation dimension (where the ROADS variable was employed). In both cases, relevant data series on the county level (such as information on pollution levels, recreational opportunities and conservation activity as it pertains to environmental quality, and information on voter participation and participation in voluntary organizations as it pertains to the alienation aspect of development) either do not exist or are not readily available. The assessment of developmental status yielded by the index presented in this thesis must be viewed as a reconciliation of conceptual desirability and empirical feasibility, with its consequent imperfections.

Relative changes in developmental status may be discerned by periodic recalculation of the Factor 1 scores, using updated observations for the variables to yield a current ranking of the sixty counties. The factor score coefficients derived in this study may be used to recalculate the factor scores, although it should be noted that the validity of the factor score coefficients is subject to time limitations. Since the variable weights may change over time, the most rigorous reevaluation of developmental status would require complete factor analysis of updated observations for the fourteen variables. This procedure would yield new factor score coefficients.

For the convenience of the future researcher who may want to update the county rankings, Table XIV cites the source of the data for each of the fourteen indicators used in the index, as well as the periodicity of its publication. It will be noted that data for ten of the fourteen variables were obtained from the decennial Census of the Population; new observations for these variables will be forthcoming only every decade. Of particular interest is the fact that new data concerning the geographical location of doctors are published biennially in the American Medical Directory. Given the high degree of correlation (.863) between the DOCTORS indicator and Factor 1, as cited in chapter V, recomputation of the biennial rankings based on the DOCTORS indicator might be useful in evaluating changes in relative status.

In evaluating such relative changes in status among the sixty counties, the ranking results, rather than factor scores, should be compared. Since factor scores are computed in standardized form, with a distribution mean of zero and a standard deviation of one, a comparison of factor scores from one time period to the next would have no meaning. Note also that a lower ranking for a specific county in subsequent computations may indicate a decline in comparative status, although the absolute level of development within the county may have improved along with a general improvement of conditions in the region.

TABLE XIV

PERIODIC DATA SOURCES FOR LEVEL OF DEVELOPMENT INDICATORS
USED IN CENTRAL APPALACHIAN STUDY

Indicators	Data Source
INCOME	_Census of the Population_ (decennial)
POVERTY	_Census of the Population_ (decennial)
NOCAR	_Census of the Population_ (decennial)
UNDEREMP	_Census of the Population_ (decennial)
INFDEATH	State Department of Health Vital Statistics Bulletins (annual)
HOSBEDS	State Department of Health inventories (annual)
DOCTORS	_American Medical Directory_ (biennial)
HSGRADS	_Census of the Population_ (decennial)
UNSKILL	_Census of the Population_ (decennial)
ENROLL	_Census of the Population_ (decennial)
MNGMFG	_Census of the Population_ (decennial)
ROADS	State Department of Highways inventories (annual)
DEPENDCY	_Census of the Population_ (decennial)
POPCHAN	_Census of the Population_ (decennial)

BIBLIOGRAPHY

BIBLIOGRAPHY

Anderson, Charles W., "Changing Concepts in Development Theory," Growth and Change, v.2, no.3, July 1971, pp. 29-35.

Andrews, Frederick, "Is the GNP an Accurate Measurement?", Current, no.138, March 1972, pp. 31-36.

Bauer, Raymond A., editor, Social Indicators, (M.I.T. Press, Cambridge, Massachusetts, 1966).

Bell, Daniel, and Olson, Mancur Jr., "Toward a Social Report," The Public Interest, no.15, Spring 1969, pp. 72-105.

Caudill, Harry M., Night Comes to the Cumberlands, (Little, Brown and Company, Boston, Massachusetts, 1962).

Cleland, Charles L., editor, Scaling Social Data, Southern Cooperative Series Bulletin No.108, December 1965.

Crosswhite, William M., editor, People in Poverty: Selected Case Studies, Agricultural Policy Institute, School of Agriculture and Life Sciences, Series 42, North Carolina State University, Raleigh, North Carolina, January 1970.

Duncan, Otis Dudley, "Social Forecasting: the State of the Art," The Public Interest, no.17, Fall 1969, pp. 88-118.

Gross, Bertram M., editor, "Social Goals and Indicators for American Society," a two-volume collection of papers in the Annals of the American Academy of Political and Social Science, nos.371 and 373, May and September 1967.

Gross, Bertram M., The State of the Nation, (Tavistock Publications Limited, London, 1966).

Henriot, Peter, "Political Questions about Social Indicators," Western Political Quarterly, v.23, no.2, June 1970, pp. 235-55.

Nie, Norman H., Bent, Dale H., and Hull, C. Hadlai, Statistical Package for the Social Sciences, (McGraw-Hill Book Company, New York, 1970), Chapter 17, "Factor Analysis," pp. 209-44.

President's National Advisory Commission on Rural Poverty, The People Left Behind, (U. S. Government Printing Office, Washington, D.C., 1967).

Rummel, R. J., Applied Factor Analysis, (Northwestern University Press, Evanston, Illinois, 1970).

_______. "Understanding Factor Analysis," Journal of Conflict Resolution, v.XI, no.4, December 1967, pp. 444-80.

Sheldon, Eleanor B., and Moore, Wilbert E., editors, Indicators of Social Change: Concepts and Measurements, (Russell Sage Foundation, New York, 1968).

U. S. Department of Agriculture, Economic Research Service, Rurality, Poverty and Health: Medical Problems in Rural Areas, Agricultural Economics Report No.172, (U.S. Government Printing Office, Washington, D.C., 1970).

U. S. Department of Health, Education and Welfare, Toward a Social Report, (University of Michigan Press, Ann Arbor, Michigan, 1970).

Weller, Jack E., Yesterday's People, (University of Kentucky Press, Lexington, Kentucky, 1965).

West, Jerry G., Poverty: Its Meaning and Its Causes with Selected Case Studies, Agricultural Policy Institute, School of Agriculture and Life Sciences, North Carolina State University, Raleigh, North Carolina, July 1968.

VITA

Ellen Gouin is a native of Arkansas, born in Texarkana on May 24, 1945. She attended public schools in Louisiana and Texas before receiving her high school diploma from Midland (Texas) High School in 1963. Her freshman year of college study was spent at Rice Institute in Houston, Texas. From 1964-67, she attended Mount Holyoke College in South Hadley, Massachusetts. In 1967, she received a Bachelor of Arts degree with honor in economics.

Following college commencement, she joined the Peace Corps as a public health educator with an assignment in Upper Volta, West Africa. After a three-year stay in Upper Volta, she returned to the United States in the fall of 1970 to pursue graduate study in agricultural economics at The University of Tennessee. Her studies at the University were supported by a National Science Foundation Traineeship.

Ellen married René Yves Gouin, an agronomist employed as a technical advisor in Upper Volta, in April of 1969. Their household has since grown to include a small girl (Lucie) and a small dog (Silex).