Social and Economic Indicators for Montana Counties

While economic growth has been a positive factor in the U.S. economy, concern exists about the quality of life across the population. This paper examines social and economic well-being in the 56 counties of Montana. Results show that four indices are important in measuring well-being. Counties varied in their scores on the four indices. These results show that well-being is a multi-faceted concept and is not consistently good or poor in any given county.

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Introduction

The current political debate over welfare reform has once again piqued interest in examining issues related to economic well-being and quality of life. Many citizens on both sides of the political fence fear that welfare reform will produce a further spread between the very rich and the poor, with a commensurate reduction in the overall quality of life especially for the working poor. Concern about measuring quality of life in the United States is over 50 years old, beginning with the President Hoover's Committee on Social Trends in the 1930s. Since that time, defining what constitutes quality of life has been an ongoing research issue in many disciplines including economics, sociology, psychology, political science, and geography.

Helbum (1982) categorized the many definitions of quality of life into two types. The first definition is subjective and includes perceiving, feeling, or judging the quality of life from a personal framework. The second meaning is objective and measurable with quantifiable attributes that one could observe. The term, "social indicators," are those objective measures that capture various attributes associated with well-being or quality of life and are used in this paper.

Quality of life includes economic well-being as an underlying requirements for achieving many other areas of well-being such as health and education. Distribution of income is one empirical measure of economic well-being. Economists have long realized that general economic growth is not necessarily shared evenly across the population or across geography (Hibbs & Dennis, 1988; Tickamyer & Duncan, 1984). The increasing trend in the United States towards greater income inequality is a concern because of the societal issues associated with the distance between the "haves" and the "have-nots." In addition to income disparity, other social measures are important to quality of life as well. Infant mortality rates, teen-age pregnancy, prevalence of crime, environmental quality and other indicators provide a more holistic idea of quality of life than income alone.

Measurement of social and economic well-being at the macro level is useful for examining general well-being but may not spotlight the populations or geographic locations in which well-being is particularly high or low. The variation in well-being can be wide, even within a small geographic area. The purpose of this paper is to examine socioeconomic indicators of quality of life by county in order to gain a micro-level view in one state, the state of Montana, of how well-being varies by county. The objective of the paper is examine the variations in social indicators for each Montana county as a first step in creating a methodology for tracking social and economic well-being in a longitudinal manner.

Review of Literature

Social indicators have been devised and used in many disciplines including economics, sociology, psychology, political science and environmental sciences. Measures vary according to the values various disciplines place on the concept being measured.

One measure currently being calculated is the Index of Social Health for the United States by the Fordham Institute for Innovation in Social Policy (Miringoff & Miringoff, 1995). This measure combined sixteen separate social indicators into one index. These social indicators include measures such as health insurance coverage for the adult population age 65 and under, food stamp coverage, out-of-pocket health cost for those over 65, school performance, and other measures of social well-being. In tracking the Index from 1973 to 1995, a pattern of decline

in social health has been discovered. The Index was at a high of 77.5 in 1973 and fell to 40.6 in 1993, with a consistent pattern of decline in the 20-year time period. This occurred during the time period when the gross domestic product was growing at a healthy rate each year. The disparity between economic growth and the reduction in social well-being indicated by the Index shows that economic well-being and social well-being do not necessarily move in tandem (Miringhoff & Miringhoff, 1996).

One of the first studies of social well-being in counties was reported by Ross, Bluestone, and Hines (1979). This study examined indicators of social well-being for counties in the U.S. using factor analysis. The study found four important social indicators: socioeconomic status; health status; family status; and, alienation.

Abdel-Ghany, Gibbs, and Sharpe (1991) studied quality of life indicators for Alabama counties. They used factor analysis to identify patterns of relationships among 14 indicators of quality of life. They found that four indicators accounted for 77.6% of the total variance among the 14 original indicators. The four indicators were socioeconomic level; crime level; health status; and political participation. None of the counties studied were consistently in the highest or lowest quintile for the four indicators except for one county, which placed in the lowest quintile for all four indicators. In a similar study of Georgia counties (Abdel-Ghany, Bachtel & Sweaney, 1997), four composite indicators also showed no clear pattern of the dimensions of quality of life among the counties. Abdel-Ghany and Tymes (1997) further studied quality of life indicators in Alabama and found four composite measures of quality of life: Socioeconomic status, crime levels, schooling, and health. Results from these three studies show that county variation is wide and no one social or economic policy can be used to improve social well-being for all counties. No previous studies of well-being have been done for counties in Montana.

Methods

Data

The sources of data for this study include the 1990 United States Census of Population (U.S. Bureau of the Census, 1994) and the Montana Kids Count 1996 Data Book. These data were available by county. While some states may have county divisions that do not reflect current cultural and economic units, Montana is a rural state where counties serve as both geographic boundaries as well as social and political entities. The county seat in the majority of Montana counties is the place where the largest high school in the county is located. Governmental business is conducted at the county seat and it is usually the largest trade center in the county. So, in rural Montana, the county remains as a useful unit of analysis for economic, social and political reasons.

An initial pool of 16 indicators reflecting conditions pertaining to quality of life in the 56 Montana counties were selected. The 16 indicators were chosen because they had been found to be significant in other studies and were available for each county in the state. Due to inconsistencies in the loading of some indicators on basic dimensions of factor analysis, the following set of nine indicators were selected:

Percent of college graduates = Percent of population 25 years and older with college or professional degree
Per capita income = Yearly per capita income in dollars
Teenage pregnancy rate = $\frac{\text{Total teen pregnancy}}{\text{Total females (10-19)}} \times 1{,}000$
Infant mortality = $\frac{\text{Death of less than one year of age}}{\text{Total live births}} \times 1{,}000$
Percent of persons above poverty line = Percent of persons who were not poor
Employment rate
Female labor force participation rate
Dependency ratio = Percent of persons under the age of 18 and above the age of 65 to total population
Housing with plumbing = Percent of houses that have plumbing

Statistical analysis

Principal component factor analysis was used to analyze the data. This procedure weights the indicators by the variances in the individual indicators. It allows the transformation of the original data set into a new data set where the indicators are pairwise uncorrelated and where the first principal component will have the maximum variance with those uncorrelated with the first principal component, etc. Since there are 56 counties in the sample and nine indicators, the data matrix is an 159 x 14 matrix

$$X = [x_{ij}] \qquad i = 1,...,56 \qquad j = 1,...,9$$

This X matrix is transformed into a new matrix Z, where Z is the principal component matrix of X. The eigenvalues of the principal components represent the variance in the Z matrix. Construction of composite indexes from the selected nine indicators involved three steps: (1) factor analysis using the varimax method of axis rotation was used to identify underlying patterns of relationships among the nine indicators of quality of life. A criterion of 0.60 was established as the minimal loading necessary for the including the indicators into composite measures; (2) derivation of numerical scores from each subset of variables to provide single index scores of each composite for each county; and (3) standardizing the index scores to a common scale having a mean value of 100 and the same variation among counties.[3]

Results and Discussion

The means and standard deviation of the nine indicators used in the analysis are listed in Table 1. Four composite measures were identified as a result of factor analysis: Socioeconomic status 1, socioeconomic status 2, housing status, and infant mortality as presented in Table 2. Each factor of quality of life was defined by a subset of indicators with factor loading greater than 0.60. These factor loadings are underscored in Table 2. The four factors accounted for 86.5% of the total variance among the nine indicators.

Socioeconomic status I (Factor I) was comprised of percent of college graduates, per capita income, female labor force participation, and dependency ratio. This factor explained 34.7% of the variability among the nine selected indicators of quality of life. Socioeconomic status 2 (Factor II) explained 21.6% of the variability among the nine indicators of quality of life. This factor was defined by teenage pregnancy rate, percent of persons above poverty line, and employment rate. It is interesting to note the positive relationship of employment rate and the rate of those above the poverty line. Also note the negative relationship of the two indicators with teenage pregnancy. Housing status (Factor III) was specified by the percentage of houses with plumbing facilities. It explained 18.8% of the variability among the selected nine indicators of quality of life. Infant mortality (Factor IV) was specified by infant mortality rate. It explained 11.4% of the variability among the nine selected indicators.

Index scores were derived for each county so that high levels of socioeconomic status, housing status, and infant mortality were represented by high scores. The statistical procedures to derive the indexes are described in notes 1 and 2. The indexes were then used to examine patterns of quality of life among Montana counties. A list of the scores for each of the counties is available upon request from the authors.

Table 1
Mean and standard deviation of social indicators for Montana counties

Indicator	Mean or %	Standard Deviation
Percent of college graduates	15.90	4.55
Per capita income	10312.46	1295.96
Teenage pregnancy rate	8.50	5.64
Infant mortality rate	8.96	18.37
Percent of persons above poverty line	86.23	5.00
Employment rate	93.93	4.06
Female labor force participation rate	52.33	5.16
Dependency ratio	43.65	3.18
Housing with plumbing	96.89	2.12

Table 2
Factor analysis of nine indicators for Montana counties

Indicator	Factor I Socioeconomic Status I	Factor II Socioeconomic Status II	Factor III Housing Status	Factor IV Infant Mortality
Percent of college graduates	.81501[1]	.13509	.23751	-.11218
Per capita income	.61892	.56564	.29369	-.20428
Teenage pregnancy	-.01340	-.85356	.16771	-.15507
Infant mortality	-.07030	.04621	.06222	.96656
Percent of persons above poverty line	.16336	.66679	.56997	-.21627
Employment rate	-.00128	.91684	-.10190	-.00872
Female labor force participation	-.78584	-.06527	-.23190	.12120
Dependency ratio	-.88599	-.00777	-.07594	.09737
Housing with plumbing	.03550	-.19788	.88721	.11508
unrotated solution:				
Eigenvalue	3.12	1.94	1.24	1.03
Percent of variance explained	34.7	21.6	18.8	11.4

[1] Underscored loadings greater than 0.6 designate factors included in index for each factor. Loadings are the pattern matrix from a varimax rotation.

Socioeconomic Status I

The geographic patterns associated with Socioeconomic Status 1 found that he counties of Gallatin, Missoula, Lewis & Clark, Jefferson, Yellowstone, Cascade, Flathead, Beaverhead, Powder River, and Park had the highest index values for socioeconomic status 1. Prairie, Wibaux, Sheridan, Wheatland, Musselshell, Liberty, Big Horn, Roosevelt, Deer Lodge, and Daniels had the lowest index values.

Socioeconomic Status 2

The geographic patterns of Socioeconomic Status 2 found that high socioeconomic status was prevalent among the counties of Judith Basin, Prairie, Fallon, Garfield, Daniels, Toole, Stillwater, Jefferson, Liberty, and Golden Valley. Low socioeconomic status on the other hand was prevalent among the counties of Glacier, Big Horn, Roosevelt, Blaine, Lincoln, Deer Lodge, Rosebud, Sanders, Lake, and Silver Bow.

Housing Status

The geographic patterns of housing status identified counties with the lowest percentage of houses with plumbing facilities were Wibaux, Yellowstone, Roosevelt, Silver Bow, Gallatin, Dawson, Fallon, Lewis & Clark, and Sheridan. Counties with the highest percentage of houses without plumbing facilities include Petroleum, Phillips, Mineral, Powder River, Granite, Carter, Meagher, Broadwater, Beaverhead, and Liberty.

Infant Mortality

Counties with the highest infant mortality rate include Wibaux, Garfield, Golden Valley, Granite, Broadwater, Lincoln, Hill, Custer, Silver Bow, and Stillwater. Counties with lowest infant mortality rates include Blaine, Choteau, Dawson, Daniels, Carter, Yellowstone, Madison, Deer Lodge, and Judith Basin. Many other counties also had low infant mortality rates.

Conclusion and Discussion

This study used 16 social indicators measured for each of the 56 counties in the state of Montana. Factor analysis determined that nine of the indicators contained 86.5% of the total variability. These nine indicators were used to construct four composite indexes: two indices of socioeconomic status, one housing index and one index

measuring infant mortality. The counties with high levels of well-being were indicated as well as those at the bottom of the various indices of well-being.

An important limitation of the Housing Status Index and the Infant Mortality Index is that the number of houses with plumbing and infant mortality are relatively rare occurrences. The counties having high values on the Indices on housing and infant mortality are those with very small populations. Therefore, even one house without plumbing or one infant death will skew the mean since so few observations are present.

As was found with previous studies of social well-being in counties in Alabama and Georgia, no county was found to be consistently at the top or consistently at the bottom of all four of the indices. This would indicate that well-being is a multi-faceted concept. This is an important finding. Clearly, trying to use even as many as 16 indicators of social and economic well-being does not result in finding obvious county patterns in the state. Well-being is a multi-faceted concept and any single indicator or set of indicators communicates only one aspect of well-being.

Many ideas for further research can be gleaned from this study. The first notion is that many more measures of economic and social well-being are available from various data sources within a given state at the county level. The measures used here were ones that were used in previous studies, but the choice of measures need not be confined to these particular ones. State agencies collect a great deal of data that is never used by any other agency. By working collaboratively with agencies and offices that do collect data, many other interesting measures could be gathered.

A second line of research would be to examine predictors of the various measures of quality of life. When viewing the results of social and economic indicators for Montana counties, one could hypothesize about possible predictors. The first is that many of the counties ending up at the bottom of the social well-being indices are those counties where Indian reservations are located, although this is not always the case. Secondly, it appears that rural counties end up at the bottom of the indices more often than more urban counties. Perhaps one of the explanatory variables would be that urban counties offer more employment opportunities to more members of the family and therefore offer more income earning potential. Higher incomes would boost socioeconomic measures of well-being. A final measure that would appear to be important in examining the Montana data is the type of industry located in a county. Some of the counties at the lower end of the well-being indices are those with dry-land agriculture as a primary industry in the county. It may be that dry-land farming or cattle ranching is less stable or provide less income than other agricultural operations such as irrigated farming or feedlot cattle operations. Or perhaps agriculture in general predicts lower well-being than having a more diversified urban economic base or an extractive industry base such as timbering or mining. These predictors have been shown to be important in other studies and a non-statistical examination of the results of the Montana data show that the variables mentioned above should be examined in a linear or non-linear statistical model. From merely looking at the data and the results of the factor analysis, patterns cannot be clearly detected. However, further statistical models could test hypotheses about the characteristics of the counties and determine if a pattern is present.

Changes in public policy and changes in the world, national, regional and local economies prompt concern about well-being across a population. Repeated analyses such as the one conducted for Montana counties could become important longitudinal research efforts to document how social well-being is changing at the county level. The information could be used to design and implement social policy that can be effective in addressing the social needs of states at a micro-level rather than treating each state as a homogeneous entity.

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Endnotes

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[3] The standardized values of the set of indicators were combined to derive factor scores. Values for each county were expressed as Z scores $(X_{ik} - _k) S_k$ where X_{ik} is the value of indicator K for county i (factor loading), $_k$ is the mean value and S_k is the standard deviation of indicator K for 56 counties. The equation used to construct factor scores for each index may be expressed as:

$$I_{ij} = \sum_k Z_{ik} \qquad (1)$$

where I_{ij} = index for county i,
Z_{ik} = Z score for indicator K in county i, and
K = indicators included in the jth index.

The composite indexes derived from equation (1) results in four scales with many negative values and different standard deviations. For ease of interpretation, the factor scores derived in equation (1) were standardized and converted to a common scale through transformation to t - scores distributions with mean equal 100 and standard deviation equal 20 (Ross, Bluestone, and Hines, 1979). The indexes were transformed to t - scores as follows:

$$I^t_{ij} = 100 + 20\, I^{Z}_{ij} \qquad (2)$$

where $I^Z_{ij} = \dfrac{I_{ij} - _j}{S_j}$

and I^t_{ij} = t-score index j for county i,
I_j = index for county i,
$_j$ = mean value of index j, and
S_j = standard deviation of index j