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Determinants of employment in rural Montana counties

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THE DETERMINANTS OF EMPLOYMENT IN RURAL MONTANA COUNTIES

By

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CHAPTER I

INTRODUCTION

The principal objective of the study was to investigate the factors which have led to changes in employment in certain industries in rural Montana. The investigative procedure was multiple linear regression, a statistical technique described in a subsequent section.

The most important result was the derivation of a method by which the trend of employment for an industry in a particular county can be predicted. This technique may have positive applications for the businessman who desires to know what the future holds for a particular county. While the technique will not predict the sales for an industry, a businessman might logically conclude that an increase in employment will be quite closely correlated with an increase in sales.

Variables which are considered to be determinants of employment, or output, were regressed against employment data for selected counties. The data were broken down into a cross section by counties in Montana. Each of the 41 counties which do not contain a trade center as defined in Trade Centers and Trade Areas of the Upper Midwest by John R. Borchert and Russell B. Adams represent a sample unit. Although Montana has 56 counties, it was decided that only the 41 rural counties would be used in the study because investigation uncovered the fact that there are distinct differences between the more populous counties and the rural counties. These differences make segregation by trade center

and non-trade center beneficial. Table 1 lists the 41 counties from which sample data were obtained.

TABLE 1

NON-TRADE CENTER COUNTIES

Beaverhead	Meagher
Big Horn	Mineral
Blaine	Musselshell
Broadwater	Petroleum
Carbon	Phillips
Carter	Pondera
Chouteau	Powder River
Daniels	Powell
Fallon	Prairie
Garfield	Ravalli
Glacier	Roosevelt
Golden Valley	Rosebud
Granite	Sanders
Jefferson	Sheridan
Judith Basin	Stillwater
Lake	Sweet Grass
Liberty	Teton
Lincoln	Toole
McCone	Treasure
Madison	Wheatland
	Wibaux

Source: Trade Centers and Trade Areas of the Upper Midwest, by John John R. Borchert and Russell B. Adams; Urban Report Number 3, Upper Midwest Economic Study, September, 1963, Table 4, p. 11.

Data for 1960 and 1970 were used to provide two separate studies for two separate time periods. This provides a basis for comparison between the time periods.

CHAPTER II

SELECTION OF INDEPENDENT VARIABLES

Since the principal objective of the study was to investigate the determinants of employment change, the selected independent variables were chosen with the belief that each is influential in determining employment change. Although employment in the various industries is not affected by the same variables to the same degree, employment data for each selected industry will be regressed against the same independent variables.

Table 2 lists the independent variables which have been selected. These variables are defined in the following paragraphs.

TABLE 2

INDEPENDENT VARIABLES

Population
Per Capita Income
Percent of Families with incomes under $3000
Percent of Families with incomes over $10,000
Dependency Ratio
Distance
Square Miles
Percent of Labor Force Unemployed
Percent of County Urban

Population is the total of all persons living in a Montana county in either rural or urban location. The data are taken from the

1960 and 1970 Census of Population.[1] Population is included as an independent variable because people demand goods and services and demand is satisfied by the output produced by those employed in the industry.

Per capita income is the quotient of personal income in a Montana county divided by the population of that county. Personal income is a measure of income before taxes. It includes wage and salary income, other labor income (mainly fringe benefits of workers including employer contributions to private pension funds), income of proprietors of unincorporated business enterprises, property income (net rental income, interest, and dividends received by persons), and transfer payments (social security, welfare benefits, unemployment compensation, pensions of retired public employees, and certain other relatively minor payments for which no services are rendered currently), less personal contributions for social insurance.[2] Because finances are necessary to translate needs and desires into demands, per capita income, a measure of average welfare within a county, is considered a determinant of industry employment.

The percentage of families with incomes under $3000 and the percentage of families with incomes over $10,000 are measures of the

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[1]U. S. Bureau of Census, Census of Population: 1970, General Population Characteristics--Final Report PC (1) - B28 Montana, Table 36, pp. 28-81 (Washington, D. C.: U. S. Government Printing Office, 1971); U. S. Bureau of Census, U. S. Census of Population: 1960, General Social and Economic Characteristics, Montana--Final Report PC (1), 28C, Table 82, pp. 28-131 (Washington, D. C., 1961).

[2]U. S. Department of Commerce, Office of Business Economics, Regional Economics Information System, Unpublished Data, June 8, 1971; U. S. Department of Commerce, Office of Business Economics, Survey of Current Business, 51(8):30-31, August 1971.

distribution of income within a county.[3] These data are taken from a 25 percent sample conducted in conjunction with the census of population. The need for a distribution measure of income as opposed to the average level of income, expressed by per capita income, is because of the possibility that two counties could have the same or nearly the same per capita incomes but yet be very different in the nature of their business activities because of differences in the distribution of income among residents.

The dependency ratio is the percentage of people who are under 18 years of age or over 64 years of age.[4] This percentage measures the extent to which a county's residents are very young or very old; thus, these two groups may have specialized demands and/or different buying habits, and this may be reflected in industry employment.

The distance variable is defined as the distance in highway miles from the largest city, in most cases the county seat, to the nearest trade center. Not only does this variable measure the relative isolation of a county, it represents the cost, in terms of inconvenience and travel time, of obtaining goods and services from a source other than the home county. Consequently, the distance variable is a conceivable influence on industry employment within a county.

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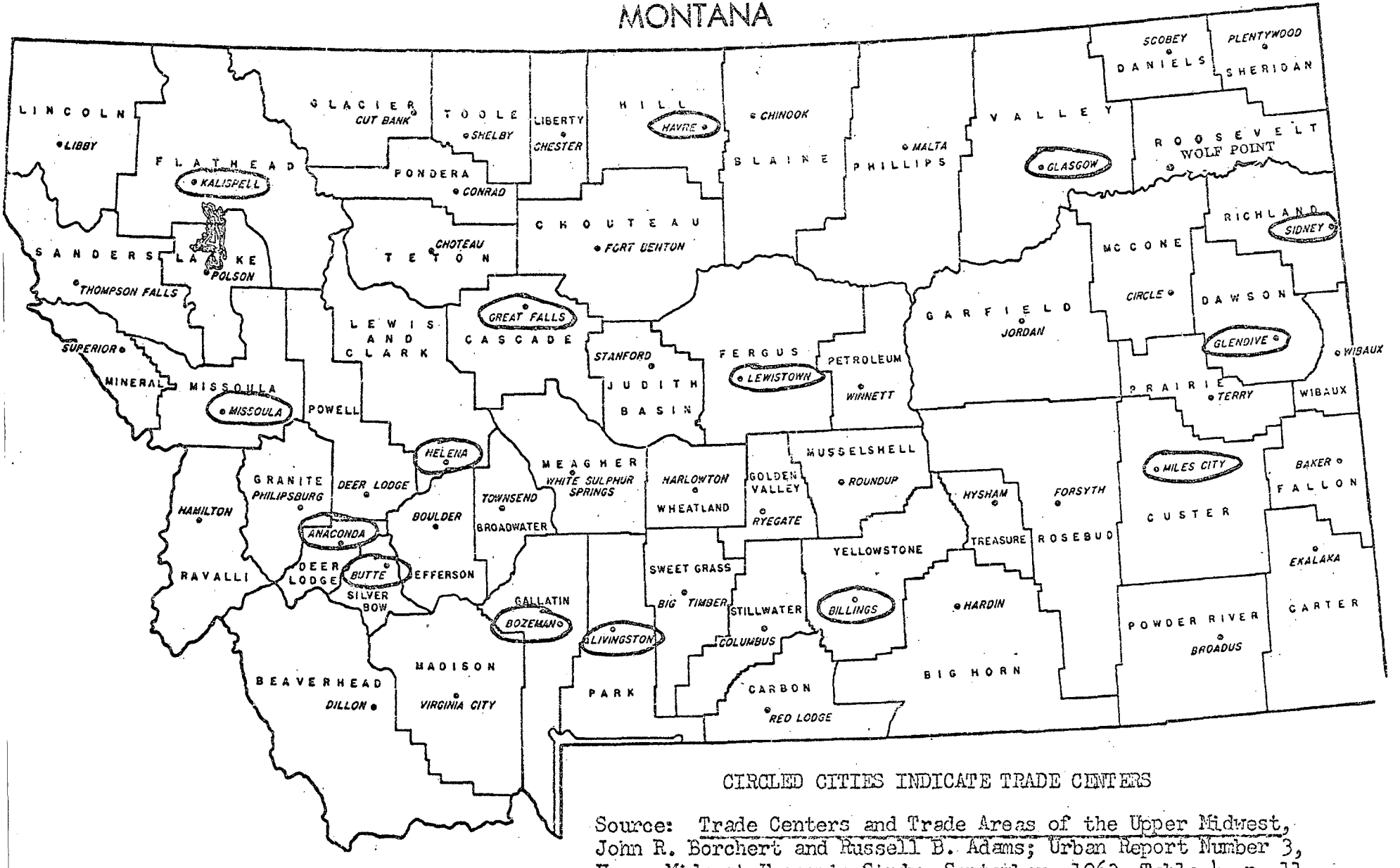
[3]U. S. Bureau of the Census, U. S. Census of Population: 1960, General Population Characteristics, Montana--Final Report PC (1) - 28B, Table 27, pp. 28-49 - 28-63 (Washington, D. C.: U. S. Government Printing Office, 1961); U. S. Bureau of the Census, Census of Population: 1970, General Population Characteristics--Final Report PC (1) - B28 Montana, Table 35, pp. 28-66 - 28-79 (Washington, D. C.: U. S. Government Printing Office, 1971).

[4]U. S. Bureau of the Census, County and City Data Book, 1967 (A Statistical Abstract Supplement), Table 2, pp. 212 and 222 (Washington, D.C.: U. S. Government Printing Office, 1967).

MONTANA



CIRCLED CITIES INDICATE TRADE CENTERS

Source: Trade Centers and Trade Areas of the Upper Midwest, John R. Borchert and Russell B. Adams; Urban Report Number 3, Upper Midwest Economic Study, September, 1963, Table 4, p. 11.

The number of square miles in a county often reflects certain characteristics of a county, one of them being that Montana counties with larger areas tend to be agriculturally oriented and less populated than the smaller counties.[5] It is probable that the size of a county has an economic effect and thus deserves investigation regarding employment change within Montana counties.

The unemployment percentage for a county is considered a determinant of employment change.[6] Since employment is a measure of labor units, it may be influenced by labor market conditions. Since the unemployment percentage is such a measure it has been included.

The percent urban variable measures the spatial concentration of population within a county. The size of this variable may be influential in determining employment in certain industries, especially those dependent upon the benefits of economies of scale. The percent urban variable is the percentage of a county's population which resides in the largest census tract in that county.[7]

Conceptually, each of the above variables can be expected to influence, in some way, industry employment. However, some variables

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[5] Ibid., pp. 212 and 222.

[6] U. S. Bureau of the Census, U. S. Census of Population: 1960, General Social and Economic Characteristics, Montana--Final Report PC (1) - 28C, Table 83, pp. 28-136-140 (Washington, D. C.: U. S. Government Printing Office, 1961); U. S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics--Final Report PC (1) - C28 Montana, Table 121, pp. 28-206 - 28-210 (Washington, D. C.: U. S. Government Printing Office, 1971).

[7] U. S. Bureau of the Census, U. S. Census of Population: 1970, Number of Inhabitants--Final Report PC (1) - A28 Montana (Washington, D. C.: U. S. Government Printing Office, 1970).

have more impact on employment of one industry than for another industry. It will be left to the regression technique to select those variables which are most highly correlated with employment in each industry.

CHAPTER III

DEPENDENT VARIABLES

The regression procedure requires that data on one or more dependent variables be regressed against various independent variables. Industry employment figures are the dependent variables which are regressed against the independent variables of the previous section.

Some industries serve a national market and their demand is partially exogenous to the region where the production takes place. Other industries produce for local consumption. For these industries production and consumption occur within the same area. Such industries are considered to be endogenous to the locality in which they are physically situated; that is, the demand for endogenous output is determined by local conditions.

Table 3 lists the four industries chosen for use in this study.

TABLE 3

INDUSTRIES CHOSEN FOR ANALYSIS

Food and Dairy Product Stores

Eating and Drinking Places

Business and Repair Services

Finance, Insurance, and Real Estate

These four industries were selected because they all are considered endogenous in the sense that the output is influenced by local factors,

county data are available for these industries. The next few paragraphs describe the industries.

The food and dairy products industry provides the essential foods to the consumers within a county. In Montana this industry is composed of many of the small "ma and pa" type businesses which stock only a small assortment of items. In addition, there are various affiliates of national chain organizations which provide a seemingly unlimited supply and assortment of food items.

The eating and drinking industry is composed of all types of restaurants, cafes and drive-ins. These places all serve prepared food to the customers. Also included in this industry are bars, saloons, and liquor stores. Drinking places are considered to be primarily those places that serve alcoholic beverages.

The business and repair service industry is directly involved in the support of businesses and residents within an area. Such services as accounting offices, data processing, office machine repair services, janitorial services, etc. are included in business services. Repair services consist of auto mechanics, fix-it shops and other places which exist to repair used equipment.

The finance, insurance and real estate industry includes commercial banks and credit agencies of all types. Brokerage firms and insurance agencies also are part of this industry.

CHAPTER IV

EXPECTATIONS REGARDING RELATIONSHIPS OF THE INDEPENDENT VARIABLES TO EMPLOYMENT

The regression coefficient for an independent variable indicates that variable's impact on the predicted value of the dependent variable. This impact or relationship to the dependent variable, of course, can be either positive or negative as indicated by the sign of the regression coefficient.

The size of the regression coefficient of an independent variable, holding all other variables constant, corresponds to the change in the predicted value of the dependent variable for every one unit change in the value of that independent variable.

The population variable represents both the demand and supply side of the economic situation. An increase in population means more people to demand, but also a greater supply of labor to meet the demand. Thus, the expected sign of the population variable for all industries is positive. An increase in total population, holding other factors constant, will increase employment.

Per capita income is a measure of the average level of welfare within a prescribed area. In general, an increase in income leads to an increase in consumption demand, suggesting that income will be positively related to employment. Although it might be possible for per capita income to be negatively correlated to industry employment

in a few cases, it is expected that the relationship will be positive for the industries selected for study in this paper. Thus an increase in income, holding other factors constant, will result in an increase in employment.

It is expected that the income distribution variable (percent of families with incomes below $3000 or over $10,000) will have some effect on industry output. But, the nature of the effect is difficult to predict. It is difficult to discern the spending pattern of people without knowing more about the social climate of the area in which they reside. For example, some families with incomes over $10,000 may have greater use for the services offered by the finance, insurance and real estate industry than others in the same category. Also, the higher income families may prefer to shop in trade centers away from their home county, indicating that local demand might be reduced with an increase in this variable. It is difficult to say with certainty which countervailing force will dominate. For these reasons, no a priori sign is given to this variable.

The dependency ratio, which provides an indication of the relative age distribution within a county, is another determinant of consumer demand. However, here again the direction of the relationship between this independent variable and employment is not entirely clear. For example, it may be that young people spend a greater part of their incomes in eating and drinking establishments than do older people. Since a change in the dependency ratio may be a result of either a change in number of people under 18 or the number over 64, it is difficult to predict the impact of an increase in the dependency ratio

on the demand for goods and services produced by the various industries. Since, once again, there are countervailing forces at work, the a priori sign of the coefficient is not predicted.

The distance variable, the distance from the city of largest population in each county to the trade center city located closest in highway miles, is a measure of the relative isolation of a county. It seems reasonable to assume that the farther a county is from a trade center, holding other factors constant, the greater will be the output demanded of local industries. For example, if the residents of a county were faced with traveling 100 miles for an after-work drink at a favorite bar, they would very likely "quit drinking" or open a similar service center closer to home. The latter is the more probable. The greater the distance to the trade center the more their willingness to buy close to home. Consequently, it is felt that the sign of the distance variable will generally be positive with respect to employment in the selected industries.

The relationship between the area of a county and employment in various industries within that county is difficult to predict. A priori knowledge of the state of Montana provides some insight. As previously mentioned, it is the general case that the larger counties in terms of area, such as Beaverhead, are primarily agricultural and for the most part are low in population. The smaller counties, such as Silver Bow, are primarily nonagricultural and in most cases have fairly large populations. Because population is expected to have a positive influence on employment, the larger and more sparsely populated, the less should be industry employment. Consequently, the a priori sign for square miles, holding other factors constant, is negative.

The impact of unemployment is also difficult to predict. On one hand, high unemployment could indicate the presence of over-supply of labor. There may be a willingness to work at lower wages, thus inducing some employers to hire, increasing employment in some industries. On the other hand, excessive unemployment may reduce demand for industry output, resulting in less output produced and lower employment. Which of these forces will be dominating is impossible to predict. Consequently, no a priori sign is given to the unemployment variable.

The percent urban variable provides an indication of the density of population within one or more specified areas in a county. It is reasoned that the larger the percent urban, the greater the probability of goods and services being supplied locally. The thought is that the grouping of the population around a specific area would result in a higher proportion of local purchases. Economies of scale might well accrue to the urban areas, giving rise to greater supply to meet the demand. Thus, the expected sign on the coefficient for the percent urban variable is positive.

TABLE 4

SUMMARY OF EXPECTED REGRESSION COEFFICIENT SIGNS

Variable	Sign
Population	Positive
Per Capita Income	Positive
Distance	Positive
Square Miles	Negative
Percent Under $3000	Undetermined
Percent Over $10,000	Undetermined
Dependency Ratio	Undetermined
Unemployment	Undetermined

The preceding section has outlined the independent variables which will be used to form the regression equations. In addition, a priori predictions of coefficient signs have been explained. The list of independent variables is by no means all inclusive; however, data availability presents a limit to the extent that variables can be included.

CHAPTER V

THE STATISTICAL PROCEDURE

Multiple linear regression is the statistical tool used to formulate the equations for employment prediction. This procedure is based upon the least squares method for fitting a straight line. That is, in theory all possible straight lines on every possible plane are fitted to the data, and the sum of the distances squared from the data points to each line is determined. The regression procedure selects the line which gives lowest value for this sum of the squares.

The study uses a particular extension of multiple linear regression called stepwise multiple regression. This procedure has been programmed for computer use by J. N. Boles, and the equations which appear in a subsequent section are the result of the use of his program.[8] The stepwise regression process, also known as the forward selection procedure, used in the study regresses each dependent variable (employment) for a particular industry against successive independent variables. The basic procedure is as follows: First, dependent variable (Y) is regressed against the independent variable (X) with which it is most highly correlated, and a first order, linear

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[8] J. N. Boles, 40 Series--Stepwise Regression System (Berkeley: California Agricultural Experiment Station, Department of Agricultural Economics, University of California, 1964),

regression equation, $Y = f(X_1)$ is obtained. The independent variable producing the highest partial correlation coefficient with the dependent variable is the next variable selected. The partial correlation coefficient is mathematically the equivalent to finding the correlation of residuals, that is, the difference between the predicted value and the actual value, of the equation $Y = f(X_1)$ and the residuals of the equation if each other independent variable were regressed against the included independent variable.[9] This procedure continues until all variables are entered into the equation. Appendix IV provides a step-by-step example of the formulation of the 1960 equation for eating and drinking establishments. For each step, the selected independent variable is identified and the R squared value, standard error, and T ratio are calculated.

There are several means of selecting the most desirable equation from the step equations. The method used in this study is to select the equation which provides the largest $\bar{R}^2$.[10] Essentially, $\bar{R}^2$ is the percentage of the variation in the dependent variable accounted for by the independent variables in the equation adjusted for degrees of freedom. The downward adjustment is an inverse function of the sample size and a direct function of the number of coefficients to be estimated. The reasoning behind selecting the equation with the highest $\bar{R}^2$ over the equation with the highest R^2 is that R^2 will continue to

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[9]N. R. Draper and H. Smith, Applied Regression Analysis (New York: John Wiley and Sons, Inc., 1966), p. 169.

[10]Ronald J. Wonnacott and Thomas H. Wonnacott, Econometrics (New York: John Wiley and Sons, Inc., 1970), p. 311.

increase with each added independent variable while the $\bar{R}^2$ will reach a maximum at some level of variables, indicating that the remainder of independent variables are not significantly adding to the explained variation.

CHAPTER VI

THE REGRESSION EQUATIONS

This section presents the equations which have been selected. The subsequent paragraphs examine these equations, which appear in Table 5. The signs of the coefficients will be compared to the a priori predictions summarized in Table 4. In addition, the 1960 equations will be compared to the 1970 equations.

The equations for the business and repair industry differ between 1960 and 1970. Table 5 shows that the unemployment rate, population, per capita income, and percent of families under $3000 income are present in both the 1960 and 1970 equations. Distance and dependency ratio are significant variables in the 1960 equation while square miles are significant in the 1970 equation. There are cases in which the signs for the coefficients differ from the a priori expectations. For example, the 1960 equation shows a negative sign for income. A possible explanation is that an increase in income results in people being able to afford to travel to other counties for goods and services. In addition, the case exists where the sign for unemployment percentage is positive for one year and negative in the other. This is not illogical because earlier it was shown that the coefficient could be either positive or negative.

The 1960 and 1970 equations for the eating and drinking establishment industry are radically different. Table 6 shows that the only

TABLE 5

BUSINESS AND REPAIR SERVICES
1960 AND 1970 REGRESSION EQUATIONS

1960:

$$\begin{aligned}\text{Employment} = {} & 68.50687 - 2.09659(\%\ \text{Unemployed}) + .00766(\text{Pop.}) - .01357(\text{Inc.}) + .74282(\%\ \text{Under \$3000}) \\ & \quad (.71311) \qquad\qquad (.00069) \qquad (.00504) \qquad (.28579) \\ & \quad -2.94004 \qquad\qquad 10.98911 \qquad -2.68868 \qquad 2.59912 \\ & - 1.57693(\text{Dependency Ratio}) + .25680(\text{Distance}) \\ & \quad (.92203) \qquad\qquad (.07998) \\ & \quad -1.71029 \qquad\qquad 3.21079\end{aligned}$$

$R^2 = .85143$
$\bar{R}^2 = .82520$

1970:

$$\begin{aligned}\text{Employment} = {} & 37.08180 + 3.01165(\%\ \text{Unemployed}) + .00672(\text{Pop.}) + .00780(\text{Inc.}) + 1.02494(\%\ \text{Under \$3000}) \\ & \quad (1.08317) \qquad\qquad (.00101) \qquad (.00598) \qquad (.79713) \\ & \quad 2.78039 \qquad\qquad 6.59322 \qquad 1.30375 \qquad 1.28578 \\ & - .00613(\text{Square Miles}) \\ & \quad (.00613) \\ & \quad -2.29853\end{aligned}$$

$R^2 = .74435$
$\bar{R}^2 = .70790$

Note: Beneath each coefficient are listed the standard error and the "t" statistic.

TABLE 6

EATING AND DRINKING ESTABLISHMENTS
1960 AND 1970 REGRESSION EQUATIONS

1960:

$$\text{Employment} = 109.91775 + \underset{\substack{(.00124)\\ 9.38649}}{.01169(\text{Pop.})} - \underset{\substack{(.01013)\\ 1.44108}}{.01459(\text{Inc.})} - \underset{\substack{(1.79141)\\ -1.10596}}{1.98123(\text{Dependency})} + \underset{\substack{(.15069)\\ 1.44369}}{.21755(\text{Distance})}$$

$$+ \underset{\substack{(.32731)\\ 1.57623}}{.51592(\%\ \text{Urban})}$$

$R^2 = .78010$

$\bar{R}^2 = .74872$

1970:

$$\text{Employment} = -35.56563 + \underset{\substack{(1.29215)\\ 1.33214}}{1.72133(\%\ \text{Unemployed})} + \underset{\substack{(.00125)\\ 12.94031}}{.01621(\text{Pop.})} + \underset{\substack{(.31119)\\ 1.69165}}{.52642(\%\ \text{Urban})} + \underset{\substack{(.00307)\\ .87236}}{.00268(\text{Square Miles})}$$

$R^2 = .90109$

$\bar{R}^2 = .89020$

Note: Beneath each coefficient are listed the standard error and the "t" statistic.

TABLE 7

FINANCE, INSURANCE, AND REAL ESTATE
1960 AND 1970 REGRESSION EQUATIONS

1960:

$$\text{Employment} = -20.98426 - \underset{\substack{(1.61392)\\-1.88713}}{3.04568}(\%\ \text{Urban}) + \underset{\substack{(.00155)\\5.73047}}{.00835}(\text{Pop.}) + \underset{\substack{(1.04716)\\.93137}}{.97530}(\%\ \text{over \$10,000}) + \underset{\substack{(.17944)\\2.16744}}{.38894}(\text{Distance}) - \underset{\substack{(.00323)\\-1.13984}}{.00368}(\text{Square Miles})$$

$R^2 = .55474$

$\bar{R}^2 = .49111$

1970:

$$\text{Employment} = -5.57410 + \underset{\substack{(.00060)\\7.68803}}{.00465}(\text{Pop.}) + \underset{\substack{(.56320)\\1.39534}}{.78585}(\%\ \text{Under \$3000}) - \underset{\substack{(.00190)\\-1.52728}}{.00290}(\text{Square Miles})$$

$R^2 = .62329$

$\bar{R}^2 = .59282$

Note: Beneath each coefficient are listed the standard error and the "t" statistic.

TABLE 8

FOOD AND DAIRY PRODUCTS
1960 AND 1970 REGRESSION EQUATIONS

1960:

$$\underset{\text{Employment}}{} = \underset{-17.67916}{} + \underset{1.35181}{}(\%\ \text{Unemployed}) + \underset{.00583}{}(\text{Pop.}) - \underset{.69411}{}(\%\ \text{Under \$3000})$$
$$\underset{}{} \quad \underset{(.95518)}{} \quad \underset{(.00095)}{} \quad \underset{(.34730)}{}$$
$$\underset{}{} \quad \underset{1.41523}{} \quad \underset{6.09604}{} \quad \underset{-1.73942}{}$$

$R^2 = .70012$

$\bar{R}^2 = .67581$

1970:

$$\underset{\text{Employment}}{} = \underset{-35.77080}{} + \underset{.00987}{}(\text{Pop.}) + \underset{.88113}{}(\%\ \text{Under \$3000}) + \underset{.77540}{}(\text{Distance}) + \underset{.77196}{}(\%\ \text{Urban})$$
$$\underset{}{} \quad \underset{(.00055)}{} \quad \underset{(.51541)}{} \quad \underset{(.07661)}{} \quad \underset{(.16479)}{}$$
$$\underset{}{} \quad \underset{17.66853}{} \quad \underset{1.70957}{} \quad \underset{2.28950}{} \quad \underset{2.13580}{}$$

$$\underset{-.00352}{}(\text{Square Miles})$$
$$\underset{(.00168)}{}$$
$$\underset{-2.09496}{}$$

$R^2 = .90976$

$\bar{R}^2 = .89700$

Note: Beneath each coefficient are listed the standard error and the "t" statistic.

independent variables which the two equations have in common are population and percent urban. The income variable in the 1960 equation has a negative sign for possibly the same reason as discussed in connection with the equations for the business and repair industry.

The two equations for the finance, insurance and real estate industry are very different. Table 7 indicates that the population and square miles variables are the only common independent variables. The signs for the coefficients of all the independent variables satisfy expectations. Table 8 shows that the 1960 and 1970 food and dairy product industry equations have in common population and percent of families with incomes under $3000. Without exception, the signs of the coefficients satisfy previous expectations.

It is readily observed that, regardless of the industry examined, the equations for 1960 and 1970 are quite different. This seems to indicate that time has a way of changing things. Since the independent variables attempt to explain variation in the dependent variable, it is possible that time has altered the relationship among the variables.

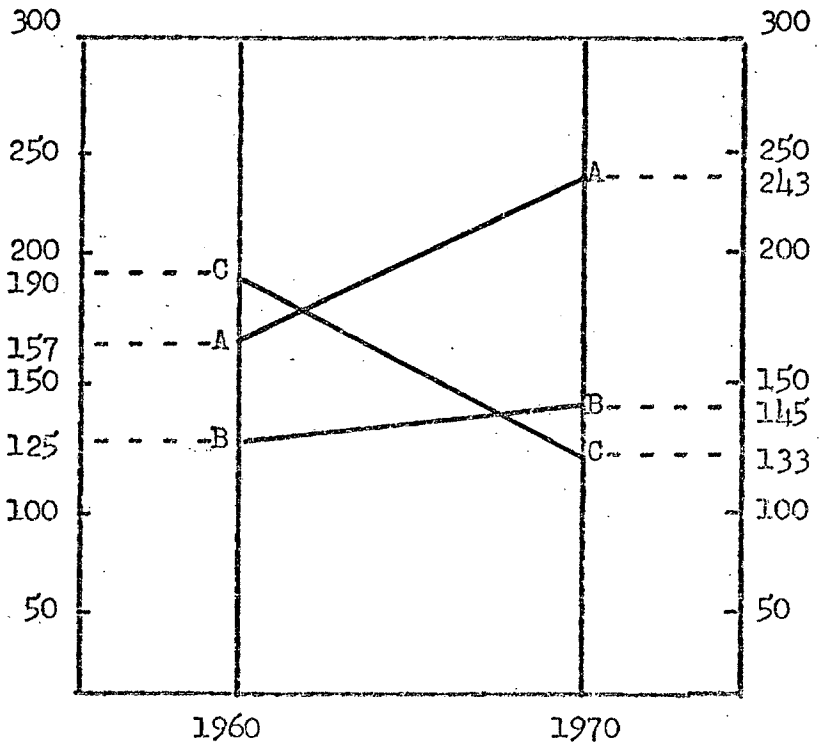
If the structure of the economic indicators is unstable, the use of these regression equations for predictive purposes is questionable. This need not, however, destroy their practical value. The primary objective of the study was to investigate the factors which lead to changes in employment. The purpose of the regression equations is to predict the trend of employment change. The basis for predicting employment change is found in Appendix II. Appendix II provides values for the difference between predictions and actual employment for each county for each of the four different industries. These values, derived

from 1960 equations and data, show which counties had either lesser or greater employment than estimated by the equations. If the equations are to be useful in predicting employment, there should be a comparatively slow growth in actual employment between 1960 and 1970 whenever the residual indicates excess employment in 1960. The opposite should be true for residuals which show employment levels to be too low. An examination of Appendix II, which shows the 1960 residuals for each county and Appendix III, which shows the 1970 actual employment, verifies that when the residual indicates excess employment in a county in a particular industry, for 1960, that industry showed only a slow growth in employment through 1970. This is compared to counties and industries which had an employment level in 1960 indicating deficient employment and which had by 1970 substantially increased employment. (See Chart I). A positive residual (actual employment greater than employment estimated by the equation) suggests an excess supply condition, which will tend to slow the growth of future employment. In fact, in 14 of 18 counties for the food and dairy industry where a positive sign appears on the residual, employment actually declined. In 17 of the 23 counties with negative residuals, employment increased. Similar results can be seen for the other industries.

Consequently, while the equations are not 100 percent effective, the 1960 equation would have improved the ability to forecast the trend of employment between 1960 and 1970. It is conceivable, but unprovable, that the 1970 equations will also provide a better than guessing indication of the growth trend in employment.

CHART I

EXAMPLE OF EMPLOYMENT GROWTH TRENDS



Line AA - Lake County - Eating and drink establishment industry.

This county and industry had a residual indicating that the 1960 actual employment was less than the equation predicted. Thus, as expected, employment grew substantially by 1970 as reflected by the slope of AA.

Line BB - Big Horn County - Eating and drinking establishment industry.

This county has a residual indicating that the 1960 actual employment was more than the equation predicted. Thus, as expected, employment grew only at a slow rate between 1960 and 1970.

Line CC - Carbon County - Eating and drinking establishment industry.

This county has a positive residual indicating excess employment in 1960. Not only did employment not grow as rapidly as in Lake County (Line AA), it actually declined by 1970.

Source: Appendix II.

While the study has developed equations capable of forecasting the trend of employment change, it has not helped in the problem of accurately predicting the level of employment. It is noted that the 1960 and 1970 equations contain certain marked differences in the variables included in the equations. This indication of instability threatens the predictive value of the equations. An examination of the residuals derived from plugging 1970 data into the 1960 equations will give an indication of whether or not the 1960 equations will be useful for predicting the 1970 level of employment. If the residuals are "small" it might be the case that the reasons behind the change in independent variables from 1960 to 1970 do not impair the predictive usefulness of the equations.

The method of comparison will be to examine the absolute residuals using the 1960 equations and the 1970 data. The absolute residual indicates the degree to which the equation fails to predict correctly 1960 employment. The total of absolute residuals is taken as a percentage of the total actual employment in 1960 for the 41 counties. This percentage reflects the average percentage error in prediction resulting from the use of 1970 data in the 1960 equations. Appendix I presents the residuals for the 1960 equations using 1970 data.

The values for the food and dairy products industry indicate that the average absolute residual in 31.84 percent of the actual value. This means that for this industry, the 1960 equations, using 1970 data, will mispredict the employment by an average of 31.84 percent.

For the business and repair service industry, the 1960 equation using 1970 data has an average absolute error of 84.66 percent of actual employment.

The finance, insurance and real estate industry equation for 1960 mispredicts the actual employment by an average of 172.24 percent.

The eating and drinking places industry has an average absolute residual of 30.27 percent of actual employment.

These values are much too high to establish hope of stability between the 1960 and 1970 equations. Consequently, the primary use of the equations will be to forecast employment growth trends in Montana counties.

CHAPTER VII

SUMMARY

The study has examined employment in rural Montana. Inter-county variations in employment for selected industries have been related to differences in the number of residents, their economic well being, and the geographical and economic structure of the region. In general, these factors were successful in explaining employment variations.

Multiple linear regression was applied to cross section data to estimate equations which will forecast employment trends for the 44 rural Montana counties used in the study. These equations will be used to determine employment predictions. If the predicted employment differs from the actual level in a particular county, the direction of this difference indicates the trend of employment growth for the various industries. For example, if the expected employment is less than the actual employment for a given year, the growth trend for employment in future years is expected to be less rapid than if the predicted employment had been greater than actual employment.

Although the outgrowth of this study does not provide a means of accurately estimating employment, it does present a method by which the trend of employment can be accurately predicted. If employment is a valid proxy for output, a businessman can use the forecasted employment trends to assist planning for expansion and business growth in a

particular county. Consequently, this study presents an additional consideration for the businessmen and is intended to be applied in conjunction with other facets of business decision making.

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APPENDIXES

APPENDIX I

FOOD AND DAIRY PRODUCT STORES
F (% UNEMPLOYMENT, POPULATION, PERCENT UNDER $3000)

1960 EQUATION, 1970 DATA

County	Actual	Predicted	Residual
Beaverhead	85.000	65.287	19.713
Big Horn	60.000	71.792	-11.792
Blaine	36.000	58.699	-22.699
Broadwater	20.000	24.422	-4.422
Carbon	85.000	54.990	30.010
Carter	20.000	23.693	-3.693
Chouteau	30.000	53.943	-23.943
Daniels	25.000	32.319	-7.319
Fallon	44.000	40.629	3.371
Garfield	.000	23.378	-23.378
Glacier	120.000	87.082	32.918
Golden Valley	.000	23.806	-23.806
Granite	16.000	34.534	-18.534
Jefferson	36.000	48.786	-12.786
Judith Basin	5.000	31.136	-26.136
Lake	117.000	108.189	8.811
Liberty	29.000	25.731	3.269
Lincoln	158.000	133.301	24.699
McCone	17.000	32.570	-15.570
Madison	52.000	44.610	7.390
Meagher	20.000	30.443	-10.443
Mineral	26.000	48.043	-27.043
Musselshell	44.000	41.274	2.726
Petroleum	3.000	12.571	-9.571
Phillips	35.000	46.878	-11.878
Pondera	75.000	51.397	23.603
Powder River	.000	31.723	-31.723
Powell	50.000	56.113	-6.113
Prairie	16.000	19.923	-3.923
Ravalli	104.000	102.511	1.489
Roosevelt	98.000	81.672	16.328
Rosebud	54.000	48.129	5.871
Sanders	70.000	67.198	2.803
Sheridan	77.000	50.403	26.597
Stillwater	33.000	39.921	-6.921
Sweet Grass	38.000	26.877	11.123
Teton	54.000	52.409	1.591
Toole	40.000	48.226	-8.226
Treasure	.000	17.912	-17.912
Wheatland	10.000	26.146	-16.146
Wibaux	11.000	18.434	-7.434

APPENDIX I (Continued)

BUSINESS AND REPAIR SERVICES
F (% Unemployment, Population, Income, Square Miles, % Under $3000)

1960 EQUATION, 1970 DATA

County	Actual	Predicted	Residual
Beaverhead	45.000	39.800	- 5.200
Big Horn	32.000	51.011	-19.011
Blaine	82.000	.874	81.126
Broadwater	16.000	-12.812	28.812
Carbon	70.000	30.853	39.147
Carter	15.000	-13.389	28.389
Chouteau	16.000	-.223	16.223
Daniels	21.000	-17.978	38.978
Fallon	43.000	-2.325	45.325
Garfield	26.000	-25.542	51.542
Glacier	72.000	39.551	32.449
Golden Valley	.000	-33.875	33.875
Granite	11.000	-.445	11.445
Jefferson	34.000	14.595	19.405
Judith Basin	9.000	-13.159	22.159
Lake	76.000	74.127	1.873
Liberty	9.000	.458	8.542
Lincoln	128.000	91.150	36.850
McCone	16.000	-32.242	48.242
Madison	25.000	8.615	16.385
Meagher	8.000	-9.170	17.170
Mineral	30.000	-26.792	56.792
Musselshell	55.000	-10.306	65.306
Petroleum	.000	-25.064	25.064
Phillips	23.000	6.848	16.152
Pondera	21.000	18.378	2.622
Powder River	5.000	15.055	20.055
Powell	25.000	13.191	11.809
Prairie	16.000	-10.426	26.426
Ravalli	101.000	80.230	20.770
Roosevelt	133.000	32.633	100.367
Rosebud	6.000	6.467	-.467
Sanders	60.000	20.570	39.430
Sheridan	79.000	12.084	66.916
Stillwater	56.000	-3.333	59.333
Sweet Grass	18.000	-6.497	24.497
Teton	35.000	1.736	33.264
Toole	40.000	11.949	28.051
Treasure	8.000	-22.312	30.312
Wheatland	21.000	-2.870	23.870
Wibaux	6.000	-30.017	36.017

APPENDIX I (Continued)

EATING AND DRINKING PLACES
F (% UNEMPLOYMENT, POPULATION, INCOME, SQUARE MILES, DEPENDENCY)

1960 EQUATION, 1970 DATA

County	Actual	Predicted	Residual
Beaverhead	198.000	115.293	82.707
Big Horn	145.000	121.442	23.558
Blaine	124.000	60.137	63.863
Broadwater	57.000	22.510	34.490
Carbon	133.000	91.646	41.354
Carter	30.000	19.145	10.855
Chouteau	80.000	54.832	25.168
Daniels	48.000	18.611	29.389
Fallon	76.000	45.931	30.069
Garfield	30.000	8.357	21.643
Glacier	172.000	114.255	57.745
Golden Valley	29.000	5.916	23.084
Granite	27.000	54.431	-27.431
Jefferson	44.000	80.548	-36.548
Judith Basin	58.000	28.033	29.967
Lake	243.000	173.670	69.330
Liberty	47.000	36.298	10.702
Lincoln	287.000	206.231	80.769
McCone	49.000	5.188	43.812
Madison	96.000	60.091	35.909
Meagher	35.000	38.468	-3.468
Mineral	56.000	37.414	18.586
Musselshell	114.-00	41.778	72.221
Petroleum	5.000	8.104	-3.104
Phillips	76.000	53.600	22.400
Pondera	90.000	70.877	19.123
Powder River	22.000	24.722	2.722
Powell	93.000	79.809	13.191
Prairie	56.000	29.884	26.116
Ravalli	273.000	173.331	99.669
Roosevelt	129.000	107.021	21.979
Rosebud	100.000	55.635	44.365
Sanders	150.000	91.889	58.111
Sheridan	88.000	67.520	20.480
Stillwater	32.000	48.719	-16.719
Sweet Grass	26.000	33.158	-7.158
Teton	57.000	56.238	.762
Toole	86.000	62.585	23.415
Treasure	.000	8.418	-8.418
Wheatland	40.000	35.104	4.896
Wibaux	5.000	-2.175	7.175

APPENDIX I (Continued)

FINANCE, INSURANCE, AND REAL ESTATE
F (% UNEMPLOYMENT, POPULATION, SQUARE MILES, % OVER $10,000, DISTANCE)

1960 EQUATION, 1970 DATA

County	Actual	Predicted	Residual
Beaverhead	33.000	75.072	-42.072
Big Horn	13.000	85.502	-72.502
Blaine	21.000	28.650	-7.650
Broadwater	6.000	26.005	-20.005
Carbon	33.000	65.505	-32.505
Carter	.000	63.382	-63.382
Chouteau	33.000	72.605	-39.605
Daniels	19.000	66.182	-47.182
Fallon	11.000	62.780	-51.780
Garfield	4.000	27.015	-23.015
Glacier	40.000	101.693	-61.693
Golden Valley	.000	31.561	-31.561
Granite	.000	35.293	-35.293
Jefferson	13.000	53.431	-40.431
Judith Basin	.000	48.607	-48.607
Lake	53.000	122.070	-69.070
Liberty	5.000	84.048	-79.048
Lincoln	50.000	176.516	-126.516
McCone	7.000	45.327	-38.327
Madison	15.000	50.508	-35.508
Meagher	6.000	32.318	-26.318
Mineral	.000	14.882	-14.882
Musselshell	15.000	28.696	-13.696
Petroleum	.000	14.154	-14.154
Phillips	20.000	56.532	-36.532
Pondera	47.000	77.710	-30.710
Powder River	7.000	51.100	-44.100
Powell	15.000	61.592	-46.592
Prairie	10.000	29.952	-19.952
Ravalli	104.000	122.498	-18.498
Roosevelt	35.000	89.734	-54.734
Rosebud	35.000	42.346	-7.346
Sanders	51.000	64.492	-13.492
Sheridan	43.000	88.445	-45.445
Stillwater	55.000	32.424	22.576
Sweet Grass	7.000	30.222	-23.222
Teton	38.000	68.597	-30.597
Toole	38.000	81.994	-43.994
Treasure	.000	37.935	-37.935
Wheatland	19.000	52.482	-33.482
Wibaux	7.000	27.179	-20.179

APPENDIX II

FOOD AND DAIRY PRODUCT STORES
F (% UNEMPLOYMENT, POPULATION, % UNDER $3000)
1960

County	Actual	Predicted	Residual
Beaverhead	50.000	52.212	-2.212
Big Horn	51.000	70.410	-19.410
Blaine	63.000	55.808	7.192
Broadwater	8.000	18.317	-10.317
Carbon	88.000	52.872	35.128
Carter	17.000	18.243	-1.243
Chouteau	54.000	52.138	1.862
Daniels	18.000	27.050	-9.050
Fallon	16.000	29.990	-13.990
Garfield	7.000	6.430	.570
Glacier	93.000	84.404	8.596
Golden Valley	24.000	6.363	17.636
Granite	47.000	37.300	9.700
Jefferson	46.000	31.714	14.286
Judith Basin	11.000	24.607	-13.607
Lake	61.000	86.501	-25.501
Liberty	23.000	30.181	-7.181
Lincoln	140.000	103.790	36.210
McCone	17.000	19.863	-2.863
Madison	32.000	33.363	-1.363
Meagher	22.000	30.733	-8.733
Mineral	27.000	40.098	-13.098
Musselshell	61.000	34.537	26.463
Petroleum	.000	14.667	-14.667
Phillips	36.000	40.122	-4.122
Pondera	31.000	53.865	-22.865
Powder River	22.000	17.086	4.914
Powell	64.000	52.596	11.404
Prairie	24.000	17.554	6.445
Ravalli	65.000	75.446	-10.446
Roosevelt	66.000	79.256	-13.256
Rosebud	22.000	43.641	-21.641
Sanders	68.000	59.222	8.778
Sheridan	39.000	46.138	-7.138
Stillwater	49.000	39.437	9.563
Sweet Grass	17.000	25.979	-8.979
Teton	83.000	48.067	34.933
Toole	42.000	63.584	-21.584
Treasure	9.000	10.343	-1.343
Wheatland	36.000	23.979	12.021
Wibaux	11.000	1.891	9.109

APPENDIX II (Continued)

FINANCE, INSURANCE, AND REAL ESTATE
F (% UNEMPLOYMENT, POPULATION, SQUARE MILES, % OVER $10,000, DISTANCE)
1960

County	Actual	Predicted	Residual
Beaverhead	60.000	43.925	16.075
Big Horn	53.000	47.771	5.229
Blaine	42.000	31.245	10.755
Broadwater	8.000	9.605	-1.605
Carbon	69.000	62.732	6.268
Carter	8.000	37.319	-29.319
Chouteau	17.000	58.366	-41.366
Daniels	30.000	34.037	-4.037
Fallon	39.000	35.162	3.838
Garfield	7.000	10.504	-3.504
Glacier	121.000	88.482	32.518
Golden Valley	4.000	10.447	-6.447
Granite	8.000	.800	7.200
Jefferson	7.000	28.744	-21.744
Judith Basin	127.000	40.219	86.781
Lake	73.000	86.264	-13.264
Liberty	29.000	55.327	-26.327
Lincoln	40.000	67.707	-27.707
McCone	9.000	14.403	-5.403
Madison	41.000	37.716	3.284
Meagher	17.000	16.287	.713
Mineral	4.000	4.362	-.362
Musselshell	53.000	32.089	20.911
Petroleum	.000	2.932	-2.932
Phillips	46.000	42.081	3.919
Pondera	71.000	68.527	2.473
Powder River	16.000	29.967	-13.967
Powell	17.000	39.352	-22.352
Prairie	7.000	10.555	-3.555
Ravalli	99.000	83.334	15.666
Roosevelt	43.000	75.915	-32.915
Rosebud	26.000	21.120	4.879
Sanders	53.000	44.450	8.550
Sheridan	37.000	52.649	-15.649
Stillwater	35.000	38.225	-3.225
Sweet Grass	39.000	10.057	28.943
Teton	66.000	64.091	1.909
Toole	121.000	76.273	44.727
Treasure	.000	11.965	-11.965
Wheatland	24.000	46.980	-22.980
Wibaux	8.000	2.010	5.990

APPENDIX II (Continued)

BUSINESS AND REPAIR SERVICES
F(% UNEMPLOYMENT, POPULATION, INCOME, DISTANCE, % UNDER $3000, DEPENDENCY)
1960

County	Actual	Predicted	Residual
Beaverhead	47.000	47.885	-.885
Big Horn	65.000	55.396	9.604
Blaine	35.000	36.910	-1.910
Broadwater	8.000	10.652	-2.652
Carbon	54.000	63.587	-9.587
Carter	8.000	26.840	-18.840
Chouteau	31.000	27.590	3.410
Daniels	41.000	33.762	7.238
Fallon	20.000	32.372	-12.372
Garfield	19.000	19.115	-.115
Glacier	82.000	81.918	.082
Golden Valley	.000	6.931	-6.931
Granite	24.000	5.007	18.093
Jefferson	33.000	30.756	2.244
Judith Basin	22.000	14.265	7.735
Lake	87.000	86.431	.569
Liberty	8.000	-.123	8.123
Lincoln	46.000	62.379	-16.379
McCone	18.000	25.285	-7.285
Madison	47.000	38.119	8.881
Meagher	12.000	10.521	1.479
Mineral	4.000	-1.882	5.882
Musselshell	33.000	28.099	4.901
Petroleum	5.000	-3.824	8.824
Phillips	65.000	45.224	19.776
Pondera	49.000	48.351	.649
Powder River	8.000	12.771	-4.771
Powell	32.000	39.562	-7.562
Prairie	3.000	7.830	-4.830
Ravalli	109.000	89.487	19.513
Roosevelt	65.000	73.793	-8.793
Rosebud	13.000	27.283	-14.283
Sanders	24.000	37.302	-13.302
Sheridan	67.000	46.621	20.379
Stillwater	20.000	29.619	-9.619
Sweet Grass	18.000	15.464	2.536
Teton	55.000	47.032	7.968
Toole	38.000	41.633	-3.633
Treasure	8.000	1.283	6.717
Wheatland	8.000	22.582	-14.582
Wibaux	4.000	11.169	-7.169

APPENDIX II (Continued)

EATING AND DRINKING PLACES
F (% UNEMPLOYMENT, POPULATION, INCOME, DISTANCE, DEPENDENCY)
1960

County	Actual	Predicted	Residual
Beaverhead	163.000	113.976	49.024
Big Horn	125.000	122.480	2.520
Blaine	108.000	90.735	17.265
Broadwater	40.000	41.066	-1.066
Carbon	198.000	120.290	77.710
Carter	36.000	59.230	-23.230
Chouteau	66.000	79.137	-13.137
Daniels	67.000	74.069	-7.069
Fallon	88.000	74.901	13.099
Garfield	30.000	34.305	-4.305
Glacier	178.000	163.477	14.523
Golden Valley	21.000	25.106	-4.106
Granite	77.000	60.994	16.006
Jefferson	69.000	81.976	-12.976
Judith Basin	54.000	51.265	2.735
Lake	157.000	164.037	-7.037
Liberty	49.000	38.798	10.202
Lincoln	136.000	162.900	-26.900
McCone	24.000	56.143	-32.143
Madison	63.000	79.812	-16.812
Meagher	67.000	60.075	6.925
Mineral	52.000	57.048	-5.048
Musselshell	108.000	71.051	36.949
Petroleum	16.000	34.779	-18.779
Phillips	91.000	89.263	1.737
Pondera	109.000	105.965	3.035
Powder River	22.000	41.397	-19.397
Powell	73.000	109.316	-36.316
Prairie	69.000	40.596	28.404
Ravalli	148.000	158.206	-10.206
Roosevelt	124.000	144.744	-20.744
Rosebud	75.000	73.068	1.932
Sanders	104.000	103.358	.642
Sheridan	75.000	98.067	-23.067
Stillwater	58.000	78.849	-20.849
Sweet Grass	63.000	56.932	6.068
Teton	89.000	99.675	-10.675
Toole	126.000	109.340	16.660
Treasure	30.000	22.596	7.404
Wheatland	43.000	60.051	-17.051
Wibaux	41.000	22.927	18.073

APPENDIX III

FINANCE, INSURANCE AND REAL ESTATE
F (SQUARE MILES, POPULATION, % UNDER $3000)
1970

County	Actual	Predicted	Residual
Beaverhead	33.000	26.573	6.427
Big Horn	13.000	40.686	-27.686
Blaine	21.000	29.641	-8.641
Broadwater	6.000	19.403	-13.403
Carbon	33.000	35.678	-2.678
Carter	.000	5.172	-5.172
Chouteau	33.000	18.397	14.603
Daniels	19.000	9.560	9.440
Fallon	11.000	18.862	-7.862
Garfield	4.000	.105	3.895
Glacier	40.000	49.612	-9.612
Golden Valley	.000	2.611	-2.611
Granite	.000	9.935	-9.935
Jefferson	13.000	21.227	-8.227
Judith Basin	.000	8.938	-8.938
Lake	53.000	60.621	-7.621
Liberty	5.000	9.383	-4.383
Lincoln	50.000	72.419	-22.419
McCone	7.000	6.661	.339
Madison	15.000	20.449	-5.449
Meagher	6.000	8.770	-2.770
Mineral	.000	12.010	-12.010
Musselshell	15.000	17.021	-2.021
Petroleum	.000	4.521	-4.521
Phillips	20.000	14.743	5.257
Pondera	47.000	32.355	14.645
Powder River	7.000	6.679	.321
Powell	15.000	27.360	-12.360
Prairie	10.000	10.316	-.316
Ravalli	104.000	67.411	36.589
Roosevelt	35.000	46.623	-11.623
Rosebud	35.000	22.098	12.902
Sanders	51.000	29.671	21.329
Sheridan	43.000	22.916	20.084
Stillwater	55.000	20.958	34.042
Sweet Grass	7.000	17.301	-10.301
Teton	38.000	24.745	13.255
Toole	38.000	26.758	11.242
Treasure	.000	6.614	-6.614
Wheatland	19.000	12.792	6.208
Wibaux	7.000	10.408	-3.408

APPENDIX III (Continued)

FOOD AND DAIRY PRODUCT STORES
F (% URBAN, POPULATION, SQUARE MILES, DISTANCE, % UNDER $3000)
1970

County	Actual	Predicted	Residual
Beaverhead	85.000	68.215	16.785
Big Horn	60.000	79.906	-19.906
Blaine	36.000	47.063	-11.063
Broadwater	20.000	28.388	-8.388
Carbon	85.000	62.394	22.606
Carter	20.000	16.791	3.209
Chouteau	30.000	37.517	-7.517
Daniels	25.000	26.684	-1.684
Fallon	44.000	46.706	-2.706
Garfield	.000	2.892	-2.892
Glacier	120.000	107.859	12.141
Golden Valley	.000	-1.653	1.653
Granite	16.000	21.384	-5.384
Jefferson	36.000	33.548	2.452
Judith Basin	5.000	12.236	-7.236
Lake	117.000	119.853	-2.853
Liberty	29.000	28.364	.636
Lincoln	158.000	156.751	1.249
McCone	17.000	11.039	5.961
Madison	52.000	40.727	11.273
Meagher	20.000	26.840	-6.840
Mineral	26.000	23.519	2.481
Musselshell	44.000	35.682	8.318
Petroleum	3.000	1.682	1.318
Phillips	35.000	40.486	-5.486
Pondera	75.000	62.702	12.298
Powder River	.000	14.106	-14.106
Powell	50.000	58.845	-8.845
Prairie	16.000	14.061	1.939
Ravalli	104.000	126.819	-22.819
Roosevelt	98.000	89.455	8.545
Rosebud	54.000	41.003	12.997
Sanders	70.000	68.722	1.228
Sheridan	77.000	51.851	25.149
Stillwater	33.000	28.371	4.629
Sweet Grass	38.000	28.378	9.622
Teton	54.000	44.501	9.499
Toole	40.000	61.321	-21.321
Treasure	.000	7.521	-7.521
Wheatland	10.000	31.662	-21.662
Wibaux	11.000	8.762	2.238

APPENDIX III (Continued)

BUSINESS AND REPAIR SERVICES
F (% UNEMPLOYMENT, POPULATION, INCOME, SQUARE MILES, % UNDER $3000)
1970

County	Actual	Predicted	Residual
Beaverhead	45.000	35.842	9.158
Big Horn	32.000	51.403	-19.403
Blaine	82.000	56.631	25.369
Broadwater	16.000	27.563	-11.563
Carbon	70.000	51.367	18.633
Carter	15.000	11.152	3.848
Chouteau	16.000	25.904	-9.904
Daniels	21.000	15.371	5.629
Fallon	43.000	35.285	7.715
Garfield	26.000	4.033	21.967
Glacier	72.000	98.550	-26.550
Golden Valley	.000	13.519	-13.519
Granite	11.000	15.756	-4.756
Jefferson	34.000	27.285	6.715
Judith Basin	9.000	13.520	-4.520
Lake	76.000	90.506	-14.506
Liberty	9.000	11.277	-2.277
Lincoln	128.000	126.482	1.518
McCone	16.000	15.779	.221
Madison	25.000	32.124	-7.124
Meagher	8.000	23.700	-15.700
Mineral	30.000	47.319	-17.319
Musselshell	55.000	35.176	19.824
Petroleum	.000	5.502	-5.502
Phillips	23.000	19.572	3.428
Pondera	21.000	47.051	-26.051
Powder River	5.000	11.194	-6.194
Powell	25.000	41.914	-16.914
Prairie	16.000	8.529	7.471
Ravalli	101.000	101.457	-.457
Roosevelt	133.000	81.014	51.986
Rosebud	6.000	31.093	-25.093
Sanders	60.000	63.258	-3.258
Sheridan	79.000	35.553	43.447
Stillwater	56.000	36.422	19.578
Sweet Grass	18.000	20.465	-2.465
Teton	35.000	42.415	-7.415
Toole	40.000	44.387	-4.387
Treasure	8.000	8.471	-.471
Wheatland	21.000	16.639	4.361
Wibaux	6.000	11.521	-5.521

APPENDIX III (Continued)

EATING AND DRINKING PLACES
F (% UNEMPLOYMENT, POPULATION, SQUARE MILES, % URBAN)
1970

County	Actual	Predicted	Residual
Beaverhead	198.000	139.575	58.425
Big Horn	145.000	164.440	-19.440
Blaine	124.000	122.727	1.273
Broadwater	57.000	37.221	19.779
Carbon	133.000	112.405	20.595
Carter	30.000	30.868	-.868
Chouteau	80.000	100.632	-20.632
Daniels	48.000	39.913	8.087
Fallon	76.000	66.772	9.228
Garfield	30.000	30.738	-.738
Glacier	172.000	186.815	-14.815
Golden Valley	29.000	14.797	14.203
Granite	27.000	44.706	-17.706
Jefferson	44.000	81.820	-37.820
Judith Basin	58.000	39.264	18.736
Lake	243.000	227.002	15.998
Liberty	47.000	28.892	18.108
Lincoln	287.000	295.481	-8.481
McCone	49.000	43.126	5.874
Madison	96.000	84.818	11.182
Meagher	35.000	39.870	-4.870
Mineral	56.000	64.517	-8.517
Musselshell	114.000	65.031	48.969
Petroleum	5.000	2.643	2.357
Phillips	76.000	91.560	-15.560
Pondera	90.000	101.150	-11.150
Powder River	22.000	45.643	-23.643
Powell	93.000	107.109	-14.109
Prairie	56.000	22.086	33.914
Ravalli	273.000	231.185	41.815
Roosevelt	129.000	171.459	-42.459
Rosebud	100.000	101.739	-1.739
Sanders	150.000	127.571	22.429
Sheridan	88.000	87.157	.843
Stillwater	32.000	67.429	-35.429
Sweet Grass	26.000	42.710	-16.710
Teton	57.000	96.013	-39.013
Toole	86.000	90.892	-4.892
Treasure	.000	9.783	-9.783
Wheatland	40.000	33.520	6.480
Wibaux	5.000	14.920	-9.920

APPENDIX IV

EATING AND DRINKING PLACES
STEP RESULTS
1960

Step 001 — **Var 02**

Standard Error Y.X	=		24.32973
R^2	=		.72265
Sum Squared Residual	=	05	.23085
Ind. Variable used	=	01	
Constant Term	=		18.58172

Var.	Coef.	Std. Err.	T Ratio
2	.01134	.00112	10.08067

Step 002 — **Var 08**

Standard Error Y.X	=		23.17693
R^2	=		.75476
Sum Squared Residual	=	05	.20412
Ind. Variable used	=	02	
Constant Term	=		-11.49615

Var.	Coef.	Std. Err.	T Ratio
2	.01225	.00114	10.68569
8	.67757	.30374	2.23071

Step 003 — **Var 07**

Standard Error Y.X	=		23.07509
R^2	=		.76331
Sum Squared Residual	=	05	.19701
Ind. Variable used	=	03	
Constant Term	=		-23.31206

Var.	Coef.	Std. Err.	T Ratio
2	.01237	.00114	10.79432
7	.16240	.14049	1.15593
8	.69176	.30266	2.28558

APPENDIX IV (Continued)

Step 005 Var 06

Standard Error Y.X	=		22.86832
R^2	=		.78010
Sum Sqiared Residual	=	05	.18303
Ind. Variable used	=	05	
Constant Term	=		109.91775

Var.	Coef.	Std. Err.	T Ratio
2	-.01169	.00124	9.38649
3	-.01459	.01013	-1.44108
6	-1.98123	1.79141	-1.10596
7	.21755	.15069	1.44369
8	.51592	.32731	1.57623

Step 006 Var 05

Standard Error Y.X	=		23.00767
R^2	=		.78377
Sum Squared Residual	=	05	.17998
Ind. Variable used	=	06	
Constant Term	=		125.72616

Var.	Coef.	Std. Err.	T Ratio
2	-.01195	.00130	9.19122
3	-.01317	.01036	-1.27131
5	.45440	.59804	.75981
6	-2.67304	2.01925	-1.32377
7	.23463	.15326	1.53088
8	.54742	.33191	1.64932

Step 007 Var 01

Standard Error Y.X	=		23.31852
R^2	=		.78442
Sum Squared Residual	=	05	.17943
Ind. Variable used	=	07	
Constant Term	=		130.93779

Var.	Coef.	Std. Err.	T. Ratio
1	-.48010	1.52154	-.31553
2	.01221	.00154	7.89154
3	-.01419	.01099	-1.29165
5	.42373	.61387	.69026
6	-2.72439	2.05299	-1.32703
7	.25663	.17026	1.50724
8	.54009	.33719	1.60170

APPENDIX IV (Continued)

Step 008 Var 04

Standard Error Y.X	=	23.64368
R^2	=	.78508
Sum Squared Residual	= 05	.17888
Ind. Variable used	= 08	
Constant Term	=	126.87283

Var.	Coef.	Std. Err.	T Ratio
1	-.70647	1.70291	-.41486
2	.01242	.00170	7.30243
3	-.01175	.01358	-.86507
4	-.46688	1.48698	-.31398
5	.31401	.71382	.43989
6	-2.60313	2.11715	-1.22954
7	.27187	.17933	1.51601
8	.53823	.34195	1.57401

Step 009 Var 09

Standard Error Y.X	=	24.01077
R^2	=	.78529
Sum Squared Residual	= 05	.17872
Ind. Variable used	= 09	
Constant Term	=	124.14777

Var.	Coef.	Std. Err.	T Ratio
1	-.76664	1.76508	-.43433
2	.01232	.00181	6.78294
3	-.01258	.01463	-.85995
4	-.48098	1.51234	-.31804
5	.26422	.78165	.33802
6	-2.50966	2.21899	-1.13099
7	.27450	.18277	1.50188
8	.54303	.34840	1.55864
9	.00064	.00378	.17027