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I am submitting herewith a dissertation written by Danny Lloyd Gunter entitled "Factors Affecting Employment Patterns in Manufacturing Plants in Rural Tennessee 1964-1973." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Agricultural Economics.

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FACTORS AFFECTING EMPLOYMENT PATTERNS IN MANUFACTURING PLANTS IN RURAL TENNESSEE 1964-1973

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Finally, this manuscript is dedicated to my wife Lynda and daughter Danielle Lyn whose sacrifices during the completion of this dissertation will never be known.

ABSTRACT

The primary objectives of this research were to describe patterns of growth of recently-located manufacturing plants; develop measures of key community characteristics; and describe the relationship between key community characteristics and manufacturing plant expansion.

The expansion of manufacturing plants appears to be of almost equal importance in the creation of non-farm jobs in rural Tennessee communities. The location of new manufacturing plants accounted for roughly 2,877 jobs annually, while the expansion of manufacturing plants included in this study accounted for roughly 2,566 jobs annually for the years 1967 through 1973. Of the 296 manufacturing plants that began operations during the study period, 56 discontinued operations before the end of 1973 causing a loss of 2,347 jobs.

Factor analysis was used to develop indices of community characteristics to measure manpower availability and quality and community services. These community concepts were hypothesized to be important considerations in the manufacturing plant management decision to expand plant development. The communities included in this study were scored on their relative availability of manpower and community services.

Multiple regression analysis was employed to isolate the relationship between the community factors and manufacturing employment expansion. The hypothesized relationships were consistently statistically significant. However, the relationship between the community services

factor and employment expansion, previously hypothesized to be positive, was found to be consistently negative and significant in three of the equations of models one and two.

Further investigation of the relationship between the community services factor and employment location and expansion indicated a tendency for the larger plants (greater than 50 employees) to be located in the communities scoring higher on the community services factor. Conversely, a larger number of smaller plants (less than 50 employees) were located in the communities scoring lower on the community services factor. The smaller plants tended to expand employment in the years following initial location while the larger plants tended to maintain a stable level of employment. However, employment fluctuations were large for both the large and small plants.

The results obtained from the regression analysis may be an indication that the decision to expand manufacturing plant operations depends primarily on factors internal to the firm. Thus, communities that provide some minimal level of community services as those included in this analysis may not greatly influence manufacturing plant expansions by altering one or more of the macro community variables included in this analysis.

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CHAPTER I

INTRODUCTION

As employment opportunities continue to decline in the primary industries (agriculture, mining, forestry), many rural community leaders have attempted to attract industry to keep their communities economically viable.[1] Because of the employment-generating potential of the manufacturing industry, much of the community leaders' efforts have focused primarily on influencing plant location decisions of the management of industrial companies.[2] Summers suggests that a more balanced population distribution and greater equality of life might be achieved with the expansion of employment opportunities in the nonmetropolitan areas.[3] Furthermore, a report by the President's Advisory Commission on Rural Poverty suggests that urban leaders see rural industrialization as a means of solving urban problems, such as congestion, pollution, and excessive demand for public services associated with metropolitan areas.[4]

Employment increased in the manufacturing industry in rural communities of the nation at a rate of 4.6 percent annually during the

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[1]U.S. Department of Agriculture, Planning for Rural Industry, PA 894, Federal Extension Service (Washington, D.C., 1969), p. 6.

[2]U.S. Department of Commerce, Industrial Location as a Factor in Regional Economic Development (Washington, D.C., 1967), p. 1.

[3]Gene F. Summers, "Large Industry in a Rural Area: Demographic, Economic, and Social Impacts," Rural Industrialization: Prospects, Problems, Impacts and Methods, A series of papers compiled by the Subcommittee on Rural Development of the Committee on Agriculture and Forestry, United States Senate (Washington, D.C., 1974), p. 9.

[4]John R. Fernstrom, Effective Community Industrial Development Programs: Bringing in the Sheaves (Corvallis, 1973), p. 11.

1960's, more than double the rate of employment increase in the metropolitan areas.[5] This trend is likely to continue because of labor, land, and tax cost advantages to the firms.[6] Haren indicates that other factors contributing to this trend include development of the interstate highway system; improvement in processing, marketing, and transportation technologies; and the increasing attractiveness of small cities and towns as a place to live and work.[7]

Community leaders often make significant investments to attract industry to their community. For example, community leaders may purchase land for industrial parks, then grade, drain, and provide necessary utilities at the site in an attempt to attract a manufacturing plant to the community. Some rural communities have difficulty attracting a manufacturing plant and permanently retaining a plant after location. Consequently, communities without industry, or those rural communities unable to retain industry, sometimes experience population declines which weaken the local tax base.

The location and retention of a manufacturing plant in a community should be viewed in a dynamic framework. Decisions made by the plant management, including the locating and expansion decisions, are influenced by (1) society, (2) politics, (3) economics, (4) technology, and (5) other industries (Figure 1). The particular strategy plant management adopts should depend upon the dynamic conditions of

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[5]U.S. Department of Agriculture, "Industrial Growth in Today's Rural Areas," The Farm Index, November, 1972, p. 11.

[6]Summers, op cit., p. 10.

[7]Claude C. Haren, "Rural Industrial Growth in the 1960's," American Journal of Agricultural Economics, Vol. 52, No. 3, August, 1970, p. 431.

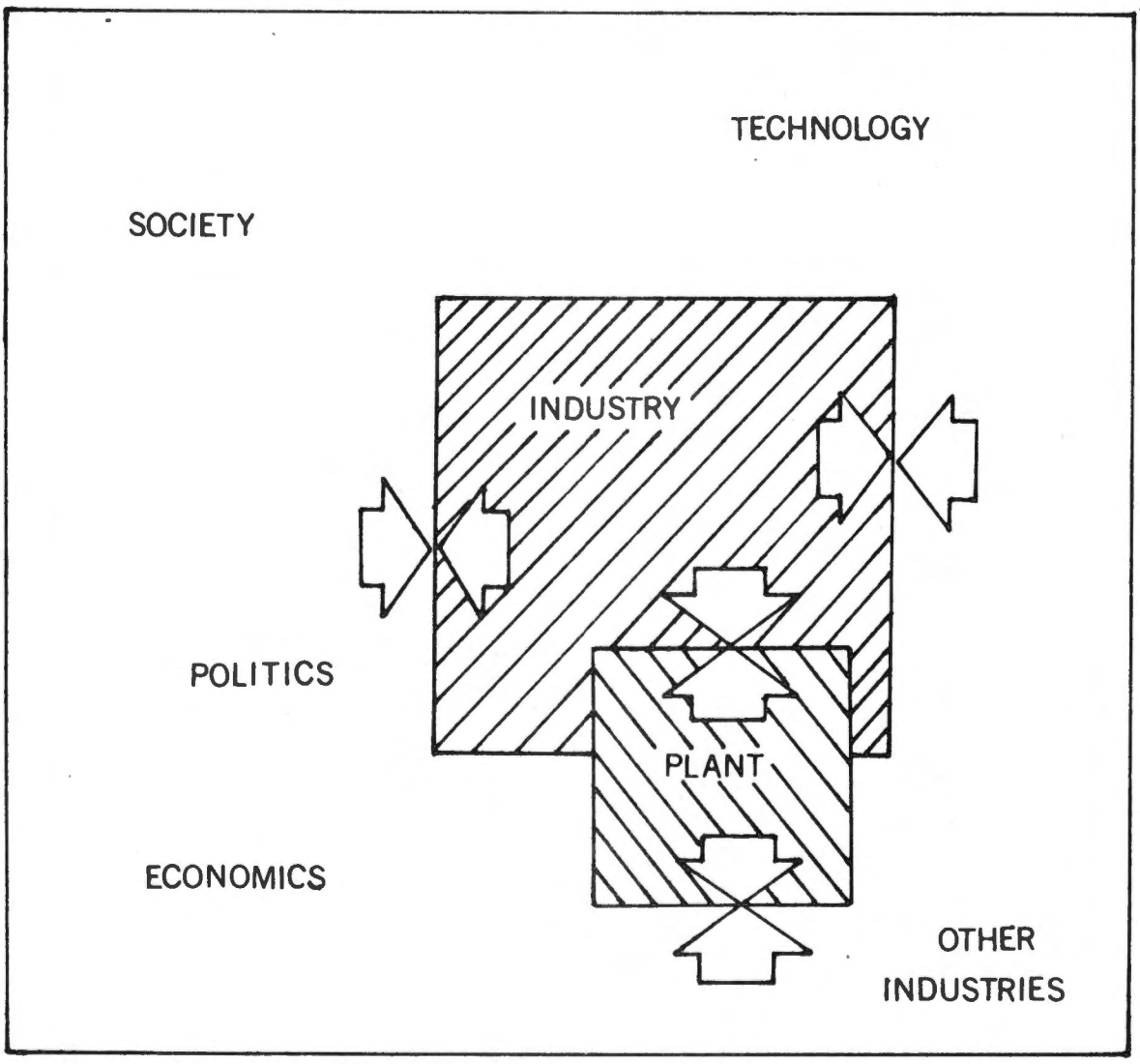


Figure 1. Dynamic Environment of the Plant.

Source: Adapted from Newman, William H., and James P. Logan, Strategy, Policy and Central Management. Cincinnati: South-Western Publishing Company, 1971.

the plant's environment, the general outlook for the particular industry, and the particular plant's position in the industry.[8]

The complexity of the plant's socioeconomic environment is reflected in the interrelationships and interdependence of various social and economic systems. Since complete awareness of these interrelationships is impossible, decisions on the part of plant management to locate or expand a plant are based on imperfect knowledge.[9] Further, state and national leaders may often disagree on the factors which have contributed to their past successes or failures in locating and retaining manufacturing plants and on their needs for future improvements.

There has been little empirical research explaining the relative importance of retention and growth of manufacturing plants once their operations begin in the community. Research on industrial employment in the community usually aggregates the effects of expansion, new plant locations, and the contraction of plant operations at the community or county level. It is suggested that all three of these actions by plant management are conceptually distinct but associated with a similar set of determining factors.

The relative importance of investment in manufacturing plant expansions as compared to investments made in new plant locations in Tennessee was pointed out by Carrier and Schriver[10] in a 1969 study on

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[8]William H. Newman and James P. Logan, Strategy, Policy, and Central Management (Cincinnati, 1971), p. 50.

[9]Fernstrom, op. cit., p. 6.

[10]Ronald E. Carrier and William R. Schriver, Plant Location Analysis: An Investigation of Plant Location in Tennessee (Memphis, 1969), p. 160.

industrial location in Tennessee. This study indicates that the total annual investment made by expanding firms is roughly equal to the total annual investment made in plant locations. Kaldor,[11] in a recent study of rural Iowa communities, found that expansion of existing firms during 1968-70 added about 48 new jobs per community while only 40 new jobs per community resulted from the location of a new plant.

The need for further research on retention and growth of manufacturing plants in local communities seems evident. Without a more definite statement of the ability of communities to enhance the retention and growth of plants, there can be little organization and planning for this aspect of community development.

I. THE PROBLEM

The specific problem that this study will focus on is the retention and growth of manufacturing plants in rural communities.[12] Expansion of existing manufacturing plants in the community is sometimes overlooked by community leaders as a source of significant increases in nonfarm employment. The expansion and retention of

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[11] Don Kaldor and Mike Dahlke, Industrialization Efforts and Experiences in Iowa's Rural Communities (The Center for Agriculture and Rural Development, Iowa State University, 1973).

[12] The Southern Regional Rural Development Research Council was the specific group that provided initial support for the particular research for my dissertation. They recognized research in the area of new plant retention and growth and the relationship to community characteristics as a priority area of need, while noting the uncertainty of a successful effort to draw definitive policy recommendations from this type research. Nevertheless, they concede that if the research is successful in pointing to some significant relationships between communities and plant retention and growth, their investment will be worthwhile.

manufacturing plants in a community has received limited attention from industrial development leaders as compared with the location of new manufacturing plants.

This research attempts to determine the effect of community characteristics on the expansion[13] of established manufacturing plants in nonmetropolitan communities of Tennessee. After the initial location of a manufacturing plant, patterns of production can vary depending upon both the internal and external considerations (Figure 2). Production in a plant can either be maintained, increased, decreased, or discontinued. The purpose of this study is to consider some of the external forces that the firm encounters and determine the importance of these influences on the plant's employment.[14]

Rural community leaders need some indication of growth and new employment potential of industrial plants located in their communities. Further, community leaders need an indication of the relationship between community characteristics and manufacturing plant management decisions to expand or contract plant employment. It is suggested that

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[13]Expansion is defined to mean an increase in established plant employment, whereas expansion is often defined in terms of growth in manufacturing employment for the total community including new plants and expansions. Alternatively, contraction will be used to describe those plants showing negative employment growth.

[14]Since community development is generally concerned with job creation, Figure 2 provides the alternative means by which a firm can expand. Given the increased demand, the firm has two alternatives: (1) it can increase the existing plant, or (2) it can expand production in a new plant. Since this research is concerned with expansion of existing plants, we will carry the alternatives for expansion of existing plant production one further step. Given that the firm decides to expand production at the existing plant, then production can be expanded by

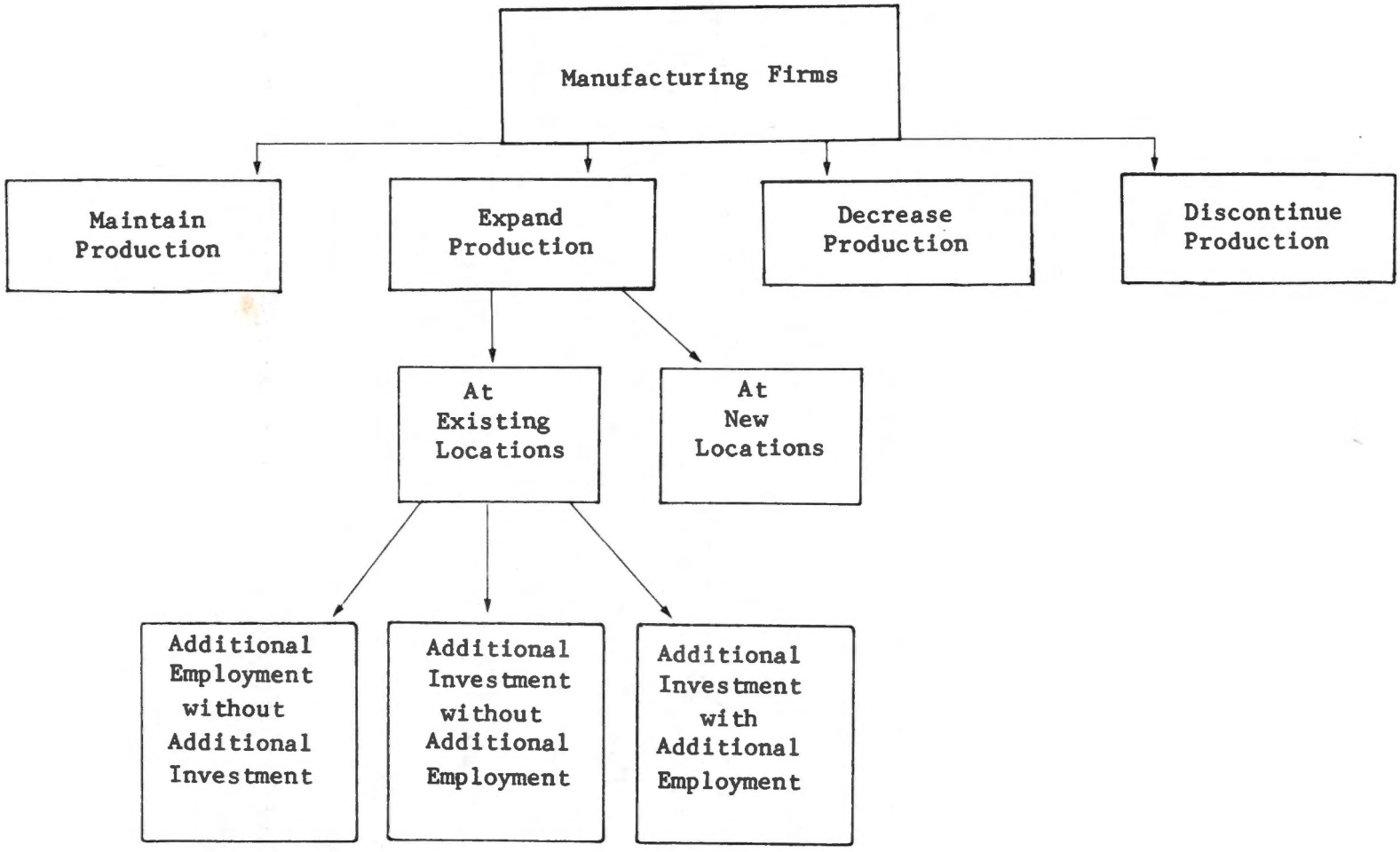


Figure 2. Alternative Production Patterns Followed by Manufacturing Plants (The Case of Expansions).

the initial location of a manufacturing plant is on a trial basis with the future expansion being determined by the relative success of the venture and relationships with the community. If so, then community leaders need to know which decisions can enhance the potential of employment expansion by firms in the community.

II. OBJECTIVES

This study is designed to provide basic information on the extent to which community leaders can enhance the retention and growth of manufacturing plants in the communities. No known empirical research has been conducted to identify the relationship between employment changes in firms and key community characteristics. To partially fulfill this need, the objectives of the study are:

1. To describe and summarize patterns of retention, growth, decline, and cessation of operations of manufacturing plants that located in nonmetropolitan communities of Tennessee from 1967 through 1973.
2. To develop measures of key community factors hypothesized to be important in the plant expansion or contraction decision.

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adding additional employees to the workforce, such as a night shift, if we assume that the equipment is less than fully utilized. A second method for increasing production would be to add some labor-saving equipment or equipment with larger capacity which requires no additional manpower. This would be the case of additional investment without additional employment. A third method to increase the existing plant production would be to expand both the equipment and workforce. This decision might be exemplified by the addition of the same type equipment as already exists in the plant.

3. To determine if manufacturing retention, growth, decline, and cessation of plant operations are related to community characteristics.

III. THEORETICAL FRAMEWORK

Penrose stated, ". . . no economist has yet attempted a general theory of the growth of firms."[15] While it is not the specific objective of this research to develop a theoretical growth model for the firm, an effort will be made to determine the importance of the inclusion of community variables in any such theory developed. Essentially, this study is exploratory in nature. The theoretical framework for this analysis was drawn from location theory.

Confusion exists as to how firm growth should be analyzed. Viewing the firm as ". . . a collection of productive resources,"[16] it can be concluded that measuring firm growth is dependent upon measurement of increases in the firm's output. Optimum size plants are usually thought to be those with the lowest average cost per unit of output. Coase suggests that ". . . a firm will tend to expand until the cost of organizing an extra transaction within the firm becomes equal to the cost of carrying out the transaction by means of an exchange on the open market or the costs of organizing in another firm."[17] Traditionally,

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[15] Edith T. Penrose, The Theory of the Growth of the Firm, (Great Britain, 1959), p. 1.

[16] Ibid., p. 24.

[17] R. H. Coase, "The Nature of the Firm," Economica, Vol. 4, No. 16, November, 1937, p. 395.

the level of profit attained by a firm has been presumed to determine the firm's optimum size. This traditional view is sometimes used as an argument against the need for further research in the area of firm growth.[18]

According to Penrose, growth of a firm may be subject to the managerial talent within the firm, the product and factor market over which the plant has little control, and uncertainty and risk which is both internal and external to the firm.[19] The inducements as well as the difficulties of firm expansions may be either internal or external.[20] The external considerations which enhance the profitability include the demand for products of a particular firm, technological innovations which may require large-scale operations or plants, and changes in market positions of firms allowing for monopolistic advantages.[21] External obstacles to the expansion of a firm include keen competition in the products markets which makes expansion difficult, restrictions on the use of technology, prohibitive cost of expanding, and limitations on resources necessary for the expansion.[22]

Review of the literature on plant location provides additional insight into the subject of plant expansions. It is hypothesized in this study that decisions to expand or locate a new manufacturing plant

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[18] Penrose, op. cit., p. 2.

[19] Ibid., p. 43.

[20] Ibid., p. 65.

[21] Ibid.

[22] Ibid., p. 66.

are based on a similar set of factors. Weber[23] built on the earlier contribution of von Thunen and concluded that plant location decisions are based upon least cost considerations of the firms. Weber's analysis assumed competitive markets; thus, each firm could sell its total production at a constant price. Further, Weber's analysis classified industry into those oriented to transportation, labor, or other industries and markets. His analysis was dependent upon the product of the firm and how its production cost was minimized as the firm combined raw materials and labor.

Hoover[24] and Losch[25] introduced demand and the agglomeration factor[26] into the general theory of location. Neither of these factors were included by von Thunen, and demand was not considered by Weber since he was concerned with a perfectly competitive market. Greenhut's[27] theory of location revolves on the firm attempting to maximize the difference between cost and receipts. In addition to demand and cost, Greenhut indicated that personal considerations of the firm's management was an important factor in the location decision of the firm.

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[23]Alfred Weber, Theory of the Location of Industries, edited by C. J. Friedrich (Chicago, 1920).

[24]E. M. Hoover, The Location of Economic Activity (New York, 1948).

[25]August Losch, The Economics of Location, translated by William H. Woglom (New Haven, 1954).

[26]The agglomeration hypothesis is based on the idea that firms may experience external economies by locating plants near other manufacturing plants. Thus, a common phrase in economic development literature is "industry attracts other industry."

[27]Melvin L. Greenhut, Plant Location in Theory and in Practice (Chapel Hill, 1956).

Beyond the classical location theory (von Thunen, Weber, Losch, Hoover, and Greenhut), Nishioka and Krumme[28] categorized plant location factors most often discussed in the literature into four broad groups. The factor groups included the location of raw materials, the location of the markets for the firm's products, specific factors concerning the site, such as cost and spaciousness, and particularly community characteristics. Focusing on the determination of the relative importance of manufacturing plant expansions, the summary of plant location research developed by Nishioka and Krumme provides the framework for this analysis.

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[28]Hisao Nishioka and Gunter Krumme, "Location Conditions, Factors, and Decisions: An Evaluation of Selected Location Surveys," Land Economics, Vol. 49, No. 2, May, 1973), pp. 195-205.

CHAPTER II

METHODOLOGY

I. THE ANALYTICAL FRAMEWORK

Tentative directions can be drawn about an analytical framework for plant expansions based on location and firm growth theory. The conceptualization of the expansion model used in this study is based on the variables which have been demonstrated to affect the location decision of plant management. Accordingly, the general form of a plant expansion equation is:

$$\text{Employment Expansion} = f(\text{Markets, Resources, Community Characteristics})$$

Employment expansions are suggested to be a function of demand for the particular plant's products, availability of resources, and community characteristics. Given that firms evaluate these variables when locating plants, then the same variables should be important in the plant expansion decision.

In order to obtain net measures of the relationship between employment expansions, contractions, and community characteristics, it is necessary to determine the amount of change in the dependent variable (employment change) that is explained by the aggregate demand for the plant's products and by relative resource availability. Thus, measures of markets and resource variables are included in the expansion equation.

The national demand for products by major manufacturing industry groups (SIC's) was chosen as the best available measure for the market variable (Table 1). The terms "major manufacturing industry group" or "SIC Code" refer to Table 1 throughout this study. The measure used was the annual dollar value of shipments nationally by SIC group. It is assumed that a positive relationship exists between annual value of shipments nationally and annual plant expansion. As the demand for a product increases, manufacturing plants in the aggregate will be expanded or new plants will be located in response to the demand shift. Plants in the aggregate are not expected to expand when the national demand for their products is falling or is relatively stable.

Two resource availability measures are included in the analysis; one, a measure of the relative labor resource cost and two, the relative raw material cost.

A lower relative labor cost is hypothesized to stimulate manufacturing employment expansion in the community. Thus, the labor resource cost is an important consideration in the expansion decision of firms as they view differential wage rates at each of their plant locations. Thus, a wage index for labor cost in Tennessee and the nation by SIC is included in the analytical model.

The locational influence of sources of raw materials is important and will vary according to the kind of material and how the manufacturer uses it in production. Wheat suggests that raw materials are an important consideration for the firm choosing a location when transportation costs of raw materials are a large part of the finished

Table 1. Major Manufacturing Industry Groups

SIC	Industry Group	SIC	Industry Group
20	Food and kindred products	30	Rubber and plastics products
21	Tobacco manufactures	31	Leather and leather products
22	Textile mill products	32	Stone, clay, and glass products
23	Apparel and related products	33	Primary metal industries
24	Lumber and wood products	34	Fabricated metal products
25	Furniture and fixtures	35	Machinery, except electrical
26	Paper and allied products	36	Electrical machinery
27	Printing and publishing	37	Transportation equipment
28	Chemicals and allied products	38	Instruments and related products
29	Petroleum and coal products	39	Miscellaneous manufacturing

Source: U. S. Department of Commerce, Growth and Labor Characteristics of Manufacturing Industries, Washington: U. S. Government Printing Office, 1972.

goods cost.[1] The perishability, degree of mobility, and the amount of weight that the raw material loses during processing are three important considerations of raw-material-based firms.[2]

Transportation and communication facilities allow for the decentralization of manufacturing plants. Most raw material and finished products can be transported from various rural locations with relative ease because of modern highways and trucking facilities supplementing the railroad system. However, relative cost of raw material varies among communities and among industry groups. Thus, a material cost index is included in the analytical model to provide a measure of the influence of relative material cost between Tennessee and the nation by SIC group. A lower relative material cost is hypothesized to stimulate manufacturing employment expansion relative to plants elsewhere in the nation, ceteris paribus.

Plant location studies suggest that the community influenced variables important in the location of new plants include: manpower availability; manpower quality; transportation facilities; community services that affect production cost such as fire protection and sewage treatment; agglomeration variables; and health and police protection considerations. It is hypothesized that these same community variables are important in plant expansion decisions.

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[1] Leonard Wheat, Regional Growth and Industrial Location (Lexington, 1973), p. 27.

[2] Wheat further indicates that the resource of raw material influence on location is growing weaker because of depletion of rich deposits of many raw materials and the multistage production process where many firms are not direct users of natural resources.

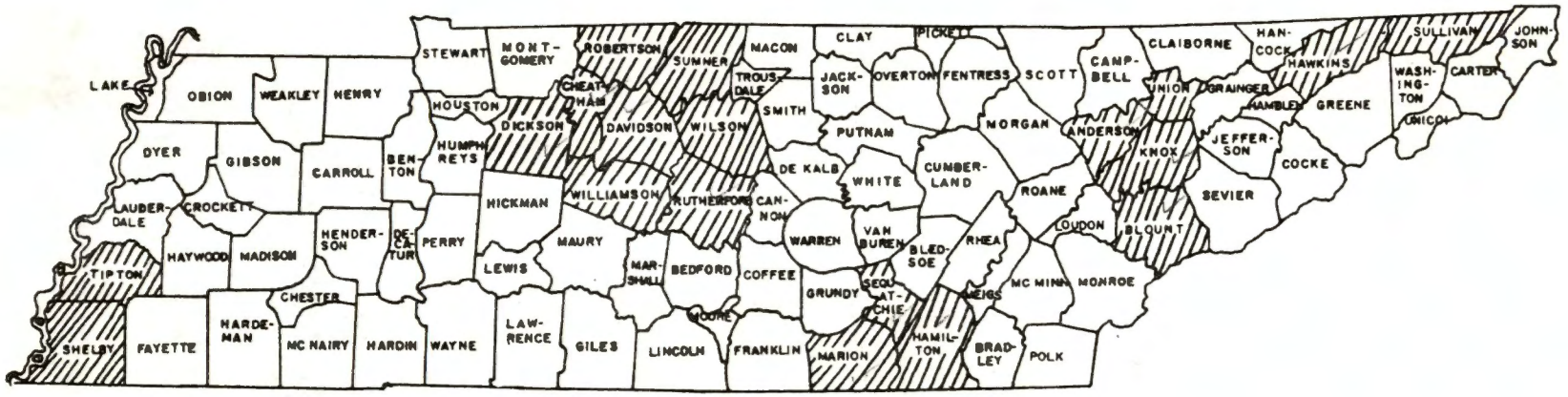
II. SPECIFICATION OF VARIABLES AND DATA COLLECTION

The data required to test the hypotheses advanced include measures of (1) changes in plant employment as the result of plant expansions; (2) a measure of the demand for the plant's products; (3) a measure of the relative labor and material cost in the community; and (4) measures of key community characteristics. The data for analysis were taken from secondary sources. The study area is defined as the nonmetropolitan communities of Tennessee contained in the rural counties as defined by the Office of Management and Budget in April, 1973 (Figure 3). Communities included are those which had a manufacturing plant location during the period 1964 through 1973.

Two analytical models were developed. The first model assumes that changes in the plant's employment during the first through the fifth year[3] of operations have common patterns. That is, manufacturing plant employment changes for plants with one year of operating experience are assumed to be similar irrespective of the calendar year during which the first year of experience occurred. Thus, plants with one year of operating experience can be analyzed in one group while plants with two years operating experience are analyzed in a separate model. Similarly, plants with three, four, and five years operating experience are analyzed separately.

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[3] A year is defined in model one as being a twelve month period of plant operations.



▨ - SMSA'S AS DEFINED BY OMB, APRIL, 1973.

Figure 3. State of Tennessee Counties.

Conversely, the second model is based on the assumption that manufacturing plants have similar employment changes over a constant time period regardless of the years of operating experience.[4] Thus, this group is analyzed with a single equation.

The procedure used to calculate manufacturing employment changes in the rural communities required identifying all new manufacturing plants locating in the rural communities between 1964 and 1973. Model one is based on plants that began operations during the years 1967 through 1973; whereas, model two is based on plants that began operations between the years 1964 and 1969 with employment changes observed between 1969 and 1973.

The procedure used to identify these plants was to review stated intentions of firms to locate a plant as summarized annually by the Tennessee Valley Authority in Industrial Development in the TVA Area During 1964-1973.[5] The firm name, SIC, and city and county of location from the TVA publication were then checked with personnel in the Tennessee Department of Employment Security to insure that the plant had in fact located and started operation. The employment levels of the plants included were taken from the records of the Tennessee Department of Employment Security.[6]

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[4]Model two is based on the assumption that manufacturing plants with five years or less of operating experience have common patterns of employment changes. Thus, this group of plants are classified as "new plants" for purposes of this analysis.

[5]Tennessee Valley Authority, Industrial Development in the TVA Area During 1964-1973 (Chattanooga, annual from 1964).

[6]Permission for access to the Tennessee Department of Employment

For model one employment changes of manufacturing plants were stratified into five separate groups based on years of operating experience. That is, the first year of each plant's operations was analyzed as one group. Similarly, the second through the fifth year of each plant's operations were analyzed in separate groups. The employment record of each firm was reviewed, and the average monthly employment was calculated for each 12-month period after omitting three months of initial employment. A firm's first year change in employment is the absolute difference between the average monthly employment in the first 12 months of operation and the average monthly employment in the second 12 months of operation, that is year 2 minus year 1. The changes for the second year through the fifth year of operations were calculated in a similar manner as for the first 12-month period. Thus, the cross-sectional set of employment changes represent the dependent variable in model one.

For model two the changes in manufacturing employment in plants that began operations in the years 1964 through 1969 were observed during the years 1969 through 1973. Hence, changes in manufacturing employment are observed for a common time period for plants with five years or less of operating experience. The employment changes due

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Security data tape at the Center for Business and Economic Research, University of Tennessee, Knoxville, was provided by Commissioner Ernest Griggs. Assistance in securing the data from the Employment Security tapes was provided by Dr. Dave Hake, Director of the Center for Business and Economic Research, and Miss Patricia Price, Manager of Data Systems, Center for Business and Economic Research, University of Tennessee, Knoxville.

to the expansion or contraction of newly-located plants were analyzed apart from employment changes due to new plant locations. The calculation of the change in employment for each plant was accomplished by: (1) determining the employment of the newly-located manufacturing plants in December 1969 for each plant; (2) determining the amount of employment in the plant in December 1973; and (3) subtracting the level of employment for each plant in 1969 from the level of employment in 1973. The cross-sectional change in employment from 1969 to 1973 for the newly-located plants in each community is the dependent variable in model two.

For model one the demand for a plant's products was measured with a national value of shipments variable by SIC for each year. Information on national value of shipments for each SIC code was taken from the Current Industrial Reports: Manufacturers' Shipments, Inventories and Orders,[7] a monthly publication of the U.S. Department of Commerce. The national changes in demand for products of an SIC code were calculated for individual plants included in the analysis corresponding to the 12-month periods of plant operations. The change in value of shipments for each plant was calculated in a manner similar to that used to calculate change in plant employment for model one.

For model two the procedure used to calculate the changes in

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[7]U.S. Department of Commerce, Current Industrial Reports: Manufacturers' Shipments, Inventories, and Orders (Washington, D.C., monthly from 1963).

national demand for the newly-located manufacturing plants' products was to (1) identify each plant by SIC and (2) determine the change in the national value of shipments as defined by the United States Department of Commerce for 1969 to 1973. Information on the national value of manufacturers' shipments is available for 1969 and 1973 from the Department of Commerce, Current Industrial Reports.[8] The change in the value of shipments by SIC was used as a proxy for the demand for the plants' manufactured products.

The resources variables in models one and two, measured as a wage index and a material cost index between plants in Tennessee and the nation, were calculated for each SIC. The hourly wage index for each plant was computed by dividing the national wage for the SIC codes by the Tennessee hourly wage for all SIC codes. Thus, the wage index is dependent upon the SIC code of the manufacturing plant and the relative wages paid by the manufacturing plants in the Tennessee communities as compared with the nation. The wage index is a cross-sectional comparison of hourly wages in Tennessee to hourly wages in the nation for the year 1972.[9] Wages per hour by SIC code were calculated from information contained in the 1972 Census of Manufactures[10] on total wages paid by SIC and total manhours worked.

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[8] Ibid.

[9] The year 1972 was selected to measure the wage index because the 1972 Census of Manufactures provides more complete information on wages paid and manhours worked in Tennessee and the nation than other source documents.

[10] U.S. Department of Commerce, 1972 Census of Manufactures Preliminary Report (Washington, D.C., 1974).

Wages per hour were calculated by dividing the total wages paid by the total number of manhours for the respective SIC codes.

The material cost index for each plant is a cross-sectional comparison of material cost in Tennessee and the nation for the year 1972.[11] This variable is calculated in a manner similar to that used to calculate the hourly wage index. The material cost index for each plant in models one and two was calculated by dividing the material cost per unit of output in the nation by the material cost per unit of output in Tennessee for all SIC groups, from information contained in the 1972 Census of Manufactures.[12]

Factor analysis was used to develop measures of key community characteristics hypothesized to influence plant expansions for both models.[13] Specifically, the methodology was: (1) the development of hypotheses as to which community characteristics influence plant expansion; (2) the development of a list of quantifiable variables thought to measure a particular community concept;[14] (3) the selection

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[11]The year 1972 was selected to measure the material cost index because the 1972 Census of Manufactures provides more complete information on material cost and value of shipments for Tennessee and the nation than other source documents.

[12]U.S. Department of Commerce, 1972 Census of Manufactures Preliminary Report (Washington, D.C., 1974).

[13]Data on community characteristics for models one and two are from the same source documents. However, the communities included in model one are not identical to those of model two. Although communities in either model may also appear in the alternative model.

[14]An attempt was made to include information for selected variables for the year 1970. However, information on some of the variables was not available for 1970, and data for alternative years were used in

of a technique (factor analysis) to provide a measure of the ranking of communities on the community characteristics hypothesized to influence plant expansion.

A list of variables was developed to provide a measure of each community characteristic thought to influence manufacturing plant expansion. The procedure for locating a measure of the community characteristic relied upon variables suggested by other research in the area of plant location analysis, economic development research, and theoretical literature. A minimum of four measures was isolated for each of the particular community characteristics (Table 2). The variables in Table 2 are grouped by the particular community characteristic they are commonly used to measure.

Variables 1 through 6 were selected as measures of manpower availability in each of the rural communities included in the analysis (Table 2).[15]

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the analysis whenever necessary. The fact that the measures are not all for the year 1970 did not present analytical problems. However, the assumption was made that the variables used to measure a particular concept are somewhat stable or structural changes are minimal. For example, the change in water or sewage capacity in a community may remain unchanged for a number of consecutive years.

15 Data on community population were obtained from the 1970 Census of Population, Number of Inhabitants: Tennessee, Series PC (1)--A441 Table 10, "Population of County Subdivisions: 1970 and 1960 (U.S. Government Printing Office, Washington, D.C., 1973). Data on the amount of unemployment benefits paid in each county were obtained from the 1971 Tennessee Statistical Abstract, Chapter XII, Table 12.17, "Selected Employment Security Data of Industries Covered by Unemployment Insurance, Tennessee Counties, 1969" (University of Tennessee, Knoxville, 1971). Data on the population

Table 2. Community Variables by Concept Thought to be Measured

Variable Groups	Variable Number	Variable Name
Manpower Availability	1	Community population, 1970
	2	Payments in the county under the state employment insurance program, 1969
	3	Population density in the county, 1970
	4	Percent urban population in county, 1970
	5	Population in contiguous counties, 1970
	6	Relative economic utilization of manpower in the county, 1970
Manpower Quality	7	Percent of females in the labor force of the county, 1970
	8	Percent of persons 25 years and older with a high school education in the county, 1970
	9	Vocational and technical school in the county before 1971; yes = 1, no = 0
	10	Median age of the population in the county, 1970
	11	Education expenditure per pupil in the community or county, 1971-72
	12	Presence of a senior or community college in community, 1970; none = 0, community or private = 1, senior = 2
	13	Percent unskilled labor in the county, 1970
Transportation	14	Distance to the nearest Standard Metropolitan Statistical Area (SMSA) from community
	15	Water transportation available in the county, 1970; yes = 1, no = 0
	16	Rail transportation available in the county, 1970; none = 0, one = 1, two = 2
	17	Availability of an interstate highway in community; yes = 1, no = 0
Industrial and Community Services	18	Manufacturing employment in county, 1970
	19	Number of manufacturing plants in the county, 1970
	20	Employment in wholesale and retail trade in county, 1970

Table 2 (continued)

Variable Groups		Variable Name
Industrial and Community Services (continued)	21	Municipal fire rating of the community, 1970
	22	Gallons per day of excess water service available in community
	23	Gallons per day of excess sewage capacity available in the community
	24	Dollar amount of general obligation bonds issued for municipal financing of manufacturing plants in the community, 1955-1973
	25	Dollar amount of local revenue bond financing of manufacturing plants in the community, 1951-1973
	26	Industrial park in the community with five or more plants; yes = 1, no = 0
	27	Actual property tax rate in the county, 1970
Police and Health Protection	28	Police protection expenditure in the county per capita, 1971-72
	29	Physicians per 1,000 persons in the county, 1969
	30	Hospital beds per 1,000 persons in the county, 1971
	31	Local government expenditure on health and hospitals per capital in county, 1971-72

Variables 7 through 13 were selected as measures of manpower quality to provide an indication of the desirability of local manpower in the community as potential employees in manufacturing plants (Table 2).[16] Manpower quality is hypothesized to be reflected in the education and skill level available in the community.

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density in the county were obtained from the 1974 Tennessee Statistical Abstract, Chapter XVI, Table 16.10, "Land Area, Density and Population Living in Urban and Rural Areas, Tennessee Counties, 1970 Decennial Census" (University of Tennessee, Knoxville, 1974). Data on the percent urban population in the county were obtained from the 1974 Tennessee Statistical Abstract, Chapter XVI, Table 16.10, "Land Area, Density and Population Living in Urban and Rural Areas, Tennessee Counties, 1970 Decennial Census" (University of Tennessee, Knoxville, 1974). Contiguous county population was defined as the population of the county plus the population of all adjoining counties with the exception of counties included in the Standard Metropolitan Statistical Area (SMSA). The procedure used in the calculation of contiguous county population was to define the contiguous counties and sum the population for individual counties in the study. Data on county population in Tennessee were obtained from the 1970 Census of Population, Number of Inhabitants: Tennessee, Series PC (1)--A441, Table 10, "Population of County Subdivisions 1970 and 1960" (U.S. Government Printing Office, Washington, D.C., 1973). Data on county population for states other than Tennessee were obtained from the County and City Data Book 1972: A Statistical Abstract Supplement, Table 2 "Counties" (U.S. Government Printing Office, Washington, D.C., 1973). County population from states other than Tennessee included in the estimate of contiguous county population included: Jackson, Lauderdale, Limestone, and Madison counties, Alabama; Mississippi County, Arkansas; Fammin, Murray and Whitfield counties, Georgia; Allen, Bell, Calloway, Christian, Clinton, Fulton, Graves, Hickman, McCreary, Monroe, Todd, Trigg, Wayne, and Whitley counties, Kentucky; Alcorn, Benton, Marshall, Tippah, and Tishomingo counties, Mississippi; Pemiscot, and New Madrid counties, Missouri; Ashe, Avery, Cherokee, Graham, Haywood, Madison, Mitchell, Swain, Watauga, and Yancey counties, North Carolina; Lee and Grayson counties, Virginia. Data on the relative economic utilization of manpower for Tennessee counties were obtained by personal contact with personnel in the Economic Research Service, U.S. Department of Agriculture, Washington, D.C. The estimates provided are preliminary and unpublished as of the date obtained. The table provided was entitled "Relative Economic Utilization for Persons in the Rural and Urban Labor Forces, by Sex and Race for States and Counties, 1970."

[16]Data on the percentage of females in the labor force were

Variables 14 through 17 were selected as measures of transportation availability (Table 2). The accessibility of the community is

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calculated from information obtained from the County and City Data Book 1972: A Statistical Abstract Supplement, Table 2, "Counties" (U.S. Government Printing Office, Washington, D.C., 1973). The procedure used to calculate this variable was to divide the number of females in the civilian labor force of the county by the total number of civilians in the labor force of the county and multiply by 100.

Data on the percentage of persons 25 years and older with a high school education were calculated from information obtained from the County and City Data Book 1972: A Statistical Abstract Supplement, Table 2, "Counties" (U.S. Government Printing Office, Washington, D.C., 1973). The procedure used to calculate the variable was to divide the number of persons 25 years and older with a high school education in the county by the total population in the county for each of the counties in the study. Data on locations of vocational and technical schools in Tennessee were provided by personnel in the Industrial Development Division of the Tennessee Department of Economic and Community Development, Andrew Jackson State Office Building, Nashville, Tennessee. Information on this variable was included in the data analysis as a zero or one for absence or presence of a vocational and technical school. Communities with a vocational and technical school were assigned a one, and communities without vocational and technical schools were assigned a zero.

Data on the median age of the population in the county were obtained from the 1971 Tennessee Statistical Abstract, Chapter XVI, Table 16.8, "Population by Age, Tennessee Counties, 1970 Decennial Census" (University of Tennessee, Knoxville, 1971).

Data on the education expenditure per pupil and average daily attendance for 1971-72 were obtained from the 1974 Tennessee Pocket Data Book: Economic Review and Prospects, "Education" (University of Tennessee, Knoxville, 1974). The expenditure per pupil was calculated for the community where the data allowed. Otherwise, the expenditure per pupil is on a county basis. Data on the presence of a senior and community college in the community were obtained from the 1974 Tennessee Statistical Abstract, Chapter VI, Table 6.19, "Enrollment in State Institutions of Higher Education, by Institution, Tennessee, Selected Academic Years 1959-60 through 1971-72" (University of Tennessee, Knoxville, 1974). Data on private institutions for higher education were obtained from the 1974 Tennessee Statistical Abstract, Chapter VI, Table 6.22, "Accredited Private Institutions of Higher Education in Tennessee, Degrees Conferred Academic Year 1970-71 and Fall Enrollment 1972" (University of Tennessee, Knoxville, 1974). The data on availability of a college was coded in a manner that indicates a senior college to be more important than a community college, since plant management are assumed to be more interested in earning undergraduate or graduate degrees.

Data on unskilled labor were calculated from information on

reflected in the availability of railroad, interstate, and water transportation.[17]

Variables 18 through 27 should provide measures of agglomeration factor and the community services that affect the production cost of the manufacturing plant (Table 2, page 25).[18]

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skilled labor by county from a Bureau of Census tape entitled "Fourth Count Population," File B, University of Tennessee Computing Center, Knoxville. The percent of unskilled labor in the county was determined by subtracting the percent skilled labor from 100.

[17]Data on the highway distance from each community to the nearest metropolitan center in an SMSA were calculated from a Tennessee State Highway map. The most direct route by major highway was used to calculate the mileage. Data on the availability of water transportation in the county were obtained from Tennessee maps contained in the 1974 Commercial Atlas and Marketing Guide (Rand McNally and Company, Chicago, 1974). This information was checked by personal contact with personnel of the Navigation Development Relations Staff, Tennessee Valley Authority, Knoxville, Tennessee. Water transportation is available to those communities located adjacent to the Tennessee, Cumberland, Mississippi, and portions of the Clinch and Hiawassie Rivers. Data on the availability of railroad transportation in the community were obtained from the 1973 Commercial Atlas and Marketing Guide (Rand McNally and Company, Chicago, 1973). Data on the availability of an interstate highway in the county were obtained from a Tennessee State Highway map. For model one this variable was included as a zero if no interstate highway was available while the availability of an interstate highway was indicated by a one. For model two interstate highway accessibility was included as mileage to the nearest interstate. Mileage was calculated for each community in model two by the closest route to the nearest highway either within the state or in an adjoining state.

[18]Data on manufacturing employment in the county were obtained from the 1974 Tennessee Statistical Abstract, Chapter XII, Table 12.5, "Number of Employees by Major Industry Group, for Persons 16 Years and Over, Tennessee Counties, 1970" (University of Tennessee, Knoxville, 1974). Data on the number of manufacturing plants in the county in 1970 were obtained from Covered Employment and Wages by Industry Statewide and by County, 1970 (Tennessee Department of Employment Security, 1972). Data on employment in wholesale and retail trade in the county, 1970, were obtained from the 1974 Tennessee Statistical Abstract, Table 12.5, "Number of Employees by Major Industry Group, for Persons 16 Years and Over, Tennessee Counties, 1970" (University of Tennessee, Knoxville, 1974).

Data on the municipal fire rating were provided by personnel in

Variables 28 through 31 were selected to provide an indication of the availability of medical services and facilities and the level of public safety provided in the community. The availability of police

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the Insurance Services Office of Tennessee, Nashville, Tennessee. Information on municipal fire ratings was provided in the form of an unpublished letter to insurance agents in Tennessee concerning "public fire protection classifications for municipalities in Tennessee." This information is considered to be privileged and confidential and was only used for analytical purposes in this study.

Data on gallons per day of excess water and sewage capacity in the community were calculated from information provided by personnel in the Tennessee Department of Economic and Community Development, Andrew Jackson State Office Building, Nashville, Tennessee. This office provided the gallons per day capacity of the water and sewage system of each community in the state along with the current gallons per day consumption of available capacity in each community. Excess capacity available was determined by subtracting gallons per day current capacity from gallons per day of current consumption for the water and sewage services. The dates of measurement of the available capacity were the years 1970 through 1974. Since capacity is somewhat stable and the information provided was the best available, the estimates were assumed to be consistent with other cross-sectional data included in the study.

Data on the dollar amount of general obligation bonds issued for the municipal financing of manufacturing plants in the community during 1955-1973 were obtained from "a roster of municipalities and/or counties indicating the issuance of general obligation bonds for the construction of buildings, structures, or facilities rented or leased to industry." This roster is maintained by the Tennessee Department of Economic and Community Development, Industrial Development Division, Andrew Jackson State Office Building, Nashville, Tennessee. Amounts of bonds issued were summed over all years by community or county where appropriate. Data on the dollar amount of local revenue bond financing of manufacturing plants in the community for the years 1951 through 1973 were obtained from "a roster of municipalities and/or counties indicating the issuance of Revenue Bonds for the construction of buildings, structures, or facilities and purchase of equipment and/or machinery for lease to industry." This roster is maintained by the Tennessee Department of Economic and Community Development, Industrial Development Division, Andrew Jackson State Office Building, Nashville, Tennessee. Amounts of revenue bonds issued were summed over all 11 years by community or county where appropriate.

Data on the availability of an industrial park in the community with five or more manufacturing plants were obtained from personnel in the Tennessee Department of Economic and Community Development,

protection, number of doctors and hospital beds, and local government expenditure for health services.[19]

III. DATA ANALYSIS

Tabular analysis was used to provide an indication of the relative importance of manufacturing plant growth in the creation of nonfarm employment in the rural Tennessee communities. Beyond the tabular analysis, factor analysis and multiple regression techniques were employed for alternative purposes.

Industrial Development Division, Andrew Jackson State Office Building, Nashville, Tennessee. Data on the actual property tax rate in the county were obtained from The 1973 Annual Survey of County and City Government in Tennessee, "Tax Rates for Tennessee Counties for the Years, 1964-1974," Research Report No. 190 (Tennessee Taxpayers Association, Nashville, 1974).

[19]Data on police protection expenditure per capita in the county were calculated from information on total expenditures on law enforcement which was obtained from the 1974 Tennessee Statistical Abstract, Chapter X, Table 10.23, "General Expenditures of Tennessee County Governments, by Function, 1971-72" (University of Tennessee, Knoxville, 1974). The total expenditure on law enforcement in the county was divided by the county population in 1970 to obtain the expenditure per capita data.

Data on physicians per 1000 persons in the county were calculated from information obtained from the 1971 Tennessee Statistical Abstract, Chapter XX, Table 20.19, "Selected Statistics on Medical Facilities in Tennessee Counties, 1968-1969" (University of Tennessee, Knoxville, 1971). Data on the number of hospital beds per 1000 persons in the county were calculated from information obtained from the 1974 Tennessee Statistical Abstract, Chapter XX, Table 20.19, "Selected Statistics on Medical Facilities in Tennessee Counties, 1971-72" (University of Tennessee, Knoxville, 1974). Data on local government expenditure on health and hospitals per capita were calculated from information obtained from the 1974 Tennessee Statistical Abstract, Chapter X, Table 10.23, "General Expenditures of Tennessee County Governments, by Function, 1971-72" (University of Tennessee, Knoxville, 1974). The per capita expenditure on health was obtained by dividing the total expenditure on health and hospitals in the county by the county population in 1970.

In order to obtain measures of each community concept, it was necessary to isolate some underlying influence among the variables thought to measure particular community characteristics. The factor analysis mathematical technique was used to isolate measures of the community concepts thought to influence manufacturing plant expansions.[20] Factor analysis was used to isolate common patterns in community data for communities included in both models one and two.

Factor analysis is an analytical tool which allows the reduction of a large amount of observable data into a small amount of unobservable data (factors).[21] The data reduction is accomplished by reducing the data to its "common patterns." The "common patterns" are the result of an underlying relationship or regularities among the independent variables. It is not possible to know a priori how many significant factor patterns will be isolated. Factor analysis has many uses, but in this study the technique is applied in two ways--as an explanatory tool and as a measuring device. As an exploratory tool, factor analysis will allow the identification of underlying influences among the variables and possibly the reduction of the number of independent variables. As a measuring device, it is possible to score the factors or develop an index which can be used as new variables in the expansion equation.

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[20] Two factor analysis models were required since the communities in model one and two may be different.

[21] Norman H. Die, Dale H. Bent and C. Hadlai Hull, Statistical Package for the Social Sciences (New York, 1970), p. 209.

The conceptual factor analysis model is presented in Figure 4, and the more familiar conceptual multiple correlation is presented in Figure 5. While the more familiar multiple regression analysis is primarily concerned with the relationship of the dependent (Y) and independent (X) variables, factor analysis is interested in the relationship of all independent (X) variables to each factor (F) isolated.

The steps to be followed in factor analysis include the preparation of the correlation matrix, the extraction of the initial factors, and the rotation of the factors into the terminal factors. In this analysis, the correlation matrix between the individual community characteristics is used to satisfy the first step in factor analysis. Thus, the correlation coefficient, or Pearson "r," between each pair of community characteristics is calculated. Before calculation of the correlation matrix, the raw data were normalized because of the skewness detected in the raw data using the Pearsonian coefficient of skewness.[22] In factor analysis language, the factors are determined by an "R-factor analysis." That is, the factors isolated are dependent upon underlying relationships between sets of variables rather than relationships among communities (observations).

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[22]The Pearsonian skewness coefficient is calculated as:

$$\frac{\sum_{i=1}^{N} \{(X_i - \bar{X}_i/S\}^3}{N}$$

where: X_i = ith observation, $\bar{X}_i$ = mean, S = standard deviation, N = sample size.

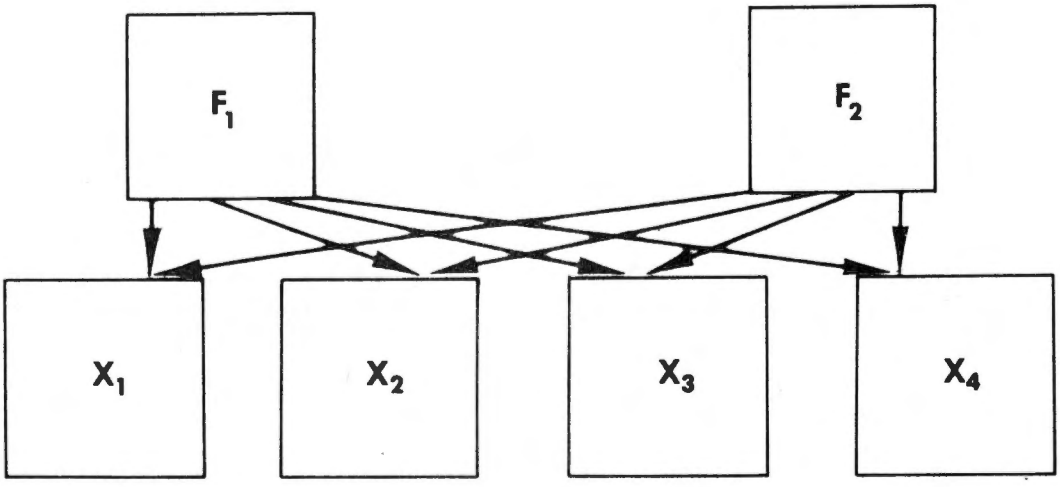


Figure 4. Conceptual Factor Analysis Model.

Source: Adapted from Van de Geer, John P., Introduction to Multivariate Analysis for the Social Sciences, San Francisco: W. H. Freeman and Company, 1971.

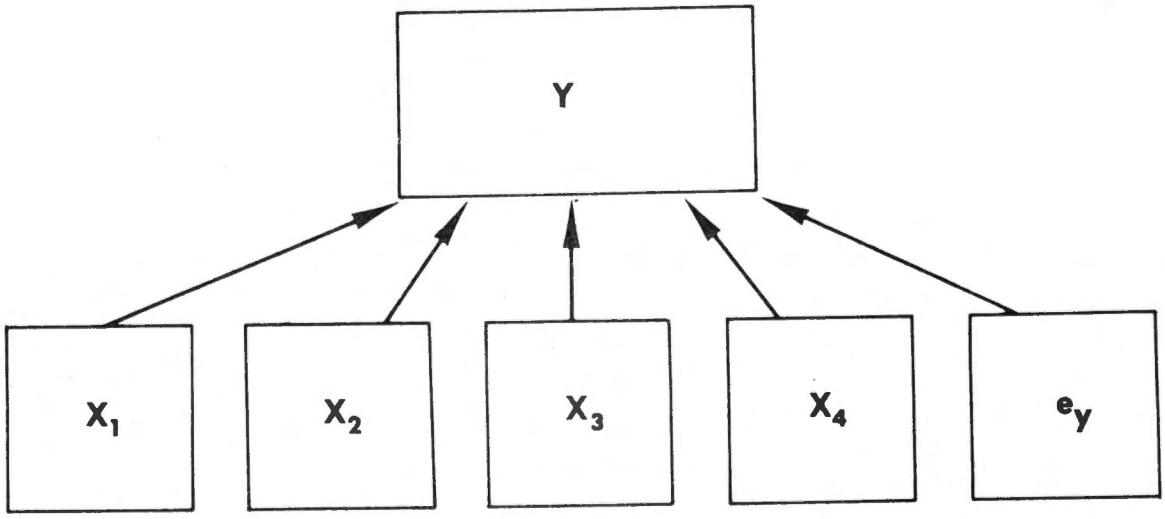


Figure 5. Conceptual Multiple Correlation Model.

Source: Adapted from Van de Geer, John P., Introduction to Multivariate Analysis for the Social Sciences, San Francisco: W. H. Freeman and Company, 1971.

The extraction of factors from the correlation matrix is accomplished by use of the classical factor analysis. The classical factor method analyzes only the common variance in the data matrix. Horst[23] provides a general equation for factor analysis:

$$x = u + e$$

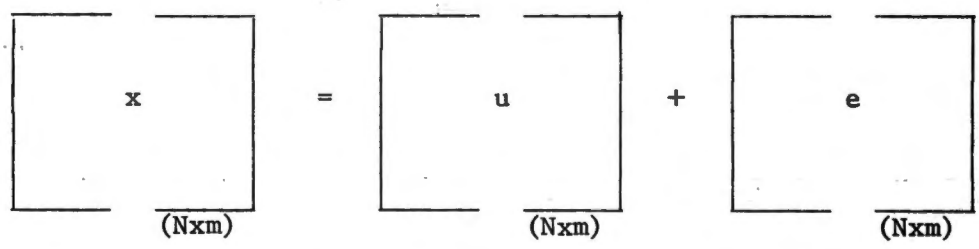
where

x = the sum of the matrix of true measures and error matrix (data matrix)

u = matrix of true measures

e = matrix of error measures.

Diagrammatically, the above equation may be as follows:



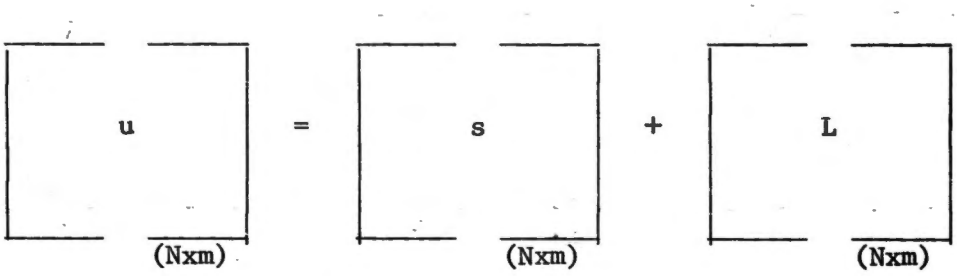
Factor analysis is concerned with the reduction in rank of the "u" matrix "in such a way that it will resemble the 'x' matrix."[24] The product of the factor analysis will be two matrices, the factor score and factor loading matrix:[25]

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[23]Paul Horst, Factor Analysis of Data Matrices (New York, 1965), p. 95.

[24]Ibid.

[25]Ibid., p. 96.



where:

u = true measures matrix

s = factor score matrix

L = factor loading matrix.

The classical factor analysis technique may be expressed mathematically:[26]

$$z_j = a_{j1}F_1 + a_{j2}F_2 + \ldots + a_{jm}F_m + d_jU_j \quad (j = 1, 2, \ldots, m)$$

where:

z_j = characteristic j

$a_{j1} \ldots a_{jm}$ = common factor coefficients

$F_1 \ldots F_m$ = common factors

U_j = unique factor

d_j = unique factor coefficient

assuming:

1. The common and unique factors have a mean of zero and common variance.
2. There is no correlation between the common and unique factors.
3. The variance in the data matrix is due to common factors, specific factors, and error in measurement.

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[26]Narry H. Harman, Modern Factor Analysis (Chicago, 1960), p. 13.

The classical or common factor analysis method assumes that the variation in the data matrix is made up of common and unique variance. That is, variation in each variable may be the result of a source common to other variables in the data matrix while other variation is unique to each variable.

The factor loading matrix must then be rotated into meaningfulness. This step is concerned with identification of the nature of the factors isolated in the initial factor loading matrix. The rotation of the original factor loadings is to isolate more meaningful, simpler, or more theoretically sound factor patterns. The varimax method of rotation was utilized. The effects of the varimax orthogonal factor rotation are shown in Figure 6 for a hypothetical rotation problem. The data for this hypothetical problem are shown in a side display as unrotated and rotated factors. From Figure 6, the factor patterns become more obvious after the initial factors have been rotated while the relative position of the variable is not changed.[27]

The factor score matrix was then calculated:[28]

$$B = aS^{-1}$$

$$Y = zB$$

where:

a = the principal factor loading matrix after rotation

S = the basic diagonal of the correlation matrix

Y = the principal factor score matrix

z = the normalized data matrix.

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[27]Nie, Bent and Hull, op. cit., p. 221.

[28]Horst, op. cit., p. 477.

Example of Factor Matrix Rotation

Variable	Unrotated Factors		Rotated Factors	
1	.75	.63	.14	.95
2	.69	.57	.14	.90
3	.80	.49	.18	.92
4	.85	-.42	.94	.09
5	.76	-.42	.92	.07

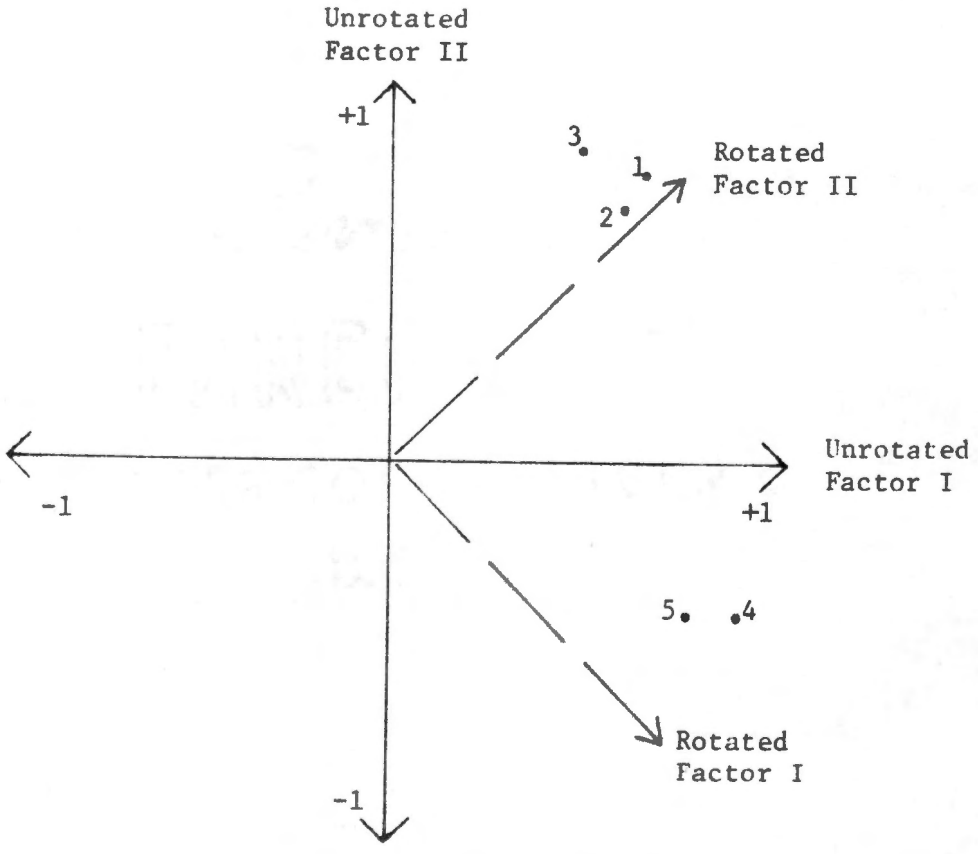


Figure 6 . Hypothetical Example of Rotation of Initial Factor Matrix.

Source: Nie, Norman H., Dale H. Bent and C. Hadlai Hall, Statistical Package for the Social Sciences, New York: McGraw-Hill, Inc., 1970.

The factor score matrix allows the calculation of a final factor score for each community represented in the original data matrix. These factor scores of communities can then be used as new variables in the employment expansion equation.

The employment expansion equation specified above will be estimated using the Ordinary Least Squares (OLS) multiple regression technique. The OLS technique minimizes the variance in the error terms. The general form of the regression is:

$$Y_j = a + \sum_{i=1}^{R} b_i X_{ij} + u_j \qquad (j = 1, 2, \ldots N)$$

where the following assumptions are made:

1. X_{ij} and u_j are independent of each other.
2. The u_j's are independent of each other with a mean zero and constant variance throughout.
3. The u_j's are normally distributed.
4. Y_j is a linear function of the X_{ij}'s.
5. The X_{ij}'s are independent of each other.

Five multiple regression equations are estimated for model one while model two consists of a single equation.

CHAPTER III

PATTERNS OF PLANT LOCATION, EXPANSION, AND DECLINE

Information on the relative importance of manufacturing plant location and growth in the creation of employment in the rural Tennessee communities is presented in this chapter to provide a more complete setting for interpreting other analytical results and deriving policy implications. Information is also presented on employment lost by the contraction and closing of manufacturing plants during the period 1967 through 1973.

Employment resulting from the location of each plant is represented by the annual average employment the year the firm began operations. The calculation of employment for this chapter is on a calendar year basis rather than for a 12-month operating period as discussed in Chapter II. Expansion or contraction of employment was calculated by subtracting the average employment of year one from the average employment in year two. Similarly changes in employment for the other years were determined by subtracting consecutive years employment. The information on employment in this chapter was tabulated by plant and by two-digit SIC. In cases where firms did not begin operations in January of the location year, the average employment was treated as if the firm had been there for the entire 12 months. Firms that discontinued operations in months other than December were treated as if the plant had continued operations for a full year.

The Tennessee Department of Employment Security allows firms with more than one plant location to report employment for all plants through one account number. An effort was made to insure that the employment obtained for the plants in the sample is for individual plants and not a compilation of employment for a number of branch plants. The employment levels for each plant in the sample were checked against the 1973 Directory of Manufacturers or by telephone with industrial development personnel in the community when not contained in the directory.

I. NEW MANUFACTURING PLANT LOCATIONS

During the 1967-1973 time period, 296 firms located in 105 rural Tennessee communities (Table 3). Thus, for the seven years of the study period, an average of 42 firms per year began operations, representing every SIC group, with the exception of SIC 21 (tobacco manufactures). SIC 23 (apparel and related products) had the highest number of new locations with 43 new plants. Only one plant in SIC 29 (coal and related products) began operations during the study period.

Three persons were employed as a result of the location of a plant in SIC 29 (petroleum and coal products) while 4,585 persons were employed as a result of the location of 43 plants in SIC 23 (apparel and related products). A total of 20,138 jobs were created during the study period by the location of new manufacturing plants, for an annual average of 2,877 jobs. The number of employees per plant location was highest in SIC 31 (leather and leather products) with 265. However, for all SIC groups, average new manufacturing employment was 68.

Table 3. Number of New Manufacturing Plant Locations by Standard Industrial Classification Code (SIC) and the Resulting Employment for Manufacturing Plants Locating in Rural Tennessee Communities, 1967 Through 1973

SIC	Number New Plant Locations	Employment Created by New Plant Location	Employees Per New Plant Location
20	8	606	75.8
21	--	--	--
22	19	1,882	99.1
23	43	4,585	106.6
24	31	445	14.4
25	24	866	36.1
26	14	503	35.9
27	2	100	50.0
28	10	836	83.6
29	1	3	3.0
30	17	1,885	110.9
31	3	368	122.7
32	5	49	9.8
33	11	441	40.1
34	27	807	38.4
35	28	1,559	55.7
36	17	4,500	264.7
37	23	371	16.1
38	5	60	12.0
39	8	272	34.0
Totals	296	20,138	
Annual Averages	42.3	2,876.8	68.0

II. MANUFACTURING PLANT EXPANSIONS

Whereas new plant locations are given widespread publicity by industrial developers, information on plant expansion is less frequently indicated to be important in community growth. From 1967 through 1973 there were 494 employment expansions by the 296 firms that located in rural Tennessee communities (Table 4) averaging 70 expansions per year. SIC 21 (tobacco manufactures), 27 (printing and publishing), and 29 (petroleum and coal products) had no expansion of employment during the study period. The highest number of employment expansions was in SIC groups 23 (apparel and related products) with 77 expansions of employment during the period 1967-1973.

Employment created by the manufacturing plant expansions ranged from 17 employees for SIC 38 (instruments and related products) to 3,606 employees for SIC number 36 (electrical machinery). A total of 17,965 jobs were created by 494 manufacturing plants' expansions during the study period. An annual employment increase of 2,566 jobs resulted from these expansions. The average number of jobs created by each plant expansion ranged from about 6 for SIC 38 (instruments and related products) to about 98 for SIC 36 (electrical machinery). An average of 36 jobs were created per plant expansion over all SIC groups represented in the study.

III. MANUFACTURING PLANT CLOSINGS

Of the 296 manufacturing plants that located during the 1967-1973 period, 56 discontinued operations during the same period (Table 5).

Table 4. Number of Manufacturing Plant Expansions[a] By Standard Industrial Classification Code (SIC) and the Resulting Employment for Manufacturing Plants Locating in Rural Tennessee Communities, 1967 Through 1973

SIC	Number of Plant Expansions	Employment Created by Plant Expansion	Employment Per Plant Expansion
20	5	54	10.8
21	--	--	--
22	28	1,290	46.1
23	77	2,694	35.0
24	38	788	20.7
25	38	1,367	36.0
26	29	650	22.4
27	--	--	--
28	21	581	27.7
29	--	--	--
30	17	601	35.4
31	6	181	30.2
32	11	85	7.7
33	29	719	24.8
34	50	1,672	33.4
35	60	2,118	35.3
36	37	3,606	97.5
37	29	637	22.0
38	3	17	5.7
39	16	905	56.6
Totals	494	17,965	
Annual Averages	70.6	2,566.4	36.4

[a]Expansion is defined as an increase in established plant employment.

Table 5. Manufacturing Plant Closings by Standard Industrial Classification Code (SIC) and Resulting Employment Decline for Manufacturing Plants that Located in Rural Tennessee Communities, 1967 Through 1973

SIC	Number of Plant Closings	Employment Loss Due to Plant Closings	Employees Released Per Plant Closing
20	3	18	6.0
21	--	--	--
22	3	109	36.3
23	8	355	44.4
24	5	63	12.6
25	9	450	50.0
26	1	212	212.0
27	--	--	--
28	3	9	3.0
29	--	--	--
30	2	768	384.0
31	1	22	22.0
32	--	--	--
33	--	--	--
34	1	15	15.0
35	8	22	2.8
36	2	170	85.0
37	7	95	13.6
38	1	2	2.0
39	2	37	18.5
Totals	56	2,347	
Annual Average	8.0	335.3	41.9

No plant closings occurred in SIC 21 (tobacco manufactures), 27 (printing and publishing), 32 (stone, clay, and glass products), and 33 (primary metal industries) during the 1967-1973 period. Nine plant closings occurred in SIC 25 (furniture and fixtures) which represents the highest number of plant closings for any SIC group. There was an annual average of eight plant closings for the SIC groups represented in the study.

Employment declines resulting from the discontinuance of plant operations ranged from 2 for SIC 38 (instruments and related products) to 768 for SIC 30 (rubber and plastic products). Total employment decline resulting from all plant closings was 2,347 for an annual average of 335 for the 1967 through 1973 period. For all SIC groups about 42 jobs were lost per plant that closed.

IV. CONTRACTIONS OF MANUFACTURING PLANT EMPLOYMENT

Along with plant closings, contraction of plant operations also results in a decline in the number of jobs in a community. For the 296 plants represented in this study, there were 164 contractions of employment from 1967 through 1973 (Table 6). Plants in SIC 27 (printing and publishing) and 29 (petroleum and coal products) had no contractions of employment. Employment released by contractions of manufacturing plants ranged from 6 for SIC 32 (stone, clay, and glass products) to 1,835 for SIC 23 (apparel and related products). A total of 5,710 employees was released by the 296 firms represented in the study, for an average of 816 employees per year due to contraction of manufacturing plant operations.

Table 6. Number of Manufacturing Plant Contractions[a] of Employment by Standard Industrial Classification Code (SIC) and the Resulting Employment Decline for Manufacturing Plants that Located in Rural Tennessee Communities, 1967 through 1973

SIC	Number of Employment Declines	Employment Loss Due to Decline	Employees Released Per Plant Decline
20	5	38	7.6
21	--	--	--
22	13	1,299	99.9
23	37	1,835	49.6
24	13	142	10.9
25	10	206	20.6
26	4	11	2.8
27	--	--	--
28	7	425	60.7
29	--	--	--
30	9	136	15.1
31	4	173	43.3
32	3	6	2.0
33	4	21	5.3
34	9	195	21.7
35	17	287	16.9
36	5	666	133.2
37	12	155	12.9
38	2	10	5.0
39	10	105	10.5
Totals	164	5,710	
Annual Averages	23	816	34.8

[a]Contraction is defined as a decrease in established plant employment.

Employees released per plant contraction ranged from 2 for SIC 32 (stone, clay, and glass products) to about 133 for SIC 36 (electrical machinery). About 35 jobs were lost per plant contraction.

V. BALANCE SHEET FOR PLANTS AND EMPLOYMENT

The findings presented provide insight into the employment patterns resulting from new manufacturing plant location, retention, and contraction. The primary concern of community leaders, however, is with the total manufacturing employment picture that exists in their respective communities. Approximately 81 percent of the new manufacturing plants that located in the study area from 1967 through 1973 were in operation as of December, 1973 (Table 7). The largest number of plant closings occurred in SIC 25 (furniture and fixtures) with 9 plant closings which represents 38 percent of the new plant locations in SIC 25.

Employment created by both new manufacturing plant locations and the expansion which followed ranged from 3 employees for SIC 29 (petroleum and coal products) to 8,106 employees for SIC 36 (electrical machinery) (Table 8). A total of 38,124 jobs were created by the location and expansion of the plants during the study period. Thus, plant locations and expansions accounted for approximately 5,443 new jobs annually in rural Tennessee communities for the 1967-1973 study period. However, these numbers must be adjusted for job losses due to contraction of employment and plant closings to gain an accurate estimate of net employment created in the manufacturing sector.

Table 7. Number of Manufacturing Plants Retained by Standard Industrial Classification Code (SIC) of the Manufacturing Plants that Located in Rural Tennessee Communities, 1967 Through 1973

SIC	Number of Manufacturing Plant Locations	Number of Plant Closings	Number of Manufacturing Plants Retained	Percent Plants Retained
20	8	3	5	62.5
21	--	--	--	--
22	19	3	16	84.2
23	43	8	35	81.4
24	31	5	26	83.9
25	24	9	15	62.5
26	14	1	13	92.9
27	2	0	2	100.0
28	10	3	7	70.0
29	1	0	1	100.0
30	17	2	15	88.2
31	3	1	2	66.7
32	5	0	5	100.0
33	11	0	11	100.0
34	27	1	26	96.3
35	28	8	20	71.4
36	17	2	15	88.2
37	23	7	16	69.6
38	5	1	4	80.0
39	8	2	6	75.0
Totals	296	56	240	
Annual Average	42.3	8.0	34.3	81.1

Table 8. Amount of Manufacturing Employment Created by Plant Locations and Expansions, and Adjusted for Plant Closings and Contractions by Standard Industrial Classification Code (SIC) for the Manufacturing Plants that Located in Rural Tennessee Communities, 1967 Through 1973

SIC	Total Employment Created by Plant Locations and Expansions	Employment Declines Due to Contractions and Closings	Net Employment	Net Employment As a Percent of Total Employment Created
20	660	56	604	91.5
21	--	--	--	--
22	3,172	1,408	1,764	55.6
23	7,279	2,190	5,089	70.0
24	1,233	205	1,028	83.4
25	2,233	656	1,577	70.6
26	1,153	223	930	80.7
27	100	0	100	100.0
28	1,417	434	983	69.4
29	3	0	3	100.0
30	2,486	904	1,582	63.6
31	549	195	354	65.5
32	134	6	128	95.5
33	1,160	21	1,139	98.2
34	2,479	210	2,269	91.5
35	3,677	309	3,368	91.6
36	8,106	836	7,270	89.7
37	1,008	250	758	75.2
38	77	12	65	84.4
39	1,177	142	1,035	87.9
Totals	38,103	8,057	30,046	
Annual Average	5,443.3	1,151	4,292.3	78.8

The number of jobs lost due to plant closings and contractions ranged from zero for SIC 27 (printing and publishing) and 29 (petroleum and coal products) to a high of 2,190 for SIC 23 (apparel and related products) (Table 8). For the period under study a total of 8,057 jobs were lost due to contractions and plant closings, which represents a rate of 1,151 annually. The net employment increases due to location and expansion less the employment losses due to plant closings and contractions ranged from 3 jobs for SIC 29 (petroleum and coal products) to 7,270 jobs for SIC 36 (electrical machinery). The total jobs created net of plant contractions and closings were 30,046 for an annual average of approximately 4,292 jobs (Figure 7). The largest percentage decline in the 1967-1973 plant location employment was in SIC 22 (textile mill products) with a decrease in employment of 44 percent.

Summarily, it can be seen that expansion of manufacturing plants is almost as important as the location of a new manufacturing plant in terms of employment provided over the period 1967-1973. Additionally, any evaluation of the effects of manufacturing plant location and expansion on community employment should consider declines in employment that can result from plant contractions or closings. The data indicate that the initial employment effects of a plant location are not always sustained. Appendix A provides a further breakdown of expansions, contractions, and closings by SIC code for the period of this analysis.

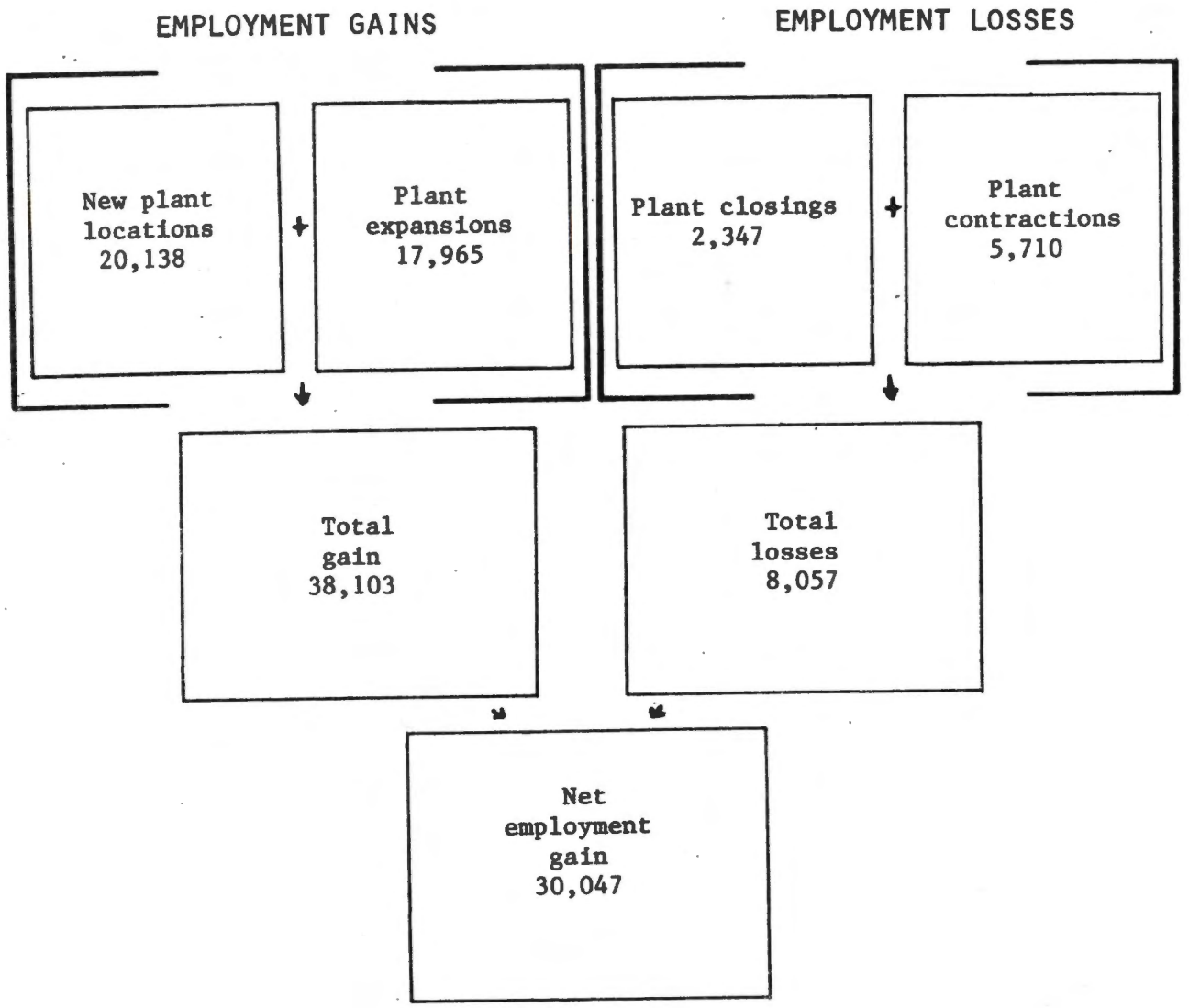


Figure 7. Employment Gains and Losses in Manufacturing Plants Located in Rural Tennessee Communities, 1967-1973

CHAPTER IV

RESULTS OF FACTOR ANALYSIS

This chapter presents the results of the factor analysis of the 31 community characteristics for 105 rural Tennessee communities included in model one. Since communities in models one and two were not identical, a second factor analysis was performed for the 72 communities included in model two. Interpretation of the results of factor analysis for model two is similar to model one; therefore, discussion in this chapter will refer to model one with any differences or clarifying results from model two being cited when appropriate. The necessary tables for the interpretation of factor analysis model two are contained in Appendix B. A primary objective of this study was to develop measures of key community concepts hypothesized to be important in the expansion or contraction of manufacturing employment in rural Tennessee communities. The measures of key community concepts were developed using the classical factor analysis mathematical method as described in Chapter II.

I. THE MATRIX OF CORRELATION COEFFICIENTS

Calculation of the matrix of correlation coefficients is the first step in the factor analysis procedure. This matrix shows the linear relationship that exists between any two variables in the data matrix (Table 9). The correlation matrix was calculated from the standardized[1] data matrix for the 31 variables described in Chapter II.

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[1]Standardization of the raw data was accomplished using the statistical packaged program provided by Norman Nie, D. H. Bent, C. H.

Table 9. Matrix of Correlation Coefficients for 31 Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	1.00																														
2	.19	1.00																													
3	.47	.26	1.00																												
4	.45	.55	.50	1.00																											
5	.12	.31	.12	.32	1.00																										
6	-.24	-.12	-.28	-.47	-.31	1.00																									
7	.12	.26	-.01	.39	.35	-.58	1.00																								
8	.46	.40	.58	.74	.36	-.61	.22	1.00																							
9	.07	.30	.09	.32	.12	-.10	.20	.11	1.00																						
10	-.21	-.08	-.28	-.02	.01	-.12	.27	-.11	.13	1.00																					
11	.33	.03	.16	.06	-.05	-.04	.08	.02	.10	-.04	1.00																				
12	.68	.16	.32	.30	.12	-.20	.15	.35	.02	-.25	.18	1.00																			
13	.24	.38	.42	.43	.14	-.10	.15	.48	.16	.05	.01	.23	1.00																		
14	-.21	-.11	-.39	-.00	.25	-.19	.44	-.13	.05	.49	-.01	-.11	-.08	1.00																	
15	.02	.06	-.10	.06	-.10	-.07	.15	.02	.24	.20	.06	-.02	.01	.10	1.00																
16	.40	.23	.17	.39	.25	-.18	.18	.32	.07	-.14	.01	.37	.11	-.03	.13	1.00															
17	.25	.18	.15	.38	-.12	-.10	-.01	.24	.25	-.14	.05	.24	.18	-.30	.02	.20	1.00														
18	.44	.56	.69	.72	.42	-.41	.35	.67	.22	-.08	.12	.30	.54	-.18	.02	.30	.20	1.00													
19	.51	.49	.70	.72	.31	-.41	.29	.63	.26	-.22	.20	.40	.44	-.15	-.02	.37	.21	.77	1.00												
20	.60	.50	.75	.74	.36	-.43	.26	.75	.16	-.20	.14	.40	.36	-.21	-.06	.31	.19	.82	.81	1.00											
21	-.64	-.16	-.23	-.37	-.15	.26	-.30	-.26	-.03	-.04	-.13	-.41	-.18	-.00	-.05	-.38	-.15	-.29	-.27	-.32	1.00										
22	.70	.14	.34	.42	.19	-.23	.23	.35	.11	-.01	.18	.37	.19	.03	-.08	.37	.11	.43	.40	.47	-.63	1.00									
23	.72	.19	.43	.35	.14	-.14	.07	.33	.03	-.19	.32	.47	.23	-.17	.02	.36	.15	.39	.34	.42	-.56	.61	1.00								
24	.45	-.01	.17	.19	.25	-.16	.11	.10	.19	-.02	.09	.38	.01	.05	.03	.27	.18	.13	.13	.20	-.41	.33	.46	1.00							
25	.43	.13	.23	.15	.33	-.16	.11	.20	-.01	-.07	.02	.29	.10	-.06	-.12	.20	.04	.14	.14	.19	-.40	.30	.34	.52	1.00						
26	.31	.04	.04	.09	.02	-.09	.06	-.02	.17	-.17	.06	.08	-.09	-.05	-.12	.14	.11	.01	.07	.10	-.36	.33	.43	.38	.30	1.00					
27	-.12	.13	-.15	-.06	-.18	.42	-.07	-.24	.34	.10	.12	-.06	.14	-.04	.06	-.10	.02	-.12	-.11	-.15	.12	-.11	-.22	-.15	-.07	-.23	1.00				
28	.02	-.09	.03	-.02	-.13	.24	.01	-.07	.13	.08	.31	.01	.08	-.02	.12	-.02	.05	-.04	.06	-.03	.02	.04	-.08	-.03	-.01	-.13	.34	1.00			
29	.43	.32	.51	.63	.29	-.45	.37	.55	.15	.10	.19	.25	.19	.05	.16	.31	.09	.51	.61	.71	-.29	.28	.30	.23	.15	.11	-.17	.09	1.00		
30	.02	-.01	.07	.11	.12	-.11	.10	.05	-.05	.05	.06	-.01	-.08	-.05	-.04	.21	-.09	.04	.10	.09	-.04	.02	-.00	-.02	-.02	-.06	-.10	-.12	.20	1.00	
31	.03	-.02	-.14	.11	-.02	-.01	.24	.02	.18	.13	-.06	-.00	.09	.09	.32	-.04	.05	-.07	-.05	.02	-.04	-.01	.04	.06	.02	.00	.03	.16	.13	-.07	1.00

[a] A correlation coefficient (r) of the magnitude of .25 or greater is statistically significant at the 1 percent level as described by F. James Rolf and Robert R. Sokal, Statistical Tables, (San Francisco, 1969), p. 224.

Interpretation of the correlation coefficient provides some indication of patterns in the data. For example, the coefficient between variable number 1, community population, and variable number 23, excess sewage treatment capacity, is .72. This relationship indicates that larger communities generally have more excess sewage treatment capacity available than smaller communities. Conversely, the correlation coefficient between population density and excess sewage treatment capacity is .19. A coefficient of this magnitude indicates a weak positive relationship between population density and the availability of excess sewage treatment capacity in the community. Likewise, other relationships between the variables are displayed in the matrix of correlation coefficients.

II. CALCULATION OF INITIAL FACTORS

The classical factor analysis patterns only the common variance in the data matrix as described in Chapter II.[2] Factoring only the common variance requires that an estimate of communality[3] be specified outside the data matrix. For this study the squared multiple correlation coefficient was used as the communality estimates to replace the 1's

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Hull, J. G. Jenkins, and Karin Steinbrenner, Statistical Package for the Social Sciences (New York, 1975), p. 187.

[2]Factoring was accomplished using the statistical program BMDC8M provided in Biomedical Computer Programs, W. J. Dixon, ed. (Berkeley: 1971).

[3]Communality is the percent of the total variance in a variable accounted for by the factors, or that part of the variation of one variable associated with other variables in the data set.

in the diagonal of the correlation matrix. Factoring of the data matrix was stopped at eigenvalues[4] less than 1.0 in keeping with the Kaiser test for factor reliability. With these restrictions the factor analysis of 31 community variables provided four factors (Table 10).

The factors provided in Table 10 may be viewed as four independent sources of variation in the data matrix. The variable loading on the factors may vary from -.999 to .999 representing the relative degree of association between the factor and each variable. These loadings can be viewed as correlation coefficients that describe the relationship between the factor and the variables in the data matrix. Since no standard definition of a high or moderate factor loading has been established an absolute factor loading of .40 or higher was chosen as a measure of significance for this study. Determination of the percentage variation in each variable associated with a factor is accomplished by squaring the factor loading and multiplying by 100. Thus, a factor loading of .40 indicates that 16 percent of the variation in the variable is associated with the factor on which the variable loaded.

The unrotated factor matrix shows that 16 variables load significantly on factor 1, while four variables load signigicantly on factor 2, four variables load significantly on factor 3, and two variables load significantly on factor 4. The communality column was determined by summing the squared factor loadings for each variable. Communality indicates the amount of variation in each variable that is associated

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[4]The sum of the squared factor loadings are referred to as eigenvalues. These values facilitate determining the amount of total or common variation in the data matrix explained by the extracted factors.

Table 10. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Unrotated Factor Matrix[a]

Variable Number	Factor 1	Factor 2	Factor 3	Factor 4	Communality
1	.764	.494	.012	.141	.848
2	.484	-.287	-.132	.135	.352
3	.691	-.014	-.424	-.118	.671
4	.810	-.317	.008	.091	.765
5	.389	-.184	.257	-.204	.293
6	-.516	.277	-.359	.344	.590
7	.377	-.355	.572	.065	.600
8	.762	-.264	-.109	-.180	.682
9	.223	-.206	.072	.441	.292
10	-.147	-.305	.472	.196	.376
11	.196	.135	-.022	.245	.117
12	.536	.302	-.019	.077	.385
13	.440	-.218	-.186	.199	.315
14	-.135	-.263	.680	.023	.550
15	.019	-.155	.177	.294	.142
16	.470	.125	.106	.015	.248
17	.281	.067	-.173	.193	.152
18	.814	-.305	-.191	-.030	.793
19	.818	-.235	-.220	.003	.773
20	.879	-.183	-.215	-.099	.862
21	-.561	-.381	-.316	-.107	.571
22	.616	.320	.189	.090	.526
23	.627	.506	.054	.054	.655
24	.384	.419	.304	.065	.420
25	.362	.340	.184	-.029	.281
26	.233	.424	.192	-.038	.272
27	-.198	-.130	-.194	.651	.518
28	-.029	-.028	-.086	.476	.236
29	.664	-.227	.119	-.002	.507
30	.091	-.074	.056	-.170	.046
31	.026	-.095	.212	.273	.129

[a]Initial factors were extracted by the classical or common factor analysis method.

with other variables in the data matrix. For example, 85 percent of the variation in community population, variable number 1, is associated with variation in the remaining 30 variables in the data matrix. Conversely, only 5 percent of the variation in hospital beds per 1,000 persons, variable number 30, is associated with remaining variables in the data matrix. The variation in each variable that is not associated with other variables in the data matrix can be described as unique variation for the variable as described in Chapter II. Thus, 15 percent of the variation in community population, variable number 1, is unique to the variable and not associated with the remaining variables in the data matrix. Conversely, 95 percent variance in the number of hospital beds per 1,000 persons, variable number 30, is unique to the variable and not associated with other variables in the data matrix.

The four factors extracted by the classical factor method explain 45 percent of the total variation in the data matrix (Table 11). Approximately 26 percent is explained by factor 1; 8 percent is explained by factor 2; 7 percent is explained by factor 3; and 5 percent is explained by factor 4. The percent of total variation in the data matrix which is explained by the factors is determined by summing the squared factor loadings and dividing by the total variance in the data matrix and multiplying the quotient by 100.

The percent common variance explained by each factor was determined by dividing the sum of the squared factor loadings for each variable by the sum of the communality for all variables in the data matrix. The results of this procedure indicate that approximately 57 percent of the common variance is explained by factor 1; 17 percent is explained

Table 11. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Total[a] and Common[b] Variance Explained and Eigenvalues

	Factor 1	Factor 2	Factor 3	Factor 4
Cumulative percent of total variance explained	25.85	33.52	40.20	45.08
Percent common variance explained	57.37	17.02	14.82	10.84
Eigenvalues	8.014	2.378	2.070	1.514

[a]Total variance is calculated as:

$$\frac{\text{Eigenvalue of factor}}{\text{Total variance in data matrix}} \times 100$$

[b]Common variance is calculated as:

$$\frac{\text{Eigenvalue of factor}}{\text{Sum of communality}} \times 100$$

by factor 2; 15 percent is explained by factor 3; and 11 percent is explained by factor 4. Thus, 74 percent of the common variance in the data matrix is explained by factors 1 and 2.

III. ROTATION OF FACTORS TO TERMINAL FACTORS

The varimax rotational method was used to rotate the factor loading matrix. This procedure aids in identifying the factors by simplifying the factor patterns. However, the results of this procedure do not alter the relative position of the variable. The varimax rotation provides orthogonal or independent factors. Thus, the factor scores are independent and conform to the assumptions of the ordinary least squares regression technique. The simplified factor patterns provide the basis for indentification and further elaboration on the factors and factor scores for the communities.

IV. IDENTIFICATION OF ROTATED FACTORS

Identification of the rotated factors requires placing a name on each factor based on an analysis of variables loading significantly on the factor. While the identification process is somewhat subjective, the names assigned the factors are based on logic, literature review, and economic theory.

Factor 1 is composed of variables that primarily measure aspects of manpower (Table 12). Included among the variables loading significantly are measures of unemployment, underemployment, degree of population concentration, local education and skill level, and existing demand for manpower in the community. Thus, factor 1 combines measures

Table 12. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Variable Number and Content of Factor 1 After Varimax Rotation (Name: Manpower Availability and Quality)[a]

Variable Number	Factor Loading	Content of Variable
2	.580	Payment in the county under the state employment insurance program, 1969
3	.692	Population density in the county, 1970
4	.820	Percent urban population in the county, 1970
6	-.446	Relative economic utilization of manpower in the county, 1970
8	.781	Percent persons in the county 25 years and older with a high school education, 1970
13	.526	Percent unskilled labor in the county, 1970
18	.872	Manufacturing employment in the county, 1970
19	.849	Number of manufacturing plants in the county, 1970
20	.870	Employment in wholesale and retail trade in the county, 1970
29	.620	Doctors per 1,000 in the county, 1969

[a]Includes variables loading at .400 or greater after varimax rotation.

of the concepts of manpower availability and manpower quality. More importantly, factor 1 provides a measure of existing demand for manpower in the community. The significant loading of the manpower demand variables, such as number of manufacturing plants, number of employees in wholesale and retail trade, combines measures of existing demand for manpower in the community with measures of manpower supply. All measures of manpower availability and quality load positively on factor 1 with the exception of variable number 6 (relative economic utilization of manpower). Logically, this variable loaded negatively indicating a lower labor supply in communities with a relatively higher percentage of manpower utilization. Based on variables loading significantly, factor 1 was named "Manpower Availability and Quality."

Factor 2 is composed of variables that primarily measure the level of community services (Table 13). This factor includes measures of the availability of higher education, transportation, water and sewage treatment services, availability of industrial financing, and facilities available for industrial location and expansion. All measures of community services load positively with the exception of variable number 21 (municipal fire rating). Since communities with higher fire ratings have less desirable levels of fire protection available, a negative loading is logical. Based upon variables loading significantly, factor 2 was named "Community Services."

Factor 3 is composed of three variables that load significantly (Table 14). Variables numbers 7 and 10 were hypothesized to be measures of the quality of manpower, while variable number 14 was hypothesized to provide a measure of transportation. A logical factor pattern could

Table 13. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Variable Number and Content of Factor 2 after Varimax Rotation (Name: Community Services)[a]

Variable Number	Factor Loading	Content of Variable
1	.820	Community population, 1970
12	.531	Presence of a senior or community college in the community, 1970
16	.400	Rail access available in the community
21	-.720	Municipal fire rating of community
22	.661	Excess water service available in the community
23	.756	Excess sewage capacity available in the community
24	.639	Dollar amount of general obligation bonds issued by the community, 1955-1973
25	.517	Dollar amount of revenue bonds issued by the community, 1951-1973
26	.508	Industrial park in the community with five or more plants

[a]Includes variables loading at absolute values of .400 or greater after varimax rotation.

Table 14. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Variable Number and Content of Factor 3 After Varimax Rotation (Unnamed)[a]

Variable Number	Factor Loading	Content of Variable
7	.666	Percent females in the labor force, 1970
10	.590	Median age of the population, 1970
14	.693	Distance to Standard Metropolitan Statistical Area

[a]Includes variables loading at absolute values of .400 or greater after varimax rotation.

not be isolated or defined for factor 3. Thus, factor 3 remains unnamed.

Factor 4 is also comprised of three variables that load significantly (Table 15). Factor 4 combines variables numbers 27 and 28 hypothesized to be a manpower availability measures. Although this factor does not provide a clear measure of any particular community concept, the positive loading of variable number 6 with variables numbers 27 and 28 suggests that there is some association between underemployment, property tax rates, and police protection expeditures. A logical conclusion about the relationship between the variables loading on factor 4 was not apparent, so the factor was left unnamed.

V. FACTOR SCORE COEFFICIENTS

As shown diagrammatically in Chapter II, the classical factor analysis technique provides a factor loading matrix, presented above, and a factor score matrix (Table 16). The factor score matrix allows the calculation of a score for each observation (community) on the extracted factor. The factor score matrix may be viewed as coefficients (weights) that allow the calculation of final factor scores for each community from the raw data matrix.

The factor score coefficient provides a linear relationship between the variable and the extracted factors. For example, the factor score coefficient for variable number 3 (population density) and factor 1 is .011 which indicates that as the population density increases in a county, the community score on factor 1 will increase. Alternatively, factor score 2 would increase for communities with a decrease in variable 21 (municipal fire rating). Thus, the relationship

Table 15. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Variable Number and Content of Factor 4 After Varimax Rotation (Unnamed)[a]

Variable Number	Factor Loading	Content of Variable
6	.503	Relative economic utilization of manpower in the county, 1970
27	.684	Property tax rate in the county per $100 assessed valuation, 1970
28	.477	Police protection expenditure per capita in the county, 1971-1972

[a]Includes variables loading at an absolute value of .400 or greater after varimax rotation.

Table 16. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Factor Score Coefficients

Variable Number	Factor 1	Factor 2	Factor 3	Factor 4
1	-.151	.695	-.114	.340
2	-.017	.036	-.011	.057
3	.011	.058	-.257	.079
4	.173	.016	.146	.125
5	-.045	.064	.013	-.067
6	.050	-.068	-.092	.285
7	.054	.044	.301	.002
8	.214	-.133	-.011	-.059
9	.019	.027	.123	.119
10	.039	-.037	.139	.053
11	.025	-.074	.010	.038
12	.028	-.063	-.026	-.020
13	.023	-.030	.026	.022
14	-.029	.035	.265	-.094
15	.044	-.053	.079	.071
16	.005	.042	-.010	-.037
17	.010	.003	-.040	.066
18	.246	-.095	.043	.071
19	.253	-.093	-.056	.082
20	.363	-.206	-.148	-.364
21	.027	-.149	-.065	.034
22	-.079	.026	.061	-.040
23	-.021	.227	-.030	-.005
24	-.054	.170	.056	.019
25	.027	.008	.039	-.093
26	-.014	.051	-.042	-.007
27	.061	-.054	.057	.402
28	-.007	.068	.035	.169
29	-.042	.010	.182	.013
30	.012	.004	-.005	-.072
31	-.006	-.008	.061	.096

between the individual variable and the factor allows a factor to be divided into its various parts. However, it is the composite index that is of interest in this analysis. That is, factor analysis was employed to provide a composite score for communities on concepts hypothesized to be related to industrial expansion. Thus, the final step involved in this analysis is the computation of scores on communities for the factors extracted.

VI. FINAL FACTOR SCORES

The final factor scores are obtained by multiplication of the matrix of factor score coefficients by the normalized data matrix. The results of this multiplication provide a factor score for each community on the extracted factors. Alternatively, the final factor scores may be viewed as the solution to the following equation:

$$F_{ij} = b_{ij1}V_{j1} + v_{ij2}V_{j2} + \ldots. b_{ijn}V_{jn}$$

where:

i = ith factor (i = 1, 2, ... n)

j = jth community (j = 1, 2, ... m)

b = factor score coefficient

n = number of variables

V = variables

The final factor scores of each community included in this study are provided in Table 17 alphabetically by community. The community of Sulphur Springs scored higher on factor 1 (manpower availability and quality) that all other communities represented in the study. Conversely, the community of Celina scored lower on factor 1 than other

Table 17. Factor Analysis of 31 Community Variables for 105 Rural Tennessee Communities: Final Factor Scores

County	Community	Factor 1	Factor 2	Factor 3	Factor 4
McMinn	Athens	1.438	-0.080	-0.073	1.002
Grainger	Bean Station	-1.154	-0.711	-1.872	0.272
Bedford	Bell Buckle	0.870	-0.818	0.873	0.084
Polk	Benton	-0.971	-0.608	-0.911	1.057
Maury	Big Bigby	1.504	-1.122	-0.154	0.079
Grainger	Blain	-1.123	-0.774	-2.087	0.334
Fayette	Braden	-1.318	-0.296	-1.651	-1.280
Haywood	Brownsville	-1.060	1.564	-0.530	-0.877
Pickett	Byrdstown	-1.474	-0.170	1.222	0.382
McMinn	Calhoun	1.707	-1.275	-0.104	0.699
Benton	Camden	-0.759	0.091	0.954	0.472
Warren	Campaign	0.682	-1.077	0.255	-0.755
Smith	Carthage	-1.150	0.653	-0.110	-0.094
Clay	Celina	-1.709	0.040	0.741	-0.319
Hickman	Centerville	-1.057	0.082	-0.402	0.512
Montgomery	Clarksville	1.414	1.850	-1.073	0.529
Bradley	Cleveland	1.800	2.154	-1.165	0.378
Maury	Columbia	0.887	0.736	-0.063	0.329
Putnam	Cookeville	0.539	1.553	-0.166	0.254
Cumberland	Crossville	-0.687	0.929	-0.246	0.139
Jefferson	Dandridge	-0.196	-0.699	-1.149	-0.663
Rhea	Dayton	-0.180	0.212	-0.013	0.983
Franklin	Dechard	-0.134	-0.470	-0.410	-1.562
Weakley	Dresden	0.142	-0.416	0.666	-1.293
Dyer	Dyersburg	-0.082	2.408	1.626	0.116
Carter	Elizabethton	0.323	1.215	-1.050	0.062
Giles	Elkton	0.183	-0.911	0.623	-0.178
Campbell	Elk Valley	-0.235	-0.671	-0.455	2.337
Houston	Erin	-1.274	-0.312	-1.079	0.543
Unicoi	Erwin	-0.606	0.708	0.162	0.398
McMinn	Etowah	1.477	-0.457	0.197	0.804
Lincoln	Fayetteville	-0.426	1.199	1.225	-1.219
Jackson	Gainesboro	-1.371	-0.213	0.722	2.084
Weakley	Greenfield	0.218	-0.612	0.474	-1.231
Green	Greenville	0.505	1.200	-1.101	0.082
Lauderdale	Halls	-0.608	-0.298	0.470	-0.353
Roane	Harriman	1.217	-0.107	0.368	1.147
Henry	Henry	0.733	-1.325	1.714	0.562
Gibson	Humboldt	1.147	0.525	0.963	-0.922
Carroll	Huntington	0.204	-0.114	1.406	0.435
Scott	Huntsville	-0.623	-0.849	-0.075	2.231
Lawrence	Iron City	0.078	-0.958	-0.185	0.034

Table 17 (continued)

County	Community	Factor 1	Factor 2	Factor 3	Factor 4
Campbell	Jacksboro	-0.198	-0.884	-0.601	2.409
Madison	Jackson	1.488	3.760	0.056	0.241
Jefferson	Jefferson City	-0.199	-0.342	-1.107	-0.931
Washington	Johnson City	1.761	2.944	-1.620	0.006
Washington	Jonesboro	2.568	-1.317	-1.298	-1.120
Roane	Kingston	1.269	-0.434	0.431	1.065
Macon	Lafayette	-0.916	0.165	0.243	-0.315
Campbell	Lafollette	-0.340	0.028	-0.474	2.337
Lawrence	Lawrenceburg	-0.350	0.996	-0.394	0.228
Loudon	Lenoir City	-0.264	0.311	-0.229	0.822
Marshall	Lewisburg	0.049	0.136	0.536	-0.260
Henderson	Lexington	-0.839	0.337	0.638	-0.757
Perry	Linden	-1.041	-0.638	1.125	0.171
Overton	Livingston	-0.719	-0.070	0.638	0.780
Loudon	Loudon	0.265	-0.158	-0.089	0.740
Hickman	Lyles	-0.829	-0.759	-0.765	0.501
Monroe	Madisonville	-0.108	-0.080	-0.269	0.571
Coffee	Manchester	0.673	0.046	-0.284	-0.875
Weakley	Martin	-0.091	0.735	0.644	-1.148
Crockett	Maury City	-1.104	-0.390	-0.122	-0.986
Carroll	McKenzie	0.213	0.057	1.417	0.423
Warren	McMinnville	0.217	0.736	0.195	-0.465
Hardeman	Middleton	-0.405	-0.269	0.122	-1.833
Putnam	Monterey	0.968	-0.747	0.018	-0.098
Hamblen	Morristown	0.996	2.991	-1.483	0.539
Johnson	Mountain City	-1.157	-0.255	-0.091	-0.350
Dyer	Newbern	0.434	-0.263	1.609	-0.091
Cocke	Newport	-0.412	0.225	-1.280	-0.139
Obion	Obion-Troy	0.807	-0.911	1.004	-1.179
Grundy	Palmer	-1.276	-0.550	-1.433	-0.355
Henry	Paris	0.185	0.566	1.839	0.950
Hardin	Pickwick	-0.177	-0.724	1.355	-0.291
Giles	Pulaski	-0.243	1.121	0.745	-0.169
Macon	Red Boiling Springs	-0.861	-0.283	0.360	-0.372
Lauderdale	Ripley	-0.973	0.992	0.441	-0.147
Roane	Rockwood	1.273	-0.555	0.486	0.907
Hamblen	Russellville	2.060	-1.200	-1.564	-0.193
Grainger	Rutledge	-1.174	-0.629	-1.944	0.322
Hardin	Savannah	-0.303	-0.107	1.274	-0.137
McNairy	Selmer	-0.526	-0.290	0.266	-0.165
Sevier	Sevierville	-0.100	0.047	-1.095	-0.983
Weakley	Sharon	0.215	-0.663	0.581	-1.324
Bedford	Shelbyville	0.416	0.947	0.722	0.434

Table 17 (continued)

County	Community	Factor 1	Factor 2	Factor 3	Factor 4
DeKalb	Smithville	-0.889	0.177	0.525	-0.459
White	Sparta	-0.588	0.106	0.593	-0.584
Rhea	Spring City	-0.094	-0.452	-0.299	0.963
Maury	Spring Hill	1.601	-1.366	-0.286	-0.117
Washington	Sulphur Springs	2.629	-1.768	-1.456	-0.966
Morgan	Sunbright	-0.823	-0.716	-0.697	0.495
Monroe	Sweetwater	-0.190	0.099	-0.270	0.494
Claiborne	Tazewell	-0.949	-0.289	-0.720	0.659
Monroe	Tellico Plains	-0.109	-0.482	-0.143	0.483
Lake	Tiptonville	-1.425	0.148	0.413	-0.364
Grundy	Tracy City	-1.354	-0.224	-1.288	-0.368
Gibson	Trenton	1.199	-0.178	1.176	-0.983
Carroll	Trezevant	0.291	-0.404	1.238	0.482
Coffee	Tullahoma	0.685	0.629	-0.404	-0.777
Obion	Union	0.311	1.028	1.039	-1.137
Humphreys	Waverly	-0.525	-0.593	-0.436	-0.472
Wayne	Wanesboro	-0.962	-0.270	0.386	-0.334
Franklin	Winchester	-0.117	-0.207	-0.171	-1.829
Cannon	Woodbury	-1.110	-0.350	0.026	-0.613
Gibson	Yorkville	1.620	-1.286	1.032	-0.969

communities in the study. Further, the community of Jackson scored higher on factor 2 (community services) than other communities in the analysis, while the community of Sulphur Springs scored the lowest on this factor. For the purposes of this study, factors 3 and 4 will not be used as variables in further analysis of the relationship between the key community factors and manufacturing plant expansion. Further evaluation of the relationship between manufacturing expansion and the unidentified factors would be meaningless.

CHAPTER V

RESULTS OF MULTIPLE REGRESSION

To clarify the relationship between the key community characteristics and employment expansion, the multiple regression statistical technique was employed. Multiple regression equations were estimated for models one and two as described in Chapter II. Five multiple regression equations were estimated in model one, and a single equation was estimated in model two.

A summary of the hypotheses from Chapter II are as follows:

(1) plant employment will increase with increases in value of shipments for each SIC; (2) plant employment will increase in communities where plants have a relative material cost advantage; (3) plant employment will increase in communities where plants have a relative wage cost advantage; (4) plant employment will increase in communities with greater manpower availability; and (5) plant employment will increase in communities with higher levels of services available. Thus, positive regression coefficients were expected for all variables in the equations.

The logic behind these hypotheses follow. The increase in value of shipment (x_1) for each SIC group is hypothesized to reflect a change in the demand for the products of plants in the SIC group. Thus, employment will increase with increases in demand for products of the plant. As the material cost and wage index (x_2 and x_3) was calculated, a larger index reflects a lower cost of material and lower wages for the particular SIC groups in Tennessee as compared to the nation.

Therefore, employment was expected to increase with larger values of each of the indices. Additionally, higher factor scores for communities on Factors 1 and 2 (manpower availability and quality and community services) are hypothesized to reflect a higher probability for manufacturing plant expansion. A positive relationship between employment expansion and variables x_4 and x_5 was expected. Thus, for the five equations in model one and the single equation of model two, positive regression coefficients were expected.

I. EMPLOYMENT EXPANSION EQUATION ONE OF MODEL ONE

The first equation estimated was for employment changes in the first full year of plant operations, where the first full year of plant operations is defined as the change in plant employment between the first 12-months of operation and the second 12-months of operation. Based on preliminary analysis, the first three months of employment for all new plant locations were excluded because of initial plant start-up adjustments in employment during this period. Employment changes for 239 plants were included in this equation.

The five independent variables explained about 9 percent of the variation in the change in employment (Table 18). The F ratio of 4.374, which is significant at the 1 percent level,[1] indicates that the independent variables acting together in the equation provide some degree of explanatory power for employment fluctuations. Although

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[1] F. James Rohlf and Robert R. Sokal, Statistical Tables (San Francisco, 1969), p. 168.

Table 18. Results of Multiple Regression Analysis Model One for Employment Changes (Y) for Manufacturing Plants With One to Five Years of Operations, from 1967 Through 1973[a]

Variables	Regression Coefficients				
	Model One				
	First Year	Second Year	Third Year	Fourth Year	Fifth Year
Intercept	7.899	50.099	-35.317	4.079	-21.195
x_1 - Change in value of shipments by SIC	-.002	.001	-.002	.001	-.001
	(.001)	(.002)	(.002)	(.001)	(.0007)
x_2 - Material cost index by SIC	-28.004	-45.288	-150.520	-44.062	-49.683
	(27.341)	(60.655)	(92.776)	(62.240)	(39.796)
x_3 - Wage index by SIC	28.608	-8.552	163.850**	38.987	65.565*
	(27.357)	(48.439)	(78.127)	(47.540)	(33.525)
x_4 - Factor 1 (manpower availability and quality)	-1.446	4.840	29.456***	18.525***	-.079
	(1.703)	(7.013)	(10.708)	(6.316)	(4.049)
x_5 - Factor 2 (community services)	-5.233	-6.734	-12.970*	-14.837***	-.001
	(3.419)	(5.032)	(7.632)	(4.562)	(3.146)
Sample size	239	170	122	79	55
R^2	.09	.02	.10	.20	.10
F	4.374***	.661	2.645**	3.745***	1.096

[a]Standard errors of regression coefficient are in parentheses below coefficient.

***Significant at the 1 percent level

**Significant at the 5 percent level.

*Significant at the 10 percent level.

a statistically significant regression coefficient above the 10 percent level was not isolated in equation one,[2] the hypothesis that plants expand in communities where a relative labor cost advantage exists tended to be supported by the positive coefficient which indicates that a one unit increase in the wage index is associated with roughly an increase of 29 jobs. The remaining hypotheses are tentatively rejected on the basis of the negative regression coefficients obtained from estimation of equation one.

II. EMPLOYMENT EXPANSION EQUATION TWO OF MODEL ONE

The second equation estimated was for a cross-sectional set of employment changes labeled as the second year employment expansion (Table 18). The dependent variable was the average employment in the third 12-months of plant operations minus the average plant employment in the second 12-months of operations. Employment changes for 170 plants were examined. Only 2 percent of the variation in the cross-sectional employment changes was explained by equation two. The F ratio of .6611 was not statistically significant at the 5 percent level. Thus, equation two provides little explanation of cross-sectional variation of employment changes. Although the regression coefficients

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[2]Statistical significance of the regression coefficient is calculated for the five equations in Table 18 with the t-test in the following manner:

$$t_b = b/s_b$$

where:

b = the regression coefficient

s_b = the standard error of the regression coefficient.

Computed values of t_b were then compared to critical values of the t-distribution contained in F. James Rohlf and Robert R. Sokal, Statistical Tables (San Francisco, 1969), p. 159.

in equation two were not statistically significant, the signs of the coefficients for x_1 (change in value of shipments by SIC) and x_4 (Factor 1--manpower availability and quality) were positive as expected. Signs on remaining variables in the equation were negative. The sign of the regression coefficient for x_1 indicates that employment expansion is positively associated with increases in value of shipments (x_1). The regression coefficient for x_4 indicates that employment expansion is positively associated with higher scores on the manpower availability and quality factor.

III. EMPLOYMENT EXPANSION EQUATION THREE OF MODEL ONE

The third equation estimated was for a cross-sectional set of employment changes labeled as the third-year employment expansion (Table 18). The dependent variable was the average plant employment in the fourth 12-months of plant operations minus the average plant employment in the third 12-months of plant operations. Employment changes for 122 plants were analyzed.

Equation three explained 10 percent of the employment change taking place in the third year of plant operations. Additionally the F ratio of 2.645 indicates a significant equation at the 5 percent level. Thus, the equation has a degree of explanatory power in evaluating employment changes in the third year of plant operations.

Regression coefficients of three independent variables are statistically significant above the 10 percent level in equation three. Variable x_3 (wage index by SIC) is statistically significant at the 5 percent level, and variable x_5 (community services) is statistically

significant at the 10 percent level. Additionally, variables x_3 and x_4 have positive signs on the regression coefficients while other variables in the equation are negatively related to the independent variable. The regression coefficient for x_3 indicates that a one unit increase in the wage index is associated with the creation of roughly 164 jobs. The regression coefficient for x_4 indicates that a one unit increase in the factor score on manpower availability and quality is associated with an increase in employment of roughly 29 persons. The significantly negative regression coefficient for x_5 indicates that a one unit increase in the community score on the community services factor is associated with a decrease of roughly 13 jobs per plant in the community.

IV. EMPLOYMENT EXPANSION EQUATION FOUR OF MODEL ONE

The fourth equation estimated was for employment changes for the fourth year of plant operations (Table 18, p. 76). The dependent variable is average plant employment for the fifth 12-month period of operations minus the average plant employment in the fourth 12-month period of plant operations. Employment changes for 79 manufacturing plants were analyzed.

The five independent variables in this equation explained 20 percent of the variation in plant employment changes. Additionally, the F ratio of 3 745 is significant at the 1 percent level. The significant F ratio suggests that the independent variables in the equation have some degree of explanatory power for the variation of the dependent variable. The signs of regression coefficients x_1

(change in value of shipments by SIC), x_3 (wage index by SIC), and x_4 (Factor 1—manpower availability and quality) are positive as expected. Hence, employment increases are positively associated with increases in value of shipment, relatively lower wage rates and communities that scored higher on the manpower availability and quality factor. The signs of the regression coefficients for variables x_2 (materials cost index by SIC) and x_5 (Factor 2--community services) are negative. Additionally, regression coefficients for variables x_4 and x_5 were significant at the 1 percent level. The significantly negative regression coefficient for x_5 again indicates that an increase in the community score on the community services factor is associated with a decrease of jobs in the community.

The fifth equation estimated was for employment changes for the fifth year of plant operations (Table 18, p. 76). The dependent variable is the average plant employment for the sixth 12-month employment period minus the fifth 12-month employment period. Employment changes for 55 manufacturing plants were analyzed.

The five independent variables in equation five accounted for 10 percent of the variation in plant employment changes. However, the F ratio of 1.096 indicates that the equation is not statistically significant above the 10 percent level in explaining variation in employment changes. The regression coefficient for variable x_3 (wage index by SIC) was positive and statistically significant at the 5 percent level. The remaining regression coefficients in equation five were negative although not statistically significant.

VI. RESULTS OF REGRESSION MODEL TWO

A single equation was estimated for model two. This equation provides an estimate of the relationship between community characteristics and manufacturing plant employment changes during a one to five year period of operations. This model was based on the assumption that plants with less than a five-year history of operations share common employment expansions patterns. The dependent variable for this equation is average plant employment in 1973 minus average plant employment in 1969. Employment changes were analyzed for 131 manufacturing plants.

The five independent variables explained 10 percent of the variation in the dependent variable (Table 19). The F ratio of 2.745 is significant at the 5 percent level. Three regression coefficients (x_3, x_4, and x_5) were significant at the 10 percent level. The expected signs of the regression coefficients were not as hypothesized for variables x_1 (change in value of shipments by SIC), x_2 (materials cost index by SIC), and x_5 (Factor 2--community services).[3] However, the negative sign on x_5 was consistent with the negative relationship isolated for x_5 in the five equations of model one.

VII. SUMMARY OF MULTIPLE REGRESSION PROCEDURES-- MODEL ONE AND MODEL TWO

The multiple regression analysis performed to isolate the

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[3]Variables in regression models one and two are identical. Therefore, the rationale concerning expected signs of the regression coefficients of model one applies to regression model two.

Table 19. Results of Multiple Regression Analysis Model Two for Manufacturing Plant Employment Changes (Y) Occurring 1969 Through 1973 for Manufacturing Plants Located in Rural Tennessee Communities, 1964 Through 1969[a]

Variables	Regression Coefficients Model Two
Intercept	-66.527
x_1 - Change in value of shipments by SIC	-.002
	(.002)
x_2 - Material cost index by SIC	-187.295
	(130.721)
x_3 - Wage index by SIC	232.007*
	(125.616)
x_4 - Factor 1 (manpower availability and quality)	43.828***
	(15.757)
x_5 - Factor 2 (community services)	-28.275
	(13.699)
Sample size	131
R^2	.10
F	2.745**

[a]Standard error of regression coefficient is in parentheses below coefficients.

***Significant at 1 percent level.

**Significant at 5 percent level.

*Significant at 10 percent level.

relationship between community characteristics (Factors 1 and 2) provided three statistically significant equations in model one, and a single significant equation in model two. However, the variation in employment changes explained by the significant equations was no greater than 20 percent. The low level of explanation of the variation in employment change in the models is likely associated with the large standard deviation about the mean of the dependent variable (Y), employment changes. For example the mean of the dependent variable in equation one of model one is about 13, while the standard deviation is approximately 67.[4]

A consistently negative regression coefficient for x_5 (Factor 2--community services) was obtained from all equations. The negative regression coefficient for variable x_5 was statistically significant in two of the five multiple regression equations of model one and in the single equation of model two. Additionally, examination of the simple correlation matrix indicates a negative correlation in four of the five equations in model one for the relationship between x_5 (community services) and Y (change in manufacturing plant employment). However, the r value of -.32 for variable x_5 and Y is statistically significant only in the simple correlation matrix of equation four of

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[4]The means and standard deviations of the dependent variable in model one are:

	Mean	Standard Deviation
Equation one	12.78	66.66
Equation two	-3.08	76.23
Equation three	13.19	106.07
Equation four	10.52	55.53
Equation five	6.69	26.98

model one. Additionally, the simple r between Y and x_5 (community services) in model two is negative but not statistically significant.[5] The relationship between x_5 and Y is interpreted to mean that a higher level of community services is associated with declines of manufacturing employment. Since a primary objective of this study was to isolate relationships between employment changes (Y) and community services (x_5), further investigation of the negative relationship was undertaken to clarify this unexpected result.

VIII. RESULTS OF FURTHER EXAMINATION OF THE NEGATIVE RELATIONSHIP BETWEEN LEVEL OF COMMUNITY SERVICES AND EMPLOYMENT EXPANSION

The relationship isolated between community services and employment expansion in the regression analysis was inconsistent with the hypothesis that communities with higher level of services would gain manufacturing employment from new plant expansion. Since the hypothesis was rejected, a more detailed analysis of the relationship between employment expansion and community scores on the community services factor was undertaken.

The expansion of plant employment in communities with a minimum level of community services occurs more frequently than in communities with higher levels of community services available. That is, communities with higher levels of community services available had relatively

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[5] Rohlf and Sokal, op. cit., p. 224.

less manufacturing plant employment expansion than did communities with lower levels of community services (Table 20).[6] Data from Table 20 show that two-thirds (27 expansions/41 expansions) of the positive increases in employment occurred in communities that scored less than 2.0 on the community services factor. Approximately a third of the positive increases in employment occurred in communities with scores of greater than 2.0 on the community services factor. Alternatively, 48 percent (15 declines/31 declines) of the declines in manufacturing plant employment occurred in communities with scores less than 2.0 on the community services factor while 52 percent of the declines in manufacturing employment occurred in communities with scores greater than 2.0 on the community services factor.

IX. RELATIONSHIP BETWEEN EMPLOYMENT EXPANSION AND EMPLOYMENT CREATED BY MANUFACTURING PLANT LOCATIONS IN THE COMMUNITY

To determine if the communities experiencing employment contractions of existing plants were experiencing location of new plants, an additional cross-tabulation was undertaken. Although the complete employment situation in each community cannot be examined in this

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[6] Information in Table 20 is based on results from factor analysis, model two and calculation of employment changes for manufacturing plants that located 1964 through 1969. The changes in employment observed are for the years 1969 through 1973. The changes in employment due to plant expansions and contractions are aggregated to the community level. Additionally, the factor scores for each community were adjusted by adding the most negative score to each community score so that community scores range from zero to positive numbers.

Table 20. Changes in Manufacturing Plant Employment Resulting from Plant Expansions in 72 Rural Tennessee Communities 1969-1973 with Community Scores on Factor 2, Community Services

Community Services Scores	Manufacturing Employment Expansion[a]									
	Less than -150	-149 through -100	-99 through -50	-49 through 0	1 through 50	51 through 100	101 through 150	151 and over	Total	Percent
	Number of Plants									
0 - .9	--	--	--	5	4	1	2	3	15	20.8
1.0 - 1.9	2	--	--	8	9	5	1	2	27	37.5
2.0 - 2.9	1	2	1	6	4	3	--	2	19	26.4
3.0 - 3.9	1	1	--	4	--	2	--	2	10	13.9
4.0 - 4.9	--	--	--	--	--	--	--	1	1	1.4
Total	4	3	1	23	17	11	3	10	72	
Percent	5.5	4.2	1.4	31.9	23.6	15.3	4.2	13.9		100.0

[a]Forty-one increases in community employment and 31 decreases in community employment were observed during the 1969-1973 study period.

analysis, data available on plant locations allow the analysis of the relationship between employment created by plant locations and employment from plant expansions (Table 21).[7] The information in Table 21 indicates that 68 percent of the positive employment expansions occurred in communities gaining less than 50 employees from new plant locations during the study period. Approximately 43 percent of the new plant locations were in communities that experienced declines in employment from the plants located during the period 1964 through 1969. Based on calculation of a simple r of .023, a statistically significant relationship does not exist between employment from manufacturing plant location and plant employment declines in the community.[8] Therefore, it can be concluded that the communities experiencing employment declines in the existing plants are not necessarily gaining new plants that are drawing employment from the existing plants.

X. RELATIONSHIP BETWEEN EMPLOYMENT CREATED BY MANUFACTURING PLANT LOCATIONS AND THE LEVEL OF COMMUNITY SERVICES

Although a significant relationship between employment created by the location of new manufacturing plants and employment created by

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[7] Information contained in Table 21 is from sources given in footnote 6. However, the information on employment from manufacturing plant locations was summarized from the employment data obtained from the Tennessee Department of Employment Security as described in Chapter II. The aggregate employment from plant locations in each community was obtained by summing the initial annual plant employment for each plant locating in the community for the period 1970-1973.

[8] The simple r computed between employment from manufacturing plant location and employment from plant expansion is .023 as computed using

Table 21. Change in Manufacturing Plant Employment Resulting from Plant Expansions in 72 Rural Tennessee Communities 1969-1973 with Change in Employment in the Community Resulting from the Location of New Manufacturing Plants, 1970-1973[a]

	Manufacturing Plant Employment Expansion 1969-1973									
1970-1973	Less than -150	-149 through -100	-99 through -50	-49 through 0	1 through 50	51 through 100	101 through 150	151 and over	Total	Percent
	Number of Plants									
0 - 50	4	1	0	14	13	7	2	6	47	65.3
51 - 100	--	--	1	3	1	2	1	1	9	12.5
101 - 150	--	1	--	2	1	2	--	1	7	9.7
151 - 200	--	1	--	3	--	--	--	1	5	6.9
201 and over	--	--	--	1	--	2	--	1	4	5.5
Total	4	3	1	23	15	13	3	10	72	
Percent	5.5	4.2	1.4	31.9	20.8	18.1	4.2	13.9		100.0

[a]Forty-one increases in community employment and 31 decreases in community employment were observed during the 1969-1973 study period.

plant expansions was not isolated, further analysis shows that a statistically significant positive relationship exists between employment created by plant locations and the level of community services (Table 22). The simple r between employment from plant location and the community services factor is .357.[9] That is, the plants with higher levels of employment tended to be located in communities that scored higher on the level of community services factor. Conversely, the manufacturing plants with lower levels of employment tended to be located in communities that scored less than 2.0 on the community services factor.

XI. SUMMARY OF FINDINGS ON RELATIONSHIP BETWEEN COMMUNITY SERVICES AND EMPLOYMENT EXPANSION AND LOCATION

During the study period a larger percentage (66) of manufacturing employment expansions occurred in communities scoring less than 2.0 on the community services factor. Additionally, the larger percentage (58) of plant locations occurred in communities scoring less than 2.0 on the community services factor. However, the location of manufacturing plants with higher levels of employment generally was in communities

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the "scattergram" program contained in Norman H. Nie, Dale H. Bent, C. H. Hull, J. G. Jenkins and Karin Steinbrenner, Statistical Package for the Social Science (New York, 1975), p. 276.

[9]The simple r between employment from manufacturing plant location and the community services factor was computed using the "scattergram" program contained in Norman H. Nie, Dale H. Brent, C. H. Hull, J. G. Jenkins and Karin Steinbrenner, Statistical Package for the Social Science (New York, 1975), p. 276.

Table 22. Increase in Community Employment Resulting from the Location of New Manufacturing Plants in Rural Tennessee Communities, 1970-1973, with Factor 2, Community Services Scores

Community Services Scores	Manufacturing Plant Employment								
	0-50	51-100	101-150	151-200	201-250	251-300	300 and over	Total	Percent
	Number of Plants								
0 - .9	15	--	--	--	--	--	--	15	20.8
1.0 - 1.9	21	2	1	1	--	--	2	27	37.5
2.0 - 2.9	10	4	4	1	--	--	--	19	26.4
3.0 - 3.9	1	3	2	3	--	--	1	10	13.9
4.0 - 4.9	--	--	--	--	--	1	--	1	1.4
Total	47	9	7	5	--	1	3	72	
Percent	65.3	12.5	9.7	6.9	--	1.4	4.2		100.0

with higher scores on the community services factor. The conclusion is drawn that a larger number of smaller plants (less than 50 employees) tend to locate in the communities scoring less than 2.0 on the community services factor. However, these plants tend to expand creating more employment by expansion than the relatively larger plants locating in the communities scoring higher on the community services factor. The negative regression coefficient for the community services factor is consistent with the findings from the tabular analysis above.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The primary objectives of this research were to describe patterns of growth of recently-located manufacturing plants; develop measures of key community characteristics hypothesized to influence manufacturing plant employment growth; and describe the relationship between key community characteristics and manufacturing plant growth. This chapter presents a summary of the key findings of this study, suggests further research, and discusses policy implications resulting from the study.

I. SUMMARY OF EMPLOYMENT GROWTH PATTERNS OF MANUFACTURING PLANTS

The results of this study provide the basis for some important conclusions concerning the relative importance of the growth of manufacturing plants in the creation of employment. The expansion of manufacturing plants was of almost equal importance to new plant locations in the creation of non-farm employment in the rural Tennessee communities during 1967 through 1973. The location of new plants accounted for approximately 2,877 jobs annually, and the expansion of the manufacturing plants included in this study accounted for approximately 2,566 jobs annually.[1] This finding is consistent with the Carrier and Schriver[2]

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[1]The data does not include plants that located in the community prior to 1967.

[2]Ronald E. Carrier and William R. Schriver, Plant Location Analysis: An Investigation of Plant Location in Tennessee (Memphis, 1969), p. 160.

implication concerning the relative importance of manufacturing plant expansion in the creation of employment. In their study they found that investment made in the expansion of plants was roughly equal to that made in the location of a new plant for the years 1950 through 1965. Further, this finding is consistent with Kaldor's conclusion that employment created by expanding firms may add more jobs per community than the location of a new plant.[3]

A total of 296 plants began operations during the 1967-1973 study period in rural Tennessee communities creating 20,138 jobs. The expansion of the 296 plants in the study added 17,965 jobs. However, 56 of the plants were closed before the end of the study period. The manufacturing plant closings cost the communities 2,347 jobs. Additionally, the contraction of manufacturing plants in the study cost the communities another 5,710 jobs before the end of 1973. Therefore, rural Tennessee communities experienced a net gain of 30,046 jobs from the location and expansion of 296 manufacturing plants after adjusting for plant employment contractions and closings.

The location and expansion of plants in SIC's 23 (apparel and related products), 35 (machinery except electrical), and 36 (electrical machinery) accounted for more than one-half (15,727) of the 30,046 net increase in jobs. The contraction and closing of plants in SIC's 22 (textile mill products), 23 (apparel and related products), and 30 (rubber and plastic) accounted for more than one-half (4,502) of the 8,057 jobs lost.

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[3]Don Kaldor and Mike Dahlke, Industrialization Efforts and Experiences in Iowa's Rural Communities (Iowa State University, 1973).

An annual average of roughly 42 plants located in the study area which created approximately 68 jobs per plant during the 1967-1973 period. Of the 296 total plant locations, an annual average of about 71 plants were expanded, creating roughly 36 jobs per plant expansion. Further, of the 296 plant locations in the study, an annual average of eight discontinued operations before the end of 1973 displacing approximately 42 employees per plant closing. Finally, an annual average of 23 plants of the 296 plants in the study contracted employment displacing roughly 35 employees per plant contraction.

II. SUMMARY OF THE DEVELOPMENT OF MEASURES OF KEY COMMUNITY CHARACTERISTICS

From a review of plant location literature, five community concepts were isolated that were hypothesized to be related to manufacturing plant location. These same community concepts were hypothesized to be related to the expansion of existing manufacturing plants. Factor analysis was used to develop comprehensive measures of the community concepts hypothesized to be related to manufacturing plant expansion.

Factor analysis was used in two ways in this study--as an exploratory tool and as a measuring device. As an exploratory tool, factor analysis allowed the identification of underlying influences among the selected measures of each of the community concepts and the reduction of the number of independent measures of the particular concepts. As a measuring device, it was possible to score the factors extracted and develop an index which was used as a new variable in an employment expansion equation.

Of the five community concepts isolated, measures of four were developed with factor analysis. Two factors were identified in this study for inclusion in the employment expansion equation. Factor one provides a measure of manpower availability and quality, and factor two provides a measure of community services. Factor two also included one variable related to the availability of transportation in the rural communities in the study.

The concept of manpower availability and quality provides an index of the relative availability of labor for manufacturing plant employment. The concept of community services provides a measure of the level of development of community services that may affect the cost of operations of manufacturing plants. The measures of manpower availability and quality and community services were hypothesized to provide comprehensive measures of the respective community concepts. That is, rather than attempt to measure the community concept with the selection of one proxy variable for each concept, variables measuring each concept were collapsed into an index.

Communities included in the study were then scored on the identified factors to provide a means of evaluating the relationship between community characteristics and manufacturing employment expansions in rural Tennessee communities. Additionally, the community scores on the identified factors provides community leaders a comprehensive comparison of their community with other communities in the state. Viewing the indices of community scores as crude indicators of the level of development, community leaders can evaluate the relative position of their community as to the level of development.

Finally, the development of comprehensive measures of community characteristics provides a useful alternative for other research in the area of rural development. Often researchers in the social science areas select a single proxy measure of a particular concept from a range of possible measures when a more appropriate measure may be a combination of several variables. Rather than include more than one proxy measure of a concept in an analytical model, variables may be combined by factor analysis into a useful composite.

III. SUMMARY OF RELATIONSHIP BETWEEN COMMUNITY CHARACTERISTICS AND MANUFACTURING PLANT EXPANSION

The community concepts of manpower availability and quality and community services were hypothesized to be important considerations in the management decision to expand employment in a particular community. The employment expansion model developed was estimated using ordinary least squares multiple regression. In order to determine the net influence of community characteristics on manufacturing plant expansion, proxy measures for product demand, wage cost, and material cost were included in the analytical model. Once employment expansion has been adjusted for the macro economic forces, then net measures of the importance of community factors were available.

The variation explained in employment expansion by the specified equation was no greater than 20 percent. Economic variables x_1 (change in value of shipments by SIC) and x_2 (material cost index by SIC) were consistently statistically insignificant in the employment expansion equation estimated. Economic variable x_3 (wage index by SIC) was

statistically significant in three of the six equations estimated. Additionally, variable x_3 had a positive regression as hypothesized in the three significant equations. Thus, the hypothesis that employment expansion occurs in communities with wage cost advantages to the firm tends to be supported by this finding.

The index on factor one (x_4 - manpower availability and quality) was statistically significant with the hypothesized positive regression coefficient in three of the six equations estimated. This finding tends to support the hypothesis that firms tend to expand in communities with a larger relative labor force.

Finally, the index on factor two (x_5 - community services) was statistically significant in three of the six equations estimated. However, the regression coefficient was consistently negative in both the significant and nonsignificant equations. The negative regression coefficient for x_5 indicated that communities providing higher levels of community services were not experiencing manufacturing employment expansion as hypothesized.

Further investigation indicated that communities with lower scores on the community services factor (x_5) experience the location of a larger number of smaller plants relative to communities scoring higher on this factor. Additionally, the data indicates a general tendency for the smaller plants to expand while the relatively larger plants locating in the communities scoring higher on the community services factor tend to maintain a relatively stable employment level.

Policy conclusions concerning the direction community leaders should consider to enhance manufacturing plant expansion cannot be drawn

conclusively from this study. Improved community services which include variables that community leaders can readily change do not appear to improve the community's ability to enhance manufacturing expansion. Hence, from this analysis it is concluded that community leaders can influence the employment expansion of plants in the community very little by manipulating community variables. More direct input into the internal decision of the firm may have more influence on the management decision to expand employment once the community has provided a minimal level of community services.

IV. LIMITATIONS OF THE STUDY

Although a conclusive policy direction for community leaders to follow in enhancing plant employment expansion was not provided, some insight has been gained concerning the relationship between community characteristics and manufacturing plant growth. This study lacked a firm growth theory to follow in order to examine the relationship between community characteristics and manufacturing plant growth. In order to isolate the desired relationship, an analytical model was developed from review of plant location theory and more recent plant location studies. Further empirical testing and possible refinement of the analytical model used in this study might provide an improved general plant expansion model.

With the analytical model specified, variables were selected for inclusion in the statistical model. The economic variables were included by two-digit SIC code. The aggregation of plants from a seven digit SIC to a two-digit SIC perhaps does not combine homogeneous groups

of plants. That is, a plant producing undergarments in SIC 23 (apparel) and related products) may not have a demand, wage, or material cost structure like a plant with the same two-digit SIC producing overcoats. Thus, generalizations about demand and production cost by two-digit SIC may have weakened the explanatory power of the model. In order to overcome weakness in the statistical model due to aggression by two-digit SIC, it would be necessary to disaggregate the plants into a more specific SIC group such as a 4 through 7 SIC code. Such a disaggregation would require more observations in order to allow statistical testing. A more conclusive policy direction could possibly be provided if the number of observations were increased to allow stratification of observations by SIC code.

The community characteristics were included in the model as an index. The indices of community characteristics developed are subjective in that a name is assigned the factors based on patterns identified in the data matrix. An effort was made to minimize subjectivity by naming factors according to the variables loading greater than .40 on the extracted factors.

Data on the manufacturing plant employment at branch locations were not considered in this analysis when reported by a single firm to the Tennessee Department of Employment Security for all plants in the firm. In order to avoid bias from this source, the levels of employment obtained from the Department of Employment Security were compared with the 1973 Directory of Manufacturers. When plant employment was for a firm rather than a single plant, the observation was omitted. Thus, the information on changes in manufacturing plant employment may

not be complete for all communities included in the study.

The weak explanation of employment changes in the models associated with the large standard deviations of the mean of the dependent variables cannot be conclusively clarified in this analysis. However, the large standard deviations are possibly the result of including both large and small plants in the same analytical model. Quite likely the employment expansion patterns of large and small firms will differ because of the variation in size of initial investment in the plant and equipment. That is, the larger manufacturing plants may be less flexible in the employment expansion possibilities than are the smaller plants due to the larger capital investment in plants and equipment.

V. RECOMMENDATIONS FOR FURTHER RESEARCH

Further research in the area of manufacturing plant growth is required before conclusive policy recommendations can be provided concerning actions community leaders can take to enhance employment expansion. Without some estimate of potential for employment growth in the existing plants in rural communities, it is difficult to evaluate the effectiveness of local leaders in enhancing manufacturing plant growth in the community. Thus, to provide a more complete evaluation of how successful a community is at enhancing plant growth, a method for establishing a community's potential for manufacturing plant employment is required.

Additional research is also needed to determine the return on the investment made by communities to attract and retain a manufacturing plant.

That is, the investment in capital and other costs, such as polluted air or water, may be greater than the benefits the community receives from the increased manufacturing employment. Generalizations about the benefits and cost to the community are often difficult because of multipliers on the benefits side and long-term social cost on the cost side. It is further suggested that the community's particular socioeconomic situation will influence the cost and benefits accruing to each.

There seems to exist a further need to determine whether a community should attempt to attract a manufacturing plant. All the rural communities of the state should not expect to attract a manufacturing plant. Thus, investment in an industrial board or other such activities may prove fruitless for some communities. In any event, it seems that community leaders may need assistance in mapping a course for the community to provide jobs and keep the community economically viable. Additional research can provide community leaders with an idea of how resources in their particular community can be utilized most effectively. Finally, research on the internal decision-making process of the firm might provide some insight for community leaders as to how they can enhance manufacturing plant growth.

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APPENDICES

APPENDIX A

Table 23. Number of New Manufacturing Plant Locations 1967 Through 1973 in Rural Tennessee Communities by Standard Industrial Classification Code (SIC)

SIC	Year							Total Locations
	1967	1968	1969	1970	1971	1972	1973	
	Number of Plants							
20	--	2	--	1	--	4	1	8
21	--	--	--	--	--	--	--	--
22	1	5	2	1	3	--	7	19
23	13	5	2	3	8	7	5	43
24	1	4	3	3	6	7	7	31
25	5	1	6	4	3	3	2	24
26	--	1	3	3	3	2	2	14
27	--	--	--	--	--	--	2	2
28	1	3	--	4	--	2	--	10
29	--	--	--	--	--	--	1	1
30	2	--	2	2	2	5	4	17
31	--	1	2	--	--	--	--	3
32	--	1	1	1	1	--	1	5
33	2	--	3	2	--	3	1	11
34	4	2	3	4	4	5	5	27
35	8	1	4	5	3	6	1	28
36	4	1	1	2	2	5	2	17
37	4	1	2	3	3	7	3	23
38	--	1	--	--	1	1	2	5
39	2	--	2	3	--	1	--	8
Total	47	29	36	41	39	58	46	296
Average number of plant locations								42.28

Table 24. Employment Created by the Location of New Manufacturing Plants in Rural Communities of Tennessee 1967 Through 1973 by Standard Industrial Classification Code (SIC)

SIC	Year							Total Locational Employment
	1967	1968	1969	1970	1971	1972	1973	
	Employment							
20	--	23	--	396	--	180	7	606
21	--	--	--	--	--	--	--	--
22	4	156	929	419	130	--	244	1,882
23	2,046	233	22	158	959	670	497	4,585
24	1	49	36	60	64	129	106	445
25	152	3	548	68	55	5	35	866
26	--	28	42	326	25	26	56	503
27	--	--	--	--	--	--	100	100
28	719	12	--	57	--	48	--	836
29	--	--	--	--	--	--	3	3
30	61	--	37	1,316	103	348	20	1,885
31	--	333	35	--	--	--	--	368
32	--	7	5	2	31	--	4	49
33	350	--	19	42	--	13	17	441
34	76	44	14	10	545	18	100	807
35	740	2	86	39	604	79	9	1,559
36	671	1,181	3	79	116	186	2,264	4,500
37	89	6	57	67	39	81	32	371
38	--	7	--	--	37	1	15	60
39	24	--	67	180	--	1	--	272
Total	4,933	2,084	1,900	3,219	2,708	1,759	3,515	20,138
Average employment created by location								2,876.85

Table 25. Number of Manufacturing Plant Expansions of Plants that Initiated Operations During 1967 Through 1973 in Rural Tennessee Communities by Standard Industrial Classification Code (SIC)

SIC	Year							Total Plant Expansions
	1967	1968	1969	1970	1971	1972	1973	
	Number of Plants							
20	--	--	1	--	--	2	2	5
21	--	--	--	--	--	--	--	--
22	--	1	6	5	5	6	5	28
23	--	9	8	12	11	20	17	77
24	--	1	4	5	6	10	12	38
25	--	4	5	7	8	8	6	38
26	--	--	1	3	6	10	9	29
27	--	--	--	--	--	--	--	--
28	--	1	4	--	6	4	6	21
29	--	--	--	--	--	--	--	--
30	--	1	1	2	1	6	6	17
31	--	1	1	1	1	1	1	6
32	--	--	1	2	3	3	2	11
33	--	2	2	4	5	7	9	29
34	--	2	4	7	12	13	12	50
35	--	8	8	11	8	10	15	60
36	--	4	3	6	6	7	11	37
37	--	4	3	3	5	6	8	29
38	--	--	1	--	--	1	1	3
39	--	2	2	2	4	3	3	16
Total	--	40	55	70	87	117	125	494
Average number plant expansions								70.57

Table 26. Employment Created by the Expansion of Manufacturing Plants that Located in Rural Communities of Tennessee 1967 through 1973 by Standard Industrial Classification Code (SIC)

SIC	Year 1967	1968	1969	1970	1971	1972	1973	Total Expansion Employment
	Employment							
20	--	--	10	--	--	37	7	54
21	--	--	--	--	--	--	--	--
22	--	2	367	283	93	349	196	1,290
23	--	294	368	243	472	536	781	2,694
24	--	8	46	37	191	257	249	788
25	--	171	50	380	149	277	340	1,367
26	--	--	9	95	189	162	195	650
27	--	--	--	--	--	--	--	--
28	--	195	144	--	50	54	138	581
29	--	--	--	--	--	--	--	--
30	--	15	14	36	103	186	247	601
31	--	--	24	5	140	3	9	181
32	--	--	3	5	6	39	32	85
33	--	110	73	89	121	167	159	719
34	--	122	92	156	225	644	433	1,672
35	--	528	249	180	146	364	651	2,118
36	--	277	221	1,250	562	360	936	3,606
37	--	114	66	58	104	163	132	637
38	--	--	4	--	--	12	1	17
39	--	279	66	24	359	62	115	905
Total	--	2,115	1,806	2,841	2,910	3,672	4,621	17,965
Average employment created by plant expansions								2,566.42

Table 27. Number of Manufacturing Plants Discontinuing Operations of Plants that Initiated Operations During 1967 Through 1973 in Rural Tennessee Communities by Standard Industrial Classification Code (SIC)

SIC	Year							Total Plant Closings
	1967	1968	1969	1970	1971	1972	1973	
	Number of Plants							
20	--	--	--	1	--	--	2	3
21	--	--	--	--	--	--	--	--
22	--	--	--	1	--	1	1	3
23	--	--	1	1	2	1	3	8
24	--	--	--	--	1	3	1	5
25	--	--	1	1	3	3	1	9
26	--	--	--	--	--	--	1	1
27	--	--	--	--	--	--	--	--
28	--	--	--	--	1	--	2	3
29	--	--	--	--	--	--	--	--
30	--	--	--	1	1	--	--	2
31	--	--	--	--	1	--	--	1
32	--	--	--	--	--	--	--	--
33	--	--	--	--	--	--	--	--
34	--	1	--	--	--	--	--	1
35	--	--	--	--	--	4	4	8
36	--	--	--	--	1	--	1	2
37	--	--	--	1	3	2	1	7
38	--	--	--	--	1	--	--	1
39	--	--	--	--	1	--	1	2
Total	--	1	2	6	15	14	18	56
Average number of plant closings								8.00

Table 28. Number of Employees Released Due to Closing of Manufacturing Plants which Located in Rural Tennessee Communities 1967 Through 1973

SIC	Year							Total Employees Released
	1967	1968	1969	1970	1971	1972	1973	
	Employment							
20	--	0	0	16	0	0	2	18
21	--	0	0	0	0	0	0	--
22	--	0	0	46	0	4	59	109
23	--	0	68	37	71	47	132	355
24	--	0	0	0	14	25	24	63
25	--	0	105	6	142	190	7	450
26	--	0	0	0	0	0	212	212
27	--	0	0	0	0	0	0	--
28	--	0	0	0	2	0	7	9
29	--	0	0	0	0	0	0	--
30	--	0	0	6	762	0	0	768
31	--	0	0	0	22	0	0	22
32	--	0	0	0	0	0	0	--
33	--	0	0	0	0	0	0	--
34	--	15	0	0	0	0	0	15
35	--	0	0	0	0	18	4	22
36	--	0	0	0	95	0	75	170
37	--	0	0	2	68	24	1	95
38	--	0	0	0	2	0	0	2
39	--	0	0	0	36	0	1	37
Total	--	15	173	113	1,214	308	524	2,347

Table 29. Number of Decreases in Employment in Manufacturing Plants that Located in Rural Tennessee Communities 1967 Through 1973

SIC	Year							Total Number of Declines
	1967	1968	1969	1970	1971	1972	1973	
	Number of Plants							
20	--	--	1	--	2	--	2	5
21	--	--	--	--	--	--	--	--
22	--	--	--	2	3	4	4	13
23	--	3	8	5	6	4	11	37
24	--	--	--	3	3	2	5	13
25	--	1	--	3	2	2	2	10
26	--	--	--	1	1	--	2	4
27	--	--	--	--	--	--	--	--
28	--	--	--	3	1	3	--	7
29	--	--	--	--	--	--	--	--
30	--	--	--	1	3	--	5	9
31	--	--	--	2	--	1	1	4
32	--	--	--	--	--	1	2	3
33	--	--	--	1	2	--	1	4
34	--	--	1	--	--	2	6	9
35	--	--	--	1	9	4	3	17
36	--	--	2	--	1	2	--	5
37	--	--	2	3	1	1	5	12
38	--	--	--	1	--	--	1	2
39	--	--	--	2	2	3	3	10
Total	--	4	14	28	36	29	53	164

Table 30. Decreases in Employment in Manufacturing Plants that Located in Rural Tennessee Communities 1967 Through 1973

SIC	Year							Total Employees Lost by Declines
	1967	1968	1969	1970	1971	1972	1973	
	Employment							
20	--	0	2	0	7	0	29	38
21	--	0	0	0	0	0	0	--
22	--	0	0	32	628	360	279	1,299
23	--	426	887	51	77	147	247	1,835
24	--	0	0	33	57	16	36	142
25	--	6	0	10	165	24	7	206
26	--	0	0	4	4	0	3	11
27	--	0	0	0	0	0	0	--
28	--	0	0	174	82	169	0	425
29	--	0	0	0	0	0	0	--
30	--	0	0	37	15	36	48	136
31	--	0	0	163	0	5	5	173
32	--	0	0	0	0	1	5	6
33	--	0	0	7	12	0	2	21
34	--	0	22	0	0	60	113	195
35	--	32	0	4	146	39	66	287
36	--	0	298	0	344	24	0	666
37	--	0	24	79	6	9	37	155
38	--	0	0	9	0	0	1	10
39	--	0	0	22	11	66	6	105
Total	--	458	1,233	625	1,554	956	884	5,710

APPENDIX B

Table 31. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Unrotated Factor Matrix[a]

Variable Number	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
1	0.739	0.504	-0.128	0.129	0.330	0.941
2	0.497	-0.348	-0.015	0.228	-0.126	0.436
3	0.814	-0.336	-0.305	0.001	-0.059	0.872
4	0.837	-0.214	0.150	0.035	-0.016	0.771
5	0.514	0.010	0.214	-0.116	-0.426	0.505
6	-0.653	0.093	-0.351	0.323	-0.103	0.674
7	0.352	0.080	0.556	0.007	-0.127	0.456
8	0.763	-0.280	0.056	-0.103	0.133	0.692
9	0.287	-0.090	0.193	0.396	-0.067	0.289
10	-0.288	0.137	0.617	0.059	0.186	0.521
11	0.204	0.071	-0.029	0.221	0.231	0.150
12	0.553	0.228	-0.033	0.109	0.080	0.377
13	0.340	-0.280	-0.071	0.215	-0.062	0.249
14	-0.202	0.187	0.588	0.005	-0.295	0.508
15	-0.117	-0.138	0.469	0.260	0.254	0.385
16	0.090	-0.008	0.130	-0.072	0.232	0.084
17	-0.334	-0.090	0.315	0.047	-0.216	0.268
18	0.854	-0.341	-0.008	-0.017	-0.213	0.891
19	0.782	-0.318	-0.088	0.115	-0.029	0.735
20	0.908	-0.271	-0.001	-0.049	-0.088	0.908
21	-0.606	-0.514	-0.023	-0.029	-0.032	0.634
22	0.618	0.445	0.019	0.145	-0.064	0.606
23	0.624	0.380	-0.091	0.024	0.135	0.561
24	0.418	0.573	0.072	0.036	-0.159	0.535
25	0.403	0.545	-0.101	-0.002	-0.194	0.507
26	0.304	0.492	-0.087	-0.083	0.012	0.350
27	-0.269	-0.075	-0.091	0.568	-0.017	0.410
28	-0.033	-0.030	-0.097	0.616	0.043	0.393
29	0.612	-0.208	0.317	-0.079	0.235	0.580
30	0.152	-0.193	0.206	-0.142	0.438	0.315
31	-0.053	0.077	0.432	0.234	-0.051	0.252

[a]Initial factors were extracted by classical or common factor analysis method.

Table 32. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Total and Common Variance Explained and Eigenvalues

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Percent of total variance	27.62	8.74	6.79	4.42	3.55
Cumulative percent of total variance	27.62	36.36	43.15	47.57	51.12
Percent common variance	54.44	17.09	13.29	8.64	6.94
Eigenvalues	8.563	2.709	2.107	1.371	1.101

Table 33. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Content and Identification of Factor 1 (Name: Labor Availability and Quality)[a]

Variable Number	Factor Loading	Content of Variable
2	.638	Payments in the county under the state employment insurance program, 1969
3	.828	Population density in the county, 1970
4	.798	Percent urban population in the county, 1970
5	.504	Population in contiguous counties, 1970
6	-.532	Relative economic utilization of manpower in the county, 1970
8	.720	Percent of persons 25 years and older with a high school education in the county, 1970
13	.456	Percent unskilled labor in the county, 1970
18	.913	Manufacturing employment in the county, 1970
19	.809	Number of manufacturing plants in the county, 1970
20	.885	Employment in wholesale and retail trade in the county, 1970
29	.553	Physicians per 1,000 persons in the county, 1970

[a]Includes variables loading at .400 or greater after varimax rotation.

Table 34. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Content and Identification of Factor 2 (Name: Community Services)[a]

Variable Number	Factor Loading	Content of Variable
1	.861	Community population, 1970
12	.513	Presence of a senior or community college in community, 1970; none = 0, senion = 1, community or private = 2
21	-.766	Municipal fire rating of the community, 1970
22	.721	Gallons per day of excess water service available in the community
23	.677	Gallons per day of excess sewage service available in the community
24	.697	Dollar amount of general obligation bonds issued for municipal financing of manufacturing plants in the community, 1955-1973
25	.673	Dollar amount of revenue bond financing of manufacturing plants in the community, 1951-1973
26	.575	Industrial park in the community with five or more plants, 1970; yes = 1, no = 0

[a]Includes variables loading at .400 or greater after varimax rotation.

Table 35. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Content and Identification of Factor 3 (Unnamed)[a]

Variable Number	Factor Loading	Content of Variable
7	.532	Percent of females in the labor force of the county, 1970
10	.571	Median age of the population in the county, 1970
14	.671	Distance to the nearest Standard Metropolitan Statistical Area from the community
15	.403	Water transportation available in the county, 1970; yes = 1, no = 0
31	.474	Local government expenditure on health and hospitals per capita in county, 1971-1972

[a]Includes variables loading at .400 or greater after varimax rotation.

Table 36. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Content and Identification of Factor 4 (Unnamed)[a]

Variable Number	Factor Loading	Content of Variable
27	.581	Actual property tax rate in the county, 1970
28	.617	Police protection expenditure in the county per capita, 1971-1972

[a]Includes variables loading at .400 or greater after varimax rotation.

Table 37. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Content and Identification of Factor 4 (Name: Health Protection)[a]

Variable Number	Factor Loading	Content of Variable
29	.468	Physicians per 1,000 persons in the county, 1969
30	.538	Hospital beds per 1,000 persons in the county, 1971

[a]Includes variables loading at .400 or greater after varimax rotation.

Table 38. Factor Analysis of 31 Community Variables for 72 Rural Tennessee Communities: Factor Score Coefficients

Variable Number	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	-0.313	0.909	-0.432	0.616	0.901
2	-0.026	-0.064	0.066	0.101	-0.085
3	0.127	-0.092	-0.495	0.108	-0.123
4	0.230	0.018	0.095	0.200	0.054
5	-0.104	0.083	-0.026	-0.049	-0.076
6	0.034	0.016	-0.181	0.543	-0.140
7	0.032	0.165	0.081	0.202	0.227
8	0.101	-0.099	-0.151	0.170	0.110
9	-0.085	-0.010	0.126	0.107	-0.025
10	0.007	0.001	0.121	0.187	0.227
11	0.037	-0.055	0.010	0.008	-0.061
12	0.068	-0.138	0.089	-0.085	-0.153
13	-0.070	0.109	0.022	0.074	0.150
14	0.094	0.015	0.307	-0.155	-0.196
15	0.063	-0.051	0.123	0.062	0.155
16	0.017	-0.066	0.019	-0.041	-0.032
17	0.009	0.102	0.044	0.132	0.103
18	0.598	-0.335	0.316	-0.289	-0.591
19	0.046	0.030	-0.143	0.386	0.036
20	0.419	0.211	0.067	-0.247	0.257
21	-0.039	0.125	-0.192	0.267	0.394
22	-0.154	0.083	0.077	-0.032	-0.101
23	-0.014	0.124	-0.030	0.002	0.082
24	-0.015	0.212	0.089	0.094	-0.085
25	0.073	0.081	0.085	-0.159	-0.281
26	0.020	0.047	-0.035	-0.014	-0.033
27	0.118	-0.028	-0.033	0.305	-0.049
28	0.098	-0.006	0.125	0.178	-0.079
29	-0.132	-0.109	0.176	-0.184	0.277
30	0.009	-0.033	-0.041	0.004	0.176
31	0.045	-0.092	0.127	0.044	-0.167

VITA

Danny L. Gunter was born April 20, 1947 in McMinnville, Tennessee. He was graduated from DeKalb County High School in Smithville, Tennessee in May, 1964. The following September he entered Tennessee Technological University, Cookeville, Tennessee, and received a Bachelor of Science degree in Agriculture Economics in June 1968. During the same month he accepted an assistantship at the University of Georgia and began working toward a Master of Science degree in Agricultural Economics. In April 1969 he entered the United States Air Force. While on active military duty he received a Master of Science degree in Business Management from the University of Arkansas in March 1972. He was discharged from the Air Force in September 1972; during the same month he accepted an assistantship at the University of Tennessee and began working toward a Ph.D. degree in Agricultural Economics. In August 1975 he accepted a position as Assistant Professor of Agricultural Economics at the University of Florida. He is married to the former Lynda G. Mitchell of Nashville, Tennessee, and they have one daughter, Danielle Lyn.