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Variables affecting the distributive impact of employment in new manufacturing industry in rural Tennessee

Maurice R. Landes

To the Graduate Council:

I am submitting herewith a thesis written by Maurice R. Landes entitled "Variables affecting the distributive impact of employment in new manufacturing industry in rural Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Thomas H. Klindt, Major Professor

We have read this thesis and recommend its acceptance:

Robert H. Orr, Billy J. Trevena

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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We have read this thesis
and recommend its acceptance:

Billy J. Trevena

Robert W. Allen

Accepted for the Council:

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Vice Chancellor
Graduate Studies and Research

VARIABLES AFFECTING THE DISTRIBUTIVE IMPACT OF EMPLOYMENT IN NEW MANUFACTURING INDUSTRY IN RURAL TENNESSEE

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Maurice R. Landes

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ABSTRACT

This study utilizes primary data collected from a sample of new rural Tennessee manufacturing plants and employees to investigate the extent to which changes in the family and wage incomes of new employees are affected by individual, family, plant, and community characteristics. The sample data are also used to estimate the primary round impact of new manufacturing employment on the distribution of income and the alleviation of poverty in the sample counties.

Multiple regression analysis is used to identify the relationship between changes in family income resulting from employment in the sample plants and worker, family, plant, and community characteristics hypothesized to influence these changes. The most important variables are those measuring changes in the labor force participation of family members which coincide with employment in the sample plants. Gains in public assistance and other incomes, years of education, plant relative size, and plant relative wage levels have significant direct relationships with income changes, while losses of public assistance and other incomes, county rates of underemployment, return migrant status, and, unexpectedly, plant skill requirements have significant inverse relationships. Correlations with family labor force participation patterns are identified as explanations for the insignificance of worker age and sex and commuter and migrant status.

Multiple regression analysis is also used to explore the relationship between worker, plant, and community characteristics and changes

in employee annual wage earnings. Change in worker employment status at job entry is the most significant determinant of overall wage changes. Employee sex and years of education, change in family size, plant relative size and relative wage levels, plant skill requirements, county rates of unemployment and underemployment, and commuter and return migrant status are also significant determinants of changes in wage earnings. Variations in the degree to which workers are underemployed in previous jobs and in jobs in the sample plants are identified as a consistent explanation for the insignificance of some variables as well as the unexpected inverse relationship between plant skill requirements and income changes.

The primary round distributive impact of employment in new manufacturing plants is described by comparing the incomes of sample families before and after employment in the sample plants to the estimated distribution of family incomes in the sample counties. While the frequencies of families in the middle quintiles of the distribution increases after employment, relatively few of the families are in the lowest income quintile before employment. Local workers compete extensively for income gains with migrating and, especially, commuting workers. Employment in the sample plants enables most previously poor families to escape poverty, but the vast majority of sample families are not previously poor.

The results of the analysis indicate that factors affecting the participation of family members in the manufacturing work force and the underemployment of rural workers are key determinants of how new manufacturing industry changes incomes and the distribution of incomes in rural communities. The characteristics of new manufacturing plants appear to affect family labor force participation patterns and the opportunities rural workers have to become more fully employed.

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CHAPTER 1

INTRODUCTION

During the past 20 years, industrialization has been a prominent aspect of economic development in rural areas of Tennessee. During this period, rural manufacturing plant locations and employment have been increasing both in absolute terms and relative to urban areas of the state. Manufacturing income, as a component of total personal income, has also been increasing in rural areas through most of this period.[1]

This trend towards increasing industrial activity in rural areas carries many potential economic benefits for rural people and communities. Basic employment opportunities created by new plants can provide direct income benefits and can also form an economic basis for the continued growth of employment, personal income, and public revenues. The creation of employment opportunities in rural communities may also facilitate the development of human capital and help to prevent the loss of that human capital through migration.

Numerous case studies have demonstrated that the incidence of industrial locations and the economic impacts of industry are not uniform among rural communities. While some communities are successful in attracting, maintaining, and expanding industry, others are not. Different communities and industries seem to exhibit varying income and

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[1]Data describing these trends are provided in Appendix A.

employment leakage to nonlocal people as well as probable differences in the amount of income and job benefits accruing to the disadvantaged.

Research into the process of rural industrialization has focused on two general areas: identification of the factors affecting location and expansion decisions in rural areas and analysis of the size and distribution of industrial impacts on rural communities. The major concern of location research has been to measure the importance of various factors which influence firms to locate plants in specific communities. Research of this type has provided decision makers at various levels with information needed to assess the potential for industrial development in certain communities and to make efficient investment decisions to attract industry.

The second general focus for rural industrialization research has been description of the magnitude and distribution of industrial impacts and the identification and analysis of the factors which influence them. Most previous industrial impact research has concentrated on measuring the magnitude rather than the distribution of impacts. The objective of this type of research has been to help policy makers on various levels predict and plan for the changes caused by industrialization in a way consistent with community and regional goals.

The purpose of this study is to investigate the distribution of income and jobs resulting from the location of new industry in rural areas of Tennessee. The main objectives are to describe these distributive effects and to utilize a conceptual model to explain variations in them. The baseline hypothesis of the conceptual model is that employee, community, and industry characteristics interact to determine the distributive effects of new plant locations. The remainder of this chapter includes an examination of the theoretical underpinnings of research into distributive impact, description of a general framework for approaching the problem of industry impact on income distribution and a review of previous research. The chapter closes with a description of the research model employed in this study.

Need for Distributive Impact Research

The objective of the bulk of industrial impact research has been to develop aggregate measures of the effect of new and expanding industry on community income and employment using multiplier statistics. Garrison [8,9], Schaffer [29], and Rheinschmiedt [26] disaggregated the multipliers in order to assess the allocation of net economic impacts between public and private sectors. These measures have provided valuable information to community leaders concerning the generation of income and jobs within the community. As Smith [34] pointed out, it is important that these traditional measures of allocative efficiency, made more sensitive to variations caused by industry and community characteristics, remain as the core of economic impact analyses.

Justification for in-depth analysis of the distribution of income and employment among individuals is found by exploring the theories of industrial location and welfare maximization. The distribution of earned (as opposed to transfer) income is affected by modifying the distribution of factor earnings through redistribution of the ownership of factors of production, changing factor prices, or changing factor employment. Bator [1] showed that under purely competitive conditions and given an original configuration of factor allocation, the price system will serve to allocate factors of production and distribute products in an efficient manner. The allocation of utility among individuals resulting from the original configuration of factor allocation will, however, only coincidentally equal the optimal distribution of utility based on a given social welfare function.

The theories of industrial location developed by Weber [49], Isard [18], and Lösch [48] similarly hold that industries tend to locate and achieve efficiency according to the prices of their relevant resource and transportation inputs. It has been conventionally hypothesized that the location of new plants in rural areas of Tennessee has been due to the availability of relatively cheap labor, perceived qualitative advantages of rural labor, improved interstate highway transportation, and the growth of southern markets.

To the extent that the location of industry in rural areas is a response to economic factors in a purely competitive market, there is no reason to expect that the reallocation of resources (income and jobs) and utility which results is consistent with regional or national objectives. National, state, and local subsidization policies designed to attract industry to rural areas alter purely competitive conditions in the interest of reallocating resources and derived benefits (jobs and income) according to equity criteria. Therefore, examination of the distributive aspects of industrial locations, subsidized or not, is of value in assessing the extent to which industrial impacts are agreeing or conflicting with regional and national equity objectives.

The importance of including distributional goals in the formulation of development objectives has been suggested by a number of scholars. Gotsch [12] has argued that improved distribution of jobs and income will serve to bring more people into the mainstream of development. The importance of this notion is supported in Tweeten's liminal theory of development [43] which states that people who are left out of the mainstream of economic life develop attitudes that make their development even more difficult. The importance of the expansion of job opportunities is also supported by Schultz [32] in his discussion of investment in human capital. He argued that unemployment leads to deterioration of human capital due to impairment of acquired skills and that transfer payments do not prevent idleness from taking its toll on the unemployed.

The above arguments support the idea that the root of income distribution is in the distribution of jobs. If new industry can succeed in improving the distribution of jobs and income, it can facilitate a reduction in transfer payments and future development costs as well as a recovery of investment in human capital.

A further justification also suggests the value of studying the distribution issue at the community level. Improved knowledge of the income and job distributional aspects of industrial development and the community and industry characteristics which affect them may also serve to curb both the apprehensions of rural communities toward the impact of growth and their costs of adjustment. Various studies of sectoral impact, including those done by Schaffer [29] and Garrison [8,9], have indicated that new industry has not been generating expected tax "bonanzas" with which to finance solutions to adjustment problems.

While decisions made at the community level in the interest of equity may not be defensible from the standpoint of efficiency in larger units of analysis, such decisions may still be justifiable. The community level is often the decision level in industrialization programs. Communities often bear the burdens of poverty as well as the costs and benefits of industrial impact. Furthermore, regional and national policies designed to redistribute incomes have yielded little progress; a fact which may indicate the need to deal with the problem at the local level.

Studies designed to measure sectoral income and employment effects have invariably determined that the bulk of direct and secondary effects are in the private sector. Multiplier statistics and other aggregate measures do not provide planners and decision makers with comprehensive measures of private sector adjustments. A logical extension of these findings is to examine the distribution of employment opportunities and income within the private sector.

A Theoretical Construct of Distributive Impact

Theoretical work attempting to explain the nature of industrial impact on the personal distribution of income within communities has been limited. The bulk of income distribution theory relates to the national aggregate rather than the community. It focuses on describing relationships between the spatial and personal distribution of investments in human capital and economic overhead capital and the spatial and personal distribution of income.

A conceptual framework which deals with the particulars of industry-community interactions on a more microcosmic level is needed for this study. Such a dynamic conceptual framework has been suggested by Carl Gotsch [11]. His framework was originally formulated to analyze the distributive impacts of new agricultural technology on rural areas but seems appropriate for approaching the problem at hand. The first element of Gotsch's system is the nature of the new industry, while the latter three elements concern the social relationships of production.

Characteristics of the Industry

The key industry characteristics bearing on distributive impact, in Gotsch's analysis, are efficiency in terms of value added, factor intensities, and the nature of forward and backward linkages into the local economy. With regard to value added, different industries require differing types and degrees of labor skills and afford differing returns to labor. As a result, firms will exhibit varying degrees of selectivity in hiring practices and will be attractive as sources of employment to people of different income classes.

In terms of factor intensities, an industry can be classified as either neutral or non-neutral in relation to prevailing community norms. Neutral industries maintain present capital labor ratios, while non-neutral industries alter the ratio by being either capital or labor using. With constant factor prices the functional distribution of income in the community will be shifted toward capital owners by capital-using industry or toward labor by labor-using industry. The influence of changes in functional distribution on personal distribution depends on the allocation of labor and capital ownership as productive assets among the income classes of the population under study.

Estimation of the distributive effects of an industry also requires detailed analysis of its forward and backward linkages into the community. An industry estimated to have an unfavorable impact in terms of the previous characteristics may have a net favorable impact resulting from its use of local resources or marketing channels.

Absolute Magnitude and Relative Distribution of Productive Assets

The relevant community assets in terms of impact analyses are those deemed productive by the industry under study through both direct and secondary effects. The absolute quantities of local productive assets, such as labor and capital, determine the extent to which local rather than imported assets are used in local production.

The ownership pattern of such assets as land, capital, labor, and entrepreneurial skills will have a strong bearing on who in the community, and outside it, may benefit from industrial development. Proprietors, landowners, skilled, and unskilled labor can all be expected to benefit differently.

Type and Distribution of Institutional Services

The types of institutional services available and their accessibility through existing markets and other units of social organization in a rural community will influence distributive impact. The accessibility of new jobs to various categories of workers in the local labor market can be expected to vary with the socioeconomic factors affecting the composition of labor supply and the composition of demand for labor skills in the industrial sector.

The availability of capital through local capital markets and organizations and the ability of various groups to gain access to those sources can influence the degree to which entrepreneurial groups, both local and nonlocal, participate in the ownership and the returns to capital stemming from industrial development. Also, the availability and quality of educational opportunities in the county can influence the quality of local labor relative to imported labor.

Social Customs and Traditions and the Local Power Structure

An understanding of the social framework in which personal, family, and group decisions are made in a rural community is crucial in assessing the abilities of various individuals, groups, and classes to organize in their own self-interest. The distribution of political authority in a community can be expected to be closely allied with the distribution of traditionally productive assets, existing institutional services, and income. In the short run, changes in the relative economic potential of certain groups may have little effect on the traditions of political authority, while in the long run, one might expect alterations of the traditional configuration in favor of the gaining groups.

Dynamics of the System

An important aspect of Gotsch's framework is that it recognizes the dynamic interactions of technological, economic, institutional, and political variables within a community. These interactions result in a cumulative effect on the distribution of income. There are several feedback loops within the system which emphasize these dynamics and provide additional analytical insight (see Figure 1). The first three loops are suggested by Gotsch, while the fourth has been added in adapting the model to the study of industrial impacts.

1. The distribution of productive assets and the disposition of political authority will interact to determine where capital is accumulated.

2. As income and power distributions change, the availability and distribution of institutional services may also change to meet the needs of the gaining parties.

3. In the long run, new industry and changes in asset distribution may influence cultural traditions and the nature of political authority. The dotted line in Figure 1 indicates that there may be significant lags in this process.

4. The availability and distribution of productive assets and institutional services as well as the holders of political power may influence the characteristics of those industries which are attracted to the community.

Gotsch provides a framework that may be helpful in designing research concerned with explaining the nature of the distributive impacts

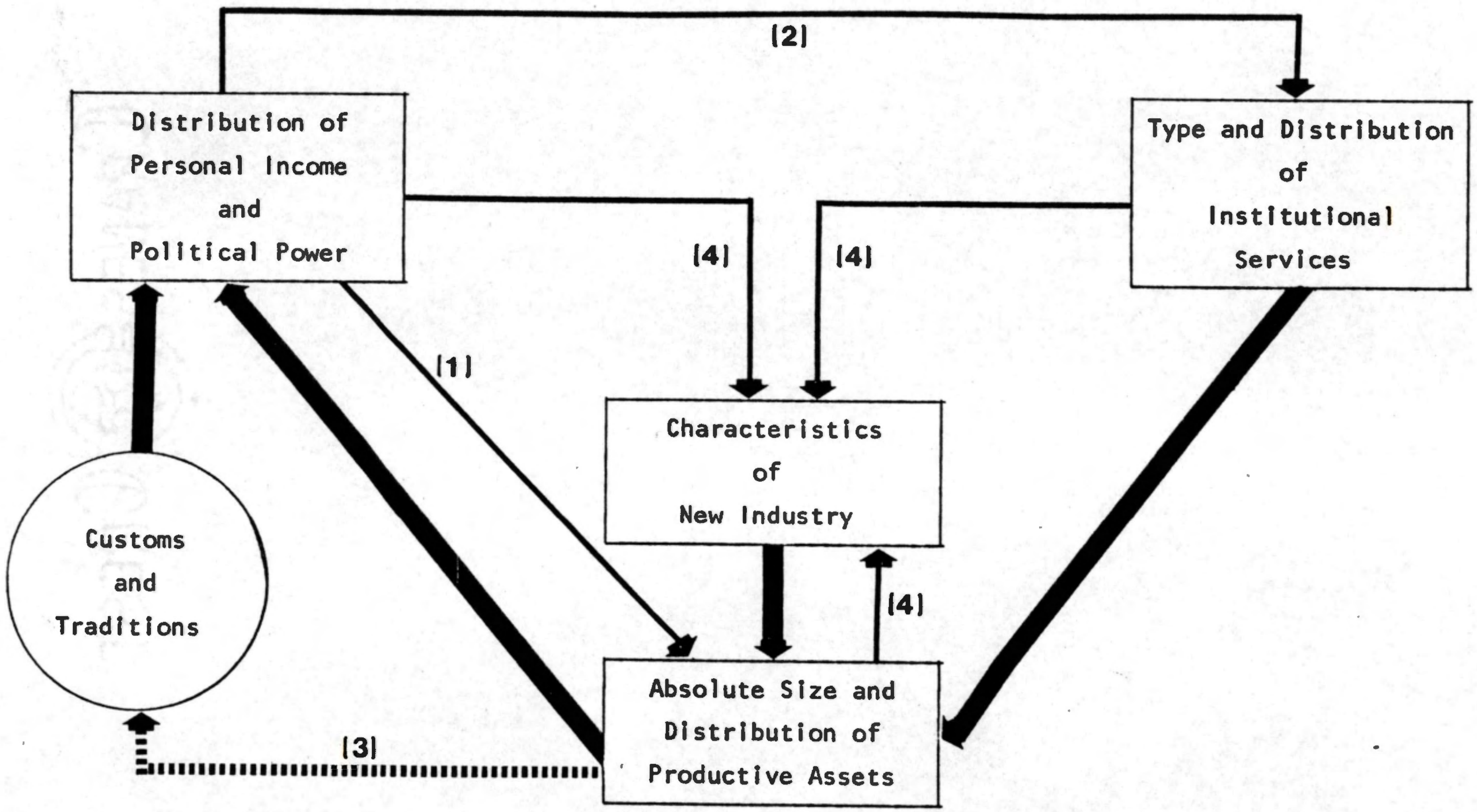

Figure 1. Flow diagram of factors influencing the distributive impact of new industry in rural areas.

of rural industrialization. His model suggests that such research must include variables which attempt to capture a broad range of technical, political, social, and economic characteristics of industries and communities if it is to adequately explain cumulative distributive effects. Gotsch's framework is used as a tool for analyzing the available literature on distributive impact and as a guide for building the research model used in this study.

Review of Empirical Research on Distributive Impact

All of the studies reviewed utilized case study methodologies and focused on the description of distributive effects rather than the evaluation of hypotheses set forth in a model of distributive impact. While the results of these studies are not generalizable beyond their respective study areas, they are useful in identifying key relationships which need future study.

In a study of four contiguous rural Oklahoma counties, Schaffer [30] used decennial census data to measure the total (direct and secondary) changes in income distribution and sources of income over a period of marked industrial development in the area (1960-70). The change in the share of personal income accruing to labor ranged from a 4.3% loss in one county to an 11.4% gain in another. The income share for proprietors declined, and the share for property owners increased in all four counties. Personal income distribution, measured by Gini coefficients, moved toward equality in all four counties during the period, but there was considerable variation in the magnitude of the changes. Likewise, there was considerable variation in the change in relative mean income by quartiles across the four counties. Schaffer did not analyze variations in the incidence of poverty in the four counties over the study period.

Schaffer did not endeavor to explain the differences in distributive changes. But the descriptive statistics provided reveal variations in population, labor force size, degree of industrial development, and unemployment rates between the four counties. Schaffer indicated variations in the composition of the industrial sectors in the four counties. These factors would likely influence the degree of competition between migrant and local, skilled and unskilled, poor and nonpoor workers for new jobs and income.

Interpretation of Schaffer's results is somewhat hampered by the methodology employed. The use of census data introduces three problems: First, it necessitates analysis over a 10-year period which does not exactly coincide with the periods of industrial development in the four counties; second, it does not enable disaggregation of the relative income benefits to local people as compared to migrating and commuting workers; and third, while the statistics encompass both direct and secondary round effects, which no other study does, it is not possible to discern exactly which distributional changes were due to new industry and which were due to other developments in the county, state, and national economies.

Rheinschmiedt [26] in a study of nine industrial locations in six rural Texas counties analyzed direct distributional impact using primary data describing the pre-employment and post-employment incomes of workers. In this sample, overall post-employment incomes were 63% higher than in the pre-employment period. Forty percent of the employees experienced increases in their annual income with their new job, 11% experienced no change, and 13% experienced annual income decreases. Thirty-six percent of the workers were previously unemployed. Pre-employment incomes were adjusted for estimated wage gains had workers remained in their previous jobs but not for inflation. Gini coefficients calculated for the two periods indicated a slight trend toward equality among those hired by the new plants. Relative mean income analysis showed that the lowest and highest quintiles increased their wage income shares, while the shares of the three middle quintiles decreased.

Rheinschmiedt's analysis focuses on distributive changes in employee wage incomes, not family incomes. This fact prevents assessment of the changing roles of other family income earners and other income sources on family incomes. It also prevents assessment of changes in family well-being and the incidence of poverty due to industrial development. Rheinschmiedt's methodology is capable of capturing direct impacts but not secondary impacts of industrial development. Failure to differentiate between those employees of local origin and those who are commuters and migrants prevents accurate estimation of even direct industrial impact on income distribution within the communities studied. One further limitation of the study is that Rheinschmiedt does not investigate possible variations in distributive impact across community or industry types, though his method of study would have permitted it.

Kuehn et al. [21] used primary data collected from employees of new and expanded plants in four developing multicounty areas to study the extent to which poor persons and their household members benefited from industrial employment opportunities.[2] The results revealed varying degrees of competition between residents, migrants, and return migrants for new jobs in the four areas (Table 1). Overall, 25% of the employees escaped poverty with their new jobs, and 22% of those employed were local residents escaping poverty. There were significant variations in the percentages of previously poor hirees in the four areas.

Kuehn suggested that the variations in the distribution of benefits might be explained by variations in the degree of unemployment, underemployment, and nonfarm development between the study areas. As can be seen from Table 1, the percentages of previously poor hirees display a direct relationship with the degree of unemployment and underemployment and an inverse relationship with the degree of nonfarm development. The same explanatory variables do not seem to explain variations in the extent of migrant-local competition for jobs. Kuehn did not attempt to explain the effects of industry characteristics on job development.

The methodology used in the Kuehn study has several limitations which were duly noted by the authors. First, secondary effects on job development were not measured. Therefore, the effects on job development

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[2]The four study areas were the four corners area of Arizona, Southern Appalachia, the Central Ozarks, and the Mississippi Delta in Arkansas.

Table 1. Selected Work Force and Study Area Characteristics Associated with New Plant Locations in Four Developing Areas Studied by Kuehn et al.

Study Area	% of Total Previously Poor	% Residents Previously Poor	% Residents	% Migrants and Return Migrants	Level of Unemployment and Underemployment	Level of Industrial Development
Delta	48.1	45.8	91.9	8.1	HIGH	LOW
Arizona	49.1	32.4	74.7	24.0	HIGH	LOW
Appalachia	18.6	16.9	80.9	18.1	LOW	HIGH
Ozarks	19.8	14.5	67.3	31.5	LOW	HIGH

Source: John A. Kuehn et al., Impact of Job Development on Poverty in Four Developing Areas, 1970, Agricultural Economic Report No. 225, Washington, D.C., USDA-ERS, 1972.

due to the refilling of vacated jobs were missed. Second, the study regions were selected because of their high incidence of poverty. The same amount of poverty impact may not be forthcoming from industrialization in more developed areas. Third, an expanding or contracting national economy may affect the hiring practices of new firms. A further analytical shortcoming is that although the study revealed an extensive commuting radius for the firms studied it did not assess the relative benefits accruing to commuting as well as migrant and local labor.

Miernyk [22] pooled data on work force characteristics of several plants, rural and nonrural, in order to distinguish the differences in direct labor market effects between subsidized and market-induced plant locations. The study revealed that the plants tended to draw from 6 to 30 times more job applications than required to fill available positions leading to high levels of competition for available openings and selective hiring practices on the part of the plants. Both groups of plants tended to hire work forces with a lower average age and higher average education than those in the county as a whole. While the data did not differentiate between migrant and local workers, Miernyk pointed out that the relative mobility of young, more educated workers indicate possibly significant migrant-local competition for jobs.

Miernyk found that both groups of plants tended to have more impact on the number of persons employed in the local economy than on the number of unemployed. It was suggested that this was due to labor force entry in the local economy, in-migration, and job transfers which increased the local labor supply, as well as selective hiring practices on the part of firms which kept certain groups of local people unemployed. The subsidized plants had the greater impact on the number of unemployed. The data, summarized in Table 2, indicate significant variations both within the market-induced group and between the two groups.

Miernyk's study focused on the description of differences in labor market effects based on the reason for plant location (subsidization or market inducement) and did not attempt to explain variations in employment impact on the basis of community and industry characteristics. But there are some strong suggestions of industry-community interactions in the data presented. Miernyk stated that the loan provisions of the subsidized plants required that they locate in areas where the unemployment rate was above, or the median family income was "well" below, the national average. These factors could explain the relatively high ratio of previously unemployed workers and new labor force entrants to previously employed hirees in subsidized plants. The characteristics of the labor markets in which the market-induced locations occurred cannot be assessed from the data reported. Miernyk did cite the need for research into the dynamics of local labor markets and hypothesized that tighter markets might lead to more new entrants and in-migrants.

The data in the Miernyk study indicate that industry characteristics may have had a bearing on the composition of hirees. Employment in the subsidized firms was much smaller than in the market-induced firms. Smaller firms may have less attraction for previously employed and migrating workers. Over half of the employees in the subsidized

Table 2. Pre-Employment Status of Hirees in Market-Induced and Subsidized Plants Studied by Miernyk

Case	% Workers Previously Employed	% Workers Previously Unemployed	% Workers Previously Not in Labor Force	No. Total Workers
Market-induced				
Michigan Motor Vehicle Parts	51	35	14	466
Ravenswood Aluminum	86	11	3	894
Mt. Airy Appliances	45	8	47	435
Total market-induced	67	16	17	1,775
Subsidized				
33 plants	35	43	22	1,262

Source: William H. Miernyk, "Local Labor Market Effects of New Plant Locations," in Karaska and Braunhall (eds.), Location Analysis for Manufacturing (Cambridge: M.I.T. Press, 1969), p. 181.

firms were women. Information on the sex of employees was not provided for the market-induced plants, but judging from the type of industries included in that group, it seems unlikely that as many women would be hired. Motor vehicle parts, appliance and aluminum manufacturing are not the types of industries which would be expected to hire predominately female work forces. Plants hiring predominately women generally require fewer skills and pay lower wages than those hiring men. If the plants in the subsidized sample were, in fact, lower wage and skill firms than those in the market-induced sample, then this may have made the subsidized plants as a group less attractive to previously employed workers and migrant workers. The data for the subsidized sample indicate higher geographic mobility for higher skilled and younger workers. This suggests that higher skill firms may tend to employ a higher percentage of in-migrants and previously employed workers and a lower percentage of local and previously unemployed workers than lower skill firms.

Miernyk also cited the need for research into the dynamics of firm skill requirements and worker skill mobility. He suggested that plant hiring requirements may change as the plant moves from start-up to full operation and that the degree of worker skill mobility, both within a firm and between firms, may also change with the availability of skilled labor within the local labor market.

None of the studies reviewed attempted to study distributive impacts of new industry using a broad, dynamic framework, such as that suggested by Gotsch. The data presented in each of the studies, however, suggest the role of industry and community characteristics in explaining variations in distributive effects. Each of the studies had methodological problems which hindered comprehensive measurement of distribution and poverty impacts. Schaffer's approach provided imprecise measurement of direct and secondary effects, while Rheinschmiedt, Kuehn, and Miernyk measured only direct impacts. Only Schaffer and Kuehn measured changes in family income. Each of the studies reviewed employed case study approaches which prevent generalization of results beyond their respective study areas.

Limiting the Scope of Analysis

Gotsch's analytical framework suggests the need for broad-based, multidisciplinary inquiry into the cumulative distributive impacts of new industry. For the purpose of this study, however, Gotsch's approach is scaled down in several ways. First, no attempt is made in this study to measure secondary round effects of new manufacturing locations. Despite the significance attributed to secondary round effects in influencing distributive impacts by Gotsch, Bryant, and Smith, among others, these effects are not analyzed because of the obvious difficulty of identifying and obtaining data from those firms and workers gaining employment or increasing earnings due to all secondary round effects of plant locations.

Second, this study focuses on the key economic interactions between families, industries, and communities affecting the distribution of jobs and incomes. Political and social aspects of communities are eliminated from the analysis, as they have been from previous studies, due to the conceptual, methodological, and data problems they create. While it is recognized that political and social limitations and potentials for community members to influence distributive impacts are important and probably vary significantly across the projected study area, they are beyond the scope of this study.

Third, this study focuses on those industry and community characteristics which influence wage and salary incomes since these constitute the major component of personal incomes in rural areas of Tennessee. The objective function of this study implies an examination of change in family income due to employment in a new manufacturing plant. Other family resource earnings and transfer payments are included as components of family income, but no attempt is made to explain variations in them. Explanation of variations in these types of income create methodological and data problems, and their change can probably be accurately monitored only after relatively long time periods.

Although it is recognized that new industrial development has significantly influenced the incomes of proprietors, property owners, and entrepreneurs in rural areas of the state, omission of these types of income should not drastically impair the accuracy of the results. This study is based on the hypothesis that new industry in rural areas is primarily oriented toward rural labor rather than other factors of production. Therefore, limiting the study to measurement of returns to labor should capture the bulk of short-run effects. Omission of industrial impacts on income from land, capital, and entrepreneurship should introduce more distortion in the analysis of income changes in higher income categories than in lower income categories. Because the resource most available to low-income rural people is their labor skills, omitting the impact on income from land, capital, and entrepreneurship should not seriously distort measurement of income changes in lower income categories.

Objectives of This Study

Within the scope of the study defined in the previous section, an attempt is made in this study to overcome some of the limitations noted in previous research. The specific objectives of this study are to:

1. Employ a methodology and obtain a sample size which yield generalizable results concerning the impact of new industry in rural Tennessee on changes in family incomes and the distribution of family incomes.

2. Analyze the extent to which the economic characteristics of individuals, communities, and new industries together influence changes in family incomes.

3. Analyze the individual, industry, and community factors affecting changes in employee wage incomes due to plant entry and within plant mobility of workers.

4. Describe the primary round distributive impact of new rural industry in Tennessee with emphasis on changes in the incidence of poverty.

General Research Model

The general form of the research model employed to analyze the role of individual, industry, and community factors in changing family incomes and employee wage incomes includes five groups of independent variables:

$$\Delta Y = f(\Delta CY, D, PC, CC, A)$$

where:

ΔY = real change in family or employee income;

ΔCY = changes in components of income;

D = demographic characteristics of individual employees and their families;

PC = plant characteristics;

CC = community characteristics;

A = variables which facilitate analysis of various aspects of distributive impact in the sample.

Three time periods are of theoretical importance in the model: the time prior to worker employment in the new plant (t_1), the time of job entry into the plant (t_2), and the current point in time (t_3). A family member entering a new plant may experience an abrupt shift in income between t_1 and t_2 particularly if he/she is unemployed or significantly underemployed in t_1. Thereafter, changes in wage income are determined by labor mobility in the firm over time (t_2 - t_3). In the analysis of changes in family incomes, the dependent variable (ΔY) is the change in real family income between t_1 and t_3. For analysis of changes in employee wage incomes, the dependent variables are changes in wage income between t_1 and t_2, t_2 and t_3, and t_1 and t_3 in separate equations. Independent variables are specified to account for the different factors influencing income changes between t_1 and t_2 and t_2 and t_3. The importance of including these different aspects of income change in the model was suggested in Miernyk's labor market study [22] and by Doeringer and Piore's study of internal labor markets [7].

Individual and Family Characteristics

The components of income (CY) include both worker and spouse wage earnings, transfer payments, and other income sources, such as second jobs and asset earnings. Family member employment in a new manufacturing plant may be accompanied by changes in spouse earnings, transfer payments, and other components of family income. Changes in these income components are measured over the period t_1 to t_3.

Demographic characteristics (D) of employees hypothesized to influence changes in income previous research [4,5,35] include age, sex, and education of the worker and change in the number of children in the family. Age is indicative of worker competitiveness and flexibility as well as stage of lifetime earnings cycle. Education reflects the relative store of human capital, basic skills, and socialization (coping skills) acquired during the education process. Family income is likely to be influenced differently by male and female entry into new plants since females are more likely to enter the labor force intermittently and play the role of supplemental family wage earner. A change in the number of children in a family may alter incentives for workers to seek out higher paying jobs.

Plant and Community Characteristics

Bryant's conceptualization [3] of how industrial labor demand and community labor supply factors interact within the institutional framework of the local labor market provides a useful theoretical framework for selecting relevant plant and community characteristics affecting job and income distribution. According to Bryant, the functioning of rural labor markets can be described with the aid of Figure 2. From top to bottom, the figure depicts three interdependent segments for skilled, semiskilled, and unskilled labor, and three distinct wage rates correspond to the skill segments. These segments also correspond to high-, medium-, and low-income categories in the analysis of employee wage and salary incomes.

Except in very tight markets, there is underemployment as well as unemployment. As a result, there are skilled workers working at semiskilled rates and semiskilled workers working at unskilled rates. The unemployed are generally unskilled, although during periods of high unemployment, more skilled workers may be unemployed. In the top segment of Figure 2, line "ac" is the supply of skilled labor competing in the local labor market. The supply curves for skilled and semiskilled labor are highly elastic due to the ability to train new entrants and the susceptibility of rural labor markets to in-migration and commuting. Line "ab" represents fully employed skilled labor, while line "bc" represents skilled workers not employed at the skilled wage and corresponds to line "bc" in the second market segment where these workers are underemployed at the semiskilled wage rate. Line "cd" represents

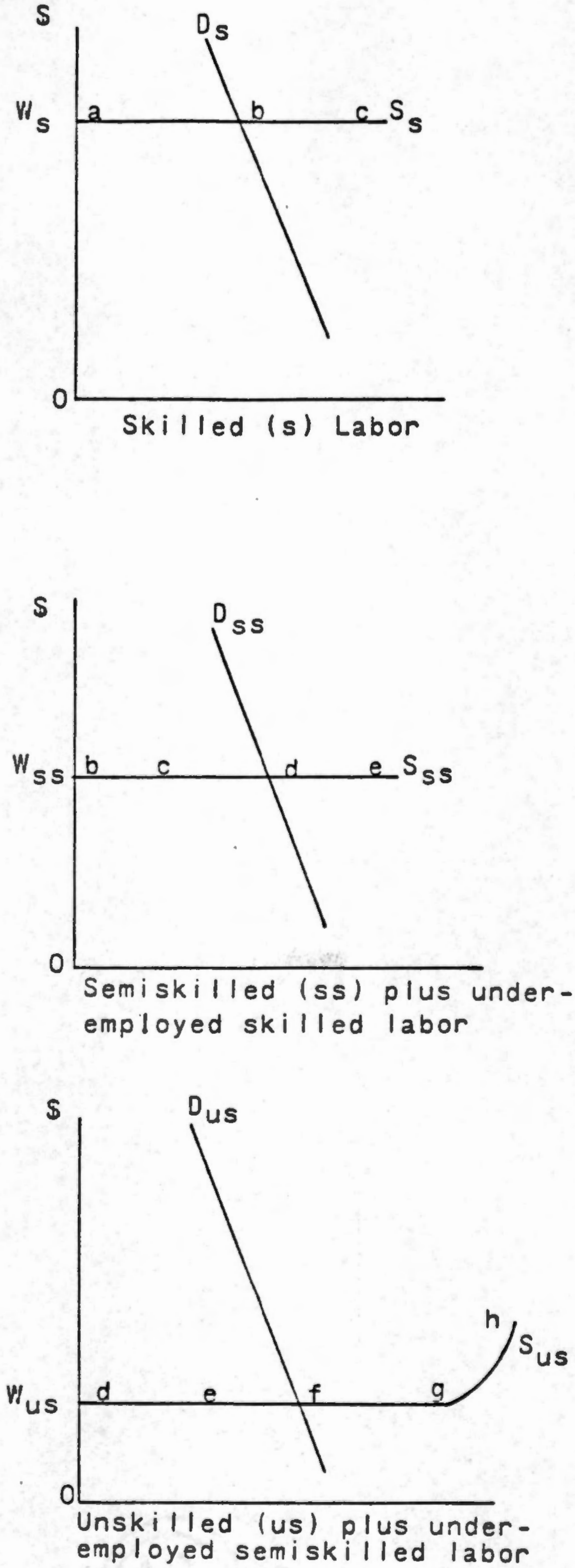

Figure 2. The segmented rural labor market.

represents semiskilled workers employed in semiskilled jobs, and line "de" represents labor qualified but not employed in semiskilled jobs. Line "de" in the bottom segment represents the semiskilled workers underemployed at unskilled rates, and line "ef" represents unskilled workers employed in unskilled jobs.

The sum of lines "bc" and "de" represents underemployment in the local labor market. Line "fg" represents those unemployed at the current level of labor force participation. Typically, the majority of the unemployed will be unskilled and poor, with small fractions being transitional skilled and nonpoor workers. The supply curve for unskilled labor eventually becomes more inelastic beyond point "g" as full employment is reached, and it takes additional wage payments to expand participation in the industrial labor force.

Direct Effects

An assessment of the direct effects of a new industry on the distribution of jobs and income is provided by first determining which labor demand curves are shifted and by how much and then determining the composition of the relevant portions of the affected supply curves. Depending on the tightness of the local market, new skilled jobs could be filled from the ranks of underemployed, transferring or unemployed skilled workers, previously employed lower skill workers who are given additional training, or trained new labor force entrants. Similarly, semiskilled openings could be filled by underemployed, transferring or unemployed semiskilled workers, employed unskilled workers who are given additional training, or by trained new labor force entrants. Finally, new unskilled jobs could be filled by transferring or unemployed skilled workers or new labor force entrants.

Newly employed workers in any of the above groups would be the applicants considered most desirable by the new firm. The hirees could come from high or low income categories, be locals, commuters or migrants, or be previously employed, unemployed, or not in the labor force. The composition of hirees in each segment of the market can be expected to be different. For instance, other things being equal, higher wage and skill openings might be more likely to be filled by workers who, because of their skills, are previously employed and have higher earnings than would be lower skill and wage jobs. Also, other things being equal, higher skill and wage openings might be more likely to attract commuters and migrants because of the attractiveness of higher earnings, the relatively high mobility of more educated and skilled workers, and because of probable shortages of skilled manpower within the local rural labor force. In terms of providing jobs for local unemployed people and moving the community distribution of income towards equality and considering only direct impacts, the proportion of jobs and income going to higher income groups, nonlocal workers, and, to some extent, previously employed workers would be considered leakages.

The above analysis suggests a number of plant and community variables theoretically relevant to $t_1 - t_2$ and $t_2 - t_3$ income changes among employees. Plant wage and skill levels determine which labor demand curves shift, and plant size determines how much they shift. These factors are expected to have a direct relationship with $t_1 - t_2$

income changes. Community rates of unemployment, underemployment, and potential labor force entry influence income changes by affecting the size and composition of labor supply. These factors are expected to have an inverse relationship with $t_1 - t_2$ income changes.

Factors influencing $t_2 - t_3$ income changes are not explicit in Bryant's formulation, but Doeringer and Piore's analysis of internal labor markets [7] suggested that similar factors are relevant. In Doeringer and Piore's terms, firms can be either relatively open or relatively closed concerning possible ports of entry for hew hirees. An open firm is one that fills all job openings from the external labor market, and a closed firm is one that hires only at one level and trains and promotes workers to higher level positions. The more closed a firm, the greater is the potential for internal labor mobility and hence $t_2 - t_3$ income changes. Different firms can be expected to have different degrees of closedness depending on the amount of specific training required and provided by the firm and the availability of required skills in the external labor market. Plant wage levels and plant size are also relevant because they are indicative of the scope for internal mobility. The degree of closedness may also be influenced by certain other internal labor market characteristics including unionization.

Doeringer and Piore also indicated that community labor supply factors influence the degree of closedness of internal labor markets. Firms operating in labor markets characterized by low unemployment, low potential labor force entry, and low underemployment have more need to train and promote workers to higher level positions and to pay higher wages to maintain work force stability. Higher rates of unemployment, potential labor force entry, and underemployment increase skill availability in local labor markets and reduce the need to use higher wages to maintain labor stability.

Distribution Analysis Variables

Two sets of variables (A) are included in the general theoretical model in order to facilitate study of the relative income benefits accruing to different categories of employees. Each of these sets of variables hold significance for analyzing distributive impact.

Residence status. The purpose of this set of variables is to measure the relative income gains of local and nonlocal families and workers. Employees of new firms are classified as locals, commuters, migrants, or return migrants. The case study literature has indicated varying incidence of local, commuting, and migrating workers in the labor forces of new rural plants. The distribution and welfare implications of the benefits accruing to each group has a different interpretation depending on whether community, regional, or national welfare maximization is the objective function of the analysis. If community welfare is the focus of analysis, then benefits going to commuting, migrating, and, to some extent, return migrating labor are considered leakages. As the size of the focal region is increased, the number of workers classified as commuters and migrants decreases, and leakages are reduced. And if national welfare is the objective function, then the residence status of employees becomes irrelevant.

In addition to the welfare and distribution implications of employee residence status, there is reason to expect different behavior among the four groups, adding relevance to their inclusion in the model. Commuting and migrating labor might be expected to experience greater income gains than local workers if they tend to fill positions requiring skills not available in the local labor market. Migrants also tend to be younger and more educated than the average worker [2,13,19] and, therefore, have more potential for income gains. Return migrants may display low or even negative income changes despite education and skill levels because of their psychic desire to return to their home areas [24].

Well-being status. The purpose of this set of variables is to provide a measurement of direct changes in the quintile distribution of family incomes, with incomes adjusted for family size, within the sample. Family incomes are adjusted for family size in order to obtain a more comprehensive view of changes in actual family well-being due to employment in new manufacturing plants. These variables facilitate analysis of distributional changes within the sample but not within the community as a whole. Description of distributional changes in the study area as a whole is done outside the model in Chapter 5.

Organization of the Study

The discussion in this chapter has provided the conceptual groundwork for this study. Chapter 2 contains a description of the methods and survey instruments used to collect primary data and a description of the sample of families, plants, and communities obtained in the survey. Chapter 3 includes the specification of the analytical tools and variables used to study the roles of individual, plant, and community characteristics in changing family incomes in the sample due to jobs in new manufacturing plants. The results of that analysis are also reported. Chapter 4 provides the model specification and results of the analysis of changes in employee wage earnings over the three time periods: $t_1 - t_2$, $t_2 - t_3$, and $t_1 - t_3$. Chapter 5 contains a description of the primary round impact of employment in the sample plants on the distribution of income and the alleviation of poverty in the sample communities. Finally, the conclusions and implications of the study and needs for further research are discussed in Chapter 6.

CHAPTER 2

DATA COLLECTION AND SAMPLE CHARACTERISTICS

To fulfill the objectives of this study, primary data were required to measure changes in family incomes and employee wage incomes due to employment in new manufacturing plants. Primary data collection was also needed to obtain information about the characteristics of the new plants employing the workers sampled. Data on the theoretically relevant characteristics of communities in the study area were available from secondary sources. Achieving the desired generalizable results from the analysis required data from a relatively large random sample of employees, manufacturing plants, and rural communities within the state.

The purpose of this chapter is to describe the procedures used to draw the sample and complete the survey and to describe the sample of plants, communities, and employees obtained. The first section of this chapter discusses the general procedure used to draw the sample, defines the study population from which the sample was selected, and describes the survey instruments used to collect primary data. The second section describes the specific procedures used to select the plant sample and the characteristics of the plant sample. The final section discusses the methods used to collect employee data and the characteristics of the employee sample.

General Procedures

The sample was drawn by a random selection of manufacturing plants located in rural areas of the state. Random selection of plants in this manner yielded a weighted random sample of communities because each community's probability of selection was weighted by the number of plants located in it. Plant data were collected through personal interviews with plant management personnel. Employee data was then collected by questionnaire at the employee's place of work by sampling the work forces of the plants whose management agreed to participate in the study. This method of collecting employee data at the place of work was similar to that successfully used by Kuehn et al. [21].

Study Population

Sample plants were selected from the population of manufacturing firms with 20 or more employees that located in rural Tennessee counties between January 1, 1970, and December 31, 1973. The definition of manufacturing plants used was the one employed by the Census of Manufacturers [45] and included all plants with two-digit Standard Industrial Classification (SIC) codes 20 through 39. The definition of rural area used was any county in the state that was not part of a Standard Metropolitan Statistical Area (SMSA) as of 1973.[3]

The study population of plants was limited to those firms locating

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[3]SMSA counties as of July 1, 1973, were Anderson, Blount, Cheatham, Davidson, Dickson, Hamilton, Hawkins, Knox, Marion, Robertson, Rutherford, Sequatchie, Shelby, Sullivan, Sumner, Tipton, Union, Williamson, and Wilson.

between 1970 and 1973 for two reasons: First, a comprehensive listing of these plants, and some information, was available from a previous survey completed in 1974. Second, it was considered important to put some limitation on the time span over which income changes were occurring in the data. The survey for this study was conducted during 1977, and with this group of plants used as the study population, the maximum length of the period of income change was 8 years. The study population omitted plants with less than 20 employees because the 1974 survey also omitted those plants, and there was no reason to believe that this omission would bias the results of this study.

The study population included 160 manufacturing plants. These plants were located in 60 of the 76 Tennessee counties defined as rural for the purposes of this study.

Survey Instruments

Copies of the questionnaires used for collecting plant and employee data are provided in Appendix B. Questions on the plant questionnaire were designed to collect information concerning plant employment, skill requirements, training programs, and wage levels. The employee questionnaire was designed to obtain data on employee demographic characteristics, residence and labor force status, and the components of family income during the year before beginning work in the sample plant (t_1) and the year preceding the time of the survey (t_3).

Pretests were useful in shortening and simplifying the questionnaires so that survey time could be minimized. The employee questionnaire was designed so that it could be completed either by an interviewer or by the employee depending on the survey procedure agreed upon by plant management. This approach afforded flexibility which was valuable in securing the cooperation of plant managers and achieving desired completion rates.

Plant Sample

Sampling Procedures

The literature surveyed set no precedent for an appropriate plant sample size for this study. It was decided that a random 20% sample of the 160 firms in the study population would be both statistically adequate and manageable in terms of data collection.

It was anticipated that a number of plant managers would elect not to participate in the study for various reasons. To cope with this eventuality and maintain the randomness of the sample, two mutually exclusive samples of 32 firms were drawn from the study population using a random numbers table. Rejections from the primary list were replaced from the alternate list. Due to a higher than expected rejection rate and a greater than expected incidence of plants changing locations or going out of business, it was necessary to draw a third random listing from the study population in order to achieve the desired sample size. In all, 79 firms were contacted with 35 agreeing to participate in the study and 29 rejecting. In addition, 4 plants had moved and 11 had gone out of business since the 1974 survey.

Characteristics of the Sample of Plants

The plant final sample consists of 35 plants or a 21.9% sample of the 160 plants in the study population. Comparison of the plant sample to either the study population or rural Tennessee plants in general is difficult because of lack of comparable data. The average number of total personnel per plant in the sample was 105 (standard deviation - 124) at the time of the survey in 1977, while the average total personnel per plant for the study population was 131 (standard deviation = 138) in 1974. Because both the sample and the study population omitted firms of less than 20 employees, a comparable average total personnel figure for all rural Tennessee plants is not available.

Table 3 presents a breakdown of plants in all rural Tennessee counties, plants in the study population, and plants in the sample by employment size class. Although the data are not strictly comparable because the data source for each group is for a different year, the plant sample seems to be more heavily weighted toward smaller plants than the other two groups. This possible bias toward smaller plants in the sample is probably due to a higher rejection rate among larger firms due to the reluctance on the part of management in such plants to participate in the employee survey.

Table 4 presents a breakdown of plants in all rural Tennessee counties, the study population, and the plant sample by two-digit SIC code. These codes classify firms by type of final product and are useful for describing the distribution of types of manufacturing industry represented in the three groups. While all 20 of the SIC codes describing manufacturing industry are represented in rural Tennessee counties, 18 are represented in the study population and 12 in the sample. The 12 industry types included in the sample account for 82.4% of all

Table 3. Manufacturing Plants with Greater than 20 Employees by Employment Size Class in All Rural Tennessee Counties, in the Study Population and in the Sample

Size Class	All Rural Tennessee Counties (1972)[a] No.	%	Study Population (1974)[b] No.	%	Sample (1977) No.	%
20-99	494	47.6	89	56.3	24	70.6
100-249	260	25.0	48	30.4	7	20.6
250 and over	284	27.4	21	13.3	3	8.8
Total	1,038	100.0	158[c]	100.0	34[d]	100.0

[a]Rural is defined as all counties outside SMSA areas in 1973. Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Manufacturers (Washington, D.C.: U.S. Government Printing Office, April 1975).

[b]Source: 1974 Survey of Rural Tennessee Manufacturing Plants, Department of Agricultural Economics and Rural Sociology, The University of Tennessee, Knoxville.

[c]Total employment data are not available for two plants in the study population.

[d]One plant in the sample had less than 20 employees at the time of the survey.

Table 4. Manufacturing Plants with Greater than 20 Employees by Two-Digit SIC Code in All Rural Tennessee Counties, in the Study Population and in the Sample

SIC Code	Final Product	All Rural Tennessee Counties[a] (1972) No.	%	Study Population[b] (1974) No.	%	Sample (1977) No.	%
20	Food & Kindred Prod.	182	15.7	5	3.1	0	0
21	Tobacco Manufacturers	4	.3	0	0	0	0
22	Textile Mill Prod.	74	6.4	8	5.0	0	0
23	Apparel & Other Textile Prod.	196	16.9	32	20.1	5	14.3
24	Lumber & Wood Prod.	106	9.1	16	10.1	3	8.6
25	Furniture & Fixtures	78	6.7	14	8.8	6	17.1
26	Paper & Allied Prod.	39	3.4	7	4.4	4	11.4
27	Printing & Publishing	75	6.4	5	3.1	0	0
28	Chemicals & Allied Prod.	32	2.8	1	.6	1	2.9
29	Petroleum & Coal Prod.	2	.2	0	0	0	0
30	Rubber & Plastics Prod.	38	3.3	8	5.0	3	8.6
31	Leather & Leather Prod.	44	3.8	2	1.3	0	0
32	Stone, Clay, & Glass Prod.	48	4.1	4	2.5	1	2.9
33	Primary Metal Indus.	32	2.8	4	2.5	0	0
34	Fabricated Metal Prod.	53	4.6	13	8.2	2	5.7
35	Machinery, Except Electrical	47	4.0	11	6.9	2	5.7
36	Electrical Equipment & Supplies	45	3.9	15	9.4	4	11.4
37	Transportation Equipment	27	2.3	8	5.0	3	8.6
38	Instruments & Related Prod.	3	.3	4	2.5	0	0
39	Miscellaneous Manufacturing Indus.	37	3.2	2	1.3	1	2.9
	Total	1,162	100.2[c]	159[d]	99.8[c]	35	100.1[c]

[a]Rural is defined as all counties outside SMSA areas in 1973. Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Manufacturers (Washington, D.C.: U.S. Government Printing Office, April, 1975).

Table 4, continued

[b]Source: 1974 Survey of Rural Tennessee Manufacturing Plants, Department of Agricultural Economics and Rural Sociology, The University of Tennessee, Knoxville.

[c]Does not add to 100% due to rounding.

[d]SIC code is not available for one plant in study population.

manufacturing firms with greater than 20 employees locating in rural Tennessee between 1970 and 1973 and 64.2% of all such firms located in rural Tennessee in 1972. Examination of the percentage distributions in the sample and the study population indicates that the sample tends to overrepresent SIC codes 25 and 26 and underrepresent SIC codes 22 and 23. The percentage distributions for the sample and all rural Tennessee plants indicate that the sample tends to overrepresent SIC codes 25, 26, 30, 36, and 37 while underrepresenting SIC codes 20, 22, and 27.

It is difficult to compare the firms in the sample to either the study population of plants or all rural Tennessee plants in terms of average skill and wage levels. Comparable skill measures are not available for the study population and all rural Tennessee plants. Comparable wage data are also not available for plants in the study population or for all rural Tennessee plants. The average weekly wage in 1977 for the production workers in the 35 sample plants is $143 without overtime and $156 with overtime. The average weekly wage for rural Tennessee production workers in plants of all sizes in 1972[4] and adjusted to 1977 levels using the Consumer Price Index[5] is $149.

The above observations concerning the size and type distributions of plants in the sample suggest that the sample is not entirely

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[4]U.S. Department of Commerce, Bureau of the Census, 1972 Census of Manufacturers (Washington, D.C.: U.S. Government Printing Office, April, 1975).

[5]U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, Vols. 49-58.

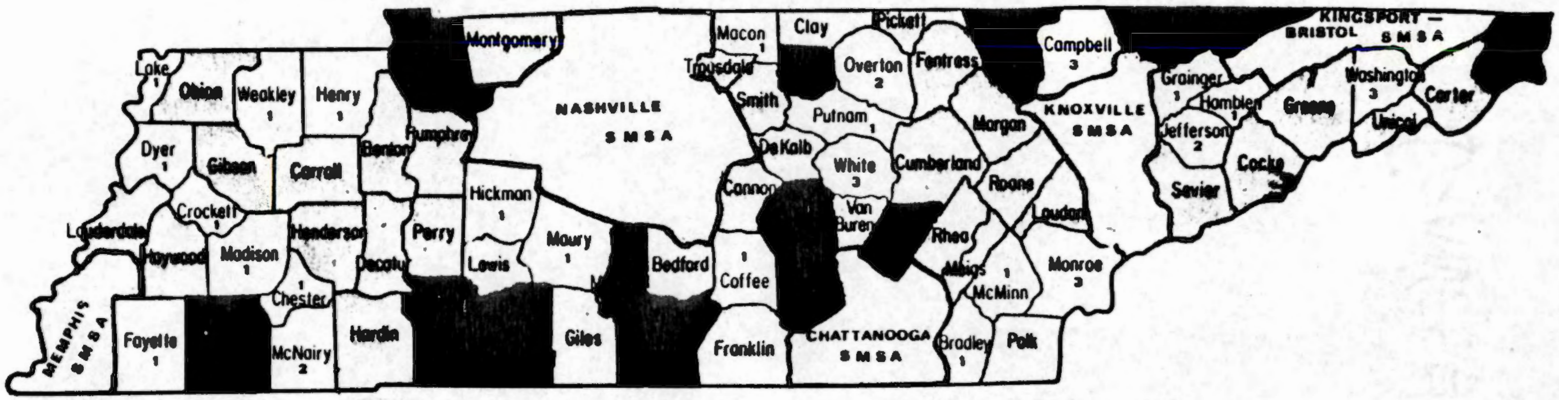
representative of the sizes and types of industries either in the study population or in rural Tennessee as a whole. Therefore, the results of this study may not hold for the sizes and types of industries not represented in the sample.

Characteristics of the Communities Represented in the Sample

Community data were collected from secondary sources. For the purpose of this study, the community is defined as the county in which the sample plant was located. This definition is necessary because reliable data on the theoretically relevant community factors are not available at the municipal level. It is not felt that this definition of community hinders achievement of study objectives. Numerous case studies of rural industrial impact have indicated that the spatial spread of the impacts of new rural plants is at least countywide. The county also constitutes a viable policy making unit in matters relating to industrial development planning. The specific sources of secondary data are indicated as operational variables are specified.

The 35 sample plants were located in 24 of the 60 rural Tennessee counties represented in the study population. Figure 3 shows the 24 counties represented in the sample and the number of sample plants in each county. Figure 3 also shows the areas excluded from the study either due to inclusion in an SMSA area or because no manufacturing plant of adequate size located in the county between 1970 and 1973.

Table 5 presents a selected group of statistics for the sample counties, the study population counties, and all rural Tennessee counties for the purpose of examining the representativeness of the sample



--denotes county included in sample

--denotes county included in study population but not in sample

--denotes rural counties not included in the study population because they received no new locations of manufacturing plants of greater than 20 employment between January 1970 and December 1978

Note: SMSA areas are defined using the 1973 definition.

Note: Numbers denote the number of respondent plants in each sample county.

Figure 3. Map of rural Tennessee counties included in the study population and in the sample including the number of sample plants in each sample county.

Table 5. Selected Characteristics of Counties in the Sample, Counties in the Study Population, and All Rural Tennessee Counties

Row	Area	No.	Average Population 1970[a]	Average Per Capita Income 1970[b]	Average Manufacturing Employment 1970[c]	Average Number of Manufacturing Plants 1976[c]	Average Weekly Wage per Manufacturing Works 1976[c]	Average Size of Labor Force 1976[d]
1	Counties in the sample	24	28,205 (17,003)[e]	2,547 (388)	4,206 (3,409)	51 (34)	147 (28)	13,266 (8,520)
2	Counties in the study population	60	23,247 (15,614)	2,486 (414)	3,163 (2,663)	38 (27)	147 (34)	10,764 (7,288)
3	All rural Tennessee counties[f]	76	21,362 (14,810)	2,441 (421)	2,860 (2,570)	35 (26)	143 (36)	9,731 (6,988)
4	Counties in the sample weighted by number of plant locations	24	3,545 (41,472)	2,490 (385)	3,990 (3,254)	52 (31)	141 (26)	13,289 (8,726)
5	Counties in the study population weighted by the number of plant locations	60	34,528 (40,378)	2,573 (401)	4,566 (3,650)	53 (33)	151 (30)	14,459 (9,107)

[a]Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population (Washington, D.C.: U.S. Government Printing Office, 1972).

[b]Source: U.S. Department of Commerce, Bureau of Economic Analysis, Local Area Personal Income, 1969-1974, Vol. 3 (Washington, D.C.: U.S. Government Printing Office, 1976).

[c]Source: Tennessee Department of Employment Security, Research and Statistics Section, Covered Employment and Wages by Industry, Statewide and by County, 1976 (Nashville: Tennessee Department of Employment Security, October 1977).

[d]Source: Tennessee Department of Employment Security, Research and Statistics Section, CPS Labor Force Summary, Annual Average 1976 (Nashville: Tennessee Department of Employment Security, March 1977).

[e]Numbers in parentheses are standard deviations.

[f]Rural is defined as all counties not in SMSA areas in 1973.

counties. Comparison of the statistics in rows 1, 2, and 3 in Table 5 indicates that the 24 sample counties have noticeably larger populations, per capita incomes, manufacturing employment, numbers of manufacturing firms, and labor forces than either the 60 counties in the study population or the 76 counties defined as rural. This indicates that larger counties with higher per capita incomes and higher levels of industrial development are overrepresented in the sample. The fact that the statistics for the study population counties have values between the other two groups suggests that overrepresentation of larger, more developed counties in the sample is at least partially due to the tendency for plants to locate in such counties during the period 1970 to 1973.

The representativeness of the sample in terms of the study population can be better judged by examining the weighted means presented in rows 4 and 5 of Table 5 because the method of sample selection weighted each county's probability of selection by the number of plant locations occurring in a county during the 1970-1973 period. Examination of these weighted means for the sample (row 4) and the study population (row 5) suggests that the sample compares closely to the study population using most measures.

The above observations suggest that underrepresentation of smaller, less developed counties in the sample is more due to lack of industrial activity in such counties during the 1970-1973 period than sample bias. The underrepresentation of smaller, less developed counties in the sample, however, must be recognized when attempting to apply the results of this study to such counties.

Employee Sample

Sampling Procedures

Employee data were collected by questionnaire at the employee's place of work. Previous studies involving employee surveys utilized case study methodologies and therefore did not establish a precedent as to the appropriate employee sample size for this study. It was decided that a random 20% sample of each plant's work force would be manageable in terms of data collection, provide an adequately representative sample of each firm's employees, and yield a sufficient number of observations for the planned analysis.

Employee Survey Procedures and Problems

In order to assure a random sample of each plant's work force and a complete set of data on each employee, the preferred survey procedure was to select the 20% sample at random from a comprehensive employee list at each plant and complete the questionnaires through personal interviews. Problems arose, however, which necessitated the use of procedures other than the preferred ones in order to complete the survey. First, pretests revealed that salaried supervisory and management level personnel often were not willing to provide the needed income data. These types of personnel were omitted from the survey, although it was recognized that this biased the sample away from high income employees. Salaried workers comprised approximately 8% of the total persons employed by the plants in the study population.

Second, many plant managers, for various reasons, would not agree to participate in the study using the preferred survey procedures. The major reasons were unwillingness to lose the production time involved in personal interviews either because of the size of the plant, the type of production process, or reluctance to subject employees to the interview. Because of these problems, three methods of collecting employee data were eventually used in completing the survey:

1. The preferred method involving random selection of employees and personal interviews with each.

2. Distribution of questionnaires to all plant employees at their place of work to be completed voluntarily on the employee's own time and returned to the place of work.

3. A combination of 1 and then 2 when method 2 alone failed to yield a sufficient number of returns.

It was recognized that each of the less preferred methodologies (2 and 3) could introduce biases into the employee samples obtained. It was considered probable that the employees sampled using methods 2 and 3, plant and community factors being equal, would be more educated and therefore have higher incomes and income changes than those sampled using method 1. Completion of the employee survey, however, required flexibility in the survey approach, and there was no alternative to accepting whatever biases the less preferred methods introduced.

Results of the Employee Survey

The employee survey yielded 712 completed questionnaires. The goal of the survey was to obtain at least a 20% sample of the total number of production workers employed in each sample plant. The average sample size achieved in the survey is 23.6% (standard deviation = 7.8). The range of sample sizes, however, is from 13.8% to 40.0% with 22 plants having a sample size equal to or greater than 20% and 13 plants having a sample size of less than 20%. The largest sample sizes were achieved using method 2.

The variations in employee sample sizes across plants could lead to bias of statistical results for plant and community measures if employee sample sizes are correlated with plant and community measures used in the analysis. Further analysis indicates that there are no significant correlations between plant and community measures which are used in this study and employee sample sizes obtained using each sampling methodology.

Deletions from the Sample

For the purpose of analysis, certain of the 712 employee observations are deleted from the employee sample due to incomplete or inconsistent data. The major group deleted consists of persons reporting zero total family income in period t_1, usually because of nonparticipation in the labor force and/or residence with parents during that period. This group is deleted from the analysis because it is assumed that such responses constitute incomplete reporting of income. Similarly, all persons reporting residence with parents in period t_1 and not in period t_3 and not reporting income contributed by parents are deleted because of inconsistent reporting of income. Those persons living with parents in both t_1 and t_3 are kept in the sample. It is assumed that, while this situation may result in inaccurate absolute income levels in each period, it will not seriously distort the amount of income change between t_1 and t_3. In all, the deletions amount to 147 observations.

The deletions result in a reduction of the average per plant sample size to 18.4% (standard deviation = 4.9). The range of per plant sample sizes after deletions is 12.0% to 29.4% with 12 plants having a sample of greater than or equal to 20% and 23 having a sample size of less than 20%.

There are no significant correlations between plant and community variables included in this study and plant employee sample sizes after deletions for each sampling methodology. There are also no significant correlations between plant and community variables and the rate of deletions from each employee sample.

It was not anticipated prior to completion of the survey that it would be necessary to make such a large number of deletions. The deletions have the obvious effect of reducing the size and efficiency of both the overall sample and the individual plant samples. The number of remaining observations (565) is, however, sufficient to carry out the planned analyses.

Characteristics of the Employee Sample Before and After Deletions

Statistics for selected characteristics of the sample before and after deletions and for the deleted group are presented in Table 6. Examination of these statistics suggests that employees deleted from the sample row (row 3) are noticeably younger and more educated than

Table 6. Selected Characteristics of the Employee Sample Before and After Deletions and for the Deleted Group

Row	Group	No.	Average Age	% Female	% Male	Average Years of Education	Average Months Worked in Plant	Average Weekly Wage in t_1 ($ 1977)	Average Weekly Wage in t_3 ($ 1977)	Average Family Income in t_1[a] ($ 1977)	Average Family Income in t_3[a] ($ 1977)
1	Sample before deletions	712	31 (10)[b]	52	48	11 (2)	34 (25)	95 (74)	158 (50)	8,736 (5,698)	12,682 (5,075)
2	Sample after deletions	565	33 (10)	52	48	11 (2)	35 (26)	108 (71)	159 (49)	10,107 (5,080)	13,077 (5,041)
3	Deleted group	147	28 (10)	53	47	12 (2)	30 (24)	37 (56)	154 (54)	1,625 (2,590)	10,691 (4,882)

[a]Family income is computed as the total of wage and salary incomes, second job incomes, public assistance incomes, and other incomes for the year.

[b]Numbers in parentheses are standard deviations.

those remaining in the sample (row 2). Also, as would be expected due to the rationale for the deletions, the deleted group has significantly lower wage earnings and family incomes in the year prior to employment (t_1). These data suggest that the sample used for statistical analysis in this study may underrepresent younger, more educated workers who are new labor force entrants and, therefore, may not adequately explain industrial impact on these workers. Depending on the amount of income contributed by parents, the deletions may also cause underrepresentation of persons with relatively low family incomes in period t_1.

It is not possible to accurately assess the representativeness of the employee sample in terms of the rural Tennessee population as a whole. The employee sample is a selection from the population of production workers in rural Tennessee manufacturing plants in 1977. Aggregate statistics relating to the average age, sex, education, and incomes for this class of worker are not available.

Characteristics of the Employee Sample by Sampling Methodology

Table 7 contains selected statistics describing characteristics of the employee sample after deletions according to the method used to survey the plant and for the sample as a whole. These data are not provided for the sample before deletions were made because the deletions do not change either the relative share of employees sampled by each method or the conclusions to be drawn from the statistics.

Table 7 shows that the majority of questionnaires were collected using method 2. Employees surveyed using method 1 have a markedly lower mean level of education, lower wage incomes in periods t_1 and t_3, and

Table 7. Selected Characteristics of the Employee Sample After Deletions for the Three Methods Used to Collect Employee Data

Method[a]	Number of Sample Employees	Average Age	% Female	% Male	Average Education	Average Weekly Wage in t_1 ($ 1977)	Average Weekly Wage in t_3 ($ 1977)	Average Family Income in t_1[b] ($ 1977)	Average Family Income in t_3[b] ($ 1977)
1	141	32 (11)[c]	44	56	10 (3)	101 (65)	132 (33)	10,013 (5,034)	11,572 (4,889)
2	374	33 (10)	58	42	11 (2)	109 (70)	166 (49)	10,208 (5,062)	13,602 (5,011)
3	50	31 (9)	24	76	11 (3)	122 (86)	178 (60)	9,619 (5,403)	13,419 (4,927)
Total	565	32 (10)	52	48	11 (2)	108 (71)	159 (49)	10,107 (5,080)	13,078 (5,041)

[a]Method 1 = Random selection of employees and personal interviews with each

Method 2 = Distribution of questionnaires with voluntary completion by employees

Method 3 = Combination of Method 1 and Method 2

[b]Family income is computed as the total of wage and salary incomes, second job incomes, public assistance incomes, and other incomes for the year.

[c]Numbers in parentheses are standard deviations.

smaller family income changes between t_1 and t_3 than those surveyed using methods 2 and 3. The actual sex composition of the plants in each group is not known. But the two largest plants were sampled using method 2 and are known to have had predominantly female work forces.

The above observations concerning the age and income differences by survey method suggest sample bias only if the characteristics of the plants and counties surveyed by each methodology are similar. If plants surveyed using method 1 are, in fact, lower skill and wage plants than those surveyed using the other methods, then the observed difference in educational levels, income, and income changes may not be due entirely to sample bias. Also, suspicions of sample bias may be diminished if the plants surveyed using method 1 tend to be located in less developed, lower income counties where incomes and levels of education could be expected to be relatively low. Table 8 provides statistics on selected characteristics of the plants surveyed using each of the three survey methods. The weighted average hourly wage figures in column 3 and the weighted average plant skill level percentages in columns 4, 5, and 6 are computed using wage and skill data provided by plant management. These statistics suggest that employees surveyed using method 1 are, in fact, employed in lower wage and skill firms than those surveyed using method 2.

The data in Tables 7 and 8 suggest that there may be more reason to expect bias within the group of employees surveyed using method 3. This group has the highest average years of education, while the plants in which they were employed have the lowest average skill levels. And

Table 8. Selected Characteristics of the Sample Plants According to the Method Used to Collect Employee Data in the Plants

Method[a]	(1) No. of Sample Plants	(2) Average No. of Production Workers	(3) Average Hourly Wage ($ 1977)	(4) Average % Skilled Workers	(5) Average % Semiskilled Workers	(6) Average % Unskilled Workers
1	12	75 (72)[b]	3.31 (.60)	1 (2)	10 (13)	89 (14)
2	18	108 (142)	3.37 (.65)	6 (9)	15 (14)	80 (19)
3	5	65 (34)	3.69 (.54)	0 (0)	6 (6)	94 (6)
Total	35	91 (111)	3.65 (.66)	4 (8)	13 (13)	83 (18)

[a]Method 1 = Random selection of employees and personal interviews with each

Method 2 = Distribution of questionnaires with voluntary completion by employees

Method 3 = Combination of Method 1 and Method 2

[b]Numbers in parentheses are standard deviations.

while employees surveyed by method 3 have the highest wage income figures in Table 7, the plants in which they are employed do not have the highest average wage level in Table 8.

Table 9 provides data for selected characteristics of the counties of location of the sample plants by the survey methodology used. These data indicate that plants and employees surveyed by method 1 tend to be located in smaller counties with lower per capita incomes and lower levels of manufacturing development than those surveyed by the other two methods. Also, plants and employees surveyed by method 3 tend to be located in the largest counties with the highest level of manufacturing development. This information suggests that the variations in employee characteristics by survey method observed in Table 7 are not necessarily due to bias introduced by the different survey methods but may partially result from variations in plant and community characteristics between workers surveyed using each method.

The statistics presented above do not prove or disprove the existence of bias in the employee sample due to the three different survey methods used. The possibility of sample bias must be taken into account when interpreting the results of the analysis. No procedures are used to control for possible sample bias in the statistical analyses which follow.

Table 9. Selected Characteristics of the Counties in the Sample According to the Method Used to Collect Employee Data in Sample Plants in the Counties

Method[a]	No. of Sample Counties*	Average* Population (1970)[b]	Average* Manufacturing Employment (1976)[c]	Average* Manufacturing Weekly Wage (1976)[c]	Average* Per Capita Income ($ 1970)[d]	Average* Unemployment Rate (1976)[e]
1	12	20,610 (7,805)[f]	2,999 (2,978)	126 (16)	2,261 (258)	8.4 (3.0)
2	18	31,849 (18,696)	4,447 (3,085)	150 (27)	2,634 (375)	7.6 (3.3)
3	5	39,125 (28,458)	5,396 (4,316)	152 (28)	2,523 (478)	6.3 (.8)
Total	35	29,035 (18,275)	4,086 (3,249)	142 (26)	2,490 (385)	7.7 (3.0)

*Statistics are weighted by the number of plants surveyed by each method in each county.

[a]Method 1 = Random selection of employees and personal interviews with each
Method 2 = Distribution of questionnaires with voluntary completion by employees
Method 3 = Combination of Method 1 and Method 2

[b]Source: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population (Washington, D.C.: U.S. Government Printing Office, 1972).

[c]Source: Tennessee Department of Employment Security, Research and Statistics Section, 1976 Covered Employment and Wages by Industry, Statewide and by County (Nashville: Tennessee Department of Employment Security, October 1977).

Table 9, continued

[d]Source: U.S. Department of Commerce, Bureau of Economic Analysis, Local Area Personal Income, 1964-1974, Vol. 3 (Washington, D.C.: U.S. Government Printing Office, 1976).

[e]Source: Tennessee Department of Employment Security, Research and Statistics Section, CPS Labor Force Summary, Annual Average 1976 (Nashville: Tennessee Department of Employment Security, March 1977).

[f]Numbers in parentheses are standard deviations.

CHAPTER 3

ANALYSIS OF FACTORS INFLUENCING CHANGES IN FAMILY INCOMES

The purpose of this chapter is to present the analysis of factors influencing changes in family incomes due to employment in new rural manufacturing firms. The first part of this chapter includes the specification of variables and hypothesized relationships necessary to operationalize the theoretical model developed in Chapter 1 using ordinary least squares multiple regression analysis. The operationalized model is then used to analyze changes in family incomes, and the results of the analysis are reported. The chapter closes with a summary of the results and conclusions of the analysis.

Model Specification and Expected Relationships

The model developed in Chapter 1 for analysis of factors influencing changes in incomes due to family member employment in a rural manufacturing plant includes seven groups of variables: the dependent variable (ΔY), changes in the components of family income (ΔCY), demographic characteristics of employees (D), a control or time variable (T), plant characteristics (PC), community characteristics (CC), and analytical variables used to study within-sample distributive effects (A). Variables are specified and relationships hypothesized with consideration to the differing nature of the effects these variables may have on $t_1 - t_2$ and $t_2 - t_3$ shifts in employee and/or family incomes.

Dependent Variable

The dependent variable used for this analysis is the real change in annual total family income between the year ending with the time of the survey (t_3)[6] and the year immediately preceding employment in the sample plant (t_1). Real income changes are used in order to eliminate inflationary increases in income so that actual changes in family purchasing power can be better examined. All dollar figures are adjusted to 1977 levels using the appropriate U.S. Department of Labor unadjusted Consumer Price Index for all items.[7] Total family income includes wage and salary incomes, second job incomes, transfer payments, and all other types of income, including proprietary incomes, farm earnings, and pensions, of both the employee and spouse (if present). The dependent variable is given the acronym TAFYCH and is specified in thousands of dollars in order to reduce both the range and magnitude of values for the purpose of the regression analysis.

Changes in the Sources of Family Income

Family member employment in a new plant may be accompanied by changes in family income structure between periods t_1 and t_3 including changes in spouse labor force status, changes in transfer payments received, and changes in sources of other family income. Changes in family income structure may occur either as a result of family member employment in a new plant or independently.

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[6]The survey was conducted in June, July, August, and September 1977.

[7]U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, Vols. 49-58.

The effects of changes in the components of family income are measured in the operationalized model by specifying a series of discrete (0,1) variables. The family member employed in the sample plant could be either in or out of the labor force in period t_1. Previous employment is expected to reduce the amount of income change between t_1 and t_2 (the period of entry into the firm) but improve a worker's potential for upward mobility in the firm between t_2 and t_3 because of skills obtained in previous employment. The net effect of previous employment on t_1 to t_3 family income changes is hypothesized to be negative compared to no previous employment. To measure this effect, the variable PREMP is entered and set at zero if the employee is unemployed for the entire year preceding entry into the sample plant and at one (1) if employed at all during that year. A wage income of greater than zero in t_1 is used as an indicator of previous employment, while a wage income of zero indicates no previous employment. The coefficient is expected to be negative.

Changes in spouse labor force status between periods t_1 and t_3 are characterized by one of four possibilities: the spouse entering the labor force, the spouse exiting the labor force, the spouse staying in the labor force, or the spouse staying out of the labor force. To measure the effects of these changes, discrete (0,1) variables are entered to represent a spouse entering (SPENT), exiting (SPEX), or staying in (STAYIN) the labor force. The situation occurring when the spouse stays out of the labor force in both periods (STAYOUT) is the omitted class against which the others are tested. Positive values for spouse wage incomes in t_1 and t_3 are used as indicators of labor force participation, while spouse wage incomes of zero in t_1 and t_3 indicate labor force nonparticipation.

Spouse entry into the labor force (SPENT) is hypothesized to have a positive influence on income change compared to the STAYOUT situation because the family gains a source of income. Similarly, spouse exit (SPEX) is expected to reduce income changes compared to the omitted class because of the loss of a source of income. STAYIN is expected to have a positive relationship with family income change because spouses remaining in the labor force are expected to earn wage gains between t_1 and t_3.

Families may gain, lose, maintain, or never have transfer payments and/or some other income as a source of family income between t_1 and t_3. For the purpose of this analysis, discrete variables are entered only to measure the effects of a gain (GTP) or loss (LTP) of transfer payments and a gain (GOTH) or loss (LOTH) of other income as sources of family income between t_1 and t_3. The omitted classes against which these changes are measured are those observations which either maintained or never had transfer payments or some other income as a source of income between periods t_1 and t_3. The two omitted classes are not differentiated because there is no a priori reason to expect that either would result in significant differences in family income changes. Positive values for transfer and other income are used as indicators of the existence of either of these sources in t_1 and t_3, while zero values indicate their absence. The gain of transfer payments (GPA) and the gain of other income (GOTH) are expected to have a positive relationship with family income changes compared to the omitted classes, while the loss of transfer payments (LPA) and other income (LOTH) are expected to have a negative relationship. The types, frequencies, and average amounts of transfer payments and other incomes encountered in the study will be presented along with the results of the analysis.

Demographic Characteristics

Age, sex, and the level of educational attainment of the employee and the change in the number of children in the employee's family are entered into the equation to measure the demographic characteristics of employees and their families. Age (AGE) is specified in years, and an inverse relationship with family income change is expected. Younger workers and families are hypothesized to be more competitive and less likely to have reached their income potential resulting in greater t_1 - t_2 and t_2 - t_3 income gains than older workers and families.

Sex (SEX) is specified in the equation as a discrete variable with male employees denoted by a zero (0) and females by a one (1). While female employees may have less impact than males on family income due to upward wage mobility (t_2 - t_3), they are expected to have a greater influence than males on family income gains between t_1 and t_2. This is because female workers are expected to be more likely to be new labor force entrants and supplemental, rather than primary, family wage earners. It is hypothesized that the relatively large t_1 - t_2 shift for females will offset the smaller t_2 - t_3 change resulting in a positive coefficient for the sex variable.

Education (EDUC) is specified in the equation as the total number of completed years of primary and secondary school, college, vocational school, and any other type of formal education. It is hypothesized that more educated workers will have relatively greater wage income shifts in both the $t_1 - t_2$ and $t_2 - t_3$ periods leading to relatively greater family income gains.

Change in the number of children in an employee's family (FAMCH) is specified as the number of children in t_3 minus the number of children at the end of period t_1. Greater increases in family size are expected to lead to greater increases in family income between t_1 and t_3 because of greater incentives to seek higher paying jobs.

Time Variable

The employees included in the sample could have been employed in the sample plants for varying lengths of time from 1 day to 81 months (January 1970 through September 1977). The scope for change in the various components of family income, including employee wage gains due to within-firm mobility and changes in the wages of other family members, is expected to be influenced by the period of time over which income changes are measured ($t_1 - t_3$). To control for the time factor, the number of months each employee worked in the sample plant (MOWKPL) is entered into the equation and a positive coefficient is expected.

Plant Characteristics

Following the analysis of plant characteristics theoretically relevant in influencing $t_1 - t_2$ and $t_2 - t_3$ income changes among employees in Chapter 1, variables are specified in the equation to measure the effects of plant size, wage levels, and skill levels on family income changes. Plant size (in terms of employment) is indicative of the shift in labor demand caused by the location of a new plant. The amount of pressure a given sized plant places on local labor resources depends on the amount of labor demand created relative to community labor supply. The greater the labor needs of the plant relative to supply, the greater is the expected increase in employee wage incomes (hence family incomes) in both the $t_1 - t_2$ and $t_2 - t_3$ periods because of greater upward pressure on wage rates and because more previously unemployed and underemployed persons are likely to be employed. Also, plants of greater relative size are hypothesized to provide greater opportunity for upward mobility of workers in the $t_1 - t_3$ period. To test this hypothesis, plant size as a percentage of the total community labor force (SIZRLF) is entered into the equation. SIZRLF is specified as total plant employment in 1977 divided by the total county labor force in 1977[8] multiplied by 100.

Plant wage levels relative to prevailing labor market wage levels are hypothesized to be indicative of the scope for employee income changes between t_1 and t_3. Plants offering higher relative wages and probably requiring greater labor skills could contribute to relatively smaller $t_1 - t_2$ wage shifts if hirees tend to be skilled and previously employed. But because previous employment is already controlled for in the equation and because of the high levels of underemployment commonly experienced in rural labor markets, it is expected that workers

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[8]Tennessee Department of Employment Security, Research and Statistics Section, CPS Labor Force Summary: 1977 (Nashville: Tennessee Department of Employment Security, 1977).

employed in plants with higher relative wage levels will experience greater t_1 to t_2 wage income changes.[9] Workers employed in plants with higher relative wage levels are also expected to have greater $t_2 - t_3$ wage increases because of greater scope for such changes and management desire to maintain its relatively skilled work force.

Plant wage levels relative to the community (RLWAGE) are specified in the equation as the average weekly wage of the worker sample in each plant in t_3 as a percentage of the average weekly manufacturing wage in the county in which the plant is located in 1977.[10] A positive coefficient is expected for RLWAGE.

Plant skill levels are expected to influence income changes in a way similar to plant wage levels. In tight labor markets with low rates of underemployment, high skill firms would be expected to hire experienced and probably previously employed workers leading to relatively smaller $t_1 - t_2$ income changes. But in labor markets characterized by relatively high rates of unemployment and underemployment, higher skill plants are expected to provide greater scope for workers to escape underemployment leading to greater $t_1 - t_2$ income gains. Income gains between t_2 and t_3 are also expected to be greater in higher skill plants

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[9]Underemployment is also included as a variable in the equation. But all counties in the sample are rural and all probably have "loose" labor markets with relatively high rates of underemployment compared to more developed urban labor markets. Therefore, the hypothesized relationship is expected to hold in most, if not all, of the sample counties regardless of the underemployment rate.

[10]Tennessee Department of Employment Security, Research and Statistics Section, Covered Employment and Wages by Industry Statewide and by County (Nashville: Tennessee Department of Employment Security, 1970-1977).

due to improved possibilities for upward mobility and management desire to keep trained workers.

In tight labor markets wage and skill levels can be expected to be highly correlated. It is anticipated, however, that the relative wage measure and the skill index, which is an absolute measure, will not necessarily be correlated in the relatively loose and underdeveloped labor markets in a number of the counties involved in this study. Therefore, measures of both wage and skill levels are included in the equation.

Plant skill requirements were measured by asking plant managers to categorize all production workers in their plant as being skilled, semiskilled, or unskilled according to the years of training required to perform job tasks (see Plant Questionnaire, Appendix B). Workers requiring 3 or more years of training are considered skilled, those requiring 1 or 2 years of training are considered semiskilled, and those requiring less than a year of training are considered unskilled. From this categorization a weighted skill index (SKILL) is computed for each plant by weighting the percentage of skilled workers by positive one (+1), the percentage of semiskilled workers by zero (0), and the percentage of unskilled workers by negative one (-1), and summing the results. Subsequently, one (+1) is added to each score for ease of interpretation in the regression analysis. This measure can theoretically range from zero (0) (100% unskilled) to two (2) (100% skilled). A positive relationship with the dependent variable is expected.[11]

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[11]Two other methods of measuring plant skill requirements were considered for this study. For an explanation of the other approaches, see Appendix C.

Community Characteristics

The theoretical discussion of the operation of rural labor markets presented in Chapter 1 suggests the role of labor supply factors in effecting changes in employee wage earnings and, hence, family incomes. The composition of community labor supply is determined, in part, by the rates of underemployment, unemployment, and potential labor force entry. Higher rates of underemployment suggest greater percentages of the labor force producing at less than capacity in current employment and, therefore, greater availability of workers capable of moving into higher wage and skill jobs. This excess supply is expected to result in suppressed wage rates in the labor market leading to smaller t_1 - t_3 income gains.

Higher rates of unemployment and potential labor force entry suggest greater availability of persons who are currently idle but available to take new jobs. Higher rates of unemployment and potential labor force entry are, therefore, also expected to result in suppressed wage rates and lower wage and income gains. Because both the rate of unemployment and the rate of potential labor force entry reflect the supply of available but idle labor in the community, the two rates are combined for the purpose of this analysis. The resulting measure is felt to be a more accurate measure of the availability of unemployed labor than either measure alone.

The rates of unemployment and potential labor force entry need not be highly correlated with the rate of underemployment. Underemployment is associated with the types (skill level) of jobs and workers available in the labor market, while rates of unemployment and potential labor force entry are associated with the numbers of available jobs and workers.

The rates of underemployment (UNDERR) specified in the equation are those computed by Snell and Leuck [36] for each Tennessee county using 1970 data. Because these rates conceptually embody both unemployment and underemployment in the community, the 1970 county unemployment rate[12] is subtracted from each figure. Using underemployment rates computed using 1970 data creates a measurement problem because a 1977 rate would more accurately describe labor market conditions at the time of the survey. The data required to calculate underemployment rates for 1977 are not available. Specification of UNDERR using 1970 data requires the assumption that underemployment rates in each of the sample counties did not change relative to each other between 1970 and 1977. A negative coefficient is expected for UNDERR.

The combined rate of unemployment and potential labor force entry (UNPTR) is also specified using 1970 data. Data on labor force size and numbers of unemployed persons in each sample county are from the 1970 census.[13] Potential labor force entry in each county is calculated using the method developed by Stoll [37]. The use of 1970 data to specify UNPTR also creates a measurement problem as the 1977 rate would be more appropriate. Data required to compute potential labor force entry for 1977 by Stoll's method are not available. Use of 1970 data

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[12]U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population, General Social and Economic Characteristics, Tennessee (Washington, D.C.: U.S. Government Printing Office, 1972).

[13]Ibid.

to specify UNPTR also requires the assumption that these rates did not change relative to each other in the sample counties between 1970 and 1977. An inverse relationship is expected between UNPTR and the dependent variable.

Residence Status Variables

Measurement of the relative income changes for local as compared to commuting, migrating, and return migrating labor is expected to indicate the extent to which nonlocal workers compete with local workers for income gains from new employment opportunities. Migrating and commuting labor may tend to have greater income gains than local workers if they tend to provide skills not available among local workers and command higher wagers. Returning migrating workers may be more likely to incur income losses in order to return to their home county.

Employee residence status is entered into the equation using a series of discrete variables. Workers are designated as commuters (COMM) if they did not reside in the county in which the sample plant is located at the time of the survey. Workers are designated as migrants (MIG) if they lived in the county in which the sample plant is located at the time of the survey, if they had never previously lived in that county, and if they had moved to that county after the age of 16. The latter restriction is placed on the definition of migrant because persons moving prior to the age of 16 are not likely to be in the labor force and seeking employment. Return migrants (RMIG) are defined as workers who lived in the county in which the sample plant is located at the time of the survey, had previously lived in that county, and had returned to that county after the age of 16. Any employees in the sample not qualifying for any of the above categories are considered local.

Local workers are the omitted class in the series of discrete variables measuring employee residence status against which the income gains of the three "nonlocal" groups are tested. It is hypothesized that commuters (COMM) and migrants (MIG) will have greater income gains and return migrants (RMIG) smaller income gains than local workers.

Well-Being Status Variables

The purpose of this group of variables is to measure the changes in family income accruing to families with different levels of relative well-being prior to family member employment in the sample plants. These changes in income are analyzed by adjusting total family incomes in t_1 for family size to reflect well-being, ranking the adjusted incomes, classifying the sample into quintiles, and entering each family's quintile of well-being into the regression equation using a series of discrete (0,1) variables (Q_1, Q_2, Q_4, Q_5). A one (1) indicates a family's presence in a particular quintile in t_1, and a zero (0) indicates its absence. The third quintile is the omitted class against which the family income changes of the remaining four quintiles are tested. A positive coefficient indicates that families in that quintile have greater income gains than families in the third quintile, and a negative coefficient indicates that families in that quintile have smaller income gains. There are no hypothesized relationships since these variables are entered only for the purpose of analyzing changes in the distribution of income gains within the sample.

Each family's well-being status in t_1 is calculated by subtracting the poverty level income for the appropriate family size from real family income in t_1.[14] Family well-being is thus defined as a family's residual income above (or below) the official poverty level for that family. The level of well-being is positive when a family's income is above poverty and negative when it is below poverty.

Results of the Regression Analysis

The results of the multiple regression analysis are presented in Table 10. The variables in the regression model are grouped in Table 10 to illustrate the contribution of each variable group (ΔCY, D, T, PC, CC, A) to the total $\underline{R}^2$ of .602. The cumulative $\underline{R}^2$ in the right-hand column is the portion of total explained variation in the dependent variable (TAFYCH) contributed by successive groups of variables. Most of the explained variation (63%) is associated with the group of variables measuring changes in the sources of family income: PREMP, SPENT, SPEX, STAYIN, GPA, LPA, GOTH, and LOTH. Demographic characteristics, including the control variable, account for 1%; plant characteristics, 6%; community characteristics, 4%; residence status, 2%; and pre-employment well-being status, 23% of the explained variation in TAFYCH. The variable SKILL is the only variable not to have the hypothesized sign.

Selected statistics for all independent variables in the equation are presented in Table 11, and a correlation matrix for all variables

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[14]The poverty levels for families of different size used are those used by the Bureau of the Census in 1970 adjusted to 1977 levels using the U.S. Department of Labor unadjusted Consumer Price Index for all items.

Table 10. Results of Multiple Regression Analysis of Factors Hypothesized to Explain Changes in Family Income Associated with New Manufacturing Jobs in Rural Tennessee Counties

Variable	Specification	b Value	Standard Error	Cumulative R^2
INTERCEPT	--	-.420	1.491	
PREMP	0,1	-2.198***	.438	
SPENT	0,1	+4.896***	.466	
SPEX	0,1	-3.811***	.522	
STAYIN	0,1	+2.955***	.414	
GPA	0,1	+1.724**	.718	
LPA	0,1	-.623*	.364	
GOTH	0,1	+1.556***	.395	
LOTH	0,1	-5.312***	1.292	.381
AGE	years	-.003	.016	
SEX	0,1	+.166	.332	
EDUC	years	+.226***	.063	
FAMCH	number	+.096	.227	
MOWKPL	months	+.011*	.006	.388
SIZRLF	%	+.287***	.072	
RLWAGE	%	+.041***	.007	
SKILL	index	-1.476***	.668	.425
UNDERR	%	-.127***	.024	
UNPTR	%	-.019	.013	.451
COMM	0,1	+.203	.374	
MIG	0,1	+.328	.395	
RMIG	0,1	-1.141***	.373	.463
Q_1	0,1	2.158***	.453	
Q_2	0,1	1.036**	.438	
Q_4	0,1	-1.846***	.438	
Q_5	0,1	-4.720***	.452	.602

R^2 = .602 F = 31.10 n = 539 Mean of dependent variable (TAFYCH) = 2.894

*Significant at the .10 level of t
**Significant at the .05 level of t
***Significant at the .01 level of t

Table 11. Selected Statistics for Variables Included in the Regression Analysis of Changes in Family Incomes

Variable	Specification	Mean	Standard Deviation	Minimum	Maximum
TAFYCH	$ 1977 (000's)	2.894	3.012	-19.978	17.524
PREMP	0,1	.834	.373	0	1
SPENT	0,1	.104	.306	0	1
SPEX	0,1	.113	.317	0	1
STAYIN	0,1	.428	.495	0	1
GPA	0,1	.039	.194	0	1
LPA	0,1	.166	.373	0	1
GOTH	0,1	.140	.347	0	1
LOTH	0,1	.012	.111	0	1
AGE	years	32.467	10.273	17	64
SEX	0,1	.517	.500	0	1
EDUC	years	10.973	2.405	1	18
FAMCH	number	.218	.648	-2	5
MOWKPL	months	34.727	25.785	1	93
SIZRLF	%	2.628	2.346	.083	6.462
RLWAGE	%	105.469	25.879	46.286	172.989
SKILL	index	.205	.243	0	1.281
UNDERR	%	23.279	6.599	8.549	33.022
UNPTR	%	11.642	11.399	-5.631	45.491
COMM	0,1	.177	.382	0	1
MIG	0,1	.152	.360	0	1
RMIG	0,1	.166	.373	0	1
Q_1	0,1	.211	.408	0	1
Q_2	0,1	.200	.400	0	1
Q_4	0,1	.196	.398	0	1
Q_5	0,1	.200	.400	0	1

is provided in Appendix D. The remainder of this section includes detailed analysis of the regression results for each group of explanatory variables in the model. Where applicable, the analysis of regression results includes discussion of possible violations of the assumptions of ordinary least squares multiple regression analysis which may result in the bias or inefficiency of estimated coefficients.

Changes in the Sources of Family Income

PREMP. The coefficient for the variable PREMP is significant and has the hypothesized sign. The coefficient indicates that, with other variables in the equation held constant, workers in the sample who have wage earnings in the year prior to employment in the sample firm have smaller family income changes than workers with no previous wage earnings by the amount of $2,198. The mean value for PREMP in Table 2, page 19, indicates that 83.4% of the sample workers were employed in the year prior to entering the sample plants. It should be noted that the seemingly low percentage (16.6%) of previously unemployed workers is, in part, due to the deletions from the sample noted in Chapter 2. Many of the deleted observations are previously unemployed workers who failed to report any source of income in period t_1.

SPENT, SPEX, and STAYIN. Each of these variables is significant and has the hypothesized sign relative to the omitted class of workers who have no spouse in the labor force in either t_1 or t_3. Examination of the means of the spouse labor force participation variables in Table 11 indicates that 10.4% of the workers sampled have spouses enter, 11.3% have spouses exit, and 42.8% have spouses remain in the labor force between t_1 and t_3. The omitted class of workers who have no spouse in the labor force in either period constitutes 35.5% of the sample.

The regression results suggest that changing family labor force participation patterns, measured in the equation by the variables PREMP, SPENT, SPEX, and STAYIN, are powerful determinants of changes in family incomes due to employment in the sample plants. These four variables account for 57% of the total variation in family income changes explained by the model. Table 12 contains frequencies, mean family incomes in t_1 and t_3, and mean family income changes associated with each of the six patterns of family labor force participation measured in the model. As would be expected, the greatest income gains (occurring in 22% of the observations) accrue to those families adding members to the labor force. And the greatest income losses (occurring in 9% of the observations) are associated with the loss of a labor force participant. The percent of families with both spouses working increases from 40% in t_1 to 53% in t_3.

<u>GPA, LPA, GOTH, and LOTH</u>. The public assistance (GPA, LPA) and other income (GOTH, LOTH) variables are significant with the hypothesized signs and account for 6% of the explained variation in family income changes. Examination of the means for these variables in Table 11 shows that 16.6% of the sample families lose and 3.9% gain public assistance as a source of family income between t_1 and t_3. Also, 1.2% of the sample lose while 14% gain some other source of family income. Tables 13 and 14 present the types, frequencies, and average annual amounts of

Table 12. Frequencies, Average Family Incomes, and Average Family Income Changes (TAFYCH) Associated with Various Patterns of Family Labor Force Participation in the Sample[a]

Number of Employed Spouses in t_1 and t_3	Frequency (%)	Average Family Income in t_1	Average Family Income in t_3	TAFYCH
None (t_1) - one (t_3)	11 (2)	4,719	10,246	5,527
None (t_1) - two (t_3)	1 (0)	3,024	11,696	8,672
One (t_1) - one (t_3)	194 (35)	6,898	9,271	2,373
One (t_1) - two (t_3)	124 (22)	8,971	15,591	6,620
Two (t_1) - two (t_3)	174 (31)	14,014	16,620	2,606
Two (t_1) - one (t_3)	50 (9)	13,732	9,943	-3,789
Total	554 (99)[b]	10,164	13,078	2,915

[a]All dollar figures are in 1977 dollars.

[b]Does not add to 100% due to rounding.

Table 13. Types, Frequencies, and Average Annual Amounts of Public Assistance Income Observed in the Sample Families in t_1 and t_3

Type	t_1		t_3	
	Frequency	Average Annual Amount ($ 1977)	Frequency	Average Annual Amount ($ 1977)
Unemployment compensation	89	1,302	10	3,234
Aid to families with dependent children	3	1,629	1	588
Aid to the disabled	2	3,205	2	3,960
Veterans disability	0	--	2	756
Social security	10	3,403	18	3,603
Workmen's compensation	1	2,168	1	4,420
WIC[a]	0	--	3	284

[a]Special supplemental food program for women, infants, and children

Table 14. Types, Frequencies, and Average Annual Amounts of Other Income Observed in the Sample Families in t_1 and t_3

Type	t_1		t_3	
	Frequency	Average Annual Amount ($ 1977)	Frequency	Average Annual Amount ($ 1977)
Farming (part-time)[a]	38	740	46	2,082
Self-employment (nonfarm)	10	2,796	4	3,245
Rent (structure)	2	448	6	950
Land lease/rental	0	--	3	483
Proprietorship	0	--	1	1,500
Child support	6	1,548	13	1,712
Pension (private)	1	6,336	2	6,020
National Guard	5	1,980	4	1,819
Veterans benefits (educational)	4	3,640	4	4,377
Veterans pension	0	--	2	6,050
Job training grant	2	2,592	0	--

[a]For part-time farming the dollar figure is the average annual return to land, labor, and capital. This figure is determined from data collected in a supplementary questionnaire which asked for detailed information on part-time farming operations. The supplementary questionnaire was attached to the employee questionnaire in Appendix B at the time of the survey to obtain data for another study. That supplemental questionnaire is not included in this study because the study of changes in part-time farming operations is not included in the objectives of this study.

public assistance and other incomes, respectively, encountered in the sample. The most prevalent sources of public assistance incomes in both periods are unemployment compensation and social security payments. The most prevalent source of other income in both periods is part-time farming. It is interesting to note the nearly threefold increase in average part-time farming incomes associated with the nonfarm employment of a family member between t_1 and t_3.

The variable LOTH has the largest coefficient (-5.312) of any variable in the equation. Its interpretation is that, other things being equal, families that lose sources of other income between t_1 and t_3 have smaller family income changes by the amount of $5,312. Further analysis of the seven observations losing other incomes shows that three lost farm incomes, two lost self-employment incomes, and one each lost veterans' educational benefits and National Guard payments. The average amount of other income lost by these families is $5,022.

Demographic Variables

Variables in this group measure the influence of worker age (AGE), sex (SEX), and education (EDUC) and change in the number of children in the family (FAMCH) on family income changes. While the coefficients for each variable in the group have the hypothesized sign, only EDUC is significant.

AGE. Worker age is expected to have a significant negative effect on income changes because it is hypothesized that older workers and families are less competitive and more likely to have reached their income potential. Table 15 provides means of selected equation variables for different age groups of workers. The differences in the means of TAFYCH across groups suggest that there is, in fact, variation in the dependent variable, but the relationship appears not to be of the linear form specified. The 30-39-year-old group has the highest average income change, while the youngest and oldest groups have the smallest changes.[15]

The insignificance of AGE may be caused by multicollinearity in the equation which can leave estimators statistically unbiased but inefficient (without minimum variance). The correlation matrix (see Appendix D) reveals two noticeable correlations between AGE and EDUC (r = -.348) and AGE and MOWKPL (r = .360). SEX is also significantly correlated at the .05 level of t with PREMP, SPENT, GPA, GOTH, SEX, FAMCH, UNDERR, MIG, Q_1 and Q_2. Regression of AGE against all other independent variables in the model yields an R^2 of .38 with SPENT, GPA, GOTH, EDUC, FAMCH, MOWKPL, UNDERR, and MIG significant at the .05 level of t or greater.[16]

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[15]The observed trend in the data suggests that the AGE coefficient may not be only insignificant but biased due to the specification of the incorrect functional form. Two alternate specifications, the addition of a squared term for AGE and a series of discrete variables corresponding to the five age groups in Table 15, were tried. Neither of these specifications improve either the significance level of the age variable(s) or the R^2 of the equation.

[16]Multiple regression and mean analysis are used to identify correlations because correlation coefficients do not identify multicollinearity problems which may be caused by complex correlations with groups of other variables. Correlation coefficients also are not useful in identifying nonlinear relationships between variables.

Table 15. Means of Selected Variables by Employee Age Group

Variable	Age Group: Under 20 Years	20-29 Years	30-39 Years	40-49 Years	50 Years and Over	All
TAFYCH	2,438	2,997	3,279	2,918	1,925	2,956
	(3,078)[a]	(5,027)	(4,833)	(3,959)	(4,324)	(4,698)
PREMP	1.00	.87	.76	.78	.84	.83
SPENT	.08	.13	.14	.02	.02	.10
SPEX	.04	.13	.09	.10	.18	.11
STAYIN	.21	.40	.50	.47	.33	.43
GPA	.00	.03	.03	.05	.13	.04
LPA	.04	.18	.17	.22	.04	.17
GOTH	.04	.12	.13	.18	.20	.14
LOTH	.00	.02	.03	.01	.00	.01
SEX	.42	.46	.54	.63	.60	.52
EDUC	11.29	11.62	11.06	9.76	9.11	10.97
FAMCH	.12	.30	.22	.10	.02	.22
MOWKPL	7.21	27.53	41.06	44.11	49.49	34.73
SIZRLF	2.13	2.71	2.68	2.49	2.51	2.63
RLWAGE	98.67	107.73	108.18	98.79	99.87	105.47
SKILL	.18	.21	.22	.18	.18	.21
COMM	.12	.15	.24	.22	.07	.18
MIG	.08	.14	.12	.22	.22	.15
RMIG	.00	.13	.25	.18	.16	.17
Q_1	.12	.17	.20	.32	.33	.21
Q_2	.50	.22	.17	.15	.11	.20
Q_4	.04	.22	.21	.14	.20	.20
Q_5	.08	.19	.20	.25	.22	.20
n	24	252	157	87	45	565

[a]Numbers in parentheses are standard deviations.

Close examination of Table 15 reveals a number of other relationships which may be contributing to the insignificance of AGE. All of the workers in the under-20 group are previously employed, compared to smaller percentages in the other groups, contributing to relatively smaller income gains for that group as a whole.[17] There is also a complex correlation between the spouse labor force participation variables and employee age. Twenty-nine percent of the under-20 group and 35% of the over-50 group have spouses that either enter or stay in the labor force. Spouses tend to enter or stay in the labor force at higher rates in the other three groups: 53% in the 20-29 group, 64% in the 30-39 group, and 49% in the 40-49 group. This means that the younger and older groups of workers tend to be influenced less by the greater income gains associated with spouses entering or staying in the labor force than the middle age groups.

SEX. It is hypothesized that female workers will be more likely to be new labor force entrants and additional family income earners than males and, hence, contribute relatively more than males to family income gains. Examination of the correlation coefficients (Appendix D) suggests that the insignificance of the sex variable may also be due to multicollinearity. SEX is significantly correlated at the .05 level with PREMP, SPENT, STAYIN, GPA, AGE, EDUC, FAMCH, SIZRLF, RLWAGE, and SKILL.

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[17]This occurrence in the data is probably due to the deletion of workers who were, in many cases, young, new labor force entrants who failed to report any income in t_1. These deletions are detailed in Chapter 2.

Examination of the means of selected variables by sex in Table 16 indicates that the variables PREMP, SPENT, SPEX, and STAYIN appear to be explaining the portion of expected family income gains due to new labor force entry and labor force participation by both spouses due to female employment in the sample plants. Male employees are previously employed 93% of the time, while females are previously employed only 74% of the time. And the means of the spouse labor force participation variables indicate that 60% of the female employees are associated with families with both spouses working in t_3 compared to only 45% for male employees. To further examine this relationship, Table 17 contains frequencies and mean family income changes (TAFYCH) associated with the four major combinations of family labor force participation encountered in the sample (see Table 12, page 77) for males and females.

Sixty-four percent of the females and only 37% of the males represented in Table 17 are associated with the combinations yielding the highest average income gains [one (t_1) - two (t_3) and two (t_1) - two (t_3)].[18] But examination of the average income changes associated with each combination reveals that in all cases, except the first [one (t_1) - one (t_3)], the income changes are smaller for the families of female workers.

Table 16 also shows that female employees tend to be older, less educated, have smaller changes in family size, and be employed for shorter periods of time than male employees. Also, while female workers

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[18]These percentages differ from those calculated from Table 16, page 85, because differing numbers of observations are available for the calculations.

Table 16. Means of Selected Variables by Sex of the Employee

Variable	Male	Female	All
TAFYCH	2,948 (4,452)[a]	2,964 (4,842)	2,956 (4,698)
PREMP	.93	.74	.83
SPENT	.14	.07	.10
SPEX	.10	.13	.11
STAYIN	.31	.53	.43
AGE	31.20	33.65	32.47
EDUC	11.24	10.72	10.97
FAMCH	.32	.12	.22
MOWKPL	36.38	33.18	34.73
SIZRLF	1.93	3.28	2.63
RLWAGE	114.49	97.04	105.47
SKILL	.25	.16	.21
n	273	292	565

[a]Numbers in parentheses are standard deviations.

Table 17. Frequencies and Average Family Income Changes (TAFYCH) for Male and Female Employees Associated with Four Patterns of Family Labor Force Participation

Number of Employed Spouses in t_1 and t_3	Male		Female	
	Frequency (%)	TAFYCH	Frequency (%)	TAFYCH
One (t_1) - one (t_3)	122 (46)	2,301	72 (26)	2,741
One (t_1) - two (t_3)	47 (18)	6,895	77 (28)	6,520
Two (t_1) - two (t_3)	76 (29)	2,893	98 (36)	2,383
Two (t_1) - one (t_3)	21 (8)	-2,451	29 (11)	-4,759
Total	266 (101)[a]	2,948	276 (101)[a]	2,964

[a]Does not add to 100% due to rounding.

tend to be employed in larger, less skilled plants, they also tend to be employed in plants with lower relative wage levels. In fact, the average annual wage payment for females in t_3 is only \$7,250 compared to \$9,448 for males.

The picture which emerges from the above analysis is that the factors which differentiate male and female workers in terms of potential to change family incomes are measured elsewhere in the equation. It appears that while female employees are associated with family labor force participation patterns conducive to higher family incomes and income changes than males, lower wage payments to females offset these changes. The means of TAFYCH by sex in Table 16 indicate that income changes associated with female and male employees are virtually the same.

Discrete variables such as that specified for SEX often introduce heteroscedasticity in a regression framework. An *F*-test between the residual variances for females and males indicates that females are associated with a significantly greater residual variance than males. Heteroscedasticity does not statistically bias coefficients but can cause them to be inefficient.

EDUC. The level of educational attainment of the employee is significant in the equation with the hypothesized positive relationship with change in family income. The coefficient is interpreted as meaning that with other variables in the model held constant an additional year of formal education contributes \$226 to family income gains due to employment in one of the sample plants.

FAMCH. It is hypothesized that a change in the number of children in a family (FAMCH) will have a direct relationship with family income changes because additional children will lead family members to cover higher family costs by seeking higher paying jobs. But FAMCH is not significant in the regression results. Table 18 contains means of selected variables for three values of FAMCH which suggest that while there is variation in TAFYCH across values of FAMCH other variables in the equation may be explaining this variation. While family labor force participation patterns (measured by PREMP, SPENT, SPEX, and STAYIN) do not seem to exhibit any clear-cut difference among the levels of FAMCH, there appear to be significant positive correlations with GPA, GOTH, MOWKPL, and RLWAGE and a negative correlation with SEX. The positive relationship with RLWAGE suggests that increases in numbers of children do lead workers toward higher paying jobs.

Time Variable (MOWKPL)

This variable, measuring the number of months a worker was employed in the sample plant, is included in the model to control for the length of time over which income and other family changes occur. MOWKPL is significant in the results and has the hypothesized positive effect on the dependent variable. The coefficient is interpreted as indicating that, with all other factors in the equation held constant, each additional month of employment results in an $11 gain in real family income between t_1 and t_3.

Table 18. Means of Selected Variables by Change in the Number of Children in the Family Between t_1 and t_3[a]

Variable	FAMCH 0	FAMCH +1	FAMCH +2	All
TAFYCH	2,810 (4,395)[b]	3,133 (6,264)	6,327 (3,318)	2,894 (3,012)
PREMP	.82	.91	.87	.83
SPENT	.08	.21	.20	.10
SPEX	.11	.14	.07	.11
STAYIN	.46	.32	.40	.43
GPA	.03	.07	.13	.04
LPA	.18	.09	.13	.17
GOTH	.11	.20	.40	.14
LOTH	.02	.00	.00	.01
AGE	33.21	27.38	30.40	32.47
SEX	.56	.36	.13	.52
EDUC	10.86	11.63	10.87	10.97
MOWKPL	32.67	42.57	55.67	34.73
RLWAGE	104.29	109.11	118.77	105.47
$\underline{n}$	459	76	15	565

[a]The actual range of FAMCH is from -2 to +5. Only three values of FAMCH are included in the table because these values account for 97% of all observations.

[b]Numbers in parentheses are standard deviations.

Plant Variables

The three variables entered into the equation to measure characteristics of the sample plants (SIZRLF, RLWAGE, and SKILL) account for 6% of the total explained variation in the dependent variable. Each variable is significant despite the fact that these variables are the most intercorrelated of any group in the equation. SIZRLF and RLWAGE have the hypothesized direct relationship with TAFYCH, while SKILL has an unexpected negative coefficient.

SIZRLF. Plant labor force size relative to the size of the community labor force is intended to measure the amount of pressure new plants exert on local labor resources and is hypothesized to have a direct influence on changes in employee wage earnings and family incomes. The interpretation of the coefficient for the variable SIZRLF is that with all other variables in the equation held constant a 1% difference in the size of a plant's labor force relative to the county labor force results in a $287 difference in the change in total family income due to family member employment in that plant.

Certain characteristics of the sample of plants used in this study suggest that the coefficient and sign of SIZRLF be interpreted with care. The two largest plants in the sample have predominately female work forces. This correlation between SEX and SIZRLF is indicated by the significant correlation coefficient (r = .288) in Appendix D and particularly by the means of SIZRLF by sex shown in Table 16, page 85. While this correlation does not statistically bias the coefficients of either variable, it may hinder the generalized interpretation of the coefficient for SIZRLF. Plants of large relative size which employ predominately male work forces may exhibit different impacts on employee wage and family income changes than the plants of large relative size included in this study.

RLWAGE. Plants with higher average wage levels relative to the prevailing manufacturing wage rate in the community are expected to lead to greater $t_1 - t_2$ and $t_2 - t_3$ wage gains and, hence, family income gains for their employees. The empirical result is as expected with the coefficient indicating that holding all other variables in the equation constant a 1% difference in a plant's weekly manufacturing wage results in a direct $41 difference in the change in an employee's total family income.

SKILL. The skill variable, although having a significant coefficient, is the only variable in the equation not to carry the hypothesized sign. It is expected that higher skill plants provide greater scope for employee wage gains and, hence, family income gains. The significant negative coefficient is surprising in light of the strong positive correlation (r = .497) between SKILL and RLWAGE which carries a positive coefficient in the equation. Also, when the employee sample is categorized into three groups on the basis of the skill index of the plant in which each worker is employed and average family income changes are computed for each group, the higher skill groups do, in fact, have greater family income gains (TAFYCH) than the lower skill groups (TAFYCH for high skill group = $3,019, TAFYCH for middle group = $2,816, TAFYCH for low group = $2,726). The interpretation of the negative coefficient suggests that with other factors in the equation held constant, employees in plants with higher skill indices have smaller family income gains than those in plants with lower skill indices.[19]

The unexpected negative coefficient for the skill variable may be the result of measurement problems associated with specifying SKILL and/or statistical problems in the model. The sign could be negative if, in the sampling process, higher skilled workers were underrepresented in the samples of plants having higher skill indices causing observed behavior within the employee samples obtained from those plants to be other than expected; or the unexpected relationship could occur if the skill index used to specify SKILL is an inaccurate measure. These possibilities can be partially discounted due to the strong correlation between SKILL, which is measured using data provided by plant management and the plant wage measure (RLWAGE), which is calculated using data from the employee samples. It is theorized that relative wage measures and absolute skill levels of plants do not necessarily have to be very highly correlated because of cross sectional differences in rates of unemployment and underemployment.

Another explanation for the negative coefficient concerns the efficiency or reliability of the estimated coefficient for SKILL. A high degree of multicollinearity in the equation, while not causing statistical bias of the coefficient, can cause the variance of the

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[19]This interpretation must be qualified by the fact that only a limited range of skill indices is observed in the sample of plants used in this study (range = .00 to 1.28 with a mean of .223).

coefficient to be so large and the estimate so inefficient (unreliable) that it has the opposite sign. A high degree of multicollinearity seems to be a plausible explanation since the plant variables are the most intercorrelated of any variable group in the model. Regression of SKILL on the other independent variables in the equation, to test for a high degree of multicollinearity, results in an $\underline{R}^2$ of .36 with LPA, GOTH, EDUC, RLWAGE, UNDERR, UNPTR, and Q_2 significant at the .05 level.

The above observations do not conclusively prove or disprove that the negative coefficient for the skill variable is the result of statistical problems in the model. Since the hypothesized direct relationship between family income changes and plant skill levels is the result of expected greater employee wage gains in higher skill plants, the analysis of factors influencing changes in wage earnings in Chapter 4 may clarify the role of plant skill requirements.

Community Variables

The variables measuring characteristics of the community labor supply (UNDERR and UNPTR) account for 4% of the total explained variation in family income change. While both UNDERR and UNPTR have the hypothesized negative sign, UNPTR is not significant.

UNDERR. Higher rates of underemployment are expected to have an inverse effect on family income gains because they are indicative of increased availability of employed workers capable of more skilled work resulting in suppressed wage rates. The significant coefficient for the underemployment variable suggests that with other factors in the equation held constant a 1% difference in the county rate of underemployment results in an indirect difference of $127 in family income changes for sample workers employed in that county.

UNPTR. This variable, measuring the combined rates of unemployment and potential labor force entry, is also expected to have an inverse relationship with family income changes because greater supplies of idle labor are expected to suppress wage rates. UNPTR has the hypothesized sign but is significant at only the .145 level of t. A possible cause of the insignificance of UNPTR is multicollinearity. UNPTR is significantly correlated at the .05 level with PREMP, LPA, LOTH, SIZRLF, SKILL, UNDERR, and Q_1. UNPTR and UNDERR are positively correlated (r = .171). These correlations between UNPTR and other independent variables are shown in Table 19 which contains means of selected independent variables for three categories of UNPTR. Also, analysis of family labor force participation patterns within each category shows that employees in areas with higher values of UNPTR are the least likely to be associated with the patterns resulting in the greatest income gains and the most likely to be associated with patterns resulting in the smallest income gains. Regression of UNPTR on the remaining independent variables results in an R^2 of .22 with STAYIN, SEX, SIZRLF, RLWAGE, SKILL, UNDERR, Q_1, Q_4, and Q_5 significant at the .05 level or greater.

The insignificance of UNPTR may also be attributed to the measurement problems involved in the specification of UNPTR noted earlier in this chapter. The theoretically most desirable county rates

Table 19. Means of Selected Variables by Three Categories of the Community Rate of Unemployment and Potential Labor Force Entry (UNPTR)

Variable	High	Medium	Low
TAFYCH	2,324	3,283	3,266
	(4,106)[a]	(5,182)	(4,608)
Family income (t_1)	9,440	10,273	10,678
Family income (t_3)	11,765	13,608	13,925
PREMP	.80	.86	.85
SPENT	.10	.14	.06
SPEX	.11	.12	.11
STAYIN	.39	.43	.47
GPA	.03	.04	.05
LPA	.21	.15	.14
GOTH	.12	.16	.13
LOTH	.03	.00	.00
AGE	31.87	31.13	35.08
SEX	.46	.50	.61
EDUC	10.72	11.15	11.03
FAMCH	.21	.19	.28
MOWKPL	32.04	33.01	40.40
SIZRLF	1.42	3.97	2.18
RLWAGE	104.52	115.73	92.07
SKILL	.16	.21	.25
UNDERR	24.20	25.82	18.57
COMM	.20	.12	.24
MIG	.13	.13	.21
RMIG	.14	.22	.12
_n_	188	220	156

[a]Numbers in parentheses are standard deviations.

of unemployment and potential labor force entry are those for the year of a worker's entry into the firm and for the survey year. But due to data limitations, the rates specified are for 1970 only. Thus, UNPTR may have mismeasured the relevant rate for some observations.[20]

Residence Status Variables

The series of discrete variables entered in the equation to measure family income changes of commuting (COMM), migrating (MIG), and return migrating (RMIG) workers relative to local workers account for 2% of the total explained variation in the dependent variable. While each of the variables have the hypothesized sign, only return migrants have significantly different changes in family income, net of other factors, relative to local workers. Forty-nine percent of the employees in the sample are classified as local, 18% as commuters, 15% as migrants, and 17% as return migrants.

COMM and MIG. Commuters and migrants (nonlocals) are expected to have significantly higher income gains than local workers. It is expected that nonlocals will be younger, more educated, and more highly skilled than local workers and, thus, have greater scope for income

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[20]While the same measurement problem is encountered in the specification of UNDERR, which is significant in the equation, one might expect more fluctuation in unemployment rates than in underemployment rates because of conceptual differences between the two. The percentages of idle workers may fluctuate over rather short time periods due to worker mobility and changes in the level of economic activity. Underemployment rates, on the other hand, relate measures of human capital stock to average earnings in the county and would seem to be less susceptible to either short-run fluctuations or relative changes.

gains. It is also expected that nonlocals will tend to be attracted by larger, higher wage and skill firms in areas of lower surplus labor and, hence, be able to command relatively high wages. While neither COMM nor MIG is significant net of other factors in the regression results, the means of family income change by residence status in Table 20 suggest that commuters and migrants do have somewhat greater income changes than local workers. Since other independent variables included in the model measure some of the same individual, plant, and community characteristics which are expected to differentiate workers by residence status, it is possible that the statistical insignificance of COMM and MIG is due to multicollinearity. COMM is significantly correlated at the .05 level with UNDERR, MIG, and RMIG, while MIG is significantly correlated with PREMP, AGE, UNDERR, COMM, and RMIG.

Examination of Table 20 suggests that a number of the hypotheses regarding the characteristics of commuting and migrating workers are not supported in this sample. Commuters and migrants tend to be older and have only marginally higher levels of formal education than local workers. And the hypothesis that commuters and migrants tend to provide more skilled labor than local workers is contradicted by the fact that they are less likely to be previously employed. Also, while commuters and migrants are employed in plants with marginally higher skill levels and in areas of lower unemployment and underemployment, they are employed in plants with lower relative size and wage levels than local workers. The above observations indicate that, while a number of the suspected independent variables are not correlated with COMM and MIG in the

Table 20. Means of Selected Variables by Employee Residence Status

Variable	Residence Status				
	Local	Commuter	Migrant	Return Migrant	All
TAFYCH	3,148 (4,510)[a]	3,468 (4,933)	3,525 (3,878)	1,403 (5,313)	2,956 (4,698)
PREMP	.88	.77	.70	.87	.83
SPENT	.11	.11	.06	.10	.10
SPEX	.12	.09	.10	.13	.11
STAYIN	.39	.49	.50	.43	.43
GPA	.05	.02	.03	.03	.04
LPA	.17	.13	.20	.18	.17
GOTH	.16	.12	.16	.10	.14
LOTH	.00	.02	.02	.02	.01
AGE	31.24	32.46	35.51	33.84	32.47
SEX	.48	.50	.58	.59	.52
EDUC	10.96	11.11	11.08	10.69	10.97
FAMCH	.28	.18	.13	.15	.22
MOWKPL	34.01	36.89	31.91	36.55	34.73
SIZRLF	2.75	2.31	2.30	3.02	2.63
RLWAGE	108.02	100.63	101.41	108.04	105.47
SKILL	.20	.22	.23	.19	.21
UNDERR	23.99	21.74	21.91	24.45	23.28
UNPTR	11.68	10.82	10.34	13.16	11.64
n	275	100	86	94	565

[a]Numbers in parentheses are standard deviations.

expected way, there is evidence of intercorrelations which may be causing the insignificance of these two variables.

The means of PREMP, SPENT, SPEX, and STAYIN shown in Table 20 also indicate an unexpected complex correlation between patterns of family labor force participation and residence status which may also be contributing to the insignificance of COMM and MIG. The nature of this complex correlation is seen most clearly in Table 21, which contains frequencies by residence status and average family income changes for the four most prevalent combinations of family labor force participation in the sample. Sixty-two percent of the commuters and 61% of the migrant employees are from families whose labor force participation patterns are associated with the greatest income gains [one (t_1) - two (t_3) and two (t_1) - two (t_3)] compared to 51% for local workers. And only 4% of the commuters and 5% of the migrants are from families associated with the smallest income gains [two (t_1) - one (t_3)] compared to 11% for local workers.

The means of selected variables for local, commuting, and migrating workers by sex provided in Table 22 suggest that another explanation for the insignificance of COMM and MIG is the differing characteristics of males and females within those groups. While nonlocal workers still tend to be older than local workers, nonlocal males tend to be more educated and nonlocal females less educated than their local counterparts. The means of PREMP show that while nonlocal males are slightly less likely to have work experience in the previous year than local males nonlocal females are much less likely to have such experience than local females.

Table 21. Frequencies of Local, Migrant, and Commuting Families Associated with Four Patterns of Family Labor Force Participation and Average Family Income Change (TAFYCH) for Each Pattern

Number of Employed Spouses in t_1 and t_3	Residence Status			TAFYCH
	Local (%)	Commuter (%)	Migrant (%)	
One (t_1) - one (t_3)	100 (38)	34 (35)	27 (34)	2,709
One (t_1) - two (t_3)	55 (20)	27 (28)	21 (27)	7,016
Two (t_1) - two (t_3)	81 (31)	33 (34)	27 (34)	2,820
Two (t_1) - one (t_3)	29 (11)	4 (4)	4 (5)	-3,301
Total	265 (100)	98 (101)[a]	79 (100)	3,245

[a]Does not add to 100% due to rounding.

Table 22. Means of Selected Variables for Local, Commuting, and Migrating Workers by Sex

Variable	Local		Commuter		Migrant	
	M[a]	F	M	F	M	F
PREMP	.96	.80	.94	.60	.89	.56
AGE	30.51	32.03	31.08	33.84	32.81	37.46
EDUC	11.01	10.91	11.45	10.76	12.03	10.40
RLWAGE	117.48	97.94	110.77	90.48	113.21	92.90
SIZRLF	2.02	3.54	1.91	2.70	1.65	2.77
SKILL	.24	.16	.27	.16	.36	.13
UNDERR	23.58	24.43	21.71	21.77	20.05	23.24
UNPTR	11.98	11.35	11.49	10.15	7.10	12.67
n	142	133	50	50	36	50

[a]M = Male; F = Female

The statistics for plant characteristics in Table 22 show that both male and female local workers tend to be employed in larger, higher wage plants than nonlocal males and females. But nonlocal males tend to be employed in higher skilled plants, and nonlocal females in lower skilled plants, than their local counterparts. In terms of community characteristics, the expected relationships found in Table 20 still hold with the exception that migrant females are more likely than local or commuting females to be employed in areas of high underemployment.

The above observations indicate that COMM and MIG may also be insignificant because they do not comprise homogeneous groups. This explanation is supported by the presence of heteroscedasticity associated with these variables in the regression equation. $\underline{F}$ tests conducted on the residual variances of observations having zero (0) and one (1) values for COMM and MIG are significant for both variables.

RMIG. Return migrants are expected to have lower income gains than local workers because previous research has indicated that return migrants often sacrifice income in order to return to their home areas to live and work. The significant negative coefficient for RMIG supports this hypothesis. The coefficient is interpreted as meaning that net of other factors in the equation the families of return migrant workers in the sample have lower income gains than the families of local workers by the amount of $1,141.

Well-Being Status Variables (Q_1, Q_2, Q_4, Q_5)

Each of the series of discrete variables entered into the equation to measure the income gains of families by quintile of well-being in t_1

(Q_1, Q_2, Q_4, Q_5) is significant in the regression results. The sign and magnitude of the coefficients on these variables indicate the extent to which families in a particular quintile of well-being in t_1 gain or lose relative to those families in the third quintile due to family member employment in the sample plants. Variables Q_1 and Q_2 have positive coefficients, while Q_4 and Q_5 have negative coefficients. These results suggest that with other variables in the equation held constant family member employment in the sample plants has an equalizing effect on levels of well-being within the sample of families.

The above interpretation is substantiated by the analysis of relative mean incomes by quintile of well-being status for the sample distributions in t_1 and t_3 shown in Table 23. The relative mean income of a quintile is calculated as the mean of that quintile divided by the mean of the distribution as a whole. The figures in Table 23 show that families in quintiles 1, 2, and 3 gain relative to the mean of the distribution as a whole between t_1 and t_3, while families in quintiles 4 and 5 lose.

Other Statistical Properties of the Model

The unbiased and efficient estimation of population parameters using multiple regression analysis requires that certain statistical assumptions not be violated. The six basic assumptions of the ordinary least squares multiple regression model are: (1) that the error terms (or residuals) are normally distributed; (2) that the error terms have a zero mean (no specification bias); (3) that the error terms have a constant variance (homoscedasticity); (4) that the error terms are not

Table 23. Mean Well-Being Income Levels by Quintile and Relative Mean Well-Being Income by Quintile for Sample Families in t_1 and t_3

Quintile	t_1 Mean Income ($ 1977)	t_1 Relative Mean Income	t_3 Mean Income ($ 1977)	t_3 Relative Mean Income
1	1,093	-22%	1,539	20%
2	1,895	39%	4,546	59%
3	4,215	86%	7,150	93%
4	7,367	151%	10,225	133%
5	12,274	251%	14,862	194%
All Quintiles	4,885	--	7,662	--

correlated with each other (no serial correlation); (5) that the independent variables are nonstochastic; and (6) that the independent variables are linearly independent of each other (no multicollinearity).

Possible problems with heteroscedasticity, multicollinearity, and stochastic independent variables related to the insignificance or inefficiency of certain coefficients in the model have already been discussed in the previous pages and will not be discussed further. Violation of the normality assumption does not result in either biased or inefficient regression estimates, and serial correlation is not considered to be a problem in cross sectional models. The only remaining problem is that of possible specification bias.

Specification bias normally results from the use of an improper functional form within the model or from the exclusion of some relevant explanatory variable. The use of improper functional form results in regression coefficients which are biased and inefficient estimates of population parameters. The only variable in the model for which a nonlinear form was tested is AGE and, as reported previously, the nonlinear forms do not improve either the equation $\underline{R}^2$ or the significance level of any independent variables. Plots of the error terms against the dependent variable (TAFYCH) and each of the continuous independent variables suggest that the linear forms specified in the model are appropriate.

Specification bias may also result from the exclusion of some relevant independent variable from the model. If some relevant explanatory variable is omitted and it is correlated with included variables, then the coefficients of those variables are biased and inefficient. If the omitted variables are not correlated with included variables, then no bias or inefficiency results. The $\underline{R}^2$ of this model which indicates that only 60% of the total variation in TAFYCH is explained by the model suggests that some relevant explanatory variable(s) have been omitted from the model. Plots of the error terms against TAFYCH also reveal that the model tends to consistently underestimate both high positive and low negative family income changes. The result is a noticeable direct linear relationship between the error terms and TAFYCH. Analysis of the outlying observations on the residual plots to detect similarities in those observations does not suggest the nature of any excluded explanatory variable(s).

Conclusions

The analysis of factors influencing changes in family incomes due to family member employment in the sample plants undertaken in this chapter is the first step in this study of the primary round impacts of new manufacturing industry on the distribution of incomes in rural areas. The regression results support the baseline hypothesis of the conceptual model used in this study: that individual, family, plant, and community characteristics interact to determine how family incomes change due to new plant locations.

The most important group of explanatory variables in the model are those which measure changes in family labor force participation patterns. The highest family incomes and the greatest positive changes in family incomes are associated with families adding a second spouse to the employed labor force. And the greatest losses in family income are associated with families losing a previously employed spouse. The net increase in families with two spouses employed observed in this sample suggests that many rural families feel that they are not able to achieve an acceptable standard of living with only one spouse in the labor force. Only 9% of all families in the top two quintiles of well-being in t_1 and 4% of all families in the top two quintiles of well-being in t_3 have one family wage earner. The percentage of one-earner families decreases from 59% in t_1 to 45% in t_3. And the percentage of two-earner families increases from 41% in t_1 to 55% in t_3. The dominance of family labor force participation patterns in explaining both levels of well-being and changes in well-being suggests that they be considered when interpreting other results.

Gains and losses of public assitance incomes are significant factors in explaining family income changes. While approximately 4% of the sample families gain some source of public assistance, 17% give up public assistance payments due to family member employment in manufacturing plants. The percentage of sample families receiving unemployment compensation decreases from 16% in t_1 to 2% in t_3. The gain or loss of other sources of income are also significant with 14% of the sample families gaining and 1% losing some other source of family income between t_1 and t_3. The frequency of families engaged in part-time farming enterprises (7% of the sample in t_1 and 8% in t_3) and the nearly threefold increase in average part-time farming earnings (from

\$740 in t_1 to \$2,082 in t_3) suggests the importance of further study of factors influencing part-time farming earnings.

With the exception of the level of educational attainment, the demographic characteristics of individual workers do not prove to be highly significant, net of other factors, in the regression results. The analysis of these variables suggests that their role may be overshadowed by patterns of family labor force participation. Since the demographic characteristics are primarily hypothesized to influence the wage earning potential of individual workers, the role of these factors may be illuminated by further study of changes in employee wage earnings as opposed to family incomes. While employee sex is insignificant, net of other factors, in the regression analysis, the fact that the sample contains a majority of female respondents suggests that female workers often take the role of primary (or necessary), rather than supplemental, family wage earners. The crucial role of working female spouses is underscored by the observed need for two working spouses in order to attain high relative levels of well-being within the sample.

Variables measuring the quality and quantity of labor demanded by new plants and labor supplied by rural communities are significant in the regression results. Larger plants offering higher relative wages appear to be contributing significantly to family income gains, net of other factors. But the role of plant size needs to be interpreted carefully because the larger plants in the sample also have predominately female work forces. More study is needed to determine the influence of plant skill levels on income changes. Further analysis of the role of plant variables, including skill measures, in changing employee wage earnings may provide valuable information. Despite measurement problems associated with specifying community labor supply variables, county rates of unemployment and potential labor force entry and rates of underemployment contribute significantly to the results.

The proven significance of plant and community characteristics in effecting income changes suggests that policy relevant information may be gained by further analysis of the impacts of various types of plants on different types of communities. And the dominant role of family labor force participation patterns in explaining family income changes suggests that more attention be given to the interactions between plant and community variables which affect these patterns.

While workers classified as return migrants have significantly different income changes than local workers, commuters and migrants do not. The fact that 33% of the workers sampled are commuters and migrants suggests, however, that these groups compete extensively with local workers for new jobs. The results have shown that migrants and commuters are not homogeneous groups and are not necessarily employed in larger, higher wage plants than local workers, as hypothesized. Also, the expected greater family income gains for commuters and migrants may be masked by tendencies for increased family labor force participation in these groups. Further analysis of the interactions between changes in employee wage earnings, plant characteristics, and commuting and migration may lead to better understanding of the factors differentiating local and nonlocal workers.

Both the regression results and the relative mean income analysis reflect an equalization of levels of well-being within the sample families. But further study is needed to assess the direct impact of employment in the sample plants on the distribution of incomes within the sample communities as a whole. Also, further analysis is needed to assess the extent to which this sample of new rural manufacturing firms has succeeded in bringing families out of poverty.

CHAPTER 4

ANALYSIS OF FACTORS INFLUENCING CHANGES IN EMPLOYEE WAGE EARNINGS

This chapter contains an analysis of the role of individual, plant, and community characteristics in affecting changes in employee wage incomes due to employment in new rural manufacturing plants. The results of the analysis of factors influencing changes in total family incomes in the previous chapter indicate that changes in family labor force participation coinciding with employment in the sample plants tend to dominate that analysis and, perhaps, cause the statistical insignificance of other variables. Investigation of the factors influencing changes in employee wage incomes, as opposed to changes in total family incomes, may clarify the role of a number of demographic variables, including worker age, sex, and residence status which are statistically insignificant in the analysis of family income changes in Chapter 3. Also, focusing on changes in wage earnings may help identify the reasons for the unexpected inverse relationship observed between plant skill levels and family income gains.

The conceptual model of factors influencing income changes developed in Chapter 1 is used in selection of appropriate variables for this part of the study. Variables fall into the same seven categories outlined in Chapters 1 and 3. Independent variables measuring the effects of changes in spouse earnings, public assistance, and other incomes are excluded from this analysis because they are not included in the calculation of employee wage incomes. The only variable remaining in the components of income category is change in the employment status of the sample worker. Also, variables measuring the relative income gains of families with various levels of well-being prior to employment in the sample firms are excluded from the group of analytical variables. These variables are omitted because employee wage incomes do not provide an accurate or useful measure of overall family income or well-being status.

The analysis in this chapter involves the specification and empirical testing, using ordinary least squares multiple regression analysis, of three separate equations: the first, to study factors influencing wage changes due to worker entry into the sample firm (t_1 - t_2); the second, to study wage changes due to worker mobility within the firm (t_2 - t_3); and the third, to study overall changes (t_1 - t_3) in employee wage earnings. The use of three equations allows separate analysis of the influence of individual, plant, and community variables on each component of overall changes in wage earnings. The data used for this part of the study are from the same sample of workers described in Chapter 2 and analyzed in Chapter 3.

The first section of this chapter includes the specification of variables and hypothesized relationships for each of the three equations. The second section contains the analysis of the empirical findings for each equation. The final sections provide a discussion of the statistical properties of the three models and a summary of the conclusions and implications of the analysis.

Specification of the Models and Expected Relationships

Variable groups involved in the regression analysis of changes in employee wage earnings include the dependent variables, changes in worker employment status, demographic characteristics of workers, a time variable, plant characteristics, community characteristics, and worker residence status variables. The operational variables relevant to the analysis of $t_1 - t_2$, $t_2 - t_3$, and $t_1 - t_3$ changes in wage earnings and the hypothesized relationships are discussed by variable group. Many of the operational variables are specified in the same way and have the same variable names as in the analysis of family income changes in Chapter 3.

Dependent Variables

The dependent variables in each equation are specified in terms of real changes in employee's total annual wage earnings. Employee wage earnings in each time period are adjusted to 1977 price levels using the appropriate U.S. Department of Labor unadjusted Consumer Price Index for all items.[21] These adjustments are made so that actual changes in employee purchasing power can be studied.

The dependent variable in the equation analyzing employee wage changes due to job entry ($t_1 - t_2$) has the variable name WCH12 and is specified as total annual employee wage earnings at job entry (t_2)

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[21] U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, Vols. 49-58.

minus total wage earnings in the year preceding employment in the sample plant (t_1). The dependent variable in the equation analyzing employee wage changes due to job mobility in the sample plant (t_2 - t_3) has the variable name WCH23 and is specified as total annual wage earnings in the survey year (t_3) minus total wage earnings in t_2. The dependent variable in the equation analyzing overall changes in employee wage earnings (t_1 - t_3) has the variable name WCH13 and is specified as total annual wage earnings in t_3 minus total annual wage earnings in t_1. These variables are specified in thousands of dollars for the purpose of the regression analyses.

Change in Worker Employment Status

Worker employment in a new manufacturing plant may constitute a change in that worker's employment status. Workers may be either employed, unemployed, or not in the labor force in t_1. To control for and measure the effects of change in worker employment status on changes in wage earnings, the discrete variable PREMP is entered in each equation. PREMP is set at zero (0) is a worker has no wage earnings in t_1 and at one (1) if a worker has any wage earnings in t_1.

Employment in the previous year is expected to result in a less abrupt shift in wage earnings due to worker entry into a sample plant, so a negative coefficient is expected for PREMP in the t_1 - t_2 equation. Workers with employment experience in the previous year are expected to have relatively greater wage gains due to mobility within a firm because of skills gained in previous employment. A positive coefficient is hypothesized for PREMP in the t_2 - t_3 equation. In terms of overall wage changes, it is expected that the smaller $t_1 - t_2$ shift in wage earnings associated with previous employment will result in a negative coefficient for PREMP in the $t_1 - t_3$ equation.

Demographic Characteristics

Demographic characteristics of employees included in this analysis are worker age, sex, and education and the change in the number of children in the employee's family. These variables are specified in the same way and have the same variable names as in Chapter 3.

Older workers are hypothesized to be less competitive and more likely to have reached their earning potential in period t_1 resulting in smaller shifts in wage earnings between t_1 and t_2 and between t_2 and t_3. A negative coefficient is expected for worker age (AGE) in all three equations.

Female employees are hypothesized to have greater abrupt shifts in wage earnings ($t_1 - t_2$) than males because it is expected that females will be more likely to enter the labor force intermittently to supplement family incomes. Female workers, however, may have smaller wage gains within manufacturing plants ($t_2 - t_3$) because of less previous work experience. The sex variable (SEX) is expected to have a positive coefficient in the $t_1 - t_2$ equation and a negative coefficient in the $t_2 - t_3$ equation. In the $t_1 - t_3$ equation, a positive coefficient is expected because it is anticipated that the greater $t_1 - t_2$ shift for females will predominate the smaller $t_2 - t_3$ shift.

Employees with greater years of formal education are hypothesized to be more competitive, more skilled, and have greater scope for wage gains through employment in manufacturing plants than workers with fewer years of education. A positive coefficient is expected for the education variable (EDUC) in all three equations.

Increases in the number of children in workers' families are expected to motivate workers to seek higher paying jobs resulting in greater wage gains between t_1 and t_2 and between t_2 and t_3. The number of children in the sample families at the beginning of period t_1 is, however, not available in the survey data. The survey instruments measured the number of children in sample families in t_3 and at the end of the t_1 period. The variable measuring the effects of changes in the number of children in worker families (FAMCH) is, therefore, included only in the t_2 - t_3 and the t_1 - t_3 equations, and positive coefficients are expected.

Time Variable

The employees included in the sample could have been employed in the sample plants for varying lengths of time. Greater periods of employment are expected to provide greater scope for wage gains between t_2 and t_3 and between t_1 and t_3. The time variable is not relevant to t_1 - t_3 wage changes because the time period over which t_1 - t_2 changes occur is 1 year for all employees. The number of months each worker is employed in a sample plant (MOWKPL) is included in the t_2 - t_3 and t_1 - t_3 equations, and positive coefficients are expected.

Plant Characteristics

As in the analysis of family income changes, variables are included in each of three equations analyzing changes in employee wage incomes to measure the effects of plant relative size, plant relative wage levels, and plant skill levels. Greater plant size relative to the size of the local labor force is hypothesized to affect greater pressure on wage rates and greater opportunity for workers to escape unemployment and underemployment, resulting in greater wage gains due to job entry and within-firm mobility. Plant relative size (SIZRLF) is specified in the same way as in the family income equation in Chapter 3 and is expected to have a positive coefficient in all three equations.[22]

Plant average wage levels relative to the average manufacturing wage in the community are intended to measure the scope for wage gains for new workers due to job entry and due to upward wage mobility in the plant. Greater relative wage levels are hypothesized to provide greater opportunity for wage gains in both periods. To measure the effects of plant relative wage levels on employee wage changes due to job entry, the variable RLWAGE2 is entered in the $t_1 - t_2$ equation. RLWAGE2 is specified as the average weekly entry level wage in the plant as a percentage of the average weekly manufacturing wage in the county, and a positive coefficient is expected.

To measure the effects of plant relative wage levels on employee wage changes due to wage mobility in the firm and on overall wage changes, RLWAGE3 is entered in both the $t_2 - t_3$ and the $t_1 - t_3$ equations. RLWAGE3 is specified as the average weekly wage in the plant

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[22]The conceptually appropriate measure of plant relative size in the $t_1 - t_2$ equation would be calculated using plant size in t_2 since each of these variables may change between t_2 and t_3. Data limitations prevent the use of this more appropriate specification of SIZRLF in the $t_1 - t_2$ equation.

in t_3 as a percentage of the average weekly manufacturing wage in the county. Positive coefficients are expected in each equation.

Plant skill levels are also expected to be directly correlated with changes in wage earnings between t_1 and t_2 and between t_2 and t_3. Greater plant skill requirements are hypothesized to lead to greater $t_1 - t_2$ wage gains by providing greater opportunity for workers to escape underemployment and greater $t_2 - t_3$ gains by providing greater opportunity for workers to move up to higher skill jobs. Plant skill levels (SKILL) are specified using the same index described in Chapter 3, and positive coefficients are expected in all three equations.

Community Characteristics

The community variables, intended to measure the quality and quantity of labor available in the communities in which the sample plants are located, are specified in the same way and have the same variable names as in the analysis of family income changes in Chapter 3. County rates of underemployment (UNDERR) are intended to measure the availability of workers capable of moving into higher wage and skill jobs. Greater availability of underemployed labor is hypothesized to suppress wage rates and wage gains resulting in smaller $t_1 - t_2$ and $t_2 - t_3$ changes in employee wage earnings. County rates of unemployment and potential labor force entry (UNPTR) are intended to measure the availability of willing but idle labor to newly locating plants. Greater availability of idle but willing labor is also expected to suppress wage rates resulting in smaller wage gains in each period. Due to the problems of data availability noted in Chapter 3, both UNDERR and UNPTR are measured using 1970 data, while the conceptually desirable period of measurement is the year an employee enters the sample plant (t_2). Negative coefficients are expected for both UNDERR and UNPTR in all three equations.

Residence Status Variables

The relative $t_1 - t_2$, $t_2 - t_3$, and $t_1 - t_3$ wage gains accruing to local, commuting, migrating, and return migrating workers are measured by entering employee residence status in each equation using a series of discrete (0,1) variables. The definitions and variable names for commuting (COMM), migrating (MIG), and return migrating (RMIG) workers are the same as those used in Chapter 3. Local workers are the omitted class against which the gains of the remaining three groups are compared.

Commuting and migrating workers are again hypothesized to be more competitive than local workers and to provide skills not available in the local work force, resulting in greater wage gains in all periods when compared to local workers. COMM and MIG are expected to have positive coefficients in all three equations. Return migrants, on the other hand, have been shown in previous research to be likely to accept income losses in order to return to their home areas to live and work. RMIG is expected to have a negative coefficient in all three equations.

Results of the Regression Analyses

The results of the multiple regression analysis of factors influencing $t_1 - t_2$, $t_2 - t_3$, and $t_1 - t_3$ changes in employee wage earnings are reported in Tables 24, 25, and 26. In each table the independent variables are grouped so that the contribution of each variable group to the total $\underline{R}^2$ of the equation can be observed. The cumulative $\underline{R}^2$ in the right-hand column of Tables 24, 25, and 26 shows the portion of the total $\underline{R}^2$ of each equation contributed by successive groups of independent variables.

The $\underline{R}^2$ of the $t_1 - t_2$ equation is .382 with 91% of the explained variation associated with the variable PREMP. The other groups of variables, measuring the effects of demographic characteristics of workers, plant characteristics, community characteristics, and employee residence status, each account for approximately 2% of the explained variation in employee wage changes due to job entry ($t_1 - t_2$).

The $t_2 - t_3$ equation has an $\underline{R}^2$ of .280. PREMP accounts for 3% of the explained variation in this equation, while demographic characteristics account for 30%; the time variable, 1%; plant characteristics, 27%; community characteristics, 36%; and employee residence status, 3%.

The equation analyzing factors influencing overall wage changes of employees due to employment in the sample plants ($t_1 - t_3$) has an $\underline{R}^2$ of .428. In this equation the variable PREMP accounts for 67% of the explained variation in the dependent variable, while demographic characteristics account for 3%; plant characteristics, 14%; community characteristics, 13%; and employee residence status, 3%.

Selected statistics for all variables included in the three equations are provided in Table 27. A correlation matrix of all variables included in the equations is provided in Appendix D. The remainder

Table 24. Results of the Multiple Regression Analysis of Variables Hypothesized to Explain Changes in Employee Wage Incomes Due to Job Entry in the Sample Plants (t_1 - t_2)

Variable	Specification	b Value	Standard Error	Cumulative R^2
INTERCEPT	--	5.336***	1.104	
PREMP	0,1	-5.072***	.323	.351
AGE	years	-.010	.012	
SEX	0,1	.710***	.262	
EDUC	years	-.030	.051	.359
SIZRLF	%	.109*	.058	
RLWAGE2	%	.027***	.008	
SKILL	index	-1.439***	.579	.367
UNDERR	%	-.052**	.022	
UNPTR	%	-.014	.011	.376
COMM	0,1	-.156	.313	
MIG	0,1	.081	.328	
RMIG	0,1	-.767***	.314	.384

R^2 = .384 F = 27.74 n = 548 Mean of Dependent Variable(WCH12) = 1.751

*Significant at the .10 level of t

**Significant at the .05 level of t

***Significant at the .01 level of t

Table 25. Results of Multiple Regression Analysis of Variables Hypothesized to Explain Changes in Employee Wage Incomes Due to Wage Mobility Within Sample Plants (t_2 - t_3)

Variable	Specification	b Value	Standard Error	Cumulative R^2
INTERCEPT	--	.265	.721	
PREMP	0,1	-.102	.206	.009
AGE	years	.003	.008	
SEX	0,1	-.480***	.172	
EDUC	years	.063**	.033	
FAMCH	number	.284**	.119	.094
MOWKPL	months	.006*	.003	.096
SIZRLF	%	.207***	.038	
RLWAGE3	%	.023***	.004	
SKILL	index	-.763**	.355	.172
UNDERR	%	-.102***	.013	
UNPTR	%	-.011	.007	.272
COMM	0,1	-.378*	.201	
MIG	0,1	.180	.209	
RMIG	0,1	-.158	.199	.280

R^2 = .280 F = 14.69 n = 545 Mean of Dependent Variable(WCH23) = 1.195

*Significant at the .10 level of t

**Significant at the .05 level of t

***Significant at the .01 level of t

Table 26. Results of Multiple Regression Analysis of Variables Hypothesized to Explain Changes in Employee Wage Incomes Due to Employment in Sample Plants (t_1 - t_3)

Variable	Specification	b Value	Standard Error	Cumulative R^2
INTERCEPT	--	5.728***	1.110	
PREMP	0,1	-5.141***	.316	.285
AGE	years	-.005	.013	
SEX	0,1	.199	.265	
EDUC	years	.037	.050	
FAMCH	number	.085	.183	.297
MOWKPL	months	.002	.005	.297
SIZRLF	%	.265***	.059	
RLWAGE3	%	.039***	.006	
SKILL	index	-1.927***	.547	.357
UNDERR	%	-.124***	.020	
UNPTR	%	-.022**	.011	.413
COMM	0,1	-.515*	.307	
MIG	0,1	.218	.322	
RMIG	0,1	-.941***	.307	.428

R^2 = .428 F = 28.36 n = 546 Mean of Dependent Variable(WCH13) = 2.948

*Significant at the .10 level of t

**Significant at the .05 level of t

***Significant at the .01 level of t

Table 27. Selected Statistics for Variables Included in the Regression Analyses of Changes in Employee Wage Incomes

Variable	Specification	Mean	Standard Deviation	Minimum	Maximum
WCH12	$ 1977 (000's)	1.751	2.570	-17.214	15.029
WCH23	$ 1977 (000's)	1.195	1.628	-8.566	9.735
WCH13	$ 1977 (000's)	2.948[a]	2.506	-13.518	16.159
PREMP	0,1	.834	.373	0	1
AGE	years	32.47	10.27	17	64
SEX	0,1	.517	.500	0	1
EDUC	years	10.973	2.405	1	18
FAMCH	number	.218	.648	-2	5
MOWKPL	months	34.727	25.785	1	93
SIZRLF	%	2.628	2.346	.083	6.462
RLWAGE2	%	90.683	19.784	45.157	147.878
RLWAGE3	%	105.469	25.879	46.286	172.989
SKILL	index	.205	.243	0	1.281
UNDERR	%	23.279	6.599	8.549	33.022
UNPTR	%	11.642	11.399	-5.631	45.491
COMM	0,1	.177	.382	0	1
MIG	0,1	.152	.360	0	1
RMIG	0,1	.166	.373	0	1

[a]WCH13 does not equal the sum of WCH12 and WCH23 due to rounding error.

of this section includes analysis of the regression results for each equation. The discussion is organized according to the six groups of explanatory variables included in the equations. Where applicable, the analysis includes discussion of possible violations of the assumptions of ordinary least squares multiple regression analysis which may result in the statistical bias or inefficiency of estimated coefficients.

Change in Worker Employment Status

The variable PREMP is significant and has the expected inverse relationship with changes in wage earnings in both the t_1 - t_2 and the t_1 - t_3 equations. But PREMP has an insignificant and negative coefficient in the t_2 - t_3 equation, while a positive coefficient is hypothesized. It is expected that the transfer of labor skills acquired in previous employment will give workers greater upward wage mobility in the new plant.

The means of the dependent and independent variables included in all three equations by previous employment status and sex of the worker are provided in Table 28. Examination of Table 28 indicates that previously employed workers do, in fact, have greater t_2 - t_3 wage gains (WCH23) as well as smaller t_1 - t_2 (WCH12) and t_1 - t_3 (WCH13) wage gains than previously unemployed workers. Possible statistical explanations for the insignificant and negative coefficient for PREMP in the t_2 - t_3 equation can be identified by examining the means of the independent variables included in that model in Table 28 and the correlation coefficients in Appendix D. PREMP has significant (at the .05 level of t) positive correlations with EDUC, RLWAGE3, and SKILL and

Table 28. Means of Selected Variables by Previous Employment Status and Sex

Variable	Previously Unemployed Workers (PREMP = 0)		Previously Employed Workers (PREMP = 1)	
	Male	Female	Male	Female
WCH12	6,833	5,995	612	1,366
	(2,620)[a]	(1,075)	(3,176)	(2,152)
WCH23	1,127	762	1,618	848
	(1,401)	(1,112)	(2,319)	(1,409)
WCH13	7,960	6,755	2,230	2,213
	(3,355)	(1,497)	(3,300)	(2,361)
AGE	33.61	35.46	31.03	33.01
EDUC	9.93	10.56	11.32	10.78
FAMCH	.22	.07	.33	.14
MOWKPL	30.83	32.57	36.79	33.40
SIZRLF	.83	2.76	2.01	3.46
RLWAGE2	88.28	82.93	97.62	85.42
RLWAGE3	102.73	92.46	115.32	98.65
SKILL	.10	.13	.26	.17
UNDERR	20.78	23.90	22.87	23.75
UNPTR	15.42	14.28	11.09	11.05
COMM	.17	.26	.18	.14
MIG	.22	.29	.13	.13
RMIG	.22	.11	.14	.22
_n_	18	76	255	216

[a]Numbers in parentheses are standard deviations.

significant negative correlations with AGE, SEX, UNPTR, and MIG. The above noted correlations may cause the coefficient for PREMP to be both negative and insignificant in the t_2 - t_3 equation due to multicollinearity.

The insignificant and negative coefficient for PREMP in the t_2 - t_3 equation may also be caused by heteroscedasticity which is often introduced by discrete variables. An F test of the residual variances for zero (0) and one (1) values of PREMP indicates that previously employed workers are associated with a significantly greater residual variance than previously unemployed workers in the t_2 - t_3 equation.

The problems with multicollinearity and heteroscedasticity suggest conceptual explanations for the insignificant negative coefficient for PREMP in the t_2 - t_3 equation. PREMP is positively correlated with a number of variables carrying positive coefficients and negatively correlated with variables carrying negative coefficients in the t_2 - t_3 equation. These relationships suggest that many previously employed workers, while having higher average t_2 - t_3 wage gains, still do not have t_2 - t_3 wage gains commensurate with other individual, plant, and community characteristics which are in their favor. The reason for this may be that many previously employed workers have little scope for t_2 - t_3 gains (as well as t_1 - t_3 gains) within this sample of rural plants because the plants provide them with few opportunities to improve significantly on previous wage earnings. The significantly greater residual variance for previously employed workers in the t_2 - t_3 equation indicates that the insignificance of PREMP may be due to variations in the degree of underemployment among workers in their previous jobs which affords them with differing potentials for wage gains.

Demographic Variables

AGE. The age variable is expected to have a negative coefficient in all three equations because older workers are hypothesized to be both less competitive and more likely to have achieved their earning potential in prior employment. The variable AGE has an insignificant coefficient in all three equations and a positive coefficient in the $t_2 - t_3$ equation.

To identify possible explanations for these results, Tables 29 and 30 provide a mean analysis of employee wage changes (WCH12, WCH23, and WCH13) and total wage earnings in t_1 and t_3 for five age groups of workers by sex. Table 29 contains the mean analysis for previously unemployed workers (PREMP = 0), while Table 30 includes only previously employed workers (PREMP = 1). Breaking down the mean analysis by PREMP and sex allows observation of wage changes and wage earnings by age group while controlling for two key determinants of wage changes. Means of MOWKPL for each cell are provided so that the time factor may also be taken into consideration.

Examination of Tables 29 and 30 reveals that there are no consistent trends in wage changes for either males or females across age groups. Among previously unemployed workers, older males and younger females have the greatest $t_1 - t_2$ gains; older males and females have the greatest $t_2 - t_3$ gains; and older males and younger females have the

Table 29. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) for Previously Unemployed Workers by Age Group and Sex[a]

	Age Group									
	Under 20		20-29		30-39		40-49		50 and Over	
Variable	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	--	--	6,245	6,147	7,266	6,091	9,562	5,947	3,050	5,105
			(2,422)[b]	(1,066)	(1,986)	(997)	(4,318)	(1,290)	(--)	(316)
WCH23	--	--	534	783	1,827	914	588	609	2,046	393
			(905)	(1,052)	(1,579)	(1,168)	(2,241)	(1,250)	(--)	(587)
WCH13	--	--	6,780	6,882	9,093	7,030	10,150	6,556	5,096	5,498
			(2,608)	(1,535)	(3,235)	(1,587)	(6,560)	(1,312)	(--)	(803)
Annual Wage in t_1	--	--	0	0	0	0	0	0	0	0
Annual Wage in t_3	--	--	6,780	6,882	9,093	7,030	10,150	6,556	5,096	5,498
MOWKPL	--	--	28.8	20.3	29.7	35.3	50.5	36.2	16.2	53.0
n	0	0	8	22	7	31	2	17	1	6

[a]Workers defined as previously unemployed if PREMP = 0. All dollar figures in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

Table 30. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) for Previously Employed Workers by Age Group and Sex[a]

Variable	Under 20		20-29		30-39		40-49		50 and Over	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	1,712	1,288	1,056	1,222	-367	1,458	654	1,312	122	1,911
	(1,746)	(1,129)	(3,011)	(2,139)	(3,609)	(2,529)	(3,137)	(1,932)	(2,832)	(1,987)
WCH23	956	592	1,575	694	1,962	999	1,380	1,078	1,573	858
	(1,196)	(869)	(2,339)	(1,486)	(2,458)	(1,195)	(2,061)	(1,559)	(2,746)	(1,491)
WCH13	2,668	1,880	2,630	1,916	1,595	2,457	2,034	2,390	1,696	2,768
	(1,797)	(1,666)	(3,197)	(2,185)	(3,800)	(2,827)	(3,084)	(2,319)	(3,119)	(2,173)
Annual Wage in t_1	4,962	4,230	6,660	5,221	8,674	4,891	7,586	5,064	8,253	5,279
Annual Wage in t_3	7,630	6,110	9,325	7,137	10,268	7,348	9,620	7,453	9,949	8,048
MOWKPL	8.6	5.2	30.6	25.0	47.9	37.4	48.9	43.5	41.9	56.2
n	14	10	128	94	66	53	30	38	17	21

[a]Workers defined as previously employed if PREMP = 1. All dollar figures in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

greatest $t_1 - t_3$ gains. Among previously employed workers, younger males and older females have the greatest $t_1 - t_2$ gains; older females have the greatest $t_2 - t_3$ gains with no perceptible trend for males; and younger males and older females have the greatest overall wage gains. These observations suggest that the insignificance of the age variable can be attributed to lack of a consistent relationship between wage changes and worker age in the sample data. The positive coefficient for AGE in the $t_2 - t_3$ equation appears to be partially substantiated by the mean analysis.

The relatively large wage gains of many older workers in the sample, and especially older female workers, suggest that older workers are not necessarily more likely than younger workers to have achieved their earning potential prior to employment in the sample plants. The implication is that many older workers, and especially older females, are underemployed in their previous jobs, and the sample plants give them an opportunity to become more fully employed.

Multicollinearity may also be contributing to the prevailing insignificance of AGE. AGE is noticeably correlated with EDUC ($\underline{r}$ = .348) and MOWKPL ($\underline{r}$ = .360) and is also significantly correlated at the .05 level with PREMP, SEX, FAMCH, RLWAGE2, UNDERR, and MIG. Regression of AGE on all other independent variables yields an $\underline{R}^2$ of .33 with SEX, EDUC, FAMCH, MOWKPL, UNDERR, and MIG significant at the .05 level of $\underline{t}$ or greater.

<u>SEX</u>. Female employees are hypothesized to have relatively greater $t_1 - t_2$ and $t_1 - t_3$ shifts and relatively smaller $t_2 - t_3$

shifts in wage earnings than males. As expected, SEX has a significantly positive coefficient in the $t_1 - t_2$ equation and a significantly negative coefficient in the $t_2 - t_3$ equation. In the $t_1 - t_3$ equation, SEX has the hypothesized positive coefficient but is insignificant.

Examination of the average wage changes by previous employment status and sex of the worker in Table 28, page 126, suggests an explanation for the insignificance of SEX in the $t_1 - t_3$ equation. Among previously employed workers, who constitute the majority of the sample, the relatively greater $t_1 - t_2$ gains and relatively smaller $t_2 - t_3$ gains for female workers result in nearly equal $t_1 - t_3$ gains for males and females.

The significantly greater gains for females at job entry, with previous unemployment controlled for in the equation, suggest that females are more likely to be sporadically employed and/or underemployed than males in their previous jobs. The significantly smaller wage gains for females within the sample plants indicate that the plants provide less skilled and lower paying jobs for female workers than for males. The observation that female workers have greater gains at job entry while being employed in plants with sharply lower wage levels and skill requirements than males also indicates that females are more likely to be underemployed in their previous jobs. But an equally appropriate explanation for the greater entry level gains for females may be that the sample plants, while offering generally lower wage and skill jobs for females, still provide more opportunities for females to improve on previous wage earnings than they do for males. There is no assurance that the wage levels and skill requirements of the sample plants hiring male workers constitute a substantial improvement over previously available jobs.

The insignificance of SEX in the $t_1 - t_3$ equation may also be caused by heteroscedasticity and by intercorrelations between SEX and other independent variables which also occur in the other two equations. SEX is significantly correlated at the .05 level with PREMP, AGE, EDUC, FAMCH, SIZRLF, RLWAGE3, and SKILL. F tests indicate that female workers are associated with significantly greater residual variances than male workers in all three equations.

EDUC. Greater years of formal education are expected to be indicative of greater labor skills and increased potential for wage gains for workers over all three time periods. The variable, EDUC, however, has a significantly positive coefficient in only the $t_2 - t_3$ equation. In the $t_1 - t_2$ equation, EDUC has an insignificant negative coefficient, and in the $t_1 - t_3$ equation, EDUC has an insignificant positive coefficient.

To investigate possible explanations for these insignificant and unexpected relationships, Tables 31 and 32 provide mean analyses of wage changes and wage earnings by four categories of EDUC and worker sex for previously unemployed and previously employed workers, respectively. With the exception of $t_2 - t_3$ wage changes (WCH23), examination of Tables 31 and 32 indicates no consistent relationships between years of education and wage gains for male and female workers. In terms of $t_1 - t_2$ wage changes (WCH12), previously unemployed males and females

Table 31. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) for Previously Unemployed Workers by Years of Formal Education and Sex[a]

	Years of Formal Education							
	Under 8		8-11		12		Over 12	
Variable	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	5,866	5,548	7,351	5,979	7,725	6,119	4,113	5,887
	(500)[b]	(1,252)	(2,859)	(1,133)	(1,751)	(1,062)	(2,941)	(764)
WCH23	-458	1,113	868	638	891	762	1,503	1,514
	(1,088)	(1,154)	(1,332)	(1,105)	(346)	(1,043)	(147)	(959)
WCH13	5,408	6,661	8,219	6,617	8,615	6,910	5,616	7,151
	(5,883)	(1,997)	(3,653)	(1,483)	(1,777)	(1,471)	(3,089)	(1,121)
Annual Wage in t_1	0	0	0	0	0	0	0	0
Annual Wage in t_3	5,408	6,661	8,219	6,617	8,615	6,910	5,616	7,151
MOWKPL	7.0	31.3	52.0	34.5	24.0	31.3	21.5	27.8
n	2	7	6	30	5	32	2	6

[a]Workers defined as previously unemployed if PREMP = 0. All dollar figures in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

Table 32. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) for Previously Employed Workers by Years of Formal Education and Sex[a]

	Years of Formal Education							
	Under 8		8-11		12		Over 12	
Variable	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	265	1,917	666	970	1,008	1,565	-91	1,059
	(3,797)[b]	(1,793)	(3,249)	(2,028)	(2,464)	(2,181)	(3,868)	(2,494)
WCH23	475	332	1,043	918	1,816	860	2,226	928
	(1,651)	(1,559)	(2,486)	(1,431)	(2,281)	(1,464)	(2,219)	(679)
WCH13	740	2,249	1,709	1,888	2,824	2,425	2,135	1,986
	(3,188)	(1,976)	(3,195)	(2,307)	(2,665)	(2,425)	(4,142)	(2,488)
Annual Wage in t_1	6,933	4,580	7,153	5,253	6,364	4,952	9,118	5,706
Annual Wage in t_3	7,673	6,829	8,862	7,141	9,228	7,377	11,253	7,693
MOWKPL	45.3	32.5	37.7	35.7	32.7	30.0	38.6	35.0
n	19	10	65	88	104	99	63	13

[a]Workers defined as previously employed if PREMP = 1. All dollar figures in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

with 12 years of education have the greatest gains, but among previously employed workers, females with less than 8 years and males with 12 years of education have the greatest gains. And previously employed male workers with over 12 years of education have the smallest $t_1 - t_2$ gains (-$91) of any group. The persistently lower $t_1 - t_2$ gains for workers with greater than 12 years of education may explain the negative coefficient for EDUC in that equation.

Examination of the trends in overall wage gains (WCH13) in Tables 31 and 32 suggests that previously unemployed workers with more years of education do tend to have greater overall gains. But among previously employed workers, the greatest $t_1 - t_3$ gains are received by workers with 12 years of education.

The insignificance of EDUC in the $t_1 - t_2$ and $t_1 - t_3$ equations appears to be due to the relatively small gains associated with the most educated workers in those periods. A possible explanation for this occurrence is that the most educated workers already have relatively high wage earnings in t_1 and, therefore, have less scope for incremental $t_1 - t_2$ and $t_1 - t_3$ gains because of the wage structure of the sample plants and/or because they are comparatively less underemployed in their previous jobs. The most educated workers do, however, realize the greatest wage gains within the sample firms ($t_2 - t_3$) in all cases.

The variable EDUC is noticeably correlated with AGE ($\underline{r}$ = .348) and also has significant correlations with PREMP, SEX, RLWAGE3, SKILL, and UNDERR. Regression of EDUC on all other independent variables results in an $\underline{R}^2$ of .22 with PREMP, SEX, RLWAGE3, SKILL, and UNDERR significant at the .05 level.

FAMCH. The effects of changes in the number of children in a worker's family (FAMCH) on wage gains are measured in the $t_2 - t_3$ and the $t_1 - t_3$ equations. Increases in the number of children in a worker's family are hypothesized to motivate workers to achieve greater wage gains resulting in positive coefficients in both equations. FAMCH has a positive coefficient in both the $t_1 - t_2$ and the $t_1 - t_3$ equations but is significant only in the $t_2 - t_3$ equation.

Mean analysis of wage changes associated with different values of FAMCH supports a significant positive relationship between FAMCH and $t_2 - t_3$ wage gains but not $t_1 - t_3$ wage gains. The greatest $t_1 - t_3$ gains tend to be associated with greater values of FAMCH for female but not for male workers. The mean analysis suggests that the inconsistent relationship between FAMCH and overall wage gains can be attributed to inconsistent variations in the $t_1 - t_2$ component of overall changes. As noted previously, changes in family size over the $t_1 - t_2$ period are not available in the survey data.

Time Variable

The time variable (MOWKPL) is included in the $t_2 - t_3$ and the $t_1 - t_3$ equations to control for and measure the effects of differing lengths of employment in the sample plants on wage gains. MOWKPL has the expected positive coefficient in both the $t_2 - t_3$ and the $t_1 - t_3$ equations, but is significant in only the $t_2 - t_3$ equation.

Mean analysis of wage changes associated with various lengths of employment confirms the trend toward greater $t_2 - t_3$ gains with longer periods of employment. But greater overall ($t_1 - t_3$) wage gains are not necessarily correlated with longer periods of employment because of inconsistent variations in the $t_1 - t_2$ component of overall changes. MOWKPL is significantly correlated at the .05 level with AGE and FAMCH.

Plant Variables

SIZRLF. The plant size variable is significant and has the hypothesized positive coefficient in each equation. These results suggest that within the sample and with other variables held constant employment in plants with greater size relative to the size of the local labor force leads to greater wage gains for workers. These results must be qualified, however, by the fact that the two largest plants in the sample have predominately female work forces.

RLWAGE2 and RLWAGE3. The plant relative wage variables (RLWAGE2 in the $t_1 - t_2$ equation and RLWAGE3 in the $t_2 - t_3$ and $t_1 - t_3$ equations) are significant and have the hypothesized signs in their respective equations. These results indicate that within the sample and with other variables held constant employment in plants with greater average wage levels relative to the average manufacturing wage in the county results in greater wage gains for workers.

SKILL. Plant skill levels are a significant variable in each equation but, as in the regression analysis of family income changes reported in Chapter 3, do not have the hypothesized positive relationship with wage changes in any time period.

Possible statistical explanations for the negative coefficients include unreliability of the skill index used to measure plant skill levels which is discussed in Chapter 3 and multicollinearity. SKILL is highly correlated with RLWAGE2 (r = .413) and RLWAGE 3 (r = .497) and is also significantly correlated at the .05 level with PREMP, SEX, EDUC, SIZRLF, UNDERR, and UNPTR. Regression of SKILL on other independent variables results in an R^2 of .36 using the remaining variables included in the t_1 - t_2 equation and for those included in the t_2 - t_3 and the t_1 - t_3 equations.

There also appear to be conceptual explanations for the negative skill coefficients in each equation which can be identified through mean analysis. Table 33 contains average wage changes and wage earnings in each period by previous employment status (PREMP), three categories of SKILL, and SEX. Examination of t_1 - t_2 wage changes in Table 33 reveals that, while female workers in more highly skilled plants tend to have greater t_1 - t_2 wage gains, male workers in more highly skilled plants tend to have smaller t_1 - t_2 gains. The negative coefficient for SKILL in the t_1 - t_2 equation and, perhaps the t_1 - t_3 equation, appears to be due to the relatively small gains for previously employed male workers entering more highly skilled plants.

Examination of the total wage earnings figures in Table 33 suggests explanations for these findings which are consistent with the interpretation of the results for the sex variable. First, previously employed males working in higher skill plants tend to have higher wage earnings prior to entry suggesting that they may be relatively less underemployed in t_1 and have less scope for wage gains between t_1 and t_2 (and between t_1 and t_3). The greater wage gains in all periods for

Table 33. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) by Previous Employment Status, Plant Skill Level, and Sex of the Workers[a] (All Wage Figures Include Overtime Payments)

Variable	Previously Unemployed Workers (PREMP = 0)						Previously Employed Workers (PREMP = 1)					
	Plant Skill Level						Plant Skill Level					
	High		Medium		Low		High		Medium		Low	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	7,449 (3,589)[b]	6,273 (891)	8,646 (1,229)	6,083 (1,439)	5,615 (1,309)	5,612 (662)	392 (3,098)	1,531 (2,131)	842 (3,713)	1,272 (2,298)	974 (2,731)	1,174 (1,852)
WCH23	2,157 (1,381)	1,052 (1,122)	1,041 (196)	760 (1,039)	258 (1,093)	475 (1,144)	1,827 (2,261)	1,196 (1,223)	1,933 (2,362)	938 (1,513)	690 (2,234)	-232 (1,041)
WCH13	9,606 (4,444)	7,325 (1,131)	9,687 (1,127)	6,843 (1,882)	5,872 (1,039)	6,087 (1,132)	2,219 (3,164)	2,727 (2,190)	2,775 (3,922)	2,210 (2,582)	1,664 (2,866)	942 (1,701)
Annual wage in t_1	0	0	0	0	0	0	7,653	4,942	7,342	5,384	6,303	4,664
Annual wage in t_3	9,606	7,325	9,687	6,843	5,872	6,087	9,872	7,669	10,117	7,594	8,045	5,606
MOWKPL	37.4	26.2	38.3	37.0	22.2	34.7	36.4	27.1	37.6	43.8	36.9	24.7
n	7	26	3	25	8	25	145	92	57	87	53	37

[a]All dollar figures are in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

previously employed females in higher skill plants may result from females being relatively more underemployed in t_1. This point is substantiated by the observation that females employed in higher skill plants, unlike males, do not necessarily have the greatest wage earnings prior to entry.

A second explanation is also consistent with the above observations. Male workers in more highly skilled plants may have relatively small wage gains because they remain underemployed. The generally low skill indices for the sample plants indicate that the plants may provide little scope for new workers to become more fully employed. While the jobs provided for females in the sample plants are apparently less skilled than for males, they appear to be a significant improvement over previous alternatives.

Examination of t_2 - t_3 wage changes in Table 33 shows that the sample data tend to support the hypothesized greater within-plant wage gains for workers employed in higher skill plants. The significant negative coefficient for skill in the t_2 - t_3 equation suggests, then, that the gains for workers in higher skill plants are not as great as they should be based on the values of other independent variables associated with these workers. Further analysis suggests that factors which differentiate internal labor markets in high- and low-skill plants may contribute to the negative coefficients. Table 34 provides the same mean analysis as Table 33 except that overtime payments to workers have been excluded from t_2 and t_3 earnings. Table 34 reveals a sharper trend toward greater t_2 - t_3 wage gains for workers in higher skill

Table 34. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) by Previous Employment Status, Plant Skill Level, and Sex of the Worker[a] (All Wage Figures Exclude Overtime Payments)

	Previously Unemployed Workers						Previously Employed Workers					
	Plant Skill Level						Plant Skill Level					
	High		Medium		Low		High		Medium		Low	
Variable	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	6,322 (2,507)[b]	6,073 (810)	5,731 (681)	5,937 (1,405)	5,295 (1,171)	5,178 (586)	-504 (2,939)	1,152 (1,943)	-438 (3,457)	1,200 (2,256)	163 (2,540)	722 (1,690)
WCH23	2,167 (907)	1,165 (795)	807 (431)	774 (991)	424 (913)	297 (745)	1,968 (1,747)	1,336 (911)	1,417 (1,523)	775 (1,243)	1,005 (1,824)	-16 (618)
WCH13	8,489 (2,820)	7,238 (1,040)	6,538 (1,093)	6,711 (1,833)	5,719 (825)	5,475 (641)	1,464 (2,959)	2,488 (1,965)	979 (3,722)	1,975 (2,517)	1,168 (2,606)	706 (1,566)
Annual wage in t_1	0	0	0	0	0	0	7,653	4,942	7,342	5,384	6,303	4,664
Annual wage in t_3	8,489	7,238	6,538	6,711	5,719	5,475	9,117	7,430	8,321	7,359	7,471	5,370
MOWKPL	37.4	26.2	38.3	37.0	22.2	34.7	36.4	27.1	37.6	43.8	36.9	24.7
n	7	26	3	25	8	25	145	92	57	87	53	37

[a]All dollar figures are in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

plants. The tendency toward lower overtime payments in more highly skilled plants reflects a desire on the part of management to hold down labor costs in those plants which may result in smaller wage gains for workers. Management desire to hold down labor costs could stem from a need to recover relatively high training costs. This possibility is supported by the high correlation ($\underline{r}$ = .823) between SKILL and the average months of training per worker in the plant.

Table 33 reveals that the hypothesized relationship of greater overall wage gains associated with employment in higher skill plants tends to be supported by the data for female workers but not for male workers. Male workers in the medium skill category have the greatest $t_1 - t_3$ wage gains and the greatest total wage earnings in t_3. In Table 34, however, the exclusion of overtime payments in t_3 results in the expected trends in overall wage gains and t_3 wage earnings for both males and females. Since $t_1 - t_3$ wage changes are determined by the $t_1 - t_2$ and $t_2 - t_3$ components, the explanations discussed above are all relevant to the negative coefficient for SKILL in the $t_1 - t_3$ equation.

<u>Community Variables</u>

<u>UNDERR</u>. Greater rates of underemployment are hypothesized to suppress community wage rates and worker wage gains due to job entry ($t_1 - t_2$) and due to within-firm mobility ($t_2 - t_3$). UNDERR is significant and has the hypothesized inverse relationship with wage gains in all three models. The interpretation of these results is that, with other

things being equal, a greater rate of underemployment in a community results in lower wage gains for workers employed in a sample plant in that community.

UNPTR. Greater rates of unemployment and potential labor force entry are also expected to suppress wage rates in a community resulting in smaller wage gains over each time period. UNPTR has the hypothesized sign in each equation but is significant at the .10 level of *t* or better in only the $t_1 - t_3$ equation. UNPTR is significant at the 11% level of *t* in the $t_2 - t_3$ equation and at the 20% level of *t* in the $t_1 - t_2$ equation.

The insignificance of UNPTR in the $t_1 - t_2$ and the $t_2 - t_3$ equations may be caused by intercorrelations with other independent variables. Correlations between UNPTR and PREMP, SIZRLF, RLWAGE2, RLWAGE3, SKILL, and UNDERR are significant at the .05 level. Regression of UNPTR on other independent variables in each equation results in an R^2 of .21 for variables in the $t_1 - t_2$ model and .18 for variables in the $t_2 - t_3$ and $t_1 - t_3$ models. As reported in Chapter 3, the insignificance of UNPTR may also result from specifying UNPTR using 1970 data, while the conceptually appropriate measurement is for the year in which a worker began employment in a sample plant.

Mean analysis of wage gains associated with three categories of UNPTR by previous employment status and worker sex supports the hypothesized trends. Smaller $t_1 - t_2$, $t_2 - t_3$, and $t_1 - t_3$ wage gains, as well as smaller t_1 and t_3 total wage earnings are associated with higher rates of unemployment and potential labor force entry.

Residence Status Variables

COMM. Commuting workers are hypothesized to have greater wage gains than local workers in all three time periods because it is expected that commuting workers will be more aggressive and experienced and tend to provide skills not available among local workers. The results of the regression analyses indicate, however, that, with other factors being equal, commuting workers tend to have smaller wage gains than local workers in all three time periods. The variable COMM has a negative coefficient in all three equations and is significant in the $t_2 - t_3$ and the $t_1 - t_3$ equations.

The unhypothesized coefficients may be the result of multicollinearity because other independent variables in the equations also measure characteristics which differentiate commuting and local workers. These correlations are noted in the results of the analysis of family income changes in Chapter 3. While most of these correlations are not in the hypothesized direction, they may contribute to the expected coefficients for COMM in the regression equations.

Mean analysis of employee wage changes and total wage earnings by residence status and sex for previously unemployed (Table 35) and previously employed workers (Table 36) suggests conceptual explanations for the insignificant and negative coefficients for COMM. Examination of these tables indicates that, while commuting females have greater wage gains than local females in most cases, the negative coefficients for COMM in each equation may be due to the sharply lower wage gains for previously employed commuting males in each time period. Further

Table 35. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) for Previously Unemployed Workers by Residence Status and Sex[a]

	Residence Status							
	Local		Commuter		Migrant		Return Migrant	
Variable	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	6,165	5,992	5,956	6,356	8,997	5,783	7,530	5,687
	(1,532)[b]	(998)	(434)	(1,111)	(2,481)	(1,060)	(3,531)	(1,261)
WCH23	309	674	1,775	552	1,182	1,077	1,746	662
	(937)	(944)	(507)	(1,428)	(759)	(1,001)	(2,572)	(1,043)
WCH13	6,474	6,620	7,731	6,951	10,179	6,860	9,276	6,349
	(2,030)	(1,366)	(120)	(1,734)	(3,166)	(1,574)	(5,169)	(1,093)
Annual Wage in t_1	0	0	0	0	0	0	0	0
Annual Wage in t_3	6,474	6,620	7,731	6,951	10,179	6,860	9,276	6,349
MOWKPL	28.2	28.4	24.3	39.7	43.0	30.9	30.2	33.0
n	6	26	3	20	4	22	4	8

[a]Workers defined as previously unemployed if PREMP = 0. All dollar figures in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

Table 36. Average Annual Wage Changes, Annual Wage Earnings, and Months Worked in Plant (MOWKPL) for Previously Employed Workers by Residence Status and Sex[a]

	Residence Status							
	Local		Commuter		Migrant		Return Migrant	
Variable	Male	Female	Male	Female	Male	Female	Male	Female
WCH12	1,181	1,213	474	1,706	343	1,849	-1,100	1,387
	(2,387)[b]	(2,027)	(3,740)	(1,906)	(2,826)	(2,195)	(4,615)	(2,422)
WCH23	1,852	727	907	933	2,327	577	1,064	1,129
	(2,355)	(1,357)	(2,248)	(1,779)	(2,008)	(993)	(2,422)	(1,365)
WCH13	3,033	1,940	1,381	2,638	2,670	2,426	-36	2,516
	(2,848)	(2,030)	(3,366)	(2,229)	(2,350)	(1,695)	(4,352)	(2,951)
Annual Wage in t_1	6,473	5,309	8,493	4,755	7,225	4,587	9,173	4,872
Annual Wage in t_3	9,537	7,249	9,874	7,394	9,895	7,013	9,137	7,388
MOWKPL	35.5	33.9	39.4	32.4	33.4	29.5	41.6	33.9
n	136	107	47	30	32	28	35	47

[a]Workers defined as previously employed if PREMP = 1. All dollar figures in 1977 dollars.

[b]Numbers in parentheses are standard deviations.

examination of Table 36 suggests that the relatively small wage gains of commuting males may stem from a tendency for commuting males to be less underemployed than local males in t_1 and, therefore, have less scope for wage gains. This explanation is supported by the observation that previously employed commuting males also have sharply higher total wage earnings than their local counterparts in t_1. Previously employed commuting females, on the other hand, have lower wage earnings in t_1 and greater wage gains than previously employed local females. This suggests that commuting females may tend to be more underemployed, as well as more likely to be previously unemployed, in t_1 and, therefore, have greater scope for wage gains than their local counterparts.

The mean analysis in Tables 35 and 36 reflects the differing characteristics of commuting males and females which are also noted in Chapter 3. _F_ tests of the residual variances for zero (0) and one (1) values of COMM in the regression equation indicate the presence of heteroscedasticity. Commuters are associated with a significantly greater residual variance than noncommuters in each equation.

MIG. Migrating workers are also hypothesized to have greater wage gains than local workers in all three time periods because it is expected that they will tend to be more aggressive and experienced and provide skills not available among local workers. The results of the regression analyses suggest that, while migrants do tend to have greater wage gains than locals, with other things being equal, the gains are not significantly different.

The insignificance of MIG may be the result of multicollinearity and/or heteroscedasticity. The results of the analysis of family income changes reported in Chapter 3 reveal a number of correlations between MIG and other independent variables also included in this analysis. Migrant workers tend to be older and more likely to be previously unemployed and female than local workers. Migrants also tend to be employed in smaller, lower wage plants in areas with lower rates of underemployment and unemployment. $\underline{F}$ tests of the residual variances for zero (0) and one (1) values of MIG also indicate the presence of heteroscedasticity in each equation. Migrant workers are associated with significantly greater residual variances in the t_2 - t_3 and the t_1 - t_3 equations.

Examination of the average wage gains associated with local and migrant workers in Tables 35 and 36, pages 146 and 147, respectively, and of plant and community characteristics associated with locals and migrants by sex in Table 24, page 121, reveals that the presence of heteroscedasticity and the insignificance of MIG may be due to the differing characteristics of male and female migrants. Migrant males tend to have greater total wage earnings in both t_1 and t_3 than local males. And while previously unemployed male migrants have greater wage gains than their local counterparts, previously employed male migrants have greater gains than locals in only the t_2 - t_3 period. Male migrants also tend to be more educated and employed in more highly skilled plants in areas of lower underemployment and unemployment than any other group. These observations suggest that male migrants, as a group, tend to work in more highly skilled jobs than their local counterparts. And the relatively low overall wage gains observed among previously employed migrant males may result from less underemployment within this group in t_1.

Migrating female workers, on the other hand, seem to be characterized as less educated workers who fill less skilled jobs and who are more likely to be unemployed and underemployed in t_1 and thus have greater scope for wage gains. While migrating females tend to have greater overall wage gains than local females, previously employed migrant females have lower total wage earnings than their local counterparts in t_1 and t_3.

<u>RMIG</u>. Return migrant workers are expected to have lower wage gains than local workers because it has been shown in previous research that return migrants often sacrifice wage earnings in order to return to their local areas to live and work. The results of the regression analysis support this hypothesis. The variable RMIG has a negative coefficient in each equation and is highly significant in the t_1 - t_2 and the t_1 - t_3 equations.

The mean analysis in Tables 35 and 36 indicates that the insignificance of RMIG in the t_2 - t_3 equation is due to the absence of a consistent trend in t_2 - t_3 gains within the group of return migrants. Previously unemployed male return migrants have greater t_2- t_3 gains than their local counterparts, and previously employed male return migrants have lower t_2 - t_3 gains than their local counterparts. And previously unemployed female return migrants have marginally lower t_2 - t_3 gains, while previously employed female return migrants have higher t_2 - t_3 gains than their local counterparts.

Tables 35 and 36, pages 146 and 147, respectively, also reveal differences between male and female return migrants. The significantly negative coefficients for RMIG in the t_1 - t_2 and t_1 - t_3 equations appear to be due to the markedly lower (and negative) gains of previously employed male return migrants in these periods. But previously employed female return migrants have greater t_1 - t_2 and t_1 - t_3 wage gains than their local counterparts. Further analysis indicates that return migrating females tend to be employed at greater skill levels than local females.

Other Statistical Properties of the Models

The six assumptions involved in the unbiased and efficient estimation of population parameters using multiple regression analysis are discussed in Chapter 3. Possible problems with heteroscedasticity, multicollinearity, and stochastic independent variables have been discussed in the preceding analysis of the regression results. The only assumption requiring further discussion is that of specification bias.

Plots of the error terms against the dependent variable and each of the continuous independent variables for each equation indicate that the linear forms specified in each model are appropriate. The plots of the error terms against the dependent variable for each equation indicate, however, that each model tends to consistently underestimate both large and small changes in wage earnings. The result is a noticeable direct linear relationship between the error terms and the dependent variable for each equation. This observation, along with the low $\underline{R}^2$ for each model, suggests that relevant explanatory variables have been omitted from the equations. If the omitted variables are correlated with any variables already included in the models, then the coefficients estimated for those included variables may be both biased and inefficient. Analysis of the observations having extreme residual values in the regression equation does not reveal any similarities which suggest the nature of any omitted explanatory variable(s).

Conclusions

The objective of the analysis of changes in the employee wage component of family incomes included in this chapter has been to further clarify the role of the characteristics of individual workers, plants, and communities hypothesized to influence changes in both employee wage incomes and family incomes due to employment in new rural manufacturing plants. The regression results reported in this chapter support the central hypothesis of this study: that individual, plant, and community characteristics interact to determine how incomes change due to employment in new rural manufacturing plants. The emphasis has been to examine the role of variables which prove to have either insignificant or unhypothesized effects on changes in wage earnings and family incomes.

The most significant factor affecting overall changes in worker wage earnings is a change in a worker's employment status from employed to unemployed. The analysis of the regression results also indicates that the degree to which workers are underemployed[23] in previous jobs and in jobs provided by the sample plants is an important determinant of changes in wage earnings.

Previous work experience does not contribute significantly or positively to wage gains earned by workers in the sample plants. This finding may indicate that skills attained in previous jobs are not necessarily transferable to work in the sample plants. The insignificance of PREMP in explaining within-plant gains may also be explained by variations in the degree of underemployment among previously employed workers which affords them with differing potentials for wage gains or by the limited potential the sample plants provide to improve wage earnings.

As in the analysis of changes in family incomes in Chapter 3, demographic characteristics of individual workers are not highly significant in explaining overall changes in wage earnings. But this analysis does suggest conceptual explanations for the overall insignificance of each of the demographic variables, all of which involve underemployment. Worker age appears to be insignificant because it is not necessarily indicative of the tendency for workers to have achieved their earning potential in previous employment. It appears that in the rural labor markets studied many older workers, and particularly older female workers, are underemployed in their previous jobs and have considerable scope for wage gains.

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[23]The definition of underemployment used here is the extent to which workers are employed at less than their wage earning potential. This definition includes sporadic employment and both voluntary and involuntary underemployment.

The insignificance of worker sex in explaining overall wage changes seems to be caused by the tendency for the greater gains for females at job entry to be offset by the smaller gains for females within the sample plants. The significant positive coefficient for worker sex in the $t_1 - t_2$ equation indicates that female workers are either more likely than males to be underemployed in their previous jobs or have greater opportunity than males to improve on previous wage earnings by working in the sample plants. The greater gains for females due to job entry appear to be offset because females tend to be employed in lower wage and skill plants that offer less scope for within-plant wage gains.

The data tend to support the hypothesis that more years of formal education lead to greater overall wage gains for workers with no more than 12 years of school. But the relatively low wage gains at job entry for the most educated workers appear to be causing the insignificance of education in explaining overall wage changes. This occurrence may be the result of relatively low levels of underemployment among more educated workers or of the limited opportunities the sample plants provide for more educated workers to achieve substantial wage gains. Greater years of formal education do, however, enable workers to achieve significantly greater wage gains within the sample plants and to achieve greater total wage earnings.

Plant variables measuring plant relative size, plant relative wage levels, and plant skill levels prove to be significant determinants of changes in wage earnings among the sample workers. The role of plant size must be interpreted carefully because the largest plants in the sample have predominantly female work forces. Plant skill levels, which have an unexpected inverse relationship with family income changes in Chapter 3, also have a significant inverse relationship with changes in wage earnings in all periods. The negative coefficients appear to be caused by the relatively small wage gains of previously employed males in more highly skilled plants. Female workers in more highly skilled plants have the expected greater wage gains in all periods. The significant negative coefficients for the skill variable may be explained by relatively low levels of underemployment among males employed by higher skill plants, by the limited opportunities the higher skill plants provide for males to improve wage earnings, and by factors including overtime policies and job training costs, which differentiate internal labor markets in high- and low-skill plants.

Despite measurement problems associated with specifying the roles of underemployment and unemployment and potential labor force entry, these variables prove to be significant determinants of wage changes. The apparent role of underemployment in interpreting the results of this chapter suggests that more attention be given to both the measurement and effects of underemployment in rural labor markets.

The analysis of the relative wage gains of local and nonlocal workers supports the hypothesis that return migrants, as a group, tend to accept relatively small wage gains, and even wage losses, to return to their home areas. But differences in the characteristics of male and female commuters and migrants appear to be causing commuting workers to have unexpectedly lower overall gains and migrating workers insignificantly greater gains than local workers. Commuting males appear to be less underemployed and migrating males both more skilled and less underemployed than their local counterparts. Commuting and migrating females, on the other hand, appear to be workers with equal or lower skills who are relatively underemployed when compared to their local counterparts. The findings suggest that the hypothesis that commuters and migrants as groups have greater scope for wage gains because they tend to provide skills not available in the local work force is incorrect because of the influence of underemployment on wage gains and because commuters and migrants do not comprise homogeneous groups.

CHAPTER 5

IMPACT OF THE SAMPLE PLANTS ON THE DISTRIBUTION OF FAMILY INCOMES AND THE ALLEVIATION OF POVERTY

This study has, so far, focused on the identification of factors effecting changes in family incomes and employee wage incomes due to employment in new rural manufacturing plants. The preceding analyses also include an examination of changes in the distribution of well-being incomes within the sample of rural manufacturing workers. In this chapter, the scope of the study is broadened, and the primary round impacts of employment in new manufacturing plants on the distribution of family incomes and on the alleviation of poverty within the sample communities are investigated.

The first section of this chapter includes a description of the methodology used to examine primary round distributive impacts and an analysis of the results. The second section of the chapter focuses on the impact of employment in the sample plants on the alleviation of poverty. The final section presents the conclusions of the analysis.

Primary Round Impacts on the Distribution of Family Incomes

Method of Analysis

The method used to analyze community distributive impacts includes three steps. The first step is to estimate the quintile ranges and quintile means of a family income distribution which is the aggregate, or average, of the 24 counties included in the study using 1970 census data. The second step is to adjust the estimated quintile ranges and means to 1977 price levels. The final step is to assess the primary round distributive effects of employment in the sample plants by examining the frequencies of sample families in each quintile of the aggregate distribution based on family incomes before and after employment.

The reason for combining the distributions of the 24 sample counties into one aggregate distribution is that the procedure used to draw the sample was designed to obtain a random and efficient sample of plants and of employees within those plants but not a random and efficient sample of plants and workers within each county. As a result, there are not necessarily enough plant or employee observations in each county to analyze countywide distributive effects on a county-by-county basis. By aggregating the sample counties and combining employee observations, there are sufficient observations in each quintile of the aggregate distribution to permit useful analysis. This analytical approach essentially shows how employment in a random sample of manufacturing plants influenced the distribution of incomes in the average county in which the plants are located.

The method of analysis involves two major assumptions. Since 1970 census data are used to estimate the aggregate income distribution of the 24 sample counties and because individual workers in the sample became employed in the sample plant between 1970 and 1977, the major assumption of this method is that the aggregate distribution remained static between 1970 and 1977. If the aggregate distribution was not static, the actual quintile means and ranges will be different from those estimated, and the frequencies of sample family observations in each quintile will be distorted. This assumption is necessary because data required to estimate the distribution of income in the sample counties are only available for 1970 and other census years. While the income distributions in the sample counties probably changed between 1970 and 1977, there is no reason to believe that they changed enough to seriously distort this analysis.

A second assumption involved in this method of analysis is that the employee sample is equally efficient in each of the 24 sample counties combined into the aggregate distribution. As noted above, the sampling method used to collect the employee sample violates this assumption. But the bias introduced by this problem is reduced somewhat by aggregation of the sample counties and sample families rather than doing the analysis on a county-by-county basis.

Estimation of Characteristics of the Aggregate Distribution

The income distribution characteristics which are estimated for this analysis are the quintile ranges, quintile means, and the overall mean of the aggregate distribution for the 24 sample counties. The data provided by the 1970 census used to estimate the aggregate distribution are the number of total families in each county within 15 income categories.[24] These frequencies for each category are summed

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[24] U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population (Washington, D.C.: U.S. Government Printing Office, 1972).

across the 24 sample counties, and the resulting totals are used to calculate the cumulative percentage of the total population of families in each successive income category. The cumulative percentage distribution is then divided into five groups (quintiles), each containing 20% of the total families, and the means and ranges of each quintile are estimated by linear interpolation.[25]

The assumptions involved in using the categorical census data to compute these characteristics of the aggregate distribution are several: First, because the census data are reported with an open-ended category for the highest income group ($50,000 or more), it is necessary, in order to do the interpolation, to assume a maximum income for the open-ended category. For the purpose of this study, the maximum is assumed to be $100,000 for each county. Calculations using other maximum values result in very little difference in the means of any quintile or in the ranges of any of the lower four quintiles.

A second assumption which is made in estimating the characteristics of the aggregate distribution is that the mean income earned by families in each of the census income categories is the same as the median of that category. While this is probably not the case, the assumption is necessitated because the census data, as reported, do not provide enough information to characterize the distributions any differently. The final assumption, made for the purpose of interpolation,

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[25]The linear interpolation procedure was done using a computer algorithm developed by John Devine and Morgan Gray, Instructor and Research Associate, respectively, Department of Agricultural Economics and Rural Sociology, The University of Tennessee, Knoxville, Tennessee, 1978.

is that of linearity between each of the points in the cumulative percentage distribution. The limitations of the census information also require that some assumption be made regarding the functional form of the distribution as a whole.[26]

The final step in the estimation of the characteristics of the aggregate distribution is to inflate the quintile means and ranges to 1977 price levels so that they are comparable to the sample income data. The 1970 census data are reported in 1969 dollars. The adjustments are made using the U.S. Department of Labor unadjusted Consumer Price Index for all items.[27]

Primary Round Distributive Impact of Employment in the Sample Plants

The primary round impact of the sample plants on the distribution of income in the sample counties is assessed by examining the frequencies of sample families in each quintile of the aggregate distribution based on family incomes before (t_1) and after (t_3) employment in the sample plants.[28] For this purpose, Table 37 provides the estimated quintile ranges and means of the aggregate distribution and

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[26]Attempts were also made to fit nonlinear forms to the cumulative distribution, but there was no reason to believe that these forms result in more or less bias in the estimated characteristics of the distribution than do linear forms.

[27]U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, Vols. 49-58.

[28]In this analysis the family incomes of sample workers are not adjusted for family size to reflect well-being. While adjusting incomes for family size might provide a more valuable measure for assessment of relative changes in family welfare, it is not possible to make these adjustments in the census data.

Table 37. Aggregate Family Income Quintiles, Quintile Ranges, and Quintile Mean Incomes for the 24 Sample Counties with Employee Sample Frequencies and Mean Family Incomes by Aggregate Quintile in t_1 and t_3[a]

Aggregate Family Income Quintile	Income Range	Mean Income	Sample in t_1		Sample in t_3	
			Frequency (%)	Mean Income	Frequency (%)	Mean Income
1	0-4,804	2,672	79 (14)	3,684	5 (1)	4.783
2	4,804-8,701	6,772	178 (32)	6,560	121 (22)	7,061
3	8,701-12,701	10,642	136 (24)	10,687	151 (27)	10,690
4	12,701-18,079	15,116	136 (24)	14,846	193 (35)	15,276
5	18,079-100,000	29,097	36 (6)	21,654	84 (15)	21,473
All quintiles	0-100,000	12,861	565 (100)	10,108	554 (100)	13,076

[a]Aggregate family income quintiles, quintile ranges, and quintile mean incomes computed using 1970 census data. All dollar figures in 1977 dollars.

the frequency of employee sample representation in each quintile in t_1 and t_3.

Examination of Table 37 shows that most of the sample families (80%) have family incomes that place them in the middle three quintiles of the distribution before employment in the sample plants (t_1). And while more families (46%) are in the lowest two quintiles in t_1 than in the highest two quintiles (30%), relatively few families (14%) are in the lowest quintile. Also, the 79 sample families in the lowest quintile in t_1 have an average income ($3,687) higher than the average for that quintile ($2,672).

After employment in the sample plants (t_3), the majority of the sample families (84%) are still in the middle three quintiles, but more sample families have shifted into the third and, especially, the fourth quintile. Also, in t_3 only 23% of the sample families remain in the lowest two quintiles, while 50% are in the highest two quintiles. One percent of the sample families is in the bottom quintile in t_3, while 15% are in the top quintile.

The sharp movements of sample families into higher income quintiles between t_1 and t_3 show that employment in the sample plants is moving many families to higher relative income levels. Between t_1 and t_3 there is also a gain in the percentage of sample families in the middle quintile (24% to 27%) and in the middle three quintiles (80% to 84%) of the aggregate distribution. These movements do not, however, necessarily indicate that employment in the sample plants is contributing to a more equal distribution of income because relatively few of the sample families participating in these gains are in the lowest income quintile in t_1.

The Distributive Gains of Local and Nonlocal Families

The importance of the degree to which local and nonlocal families compete for the jobs and income gains stemming from growth in manufacturing employment in a community depends on whether the level of analysis is local, regional, or national. At the local level the income gains accruing to workers coming from outside the community to take jobs in a new plant are leakages which reduce the potential for distributive gains within the community. But as the area of analysis becomes larger (regional or national), smaller percentages of workers come from outside the borders of the study area, and the relevance of local-nonlocal competition diminishes. To examine the relative gains of local, commuting, migrating, and return migrating workers, Table 38 provides the frequencies of sample families by residence status in each aggregate income quintile in t_1 and t_3.

Table 38 shows that local families are more likely than any other group to be in the lowest quintile (16%) and the lowest two quintiles (52%) in t_1. Local families are also the least likely to be in the top quintile (4%) or the top two quintiles (27%) in t_1. In t_3, 23% of the local families remain in the lowest two quintiles with only return migrant families (29%) more likely to be in those two quintiles in t_3. Local families also have the smallest percentage representation in the top quintile (11%) and the top two quintiles (36%) in t_3.

Commuting and migrating families have the smallest percentage representation in the lowest quintile and smaller representation than local families in the lowest two quintiles in t_1. Commuting and migrating

Table 38. Frequencies of Sample Families in Each Quintile of the Aggregate Income Distribution by Residence Status in t_1 and t_3

Aggregate Family Income Quintile	Local		Commuter		Migrant		Return Migrant		All Families[a]	
	t_1 (%)	t_3 (%)	t_1 (%)	t_3 (%)	t_1 (%)	t_3 (%)	t_1 (%)	t_3 (%)	t_1 (%)	t_3 (%)
1	43 (16)	4 (1)	10 (10)	0 (0)	11 (13)	0 (0)	13 (14)	1 (1)	77 (14)	5 (1)
2	100 (36)	59 (22)	28 (28)	18 (18)	26 (30)	14 (17)	22 (23)	26 (28)	176 (32)	117 (22)
3	56 (20)	80 (30)	30 (30)	19 (19)	22 (26)	26 (31)	24 (26)	25 (27)	132 (24)	150 (28)
4	64 (23)	94 (35)	23 (23)	40 (40)	20 (23)	27 (32)	28 (30)	28 (30)	135 (24)	189 (35)
5	12 (4)	30 (11)	9 (9)	23 (23)	7 (8)	17 (20)	7 (7)	13 (14)	35 (6)	83 (15)
All quintiles	275 (99)[b]	267 (99)[b]	100 (100)	100 (100)	86 (100)	84 (100)	94 (100)	93 (100)	555 (100)	554 (101)[b]

[a]Figures for all families are not the same as Table 37 because some observations have missing values for family residence status.

[b]Does not add to 100% due to rounding.

families also have the greatest representation in the highest quintile and greater representation than local families in the top two quintiles in t_1. In t_3 commuters and migrants have the smallest representation in both the bottom quintile and the bottom two quintiles while having by far the greatest representation in the top quintile and the top two quintiles. Tests using the Z statistic[29] indicate that local, commuting, and migrating families do not have significantly different percentage movements out of the bottom two quintiles between t_1 and t_3. Commuters do, however, have significantly greater percentage gains than locals in the top two quintiles.

Return migrating families have the lowest representation in the bottom two quintiles and the greatest representation in the top two quintiles in t_1. In t_3 return migrants have the greatest presence in the bottom two quintiles but still have greater representation than local families in the top two quintiles. Tests using the Z statistic indicate that return migrating families have significantly smaller movements out of the bottom two quintiles and significantly smaller movements into the top two quintiles than local families.

The analysis indicates that local and migrating families are achieving nearly equal relative income gains due to employment in the sample plants and that commuting families have significantly greater

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[29] Z tests are conducted by comparing the proportional changes of families in the specified quintiles between t_1 and t_3 for the different residence groups. Z statistics are computed using the method specified by Miller and Freund. Source: I. Miller and J. E. Freund, Probability and Statistics for Engineers (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1965), pp. 193-197.

gains than local families in the highest income quintiles. Only return migrating families have smaller relative gains than local families. But while jobs in the sample plants are enabling local families to make substantial gains, only 16% of the local workers employed come from families in the lowest income quintile. The 43 local families who are in the lowest quintile in t_1 comprise only 8% of the total sample of families with members employed by the sample plants.

Primary Round Impacts on the Alleviation of Poverty

The purpose of this section is to describe the impact of employment in the sample plants on the alleviation of poverty among the sample families. This section also includes analyses of the diminution of poverty among different residence groups and of the influence of family labor force participation patterns on poverty status.

The description of the impact of the sample plants on the distribution of family incomes in the preceding section is based on family incomes which are not adjusted for family size or age. The results of that analysis, therefore, are not necessarily indicative of the extent to which family member employment in the sample plants is alleviating poverty among the sample families. To examine changes in poverty status in this section, the sample families are classified as being either in or out of poverty in the periods before (t_1) and after (t_3) employment in the sample plants. The poverty definitions used are those provided in the 1970 census[30] for families of different ages and size adjusted

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[30] U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population (Washington, D.C.: U.S. Government Printing Office, 1972).

to 1977 price levels using the U.S. Department of Labor unadjusted Consumer Price Index for all items.[31]

The frequencies and percentages of sample families remaining in poverty, escaping poverty, entering poverty, and remaining out of poverty are provided in Table 39. Examination of Table 39 shows that 86% of the sample families are not in poverty either before or after family member employment in the sample plants, while 11% of the families escape poverty, 2% remain in poverty, and 1% enter poverty. Only 73 families or 13% of the total are in poverty in t_1, and 16 families or 3% of the total are in poverty in t_3. There is a net movement out of poverty of 58 families or 10% of the total sample.

Changes in Poverty Status for Local and Nonlocal Families

To examine the extent to which employment in the sample plants is affecting the poverty status of local and nonlocal workers, Table 40 shows frequencies for each change in poverty status by family residence status. While the migrant and return migrant groups are the most likely to have families remain in poverty, they are also the most likely to have families escape poverty between t_1 and t_3. Return migrants are also the most likely to have families entering poverty. The vast majority of each group are not in poverty in either period, with the commuting group having the greatest percentage of workers not in poverty in either period.

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[31] U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, Vols. 49-58.

Table 39. Frequencies of Changes in Family Poverty Status Between t_1 and t_3

Change in Family Poverty Status	Frequency (%)
Poverty (t_1) - Poverty (t_3)	11 (2)
Poverty (t_1) - Nonpoverty (t_3)	63 (11)
Nonpoverty (t_1) - Poverty (t_3)	5 (1)
Nonpoverty (t_1) - Nonpoverty (t_3)	475 (86)
Total	554 (100)

Table 40. Frequencies of Changes in Family Poverty Status Between t_1 and t_3 by Residence Status

Change in Family Poverty Status	Local (%)	Commuter (%)	Migrant (%)	Return Migrant (%)	All Families[a] (%)
Poverty (t_1) - Poverty (t_3)	4 (1)	0 (0)	3 (4)	4 (4)	11 (2)
Poverty (t_1) - Nonpoverty (t_3)	30 (11)	8 (8)	11 (13)	13 (14)	62 (11)
Nonpoverty (t_1) - Poverty (t_3)	0 (0)	1 (1)	0 (0)	4 (4)	5 (1)
Nonpoverty (t_1) - Nonpoverty (t_3)	233 (87)	91 (91)	70 (83)	72 (77)	466 (86)
Total	267 (99)[b]	100 (100)	84 (100)	93 (99)[b]	544 (100)

[a]Frequencies for all families are not the same as Table 39 because some observations have missing values for family residence status.

[b]Does not add to 100% due to rounding.

Migrant families have the greatest percentage net movement out of poverty (13%) followed by local families (11%) and return migrant families (10%). While most of the 34 local families who are in poverty in t_1 escape poverty in t_3, these 34 families comprise only 6% of the total sample of workers employed in the sample plants.

Changes in Poverty Status Associated with Changes in Family Labor Force Participation

The results of the analysis of factors influencing changes in family incomes reported in Chapter 3 indicate that changes in family labor force participation patterns are the dominant variables affecting changes in family income in the sample. To determine the role of these changes on family poverty status, Table 41 shows the relationship between changes in poverty status and changes in family labor force participation between t_1 and t_3. In Table 41 family labor force changes are defined in terms of the sex and number of spouses working in each period so that the role of worker sex on changes in family poverty status can also be observed.

Table 41 shows that 42% of the families escaping poverty between t_1 and t_3 do so by adding one or more spouse to the labor force (O_1M_3, O_1F_3, O_1B_3, M_1B_3, F_1B_3). The remaining 58% of the families escaping poverty do so with no change in the number of spouses in the labor force (M_1M_3, F_1F_3, M_1F_3, F_1M_3). Also, while 35% of the families leaving poverty are aided by the employment of a male spouse (O_1M_3, M_1M_3, F_1M_3, F_1B_3), 64% are aided by the employment of a female spouse (O_1F_3, F_1F_3, M_1F_3, M_1B_3). Of the 475 families not in poverty in either period, 31%

Table 41. Frequencies of Changes in Family Poverty Status Between t_1 and t_3 Associated with Changes in Family Labor Force Participation

Change in Family Labor Force Participation[a]	Change in Family Poverty Status: Poverty (t_1)-Poverty (t_3) (%)	Poverty (t_1)-Nonpoverty (t_3) (%)	Nonpoverty (t_1)-Poverty (t_3) (%)	Nonpoverty (t_1)-Nonpoverty (t_3) (%)	Total (%)
O_1M_3	1 (10)	2 (3)	0 (0)	2 (0)	5 (1)
O_1F_3	0 (0)	6 (10)	0 (0)	0 (0)	6 (1)
O_1B_3	0 (0)	1 (2)	0 (0)	0 (0)	1 (0)
M_1M_3	3 (30)	14 (23)	2 (40)	98 (21)	117 (21)
M_1F_3	2 (20)	1 (2)	0 (0)	6 (1)	9 (2)
M_1B_3	0 (0)	13 (21)	0 (0)	84 (18)	97 (18)
F_1F_3	3 (30)	19 (31)	0 (0)	41 (9)	63 (11)
F_1M_3	0 (0)	2 (3)	1 (20)	2 (0)	5 (1)
F_1B_3	0 (0)	4 (6)	0 (0)	22 (5)	26 (5)
B_1M_3	1 (10)	0 (0)	0 (0)	20 (4)	21 (4)
B_1F_3	0 (0)	0 (0)	1 (20)	28 (6)	29 (5)
B_1B_3	0 (0)	0 (0)	1 (20)	172 (36)	173 (31)
Total	10 (100)	62 (101)[b]	5 (100)	475 (100)	552 (100)

Table 41, continued

[a] t_1 = 1; t_3 = 3; 0 = No spouse working; M = Male only working; F = Female only working; B = Both spouses working

[b] Does not add to 100% due to rounding.

have just one spouse in the labor force in each period (M_1M_3, F_1F_3, M_1F_3, F_1M_3), 36% have both spouses working in each period (B_1B_3), 23% add a spouse (M_1B_3, F_1B_3), and 10% lose a spouse (B_1M_3, B_1F_3).

Conclusions

The analysis of distributive impacts in this chapter indicates, within the methodological assumptions, that families with spouses employed in the sample plants are achieving considerable relative income gains within the sample counties. While most sample families are concentrated in the middle of the aggregate distribution, it cannot be concluded that the new manufacturing jobs are contributing to a more equal distribution of income, either in a local or regional sense, because relatively few of the sample families are from the lowest income quintile. Also, the analysis suggests that when distributive effects are viewed from the local level, there are leakages to nonlocal families who tend to have greater incomes relative to local families both before and after employment in the sample plants. Commuting families tend to have greater relative income gains than local families while return migrating families tend to have smaller gains.

The investigation of the effects of family member employment in the sample plants on the alleviation of poverty tends to support the implications of the distribution analysis. While most of the previously poor sample families escape poverty after employment, comparatively few of the sample families are previously poor. Only 13% of the sample families are in poverty before employment, and only 6% of the sample families are local families who are previously poor. The analysis of poverty impacts suggest, as do the findings in Chapter 3, that working female spouses play an important role in helping the sample families escape poverty and stay out of poverty.

CHAPTER 6

CONCLUSIONS, IMPLICATIONS, AND NEEDS FOR FURTHER RESEARCH

The key objectives of this study are to investigate the role of individual, family, plant, and community variables affecting changes in employee wage incomes and total family incomes due to employment in new rural manufacturing plants. This study also endeavors to describe the primary round effects of new manufacturing jobs on the distribution of income and the alleviation of poverty in rural Tennessee counties. The analysis is carried out using primary data from a sample of rural Tennessee manufacturing plants and employees. This chapter contains a summary of the key conclusions of the analysis, a discussion of the implications of the study, and recommendations for further research.

Conclusions

Data Collection

The method used to select the sample of plants and communities studied yielded a random sample of plants locating in rural Tennessee counties between 1970 and 1973 and a county sample which was weighted by the frequency of plant locations in each county during that period. Information from secondary sources indicates that the sampling methods used resulted in a sample of plants and communities which does not represent all plant and community types in rural areas of the state.

In future studies it may be desirable to purposely stratify plant and community samples to insure the inclusion of all relevant plant and community types.

Collection of employee data at the place of work required flexibility in survey procedures in order to gain the compliance of plant management. Methods used ranged from random selection with personal interviews to mass distribution of questionnaires with voluntary participation. Descriptive analysis of the resulting employee sample suggests that the different methods may introduce sample bias. To help eliminate the possibility of sample bias in future studies of this type, it may be desirable to use a consistent employee-sampling procedure for each plant.

A large number of employee observations were deleted from the sample because they reported no source of income in the period prior to employment in the sample plants. While some of the deleted observations may have legitimately had zero income prior to employment, it is assumed that this constitutes an incomplete reporting of income. Many of the deleted observations are young workers who are new labor force participants and who resided with parents prior to employment in the sample plants. These deletions may bias the employee sample used for this analysis against very low income workers and previously unemployed workers. In future studies more specific treatment of previous income sources and, especially parent contributions, during data collection may eliminate the need to make these deletions.

Variables Affecting Income Changes

The most important factors affecting changes in worker and family incomes are changes in the employment status of workers and spouses which coincide with employment in the sample plants. The greatest family income gains are associated with families adding a spouse to the employed labor force, while the greatest losses are associated with families losing a spouse from the employed labor force. New jobs provided by the sample plants contribute to a net gain in the number of families with both spouses employed. These results suggest both the importance of working female spouses for rural families and the conclusion that many rural families feel they cannot obtain an acceptable standard of living with only one employed spouse.

The analysis of changes in employee wage earnings shows that it is not only the opportunity that new jobs provide for family members to become employed but also the scope new jobs provide for workers to escape underemployment which are important factors affecting income changes. While the sample plants are providing opportunities for many previously employed workers to become fully employed, it also appears that many workers have little opportunity to become fully employed and achieve significant wage gains in the sample plants. In the context of the rural labor markets studied, which are normally characterized by both high unemployment and high underemployment, these results are not surprising. Also, in the context of rural labor markets, it is probable that the underemployment in evidence among the sample workers is both voluntary and involuntary in nature. The dominant influence of family labor force participation patterns and underemployment suggests that these factors be considered when interpreting other results.

The demographic characteristics of workers are not highly significant variables in the analysis of changes in family incomes or employee wage earnings. The apparent explanations for their insignificance are consistent with the prevalence of underemployment in rural labor markets and the demonstrated importance of changes in family labor force participation. Middle-age families have greater average income gains than younger and older families but are also more likely to be associated with family labor force participation patterns (i.e., the addition of a spouse to the labor force or the maintenance of two spouses in the labor force) which yield the greatest gains. And while older males receive relatively small incremental wage gains from employment in the sample plants, older females receive relatively large incremental gains. Female workers are associated with average family income gains equivalent to those for male workers and are also associated with family labor force participation patterns which yield the greatest gains. Male and female workers are also associated with nearly equal overall wage gains despite the fact that females are employed in lower wage and skill jobs. The analysis of wage changes indicates that many female workers, and particularly older female workers, are underemployed in their previous jobs and that the sample plants give them an opportunity to become more fully employed. Male workers, and particularly older male workers, apparently do not have the opportunity to substantially improve on previous earnings in the sample plants.

Educational attainment does not contribute significantly to wage gains at job entry or overall wage gains but does contribute significantly to family income and within-plant wage gains of workers. The analysis suggests that while more formal education tends to lead to greater overall wage gains for workers with no more than a high school education the most educated workers have relatively small overall gains. The most educated workers apparently have relatively small gains because jobs as production workers in the sample plants provide them with little opportunity to improve on previous wage earnings and/or because they are relatively fully employed in their previous jobs. The significance of education in explaining family income gains, while it is insignificant in explaining overall wage gains, suggests that education does enhance family competitiveness in the work force. In fact, further investigation shows that both male and female workers associated with families having two spouses in the labor force in either t_1 or t_3 have greater average years of education than males and females associated with families not having two spouses working in either period.

Measures of plant relative size, plant relative wage levels, and plant skill requirements are significant determinants of changes in family incomes and employee wage incomes in all periods. These results indicate the validity of Bryant's conceptualization of rural labor markets. Plant size relative to the labor force is intended to measure the pressure placed on community labor resources and wage rates by the sample plants. Its significance must, however, be interpreted carefully because of its strong correlation with worker sex. Because the larger sample plants have predominantly female work forces, the real contribution of the larger plants may be the opportunities they offer for families to add a member to the labor force. There is no assurance that large plants hiring predominantly males will have the same effect.

Plant relative wage levels are apparently effective in measuring the potential new plants provide workers to improve on previous wage earnings and family incomes. Plant skill levels, measured by a weighted index of the percentages of skilled, semiskilled, and unskilled production workers in a plant's work force, are significant but have an unexpected inverse relationship with changes in wage earnings in all periods and with changes in family incomes. The negative coefficients are explained at least partially by the relatively small wage gains of males employed in higher skill plants. The analysis suggests that these workers may be relatively fully employed in their previous jobs and have less scope for wage gains and/or that even the more highly skilled plants in the sample may provide little opportunity for improvement on previously available jobs and earnings. Female workers in higher skill plants, on the other hand, have greater wage gains because they are relatively underemployed prior to entry and/or because the sample plants afford them more opportunity to improve on previous earnings. More skilled plants may also incur job training expenses which induce smaller wage payments and wage gains.

The above explanations, coupled with the limited range of skill indices observed in the sample plants, suggest that the negative skill coefficients can be successfully interpreted within Bryant's model of rural labor markets. Conceptually, the arguments suggest that, at least with the sample of plants and labor markets studied, there is little distinction and little scope for wage gains between the skilled sector and the less skilled sectors. The limited range of skill indices observed in the sample supports the conclusion that underemployment is prevalent in the rural labor markets included in this study. The differing gains for male and female workers associated with the skill levels of the sample plants, as well as the contrasting plant characteristics for male and female workers, suggest that plant variables may influence family labor force participation patterns. The sharply lower wage and skill levels associated with females suggest that males and females operate in distinctly different labor markets and that the opportunities, or lack thereof, which each provides to improve wage earnings, may affect family decisions concerning labor force entry.

Community rates of underemployment have significant negative coefficients in all equations indicating that they have the hypothesized effect of suppressing community wage levels and, hence, wage gains. Community rates of unemployment and potential labor force entry (UNPTR), while having the expected negative coefficient in each equation, are significant only in explaining overall changes in wage earnings. The analysis does not suggest any conceptual explanations for the insignificance of UNPTR, but its insignificance may be the result of measurement problems which make it impossible to specify UNPTR for the conceptually appropriate period.

The analysis suggests that commuting and migrating workers are not associated with significantly greater family income gains or wage gains as is hypothesized. While commuters and migrants have comparatively high average gains as well as comparatively high family incomes before and after employment, they are also associated with changes in family labor force participation which yield the greatest gains. With other things being equal, commuters have significantly smaller overall wage gains than local workers apparently because commuting males have relatively large earnings in previous jobs and have little scope for wage gains in the sample plants. Commuting females, on the other hand, have smaller earnings in previous jobs and earn substantial gains in the sample plants. Similarly, migrants have insignificantly greater wage gains than local workers, because while males have greater previous wage earnings and smaller gains in more skilled sample plants, females have lower previous earnings and greater gains in less skilled sample plants than local females.

The results suggest that commuters and migrants do not comprise homogeneous groups and that perhaps both commuting and migrating workers have differing motivations for their movements. Some commuting and migrating families, and particularly those associated with male workers, appear to move to more skilled positions and comparatively small incremental wage gains. Other families, and particularly those associated with female workers, appear to move for less skilled jobs which enable them to add family members to the work force and/or to escape underemployment and achieve substantial income gains. Because of the heterogeneous nature of the two groups, commuters and migrants are not necessarily employed in larger, higher wage and skill plants as is hypothesized. This indicates that, at least within the range of sizes, wages and skills encountered in the sample plants, plants which place more pressure on community labor resources are not necessarily more likely to hire greater numbers of nonlocal workers.

Return migrant workers have significantly smaller family income and wage gains than local workers. The differing wage changes of male and female return migrants indicate that return migrants are also not a homogeneous group. Male return migrants have comparatively small (and negative) wage gains, while females, who comprise the majority of the return migrant group, have substantial wage gains. Female return migrants are more likely to be previously employed and are employed in larger plants with higher wage and skill levels than are females in any other residence group. These findings indicate that the wage losses incurred by male return migrants in order to return to their home areas may precipitate the labor force participation of female spouses to compensate for the loss in earnings.

Primary Round Distributive Effects

A key objective of this study is to describe the primary round effects of employment in the sample plants on the distribution of family incomes and the alleviation of poverty. Employment in the sample plants affects movement toward the equality of family well-being incomes within the sample of workers studied. These findings suggest that new jobs in the sample plants provide considerable scope for families with relatively low levels of well-being to improve their incomes but limited scope for families with relatively high levels of well-being to improve their incomes.

Workers employed in the sample plants tend to come from families in the middle three quintiles of the aggregate income distribution of the sample counties. Employment in the sample plants appears to enable most families to achieve substantially higher relative incomes in the sample counties. While the percentage of sample families in the middle three quintiles increases after employment in the sample plants, the fact that comparatively few of the workers achieving the observed gains come from families in the lowest income quintile reveals that the new plants are not necessarily contributing to a more equal distribution of income in the sample counties. This conclusion is substantiated by the analysis of poverty diminution effects of employment in the plants. While family member employment in the sample plants enables most previously poor families to escape poverty, the vast majority of the families are not in poverty in either period. Only 8% of the sample families are local families from the lowest income quintile, and only 6% are local families that are previously in poverty. These findings may be biased somewhat by the use of voluntary sampling to collect much of the family data and by the deletion from the sample of workers reporting zero family income prior to employment.

The entry of family members, and particularly females, into the labor force appears to be instrumental in bringing families out of poverty. This suggests that the factors which restrict the labor force entry of family members are important determinants of the effectiveness of new industry in helping families escape poverty. The finding that many of the sample families leaving poverty do so while maintaining only one spouse in the work force indicates that opportunities for workers to escape underemployment are also instrumental to the alleviation of poverty.

The fact that 50% of the sample families are commuters, migrants, and return migrants indicates that nonlocal families compete extensively with local families for the employment opportunities created by new plants. Locals, commuters, and migrants are equally successful in escaping poverty and in moving out of the lowest two income quintiles. Commuters tend to provide the most competition for local workers and families, while return migrants tend to provide the least competition.

Implications

The findings suggest that primary considerations in assessing the distributive impact of new rural manufacturing industry are factors which promote and inhibit the labor force entry of family members. With high levels of underemployment prevalent in the rural labor markets studied, many families must place additional family members in the work force in order to achieve substantial income gains and acceptable levels of income. The substantial presence of female workers in the manufacturing work force implies the limited availability of opportunities for male workers to achieve sufficient wage earnings in the rural labor markets studied.

The analysis indicates that there are functional problems which may inhibit the ability of many families to place members in the manufacturing work force and, therefore, limit family potential to achieve relative income gains. Older families are not as likely to be associated with the labor force entry of family members. This may be due to the inability of older workers to compete effectively in the labor force. Younger families may also have limited potential to add females to the work force because of child rearing. The limited potential of many families to participate in new manufacturing jobs is also evidenced by the fact that relatively few of the sample families have very low incomes or no member in the labor force prior to employment in the sample plants. While this conclusion may be the result of sample bias, the implication is still clear that new manufacturing industry must provide opportunities for low-income families and workers with little or no industrial work experience if it is to contribute to substantial distributive gains in rural communities.

Direct interpretation of the regression coefficients for plant variables indicates that relatively large plants, paying relatively high wages and requiring little skilled labor, contribute to greater income gains and does not suggest a realistic industrialization policy. A more realistic interpretation, which is consistent with the conclusions of the analysis, is that rural communities need to promote an industrial structure which is more diversified in terms of skills required and wages offered. The negative coefficient for the skill variable must be interpreted in light of the limited range skill requirements observed in the sample plants. Previously unemployed workers tend to be employed in relatively low wage and skill plants indicating that these plants are valuable in providing opportunities for inexperienced workers and, perhaps, low-income families. But skilled and semiskilled jobs, offering higher wages, are required to enable workers to become more fully employed and achieve substantial gains in earnings. The analysis suggests that many of the rural workers studied, and particularly males, do not have the opportunities to become more fully employed that higher skill plants would provide. Job training programs which enable workers to fill more skilled positions with less cost to the firm would appear to be an important component of a policy which seeks to attract more skilled industry.

The distinction between male and female labor markets observed in this study also suggests important implications for community industrialization policy. Plants which enable females to become employed or more fully employed are especially important if jobs available for males do not offer sufficient opportunities to escape unemployment and underemployment. In this situation the effectiveness of creating more and better jobs for females in helping low-income families would depend on factors, including age, ability, and child rearing duties, which may affect the ability of females to take these jobs. Plants which enable males to become employed or more fully employed are important to help families that are not able to add female spouses to the labor force. The creation of more skilled jobs for males and females may alleviate the need for families to have two family earners and result in greater availability of vacated jobs for other workers.

The extent to which underemployment in rural labor markets is voluntary or involuntary is not resolved in this study. The implications of voluntary and involuntary underemployment would appear to be different. If underemployment is largely involuntary, resulting from sporadic layoffs and/or insufficient opportunities to improve skills and wage earnings, then the promotion of a more diversified industrial structure and job training programs would appear to be an effective policy for achieving both income gains and distributional gains. If underemployment is largely voluntary, resulting from sporadic labor force participation and/or reluctance to improve skills and earnings, then these policies may be ineffective.

The findings of this study indicate that nonlocal workers compete extensively with local workers for jobs and income gains stemming from the location of new manufacturing plants. But the heterogeneity of nonlocal groups in terms of the types of employment they seek suggests that the types of industry locating in a community, at least within the range of size, skill, and wage levels included in this sample, will not necessarily affect the degree of competition between local and nonlocal groups. The heterogeneity observed among nonlocal groups also indicates that more attention needs to be given to the definition and characteristics of nonlocal groups so that their role can be more effectively estimated.

The implication of the description of primary round distributive effects of employment in the sample plants, while perhaps biased by the sample of workers obtained, is that new manufacturing industry is not a panacea for solving poverty or income distributional problems in rural communities. This finding indicates that more attention may need to be given to variables and policies which affect the distributive impact of new manufacturing industry in rural areas.

Limitations and Needs for Further Research

The sample of plants analyzed in this study has a low average skill level and omits a number of types of manufacturing industry. The sample also underrepresents very small, low-income counties with relatively low levels of industrial development. In light of the conclusions made regarding the role of plant skill levels and to assess the distributive effects of new industry in relatively less developed areas, further research of these plant and community types is necessary. The employee sample analyzed in this study may be biased away from workers who are new labor force participants and members of low-income families. Further research which compensates for the sampling deficiencies of this study is advisable in order to validate these findings.

By design this study focuses on the distributive impact of new manufacturing industry in rural areas. The distributive consequences of the expansion of existing manufacturing plants and of the location and expansion of other nonmanufacturing industries are also important to many rural communities. Also by design, this study is limited to the investigation of primary round distributive impacts. The distributive effects of secondary round impacts of the location and expansion of rural industry is a topic which has received little attention in the literature and which may yield high returns.

The pivotal role of changes in family labor force participation in fostering income gains and distributive gains suggests the need for in-depth examination of the influence of industry and community characteristics on family behavior and household decision making. The observed need for families to have both spouses employed in the rural labor markets studied suggests the need to investigate the service needs of rural families regarding child care and, perhaps, transportation. Research into the characteristics of families not participating in the employment opportunities provided by new industry may also be valuable in identifying policies which may induce the participation of these groups.

The importance of the concept of underemployment in interpreting the results of this study indicates the need for future work on the estimation and effects of both voluntary and involuntary underemployment. Variables, including worker age, sex and education, and community rates of underemployment, which are included in this analysis, do not appear to effectively or consistently explain the existence of underemployment among rural workers.

The results of this study confirm the broad and dynamic conceptual approach to the analysis of distributive impacts theorized by Gotsch. But this study fails to incorporate many social, political and economic variables, and dynamics which are central to Gotsch's model. Future studies that endeavor to solve the measurement and methodological problems associated with capturing Gotsch's dynamic conceptualization should contribute significantly to the understanding of distributive effects.

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APPENDIXES

APPENDIX A

Table 42. Change in Number of Manufacturing Establishments with Greater Than 20 Employees in SMSA and Non-SMSA Areas of Tennessee (1958-72)[a]

Area	Change in Number of Establishments			
	Period			
	1958-63	1963-67	1967-72	1958-72
SMSA	122	84	85	291
Non-SMSA	171	129	185	485
Total	293	213	270	776
Non-SMSA/total	58.4	60.6	68.5	62.5

[a]1960 definition of SMSA which includes Anderson, Blount, Davison, Hamilton, Knox, Shelby, Sumner, and Wilson Counties.

Source: U.S. Department of Commerce, Bureau of the Census, Social and Economic Statistics Division, Census of Manufacturers (Washington, D.C.: U.S. Government Printing Office, 1958, 1963, 1967, 1972).

Table 43. Change in Manufacturing Plant Employment in SMSA and Non-SMSA Areas of Tennessee (1958-72)[a]

Area	Change in Manufacturing Plant Employment Period			
	1958-63	1963-67	1967-72	1958-72
SMSA	14,989	30,874	6,100	51,963
Non-SMSA	41,257	48,018	43,700	132,975
Total	56,246	78,892	49,800	184,938
Non-SMSA/total	73.4	60.9	87.8	71.9

[a]1960 definition of SMSA which includes Anderson, Blount, Davidson, Hamilton, Knox, Shelby, Sumner, and Wilson Counties.

Source: U.S. Department of Commerce, Bureau of the Census, Social and Economic Statistics Division, Census of Manufacturers (Washington, D.C.: U.S. Government Printing Office, 1958, 1963, 1967, 1972).

Table 44. Manufacturing Income as a Percentage of Total Personal Income[a] for SMSA[b] and Non-SMSA Areas of Tennessee for Selected Years (1950-75)

Area	Manufacturing Income as a Percentage of Total Personal Income				
	Year				
	1950	1959	1965	1970	1975
SMSA	24	25	25	24	21
Non-SMSA	17	25	28	31	28

[a]Total personal income = labor, proprietors, dividends, interest, rent, and transfers minus personal contributions for social insurance.

[b]Definition of SMSA in 1960. SMSA figures for 1950, 1959, and 1965 include one Georgia and one Arkansas county. 1970 and 1975 SMSA figures include one Arkansas county.

Source: Bureau of Economic Analysis.

APPENDIX B

Date ____________________

C O N F I D E N T I A L

Plant Questionnaire

1. Name of firm ____________________

2. Located in: county ____________ town ____________

3. Firm's SIC code (4 digit) ____________

4. What does the firm produce? ____________________

____

5. a. Is this plant unionized? Yes ___ No ___

   b. If so, since when? month ____ year ____

6. When did hiring of production workers begin? month ____ year ____

7. When did plant operations begin? month ____ year ____

8. a. How many production workers do you now have? ____
   b. How many clerical workers do you now have? ____
   c. How many supervisory personnel do you now have? ____
   d. How many management personnel do you now have? ____

9. How many of your employees are salaried? ________

10. a. What percentage of your salaried personnel came from outside this county to take thier job here? _____
    b. What percentage of your salaried personnel currently live in this county? _____

11. Are there any positions in your plant for which you specify minimum educational requirements before hiring? Yes ___ No ___

If YES, please specify:

Position	Requirement	No. of Employees
____________	____________	____________
____________	____________	____________
management	____________	____________

12. a. How many of your workers perform jobs which require three or more years of technical school or on-job training? _____
b. How many of your workers perform jobs which require one to two years of technical school or on-job training? _____
c. How many of your workers perform jobs which require little or no training? _____

13. What kind of job training does your firm provide to train workers for jobs in your plant?

a. Skill trained ______________________

Informal on-job _____ Formal on-job _____ Formal schooling ___

Other (specify) ____________________

Number of current workers who have been trained __________

Average length of training per employee ___________

b. Skill trained ______________________

Informal on-job _____ Formal on-job _____ Formal schooling ___

Other (specify) ____________________

Number of current workers who have been trained ____________

Average length of training per employee ___________

c. Skill trained ______________________

Informal on-job _____ Formal on-job _____ Formal schooling ___

Other (specify) _____________________

Number of current workers who have been trained _____________

Average length of training per employee ___________

d. What percentage of your current work force has been trained through these programs? _______

e. Are any of the training programs financed through outside funding? Yes ____ No ____

If YES:

1. Name of program ________________________________
2. Source of funds? County ___ State ___ Federal ___
3. Are there any restrictions on the type of people you hire for these programs? Yes ___ No ___
4. If YES, please specify: ____________________________

____

14. Does your firm have a specific policy of giving preference to prospective employees from this county? Yes ___ No ___

15. a. Do you hire part-time workers? Yes ___ No ___
    b. If YES, how many part-time workers do you have? _____

16. a. What is the average wage of your firm's work force? _____

Plant ________________________________

C O N F I D E N T I A L

Employee Questionnaire

1. What is your age? _____

2. Check one: Male ___ Female ___

3. Please circle each year of formal schooling you have finished:

Grade school	1 2 3 4 5 6 7 8
High school	1 2 3 4
College	1 2 3 4
Graduate school	Master's Doctorate
Vocational or technical training school	1 2 3 4
Other (please specify)	________________________

THE FOLLOWING QUESTIONS CONCERN YOUR EMPLOYMENT AT THE PLANT INDICATED AT THE BEGINNING OF THIS QUESTIONNAIRE.

4. Do you now live in the same county where the plant is located?

   Yes ___ No ___ (IF NO, SKIP TO QUESTION 5)

   If YES:

   a. How long have you lived in this county? Months ___ Years ___

   b. Did you move back to this county after having lived here earlier in your life? Yes ___ No ___

   c. If YES, when did you move back to this county? Month ___ Year ___

5. Did you quit a job with another company to take this job?

   Yes ___ No ___ (IF YES, SKIP TO QUESTION 6)

   If NO:

   a. Were you in school right before you took this job? Yes __ No __

   b. Is this your first job? Yes ___ No ___

   c. How long were you unemployed while looking for this job? ______

IMPORTANT:

THE FOLLOWING QUESTIONS CONCERN THE INCOME YOU HAVE BEEN EARNING WHILE WORKING AT THE PLANT INDICATED AT THE BEGINNING OF THIS QUESTIONNAIRE.

6. a. When did you start work at the plant? Month ___ Year ___

   b. What position or title did you hold then? ________________

   c. What wage did you earn then? $ ________ per hour

   d. How many hours a week did you work at that time on the average?
   Regular _______ Overtime _______

7. a. What position or title do you hold now? ________________

   b. What wage do you earn now? $ _______ per hour

   c. How many hours per week do you work now on the average?
   Regular _________ Overtime _______

   d. What kind of job training has the company provided for you?
   None ___ On-job ___ Formal schooling ___
   Other (please specify) ________________________________

   e. How many total months have you been laid off while working for this company? _________

8. Do you now hold a second job? Yes ___ No ___

   If YES, what are your gross earnings (before withholding) at your second job? (Please answer one)

   $ ____________ per year $ _______ per hour for ____ hours/week

   $ ____________ per month

   $ ____________ per week

9. a. Are you married? Yes ___ No ___
   b. How many children do you have? _____
   (IF NOT MARRIED, SKIP TO QUESTION 10)
   c. Does your spouse now hold a job? Yes ___ No ___
   (IF NO, SKIP TO QUESTION 10)
   d. If YES, what are your spouse's gross earnings (before withholdings) at that job? (Please answer one)
   $ ________ per year $ _____ per hour for _____ hours/week

   $ ________ per month

   $ ________ per week
   e. How many months was your spouse laid off during the last year?
   ____

10. a. Do you (or your spouse, if married) receive any form of public assistance right now? Yes ___ No ___ (IF NO, SKIP TO QUESTION 11)

b. If YES, please check the type of assistance you receive:

_____ unemployment compensation
_____ aid to families with dependent children
_____ aid to the disabled
_____ social security
_____ other (please specify) ______________________

c. What are your estimated total benefits from all forms of public assistance? (Please answer one)

$ _____ per year

$ _____ per month

$ _____ per week

11. a. Do you (or your spouse, if married) now receive income from any other source (farming, pensions, child support, rentals, etc.) which has not been mentioned so far? Yes ___ No ___

b. If YES, please specify the source and amount:

Source ______________________ (please answer one)

Amount: $ _______ per year

$ _______ per month

$ _______ per week

IMPORTANT:

THE FOLLOWING QUESTIONS CONCERN THE INCOME YOU WERE EARNING DURING THE YEAR BEFORE YOU WORKED AT THE PLANT INDICATED AT THE BEGINNING OF THIS QUESTIONNAIRE.

12. a. Did you work at all during that year?
Yes ___ No ___ (IF NO, SKIP TO QUESTION 13)
If YES:

b. How many jobs were you working then? ________

c. What position(s) or title(s) did you hold then? ______________

d. What were your gross wage earnings (before withholding) during that year? (Please answer one)

$ ________ per year $ _____ per hour for _____ hours/week

$ ________ per month

$ ________ per week

e. How many months during that year were you laid off or unemployed?

____

13. a. Were you married at that time?
Yes ___ No ___ (IF NO, SKIP TO QUESTION 14)

b. How many children did you have then? ________

c. Was your spouse working during that year? Yes ___ No ___

d. If YES, what were your spouse's gross earnings (before withholdings) during that year? (Please answer one)

$ ________ per year $ _____ per hour for _____ hours/week

$ ________ per month

$ ________ per week

e. How many months was your spouse laid off or unemployed? ______

14. a. Did you (or your spouse, if married) receive any form of public assistance during that year? Yes ___ No ___ (IF NO, SKIP TO QUESTION 15)

b. If YES, please check the type of assistance you received:

_____ unemployment compensation
_____ aid to families with dependent children
_____ aid to the disabled
_____ social security
_____ other (please specify) ____________________________

c. What were your estimated total benefits from all forms of public assistance during that year? (Please answer one)

$ ________ per year

$ ________ per month for _____ months

$ ________ per week for _____ weeks

15. a. Did you (or your spouse, if married) receive income from any other source (farming, pensions, child support, rentals, etc.) which has not been mentioned so far? Yes ___ No ___

b. If YES, please specify the source and amount:

Source ______________________________ (please answer one)

Amount: $ ________ per year

$ ________ per month for _____ months

$ ________ per week for _____ weeks

APPENDIX C

Two other methods besides the weighted skill index (SKILL) were considered for this study. Gotsch [11] among others suggests the use of value added as a measure of skills required in the production process. This measure was ruled out because of the difficulty in obtaining accurate figures for input costs and product revenues from plant management.

An attempt was also made to measure skill requirements by asking plant managers to specify the number of employees and the length of training for each employee involved in formal and informal job training programs in the plant. From this information, the average months of training per employee (AVTR) was computed. This was intended as a proxy measure of skills required relative to those available in the local labor market (if needed skills were available, less training would be necessary). This measure was ruled out because it was considered risky to equate training efficiency (skills trained per month training) across plants. Also, plant management often could not provide reliable data on numbers of current employees involved in training and the length of that training.

Table 45 presents a correlation matrix of the three skill measures considered for this study. Value added per employee (VADDED) was computed using 1972 secondary data[1] for value added and numbers of production workers employed for all plants in the state with the same

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[1]U.S. Department of Commerce, Social and Economic Statistics Administration, Bureau of the Census, 1972 Census of Manufacturers (Washington, D.C.: U.S. Government Printing Office, April 1975).

Table 45. Correlation Matrix of Three Measures of Plant Skill Requirements Considered for This Study[a]

Measure	VADDED	AVTR	SKILL
VADDED	1.000	.086	.186
AVTR		1.000	.823
SKILL			1.000

[a]A correlation coefficient of .325 is significant at the .05 level of *t*.

four-digit SIC code as the sample plant. It is interesting to note that the value added measure does not significantly correlate with either of the other two skill measures. The average training measure, however, correlates significantly with the skill index.

APPENDIX D

Table 46. Correlation Matrix of Variables Included in the Regression Analysis of Family Income Changes[a]

	TAFYCH	PREMP	SPENT	SPEX	STAYIN	GPA	LPA	GOTH	LOTH	AGE	SEX	EDUC	FAMCH	NOWKPL	SIZRLF	RLWAGE	SKILL	UNDERR	UNPTR	COMM	MIG	RMIG	Q_1	Q_2	Q_4	Q_5
TAFYCH		-.199	.350	-.437	.096	-.024	-.018	0.94	-.050	-.038	.022	.073	.038	.011	.067	.089	.007	-.092	-.031	.051	.051	-.149	.236	.134	-.077	-.384
PREMP			.137	-.050	-.266	-.008	-.081	.084	-.208	-.115	-.261	.095	.085	.048	.045	.191	.151	-.001	-.112	-.079	-.155	.046	-.166	.010	.101	.092
SPENT				-.122	-.296	-.039	.034	-.021	-.038	-.132	-.122	.048	.066	.068	-.008	.067	.008	-.015	.057	.008	-.064	-.013	.093	.075	-.067	-.142
SPEX					-.309	.246	-.040	.001	.010	.048	.055	-.037	.052	.043	.084	.076	.027	.017	.007	-.034	-.012	.020	-.089	-.081	.034	.128
STAYIN						-.100	.007	-.009	.000	.041	.236	-.002	-.103	.003	.065	-.120	-.078	.029	-.063	.058	.061	-.002	-.280	-.277	.220	.292
GPA							-.090	.051	-.023	.129	.142	-.007	.102	.112	.051	.022	-.001	.068	-.039	-.045	-.009	-.016	-.014	-.032	.039	-.055
LPA								-.043	-.050	-.025	.023	-.036	-.077	-.063	-.081	-.139	-.075	.037	.114	-.045	.036	.017	.084	-.033	-.030	-.069
GOTH									-.045	.104	-.080	.004	.172	.085	-.067	.053	-.032	.037	-.065	-.027	.028	-.057	-.021	.003	-.032	.066
LOTH										-.003	-.052	.045	-.038	.057	-.069	.017	-.014	-.075	.108	.032	.042	.036	.060	-.056	-.055	-.016
AGE											.119	-.348	-.110	.360	-.016	-.080	-.034	-.097	-.053	-.000	.127	.060	.137	-.138	-.008	.069
SEX												-.108	-.156	-.062	.288	-.337	-.195	.080	.022	-.016	.055	.061	.030	-.048	-.066	.067
EDUC													.069	-.055	.048	.134	.201	-.172	-.023	.025	.019	-.052	-.234	.021	.051	.121
FAMCH														.174	-.003	.086	.085	-.047	-.086	-.026	-.059	-.048	-.031	-.012	-.016	.009
NOWKPL															-.011	-.016	-.016	-.059	-.055	.039	-.046	.032	-.041	-.117	.008	.120
SIZRLF																.231	.134	.407	-.104	-.064	-.059	.074	-.072	-.087	.071	.026
RLWAGE																	.497	.128	.188	-.087	-.067	.044	-.041	-.081	.048	.052
SKILL																		-.155	-.110	-.016	-.018	.036	-.024	-.082	-.095	.065
UNDERR																			.171	-.108	-.088	.079	.024	-.029	.006	-.040
UNPTR																				-.033	-.048	.059	.144	-.031	-.008	-.011
COMM																					-.197	-.207	-.058	.012	.016	.035
MIG																						-.189	.023	-.052	.076	-.027
RMIG																							.002	-.045	.042	.026
Q_1																								-.258	-.255	-.258
Q_2																									-.247	-.250
Q_4																										-.247
Q_5																										

[a]A correlation coefficient of .088 is significant at the .05 level of *t*.
A correlation coefficient of .115 is significant at the .01 level of *t*.

Table 47. Correlation Matrix of Variables Included in Regression Analyses of Changes in Employee Wage Incomes[a]

	WCH12	WCH23	WCH13	PREMP	AGE	SEX	EDUC	FAMCH	MOWKPL	SIZRLF	RLWAGE2	RLWAGE3	SKILL	UNDERR	UNPTR	COMM	MIG	RMIG
WCH12		-.265	.833	-.594	.045	.235	-.064	-.087	-.062	.038	-.041	-.060	-.114	.001	.055	.047	.107	-.106
WCH23			.313	.084	.006	-.201	.186	.163	.104	.141	.068	.326	.193	-.235	-.087	-.079	.043	-.023
WCH13				-.536	.049	.116	.043	.008	-.002	.118	-.001	.127	-.002	-.135	.004	.008	.130	-.118
PREMP					-.115	-.261	.095	.085	.043	.045	.152	.191	.151	-.001	-.112	-.079	-.155	.046
AGE						.119	-.348	-.110	.360	-.016	-.104	-.080	-.034	-.097	-.053	-.000	.126	.060
SEX							-.108	-.156	-.062	.288	-.309	-.337	-.195	.078	.022	-.016	.055	.061
EDUC								.069	-.055	.048	.064	.134	.201	-.172	-.023	.025	.019	-.052
FAMCH									.174	-.003	.056	.086	.085	-.047	-.086	-.026	-.059	-.049
MOWKPL										-.011	.003	-.016	-.016	-.059	-.065	.039	-.046	.032
SIZRLF											.113	.231	.134	.407	-.104	-.064	-.059	.074
RLWAGE2												.872	.413	.370	.312	-.081	-.078	.051
RLWAGE3													.497	.128	.188	-.087	-.067	.044
SKILL														-.155	-.110	.018	.036	-.024
UNDERR															.171	-.108	-.088	.079
UNPTR																-.034	-.048	.059
COMM																	-.196	-.207
MIG																		-.189
RMIG																		

[a]A correlation coefficient of .088 is significant at the .05 level of *t*.
A correlation coefficient of .115 is significant at the .01 level of *t*.

VITA

Maurice R. Landes was born on August 6, 1949, in Chestnut Hill, Pennsylvania. He graduated from Council Rock High School in Newton, Pennsylvania, in June 1967. In September 1967, he entered Georgetown University in Washington, D.C. He received the degree of Bachelor of Science in Foreign Service, with a major in International Affairs, from Georgetown in May 1971. In June 1971, he entered the Peace Corps and served until November 1973 as a village level agricultural extension agent in the state of Punjab in northern India. From December 1973 to April 1974, he was employed as a production worker at Polar Manufacturing Company in Philadelphia, Pennsylvania. From May 1974 to July 1975, he worked as a Peace Corps trainer in India and also traveled extensively throughout India and Nepal. In September 1975, he began working toward the Master of Science degree in Agricultural Economics at The University of Tennessee, Knoxville, receiving a research assistantship in September 1976. In January 1978, he received a research associateship to complete his thesis research. In March 1979, he accepted a research position in the Economic Development Division of the Department of Agriculture in Washington, D.C.