RURAL INDUSTRIALIZATION AND THE CHANGING DISTRIBUTION OF FAMILY INCOMES

by Brady J. Deaton and Maurice R. Landes

Income distribution has been a central topic in political economy and has received continuing emphasis by our profession. Few studies, however, have been undertaken to examine the distribution effects of rural industrialization. Notable exceptions are two recent studies which call attention to the effects of industry on the lowest income groups (Reinschmiedt and Jones, Kuehn, et al.). With poverty diminution remaining an important matter of public policy, the changing size distribution of family income among new industrial workers must be a central concern for rural development policy. The size distribution of income is important in shaping the social structure of society, in reducing transfer payments, in lowering development costs, and in facilitating recovery of investment in human capital.

Research Approach

The hypothesis explored in this paper is that the distributive consequences of rural industrialization are shaped by community and industry characteristics and the demographic traits of employees and their families (Gotsch).[1] An OLS regression analysis was used to determine the association between selected measures of these variables and dollar changes in total family income (FINCH). All dollar figures were adjusted to 1977 price levels.

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Three time periods were important considerations in the analysis: the year before the worker was first employed in the sample firm (t_1), the first year of work in the firm (t_2) and the most recent year, 1977 (t_3). A family member entering the work force may experience an abrupt shift in income between t_1 and t_2 particularly if he/she was unemployed or significantly underemployed in t_1. Thereafter, wage income will be determined by labor mobility in the firm over time. The dependent variable (FINCH) was specified as family income in t_3 minus family income in t_1. Variables were included to adjust for the different factors influencing family income changes between t_1 and t_2 and between t_2 and t_3. Data for the analysis were obtained from secondary sources and by questionnaires from 714 workers. These represented a 20 percent sample of the labor force in 35 plants randomly selected from a list of all firms (185) which located in rural Tennessee between 1970 and 1973 inclusively having 20 or more employees.[2]

Variable Specification

The components of family income include both worker's and spouse's wages, transfer payments, and other income sources such as second jobs and asset earnings. Months worked in plant (MWRK) was entered as a variable to control for length of employment (t_2 to t_3). The effects of changes in labor force participation among family members were measured by introducing a discrete variable (0,1) to represent spouse taking a job (SPENT) or leaving a job (SPEX). Entry and exit were hypothesized respectively to be significant determinants of positive and negative family income changes. The gain (GOTH) or loss (LOTH) of other income,

and of public assistance were treated similarly [gain (GPA), loss (LPA)].

Discrete variables were also entered to evaluate distributive effects by residence status and family well-being. Commuters (COMM), migrants (MIG), and return migrants (RMIG) were coded 1 to test differences as compared to local residents. Changes in the well-being of families were analyzed by classifying the sample into quintiles. Family incomes in t_1 were adjusted for family size by dividing the actual income by a factor of 1 plus .3 for each additional family member.[3] The sample was broken into quintiles Q_1 to Q_5 representing successively higher levels of well-being.

Individual Characteristics

Age (AGE), years of formal education (EDUC), and sex of the worker (SEX) were hypothesized in previous research to influence changes in family incomes (Smith and Morgan) and were included in this analysis. Younger workers are more competitive and flexible and, thereby, able to take advantage of changing labor market conditions. Hence, a negative relationship was expected. Level of formal education should be positively associated with the dependent variable as it reflects the relative store of human capital, basic skills, and socialization (coping skills) acquired in the education process. Females (0,1) are expected to contribute relatively more to family income changes because they are more likely to be the spouse entering the labor force. However, salary changes between t_2 and t_3 may be less for females, partially offsetting the t_1 to t_2 shift.

Previous work experience (PREMP) may have alternative effects in a measure of association with family income change. Since PREMP was specified as 1 if wage income was above zero in t_1, the higher income associated with t_1 employment may result in a lower income shift between t_1 and t_2. Consequently, a negative relationship could be expected. However, wage increases between t_2 and t_3 should be positively affected by previous work experience which complements the effects of education. Changes in the number of children (FAMCH) was included following the hypothesis of Smith and Morgan that larger families provide incentive for workers to seek out higher paying jobs.

Rural Labor Market Conditions

Bryant's conceptualization of rural labor markets provided useful guidelines for selecting appropriate measures of supply and demand conditions. Three aspects of a plant's demand for labor were hypothesized to be important determinants of family income changes. First, higher wage plants create a larger shift from previous wages, t_1 to t_2, and provide a greater scope for upward wage mobility, t_2 to t_3. This variable was specified as the ratio of average plant weekly wage to the average weekly manufacturing wage in the county. The average plant weekly wage was measured by the average weekly wages of workers in the sample on a plant by plant basis. A positive relationship was expected.

Second, the relative skill requirements of the plant should have a similar influence on the dependent variable. Skill levels reflect the plant technology and labor demand more accurately than the relative wage, since the latter is more sensitive to local labor market conditions.

Measures of wage and skill levels will be less correlated in rural labor markets with severe underemployment since high skills may be obtained at relatively lower wages. A weighted index of the percentage of production workers in skilled, semi-skilled, and unskilled categories was used to measure the skill level of each firm.[4] A third measure selected was the size of the plant relative to the local labor force (SIZRLF) which provides a measure of labor demand relative to labor supply. Greater shifts in labor demand are expected to increase pressure for the plant to offer higher wages to attract an adequate number of workers with an appropriate range of skills.

Community factors expected to influence the distribution effects of new industry were community labor supply and the level of manufacturing development. The level of manufacturing development (RLDEV) depends on both the number and diversity of jobs in the labor market. More developed areas provide greater opportunity for upward adjustments in wages because of interfirm competition for workers. The measure of development used was the level of manufacturing employment weighted by the degree of industrial diversification (Isard, p. 270).[5]

Rates of unemployment were selected as measures of labor supply conditions. The unemployment rate at the time the worker was employed (UNEMP) may affect entry level wages, with greater unemployment rates associated with relatively lower wages. Also, the change in unemployment between t_2 and t_3 (UNEMPCH) may affect wage adjustments in the plant over the same time period. A declining unemployment rate will reflect tighter labor market conditions and relatively greater increases in wages. UNEMPCH was specified as the change in the unemployment rate t_2 to t_3 as

a ratio of the t_2 unemployment rate. Hence, a declining unemployment rate results in a positive sign and a positive association with the dependent variable.

Results of Analysis

The variables in the general regression were grouped to illustrate the relative contribution of each class to the total R^2 of .55 (Table 1). The cumulative R^2 reflects the proportion of total explained sums of squares contributed by successive groups of variables. Most of the explained variation (52 percent) is associated with the group of income determinants representing structural shifts in family earnings: spouse entry (SPENT) and exit (SPEX) from the labor force, the gain (GPA) or loss (LPA) of public assistance, and changes in other income earnings (GOTH, LOTH). Demographic characteristics, principally PREMP, explained an additional 22 percent, resident status 2 percent, the quintile ranking of pre-employment well-being 13 percent, plant characteristics 6 percent and community characteristics 3 percent.[6]

The quintile measures reflect an equalizing effect in family incomes associated with industrial employment. The lower quintiles were positively associated with changes in family income, whereas the top quintiles had negative signs. The significant coefficients were Q_1, Q_4 and Q_5.

This indirect measure of increasing equality of family incomes was verified by computing relative mean incomes (RMI) by quintile for the pre-employment period and for the current period. The RMI is the mean of the quintile expressed as a percentage of the mean of the total

Table 1. Regression Results: Variables Hypothesized to Explain Changes in Family Income (thousands of dollars) Associated with New Manufacturing Jobs in Rural Tennessee Counties.

Variable	Mean	St. Dev.	b Value	Std. Err.	Cum. R^2
INTERCEPT	-	-	.677	1.339	
SPENT (0,1)	.106	.309	4.083**	.460	
SPEX (0,1)	.112	.315	-6.050**	.454	
LOTH (0,1)	.018	.132	-4.140**	1.118	
GOTH (0,1)	.137	.344	1.735**	.421	
LPA (0,1)	.167	.373	- .681*	.377	
GPA (0,1)	.039	.194	1.644**	.751	.292
PREMP (0,1)	.832	.375	-3.598**	.418	
MWRK (months)	34.713	25.806	.014**	.007	
AGE (years)	32.475	10.280	- .044**	.017	
SEX (0,1)	.518	.500	.675**	.325	
EDUC (years)	10.971	2.407	.156**	.064	
FAMCH (#)	.219	.649	- .148	.237	.410
COMM (0,1)	.177	.382	.332	.386	
MIG (0,1)	.151	.358	.394	.408	
RMIG (0,1)	.167	.373	-1.029**	.392	.422
Q_1 (0,1)	.199	.399	1.695**	.454	
Q_2 (0,1)	.195	.397	.493	.441	
Q_4 (0,1)	.204	.403	- .792*	.427	
Q_5 (0,1)	.204	.403	-2.669**	.434	.494
RELWG (%)	.978	.225	3.246**	.847	
SKIL (Index)	.206	.243	- .734	.712	
SIZRLF (%)	.263	.235	2.663**	.700	.529
UNEMP (%)	6.976	3.111	- .057	.054	
UNEMPCH (%)	-23.093	53.403	.006*	.003	
RLDEV (Index)	2940.254	2267.404	.287*	.069	.547
R^2 = .547	F = 24.7		n = 538	Mean of FINCH = 2.334	

*Significant at the .10 level of t.

**Significant at the .05 level of t.

distribution of incomes and serves as an index of equality. The RMI measures indicated movement in each quintile toward the mean of the total sample. The quintile comparison reflects a shift toward greater equality of family incomes among employees in this sample.

The relative wages (RELWG) and size of the plant (SIZRLF) were positive and statistically significant along with the measure of relative manufacturing development (RLDEV). The measure of skills demanded by the plant (SKIL) was insignificant and negative, the opposite of the hypothesized relationship. The SKIL relationship may be partially explained by intercorrelation. The measures of plant characteristics were the most intercorrelated of all variables in the model: RELWG and SKIL at .55 and RELWG and SIZRLF at .35. The wage and skill measures may be further complicated by the extent of training offered by the firm and corresponding wage adjustments made to cover training costs. The skill measure was highly correlated with months of training ($r = .8$).

The unemployment rates were consistent with our hypothesis. The entry level rate (UNEMP) had a negative sign but was not significant. The percent change in the unemployment rate t_2 to t_3 was significant.

Changing Labor Force Participation and Family Well-Being

The regression analysis revealed the net importance of females and of spouse labor force entry and exit. Since, the sex composition of the sample is 50-50, the sex of the spouse may alter interpretation of the sex coefficient as it affects family well-being. Therefore, an attempt was made to clarify the relationship among alternative patterns of labor force participation by sex and their consequences for family well-being.

Wage changes for male and female workers for each time period were examined by quintile. In each quintile, female workers earned a larger increment in the t_1 to t_2 shift, but a lower increment in the t_2 to t_3 period compared to males. The total wage change t_1 to t_3 was greater for females. Thus, family incomes were influenced principally by the abrupt change associated with female workers taking jobs in new industry. Further analysis revealed that a combination of factors, including the type of plant and community, lower education levels, and older ages impede t_2 - t_3 wage increases for females.

The general conclusion of greater income equality based on the regression and relative mean income analysis does not necessarily reflect a decline in the incidence of poverty. The consequences of industrial jobs for rural poverty diminution is a critical policy concern and can be addressed by a more detailed examination of the data. To accomplish this objective the proportion of families in poverty in each time period was compared for nine permutations of labor force participation (Table 2).[7] Of 538 families analyzed, 112 (21%) began in poverty in t_1 and ended in poverty in t_3. Eighty-six families escaped poverty status, but 39 families dropped from above to below poverty for a net decline of only 47 families. Therefore, the number of families below poverty declined from 198 (37%) to 151 (28%) between t_1 and t_3. Three hundred and one families were above poverty in both time periods.

The largest group in poverty during both time periods (P_1P_3) was families in which only the male worked (M_1M_3). Fifteen percent of the P_1P_3 group had both spouses working in both periods (B_1B_3). Families

Table 2. Changes in Poverty Status Associated With Labor Force Participation by Household Members* (Column % in Parentheses).

Labor Force Participant	Poverty Status				
	P_1P_3	P_1NP_3	NP_1P_3	NP_1NP_3	Total
M_1M_3	33 (29)	16 (19)	16 (41)	52 (17)	117 (22)
F_1F_3	19 (17)	14 (16)	2 (5)	28 (9)	63 (12)
B_1B_3	17 (15)	9 (11)	7 (18)	141 (47)	174 (32)
M_1F_3	5 (5)	1 (1)	0 (0)	3 (1)	9 (2)
M_1B_3	23 (21)	36 (42)	1 (3)	34 (11)	94 (17)
F_1M_3	2 (2)	2 (2)	0 (0)	1 (.3)	5 (1)
F_1B_3	5 (5)	7 (8)	1 (3)	14 (5)	27 (5)
B_1M_3	2 (2)	1 (1)	4 (10)	13 (4)	20 (4)
B_1F_3	6 (5)	0 (0)	8 (21)	15 (5)	29 (5)
Total	112	86	39	301	538
% of Total	(21)	(16)	(7)	(56)	(100)

*$t_1 = 1$, $t_3 = 3$

P = Below poverty level income

NP = Above poverty level income

M = Male only working

F = Female only working

B = Both spouses working

with only one spouse working in t_1, but both working in t_3 made up 26% of those in poverty in both time periods ($M_1B_3 + F_1B_3$). Of the 86 families who escaped poverty, the largest group (42%) was M_1B_3, reflecting the importance of working females. Families falling below poverty (NP_1P_3) fell primarily into two groups M_1M_3 and B_1F_3, though 18% had both spouses working in both time periods.

Conclusions and Implications

Analyzing family income rather than simply wage earnings is necessary to gain an understanding of the effects of industrialization on family well-being. This analysis has focused only on families of workers in new manufacturing plants and does not represent income distribution for the community. At the same time, the results presented suggest that inferences based on Lorenz curves or measures of relative mean incomes of quintiles may be misleading if income is not adjusted for family size and if the changing incidence of poverty is not evaluated. Whether a poverty threshold is a reasonable measure of well-being is a question which remains unaddressed in this paper, but deserves some attention.

The broad conceptual model employed in this research helps evaluate the relative importance of plant and community characteristics for family income changes. Further refinement of these measures of the local labor market combined with a proper conceptual model of household behavior may begin to clarify policy deliberations concerning income distribution. Until this is achieved, the puzzlements of Rivlin (among others) over the constancy of the size distribution of income will remain unanswered.

This attempt to partition the size distribution question into a manageable research segment revealed that new manufacturing jobs resulted in a shift toward equality of family incomes among manufacturing workers in rural Tennessee, but resulted in only 9% fewer families in poverty. Obviously, industrialization is not a panacea for solving poverty problems as both history and other research reveals (Summers, et al.). Consequently, analysis of sectoral interactions at the local level and associated household labor force participation will be required to provide more insight into appropriate policies for modifying income distribution.

FOOTNOTES

The authors are respectively Associate Professor of Agricultural Economics, Virginia Polytechnic Institute and State University and Research Associate, University of Tennessee. This paper is based on research being conducted under Regional Project S-96, and was written while the senior author was a faculty member at the University of Tennessee. Helpful comments on the paper were received from Professor Irving Dubov, Dr. William Sanders, and Carl Siegrist.

1. This hypothesis follows the reasoning of Gotsch in his study of the impact of tubewells on rural farming communities in Pakistan.

2. These encompassed 12 different standard industrial classifications and were located in 24 different rural (non-SMSA) counties ranging in population from 7,800 to 78,800 in 1974. The average size of the sample firms was 105 employees.

3. The weight of .3 is analogous to that used to compute poverty level income by family size.

4. The skill index was based on the proportion of the plants' workers who required 3 or more years of training (skilled), 1 or 2 years (semiskilled), and less than a year (unskilled). The percentages in each group were weighted by +1, 0, -1, respectively. Subsequently, +1 was added to each score for ease of interpretation in the regression analysis. This measure could theoretically range from 0 (100% unskilled) to 2 (100% skilled). The actual range turned out to be from 0 to 1.28.

5. The coefficient of specialization compares a county's sectoral manufacturing employment structure to the average structure for all rural Tennessee counties. The greater the measure the relatively more specialized and the lower the measure the relatively more diverse the employment structure. RLDEV is computed as (1 - coefficient of specialization) X (manufacturing employment) since we expect that both the magnitude of employment and greater diversification contribute to industrial development. 1970 census data were used to compute the variable.

6. The plant and community variables were entered in sequence after other family measures were in the model. As each set was entered the sequential sums of squares (ss) were compared with the partial ss to evaluate whether inferences changed and to determine serious problems of interaction. This process revealed no changed inferences.

Discrete variables in a regression framework usually introduce heteroscedasticity and reduce the efficiency of the model. Residual plots against dependent and independent variables revealed evidence of possible heteroscedasticity which may result in inefficient, but unbiased estimators.

[7]Poverty level incomes for 1977 price levels based on Bureau of the Census figures were $3025 for a non-farm individual, plus a factor of .32 for each additional family member.

REFERENCES

Bryant, W. Keith. "Industrialization As a Poverty Policy: Towards a Micro Analysis," Papers on Rural Poverty, Raleigh: North Carolina State University, 1969, pp. 71-82.

Gotsch, Carl H. "Technical Change and the Distribution of Income in Rural Areas," American Journal of Agricultural Economics, Vol. 54, No. 2, May 1972, pp. 326-340.

Isard, Walter. Methods of Regional Analysis: An Introduction to Regional Science, M.I.T. Press, Cambridge, Massachusetts, 1960.

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

Reinschmidt, Lynn and Lonnie L. Jones. "The Impact of Industrialization on Employee Income Distribution in Rural Texas Communities," Southern Journal of Agricultural Economics, December 1977, pp. 67-72.

Rivlin, Alice M. "Income Distribution - Can Economists Help?", Richard T. Ely Lecture, American Economic Review, Vol. 65, No. 2, May 1975, pp. 1-15.

Smith, James D. and James N. Morgan. "Variability of Economic Well-Being and Its Determinants," American Economic Review: Papers and Proceedings, May 1970, Vol. LX, No. 2, 286-295.

Summers, Gene F., et al. Industrial Invasion of Nonmetropolitan America, New York: Praeger Publishers, 1976.