IMPACT OF INDUSTRIALIZATION ON EMPLOYEE INCOME DISTRIBUTION IN RURAL TEXAS COMMUNITIES*

Lynn Reinschmiedt and Lonnie L. Jones

A basis of concern for rural development has been lagging economic growth in rural communities. Many rural areas have long been faced with the dilemma of low income, inadequate or expensive community services, net out-migration and high dependency rates [14, p. 43]. Numerous programs have been enacted over the years to alleviate these problems. A recent program, the Rural Development Act of 1972, interprets the main objective of rural development as encouraging and speeding economic growth in rural areas providing for jobs, improving quality of rural life, and doing so on a self-earned, self-sustaining basis [15, p. 36]. One chief component of all these programs has been promoting industry location in rural communities.

A considerable amount of research effort has been expended in evaluating the economic impact of industrialization on rural communities [3, 4, 5, 6, 8, 9, 10, 11 and 12]. Most studies have concentrated on aggregate measures, such as increases in total employment, incomes generated and associated costs of industrial development. More recently, attention has been directed toward evaluating the distributional impact of industrial development. For example, the Garrison and Shaffer studies emphasized distribution of industrial impact among selected sectors of the local economy; most notably the municipal government, private and school district sectors have been delineated. With this breakdown of the local economy, the private sector was found to receive the bulk of net benefits resulting from industrialization. A logical extension of industrial impact studies is to address questions of distributional impact within the private sector.

Exactly how this "increased economic gain" is distributed among the industry work force or population has not been analyzed specifically. Shaffer attempted to address this distributional issue with a Lorenz curve—Gini coefficient analysis of county incomes in his study areas [10]. Several shortcomings of applying the Lorenz curve analysis to county data in an analysis of distributional aspects of industrial development are worth noting. First, in most instances Lorenz curve analyses rely on aggregate income statistics, often available only from decennial census data. Thus, the time period for which statistics are available may not lend itself readily to the time frame in question. Secondly, a number of other economic and structural changes, both national and local, may have been an influential factor in determining county income statistics.

Another consideration evolves from the fact that the basic unit of analysis in most industrial impact studies has been the community. Consequently, aggregated income statistics for areas larger than the community may not be a relevant data base for the Lorenz curve analysis. This limitation is negated to some extent by findings that a significant portion of the economic impact of industrialization is disseminated throughout areas surrounding the community. Nevertheless, county statistics do not measure changes in income distribution among those individuals most directly affected by industrialization.

Recently, a study was undertaken to evaluate the economic impact of nine industrial locations in six rural Texas communities with populations of less than 15,000 [7]. Three of nine plants were tied to

Lynn Reinschmiedt is Assistant Professor, Department of Agricultural Economics, University of Delaware; and Lonnie L. Jones is Associate Professor, Department of Agricultural Economics, Texas A & M University.

*Technical Article No. 12990, Texas Agricultural Experiment Station, Texas A & M University, College Station.

local inputs, whereas the remaining six firms could be described as "footloose." Average annual 1974 employment ranged from 28 to 152 employees. Payrolls ranged from $144,000 to $1,050,000 with a plant average of $417,058.

Results of this study showed that overall community net gains averaged $296,985 for the nine industries with a low of $113,997 and a high of $751,194.[1] Results also showed that the private sector, which consisted of those directly employed within the industry as well as businesses and individuals meeting input and service demands generated by new industry and its employees, on an average received 97 percent of total community net gains. Excepting one school district, industrialization benefits exceeded associated costs in the private, municipal government and school district sectors for all plants.

Evaluation of the individual firm's employee income status was undertaken to determine income distributional consequences within the private sector. This paper presents the framework within which the distributional aspects were evaluated and results of that analysis.

CONCEPTUAL FRAMEWORK AND DATA

Within the private sector, previous and present incomes of individuals employed at the new industries formed the data base for income distributional analysis. A sample of employees at the new industries was surveyed to determine previous and present employment and income status. Approximately 27 percent (154 individuals) of the total workforce employed by the nine industries were interviewed. Of the 154 employees surveyed, 70 respondents provided complete information on previous and post industrialization incomes. An additional 40 respondents, or 27 percent of the total sample, were previously classified as unemployed with no prior income.

An overview of the employees' previous and present income shifts resulting from industrialization can be attained simply by looking at the number of individuals who changed income positions relative to their pre-industrialization incomes. Also, evaluation of movements between designated income categories and comparison of mean incomes for previous and present income categories provide a measure of overall income changes.

Income distributional effects of industrialization can also be shown with the aid of Lorenz curves and Gini coefficients, with previous and present employee income data providing the necessary data base. While the Lorenz curve and Gini coefficient provide useful and descriptive measures of income inequality, certain complications arise in their use. Budd has stated that Gini coefficients produce an ambiguous measure of changes in equality if the two relevant Lorenz curves intersect. Even if the curves do not intersect, any given quintile may gain or lose more than another, relative to their position in some earlier period [2, p. 247].

A method of revealing these changes is to compare the mean income of quintiles relative to the mean of the distribution as a whole; i.e., the quintile's share of total income divided by size of the quintile [2, p. 247]. This ratio is referred to as "relative mean income," and it emphasizes changes in distribution among component recipient groups classified by income size. Thus, relative mean income ratios provide a measure of change within distributions rather than changes in overall inequality as measured by Gini concentration ratios. The following empirical results present income distributional changes for individuals employed in new industry using these procedures. Previously unemployed individuals were not included in either the Lorenz curve-Gini coefficient or the relative mean income analysis.[2]

EMPIRICAL RESULTS

Overall status of the 110 employees is indicated by comparing previous and present incomes.[3] Figure 1 presents a transition matrix of pre- and post-industrialization incomes. Previous income categories are listed on the left by row, with present income categories at the top of the column. Elements within the transition matrix indicate numbers of individuals previously in income categories on the left who moved to income categories designated at the top. A visual illustration of the overall impact of new industry is depicted by examining a diagonal drawn from the upper left corner to the lower right corner of Figure 1. Individuals whose previous and present income relationship places them on the diagonal

[1] Community is defined to encompass the local governments' jurisdiction in which the plant is located. Community net economic gains are the difference between the direct, indirect and induced benefits and costs associated with plant location.

[2] Although not reported here, the analysis was also performed with previously unemployed individuals included in the group. As would be expected, including these individuals accentuated the findings presented in this paper.

[3] Previous incomes were adjusted to account for potential increases in incomes had the individual remained at the previous job. A weighted yearly increase in median wages and salaries was calculated for the time period 1969-1970 by county and used to adjust previous incomes. Otherwise, all data are in nominal terms.

	Unemployed	0-999	1000-1999	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	8000-8999	9000-9999	10,000-10,999	11,000-11,999	12,000 and over	Total
Unemployed			1	2	1	17	8	3	2	3	1			2	40
0-999															0
1000-1999				1	1	1	1			2					6
2000-2999				1			1				1				3
3000-3999					1	2	3	1							7
4000-4999				1		4	5	1	1	1	1				14
5000-5999						7	1	1	3	1				2	15
6000-6999						1		1		2	1	1	2	1	9
7000-7999							2		1		1			1	5
8000-8999										1	1			1	3
9000-9999												2	1		3
10,000-10,999								1							1
11,000-11,999												1			1
12,000												1		2	3
Sub-total[b]	0	0	0	3	2	15	13	5	5	7	5	5	3	7	70
Total	0	0	1	5	3	32	21	8	7	10	6	5	3	9	110

FIGURE 1. INCOME TRANSITIONS FROM PREVIOUS TO PRESENT EMPLOYMENT[a]

[a]Previous incomes were adjusted to account for earnings differentials over the elapsed time periods.

[b]Sub-total row presents income category summaries for individuals previously employed; whereas the row designated Total includes previously employed and unemployed individuals.

made job shifts without changing income levels. Those above the diagonal improved their income position and those below experienced decreases in incomes.

Of the 70 employees previously holding jobs, 12 (17 percent) took jobs at the new industry at wage levels equal to previous wages adjusted for earning differentials over elapsed time periods. An additional 20 percent experienced an earnings decrease, and the remaining 63 percent earned more at the new job than at the previous one. Forty employees were previously unemployed (Figure 1).

Income Category Means Analysis

Raw data on the 70 previously employed were aggregated into six selected categories and analyzed for absolute and percentage change in mean income by category (Table 1). The first row in Table 1 indicates that six individuals were previously in income category $0-1,999 with a mean income of $1,683. After taking jobs at new industries, these same six individuals were earning an average of $5,471, a 225 percent increase in mean income. Percentage increases in mean income ranged from a low of eight percent in the highest income category to 225 percent in the lowest category. Overall, mean incomes increased by 63 percent. Differences in pre- and post-industrialization income levels were tested statistically using the paired t-statistic [13]. The paired t-test accounts for variance of pre- and post-income differences of individuals within the sample. The null hypothesis tested is that the mean of the population of differences between pre- and post-industrialization incomes of persons taking jobs in the nine industries is zero. The alternative hypothesis tested is that the mean of population differences is greater than zero, hence present mean income exceeds previous mean income. The calculated t value exceeded the tabulated value at the 99.95 percent level of confidence; thus, the null hypothesis of no population mean difference was rejected, and it was concluded that present population mean incomes were significantly greater than previous mean incomes.

Test of Changes in Income Distribution

Lorenz curves were constructed using survey data from the 70 previously employed workers for which

TABLE 1. PREVIOUS AND PRESENT INCOME MEANS AND PERCENT CHANGE IN MEAN INCOME BY SELECTED CATEGORIES[a]

Previous Income Categories	Number of Individuals in Previous Income Category[b]	Mean Previous Income	Mean Present Income	Percent Change in Mean Income
Dollars	Number	Dollars	Dollars	Percent
0 - 1,999	6	1,683 (9.30)[c]	5,471 (41.58)	225
2,000 - 3,999	10	3,179 (18.73)	5,334 (33.48)	68
4,000 - 5,999	29	5,020 (9.83)	6,396 (50.30)	27
6,000 - 7,999	14	7,006 (9.12)	9,380 (41.29)	34
8,000 - 9,999	6	9,076 (8.12)	10,700 (22.76)	18
10,000 and over	5	15,074 (49.01)	16,321 (61.76)	8

SOURCE: [7]

[a]Present incomes are for 1974, whereas previous incomes vary depending upon the time period during which the previous job was held (see footnote 3).

[b]The number of individuals presently in these income categories are 0, 5, 28, 10, 12 and 15.

[c]Numbers in parentheses represent coefficients of variation.

previous and present income information was available. Previous and present income distribution Lorenz curves are represented by dashed and solid line curves, respectively, in Figure 2. The Lorenz curves reveal reductions in inequality at the upper and lower parts of the distribution, and a slight increase in inequality in the middle part. For example, the 20 percent of the individuals at the lower end of the distribution increased their income share from eight percent to 11 percent of the total, whereas the cumulated percentage of income for 60 percent of the individuals decreased from 45 to 41 percent.

Gini coefficients for previous and present income distributions were .2709 and .2672, respectively. These coefficients show that income distribution tended slightly toward overall income equality for individuals employed at new plants. However, as noted earlier, interpretation of Gini coefficients calculated from intersecting Lorenz curves, such as those in Figure 2, can be misleading with respect to distributional impact.

Relative mean incomes were calculated for the same distributions to provide further information on income distributional impact. Table 2 presents information on income shares and relative mean incomes of each quintile. Part A of Table 2 shows that income shares of the lowest and highest quintiles increased 2.0 and 1.75 percent, respectively, while income shares of the three middle quintiles decreased. While observed percentage changes in income shares may not seem large, they do imply significant changes in

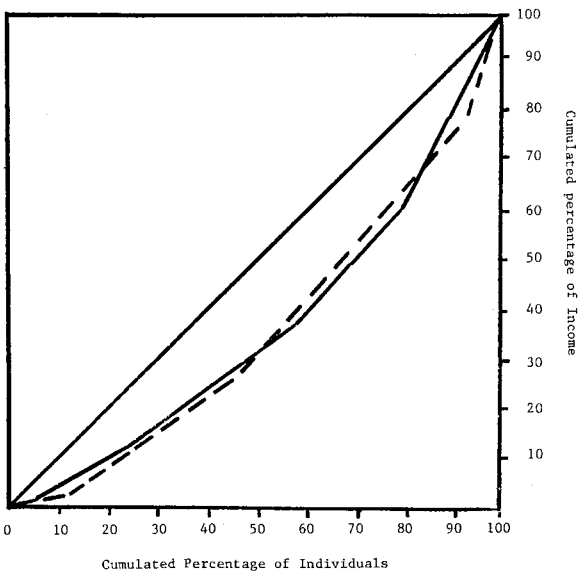

FIGURE 2. LORENZ CURVES FOR PREVIOUS AND PRESENT INCOME DISTRIBUTIONS OF EMPLOYEES[a]

[a]Dashed line represents previous income distribution and solid line represents present income distribution.

TABLE 2. DISTRIBUTION OF EMPLOYEE EARNINGS FOR PREVIOUS AND PRESENT EMPLOYMENT STATUS[a]

A. Income Share of Quintiles

Income Classification	Quintiles 1st	2nd	3rd	4th	5th
Previous income					
Dollars	34,270	61,270	73,731	95,593	150,578
Percent of total	8.25	14.75	17.75	23.0	36.25
Present income					
Dollars	56,250	74,085	85,060	124,847	208,535
Percent of total	10.25	13.50	15.50	22.75	38.00
Percentage change	2.00	-1.25	-2.25	-2.50	1.75

B. Relative Mean Incomes of Quintiles and Gini Coefficients

Income Classification	Quintiles 1st	2nd	3rd	4th	5th	Gini Coefficients
Previous income	.4125	.7375	.8875	1.1500	1.8125	.2709
Present income	.5125	.6750	.7750	1.1375	1.9000	.2672
Percentage change	24.24	-9.26	-14.52	-1.09	4.83	-1.01

SOURCE: [7]

[a]Present incomes are for 1974. Previous incomes vary depending upon the time period during which the previous job was held (see footnote 3).

relative mean incomes. Estimated relative mean incomes show that the lowest and highest quintiles gained income relative to the average. For example, relative mean income of the lowest quintile increased from .4125 to .5125, a gain of 24 percent. That is, before industrialization the lowest quintile's mean income was 41.25 percent of the mean of the income distribution. Results for remaining quintiles show that the second and third quintiles lost the greatest relative share of income; whereas, the two upper quintiles had a small negative and a small positive change in relative mean incomes (Table 2).

Analyses of income distributions indicate that overall mean incomes increased due to industrialization. Individuals in lowest and highest income groups benefited most from industrialization. The greatest benefit, in terms of income increases from new job opportunities, was among individuals with lowest incomes in previous jobs and those who were previously unemployed.

SUMMARY AND IMPLICATIONS

Results of this study indicate that location of new industry in six Texas communities had a statistically significant positive effect on incomes for those employed by the industries. Sixty-three percent of the 70 individuals for which data on previous and present earnings were available experienced increases in earnings with the job shift. An additional 17 percent took new jobs at salaries equal to their previous employment earnings. Thus, 80 percent of these individuals either increased or maintained their previous earnings. Moreover, 40 individuals or 27 percent of the plant work forces were previously unemployed.

Lorenz curves and Gini coefficients for previous and present employee income distributions showed a slight increase in overall income distribution equality. It was estimated that the relative mean incomes of the lowest quintile increased from .4125 to .5125, a gain of 24 percent. The top quintile had a small increase in its relative mean income of 4.83 percent. These results indicate that individuals directly employed by new industry in the lowest quintile of the distribution enjoyed substantial income increases and those in the highest quintile experienced moderate increases relative to all individuals in the sample.

In general, results of the overall study showed that industrialization had a positive impact on the total community. The bulk of the benefits, 97 percent on average, went to the private sector. Plant payrolls make up a significant portion of these private sector effects. Also, benefits exceeded costs in the municipal and school sectors, although the difference was less than in the private sector.

Analysis of individuals' incomes in the survey showed they were significantly increased and some redistributional changes occurred in favor of the lowest and highest portions of income distribution. New or expanded industry had a positive effect on all incomes and, on balance, benefited most favorably those individuals in the lowest income category. Moreover, 27 percent of the industry employees were hired directly from the ranks of the rural unemployed. In conclusion, these results support rural industrialization as a means of reducing unemployment and improving the relative income position of low income residents in rural areas.

REFERENCES

[1] Advisory Commission on Intergovernmental Relations. *Urban and Rural America: Policies for Future Growth*, Commission Report A-32, Washington: Government Printing Office, 1968.

[2] Budd, Edward C. "Postwar Changes in the Size Distribution of Income in the U.S.," *American Economic Review*, Volume 52, 1970, pp. 247-260.

[3] Garrison, Charles B. *The Impact of New Industry on Local Government Finances in Five Small Towns in Kentucky*, Agricultural Economics Report No. 191, ERS, USDA, September 1970.

[4] Garrison, Charles B. "New Industry in Small Towns: The Impact on Local Government," *National Tax Journal*, Volume 24, 1971, pp. 493-500.

[5] Kale, Steven. "The Impact of New or Additional Industry Upon Rurally Oriented Areas: A Selectively Annotated Bibliography With Emphasis on Manufacturing," Bureau of Business Research, College of Business Administration, University of Nebraska-Lincoln, Occasional Paper Number 2, March 1973.

[6] McElveen, Jackson V. *Rural Industrialization in the Southwest Central Plain: A Case Study of a New Brick Factory in Summerville, South Carolina*, Agricultural Economics Report No. 174, Washington: Government Printing Office, EDD, ERS, USDA, February 1970.

[7] Reinschmiedt, Lynn. "An Evaluation of Economic Benefits and Costs of Industrialization in Rural Communities in Texas," Unpublished Ph.D. dissertation, Department of Agricultural Economics, Texas A & M University, College Station, Texas, December 1976.

[8] Shaffer, Ron E. "The Net Economic Impact of New Industry on Rural Communities in Eastern Oklahoma," Unpublished Ph.D. Thesis, Department of Agricultural Economics, Oklahoma State University, Stillwater, Oklahoma, May 1972.

[9] Shaffer, Ron E. "Estimating the Economic Spillovers of New Industry," Paper presented to the Mid-Continent Section of the Regional Science Association, April 1973.

[10] Shaffer, Ron E. "Rural Industrialization: A Local Income Analysis," *Southern Journal of Agricultural Economics*, Volume 6, 1974, pp. 97-102.

[11] Shaffer, Ron E. and Luther G. Tweeten. *Economic Change from Industrial Development in Eastern Oklahoma*, Agricultural Experiment Station Bulletin B-715, Oklahoma State University, July 1974.

[12] Stevens, J. B. and L. T. Wallace. "Impact of Industrial Development on Howard County, Indiana 1947-60," Research Bulletin 784, Purdue University, August 1964.

[13] Steel, Robert G. D. and James H. Torrie. *Principles and Procedures of Statistics*, New York: McGraw-Hill, 1960.

[14] Tweeten, Luther. "The Need for the Systems Approach to Rural Development Research," *Southern Journal of Agricultural Economics*, Volume 6, No. 1, 1974, pp. 43-52.

[15] Tyner, Fred H. "Rural Development Research Under Scrutiny," *Southern Journal of Agricultural Economics*, Volume 6, No. 1, 1974, pp. 35-42.