THE DETERMINANTS OF WAGE INCREASES IN NEW MANUFACTURING PLANTS IN RURAL AREAS

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The spatial trend of manufacturing industry toward smaller towns and rural areas, particularly in the South and West, appears to be continuing into the 1980s (Haren, 1980). Economic research has been undertaken to examine the reasons for this national shift (Haren, 1970; Beale; Lonsdale et al.), the influence of community decisions on the location process (Smith et al.; Klindt et al.; Kuehn et al.), and various facets of industrial impact on rural communities (Summers et al.; Reinschmiedt and Jones; Deaton and Landes).

None of these studies provided an analysis of either the magnitude of changes in employee wages nor the subsequent growth in wages associated with continued employment in the plant. This omission is surprising in view of the importance of wage earnings in explaining the functional and size distribution of income. Results from inter-industry analysis (Klindt and Smith) suggest that the wage gains of new employees are likely to be the most significant contribution made by the industry to the community. Secondary gains resulting from household spending are also determined in part by the increased wages of workers. Therefore, analysis of initial wage changes associated with new employment and the subsequent wage trend in the firms seems to be a necessary first step in understanding community economic growth. Consequently, this research was undertaken to explore these issues.

The research reported here was designed to explain variation in wage changes of new industrial plant employees. Following the theoretical perspectives of Gotsch, wage changes were hypothesized to result from a combination of employee household, community, and plant characteristics. The greatest difficulty in this study was choosing appropriate operational measures for independent variables that were highly correlated with these theoretical factors (Bonnen).

PROCEDURE

Analysis involved specification and empirical testing, using ordinary least squares multiple regression analysis of three separate equations. The first was to study factors influencing wage changes due to worker entry into the sample firm. The second was to study wage changes relative to longevity and worker mobility within the firm. The third was to study overall changes in employee wage earnings. Since theory suggested that the effects may vary with the stage of work experience, the use of three equations allowed separate analysis of the influence of individual, plant, and community variables on each component of overall changes in wage earnings.

Primary plant and employee data for the analysis were obtained for 1977. Plant managers were interviewed from 35 plants selected at random from the population (160) of plants with more than 20 employees that located in rural (non-SMSA) areas of Tennessee during 1970 through 1973. The recent period of location served to minimize the variation in technology, management, and organization that might alter data interpretation. Efforts were made to obtain information from a 20-percent sample of employees at each plant. After necessary deletions, information on 565 employees (18.4 percent of the total) was analyzed.

Dependent Variables

Wage levels during three time periods were needed for analysis: the year preceding employment at a new industrial plant; the first year of employment at the plant; and, for 1977, the year when sample data were collected for the study. The dependent variables were: (1) initial wage change (IWC), wages during the first year of employment at the sample plant (t_2) minus wages during the preceding year (t_1); (2) subsequent wage change (SWC); wages during 1977 (t_3) minus wages during the first year of employment at the sample plant (t_2); and (3) total wage change (TWC), the sum of IWC and SWC. Employee wage earnings in each time period were adjusted to 1977 price levels so that actual changes in employee purchasing power could be assessed. The wage changes were specified in thousands of dollars in the regression analysis.

Explanatory Variables

Groups of conceptual variables expected to

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explain variations in wage changes included changes in worker employment status, demographic characteristics of workers, time, plant characteristics, community characteristics, and worker residence status. The operational variables are specified in Table 1, and means and measures of variation are presented in Table 2.

TABLE 1. Specification of Independent Variables

Employee Characteristics

PREMP - A dummy variable denoting whether an employee was (=1) or was not (=0) employed in the year preceding employment in the sample plant.

AGE - Age of an employee in years.

SEX - A dummy variable denoting whether an employee was male (=1) or female (=0).

EDUC - Years of formal education.

FAMCH - Change in the number of children in an employee's family. Not used in the Initial Wage Change model.

MOWKPL - Number of months an employee was employed in a sample plant. Not used in the Initial Wage Change model.

Plant Characteristics

SIZRLF - Plant employment as a percent of the total community labor force in 1977.

RLWAGE1 - Average weekly entry level wage in a sample plant as a percentage of the average weekly manufacturing wage in the county in 1977. Not used in the Subsequent Wage Change or Total Wage Change models.

RLWAGE2 - Average weekly wage in a sample plant as a percentage of the average weekly manufacturing wage in the county in 1977. Not used in the Initial Wage Change model.

SKILL - An index from information supplied by plant managers. Within a plant, the percentages of employees requiring three or more years, one or two years and less than one year of training, multiplied by two, one and zero, respectively, and summed.

Community Characteristics

UNDERR - County rate of underemployment in 1970.

UNPLF - County rates of combined unemployment and potential labor force entry in 1970.

Residence Status Characteristics

COMM - A dummy variable (in a set which included MIG and RMIG with local workers omitted) denoting that an employee was a commuter, i.e., did not reside in the county in which the sample plant was located at the time of the survey.

MIG - A dummy variable denoting that an employee was a migrant, i.e., lived in the county in which the sample plant was located at the time of the survey, had never previously lived in the county and had moved to the county after the age of 16.

RMIG - A dummy variable denoting that an employee was a return migrant, i.e., lived in the county in which the plant was located at the time of the survey, had previously lived in the county and had returned to the county after the age of 16.

Results

The results of multiple regression analyses of factors affecting IWC, SWC, and TWC are reported in Table 3. The R^2 for the IWC equation was .38, while the F value was 27.7. R^2 and F values for the SWC equation were .28 and 14.7, respectively, while comparable figures for the TWC equation were .43 and 28.4.

Change in Worker Employment Status. Workers may either have been 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 (0=no wage earnings in t_1, 1=positive wage earnings in t_1), was entered in each equation.

TABLE 2. Means and Standard Deviations of Variables Included in Regression Analyses of Changes in Employee Wage Incomes

Variable	Specification	Mean	Standard Deviation
IWC	$ 1977 (000's)	1.75	2.57
SWC	$ 1977 (000's)	1.20	1.63
TWC	$ 1977 (000's)	2.95	2.51
PREMP	0,1	.83	.37
AGE	years	32.47	10.27
SEX	0,1	.52	.50
EDUC	years	10.97	2.40
FAMCH	number	.22	.65
MOWKPL	months	34.72	25.78
SIZRLF	%	2.63	2.35
RLWAGE1	%	90.68	19.78
RLWAGE2	%	105.47	25.88
SKILL	index	.20	.24
UNDERR	%	23.28	6.60
UNPLF	%	11.64	11.40
COMM	0,1	.18	.38
MIG	0,1	.15	.36
RMIG	0,1	.17	.37

Employment in the previous year was expected to result in a less abrupt shift in wage earnings due to worker entry into a sample plant, thus a negative coefficient was expected for PREMP in the IWC equation. Workers with employment experience in the previous year were expected to have relatively greater wage gains because of mobility within a firm related to skills gained in the previous employment. A positive coefficient was hypothesized for PREMP in the SWC equation. However, this hypothesis was tenuous because the absence of previous work experience would tend to be reduced with tenure of employment in the sample plant. In terms of overall wage changes, it was expected that the negative IWC shift in wage earnings associated with previous employment would dominate and result in a negative coefficient for PREMP in the TWC equation.

PREMP was significant and had the expected inverse relationship with changes in wage earnings in both the IWC and TWC equations. But, PREMP had an insignificant and negative coefficient in the SWC equation, while a positive coefficient was hypothesized. Apparently, whatever advantage that accrued to workers with previous employment was bid into their starting salary.

Demographic Characteristics. Demographic characteristics of employees included in this analysis were worker age (AGE), sex (SEX),

TABLE 3. Results of Three Multiple Regression Analyses of Variables Hypothesized to Explain Changes in Employee Wage Incomes Due to Job Entry (IWC), Wage Mobility (SWC) and Employment (TWC) in Sample Plants

Variable	IWC b values (std. error)	SWC b values (std. error)	TWC b values (std. error)
Intercept	5.336** (1.104)	.265 (.721)	5.728** (1,110)
PREMP (0,1)	-5.072** (.323)	-.102 (.206)	-5.141** (.316)
AGE (years)	-.010 (.012)	.003 (.008)	-.005 (.013)
SEX (0,1)	.710** (.262)	-.480** (.172)	.199 (.265)
EDUC (years)	-.030 (.051)	.063** (.033)	.037 (.050)
FAMCH (number)	--	.284** (.119)	.085 (.183)
MOWKPL (months)	--	.006* (.003)	.002 (.005)
SIZRLF (%)	.109* (.058)	.207** (.038)	.265** (.059)
RLWAGE1 (%)	.027** (.008)	--	--
RLWAGE2 (%)	--	.023** (.004)	.039** (.006)
SKILL (index)	-1.439** (.579)	-.763** (.355)	-1.927** (.547)
UNDERR (%)	-.052** (.022)	-.102** (.013)	-.124** (.020)
UNPLF (%)	-.014 (.011)	-.011 (.007)	-.022** (.011)
COMM (0.1)	-.156 (.313)	-.378* (.201)	-.515* (.307)
MIG (0,1)	.081 (.328)	.180 (.209)	.218 (.322)
RMIG (0,1)	-.767** (.314)	-.158 (.199)	-.941** (.307)
R^2	.38	.28	.43
n	548	545	546
F	27.7**	14.7**	28.4**

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

years of formal education (EDUC), and change in the number of children in the employee's family (FAMCH).

AGE was expected to have a negative coefficient in all three equations because older workers were hypothesized to be less competitive and more likely to have already achieved their earning potential. It was recognized that the relationship probably was not linear since experience would have been gained during earlier work years, and the negative effects might not be realized until later years. In fact the coefficient was insignificant in all equations and positive in the SWC equation. Examination of the raw data and statistical properties supports rejection of the hypothesis. The relatively large wage gains of many older workers in the sample, and especially older female workers, imply that such workers were underemployed in their previous jobs, and that the sample plant provided them an opportunity to become more fully employed.

Female employees were hypothesized to have greater initial wage changes than males because it was expected that females would be more likely to enter the labor force intermittently to supplement family incomes. However, it was expected that females would have smaller subsequent changes because of less previous work experience and the low wage, low skill plants in which they were generally employed. As a result, the sex variable (SEX, M=0, F=1) was expected to have a positive coefficient in the IWC equation and a negative coefficient in the SWC equation. In the TWC equation, a positive coefficient was expected because it was anticipated that the positive initial shift for females would dominate the negative subsequent shift.

As shown in Table 3, the SEX variable had the expected sign in all three equations and was significant in the IWC and SWC equations. Opposite effects for the two component time intervals apparently removed the effects of SEX in the overall (TWC) period. The significantly greater gains for females at job entry (with previous unemployment partially controlled for in the equation) suggest that they were more likely to have been sporadically employed and/or underemployed in their previous jobs than had males. The significantly smaller wage gains for females within the sample plants indicate that the plants provided less skilled and lower paying jobs for female workers than for males. The average value of the variable used to measure plant skill levels (SKILL) was 0.25 for males and 0.16 for females. Moreover, averages of variables designed to measure sample plant wages relative to the wages in the community, RLWAGE1 and RLWAGE2, were 97.00 and 114.49 for males and 84.77 and 97.04 for females, respectively. The observation that female workers had greater gains at job entry while being employed in plants with sharply lower wage levels and skill requirements than did males also implies that females were more likely to have been underemployed in their previous jobs. It appears that the sample plants, while offering generally lower wage and skill jobs for females, still provided more opportunities for females to improve on previous wage earnings than they did for males. In model results, the SEX variable was expected to be significant because of factors associated with earnings that are generally vested variably between the sexes. The authors recognize that the results may represent a measure of these earnings factors for which sex is a proxy or of differences due to sex alone.

Employees with more years of formal education were hypothesized to be more competitive, more skilled, and to have greater potential for wage gains through employment in manufacturing plants than workers with fewer years of education. A positive coefficient was expected for the education variable (EDUC) in all three equations. However, the variable EDUC had a significantly positive coefficient only in the SWC equation. In the IWC equation, EDUC had an insignificant negative coefficient, and in the TWC equation, EDUC had an insignificant positive coefficient.

An examination of the data suggests that the lack of significance of EDUC in the IWC and

TWC equations was because of 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 had relatively high wage earnings in t_1 and, therefore, had less potential for incremental and total gains because of the wage structure of the sample plants, and/or because they had been comparatively less underemployed in their previous jobs. Yet, the most educated workers realized the greatest subsequent wage gains within the sample firms.

Consistent with the hypothesis of Smith and Morgan, increases in the number of children in workers' families were expected to motivate workers to seek higher paying jobs resulting in greater initial and subsequent wage gains. However, the number of children in the sample families at the beginning of period t_1 was 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. Therefore, the variable measuring the effects of changes in the number of children in worker families (FAMCH) was included in the SWC and TWC equations only, and positive coefficients were expected. In fact FAMCH had a positive coefficient in both equations, but was significant only in the SWC equation.

The time variable (MOWKPL) was included in the SWC and the TWC equations to control for and measure the effects on wage gains of differing lengths of employment in the sample plants. MOWKPL had expected positive coefficients in both equations, but was significant in only the SWC equation.

Plant Characteristics. Variables were included in each of the three equations 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 was hypothesized to exert positive pressure on wage rates and provide opportunity for workers to escape unemployment and underemployment, resulting in greater wage gains due to job entry and within-firm mobility. The plant size variable was significant and had 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 in relation to the size of the local labor force led to greater wage gains for workers.

Plant average wage levels relative to the average manufacturing wage in the community were intended to measure the scope for wage gains for new workers because of job entry and upward wage mobility in the plant. Greater relative wage levels were 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 RLWAGE1 was entered in the IWC equation. To measure the effects of plant relative wage levels on employee wage changes due to wage mobility in the firm and on overall wages changes, RLWAGE2 was entered in both the SWC and the TWC equations.

The plant relative wage variables were significant and had 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 in relation to the average manufacturing wage in the county resulted in greater wage gains for workers.

Plant skill levels were also expected to be directly correlated with initial and subsequent wage changes. Greater plant skill requirements were hypothesized to lead to greater initial wage gains by providing greater opportunity for workers to escape underemployment, and to greater subsequent gains by providing more opportunity for workers to move up to higher skill jobs. The operational variable SKILL was significant in each equation, but it did not have the hypothesized positive relationship with wage change in any time period. One possible explanation of the negative coefficients is unreliability of the skill index used to measure plant skill levels. Another is correlation of SKILL with other independent variables, RLWAGE1 ($r=.413$) and RLWAGE2 ($r=.497$). However, there also appears to be conceptual explanations for the negative coefficients. Examination of the raw data indicated that for the IWC period, female workers in more highly skilled plants tended to have greater wage gains, while male workers in similar plants tended to have smaller wage gains. Previously employed males working in higher skill plants tended to have higher wage earnings prior to entry, suggesting that they may have been relatively less underemployed in t_1 and had less potential for initial and total wage gains. This suggests that the negative coefficient for SKILL in the IWC equation, and perhaps the TWC equation, may have been due to the relatively small gains for previously employed male workers entering more highly skilled plants.

Community Characteristics. Community variables were included to measure the quality and quantity of labor available in the communities in which the sample plants were located. County rates of underemployment (UNDERR), developed from work by Williams and Glasgow, and Snell and Leuck, were intended to measure the availability of workers capable of moving into higher wage and skill jobs. Greater availability and underemployed labor was hypothesized to suppress wage rates and wage gains, resulting in smaller initial and subsequent changes in employee earnings. County rates of unemployment and potential labor force entry (UNPLF), calculated by a method developed by Stoll, were intended to measure the availability of willing but idle labor to newly located plants.[1] Greater availability of such labor was expected to suppress wage rates, resulting in smaller wage gains in each period.

UNDERR was significant and had the hypothesized inverse relationship with wage gains in all three models. These results suggest 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, when skill levels and relative size of the plant are controlled for in the analysis. UNPLF also had the hypothesized sign in each equation, but it was significant at the .10 level or better only in the TWC equation. UNPLF was significant at the 11-percent level in the SWC equation and at the 20-percent level in the IWC equation.

Residence Status. The relative initial, subsequent, and total wage gains accruing to local, commuting (COMM), migrating (MIG), and return migrating (RMIG) workers were measured by a series of discrete (0,1) variables, with local workers being the omitted class.

Commuting workers were hypothesized to have greater wage gains than local workers in all three time periods, because it was expected that commuting workers would be more aggressive and experienced and tend to provide skills not available among local workers. However, the results of the regression analysis indicated that, with other factors being equal, commuting workers tended to have smaller wage gains than local workers in all three time periods. The variable COMM had a negative coefficient in all three equations and was significant in the SWC and the TWC equations.

Examination of the data indicates that previously employed commuting males had sharply higher earnings in t_1 and lower total wage changes than their local counterparts. On the other hand, previously employed commuting females had lower wage earnings in t_1 and greater wage gains than previously employed local females. This suggests that commuting females may have been relatively more underemployed in t_1 and, therefore, may have had greater scope for wage gains than their local counterparts.

Migrating workers were also hypothesized to have greater wage gains than local workers in all three time periods because it was expected that they would 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 did tend to have greater wage gains than locals, with other things being equal, the gains were not significantly different. Return migrant workers were expected to have lower wage gains than local workers because they often sacrifice wage earnings in order to return to their local areas to live and work (Morgan and Deaton). The results of the regression analysis do not support rejection of this hypothesis. The variable RMIG had a negative coefficient in each equation and was significant in the IWC and the TWC equations.

CONCLUSIONS

It was argued that individual worker, plant, and community characteristics influence employee wage changes in newly located plants. In general, results of this analysis are consistent with this line of reasoning. However, the unexplained variation suggests the need for additional work in determining explanations for wage changes or in specifying explanatory variables. New plant technology represents a major production factor, the effects of which could not be accounted for in the analysis. Yet, the significant shift in manufacturing location toward rural areas is designed in part to take advantage of new technology, industrial engineering advances, and new plant organization. These variables could not be measured by this analysis.

The variables incorporated in this analysis yielded significant results that hold implications for future research and rural development policy. The persistence of continued underemployment, especially among females, will continue to make rural communities relatively attractive to some types of manufacturing firms. Rural areas can probably expect continued job expansion in this sector.

Undoubtedly, interactions among some of the variables were important and represent an important research agenda for later phases of the research. These interactions are alluded to in Gotsch, but were not readily identifiable in this research. Perhaps further post-hoc analysis will reveal some of the most important interactions among personnel, plant, and community characteristics. Clearly, the results suggest that additional research should attempt to measure a rather broad range of variables that influence wage changes. Community economic dynamics affect the wage earning potential of any specific group of workers. Knowledge of these dynamics will increase understanding of the rural development process.

[1] Due to problems of data availability, both UNDERR and UNPLF were measured using 1970 data, while the conceptually desirable period of measurement was the year in which an employee entered the sample plant (t_2). However, the relative position of most communities was assumed not to have changed significantly over the 1970–77 time period; therefore, the measure was thought to be valid.

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