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EFFECTS OF COMMUNITY ATTRIBUTES ON TOTAL EMPLOYMENT CHANGE IN NONMETROPOLITAN COUNTIES*

by

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ABSTRACT

Specific community attributes such as size and composition of the labor force, personal characteristics of local residents, geographic location, and area population are usually ignored in economic impact studies pertaining to nonmetropolitan areas. This paper demonstrates how specific community attributes influence the total employment impact resulting from an exogenous employment change.

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Industrial development in nonmetropolitan America has led to significant income and employment changes within rural communities. Communities and public officials are interested in the magnitude of local economic impact resulting from industrial development in rural economies. Prior research addressing this question are primarily concerned with estimating employment or income multipliers for important sectors of the regional economy (Braschler, 1972; Williamson, 1975; Conopask, 1978). Generally these studies are demand-oriented and view final demand for the output of an area economy as the primary exogenous growth force in an area economy (Andrews, 1953-1956).

Specific community attributes such as size and composition of the labor force, personal characteristics of local residents, geographic location, and area population are usually ignored in economic impact studies pertaining to nonmetropolitan areas. Because these community attributes affect production, consumption, and investment decisions, the economic impact resulting from an exogenous employment change differs from area to area. Although there is recognition of the potential influence of these community attributes, the systematic examination of their influence has been limited and ad hoc in its approach.

The purpose of this paper is to develop a method that permits estimation of the total employment impact in communities with different attributes, resulting from an exogenous employment change. The central hypothesis to be tested here is that several community attributes including per capita income, geographic location, population, female labor force participation, median age and education, as well as exogenous employment changes, influence the level of community employment in a given year.

The Model

Many economists have utilized economic base theory in formulating models to estimate employment multipliers in nonmetropolitan communities. The economic base theory divides total employment into basic and nonbasic employment. Nonbasic employment are jobs related to the sale of goods and services to local buyers. Basic employment are jobs directly related to the export of products to businesses and individuals outside the region. The relationship for any time period (t) may be written:

$$(1)\quad (E_T)_t = (E_b)_t + (E_{nb})_t \text{ for time } t$$

where E_t is the total employment, E_b is the basic and E_{nb} is the nonbasic employment.

The economic base theory postulates that there is a relationship between the change in total employment and the change in basic employment. The relationship may be written as:

$$(2)\quad \Delta E_T = \beta_0 + \beta_1 \Delta E_b$$

where β_0 is a constant term, β_1 is the marginal multiplier, and Δ is a symbol used for change. The ΔE_T and ΔE_b are defined as:

$$(3)\quad \Delta E_T = (E_T)_t - (E_T)_{t-\ell}$$

$$(4)\quad \Delta E_b = (E_b)_t - (E_b)_{t-\ell}$$

where ℓ is the length of the time lag. Likewise, ΔE_{nb} can be defined as:

$$(5)\quad \Delta E_{nb} = (E_{nb})_t - (E_{nb})_{t-\ell}$$

The change in total employment can be expressed as the change in basic employment plus the change in nonbasic employment.

$$(6)\ \Delta E_T = \Delta E_b + \Delta E_{nb} = \Delta E_b + [(E_{nb})_t - (E_{nb})_{t-\ell}]$$

Substituting the right-hand side of identity (6) into Equation (2), and collecting terms on the right-hand side, the relationship between changes in nonbasic and basic employment may be written as:

$$(7)\ (E_{nb})_t = \beta_0 + (E_{nb})_{t-\ell} + (\beta_1 - 1)\Delta E_b$$

Therefore, the level of nonbasic employment in time (t) depends on the level of nonbasic employment in time (t-ℓ), and the change in the basic employment. Equation (7) will be used as the fundamental equation for the model used in this study.

Of the two variables on the right-hand side of Equation (7), the change in basic employment is autonomous, but the nonbasic employment at time (t-ℓ) depends on the level of local consumption, age structure of county residents, and quality of county's labor force in period (t-ℓ).

Local consumption is defined as consumption of goods and services produced within the community, or total consumption in the county less the consumption of imported goods and services. An increase in local consumption is an increase in the local demand for local products which will generate more income and employment in the nonbasic sector. Therefore, a direct relationship between local consumption and nonbasic employment at time (t-ℓ) is hypothesized.

The age structure of local residents should also affect the level of nonbasic employment in nonmetropolitan counties. First of all, older residents tend to spend less on major investments such as land, housing, or transportation than do younger residents. Also older residents tend to have lower income and

thus tend to demand less nonbasic goods and services (Larson and Youmans, 1978). Thus, if two counties are otherwise identical, but one county has a larger proportion of older people, the level of nonbasic employment in a county with the older age structure is expected to be smaller. The median age of the population is used as a proxy, in this study, for age structure.

Higher quality or productivity of the local labor force is expected to have a positive influence on the level of nonbasic employment in a community. Median education level of males was chosen as the measure of labor force quality for this study. People with more education earn more income (Blaug, 1963). Those with higher income demand more nonbasic goods and services.

Equation (8) expresses the nonbasic employment function described above symbolically.

$$(8)\quad (E_{nb})_{t-\ell} = \beta_2 + \beta_3(C_L)_{t-\ell} + \beta_4(Q)_{t-\ell} + \beta_5(A)_{t-\ell}$$

where C_L is the local consumption, Q is median education of residents, and A is the median age of the population.

While Q and A are treated as exogenous variables, local consumption is a function of other variables. The Boehm and Pond study and its extension by Erickson relates local consumption to several factors including the accessibility to other trade centers, the purchasing power of the household, availability of goods and services within the community, and other demand-related characteristics of the household (Boehm and Pond, 1976; Erickson, 1978). Drawing upon these studies, it is possible to construct a local consumption function. The relationship between local consumption in a county and variables affecting it may be written as:

$$(9)\quad (C_L)_{t-\ell} = f(Y, L, P, F)_{t-\ell}$$

where Y stands for per capita income, L for geographic location, P for population, F for female participation rate in the labor force.

Per capita income is the major determinant in all consumption functions (Tiebout, 1962; Friedly, 1965). Generally, as per capita income increases, consumption of locally produced goods and services increases. Thus, other things equal, nonbasic employment is expected to be largest in areas with relatively high per capita income. Much of the work examining the nonbasic sector expansion phenomenon has concentrated on per capita income (Conopask, 1978). This hypothesized relation has been successfully tested using both cross-section and time series data for the United States (Kuznets, 1957).

The location of a nonmetropolitan county relative to the metropolitan counties affects the purchasing pattern of the residents of the county. According to Central Place Theory, an urban trade center acts as a service provider for other areas (Isard, 1960). The variety of services offered in the trade center attracts people and their spending from other communities. The nearby existence of a trade center attracts an outflow of income from the local community, and reduces the demand for local goods and services, decreasing the level of local consumption.

Communities with larger population typically have a larger number, and a more diverse selection of retail businesses. The size of the community's commercial sector has a strong influence on whether local residents and manufacturers make their purchases within the community or in another. Communities with only a few commercial establishments are more dependent on businesses in other areas and do not gain or lose many indirect jobs as a result of employment changes in basic sectors.

The female labor force participation rate affects consumption of locally produced goods and services in two ways. First, higher rates of female labor

force participation may increase the market demand for services traditionally performed by women at home. Many domestic activities such as food preparation, laundry, house cleaning, totally or partially become market activities. Furthermore, if the wife is working, this should increase family income and permit increased family consumption of locally produced goods and services. Therefore, a direct relationship between the level of nonbasic employment and female participation rate is suggested.

The linear form of the local consumption function is given by Equation (10).

$$(10)\quad (C_L)_{t-\ell} = \beta_6 + \beta_7(Y)_{t-\ell} + \beta_8(L)_{t-\ell} + \beta_9(P)_{t-\ell} + \beta_{10}(F)_{t-\ell}$$

Prior research suggests that the various industries which make up the basic sector in nonmetropolitan communities will have different indirect employment impacts on the local community. In general, industries which rely heavily on local workers and other local businesses for production inputs will have the largest indirect employment impacts on the local community. Partitioning the basic sector into several subsectors reflecting differential employment impacts on the local economy enhances the usefulness of empirical results. In this study, employment multipliers are estimated for manufacturing, agriculture, and a third basic sector which includes the proportion of other economic sectors devoted to the production of goods and services for export.

Substituting Equation (10) into Equation (8) and then Equation (8) into Equation (7) and dividing basic employment into three sectors yields, the regression equation to be estimated in this study:

$$(11)\quad (E_{nb})_{it} = \beta_1 + \beta_2(Y)_{it-\ell} + \beta_3(L)_{it-\ell} + \beta_4(P)_{it-\ell} + \beta_5(F)_{it-\ell}$$
$$+ \beta_6(A)_{it-\ell} + \beta_7(Q)_{it-\ell} + \beta_8(\Delta Mfg)_i + \beta_9(\Delta A_g)_i + \beta_{10}(\Delta Other)_i + e_i.$$

Parameters β_2, β_3, β_4, β_5, β_6, and β_7 estimate the average contribution of specific community attributes (per capita income, geographic location, population, female labor force participation, median age and education) in year $(t-\ell)$ to the level of nonbasic employment in year t. Parameters β_8, β_9, and β_{10} represent marginal employment multipliers for the three basic sectors. The random error term is denoted by e_i.

The Data Set

Most previous attempts to estimate multipliers were case studies of one or a few counties. The present study uses a data set consisting of observations on 276 counties for various years from 1947 to 1972. The data was compiled by Gene Summers and his associated,* from many sources, including: The Census of Population 1950, 1960 and 1970; Censuses of Manufacturers, 1947, 1952, 1958 1967 and 1972; County Business Patterns, 1959; and Censuses of Agriculture, 1950, 1954, 1959, 1964 and 1969.

Summers and his associates selected a ten percent (10%) stratified sample of the U.S. counties with nonmetropolitan status in 1950, excluding Alaska and Hawaii. Thus, the sample permits generalization to the U.S. (excluding Alaska and Hawaii) after pooling the data across regions.

For this study, the data set are modified to exclude those counties which achieved metropolitan status during the period 1950-1970. There are 264 counties which maintained nonmetropolitan status throughout the entire period.

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A critical step in the use of the economic base approach to estimate multipliers is partitioning the local economy into basic and nonbasic sectors. Both the assumption approach and location quotient method are used to identify the economic base for the 264 nonmetropolitan counties in this study. On an *a priori* basis, manufacturing and agriculture (including farming, mining, fishing, and forestry) are considered basic. The proportion of other businesses and industries which are basic in each nonmetropolitan county are determined on the basis of location quotients.

Since the data set to be used in this research mainly consists of cross-section data for 1950, 1960 and 1970, the decade will be used as the time period in which the model is estimated. While the structure of local economies may change within a very long period, the choice of a decade as the time period for estimation purposes appears reasonable (Braschler, 1972; Braschler and Kuehn, 1975). Specifically, cross-sectional data will be used to estimate the model defined in Equation (11) for two decades; 1950-1960 and 1960-1970.

Of the 264 nonmetropolitan counties considered here, 214 experienced manufacturing employment growth during the 1950-1960 time period and 208 experienced manufacturing employment increases during the 1960-1970 decade. The local economic impact of manufacturing employment changes need not be the same in counties where manufacturing employment declined as where manufacturing employment increased. Anticipating this phenomenon, the sample of 264 nonmetropolitan counties for each decennial period was divided into two subsamples: counties where manufacturing employment increased and counties where manufacturing employment declined.

The 1950-1960 Results

The Ordinary Least Squares procedure was used to estimate the parameters of Equation (11). The regression results indicate median education was highly

TABLE 1: Contribution of Selected Attributes of Nonmetropolitan Counties to County Nonbasic Employment in 1960.

COUNTY ATTRIBUTE	Contrib. to Nonbasic Empl. in Co.'s Where: MFG. EMPLOYMENT INCREASED	MFG. EMPLOYMENT DECLINED
Basic Employment		
Agric. 1950-60	.8281[a] (18.54)	.8735[a] (6.85)
Mfg. 1950-60	.6907[a] (13.09)	.4238[a] (2.01)
Third Basic 1950-60	.4736[a] (16.60)	.5179[a] (6.96)
Per Capita Income 1950	.0400 (0.03)	-.4350 (-0.12)
Population 1950	.1661[a] (90.25)	.1616[a] (44.37)
Female Participation Rate 1950	3540[a] (7.24)	4257[a] (4.11)
Median Age 1950	32.90[a] (4.50)	30.40[a] (1.745)
Distance to SMSA	.2347 (0.40)	.1252 (0.11)
	R^2 = .99	R^2 = .99
	n = 214	n = 50

TABLE 2: Contribution of Selected Attributes of Nonmetropolitan Counties to County Nonbasic Employment in 1970.

COUNTY ATTRIBUTE	Contrib. to Nonbasic Empl. in Co.'s Where: MFG. EMPLOYMENT INCREASED	MFG. EMPLOYMENT DECLINED
Basic Employment		
Agric. 1960-70	.4328[a] (5.59)	.2810 (1.12)
Mfg. 1960-70	.8753[a] (13.28)	.4592 (0.77)
Third Basic 1960-70	.4926[a] (15.57)	.3883[a] (4.17)
Per Capita Income 1960	.8155[a] (4.96)	.2664 (0.912)
Population 1960	.1378[a] (64.36)	.1416[a] (30.99)
Female Participation Rate 1960	2758[a] (3.919)	1362 (0.9191)
Median Age 1960	28.40[a] (3.232)	88.54[a] (3.541)
Distance to SMSA	-.0083 (-0.01)	.2110 (0.17)
	R^2 = .99	R^2 = .98
	n = 208	n = 56

Figures in parentheses are t-statistics.

[a]/ Statistical significance of 0.10 level using two tail test.

correlated (0.75) with per capita income in our sample. In order to increase the efficiency of the estimated parameters, median education was omitted from Equation (11) and the regression was reestimated.

The contribution of each community attribute to nonbasic employment in 1960 is reported in Table 1. Separate results are reported for the two subsamples: counties where manufacturing employment declined between 1950 and 1960, and counties where manufacturing employment increased from 1950 to 1960.

A ten percent t-test was conducted to test the statistical significance of each attribute. By this criteria 1950 per capita income and geographic location have little or no affect on the level of nonbasic employment in 1960.

The change in agriculture employment contributed significantly to the level of 1960 nonbasic employment in both county groupings. On the average, each 100 jobs lost in agriculture between 1950 and 1960 reduced nonbasic employment by

83 jobs in counties where manufacturing employment increased or 87 jobs in counties where manufacturing employment decreased.

In counties where manufacturing employment increased, each 100 manufacturing jobs gained contributed an average of about 69 employees to nonbasic employment in 1960. In counties where manufacturing employment declined by 100 jobs, an average of 42 nonbasic jobs were lost. There are at least two possible explanations of why the manufacturing employment multiplier is much smaller in counties where manufacturing employment declined. First, some workers may take other jobs in the community after leaving manufacturing employment, nullifying the detrimental impact of manufacturing employment declines. Second, the different size multipliers may represent a short run disequilibrium in optimal labor resource use. In counties where manufacturing employment is declining, local businessmen may expect a future turnaround in the local economy and are therefore hesitant to layoff some of their present employees. Similarly, nonbasic employers in counties where manufacturing employment is increasing may hire more employees than necessary to meet present demand because they anticipate future growth in the local economy.

A t-test indicated no significant difference between the impact of third basic sector employment changes in counties where manufacturing employment increased and counties where manufacturing employment decreased between 1950 and 1960. On the average, each 100 jobs gained in other basic industries contributed about 47 jobs to 1960 nonbasic employment in counties where manufacturing employment increased and about 52 jobs in counties where manufacturing employment declined.

As the reported t-ratio indicates, lagged population (1950) contributes very significantly to the level of nonbasic employment in 1960. A partial correlation coefficient of about 0.99 was obtained for both subsamples. A larger

population base makes possible agglomeration economies in the provision of locally produced goods and services and more importantly reflects the crossing of various market thresholds. On the average, each additional 100 people in nonmetropolitan counties increases nonbasic employment by 17 employees.

The female labor force participation rate in 1950 also contributed to the level of nonbasic employment in 1960. In counties where manufacturing employment increased, a 1 percent change in the female participation rate increased nonbasic employment an average of 35 jobs. In counties where manufacturing employment declined, a 1 percent increase in the female participation rate increased 1960 nonbasic employment an average of 43 jobs.

We predicted that a higher median age of residents would have a detrimental affect on the level of nonbasic employment. The results indicate the opposite. It appears that older residents tend to spend more of their wages and salaries locally than do younger residents. Younger residents may be more mobile in their shopping habits. On the average, each additional year median age in a county creates 33 nonbasic jobs in counties where manufacturing employment is increasing and 30 jobs in counties where manufacturing employment is declining.

1960-1970 Results

When the model was estimated for the 1960-1970 decade, significantly different results were obtained. The results are reported in Table 2. For counties where manufacturing employment decreased, the 10 percent t-test indicates that neither change in agriculture employment nor change in manufacturing employment contributed significantly to the 1970 level of nonbasic employment. Statistical insignificance of the employment multiplier for agriculture may reflect the massive substitution of capital for labor in American agriculture which occurred between 1950 and 1970. A landmark study by Goldschmidt (1946) of California agriculture found that capital intensive farm operations contributed

much less to the local economy than did smaller labor intensive operations. The statistical insignificance of the employment multiplier for manufacturing may indicate that individuals who lose manufacturing jobs find other jobs in the community.

Employment changes in the third basic sector had a significant impact on the level of nonbasic employment in counties where manufacturing employment increased and in counties where manufacturing employment decreased. Each 100 new jobs in these industries contributed an average of 49 jobs to nonbasic employment in counties where manufacturing employment increased or 39 jobs in counties where manufacturing employment decreased. The significantly smaller third sector employment multiplier for counties where manufacturing employment declined, again, suggests some employees leaving manufacturing take new jobs in the third sector.

The change in agriculture employment contributed significantly to the level of 1970 nonbasic employment in counties where manufacturing employment increased. Each 100 jobs lost in agriculture reduced nonbasic employment by an average of 43 jobs. Because a large amount of capital was substituted for labor in agriculture, the agriculture multiplier is only half that of the previous decade.

The change in manufacturing employment also contributed significantly to the level of 1970 nonbasic employment in counties where manufacturing employment increased. Each 100 jobs gained in manufacturing contributed 88 jobs to nonbasic employment. This multiplier for manufacturing is much larger than for the previous decade, suggesting additional support services located in nonmetropolitan communities where manufacturing employment increased during the 1960-1970 decade.

As in the previous decade, lagged per capita income (1960) does not significantly affect the level of 1970 nonbasic employment in counties where

manufacturing employment declined. However, the 10 percent t-test indicates that per capita income does contribute to the level of 1970 nonbasic employment in counties where manufacturing employment increased. On the average, each additional 100 dollars per capita income increased nonbasic employment by 82 jobs.

Population in 1960 was also an important determinant of the level of nonbasic employment in 1970. Each additional 100 people contributed an average of 14 jobs to the local economy.

The 1960 female labor force participation rate influenced the 1970 level of nonbasic employment in counties where manufacturing employment increased from 1960 to 1970. A one percent increase in the female labor force participation rate contributed an average of 28 jobs to nonbasic employment in those counties. There is no statistical evidence that the female labor force participation rate influenced the 1970 level of nonbasic employment in counties where manufacturing employment declined.

An increase in median age results in a positive contribution to nonbasic employment in counties where manufacturing employment increase and counties where manufacturing employment decreases. This is consistent with findings for the 1950-1960 time period. A one year increase in median age contributes an average of 28 jobs to nonbasic employment in counties where manufacturing employment increased and 89 jobs in counties where manufacturing employment decreased.

Finally, there is no statistical evidence that geographic location contributes to the level of 1970 nonbasic employment in either of the subsamples. This is consistent with results for the previous decennial time period.

Summary and Conclusions

Basic sector employment changes in nonmetropolitan counties during the 1950-1970 period had considerable economic impact on these counties. This

study emphasizes the influence of several community attributes on the size of employment multipliers in nonmetropolitan areas.

The decline in agriculture employment had a significant impact on nonbasic employment in all nonmetropolitan counties. Employment multipliers for agriculture estimated in this study indicate the impact of jobs lost in agriculture was greatest during the 1950-1960 decade. By 1970, the linkage between agriculture and the local economy had been weakened by massive substitution of capital for labor. This resulted in agriculture employment multipliers less than half those of the 1950-1960 decade.

A majority of counties in our sample experienced an increase in manufacturing employment during the 1950-1970 period. Our results indicate that manufacturing employment increases had a considerable positive impact on nonbasic employment in these counties. The impact of additional manufacturing jobs was greatest during the 1960-1970 decade. This result suggests long run manufacturing growth encouraged support industries, which may have previously been located outside nonmetropolitan communities during the 1950-1960 decade to locate in nonmetropolitan communities during the 1960-1970 decade. Thus, the linkage between manufacturing industries and the local economy was strengthened.

A number of counties experienced manufacturing declines during the 1950-1970 period. The relatively small manufacturing employment multipliers obtained for these counties suggests that the impact of manufacturing employment declines is dampened by employees remaining in the community after leaving manufacturing employment. The results for the 1960-1970 decade suggest that some of the employees leaving manufacturing employment take new jobs in the third sector. Employment in the third basic sector contributes significantly to the level of nonbasic employment in all nonmetropolitan counties.

The results indicate that several community attributes influence the level of nonbasic employment. The level of nonbasic employment will be greatest in counties with a larger population base, higher female labor force participation rate, and older median age. The level of per capita income also had a positive impact on the level of nonbasic employment in counties where manufacturing employment increased 1960-1970.

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