

Manufacturing Formation Rates Among Ohio Counties: 1979-1988¹

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ABSTRACT. The loss of manufacturing jobs in many areas of the nation has stimulated interest in the geographic patterns of manufacturing employment change. Changes in those patterns have been attributed to expansion and contraction of existing facilities, as well as to plant closings and new business formations. The identification of variables that are associated with spatial variations in the rates of opening of new manufacturing establishments is one research theme. The present study of the geographic pattern of formation rates of new manufacturing plants opening in Ohio between 1979 and 1988 revealed that suburban counties possessed the highest formation rates, followed by rural and central Metropolitan Statistical Area (MSA) counties, respectively. Spatial variations in the formation rates were primarily related to counties' population growth during the 1970s, plant sizes, occupational characteristics, and manufacturing employment growth between 1979 and 1988. Taxes and wages were not significantly related to formation rates.

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INTRODUCTION

The loss of manufacturing jobs in many areas of the nation, especially in northeastern United States, has stimulated interest in the geographic patterns of manufacturing employment change (Haynes and Machunda 1987, Moriarity 1986). Changes in those patterns have been attributed to expansion and contraction of existing facilities, as well as to plant closings and new business formations. It is the latter topic—plant openings—which is the focus of this article.

One theme in this literature has been the identification of variables that are associated with spatial variations in the rates of opening of new manufacturing establishments. A multitude of variables has been assessed in previously reported studies. For example, plant size distributions within regions have been examined (Gudgin and Fothergill 1984). Gould and Keeble (1984) suggested that managers in large operations tend to specialize in specific business functions. These managers, in contrast to persons in small operations, are less likely to gain the experience in the multiplicity of functions needed to open their own businesses. Furthermore, Storey (1981) observed that managers in large operations would more likely have higher salaries and greater security and, therefore, be less willing to undertake entrepreneurial risks. Finally, smaller plant size structure may reflect lower barriers to establishment of new plants (O'Farrell and Crouchley 1984).

The occupational composition of an area is thought by some to be influential since it impacts the pool of potential entrepreneurs (Gould and Keeble 1984). Because most entrepreneurs possess either managerial or technical backgrounds, and because most new businesses are initiated in the locale of the founder, higher percentages of such persons in the local labor force should be associated with higher formation rates (Watts 1987).

The impact of the local business environment, including wages and taxes, on the opening of new manufacturing facilities has been assessed (Armington 1986, Schmen-

ner et al. 1987). Armington argued that population growth in the period preceding her study period was significant because it indicated the relative attractiveness of areas to businesses and people. In addition, O'Farrell and Crouchley (1984) proposed that manufacturing employment growth in the study area (Ireland) during their study period was important because such growth would create new markets and opportunities for new businesses, as well as increase the number of potential entrepreneurs.

The purpose of the present study is to assess the geographic patterns of new manufacturing plants opening in Ohio between 1979 and 1988. More specifically, the relationship between formation rates and selected variables will be assessed by multiple regression analysis.

MATERIALS AND METHODS

In the multiple regression analysis, formation rates in Ohio's counties, or the rate of opening of new manufacturing facilities, is the dependent variable. Formation rates are defined as the number of new manufacturing plants opening during the period (1979-88) per 1,000 manufacturing employees in the base year 1979. Data describing plant openings were collected from the 1989 *Ohio Industrial Directory* (Harris Publishing Company 1989) which reports the age of facilities as well as other data. The data set does not include any plants which both opened and closed during the study period. Also, it was not possible to distinguish between relocations and start-ups. Because the directory is a survey, not a census, there is a possibility of reporting bias. The nature or extent of possible bias cannot be ascertained.

Six variables for each Ohio county were included in the regression analysis as independent variables. These six variables are: percentage population change between 1970 and 1980; plant size structure; occupational structure; percentage manufacturing employment growth during the study period; average manufacturing wages; and, per capita taxes. Whereas information on population change during the 1970s (Dept. of Commerce 1983), 1979-88 manufacturing employment growth (Harris Publishing Co. 1979, 1988), 1977 taxes (Dept. of Commerce 1983), and 1979 wages (Dept. of Commerce 1981) were directly

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compiled from the noted sources, some explanation of the measurement of the remaining variables is warranted. Plant size structure (Dept. of Commerce 1981) is the 1979 percentage of each county's manufacturing labor force working in plants with over 500 employees, and occupational structure (Dept. of Commerce 1982) represents the 1980 percentage of each county's labor force in managerial or technical occupations.

Based on the results reported in the literature, the plant size, tax, and wage variables should be negatively related to formation rates. In contrast, population change, employment growth, and occupational structure should be positively associated with the dependent variable—formation rates.

RESULTS AND DISCUSSION

Between 1979 and 1988, 3,064 new manufacturing firms opened in Ohio, resulting in an addition to total employment of 92,337 by 1988. In 1988, the new operations constituted 19.8% of the state's total number of manufacturing establishments and 6.5% of total employment. As one would expect, the average size of the new facilities was substantially smaller than that of the existing establishments. In 1988, the average manufacturing firm employed 86 people, in contrast to only 30 people for the new firms.

The state average formation rate over the study period was 2.57 new plants per 1,000 manufacturing employees. As a result of differing lengths of study periods, direct comparison with research by others is problematic. Nonetheless, Ohio's formation rate is low when compared to the British studies. For example, East Anglia had a formation rate of 3.7 between 1971 and 1981 (Gould and Keeble 1984).

Substantial variation in manufacturing formation rates can be observed among counties with a range from 7.85 for Warren County to 0.00 for Vinton County. Generally, the suburban counties of Metropolitan Statistical Areas (MSAs) were characterized by higher formation rates than either MSA central counties or non-MSA counties. The average formation rate for suburban MSA counties was 3.70 in comparison to the rural counties' average of 2.30 and 1.82 for central MSA counties. Analysis of variance was used to determine if the mean formation rates of those three groups of counties were significantly different (Table 1). The F ratio of 10.016 is significant at the 0.05 level, meaning that the observed differences in the mean

formation rates of MSA central counties, MSA suburban counties, and rural counties are significant. Thus, the observation by Garofalo and Park (1988) that the suburban areas were the primary incubators of new manufacturing activity in the Cleveland, Akron, Lorain, and Elyria metropolitan areas also applies to most metropolitan areas in Ohio. Furthermore, the only central MSA counties with formation rates exceeding the state average were Summit with a rate of 2.82, and Franklin with a rate of 2.71.

The lower formation rates for central MSA counties compared to the rates for suburban and rural counties is not surprising given the general shift of manufacturing out of metropolitan areas to suburban and rural settings (Haynes and Machunda 1987, Moriarity 1986). It is notable, however, that the suburban MSA counties, with a few exceptions such as Adams and Meigs Counties, possessed the highest formation rates. The "settlement size deglomeration model" of Moriarity (1986), which addresses the spatial reorganization of multi-plant operations, provides some insights into the attractiveness of suburban locations for new single-facility operations. According to Moriarity (1986): "Functions requiring a high level of external economies, skilled craftsmen, and technical personnel are more cost effective in small plants with lower than average wage bills and scale economies that are located in or near metropolitan areas with their high average levels of wage compensation." New plants would likely depend on the external economies and skilled labor more prevalent in suburban locations than in rural sites. By locating in suburban areas, entrepreneurs would have access to external economies and labor skills while avoiding the agglomeration diseconomies associated with central city sites.

One explanation of the high formation rates in some of the smaller rural counties was suggested by Gudgin and Fothergill (1984). They argued that a small proportion of new manufacturing operations were established by people who had worked outside of the manufacturing sector prior to opening a manufacturing facility. In the case of rural areas with few manufacturing employees, those operations established by persons not employed in manufacturing could cause an exaggeration of formation rates since the formation rates are expressed per 1,000 manufacturing employees. For example, Meigs and Adams Counties had 1979 manufacturing labor forces of only 455 and 559 respectively. Their high formation rates, as well as the high rates in some of the other small counties, may

TABLE 1

Analysis of variance of formation rates of MSA central, MSA suburban, and rural counties.

Source of variation	Sum of squares	Degrees of freedom	Mean sum of squares	F ratio
Between three county groups	39.882	2	19.941	10.016*
Within three county groups	171.248	86	1.991	

*Significant at the 0.05 level.

be explained by the work of Gudgin and Fothergill (1984). On the other hand, Haynes and Machunda (1987) found that manufacturing expansion in the rural counties of Indiana was not related to the smaller employment bases of rural areas. Unfortunately, data constraints preclude the testing of these ideas.

Regression Analysis.

In the multiple regression analysis, the relationship between formation rates for the counties and the six independent variables was assessed. Similar to Armington (1986), log linear regression was utilized.

A coefficient of determination of 0.500 ($R = 0.707$) was obtained. Thus, the seven variables contributed 50% of the variation in formation rates. This level of statistical explanation is substantially lower than was reported in most of the aforementioned studies. For example, Gudgin and Fothergill (1984) obtained a multiple regression coefficient of 0.90 for the East Midlands in the United Kingdom using only plant size and degree of urbanization as independent variables. Certainly the coefficient of determination would be higher if it had been feasible to include more variables, such as availability of venture capital, in the analysis. Nonetheless, the coefficient of determination is significant at the 0.01 level.

Because the research is primarily concerned with the relative importance of the six independent variables, the regression coefficients were converted to standardized regression coefficients. Four significant coefficients were obtained. In order of size, they were: population change, plant size structure, occupational structure, and employment growth (Table 2). Furthermore, each variable possessed the expected sign. The four significant independent variables accounted for 41% of the variation in formation rates.

The factor most strongly associated with formation rates was population change during the 1970s. In fact, this variable alone accounted for 24% of the variation in formation rates. These results conform to the findings of

Armington (1986) for metropolitan areas.

The other three significant variables—employment growth, plant size distribution, and occupational characteristics—possessed smaller standardized regression coefficients than did population growth. Of the four significant variables, the measure of occupational structure had the third lowest standardized regression coefficient. This result conflicts with Gould and Keeble's (1984) assertion that occupational structure is the primary determinant of new firm formation and that other phenomena, such as plant size structure, are only of secondary importance.

The relationship between manufacturing employment growth and formation rates should be interpreted with caution. While employment growth logically would stimulate formation rates, the relationship is in part definitional. New plants are one source of employment growth, with the only other source being the expansion of existing facilities. Thus, the counties which had conditions most conducive to the formation of new plants were: those which had more rapid population growth during the 1970s; those with a small percentage of their employment in large establishments; those experiencing manufacturing employment growth; and, those which contained a high percentage of persons in managerial and technical occupations. These results help explain the lower formation rates for central MSA counties as compared to the suburban and rural counties. Population change in central MSA counties was -0.6% during the 1970s, in comparison to 15.1% for the suburban counties and 10.6% for the rural counties. In addition, the central MSA counties had a higher percentage of employment in larger plants, 2.8% versus 2.4% for the suburban counties, and 2.6% for the rural counties. Also, the central MSA counties experienced a -16.0% change in their manufacturing labor force versus 16.2% for the suburban counties, and 2.7% in the rural counties. Finally, the occupational structures of the central MSA, suburban, and rural counties were not substantially different, with 27.7%, 25.9%, and 21.2%, respectively, in managerial and technical occupations.

The wage and tax variables were not significant determinants of manufacturing formation. In the case of wages, one cause of the insignificance may have been the 0.591 correlation between wages and occupational structure so that the wage variable added no statistical explanation beyond that already contributed by the occupational variable. On the other hand, Schmenner et al. (1987) reported the influence of average wages to be weak in their analysis of the factors influencing the location of new manufacturing facilities. The insignificance of taxes is not altogether surprising since other studies have found taxes not to be a strong influence on business formations (Armington 1986, Carlton 1983, Schmenner et al. 1987).

CONCLUSIONS

In summary, new manufacturing firm formation in Ohio between 1979 and 1988 resulted in the creation of over 92,300 new jobs. Suburban counties exhibited the highest formation rates, followed by rural and central MSA counties, respectively. Formation rates were influenced primarily by the counties' population change, plant sizes,

TABLE 2

Standardized regression coefficients from analysis of manufacturing formation rates in Ohio's counties between 1979 and 1988.

Independent Variable	Coefficient
Population change	0.319*
Plant size structure	-0.297*
Occupational structure	0.255*
Employment growth	0.231*
Average wages	0.102
Taxes	-0.079

*Significant at the 0.05 level.

employment growth, and occupational characteristics.

These results have implications for regional growth in manufacturing employment. The observed growth areas, such as suburban counties, are likely to continue to grow in part as a result of their higher formation rates, while areas experiencing slower population and employment growth will continue to lag in terms of new plant formations. Furthermore, programs designed to stimulate the development of new manufacturing establishments in lagging regions must take into account the existing occupational and plant size structures of the areas if such programs are to succeed.

Additional research on the influence of industrial structure on formation rates is needed. Substantial sectoral variations in formation rates on the state level did occur during the study period. For example, Ohio's formation rate for Paper and Allied Products was 8.25 in contrast to 0.89 for Primary Metals. Thus, logically, variations in the industrial mix of counties could influence their formation rates. Measuring the influence of industrial mix is problematic, however, since segmenting the data base into sectors results in very small numbers or zeroes for many sectors in the smaller rural counties.

Not only must the industrial mix be investigated, but also other relationships warrant further study. In particular, the background of the entrepreneurs and their location decision-making need to be better understood. Also, the impact of various governmental policies on the formation of new manufacturing firms is worthy of investigation. Finally, the suburban counties with higher formation rates could be further analyzed, including characteristics such as their location on the highway system and the development of suburban industrial parks.

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