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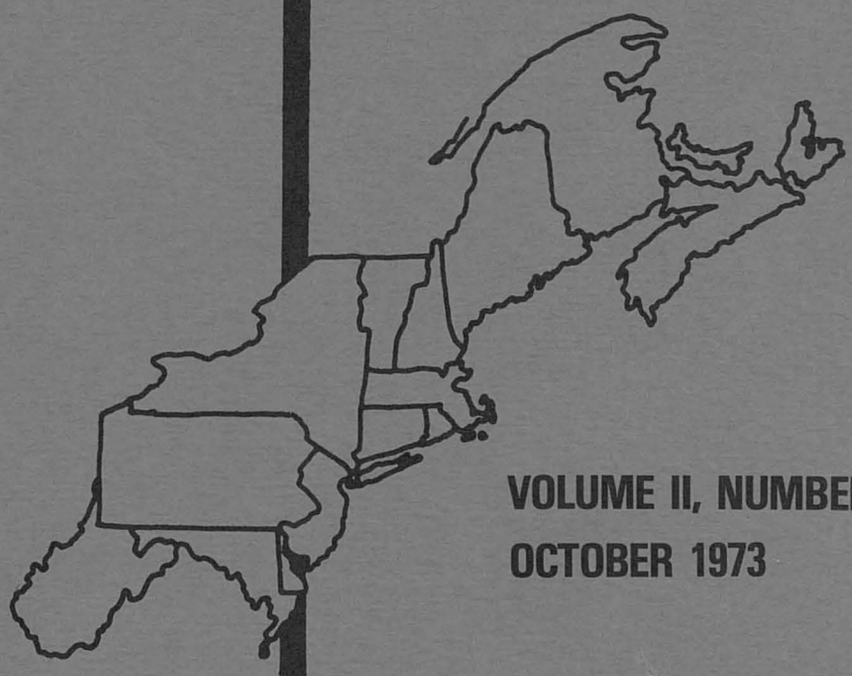

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THE EFFECT OF CHANGES IN MANUFACTURING EMPLOYMENT ON REAL ESTATE TAX RATES IN RURAL COMMUNITIES OF PENNSYLVANIA

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Rural communities in Pennsylvania, as well as in many other parts of the United States, have exhibited a great deal of variation in population trends in recent years. Many rural communities have experienced a declining population along with a decreasing employment base. This causes problems of finding new sources of employment as well as providing educational and other public services that are adequate for their remaining population but are financed by a decreasing fiscal base. On the other hand, many rural communities have experienced a new spurt of economic and population growth resulting in a need for additional public services. While the particular problems to be faced are different depending on whether the community is growing or declining, they each have their own peculiar types of problems.

Both growing and declining communities are concerned about the impact of economic and population changes on the property tax base and on the property tax rates for remaining taxpayers. The search for new industries is frequently justified as a means of expanding the tax base out of which public services are financed. It is argued that this would reduce the tax burden on other taxpayers in the community. Likewise a community that is faced with the prospect of a new manufacturing plant locating there may question whether additional tax revenues generated by the plant will be sufficient to cover the additional costs imposed by the plant. If the revenues are not sufficient to cover additional costs, the present property owners may be faced with increased tax rates. In both growing and declining communities, decision-makers need information on the potential impact of new economic activities on property tax rates which is one of the many questions presented by employment and population changes. This paper is addressed specifically to the question of what effect a change in manufacturing employment will have on the real estate tax rate in a rural community.

Developing a Model[1/]

Previous Efforts

The model used in this study is based on the current real estate tax rate of the municipality and attempts to determine the tax rate that would prevail if the industry in question had not located there. If the hypothetical tax rate (r') is greater than the actual tax rate (r), the firm can be considered a financial asset to the community.

Equation (1) shows the present millage rate or tax rate (r) which is computed by dividing the total taxes levied (T) by the total tax base (B).

$$r = \frac{T}{B} \tag{1}$$

The tax rate of a community is influenced by both the costs of providing local government and school services and the assessed value of the property taxed. Both the numerator and denominator in the basic formulation $r = \frac{T}{B}$ must be adjusted to include effects of a new plant on the tax rate.

The following model, developed by Groves and Riew,[2/] includes both cost and tax variables. It was designed to calculate the tax rate (r') which would presumably exist if the firm were not included in the township.

$$r' = \frac{T - [E' (L_r) D + E_{nr}(L_{nr})]}{B - [B' + k (W) L_r]} \tag{2}$$

where: r' = the hypothetical tax rate when the industry is excluded from the township.
T = total taxes levied by the community.
E' = per capita expenditures for school and local services.
L_r = number of resident employees of the firm.
D = average ratio of dependents to employees for the industry.
E_{nr} = expenditures per nonresident employee.

1/ This section is based on work done by John E. Gerweck and reported in "The Effect of New Industry on the Financial Position of Urban Fringe Township Government: A Case Study of Tredyffrin Township, Chester County, Pennsylvania," unpublished M.S. thesis, The Pennsylvania State University, 1971. Mr. Gerweck assisted in the present study by suggesting ways in which his model might be applied to the population being analyzed.

2/ Harold Groves and John Riew, "The Impact of Industry on Local Taxes -- A Simple Model," The National Tax Journal, June, 1963, pp. 137-146.

L_{nr} = number of nonresident employees of the industry.
B^{nr} = total assessed value of real estate after entry of the industry.
B' = assessed valuation of the industry.
k = ratio of residential assessed value to money income.
W = average income of resident workers in the industry.

A later model was developed by Kee[3/] for the same purpose as equation (2) but included different variables. Kee used two new variables, the per capita marginal increase in total taxes $(\frac{\Delta T}{\Delta N})$ and the per capita marginal increase in nonschool taxes $(\frac{\Delta T_{ns}}{\Delta N})$. These new marginal cost variables replaced the average cost variables (E', E_{nr}) used by Groves and Riew.

In this study the models developed by Groves and Riew and Kee were expanded to explicitly include any secondary population effects caused by the location of the firm under study. It is clear that the Groves-Riew-Kee models consider only the direct effects of a firm and its employees. Such a restriction may not be serious if one is studying a firm in a metropolitan setting, but the secondary population effects may be substantial in urban fringe or rural settings. In these areas, a change in basic employment, such as that provided by a new manufacturing firm, may support a noticeable addition to secondary employment, possibly accompanied by an increase in population.

An Expanded Model

In order to explicitly consider the secondary population effects of expanded manufacturing employment, the basic Groves-Riew-Kee model was expanded in this study. In essence the numerator and denominator each received a term related to secondary population effects. In the numerator the additional tax revenue attributed to secondary population growth was included. The denominator was expanded to include the addition to the tax base due to secondary population increase.

The added term in the numerator consists of two factors -- the change in per capita tax revenue and the secondary population growth, as shown in equation 3.

$$\begin{array}{c}\text{Additional tax revenue due to secondary population growth}\end{array} = \begin{array}{c}\text{Change in per capita tax revenue}\end{array} \times \begin{array}{c}\text{Secondary population growth}\end{array} \qquad (3)$$

3/ Woo Sik Kee, "Industrial Development and Its Impact on Local Finance," Quarterly Review of Economics and Business, April, 1968, pp. 19-24.

The term added to the denominator contains two separate terms -- the value of residences occupied by the secondary increase in population and the increase in the value of business properties other than the manufacturing firm under study. This can be done as in equation (4).

$$\begin{array}{c}\text{Addition to the tax base due to secondary population increase}\end{array} = \begin{array}{c}\text{Assessed value of residence occupied by secondary increase in population}\end{array} + \begin{array}{c}\text{Increase in assessed value of business due to secondary population growth}\end{array} \qquad (4)$$

In order to make use of the expanded model it is necessary to convert the basic conceptual terms back into operational variables. Using the operational form employed by Groves and Riew and Kee, our model becomes:

$$r = \frac{T - [(\frac{\Delta T}{\Delta N})\ (L_r)\ D + (\frac{\Delta T_{ns}}{\Delta N})\ (L_{nr} + P\ (\frac{\Delta T}{\Delta N})\ D')]}{B - [B' + k\ (W)\ (L_r) + R\ (P) + B'']} \qquad (5)$$

where: P = secondary increase in employment.
D' = dependency ratio of secondary employees.
R = average assessed value of homes of secondary employees.
B'' = increased assessed value of businesses employing secondary employees.
$\frac{\Delta T}{\Delta N}$ = per capita marginal increase in total taxes.
$\frac{\Delta T_{ns}}{\Delta N}$ = per capita marginal increase in nonschool taxes.

The other variables are as defined above in equation (2).[4/]

Application to Rural Communities

The operational model was used in a study of manufacturing firms located in rural Pennsylvania to determine the impact of these firms on the local tax rates. For purposes of this study all counties in the state that were not a part of a Standard Metropolitan Statistical Area were considered to be rural counties. Previous studies had identified the standard industrial code classifications of manufacturing firms that

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4/ It is realized that other types of local taxes will affect the revenues of a particular municipality. They vary considerably, however, depending on the region or locality. Therefore, our attention is focused on the real property tax since nearly all municipalities have a property tax of some form.

were expanding most rapidly in rural Pennsylvania.[5/] This expansion was either in terms of numbers of employees or numbers of manufacturing firms. The five leading industries were included in this study. They were: 2335 (Apparel and related products -- dresses), 34 (Fabricated metal products), 35 (Machinery, except electrical), 36 (Electrical machinery, equipment and supplies), and 37 (Transportation equipment). From 1961 to 1965 employment in these five SIC codes in rural areas of Pennsylvania increased by an average of 20 percent. It seemed reasonable that a community looking for a new industry to help expand the tax base might initially consider one of these fairly rapidly growing manufacturing industries.

Twenty-two firms were selected from throughout rural Pennsylvania representing these five industries. Figure 1 indicates the location of the firms included in the study sample. All of these firms began operation sometime between 1958 and 1966, and were still operating in 1971 when the study was conducted.

Data for computing the hypothetical tax rates for the communities in which the firms were located was obtained through interviews with managerial personnel in each of the firms studied and from interviews with public officials in the local communities. The firms provided information on wages paid to employees, the number of dependents claimed as exemptions for Internal Revenue Service purposes, and places of residence of the employees. County and school district officials provided information on current real estate tax rates, assessed valuation in various taxing districts, expenditures for public school, and expenditures for other local governmental services as well as the sources of funds for these services. Using the data from the firms and governmental units in the computational model of equation (5) above, the hypothetical tax rates which might have existed if the firms were not actually in the taxing districts were computed.

The average difference between the computed tax rate and the actual tax rate is shown in Table 1 for each of the SIC code industries. The positive difference shown for each industry indicates that tax rates would be higher if the manufacturing firm were to leave the community. This observation is corroborated by the comments of several local officials who indicated that they believed new industries were "paying their own way."

The differences between computed and actual tax rates were analyzed to determine their statistical significance. The results of this analysis are also presented in Table 1. For this study, a level of significance of 0.20 was chosen as the critical level. Therefore, the

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5/ Neil B. Gingrich and J. Dean Jansma, "Changes in Industrial Structure in Pennsylvania," Bulletin 756, Pennsylvania Agricultural Experiment Station, June, 1969.

Table 1
Average Difference in Computed and Actual Real Estate Tax Rates for Selected SIC Code Industries in Rural Pennsylvania, 1971

SIC Code	Number of Firms	Difference in Tax Rates Computed Minus Actual: Average (mills)	Difference in Tax Rates Computed Minus Actual: Range (mills)	t-Value	Level of Significance[a]
2335	6	11.75	0.6 to 34.6	2.26	0.10
3400	4	5.13	0.1 to 17.2	0.15	>0.80
3500	5	4.70	0.1 to 12.6	1.81	0.20
3600	2	10.70	0.1 to 21.3	1.01	0.50
3700	5	2.53	-0.6 to 4.8	0.54	0.60

[a] The tabled probability that the actual difference is zero when the sample average is as large as that shown. The terminology is that used by Wilfrid J. Dixon and Frank J. Masse, Jr. in Introduction to Statistical Analysis, pp. 89-91.

average difference in tax rates is statistically different from zero for SIC codes 2335 and 3500. The level of significance is presented for the other three SIC industries to enable readers wishing to use a different critical level of significance to make their own interpretations of the data.

It is not obvious from the data why two industries (SIC 2335 and 3500) had a significant impact on tax rates and the other three industries did not. The assessed value of firms in these two industries is about the same portion of the local tax base as for firms in other industries. Thus, it is not possible to attribute the greater impact to the size or value of the firm relative to the community tax base. The total number of employees and the proportion of those employees living in the same municipality as the firm were not appreciably different for any of the SIC code industries studied.

The two industries which had a significant impact on tax rates did tend to be clustered in the coal mining regions of rural Pennsylvania to a greater degree than were the other three industries. The firms of SIC code 2335 (Apparel -- dresses) were located, for the most part, in the eastern hard coal region of Schuylkill and Carbon Counties while the firms of SIC code 3500 (Non-electrical machinery) were clustered in the central-western coal region of Clearfield, Jefferson and Venango Counties. It is consistent with conventional expectations that new industries locate in communities with a declining basic industry, in this case coal mining. The importance of these new firms to the local community is usually considered to be first, the employment of workers who would otherwise be unemployed and second, providing a large increase in the tax base from which local services can be financed. The second effect is directly relevant to this study, but as was indicated above, the firms demonstrating a significant impact on tax rates in this study did not have a significantly larger share of the local tax base than did the other industries in the study.

Conclusions

The major conclusion to be drawn from this study of manufacturing firms in rural Pennsylvania is that they do have some impact in lowering the local property tax rate. All five of the industry groups studied lowered the tax rate, on the average. Two of these industries had a statistically significant effect on tax rates. Most communities in Pennsylvania have enacted local taxes other than the real estate tax. These include per capita taxes, wage taxes, and occupational taxes. When these tax revenues are included in an analysis, a manufacturing firm will contribute additional revenues to the community. This study did not analyze the net effect of that contribution, but it seems likely that when all revenue sources are considered the net effect of a new firm on a local community would be to increase local tax revenues more than expenditures would be increased.

Recommendations

Three problems for additional work are presented by this study. First, it would be helpful to understand why two of the five industries in the study have a significant effect on tax rates while the other three do not. From the data studied, it is apparent that the effect must lie in the interaction of factors related to secondary population growth. This should be studied further with a larger sample.

Second, a better estimate is needed for k, the ratio of residential assessed value to money income in a community. Previous studies and realtor rules of thumb indicate a definite relationship between the money income a person earns and the amount he can afford to pay for residential property. It is not clear, however, what the relationship might be in communities where many people already have unencumbered title to their homes and the economic activity in the community has been depressed for several years. A clearer understanding of k under such conditions would improve the quality of studies such as this.

Third, additional research is needed on empirical estimates of the ratio of changes in manufacturing employment to changes in population. In this study this ratio is used to estimate secondary population changes resulting from the loss of employment in the studied firm. The average ratio was computed for all rural counties in Pennsylvania for the 1960-1970 decade for use in this study. Better precision of secondary population estimates can probably be obtained by disaggregating the area considered, and perhaps reducing the time span covered. Certainly areas experiencing population growth might be separated from areas with declining populations. Efforts in this direction will require better estimates of population and employment for sub-county areas and for periods between U. S. Census of Population enumeration. The result of further research on this ratio is likely to be a more precise estimate of secondary population effects of changes in manufacturing employment. This will enable decision-makers to better understand the impact of manufacturing on the local community.

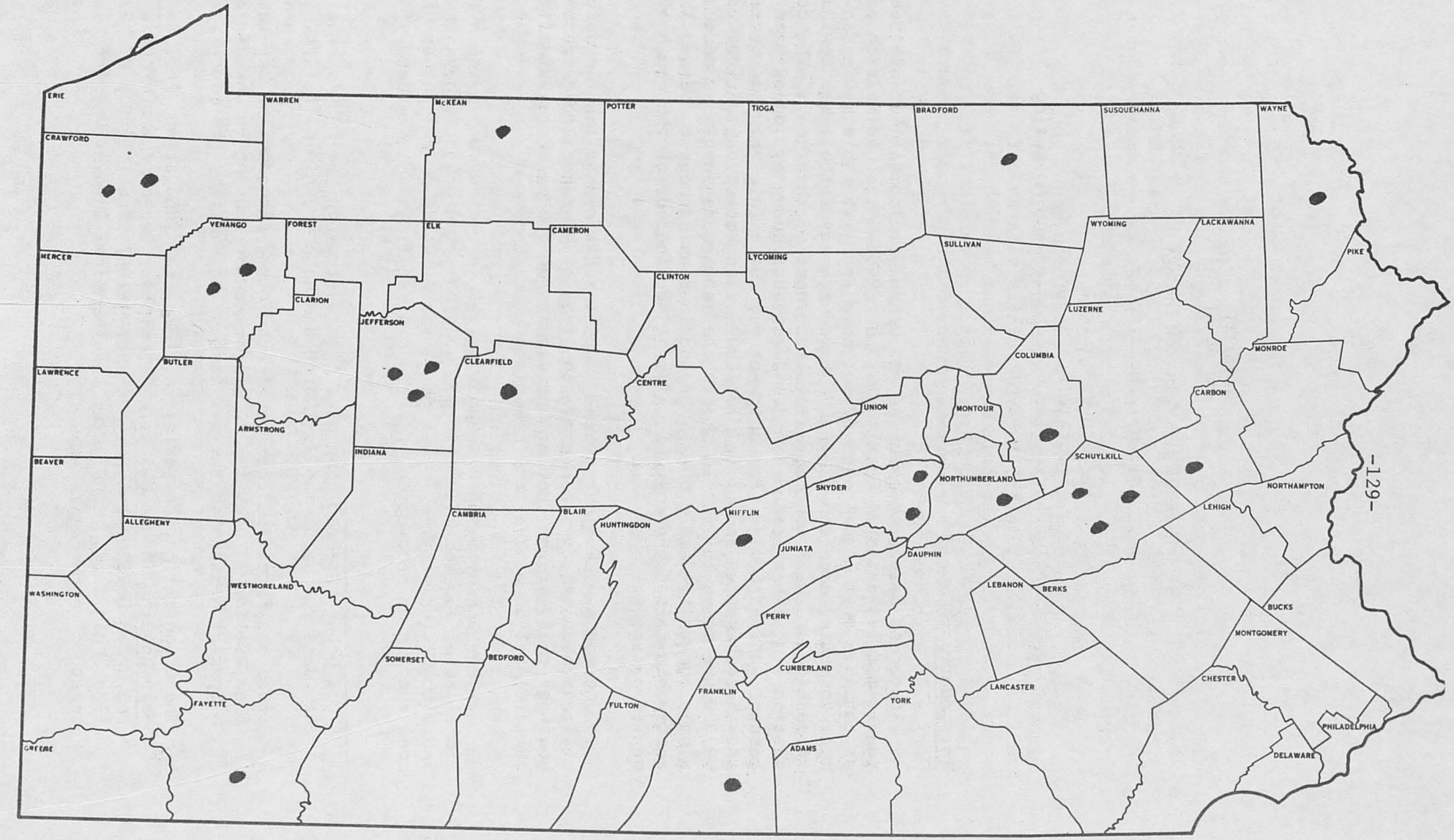

FIGURE 1. Location of Sample Firms in Rural Pennsylvania