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THE ECONOMIC IMPACT OF MANUFACTURING
PLANTS IN A FIVE COUNTY REGION
IN SOUTHEAST OHIO

By

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ABSTRACT

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This study examines the net benefits generated by manufacturing plants on local, county, and regional communities. Use of incremental income instead of consumption to measure primary benefits results in a significant increase in net benefits. Significant increases of internalized benefits occur from local to county and county to regional levels.

Author Information

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The purpose of this study is to examine the economic impact of eleven manufacturing plants on their respective communities in a five-county region in Southeast Ohio: Athens, Gallia, Jackson, Meigs, and Vinton counties. This was the area Ohio selected for study under Title V of the Rural Development Act of 1972. The analysis focuses on two issues. First, using a more general benefit-cost model than previous studies, the conceptual definitions of benefits and costs are changed from a consumption basis to an income basis. Second, the impact of size of region on the internalization of benefits and costs is examined by comparing net benefits at the local, county, and regional levels.

The region is characterized by relatively high unemployment rates, low income, and low education. Using the Ohio labor force as a percent of Ohio working age population as the standard of potential employable labor in the region, the unemployment rate in the region is about 31 percent based on 1970 Census data. However, these five counties have all experienced population growth since 1970 (Thomas). From 1970 to 1975, the number of manufacturing establishments increased by 37 (29 percent) from 128 to 165, manufacturing employment increased by 348 (7 percent) from 5112 to 5460, and manufacturing payroll increased by \$13.1 million (40 percent) from \$32.5 to \$45.6 million.^{1/} Finally, since 1970 these five counties have been the recipients of a large energy project, a large coal powered electric generating plant, three deep-shaft coal mines, and a 13-mile conveyor belt to transport the coal from the mines to the power plant.

Benefit-Cost Model

The most comprehensive previous study of the benefits and costs of manufacturing plants was completed by Shaffer and Tweeten (S-T), where the total impact of a plant on the private, local government, and school sectors was estimated. The model of this study treats the local government and school sectors similarly to S-T. The model departs in the definition of private sector benefits.

Private sector benefits consist of two components: primary and secondary. In this study, primary benefits are defined as the net incremental income accruing to resident workers of the manufacturing plant. Net incremental income is the difference between current earnings and earnings from the previous job. A resident worker is one who resides in the relevant community at his current job. Change in residence has no impact on incremental income.^{2/} Expenses incurred in taking the new employment, such as increased transportation costs, moving costs, and union dues, should be deducted from the income stream. Estimation of these costs was beyond the scope of this study. In contrast, S-T define primary benefits as local consumption by plant workers. This definition excludes savings by resident workers but includes income of non-resident workers spent in the community. Also included by S-T is income from the previous jobs of plant workers which are refilled by community residents. This component is consistent with the model of this study, but is excluded from this study because of inadequate data. High previous unemployment rates in the firms under study imply that omission of this component does not lead to serious underestimates of income benefits in this study. In other situations, this omission may lead to significant underestimates of primary benefits.

The major basis for this change in definition is that community residents are better off by the total amount of increased income, and not only by that amount spent in the local community (Oakland). Further, the consumption expenditures of non-resident workers do not increase the primary benefits of community residents, although there is an impact on secondary benefits. The focus of benefits changes from direct impact on the community in S-T to direct impact on the residents of the community in this study.

Similar to S-T, secondary benefits in the private sector are defined as incremental consumption expenditures times the local income multiplier. Two modifications are made which reduce the value of secondary benefits accruing to the community as compared to previous research. First, it is not assumed that secondary benefits accrue instantaneously, but rather over a period of six years. A relationship developed by Johnson is used:

$$(1) \quad M_t = (1 + a) - \frac{a}{25}(t - 5)^2, \quad t = 0, \dots, 5,$$

where M_t is the multiplier in year t . In year 0, $M_t = 1$, and increases to $M_t = (1 + a)$ in $t = 5$ and remains at this level in succeeding years.

Secondary benefits are $(M_t - 1)$ times incremental consumption in year t . The impact of equation (1) is to reduce secondary benefits in early years as compared to the assumption of instant benefits, and to reduce the present value of secondary benefits when discounted.

The second adjustment affects only the local level. In S-T, local multipliers are estimated by multiplying the county multiplier by the local average propensity to consume. In this study, the local multiplier is obtained as the product of the county multiplier $(M_t - 1)$ times the

ratio of local population to county population. This change results in smaller local secondary income multipliers as compared to S-T.

The local government and school sectors are treated similarly to S-T, except that only primary benefits are included. Both sectors may bear investment costs of new or expanded service facilities because of the manufacturing plant. Both are the recipients of new tax revenues and bear operating costs of additional services provided. The net contribution of the local government and school sectors to the total net benefits of a manufacturing plant are the additional revenues to the respective sectors net of transfer payments from the private sector less the additional costs of providing services to the plant and its workers. For example, new property taxes paid by the firm are net benefits which accrue through the government sector, but new property taxes paid by firm workers are transfer payments because they are included in private sector primary benefits.

To examine internalization of benefits, the net benefits are calculated at the local, county, and regional levels. The local level is the municipality or township in which the plant is located. The county level includes all benefits internalized by the county. The regional level includes all benefits internalized by the five-county study area, but excludes benefits accruing outside the five counties.

Data Base and Plant Characteristics

The data base for this study consists of a labor questionnaire completed by 93 employees of the 11 manufacturing plants, information obtained from interviews with the managers of each plant, interviews with local government and school officials, and numerous published sources. The 11 manufacturing

plants were those which agreed to participate in this study from a total of 23 plants in the region which were established or significantly expanded employment after January, 1970. Sample characteristics of the 11 plants in the study are presented in Table 1. Two of the plants are non-durable manufacturing and employ female labor; the other nine are durable and employ no female labor. Seven plants were new firms beginning operations after January, 1970 while four had employment expansions after this date.

Previous employment is defined as those workers who had been unemployed for six weeks or less prior to obtaining employment with the plant. Of the sampled plant workers, 84 percent were unemployed for more than six weeks, 58 percent for more than three months, and 26 percent for more than six months. The use of the six week cut off for previous employment is arbitrary; its impact on estimated benefits is discussed below.

The average propensities to consume in Table 1 are weighted averages of the average propensities to consume of workers by residence. These weighted average propensities cannot be used to obtain local consumption in later tables because local consumption is obtained as incremental income times average propensity to consume by residence, and then summed. The average propensities to consume used in this study exclude housing expenditures in addition to savings. To the extent that housing expenditures generate secondary benefits, secondary benefits are underestimated in this study. Of the sampled workers, housing expenditures averaged about 26 percent of income and were highly variable, while savings averaged about 9 percent.

County and regional income multipliers are estimated directly, while the local multiplier is estimated as $(M - 1)$ for the respective county times

Table 1. Characteristics of Sample Plants

Firm No.	No. of Workers	N or E ^b (No. Added)	Average Wage (\$/Hour)	Previously Employed (Percent)	Worker Residence (No.)				Average Propensity ^d to Consume		
					Local	County	Regional	Non-Regional	Local	County	Regional
1	275	E (175)	3.73	60	96	58	21	0	.26	.47	.60
2 ^a	228	N	2.51	35 ^c	140	33	3	52	.39	.51	.57
3	150	E (80)	3.85	40	25	10	35	10	.31	.37	.48
4	88	E (44)	3.61	47	17	23	0	4	.28	.58	.62
5	70	E (24)	3.18	33	15	9	0	0	.60	.71	.77
6 ^a	44	N	2.95	9	23	13	4	4	.38	.42	.48
7	17	N	4.18	100	6	11	0	0	.12	.78	.90
8	3	N	3.00	33	0	3	0	1	0	.45	.54
9	3	N	3.00	100	0	3	0	0	0	.60	.60
10	3	N	3.00	100	0	3	0	0	0	.51	.60
11	3	N	4.00	33	3	0	0	0	0	.64	.85

^aNon-Durable manufacturing firm employing female labor (firm 2, 65 percent female and firm 6, 48 percent); all other firms are durable and employ no female labor.

^bN is a new firm, E is an expanded firm with the number of added workers in parentheses.

^cThis is a reorganized firm but is treated as a new firm. It is estimated that 35 percent of the labor force (the percent of males in the work force) could obtain alternative employment.

^dWeighted average propensity to consume by worker residence.

the ratio of local to county population. County and regional multipliers were estimated by estimating the ratio of endogenous to total income (the propensity to create endogenous income) for each county and the region, and the multiplier as

$$(2) M_i = 1/(1 - d_i),$$

where d_i is the ratio of endogenous to total income.

Endogenous income was estimated by sector of the respective economy. Where available, quarterly data from the Bureau of Employment Services on employment from 1972 through 1975 was used to estimate

$$(3) E_{ik} = b_{oik} + b_{lik}E_{wk},$$

where E_{ik} is employment in the i th county or the region in the k th sector, and E_{wk} is employment in a benchmark region determined by the type of sector and the area affecting its employment (Mathur and Rosen). The ratio b_{oik}/E_{ik} adjusted for any seasonal or structural changes over the period is the proportion of endogenous employment in the k th industry for the i th area. This ratio is then assumed to be the proportion of endogenous income for the sector. Endogenous income for durable manufacturing, non-durable manufacturing, construction, retail trade, wholesale trade, finance, transportation, communications and services was estimated using this method. Endogenous income from the government sectors, property, transfer payments, residence adjustment, and mining was estimated directly, i.e., based on assumptions about these sectors.

Once these ratios were obtained, they were multiplied by sector income and summed to obtain total endogenous income for the county or region, from

which d_1 is obtained. The resulting multipliers are presented in Table 2. They are smaller in magnitude than those used by S-T, but are consistent at the county level. The multipliers of this study and of S-T adjust for value added. The region of this study has a relatively high import dependence and low ability to generate income. The multipliers are consistent with other work on this region (Husain).

Results

The annual benefit flows estimated for each firm are presented in Table 2. Three of the firms provided no primary benefits at the local level, and four firms generated no secondary benefits. The weighted mean net benefit per worker at the local level is \$1,841, increases to \$2,468 at the county level, and to \$2,677 at the regional level. Estimated mean secondary benefits are \$100 per worker at the local level, \$822 at the county level, and \$1,194 at the regional level. Based on equation (1), these levels of secondary benefits are not reached until the sixth year. Regional secondary benefits include all consumption by regional residents; to the extent that regional residents purchase goods and services outside of the five-county region, these benefits are overestimated. With respect to non-residents of the region, only consumption within the region is included.

None of the manufacturing plants imposed investment costs on the respective communities. All communities had sufficient excess capacity to provide services to the plants without expanding facilities. There was very little migration of workers as a result of the new or expanded plants under study. The four expanding plants (1,3,4,5) provided no net benefits to the government sectors because they did not add to existing plant and

Table 2. Annual Private Sector Primary and Secondary Net Benefits at Local, County, and Regional Levels, and Government Sector Net Benefits (\$/Worker)

Firm No. (Workers)	Local ^a			County			Regional ^c		Government Sectors		
	Primary	M-1 ^b	Secondary	Primary	M-1 ^b	Secondary	Primary	Secondary	Local ^d	County	School
1 (175)	1,533	0.11	45	2,235	0.56	543	2,518	954	0	0	0
2 (228)	2,120	0.06	72	2,481	0.64	997	2,559	1,304	5	19	88
3 (80)	1,311	0.11	63	1,539	0.56	452	2,039	811	0	0	0
4 (44)	1,460	0.14	124	2,038	0.56	701	2,038	1,039	0	0	-35
5 (24)	2,373	0.31	454	2,815	0.64	1,160	2,815	1,474	0	0	0
6 (44)	3,397	0.18	378	4,895	0.66	1,531	5,430	2,057	17	24	136
7 (17)	831	0.03	5	3,877	0.56	1,245	3,877	1,920	55	102	453
8 (3)	NB	NB	NB	1,530	0.66	744	1,530	975	1	5	23
9 (3)	NB	NB	NB	1,271	0.28	211	1,271	566	5	11	57
10 (3)	NB	NB	NB	1,695	0.56	480	1,695	757	56	135	427
11 (3)	2,589	NB	NB	2,589	0.64	958	2,589	1,496	13	24	105
Mean ^e (624)	1,841		100	2,468		822	2,677	1,194	5	12	55

^aNB means no benefits.

^bIncome multiplier minus one.

^cThe Regional Multiplier less one is 0.75.

^dLocal government is the municipality or township.

^eAverage benefits per worker weighted by workers per firm.

equipment. Firm 4 imposed additional costs on the school sector because costs from children of migrating workers exceeded new tax revenues and state aid.

Total annual and the present value of net benefits are presented in Table 3. The present values are computed for 20 years at a 6 percent discount rate. Only the local government and school sectors are included in local benefits; all government sectors are included at the county and regional levels. Based on the weighted mean present values, total internalized benefits increase by 62 percent at the county level over the local level. Internalized regional benefits are 16 percent greater than county benefits. At the local level, several communities, mainly townships, were not able to internalize significant proportions of total benefits.

Comparative results for local level private sector benefits using traditional concepts are presented in Table 4 for the 7 firms which generated local benefits. Based on S-T, the annual primary benefits defined as net consumption range from 21 to 62 percent of net benefits based on the model of this study. Both estimates exclude income or consumption from previous jobs which were refilled. Present values of secondary benefits based on three calculations are presented in Table 4. First is the present value of secondary benefits based on equation (1) as used in this study. Second is the present value based on the assumption that secondary benefits are fully realized in the first period; these benefits are 21 percent greater than those used in the present study. The third calculation is based on the S-T adjustment of county multipliers by the average propensity to consume locally and instant benefits; the increase ranges from 38 to 383

Table 3. Annual and Present Value (PV)^a of Total Net Benefits per Worker For Local, County, and Regional Levels (\$/Worker)

Firm No.	Local		County			Regional		Region ^b County
	Annual	PV	Annual	PV	County ^b	Annual	PV	
					Local			
1	1,578	19,096	2,779	32,647	1.71	3,472	40,214	1.23
2	2,285	27,631	3,591	41,571	1.50	3,975	45,605	1.10
3	1,374	16,577	1,991	23,258	1.40	2,850	32,958	1.42
4	1,549	18,579	2,704	31,407	1.69	3,042	34,810	1.11
5	2,827	33,425	3,975	45,901	1.37	4,289	49,065	1.07
6	3,927	46,960	6,602	77,069	1.64	7,665	88,885	1.15
7	1,344	16,329	5,731	67,083	4.11	6,407	73,888	1.10
8	25	300	2,304	26,454	88.18	2,535	28,783	1.09
9	62	750	1,555	18,460	24.61	1,909	22,031	1.19
10	483	5,872	2,793	32,958	5.61	3,070	35,740	1.08
11	2,707	32,908	3,689	42,846	1.30	4,227	48,269	1.13
Mean	2,002	24,120	3,362	39,149	1.62	3,942	45,437	1.16

^aPresent values are based on a 6 percent discount rate for a 20 year period.

^bRatios of the present values of county to local and regional to county net benefits.

Table 4. Annual Primary Benefits and Present Value (PV) of Secondary Benefits per Worker at Local Level based on Alternate Approaches (\$/Worker)^a

Firm No.	Annual Primary Benefits S-T	S-T Current	PV of Secondary Benefits					
			Present Study	Instant Benefits	Ratio ^b	S-T (M-1)	S-T Benefits	Ratio ^b
1	411	0.27	455	549	1.21	.13	649	1.43
2	1,204	0.57	727	878	1.21	.24	3,514	4.83
3	575	0.44	637	770	1.21	.13	909	1.43
4	885	0.61	1,248	1,507	1.21	.16	1,722	1.38
5	1,464	0.62	4,568	5,517	1.21	.36	6,406	1.40
6	2,099	0.62	3,805	4,595	1.21	.27	6,892	1.81
7	177	0.21	54	65	1.21	.06	129	2.40

^aFirms 8-11 have no primary or secondary benefits under any of the alternatives presented.

^bRatio is the ratio of instant benefits and S-T Multiplier adjustment (including instant benefits), respectively, to benefits in this study.

percent over the present values used in this study. When primary and secondary benefits are combined, the model of this study results in greater private sector benefits than the S-T model because the increase in primary benefits is greater than the reduction in secondary benefits.

Implications

The alternative model used in this study results in greater benefits than the traditional models such as S-T. The major basis for the change is that all incremental income of resident workers is a benefit to the community residents. The total benefits estimated in this study are underestimated to the extent that previous jobs were refilled, and overestimated to the extent that the six week previous unemployment period is too short and that costs of taking the new employment are not deducted. In addition, benefits from migrant workers who became residents are included; in some cases it may be preferable to exclude migrants.

All communities experienced net benefits from these manufacturing plants because no public investment was required. However, further expansion will require public investment at some time, and the ability to justify such investments increases substantially at the county level over the local level, and further at the regional level. These results imply that county or regional organizations can beneficially undertake many projects that may have net costs at the local or county levels.

Community characteristics are more important determinants of net benefits than firm characteristics. The level of unemployment in the community and the ability to internalize consumption expenditures through the local propensity to consume and the multiplier have greater impacts on benefits than the size or wage rate of the plant.

FOOTNOTES

Leroy J. Hushak is Associate Professor at the Ohio State University and the Ohio Agricultural Research and Development Center and Alan Osman is a former Graduate Research Associate at the Ohio Agricultural Research and Development Center.

1/ These changes are based on Ohio Bureau of Employment Services reports of employment covered by unemployment compensation. Nearly all manufacturing employment is covered.

2/ The inclusion of incremental income of migrant workers is somewhat arbitrary. There are potential cases where migrants might not be viewed as beneficial to the community or its residents, in particular where a manufacturing plant employs a high proportion of workers who previously resided outside the community. In this study, there was a small amount of worker migration.

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