

ECONOMIC IMPACT OF MANUFACTURING

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In recent years, economic development has received increased attention by state/provincial and local governments in the U.S., Canada, U.K., and many other industrialized countries (Bartik 1991; Eisinger 1988; Finsterbusch et al. 1992; Kale and Lonsdale 1987). While regional differences in growth rates and levels of affluence have long been topics of concern to both scholars and policy makers (Shaffer 1989; Tweeten and Brinkman 1976), these concerns have been heightened by the substantial restructuring that has been occurring in the manufacturing sector in recent years (Barkley and Hirschberger 1992). In addition, in the U.S. the increased efforts of state and local governments to promote economic development have resulted in part from a diminution of the federal government's activities in this area. As a result, local and state governments are committing increasing amounts of resources to development efforts (Broadway 1991; Eisinger 1991; Leistritz and Hamm 1994).

Communities and states are investing substantial and increasing levels of resources in economic development initiatives, motivated in large measure by the benefits which they expect to result from these efforts (Burnier 1992; Bartik 1991). Among the benefits commonly anticipated to result from new or expanded manufacturing facilities (or from growth in other basic economic sectors) are both *direct impacts* (the jobs in the new facility, its expenditures to employees and suppliers, and its tax payments) and *secondary impacts* (jobs created in other sectors of the local economy, increased sales of local trade and service firms, etc.). However, the benefits to be expected from a new development activity are not always easy to assess. In some cases, many of the new jobs promised by developers have not materialized, or most of these jobs have been filled by outsiders

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(Ledabur and Woodward 1990, Summers et al. 1976). The secondary benefits are even more difficult to assess, and persons promoting new development projects and seeking local/state financial assistance have sometimes employed very optimistic estimates of secondary benefits to bolster their cause (Lansford and Jones 1991).

As communities and states invest increasing levels of resources in economic development efforts, the need for a better basis for assessing the benefits that are likely to result from such activities is apparent. While a number of studies have addressed the extent to which various development incentives affect firm start-ups and expansions or facility relocations (Blair and Premus 1987, Leistritz 1991, Popovich and Buss 1989), only a few have addressed the direct effects of facility development or expansion, and fewer still have examined the secondary effects of firms of different types. This paper addresses the need for improved information about the direct and secondary economic effects of firm start-ups, expansions, and relocations by examining the direct and secondary economic effects of a group of North Dakota manufacturing firms.

The purpose of this study was to measure not only the direct economic effects (direct employment and expenditures to entities within the state) but also the secondary or indirect effects (secondary employment and total business volume of all sectors) of manufacturing firms. While the economic restructuring that has occurred over the past decade has led some communities to examine economic development alternatives such as exported services or tourism (Frederick 1993, Gibson 1993, Smith 1993, Leistritz 1993), manufacturing is still the option most frequently considered by communities seeking economic development and diversification. Further, recent experience in North Dakota indicates that manufacturing may still be a very viable source of growth for rural areas. From 1985 to 1993, the state's manufacturing employment increased by 26 percent (4,027 jobs), with most regions of the state registering substantial gains (Coon et al. 1995). Manufacturing employment as a percentage of total state employment also increased during this period.

PROCEDURES

Information needed to fulfill the project objectives was obtained through a survey of North Dakota manufacturers, conducted in 1991. The initial survey

list was developed by cross-referencing a list of manufacturers compiled by the North Dakota Department of Economic Development and Finance with a similar list developed by the North Dakota State College of Science. The intent was to obtain the most complete coverage possible of the state's manufacturing sector (SIC Groups 20-39). Because the objective of the study was to identify characteristics and needs of manufacturing firm that were serving markets outside the state, firms that served only local markets (e.g., publishers of local newspapers) were eliminated from the list. A total of 214 firms responded to the surveys, representing about 58 percent of the companies in the final survey list. However, only 113 of these (or 31 percent of the population) provided all of the information required for the economic impact analysis reported here. Analysis of these respondents' Characteristics compared to those of firms that provided incomplete information, as well as to secondary data for the state's manufacturing sector, indicated that the respondents were representative of the state's manufacturers.

The firms were asked to provide a variety of information, including current employment, employment five years prior to the survey, gross sales, the distribution of expenditures by type (i.e., for raw materials, processed materials, direct labor, subcontracting, and other), and the percentage of each type of expenditure which was made to entities within the state. In order to estimate the secondary economic effects of the various types of firms, the estimates of each firm's in-state expenditures were applied to the North Dakota Input-Output Model (Hertsgaard et al. 1984). Input-output models have been used extensively in estimating secondary economic impacts of a variety of projects and programs (Otto and Johnson 1993). Based on each firm's in-state expenditures, the input-output model provided estimates of the total economic impact (gross receipts or gross business volume of all sectors) resulting from its annual operations, as well as the secondary (indirect) employment attributable to its activities.

RESULTS

Selected characteristics of the sample firms are summarized in Table 1. Of the 113 firms, about 8 percent had been created in 1987 or more recently (i.e., less than five years prior to the survey). About 62 percent had been created prior to 1987 and had fewer than 20 employees five years prior to the survey while about 30 percent had been created prior to 1987 and had 20 or more employees five years prior to the survey.

Table 1. Selected characteristics of North Dakota manufacturing firms, 1991

Characteristics	No. of firms (no.)	% of sample (%)	Gross sales 1990 (\$000)	% of products sold out of state (%)
All firms	113	100.0	9,212	40.9
New firms	9	8.1	453	46.2
Firms established more than 5 years:				
Less than 20 employees 5 years ago	60	62.2	812 ^a	30.8 ^a
20 or more employees 5 years ago	33	29.7	23,510 ^a	62.3 ^a
Type of products:				
Durable goods	76	67.9	9,714	45.3
Nondurable goods	36	32.1	8,406	32.6
High-tech firms	13	11.5	2,218	58.7
Agribusiness firms	25	22.1	30,432 ^b	50.8
Type of establishment:				
Only location of firm	91	80.5	2,703 ^c	10.7
Headquarters of firm	12	10.6	15,375 ^d	34.9
Branch plant	10	8.8	61,044 ^d	49.4

^aFirms with less than 20 employees are significantly different from those with 20 or more at $\alpha=0.05$ using the Tukey test (Draper and Smith 1966; SAS Inst. 1985).

^bAgribusiness firms significantly different from other firms at $\alpha=0.05$ (Tukey).

^cSole locations significantly different from branch plants at $\alpha=0.05$ (Tukey).

^dHeadquarter locations significantly different from branch plants at $\alpha=0.05$ (Tukey).

About two-thirds of the respondent firm were durable goods manufacturers. Firm in the SIC categories that have been designated as high-tech (Smith and Barkley 1988) accounted for about 11 percent of the respondents. Agribusiness firm made up about 22 percent of the sample, and these firms were about equally divided between nondurable goods manufacturers (primarily food processors) and durable goods manufacturers (primarily farm equipment manufacturers).

More than four-fifths of the respondents indicated that their establishment was the only location of their firm. About 11 percent indicated that their establishment was the headquarters of a firm that had other branches, while 9 percent were branch plants.

The respondent firms reported gross sales in 1990 that averaged \$9.2 million, with 41 percent of their sales being made directly to out-of-state entities (Table I). Respondents that reported relatively high average sales included branch plants, headquarters establishments, and agribusiness firm. Relatively high percentages of out-of-state sales were reported by agribusiness firms, high-tech firm, and by establishments with 20 or more employees five years prior to the survey. New firms (created in 1987 or more recently) also reported higher than average out-of-state sales.

The sample firms reported that labor made up about 29 percent of their total expenditures, while raw materials (27 percent) and processed materials (22 percent) were also major expenditure items (Table 2). The percentage of a firm's expenditures that are made within the local area, or within the state, directly affects the extent to which these areas will experience secondary economic effects (Leistritz and Murdock 1981). The respondents reported that most of their labor expenditures were made within the county where the facility was located and almost all (99 percent) were made within the state. Subcontracting and other expenditures (e.g., utilities) were also made primarily to entities within the state. On the other hand, the majority of expenditures for processed materials and raw materials were to entities outside the state. Overall, the firms reported that 50 percent of their expenditures were made within the county and 69 percent within the state.

Table 2. Distribution of Expenditures by Respondent Firms, 1990

Expenditure category	Percent of total expenditures	Location of Supplier			
		Within county	Rest of state	Rest of U.S.	Outside U.S.
		-----percent-----			
Raw materials	27.1	20.4	24.7	50.5	4.4
Processed materials	22.3	18.8	17.3	59.4	4.6
Labor	29.3	89.7	9.1	1.2	0.0
Subcontracting	4.5	49.1	26.0	24.9	0.0
Other	16.8	65.4	15.7	18.2	0.6
Total	100.0	50.4	18.6	28.5	2.5

The respondent firms also differed substantially with respect to current employment levels and the number of jobs they had created in the last five years. The sample firms employed an average of 53 workers at the time of the survey (Table 3). A few large firms had a major influence on this figure, however; the median firm's current employment was 16. The firms had created an average of 13 jobs during the last five years, with a median value of 5. Considering all firms, 14 percent reported that their employment had decreased in the past five years, while 11 percent had no change in employment. On the other hand, a few firms had created substantial numbers of jobs. Of the sample firms, the top 6 percent (in number of jobs created) had created 54 percent of the total jobs. These findings are similar to those of Storey (1985) who reported that among a group of small manufacturers in northern England, 6 percent of the firms had created 34 percent of the jobs.

Among the top firms in job creation (6 percent of the sample or 7 firms), all but one were durable goods producers. Three of the seven firms were branch plants, while three were independent operations (the remaining firm was the headquarters unit of a firm with other branches). Only one had been established within the past five years, and only one was a high-tech firm.

Table 3. Current employment of North Dakota manufacturing firms, 1991, and jobs created in the last five years

Characteristics	Current employment		Jobs created in last 5 years	
	Mean	Median	Mean	Median
All firms	53.0	16.0	13.2	5.0
New firms	14.9 ^a	10.0	14.9	10.0
Firms established more than 5 years:				
Less than 20 employees 5 years ago	13.0 ^b	11.0	5.8	2.0
20 or more employees 5 years ago	141.7 ^{a,b}	71.0	28.2	14.0
Type of products:				
Durable goods	55.6	16.0	17.8	5.5
Nondurable goods	48.7	17.5	4.1	2.0
High-tech firms	31.8	31.0	15.4	11.0
Agribusiness firms	101.5 ^c	27.0	20.3	6.5
Type of establishment:				
Only location of firm	27.1 ^d	14.0	6.9 ^e	4.5
Headquarters of firm	86.5 ^e	52.5	17.7 ^e	7.5
Branch plant	247.6 ^{d,e}	64.5	70.3 ^{d,e}	2.0

^aNew firms are significantly different from established firms with 20 or more employees at $\alpha=0.05$ using the Tukey test.

^bFirms with less than 20 employees significantly different from those with 20 or more at $\alpha=0.05$ (Tukey).

^cAgribusiness firms significantly different from other firms at $\alpha=0.05$ (Tukey).

^dSole locations significantly different from branch plants at $\alpha=0.05$ (Tukey).

^eHeadquarter locations significantly different from branch plants at $\alpha=0.05$ (Tukey).

When considering the number of jobs created by firms of different types, new firms (created in the last five years) had generated an average of 15 jobs per firm, whereas all firms that had been established more than five years created an average of 13 jobs (Table 3). The established firms that had 20 or more employees five years prior to the survey had created an average of 28 jobs, which represented an increase of 25 percent. The established firms with less than 20 employees had created about 6 jobs on average, representing an increase of about 69 percent. When considering the total number of jobs created, however, the new firms accounted for only 9 percent of the total jobs created by all firms in the study, while the large established firms (with 20 or more workers five years before) accounted for 64 percent and their smaller counterparts for 27 percent.

Among other firm categorizations, the agribusiness firms had created an average of 20 jobs per firm, or an increase of 25 percent over the last five years (Table 3). High-tech firms had created an average of 15 jobs, an increase of about 94 percent. Establishments that were either headquarters of multi-unit firms or branch plants had created substantial numbers of jobs per firm, although these entities made up a relatively small segment of the total sample.

The percentage of expenditures that the various types of firms made within the state are summarized in Table 4. Overall, the firms reported that about 57 percent of their total expenditures were made within the state. Firms that had been established within the last five years reported the highest rate of in-state expenditures (71 percent). Established firms with fewer than 20 employees five years previous to the survey had a substantially higher percentage of expenditures within the state than their counterparts with higher employment levels. High-tech firms had a substantially lower percentage of expenditures to entities within the state than other firms. This can be attributed to the higher percentage of the components they purchased from out-of-state suppliers.

When the firms' in-state expenditures were divided by their total employment at the time of the survey (direct jobs), substantial variations were noted. Overall, the survey firms reported an average of about \$72,000 of in-state expenditures per direct job (that is, per person employed by the firm) (Table 4). Firms created within the past five years, however, reported only \$17,000 in in-state expenditures per direct job. Established firms with 20 or more employees five years prior to the survey also had a substantially higher level

of in-state expenditures per direct employee than their counterparts with fewer employees. Manufacturers of nondurable goods had substantially higher levels of in-state expenditures than durable goods manufacturers. Agribusiness firm had high levels of in-state purchases per direct employee, while those of high-tech firms were quite low.

When the firm's in-state expenditures were applied to the interdependence coefficients of the North Dakota input-output model, estimates of the gross business volume (gross receipts) resulting in various sectors of the state economy were obtained. Estimates of the level of gross receipts required in each sector to support one additional job (gross business volume to employment ratios) were then applied to the estimates of additional gross business volume to obtain estimates of the secondary employment resulting from the manufacturers' expenditures (Coon and Leistriz 1989). The total secondary employment and total gross business volume in all sectors resulting from the firms' expenditures are summarized in Table 5.

The North Dakota manufacturers accounted for an average of 229 secondary jobs, or 4.3 secondary jobs per direct job (that is, an employment multiplier of 5.3) (Table 5). Substantial variations existed, however, among firm of different types. Firms that had been established more than five years and had 20 or more employees five years prior to the survey accounted for 710 secondary jobs per firm and 5 secondary jobs per direct job. Their counterparts with fewer than 20 employees five years previous had only 1.8 secondary jobs per direct employee (24 jobs per firm), and firms created within the past five years had only 0.8 secondary jobs per direct employee (11 jobs per firm). Nondurable goods manufacturers had a substantially greater number of secondary jobs per direct job (6.1) than their counterparts engaged in durable goods manufacturing (3.6). Agribusiness firm and headquarters establishments also recorded relatively high levels of secondary jobs per direct job.

The gross business volume generated in all sectors of the North Dakota economy as a result of the manufacturers' operations and expenditures averaged \$13.5 million per firm or about \$255,000 per direct job (Table 5). Variations in gross business volume (total economic impact) per firm and per direct job among firms of different types were similar to those reported for secondary employment.

Table 4. Total expenditures, percent of expenditures within the state, and in-state expenditures per direct job, North Dakota manufacturing firms, 1991

Characteristics	Gross sales per firm (\$000)	Percent of expenditures made w/in state	In-state expenditures	
			Per firm (\$000)	Per direct job (\$000)
All firms	9,212	57.0	3,799	71.7
New firms	453	71.4 ^a	253	17.0
Firms established more than 5 years:				
Less than 20 employees	812	59.8	485 ^b	37.2
20 or more employees	23,510	49.1 ^c	11,427 ^b	80.6
Type of products:				
Durable goods	9,714	55.0	3,167	56.9
Nondurable goods	8,406	60.2	5,238	107.5
High-tech firms	2,218	44.3 ^c	875	27.6
Agribusiness firms	30,432	55.1	12,117 ^d	119.4
Type of establishment:				
Only location of firm	2,703	57.1	1,383 ^e	51.0 ^f
Headquarters	15,375	60.9	10,008	115.7 ^f
Branch plant	61,044	51.5	18,329 ^e	74.0

^aNew firms are significantly different from established firms with 20 or more employees at $\alpha=0.05$ using the Tukey test.

^bFirms with less than 20 employees significantly different from those with 20 or more at $\alpha=0.05$ (Tukey).

^cHigh-tech firms significantly different from other firms at $\alpha=0.05$ (Tukey).

^dAgribusiness firms significantly different from other firms at $\alpha=0.05$ (Tukey).

^eSole locations significantly different from branch plants at $\alpha=0.05$ (Tukey).

^fSole locations significantly different from headquarters at $\alpha=0.05$ (Tukey).

Table 5. Secondary employment and total economic impact, North Dakota manufacturing firms, 1991

Characteristics	Secondary employment		Total economic impact	
	Per firm (no.)	Per direct job (no.)	Per firm (\$000)	Per direct job (\$000)
All firms	229	4.3	13,508	255.1
New firms	11	0.8	820	55.1
Firms established more than 5 yrs				
Less than 20 employees	24 ^a	1.8	1,692 ^a	129.9
20 or more employees	710 ^a	5.0	40,828 ^a	288.1
Type of products:				
Durable goods	199	3.6	10,421	187.3
Nondurable goods	298	6.1	20,399	418.7
High-tech firms	43	1.4	2,944	92.1
Agribusiness firms	759 ^a	7.5 ^b	44,145 ^a	434.8 ^b
Type of establishment:				
Only location of firm	74 ^c	2.7 ^d	5,110 ^c	188.3 ^a
Headquarters of firm	567	6.6 ^e	38,440	444.4 ^d
Branch plant	1,237 ^c	5.0	60,015 ^c	242.4

^aFirms with less than 20 employees are significantly different from those with 20 or more at $\alpha=0.05$ using the Tukey test.

^aAgribusiness firms significantly different from other firms at $\alpha=0.05$ (Tukey).

^cSole locations significantly different from branch plants at $\alpha=0.05$ (Tukey).

^cSole locations significantly different from headquarters at $\alpha=0.05$ (Tukey).

The direct expenditures and total economic impact of North Dakota manufacturers' operations were widely distributed across the various sectors of the state's economy (Table 6). Sectors that received large direct expenditures included *households* (payrolls and profits retained within the state), *agricultural processing and miscellaneous manufacturing* (processed materials and subcontracts), *agriculture* (raw materials), and *finance, insurance, and real estate* (employee benefits, business insurance, debt service, etc.). Sectors that received large total impacts included *households, retail, agriculture, and agricultural processing and manufacturing*. The gross business volume of the *household* sector is essentially equivalent to personal income of state residents. Thus, the average manufacturing firm contributed more than \$4 million annually to the personal income of North Dakota residents. The *retail* sector gained almost \$2.6 million in gross business volume as a result of the average manufacturer's operations, with almost 97 percent of this arising as a result of secondary effects. Overall, the direct and secondary economic impacts of manufacturing were widely distributed among the other sectors of the North Dakota economy.

CONCLUSIONS AND IMPLICATIONS

As local and state governments and development organizations become more involved in economic development initiatives, accurate information about the direct and secondary effects of firm start-ups and expansions becomes increasingly important. This study of North Dakota manufacturing firms indicates that substantial variations exist among firms of different types as regards both direct and secondary economic impacts.

A commonly used measure of direct economic impacts is the number of jobs created by various types of firms (Birch 1987; Gallagher and Stewart 1986; Bollard and Harper 1986; Harrison 1994). The study firms had created an average of 13 jobs over the past five years. About 75 percent of the firms reported that their total employment had increased compared to five years before while 11 percent reported no change and 14 percent reported decreased employment. A few firms had a major influence on the overall job creation statistics—the top 6 percent of the firms (in number of jobs created) created 54 percent of the total jobs. These findings suggest that public programs that provide technical or financial assistance to manufacturers might benefit from information that would allow firms with high job-creation potential to be identified and targeted for special assistance.

Table 6. Direct expenditures and total economic impact of North Dakota manufacturers, by economic sector, average per firm

Sector	Direct expenditure (\$000)	Economic impact (gross business volume) (\$000)
Agriculture, crops, livestock	615	1,644
Transportation	404	446
Communications & public utilities	270	642
Agricultural processing & misc. manufacturing	729	1,576
Finance, insurance, real estate	604	1,146
Services	218	708
Households	874	4,055
Other ^a	<u>85</u>	<u>3,291</u>
Total	3,799	13,508

^a Includes mining, construction, retail, government

A number of authors have reported that new firm and/or small firms have been responsible for a disproportionately large percentage of net job creation (Birch 1987), but the findings of this study offer only partial support. Within the sample, small firm (less than 20 employees) had a higher rate of employment growth over the past five years than their larger counterparts (69 percent vs. 25 percent) but they accounted for only 27 percent of the total jobs created, compared to 44 percent for the larger firms. New firm created more jobs per firm, on average, than established firms, but as a group they accounted for only 9 percent of the total jobs created. Thus, these findings tend to support the view that a balanced approach to economic development may be more appropriate than an exclusive focus on small firms or new start-ups (Young et al. 1994).

Firms differed substantially not only in their direct impact but also with respect to their secondary economic impact. Firms that made substantial expenditures within the state accounted for high levels of secondary employment and for increased gross business volumes in various sectors of the state economy. Firm types that had the highest levels of secondary impact per direct job were large established firms, agribusiness firms, and headquarters units. When evaluating requests for financial assistance and incentives, development groups may wish to query firms regarding their plans to involve other local entities as suppliers or subcontractors. Brokerage networks aimed at improving the linkage between manufacturers and potential in-state suppliers also could have potential for increasing manufacturers' contributions to state and local economies.

Perhaps the most salient finding of the study, however, concerns the substantial magnitude of the direct and secondary economic impacts of manufacturing operations. The firms studied made direct expenditures to other entities within the state economy that totaled almost \$3.8 million or about \$72,000 per direct job. The total impact averaged \$13.5 million annually per firm, or \$255,000 per direct job. Further, the economic impacts were widely distributed among the various sectors of the state economy.

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