

Importance of the Manufacturing Sector to the Canadian Economy (II-C)

Elisa Au*

Industrial Analysis Branch

Industry Canada

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*The author is an economist of the Industrial Analysis Branch, Industry Canada. Address: 235 Queen Street, Ottawa, ON Canada K1A 0H5; Tel: (613) 948-1225; Fax: (613) 948-1230; e-mail: au.elisa@ic.gc.ca

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ABSTRACT

The manufacturing sector is a vital part of the Canadian economy. In 2002, it accounted for \$165 billion of Canada's gross domestic product (GDP) and more than two million jobs. Unlike the other G7 countries, the contribution of the manufacturing sector to the Canadian economy has been increasing.

From 1997 to 2002, average labour productivity growth in the manufacturing was slightly lower than the average for all industries. Part of this could be explained by the relatively low capital investment in the sector.

In 2001, the R&D expenditure by the manufacturing sector represented 70 percent of all industrial R&D expenditures. The R&D intensity for the sector is about four times greater than that of all industries in Canada.

The manufacturing sector has driven much of Canada's trade. In 2002, manufacturing exports accounted for 64 percent of Canada's total exports of goods and services. The sector became much more export dependent but Canada's overall manufacturing trade balance was negative. Nevertheless, Canada's manufacturing sector has been a success story.

Executive Summary

The manufacturing sector is a vital part of the Canadian economy. In 2002, it accounted for \$165 billion of Canada's gross domestic product (GDP) and more than two million jobs. Unlike the other G7 countries, the contribution of the manufacturing sector to the Canadian economy has been increasing. The sector's contribution to Canada's GDP increased from 15.8 percent in 1992 to 16.9 percent in 2002. The share of employment also increased slightly from 15.6 to 15.8 percent.

From 1997 to 2002, average labour productivity growth in the manufacturing sector was only 1.20 percent, which was slightly lower than the average for all industries. Part of this could be explained by the relatively low capital investment in the sector. During 1992 to 2002, manufacturing's share in total capital investment declined from 14 to 11 percent.

In 2001, the manufacturing sector spent \$8.4 billion on research and development (R&D), representing about 70 percent of all industrial R&D expenditures. The R&D intensity for the sector is about four times greater than that of all industries in Canada.

Another interesting feature of the manufacturing sector is that it has driven much of Canada's trade. In 2002, manufacturing exports accounted for 64 percent of Canada's total exports of goods and services. From 1992 to 2002, manufacturing exports increased from \$125 billion to \$305 billion with a compound annual growth rate of 9.3 percent. Also during the same period, the ratio of manufacturing exports to total shipments increased from 45 percent to 56 percent. The sector became much more export dependent. In 2002, 94 percent of these exports went to the United States. This value of shipments exceeded the amount than was sold domestically.

The largest manufacturing industry is transportation equipment, with 17 percent of total manufacturing GDP. This industry generated almost 26 percent of total manufacturing exports. Other major manufacturing exports include paper, machinery, chemical, primary metal, computer and electronic products, wood products and food. It should be noted that some of these products had negative trade balances and in fact, Canada's overall manufacturing trade balance was negative. While manufacturing exports had a larger growth rate than imports, the absolute value of the trade deficit continued to increase.

Nevertheless, Canada's manufacturing sector has been a success story. Canada is the only G7 country that experienced an increase in the relative importance of its manufacturing sector during 1991 to 2001. Some of this success was undoubtedly driven by the signatures of the FTA and NAFTA and by the low Canadian dollar.

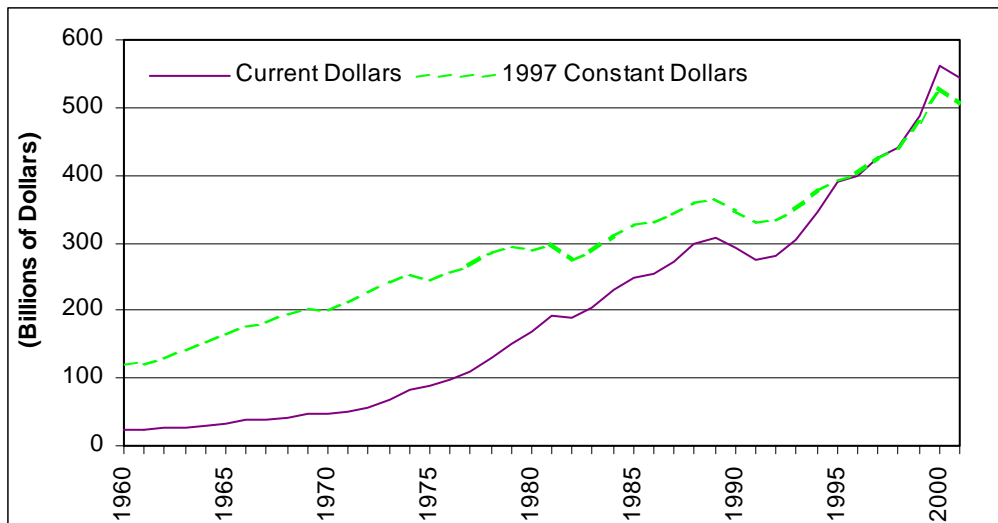
1. Introduction

Manufacturing is a vital sector of the Canadian economy. It makes a significant contribution to the gross domestic product (GDP), employment, capital investment, Research & Development (R&D), and exports. In 2002, the manufacturing sector accounted for 16.9 percent of GDP and 15.8 percent of employment. Furthermore, the manufacturing sector is the largest spender on R&D in the Canadian economy. In 2002, this sector accounted for 67.5 percent of total industrial R&D.

Statistics Canada defines a manufacturing firm as an “establishment engaged in the physical or chemical transformation of materials or substances into new products. These products may be finished... or semi finished.”¹ The manufacturing sector is categorized into 20 sub-sectors and a sector of miscellaneous industries by North American Industry Classification System (NAICS). The list of the industries is available in Appendix A.

During the last forty years, the value of manufacturing shipments has been increasing steadily. After the recession in the early 1990s, the growth of the manufacturing shipments is more prominent than the previous thirty years, as shown in Figure 1.

Figure 1: Manufacturing Shipments, 1960-2001



Source: Statistics Canada, for 1960-1969: Catalogue # 31-203, for 1970-1982, 1983-1997, 1998-2001: CANSIM Table #301-0002, #301-0001, and #301-0003, respectively. Price Index for 1960-2001: CANSIM Table #329-0038

The purpose of this report is to analyse the importance of the manufacturing sector in Canada during 1992 to 2002.² Sections 2 to 6 will examine some of the macroeconomic indicators, such as real GDP, employment, wages, capital investment, R&D expenditures and trade statistics in order to identify the contribution of the manufacturing sector to the Canadian economy. Section 7 discusses the key manufacturing industries in Canada. In section 8, we will review the location of manufacturing activity. Section 9 presents a brief analysis on the indirect

¹ Statistics Canada, Catalogue No. 12-501-XPE, 2002, p.122

² This period is selected because consistent and current data in NAICS for this period is available for most macroeconomic indicators.

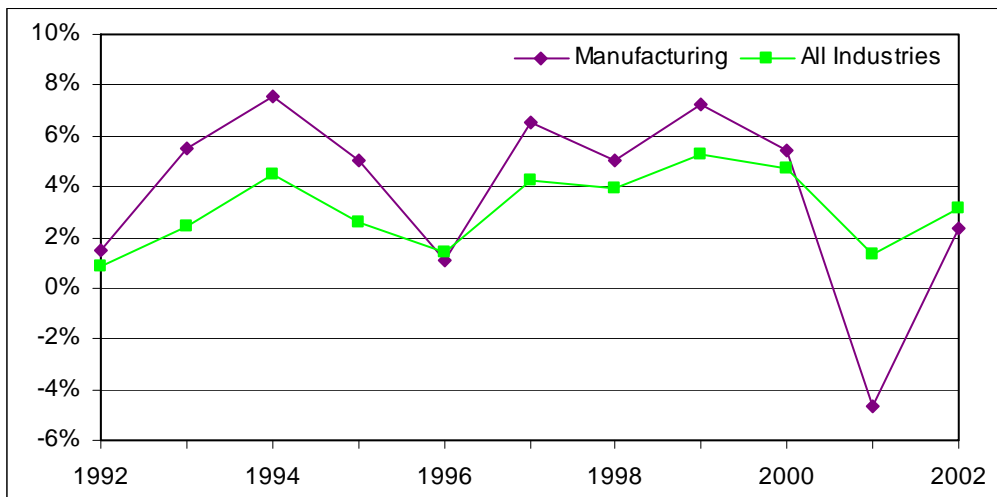
contribution by the manufacturing sector. In Section 10 the study compares the importance of manufacturing sector in the G7 countries. Section 11 concludes the paper.

2. GDP

In 2002, real GDP originating in the manufacturing sector was \$164.8 billion, or approximately 16.9 percent of total GDP.³ During 1992-2002, manufacturing GDP increased by 48 percent, or at a compound annual growth rate (CAGR) of 4.0 percent.⁴ This compares favourably with the CAGR of total GDP at 3.3 percent during the same period.

Figure 2 provides a comparison between the percentage change in annual GDP for the manufacturing sector and the total economy. It reveals the relatively more volatile and responsive nature of manufacturing activity to the business cycle.

Figure 2: Percent Change in Annual GDP, 1992-2002



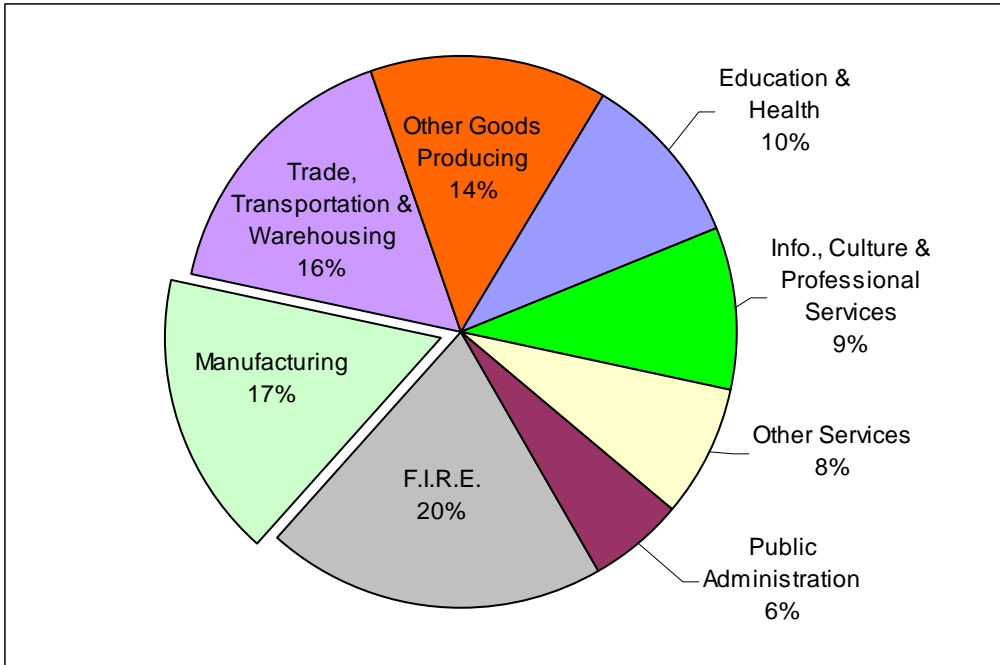
Source: Statistics Canada, CANSIM Table # 379-0017 and author's calculation

In terms of share, the manufacturing sector's GDP increased from 15.8 percent in 1992 to 16.9 percent in 2002 of total GDP. Throughout the period under review, the manufacturing sector's share in total GDP was second only to GDP originating in the finance, insurance and real estate (F.I.R.E.) sector, the share of which was 19.9 percent in 2002. It should be emphasized that the reason why F.I.R.E. shows the highest GDP share is due to the practice of statistical agencies including the value of owner-occupied dwellings in this sector's GDP. If one were to adjust for these values, output in F.I.R.E. would more than one-third lower. Figure 3 provides a picture of the relative share of the manufacturing sector and the other seven major sectors of the Canadian economy in 2002.

³ In this study, the base year for real GDP is 1997.

⁴ Throughout the paper, the compound average growth rate is calculated by the formula: $((X_{02}/X_{92})^{1/10} - 1) \times 100\%$.

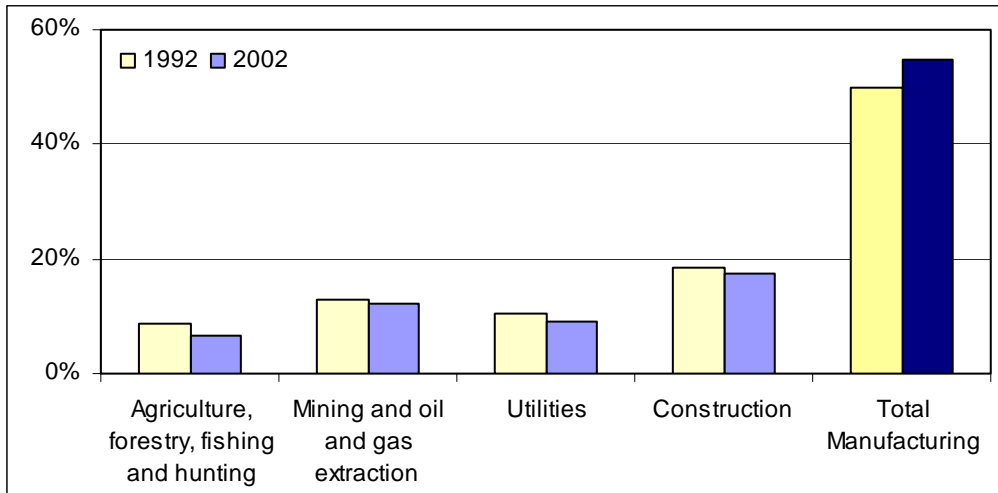
Figure 3: Percentage Share of Annual GDP, 2002



Source: Statistics Canada, CANSIM Table # 379-0017 and author's calculation

The share of GDP for the manufacturing sector within the goods producing industries is the largest and it increased from 51 percent to 55 percent over the period 1992-2002. As shown in the graph below, in 2002 there is a big gap of 37.4 percent between the share of manufacturing sector and the sector with second largest share, which is construction.

Figure 4: Percentage Share of Annual GDP of Goods Producing Industries

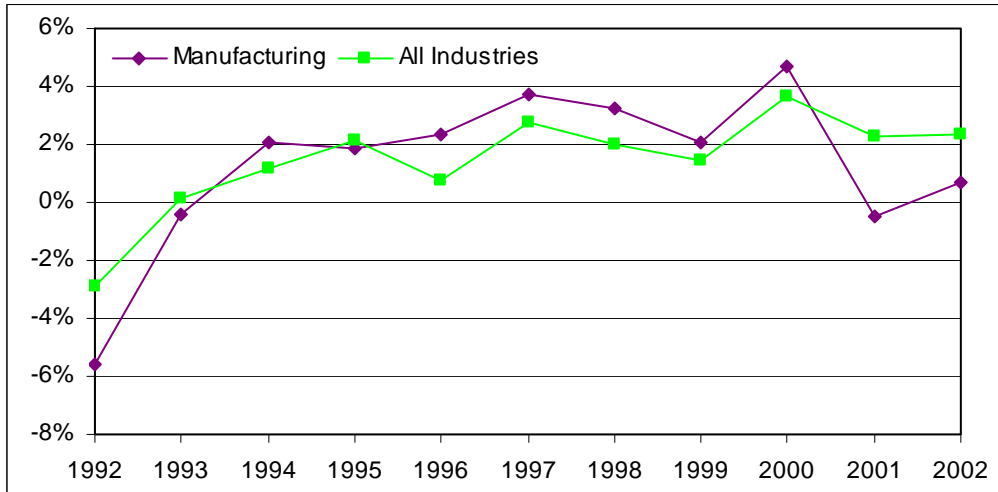


Sources: Statistics Canada, CANSIM Table #379-0017 and author's calculation

3. Employment

In 2002, the manufacturing sector contributed 2.05 million jobs to the Canadian economy, which accounts for 15.8 percent of total employment. From 1992 to 2002, employment in the manufacturing sector increased by 22 percent, or a compound annual growth rate (CAGR) of 2.0 percent. In comparison, the total Canadian employment CAGR was 1.9 percent. As shown in Figure 5, annual percentage change in manufacturing employment is more volatile and responsive to the business cycle, compared to changes in total employment in the economy.

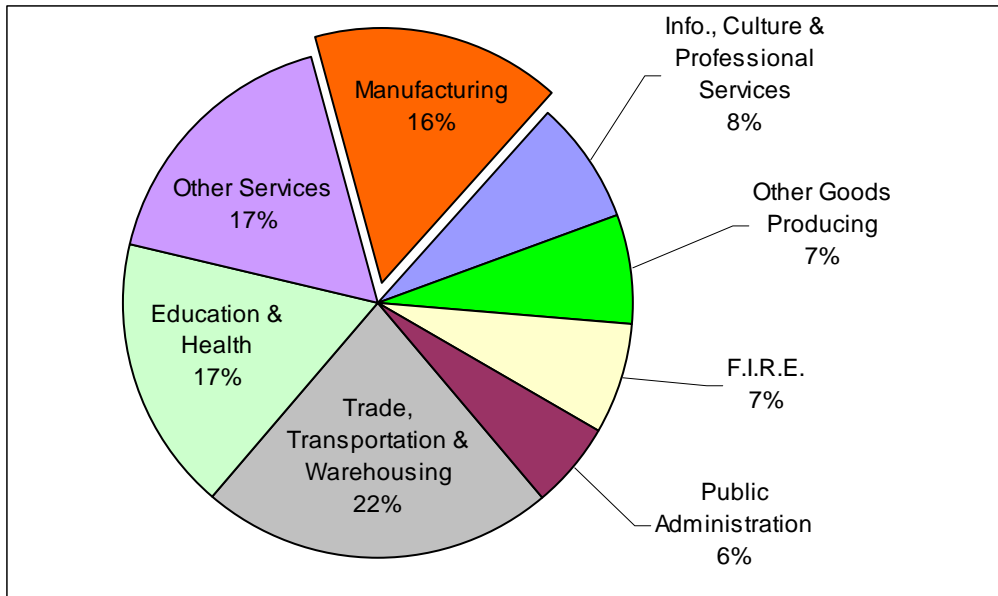
Figure 5: Percent Change in Annual Employment, 1992-2002



Source: Statistics Canada, CANSIM Table # 281-0024 and author's calculation

The share of employment for the manufacturing sector increased slightly from 15.6 percent in 1992 to 15.8 percent in 2002. Throughout the period, the sector maintained a relatively high share of employment and ranked third among the group of key sectors in 2002 (Figure 6). Services industries are relatively labour intensive, so the shares of total employment of these industries tend to be higher. It should also be noted that although GDP originating from the F.I.R.E. sector is higher than the manufacturing sector's share in total GDP, its share of total employment was less than half of the manufacturing sector's share in 2002 (Figure 6).

Figure 6: Percentage Share of Employment, 2002

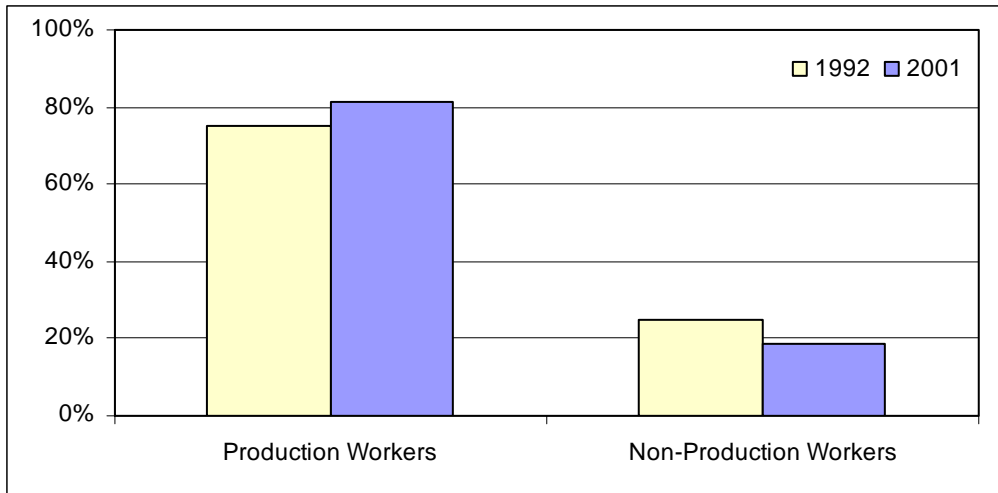


Source: Statistics Canada, CANSIM Table # 281-0024 and author's calculation

Within the manufacturing sector, employees are either engaged in manufacturing activity or in auxiliary activity. Accordingly, the Annual Survey of Manufactures categorizes manufacturing workers as: production workers and non-production workers.⁵ The share of production workers in total employment within the sector increased from 75 percent in 1992 to 81 percent in 2001, while the share of non-production workers declined from 25 percent to 19 percent, as shown in figure 7 below.

⁵ Production workers are those “engaged in processing and assembling activities, storing, inspecting (including quality control), handling, packing, warehousing, maintenance, repair, janitorial and watchmen services, etc., and working foremen doing similar work to that of employees they supervise” (Stats Can June 1979, p.23). Non-Production worker are those working in cafeterias or restaurants operated by the establishment, etc., and employees in head, administrative, sales or service offices...[including] employees engaged in new construction of building, machinery and equipment, in major repairs or alterations...[and] in sales and distribution activity...” (Stats Can June 1979, p.24)

Figure 7: Percentage Share of Production and Non-Production Workers



Source: Statistics Canada, CANSIM Table # 301-0003 and author's calculation

3.1 Labour Productivity

Labour Productivity is a measure of output per employment input. In this study, the measure is the ratio of real GDP per hour worked. Based on this measure, labour productivity in manufacturing increased from \$38 per hour in 1997 to \$40 per hour in 2002 or at a CAGR of 1.2 percent. During this period, as shown in Table 1, the manufacturing sector had a higher labour productivity level than the average level of the whole economy by about \$8 per hour.

Table 1: Labour Productivity

Industry	1997	2002	Compound Annual Growth Rate (%)
Utilities	134.36	133.45	-0.13
Mining and oil and gas extraction	96.05	106.21	2.03
Manufacturing	37.63	39.94	1.20
Service Industries ⁶	26.59	29.52	2.11
Construction	25.96	26.73	0.58
Agriculture, forestry, fishing and hunting	17.25	20.79	3.81
All industries	29.57	32.28	1.77

Source: Statistics Canada, CANSIM Table #379-0017 and #383-0009, and author's calculation

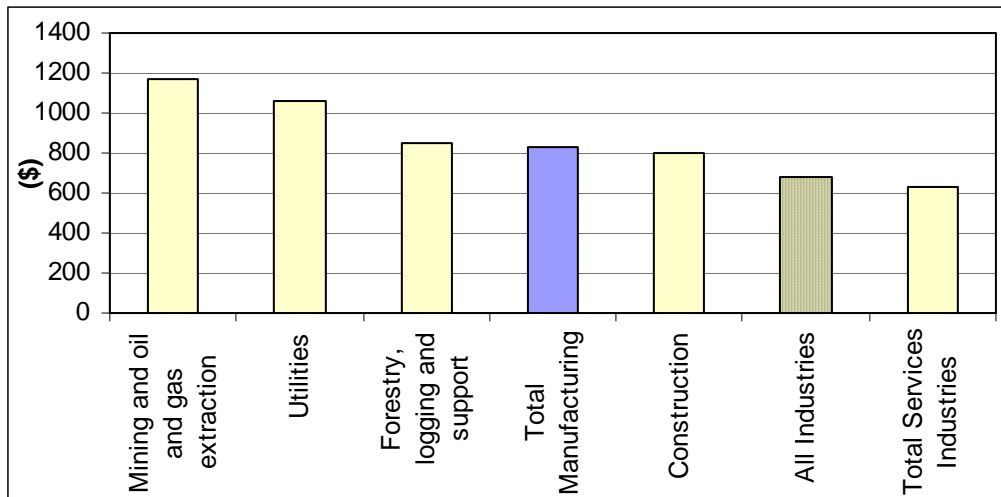
Between 1997 and 2002, the annual average growth rate in labour productivity for the manufacturing sector was lower than the average for all industries. This was essentially due to a severe drop in manufacturing output in 2001, which had a negative impact on productivity average annual growth. However, if we were to examine a longer time series on labour productivity based on the SIC classification during 1992-2001, the annual average growth rate of 2.05 percent in manufacturing would actually become higher than the average of all industries by 0.07 percentage point.

⁶ The labour productivity for service industries is calculated based on the GDP without the owner-occupied dwellings.

3.2 Weekly Wages

Labour productivity is closely related to wages. As employees become more productive, they expect to earn higher wages. The manufacturing sector has a higher labour productivity than the average of all industries, so it may be expected that weekly wages earned by employee in this sector are higher than the average. In 2002, manufacturing employees earned an annualized average weekly wages (AAWW) of \$830, which was higher than the average of all industries by 25 percent (Figure 8).

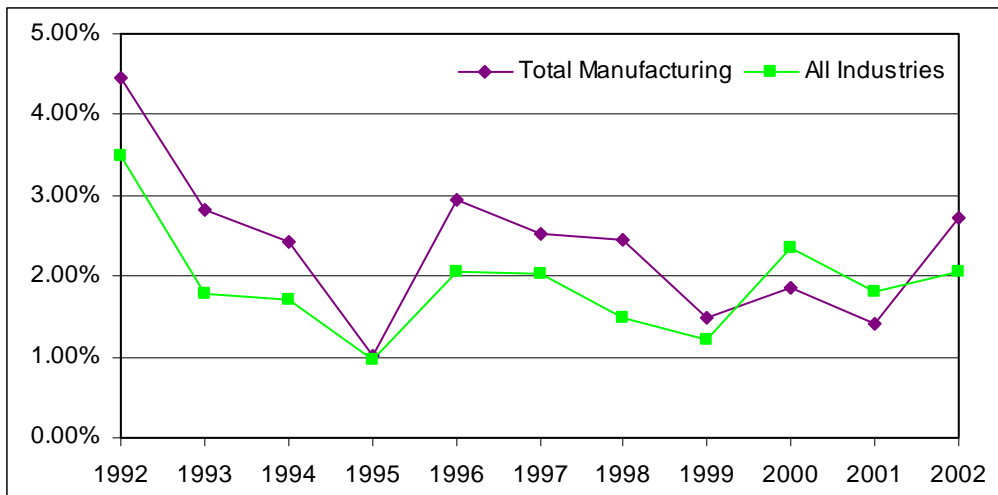
Figure 8: Annualized Average Weekly Wages, 2002



Source: Statistics Canada, CANSIM Table # 281-0027

For most of the years during 1992 to 2002, the percent change in AAWW of manufacturing employees was higher than the average of all industries (Figure 9). In 2000, the AAWW of some other sectors had a significant increase, which generated a high percent change in AAWW of all industries. Therefore, the percent change in manufacturing AAWW was slightly lower. In 2001, there was a significant decline in employment as shown in Figure 5. This could generate a downward pressure on wages, so the AAWW for manufacturing employees was lower than the average of all industries.

Figure 9: Percent Change in Annualized Average Weekly Wages



Source: Statistics Canada, CANSIM Table # 281-0027 and author's calculation

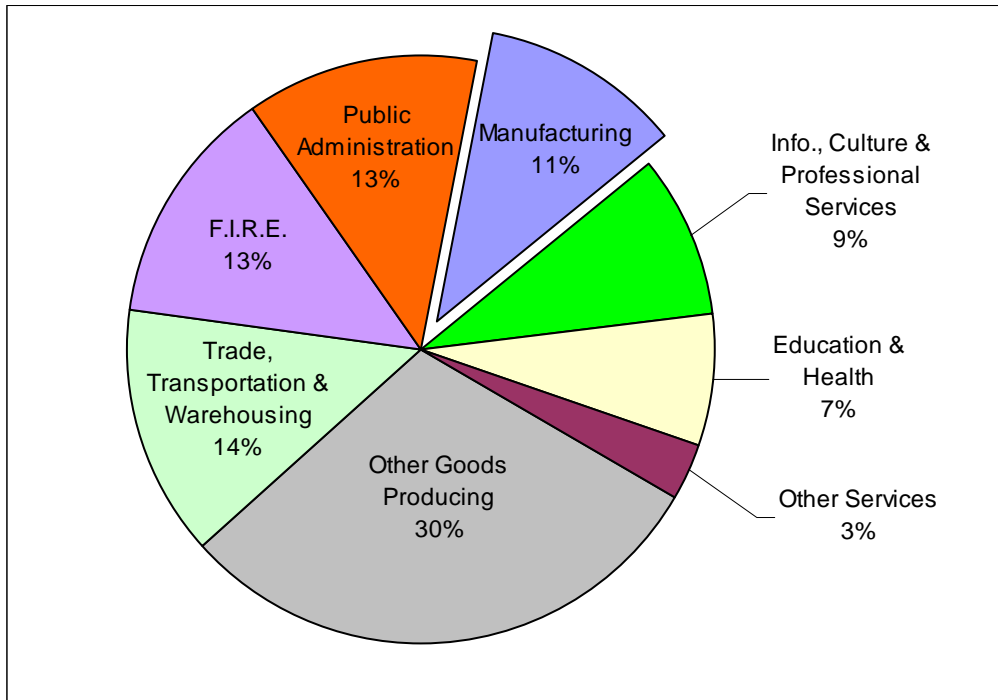
4. Capital Investment and Stock

Capital expenditure is the total investment of construction capital, and machinery and equipment (M&E) capital. In 2002, the manufacturing sector's capital expenditure was \$16.8 billion, or about 11 percent of total capital investment by all sectors. The compound annual growth rate (CAGR) of capital expenditure for the manufacturing sector was relatively low. From 1992 to 2002, CAGR was 3.0 percent, which was much lower than AAGR of the total of all industries at 5.1 percent.

During 1992-2002, the contribution by the manufacturing sector to total capital investment has been declining. In 1992, at 14 percent, the manufacturing sector had the third highest share of total capital investment by all industries. In 2002, the sector ranked fourth with a share of 11 percent (Figure 10). Furthermore, in terms of capital stock, the share by manufacturing sector fell from 12.9 percent to 11.5 percent during the period being examined due to the relatively low investment growth rate.⁷

⁷ Source: Statistics Canada CANSIM Table # 031-0002

Figure 10: Percentage Share of Manufacturing and Other Key Sectors in Total Capital Investment, 2002



Source: Statistics Canada, CANSIM Table # 029-0005 and author's calculation

Overall, the manufacturing sector allocates a relatively high portion of capital investment to M&E expenditure. In 2002, 86 percent of manufacturing capital investment was spent on M&E. In comparison, other sectors with relatively high capital investment have higher ratios of expenditures on construction capital. The CAGR of M&E investment for the manufacturing sector was 3.6 percent, which was lower than the M&E investment CAGR of 5.6 percent for the total of all industries. Because of the relatively smaller growth rate in investment, the share of manufacturing M&E capital stock has also declined from 33.3 percent in 1992 to 24.7 percent in 2002.

5. Research and Development

Innovation is a key ingredient of economic growth. In turn, innovative activity is mostly based on Research and Development (R&D). By definition, R&D “is a systematic investigation carried out in the natural and engineering sciences by means of experiment or analysis to achieve a scientific or commercial advance.”⁸ Total industrial R&D expenditure is a measure of R&D activities by industries. It includes all the spending necessary for performing R&D, such as labour cost, purchases of supplies and materials, land, buildings and equipment.

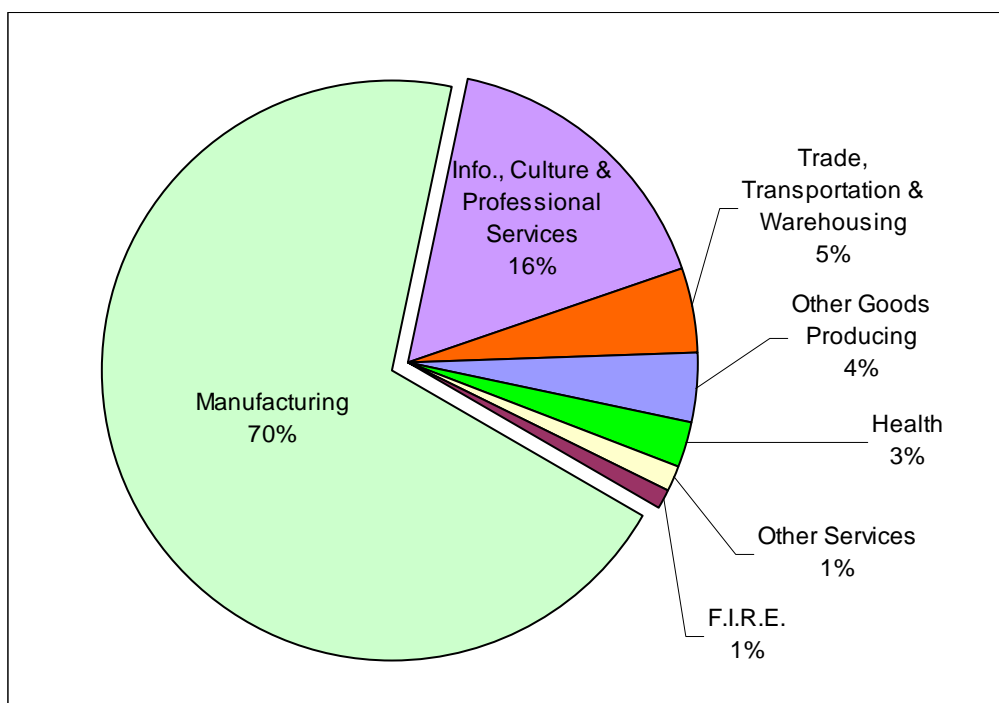
In 2001, preliminary statistics show that the manufacturing sector spent \$8.4 billion on R&D, accounting for 70 percent of total industrial R&D expenditure by all sectors (Figure 11).⁹

⁸ Statistics Canada, Catalogue No. 88-202-XIB, 2001 p.44

⁹ Source: Statistics Canada, No. 88-202-XIB

Furthermore, the Information and Communication Technologies (ICT) manufacturing industries accounted for 58 percent of all manufacturing R&D.¹⁰ In 2002, the manufacturing sector intended to spend \$7.6 billion on R&D, which is about 68 percent of total industrial R&D spending intended by all sectors.¹¹

Figure 11: Percentage Share of Total R&D Expenditure, 2001



Source: Statistics Canada, Catalogue No. 88-202-XIB, and author's calculation

Although manufacturing contributes about 17 percent of GDP, its share in R&D expenditure is more than two-thirds of the total economy. Hence, the sector has the highest R&D intensity among all the sectors.¹² In 2000, the R&D intensity for the manufacturing sector was 4.8 percent, which is 4 times greater than the 1.2 percent average of all industries. For all of the other sectors, except the professional service sector, the average R&D intensity was less than 1 percent.

As might be expected, the funds for R&D were sourced largely among performing companies.¹³ In 2000, the manufacturing sector had 58 percent of its R&D funds from the performing companies, and only 2 percent were received from the federal government. As well,

¹⁰ Source: Statistics Canada, No. 88-202-XIB, Industry Canada, www.strategis.gc.ca, and author's calculation

¹¹ Source: Statistics Canada, No. 88-202-XIB

¹² R&D intensity is the ratio R&D expenditure to GDP.

¹³ Performing Company is "the organization which carried out the R&D and submitted the [Scientific Research and Experimental Development program tax credit to Canada Customs and Revenue Agency.]" (Statistics Canada, Catalogue No. 88-202-XIB, 2001 p.41)

the manufacturing sector had a large portion of funds from foreign sources, about 38 percent in 2000.¹⁴

Although most of the resources for R&D were self-funded by the performing companies, the expenditure as a share of performing company revenues was relatively small. In 2000, the expenditure on R&D accounted for only 2.4 percent of total revenues. In comparison with the health industry and Information Culture & Professional Services industry, manufacturing R&D expenditure represents a relatively low percentage of company revenue, but it is slightly higher than the average for all industries as shown in Table 2.

Table 2: Total Intramural R&D Expenditures as a Percent of Performing Company Revenues, 2000

Industry	Percent of Company Revenue
Health	40.9
Professional Services	6.2
Manufacturing	2.4
Trade, Transportation & Warehousing	1.4
Other Services	1.4
Other Goods Producing	0.8
F.I.R.E.	0.4
Total All Industries	2.3

Source: Statistics Canada, Catalogue No. 88-202-XIB and author's calculation

6. Trade

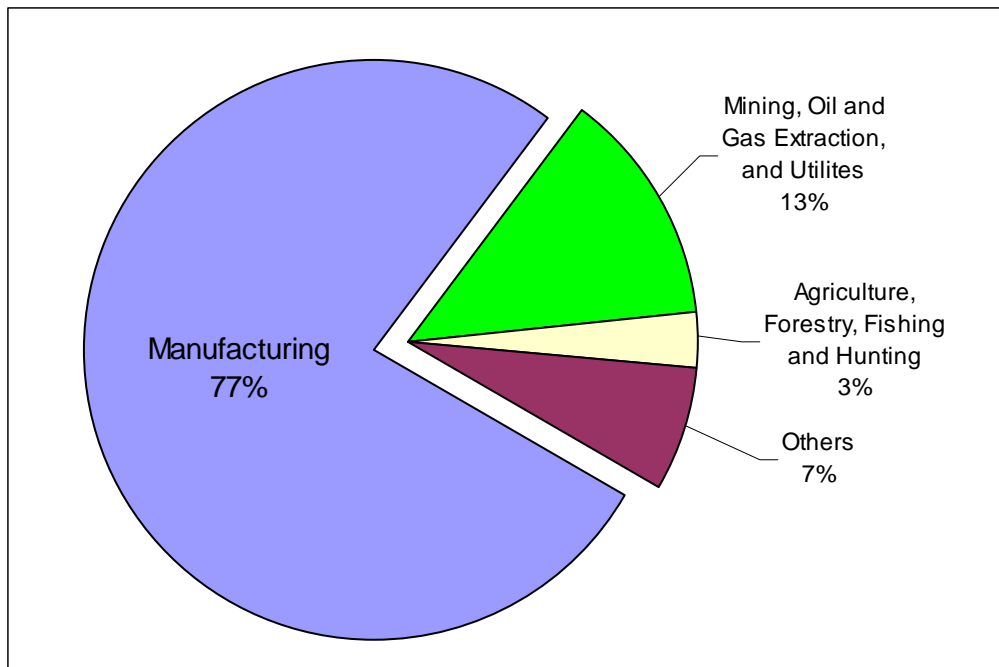
The majority of Canadian merchandise exports are manufactured products. In 2002, manufacturing exports amounted to \$305 billion, or 77 percent of total merchandise (goods) exports of the year (Figure 12).¹⁵ This share was five times larger than the total contribution of all other merchandise exporting sectors including agriculture, forestry, fishing, mining, oil and gas extraction, and utilities. Manufacturing exports accounted for about 64 percent of total Canadian exports of goods and services in 2002.¹⁶

¹⁴ Funds from foreign sources include funding from foreign related and non-related companies, universities, individuals, hospitals, or government.

¹⁵ The trade data was first classified according to the Harmonized system, which is a classification by products. When the statistics are converted to NAICS, some products are not classified to any of the Goods Producing Industries. As shown in the Figure 12, these exports are listed as "others".

¹⁶ Source: Statistics Canada, CANSIM Table # 380-0027 and author's calculation.

Figure 12: Percentage Share of Merchandise Exports, 2002



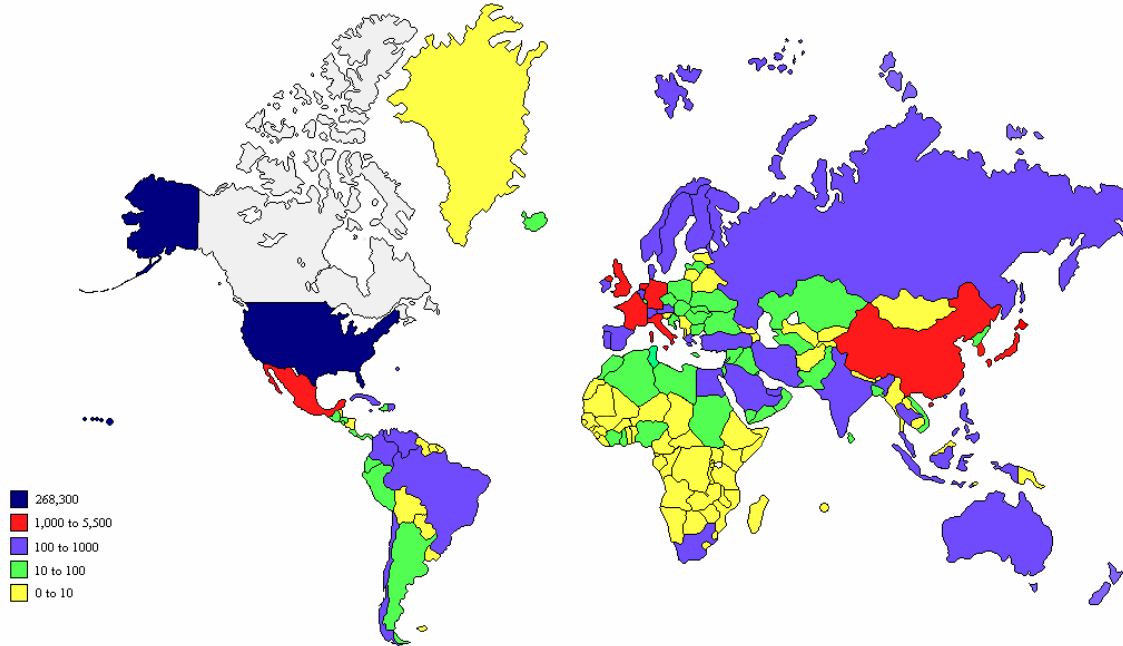
Source: Industry Canada, Trade Data Online and author's calculation

During 1992-2002, manufacturing exports increased significantly from \$125 billion to \$305 billion, with a compound annual growth rate (CAGR) of 9.3 percent. As well, the ratio of manufacturing exports to shipments increased from 45 percent to 56 percent from 1992 to 2001, reflecting the fact that the sector became progressively more dependent on the export market than the domestic market.

Figure 13 provides a map of destinations for Canadian manufacturing exports. As might be expected, the United States (U.S.) is the most important export destination for Canadian manufacturing products, accounting for 88 percent of the total in 2002. About 49 percent of total Canadian manufacturing shipments were exported to the U.S. in 2002, which was larger than the share of total output sold domestically. The G7 countries (excluding the U.S.), Mexico, and China were the next most important destinations for manufacturing exports.¹⁷

¹⁷ The G7 countries are Canada, France, Germany, Italy, Japan, United Kingdom, and United States.

Figure 13: Value of Canadian Manufacturing Exports (\$millions), 2002¹⁸



Source: Industry Canada, Trade Data Online

The share of manufacturing exports to some of the states in the U.S. was even greater than Japan's, Canada's second largest trading partner, which accounts for 1.8 percent of the manufacturing exports. The 12 states of the U.S. that had a higher share than Japan in 2002 were: Michigan (23 percent), California (8 percent), New York (6 percent), Ohio (4.4 percent), Illinois (3.6 percent), Texas (3.4 percent), Pennsylvania (3.3 percent), Massachusetts (2.4 percent), New Jersey (2.3 percent), Washington (2.2 percent), Wisconsin (1.9 percent), and Indiana (1.8 percent).¹⁹ Most of these states are concentrated in the Northeast of the U.S., which is close to Ontario and Quebec. Because of the heavy concentration of manufacturing activity in Ontario and Quebec, these two provinces are the two largest exporters of manufacturing products among the provinces.

The Canadian economy also relies heavily on manufactured imports. For most of the years under review, Canada's trade balance of manufacturing products was negative. In 2002, imports of manufacturing products totalled \$313 billion.²⁰ Furthermore, during 1992-2002, these imports have been increasing with a CAGR of 9.1 percent. Although manufactured imports have had a smaller growth rate than exports, the absolute value of trade deficit has increased from 1992 to 2002. This suggests that the manufacturing sector is expanding its export base, but the growth rate is not large enough to offset the trade deficit.

¹⁸ The mapping methodology is adopted from an online article written by Diaz.

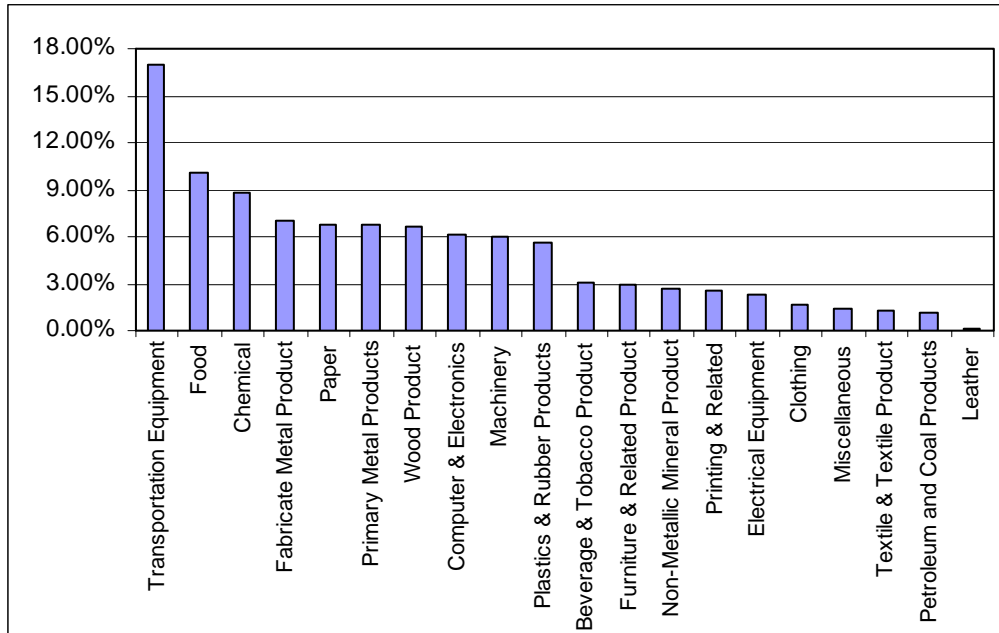
¹⁹ Source: Industry Canada, Trade Data Online and author's calculation

²⁰ The U.S. is the most important origin of Canadian manufacturing imports, accounting for 65 percent of the total in 2002

7. Key Manufacturing Industries in Canada

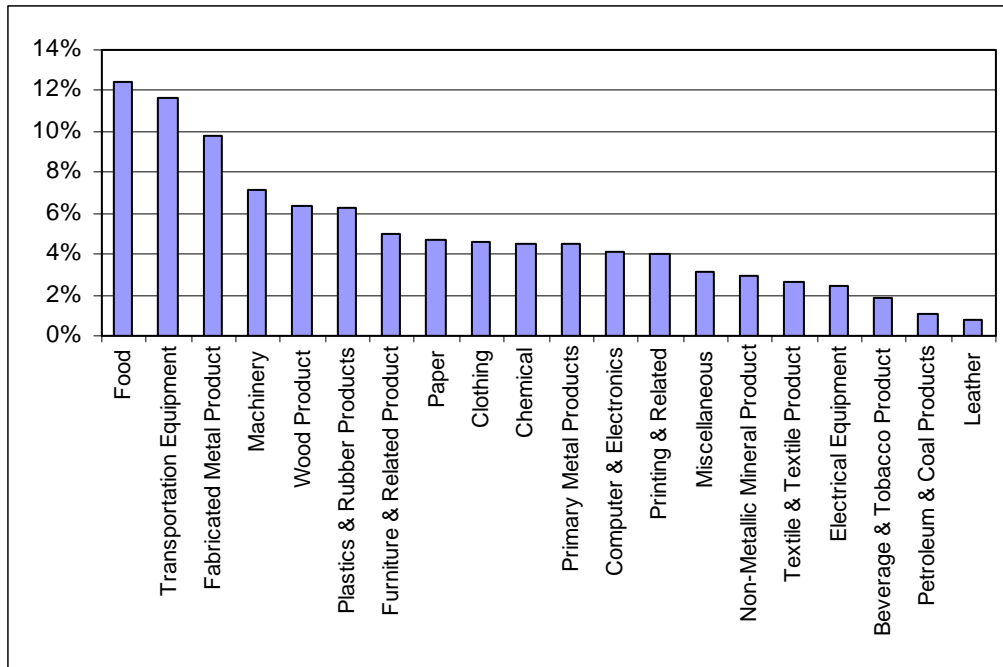
During 1992-2002, transportation equipment has been the largest manufacturing industry in Canada with a share of 17 percent of total manufacturing GDP and a GDP annual average growth rate of 6.4 percent. Figures 14 and 15 below provide a comparative picture of the relative share of 20 NAICS manufacturing industry groupings in GDP and employment in 2002.

Figure 14: Percentage Share of All Industries in Manufacturing GDP, 2002



Source: Statistics Canada, CANSIM Table # 379-0017 and author's calculation

Figure 15: Percentage Share of All Industries in Manufacturing Employment, 2002



Source: Statistics Canada, CANSIM Table # 281-0024 and author's calculation

In terms of trade, transportation equipment is by far the largest item in Canada's export and import trade. In 2002, transportation equipment accounted for \$102 billion (26 percent) and \$93 billion (27 percent) of Canadian exports and imports, respectively. Table 3 presents the dollar value and percentage shares of exports and imports of twenty key Canadian manufacturing sectors as well as the trade balance for each sector in 2002. In addition to transportation equipment, our key manufacturing exports include paper product (6.0 percent), machinery (5.6 percent), chemical products, primary metals, computer and electronic products, and wood products (each at about 5 percent). Major imports (aside from transportation equipment) include computer and electronic products (12 percent), machinery and chemical products (each at about 9 percent).

Table 3: Trade Balance of Manufacturing Industries, 2002

	Exports		Imports		Trade Balance
	(Billions Cdn \$)	%	(Billions Cdn \$)	%	(Billions Cdn \$)
Manufacturing Industries					
Transportation Equipment	101.58	25.63	93.39	26.79	8.19
Paper	23.83	6.01	6.57	1.88	17.26
Machinery	22.34	5.64	33.01	9.47	-10.67
Chemical	20.21	5.10	32.83	9.42	-12.62
Primary Metal	19.81	5.00	12.9	3.70	6.91
Computer & Electronic Product	19.55	4.93	41.85	12.00	-22.29
Wood Product	18.44	4.65	2.79	0.80	15.65
Food	17.1	4.32	12.63	3.62	4.48
Plastics & Rubber Products	12.64	3.19	10.99	3.15	1.66
Petroleum & Coal Products	9.97	2.52	2.87	0.82	7.1
Fabricated Metal Product	8.95	2.26	14.95	4.29	-5.99
Furniture and Related Product	7.49	1.89	3.72	1.07	3.76
Electrical Equipment, Appliance & Component	6.69	1.69	12.55	3.60	-5.86
Miscellaneous	3.87	0.98	10.57	3.03	-6.7
Clothing	3.07	0.77	6.08	1.75	-3.01
Non-Metallic Mineral Product	3.01	0.76	4.34	1.25	-1.33
Textile & Textile Product Mills	2.7	0.68	5.49	1.57	-2.79
Printing & Related Support Activities	2.04	0.51	1.27	0.37	0.76
Beverage & Tobacco Product	1.54	0.39	2.13	0.61	-0.59
Leather & Allied Product	0.44	0.11	2.52	0.72	-2.07
Total Manufacturing	305.27	77.03	313.44	89.90	-8.16
Total All Industries	396.32	100.00	348.65	100.00	47.66

Source: Industry Canada Trade Data Online and author's calculation.

Table 3 shows that computer and electronic products were the second highest manufacturing import in 2002. Because exports of this industry were less than half of the imports, the trade deficit (\$22.3 billion) was the largest among all the manufacturing industry groupings. On the other hand, the paper manufacturing industry is the second largest exporting sector in Canada, providing the largest trade surplus of \$17.3 billion in 2002.

8. Location of Manufacturing Activity

Each year, Statistics Canada publishes a report on manufacturing activity in the provinces and territories. The 2002 publication provides the value of shipments in 1999 and lists the top three manufacturing industries in each province and territory for the same year. Although the data is outdated and in many respects incomplete due to confidentiality requirements, it nevertheless sheds light on the location of manufacturing activity and on specialization by province. A summary of the key variables from this publication is provided in Table 4.

Table 4: Top Manufacturing Industries in each Province, 1999

Province	Total Manufacturing Shipments (\$'000,000s)	Industries	% Share of Total Shipments
Newfoundland & Labrador	1,969.4	Food Manufacturing Paper Manufacturing Transportation Equipment Manufacturing	41 n/a 6.9 in 2001
Prince Edward Island	1,029.1	Food Manufacturing Transportation Equipment Manufacturing Chemical Manufacturing	69 10 4.6
Nova Scotia	7,430.8	Food Manufacturing Paper Manufacturing Petroleum and Coal Products Manufacturing	25 15 n/a
New Brunswick	8,905.2	Paper Manufacturing Petroleum and Coal Products Manufacturing Food Manufacturing	24 n/a 19
Quebec	114,800.8	Transportation Equipment Manufacturing Food Manufacturing Primary Metal Products Manufacturing	12 10.4 10.3
Ontario	267,738.7	Transportation Equipment Manufacturing Food Manufacturing Chemical Manufacturing	40 8.0 6.4
Manitoba	10,140.3	Food Manufacturing Transportation Equipment Manufacturing Machinery Manufacturing	21 17 9.1
Saskatchewan	6,172.2	Food Manufacturing Primary Metal Products Manufacturing Petroleum and Coal Products Manufacturing	24 n/a n/a
Alberta	34,822.8	Food Manufacturing Chemical Manufacturing Petroleum and Coal Products Manufacturing	21 19 14
British Columbia	35,686.3	Wood Product Manufacturing Paper Manufacturing Food Manufacturing	33 17 10
Yukon, Northwest and Nunavut	33.8	Chemical Manufacturing Printing and Related Support Activities Plastic and Rubber Products Manufacturing	n/a n/a n/a

Source: Statistic Canada, Catalogue No. 31-203-XPB and author's calculation

The Atlantic Region concentrates on food manufacturing and paper manufacturing. Ontario and Quebec specialize in transportation equipment manufacturing. Food manufacturing and petroleum and coal manufacturing are the most important sector in the Prairies. For British Columbia, the top manufacturing industries are wood products and paper. Food Manufacturing is an important sector in most provinces. It is not the most important in all regions but is one of the top three industries in each province. However, in the Territories, food manufacturing is not as important. The top 3 manufacturing industries in the North are chemical products, printing and related support activities, and plastic and rubber products.

The National Post Journal publishes key financial information for 800 of Canada's largest corporations every year, ranked according to their annual revenue. Based on the latest annual publication (2003), the top 3 companies in each manufacturing industry in 2002 and their locations are listed in Appendix B.

9. Indirect Contribution of the Manufacturing Sector

So far, the importance of the manufacturing sector has been analysed in terms of the sector's direct contribution to the Canadian economy as measured by its output, (i.e. GDP), employment, etc. It is sometimes useful to broaden the analysis by examining the indirect effects of a sector's expansion or contraction on the rest of the economy. Although indirect impacts (as well as induced effects) are useful essentially in assessing the ripple effects of a shock to the economic system (for example, a new investment project, a policy change, closure of a facility, etc), they are sometimes employed to indicate the magnitude of the linkages that exist between the sector and the rest of the economy.²¹ Because of these linkages, an increase in manufacturing demand indirectly generates additional economic activity. For instance, it generates output from industries that provide inputs to the manufacturing sector at the intermediate level, along with associated jobs and investments. These indirect effects can be measured by employing the multiplier based on the Input-Output model of the Canadian economy.²²

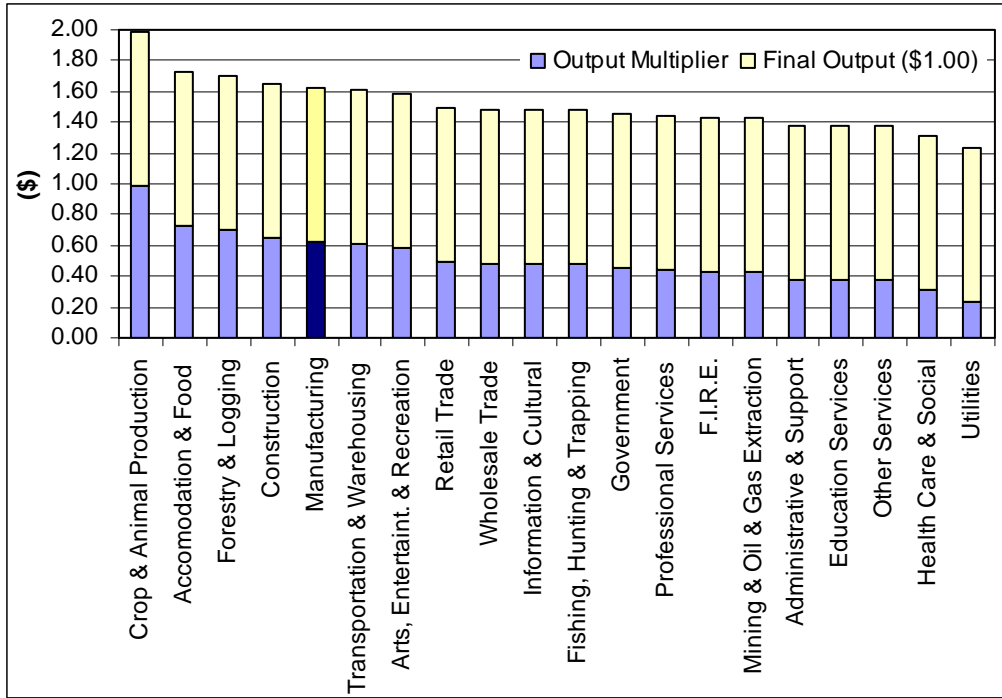
In 1999, the multiplier in the manufacturing sector was estimated at 1.62. Thus, for every dollar of manufacturing product being demanded, 62 cents of indirect or intermediate activity may be generated. As shown in figure 16, the manufacturing multiplier is generally higher than multipliers in many of the service sectors.²³

²¹ For a review of the limitation of impact analysis, see Broomhall (1993)

²² Statistics Canada calculates the multipliers by the National Open Input-Output Model. The 1999 multipliers are the most recent available data from Statistics Canada Input-Output Division at special request.

²³ When looking at a more disaggregated level, the manufacturing industries that are closely related to the primary sectors tend to have higher multipliers. (The graph at a detail level is available in Appendix C.) For instance, food manufacturing, beverage and tobacco product manufacturing, wood product manufacturing, paper manufacturing, petroleum and coal product manufacturing, non-metallic mineral product manufacturing and primary metal manufacturing have higher multiplier effects than the total of all manufacturing sector. In fact, among all the industries, the food manufacturing industry has the highest multipliers of 2.18.

Figure 16: Output Generated per Dollar of Demand Shock

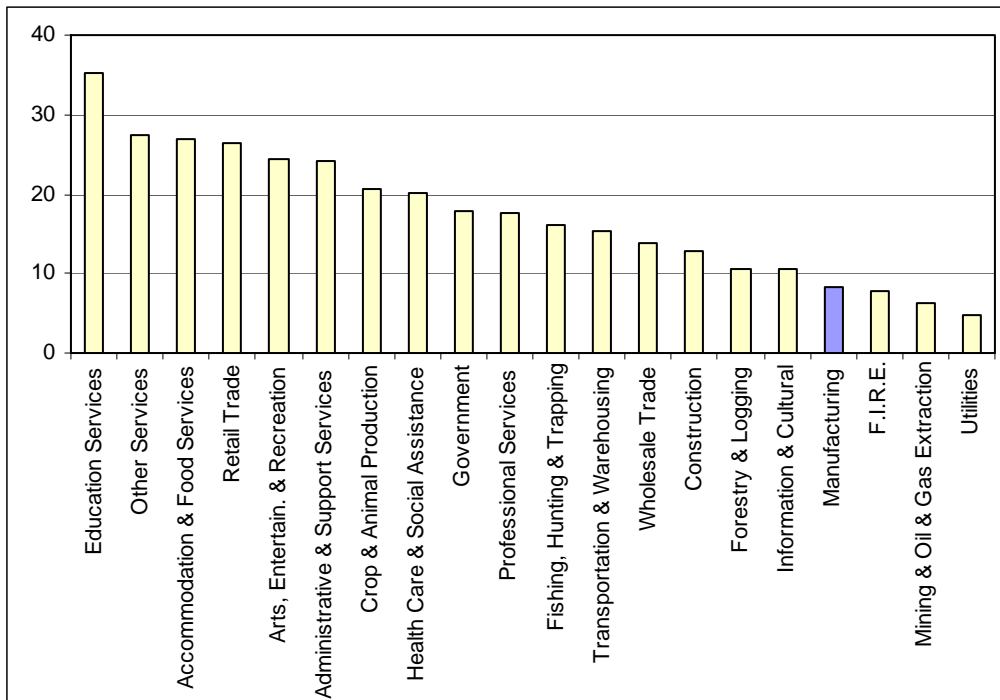


Source: Statistics Canada (Special Request)

The multiplier effect also generates extra employment in the manufacturing and non-manufacturing sectors. For every \$1 million of additional demand for manufacturing products, about 8 jobs are created as shown in figure 17. This is relatively low when compared with the service industries because the service industries tend to be more labour intensive.²⁴

²⁴ The manufacturing industries that are relatively labour intensive (i.e. relatively high ratio of employment to GDP) would have a higher employment multiplier than the total of all manufacturing industries. (The graph at a detailed level is available in Appendix C).

Figure 17: Employment Effects per Million Dollars of Final Sales



Source: Statistics Canada (Special Request)

It should be emphasized that the multiplier is not a complete measure of the economic impact. As mentioned above, induced effects may also take place and are sometimes included in impact analysis. These additional effects are generated in subsequent rounds of spending by recipients of additional income resulting from the initial expansion of output. They are usually more difficult to measure and are not included in this paper. Furthermore, the manufacturing sector has the highest share of R&D expenditure in the economy. Any knowledge spillover effects attributed to R&D are not measured. Therefore, the sector may have a larger impact on the economy than estimated by the multiplier.

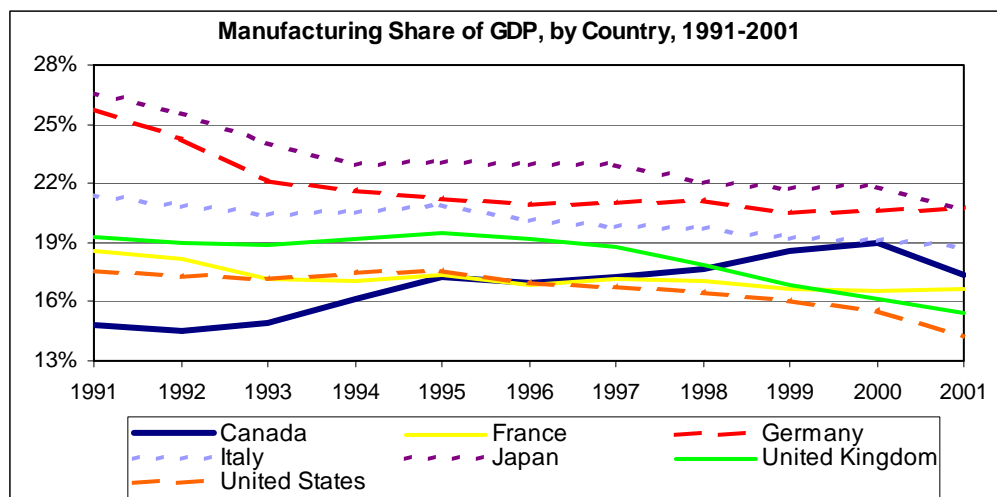
10. Manufacturing Sector in G7 Countries

Countries with different stages of development tend to specialize in different types of industry. Primary industry, such as agriculture, forestry and fishing are usually important in countries at an early stage of development. For developing countries, primary manufacturing is an important sector. As the economy of a country becomes more mature, advanced (or “high-tech”) manufacturing and service industries tend to become more important.

This section compares the importance of the manufacturing sector in the G7 countries. The data is available from the OECD OnLine Information Service and Interaction Network (OLISNET). The industry classification from this database is the International Standard Industrial Classification Version 3 (ISIC Rev.3), which is different from the SIC or NAICS being used at Statistics Canada. Therefore, in the following analysis, the data and trend for Canada may be slightly different from those shown in previous sections.

In the early 1990s, the manufacturing sector contributed between 14 and 27 percent of the G7 countries' GDP (Figure 18). During 1991-2001, the manufacturing sector declined in relative importance in all of the G7 countries except Canada. In fact, Canada seems to be the only country with an increasing share of manufacturing GDP in total output, increasing from 15 percent in 1991 to 17 percent in 2001. This may be explained in part by the fact that Canada has more than half of manufacturing shipments destined for exports.²⁵ Furthermore, because of the relatively undervalued Canadian dollar and the impact of FTA and NAFTA, the U.S. and foreign demand for Canadian manufacturing goods increased substantially during 1991-2001.

Figure 18: Share of Manufacturing GDP, 1991-2001



Source: OECD, OLISNET and author's calculation

In terms of the share of manufacturing in total employment, all G7 countries witnessed declining trends. In Canada, the share of manufacturing employment declined at the slowest rate. These output and employment trends suggest that Canada is the only G7 country that was able to maintain a relatively stable share of manufacturing GDP and had the lowest decline in manufacturing employment share. In short, the manufacturing sector has retained its relative importance in the Canadian economy in comparison to other G7 countries.

11. Conclusion

This report has shown that manufacturing sector has retained its role as a major contributor to the Canadian economy. In 2002, the sector had the highest share of real GDP, exports, and especially R&D expenditure. In the same year, the sector provided jobs with relatively higher average wages than the average of all sectors. However, the contribution by the manufacturing sector to total capital expenditure has been declining.

Among twenty manufacturing industries, transportation equipment ranks the highest in the Canadian economy, and its products are the largest item in Canadian exports. Because this key industry is mostly concentrated in Ontario and Quebec, manufacturing shipments are highest in these two provinces.

²⁵ The ratio of exports to shipments is highest in Canada.

In comparison with G7 countries, Canada was the only country with an increasing share of manufacturing in total GDP during 1991-2001. However, this should not be considered as a static phenomenon. Currently, the manufacturing sector has been fairly competitive in the global market. In order to maintain competitiveness and to sustain growth, the manufacturing sector should improve its capital investment rate to stimulate productivity growth, particularly in the light of rising Canadian dollar. Because the manufacturing sector is closely linked with other sectors in the economy, continuous growth in this sector should have a positive impact on the growth of the Canadian economy.

References:

Broomhall, David, “The Use of Multipliers in Economic Impact Estimates,” Purdue University, Cooperative Extension Service, 1993

Diaz, Jennifer, “Manufacturing in Iowa,” Center for Industrial Research and Service, [Online] <http://www.ciras.iastate.edu/mfginia.asp> (page consulted on April 14, 2003)

National Post, *FP 500: Canada’s Largest Corporations*, Toronto: National Post, June 2003.

Poole, Erik, “A Guide to using the Input-Output Model of Statistics Canada,” Statistics Canada, June 1993

Popkin, Joel, “Securing America’s Future: The Case for a Strong Manufacturing Base,” Joel Popkin and Company, Washington, D.C., June 2003.

Statistics Canada, *NAICS Canada*, Catalogue No.12-501-XPE, 2003

___, *Concepts and Definitions of the Census of Manufactures*, Catalogue No. 31-528, June 1979.

___, *Industrial Research and Development*, Catalogue No. 88-202-XIB, 2001, 2002

___, *Manufacturing Industries of Canada: National and Provincial areas 1999*, Catalogue No. 31-203-XPB, June 2002

___, *The Input-Output Structure of Canadian Economy, 1996 and 1997*, Catalogue No. 15-201-XPB, June 2001

U.S. Census Bureau, *Statistics for Industry Groups and Industries: 2001*, January 2003

Appendix A: Summary of the North American Industry Classification System (NAICS)

NAICS code	Goods Producing Industries
11	Agriculture, Forestry, Fishing & Hunting
21	Mining, and Oil & Gas extraction
22	Utilities
23	Construction
31-33	Manufacturing
311	Food Manufacturing
312	Beverage & Tobacco Product Manufacturing
313	Textile Mills
314	Textile Product Mills
315	Clothing Manufacturing
316	Leather & Allied Product Manufacturing
321	Wood Product Manufacturing
322	Paper Manufacturing
323	Printing & Related Support Activities
324	Petroleum & Coal Products Manufacturing
325	Chemical Manufacturing
326	Plastics & Rubber Products Manufacturing
327	Non-Metallic Mineral Product Manufacturing
331	Primary Metal Manufacturing
332	Fabricated Metal Product Manufacturing
333	Machinery Manufacturing
334	Computer & Electronic Product Manufacturing
335	Electrical Equipment, Appliance & Component Manufacturing
336	Transportation Equipment Manufacturing
337	Furniture & Related Product Manufacturing
339	Miscellaneous Manufacturing
	Service Producing Industries
41	Wholesale Trade
44-45	Retail Trade
48-49	Transportation & Warehousing
51	Information & Cultural Industries
52,53,55	Finance, Insurance, Real Estate, Renting and leasing, and management of companies and enterprises
54	Professional, Scientific & Technical Services
56	Administrative & Support, Waste Management & Remediation Services
61	Educational Services
62	Health Care & Social Assistance
71	Arts, Entertainment & Recreation
72	Accommodation & Food Services
81	Other Services (Except Public Administration)
91	Public Administration

**Appendix B: Location and Activity Measures of Key Canadian Manufacturing Companies
by Sector, 2002**

Company Name	Location	Revenue (\$'000s)	% Sales Outside of Canada	Assets (\$'000s)	Profits (Loss) (\$'000s)	Employees
Food Manufacturing						
GEORGE WESTON LIMITED	Toronto, ON	27446000	n/a	16630000	690000	139000
MCCAIN FOODS GROUP INC.	Florence, NB	6166377	n/a	4785638	n/a	n/a
MAPLE LEAF FOODS INC	Toronto, ON	5075879	n/a	2189247	84686	15000
Beverage & Tobacco Product Manufacturing						
MOLSON INC.	Toronto, ON	2102300	11	4521000	177600	5900
COTT CORPORATION	Toronto, ON	1881802	86	1239361	91531	2798
VINCOR INTERNATIONAL INC	Niagara, ON	376593	24	665680	26856	1753
IMPERIAL TOBACCO CANADA LIMITEE	Montreal, QC	1915000	n/a	9615000	662000	1934
Textile Mills						
LE GROUPE INTERTAPE POLYMER INC	St-Laurent, QC	944473	n/a	1109876	(85492)	2600
LES VETEMENTS DE SPORTS GILDAN INC	Ville St-Laurent, QC	600660	89	496639	66492	6000
Textile Product Mills						
COMPAGNIE BEAULIEU CANADA	Acton Vale, QC	236661	n/a	126658	n/a	1495
Clothing Manufacturing						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Leather & Allied Product Manufacturing						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Wood Product Manufacturing						
ATCO LTD	Calgary, AB	3196300	13	6403300	171600	7100
MASONITE INTERNATIONAL CORPORATION	Mississauga, ON	2542640	n/a	2308284	140583	12000
CANFOR CORPORATION	Vancouver, BC	2112300	80	2328000	11500	6500
Paper Manufacturing						
DOMTAR INC	Montreal, QC	5490000	n/a	6847000	141000	12500
ABITIBI-CONSOLIDATED INC	Montreal, QC	5122000	86	10931000	259000	16000
CASCADES INC	Kingsey, QC	3591376	51	2959429	169524	14063
Printing & Related Support Activities						
MOORE CORPORATION LIMITED	Toronto, ON	3199721	90	2271940	115015	12000
DATA BUSINESS FORMS LIMITED	Brampton, ON	207000	n/a	n/a	n/a	n/a
POLLARD BANKNOTE LIMITED	Winnipeg, MB	187745	15	103257	n/a	1300
Petroleum & Coal Products Manufacturing						
IMPERIAL OIL LIMITED	Toronto, ON	16890000	13	11868000	1210000	6460
PETRO-CANADA	Calgary, AB	10011000	20	31322000	1224000	3646
SHELL CANADA LIMITED	Calgary, AB	7232000	n/a	9355000	561000	3800
Chemical Manufacturing						
NOVA CHEMICALS CORPORATION	Calgary, AB	4855960	n/a	6561660	(127250)	4600
AGRIUM INC	Calgary, AB	3270310	n/a	3422682	n/a	n/a
DUPONT CANADA INC	Mississauga, ON	2468430	n/a	2482360	247509	3969
Plastics & Rubber Products Manufacturing						

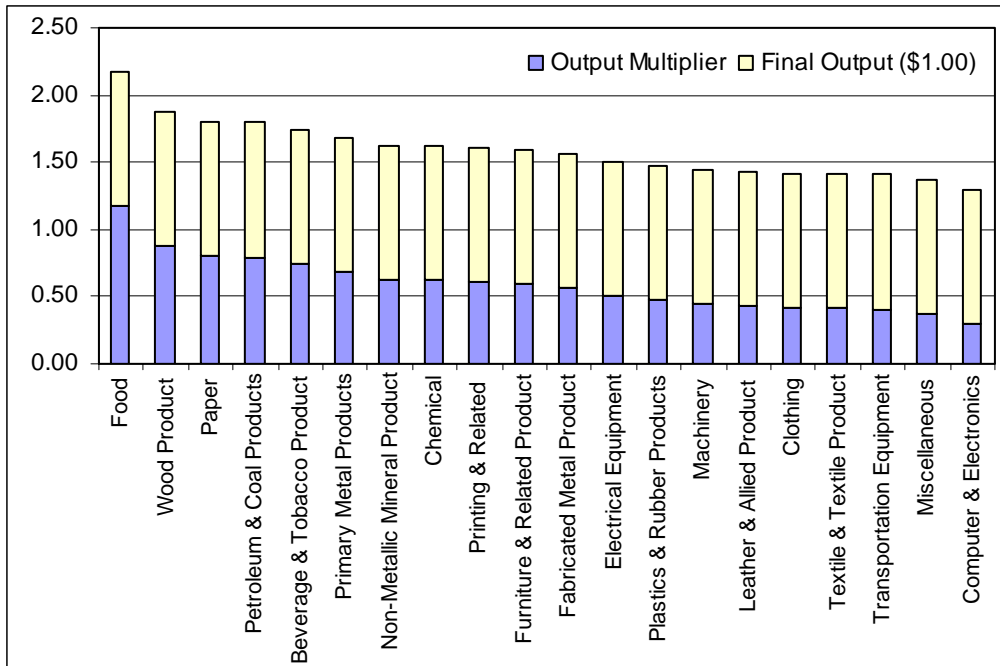
SHAWCOR LTD	Rexdale, ON	698982	80	985900	1134	4800
DOMCO TARKETT INC	East Farhan, QC	667218	85	472387	15950	2326
AMCOR SPECIALTY PACKAGING AMERICAS INC.	Mississauga, ON	550000	n/a	n/a	n/a	2500
Non-Metallic Mineral Product Manufacturing						
LAFARGE CANADA INC	Montreal, QC	2039744	n/a	n/a	n/a	n/a
GROUPE CIMENT ST-LAURENT INC	Mt Royal, QC	1189217	n/a	n/a	n/a	2059
PPG CANADA INC	Toronto, ON	905400	n/a	527344	n/a	2100
Primary Metal Products Manufacturing						
ALCAN INC	Montreal, QC	19687800	94	27674964	587180	50000
DOFASCO INC.	Hamilton, ON	3583700	31	3585100	122800	8000
STELCO INC	Hamilton, ON	2784000	17	2940000	14000	9749
Fabricated Metal Product Manufacturing						
LE GROUPE CANAM MANAC INC	Boucherville, QC	921013	54	798177	(14575)	4923
CROWN CORK & SEAL CANADA INC	Concord, ON	788000	n/a	n/a	n/a	1300
SAMUEL MANU-TECH INC	Etobicoke, ON	687765	n/a	465715	26909	n/a
Machinery Manufacturing						
SIEMENS CANADA LIMITED	Mississauga, ON	3100000	n/a	n/a	n/a	6600
CAE INC	Toronto, ON	1126500	91	2384800	150600	6000
HUSKY INJECTION MOLDING SYSTEMS LTD	Bolton, ON	911504	n/a	1113113	(19551)	2600
Computer & Electronic Product Manufacturing						
NORTEL NETWORKS CORPORATION	Brampton, ON	16538380	n/a	23382804	(5549950)	52600
IBM CANADA LIMITED	Markham, ON	5300000	28	n/a	n/a	19835
ATI TECHNOLOGIES INC	Thornhill, ON	1606147	98	1428130	(74615)	2092
Electrical Equipment, Appliance and Component Manufacturing						
JDS UNIPHASE INC	Ottawa, ON	4855960	n/a	6561660	(127250)	4600
GENERAL ELECTRIC COMPANY	Mississauga, ON	3321190	53	2856609	172545	6976
GSW INC	Oakville, ON	413851	76	245500	6520	650
Transportation Equipment Manufacturing						
GENERAL MOTORS OF CANADA LIMITED	Oshawa, ON	37000000	n/a	n/a	n/a	24500
BOMBARDIER INC	Montreal, QC	23664900	n/a	29009400	(615200)	75000
FORD MOTOR COMPANY OF CANADA, LIMITED	Oakville, ON	23328700	n/a	11398000	n/a	15074
Furniture & Related Product Manufacturing						
LES INDUSTRIES DOREL INC	Montreal, QC	1557555	97	962774	96704	4600
PALLISER FURNITURE LTD	Winnipeg, MB	518867	n/a	n/a	n/a	4720
TEKNION CORPORATION	Downsview, ON	516601	62	463589	(32006)	3600
Miscellaneous Manufacturing						
ROYAL CANADIAN MINT	Ottawa, ON	351400	61	151794	(5408)	700
MEGA BLOKS INC	Saint Laurent, QC	296427	93	195189	31661	1000

Note: n/a – not available

Source: National Post, FP500: Canada's Largest Corporations

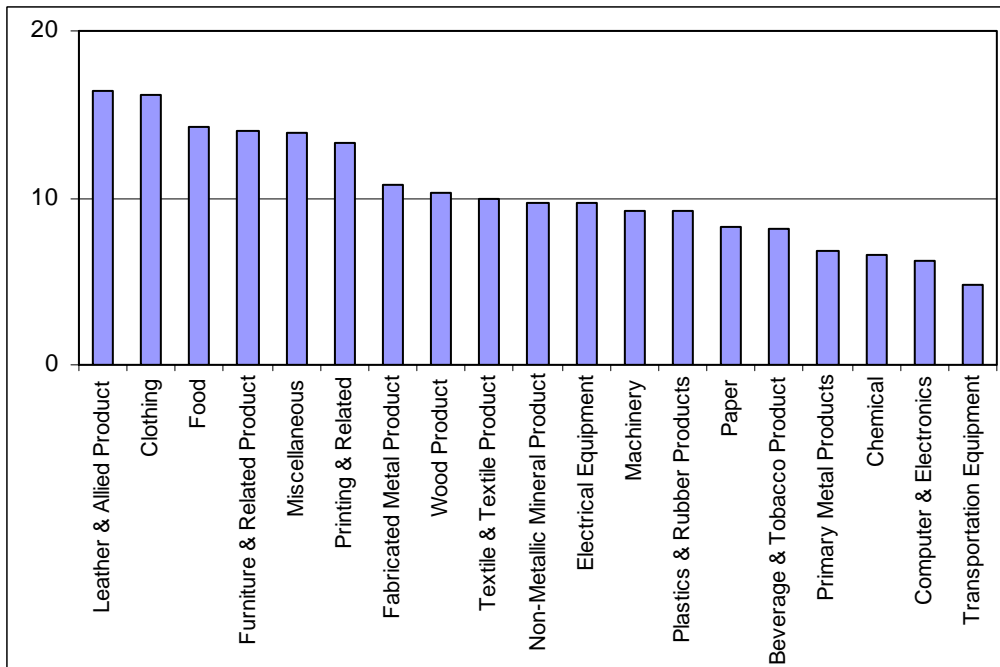
Appendix C: Multiplier Effects of Canadian Manufacturing Industries, 1999

Figure C.1: Output Generated per Dollar of Demand Shock



Source: Statistics Canada (Special Request)

Figure C.2: Employments Effect per Million of Final Sales



Source: Statistics Canada (Special Request)