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Measuring Canada's international competitiveness

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The issue of international competitiveness received much attention in the eighties as the world economy became increasingly globalized. Canadians became more and more concerned about being able to compete on world markets, although the exact nature of any competitiveness problem was often not well specified.

Does Canada in fact have a competitiveness problem? This article focuses on manufacturing and addresses the question according to three criteria:

- Are Canadian products becoming more or less price competitive?
- How successful are Canada's high-technology industries in competing in world markets?
- How has Canadian manufacturing fared in terms of productivity?

The best measure for determining trends in Canada's cost competitiveness in manufacturing is rates of change in "unit labour costs in common currency" (see *Technical notes*). This measure captures fluctuations in Canada's cost competitiveness relative to other major OECD countries. (1)

Overall cost competitiveness trends in the eighties

Canada versus the United States

Between 1981 and 1988, unit labour cost growth in Canadian manufacturing, expressed in U.S. dollars, exceeded that in the United States (3.0% per year versus 0.4%). This indicates that Canada's competitive

position vis-à-vis the U.S. was substantially weaker in 1988 than in 1981. This faster unit labour cost growth in common currency in Canada was caused by larger unit labour cost increases (3.4% per year versus 0.4%) that were only partly offset by depreciation of the Canadian dollar.

Within the 1981-88 period, Canada's cost competitiveness in manufacturing fluctuated widely. In 1982, common currency unit labour costs in Canada rose at a much faster rate than in the United States, leading to a loss of competitiveness. In 1984 and again in 1985, with the depreciation of the Canadian dollar, common currency unit labour costs rose less in Canada than in the United States. This greatly improved Canada's cost competitiveness (assuming, of course, that exchange rate fluctuations were reflected in product prices).

Canada's merchandise trade surplus with the U.S. closely reflected these changes in cost competitiveness. It almost doubled from $11.0 billion in 1982 to $21.1 billion in 1985 when Canada's relative cost competitiveness was improving.

Canada versus Europe and Japan

Between 1981 and 1988, the cost competitiveness of Canadian manufacturing deteriorated against the United Kingdom. But it remained virtually unchanged against France and improved against Japan, West Germany and Italy. The strong appreciation of the Japanese yen and the deutschemark against the Canadian dollar explains the gain in Canada's competitiveness versus Japan and West Germany. The very rapid growth in Italy's domestic currency unit labour costs (due to large increases in hourly labour compensation) explains the improvement in Canada's cost competitiveness against this country.

Within the 1981-88 period there were two large shifts in Canada's cost competitiveness vis-à-vis Japan and the major European countries, both associated with exchange rate swings. The strong appreciation of the Canadian dollar after 1980 greatly reduced Canada's competitiveness in these markets. The subsequent large depreciation of the Canadian dollar then improved the situation, and since 1987 there has been relative stability. These trends illustrate the key role exchange rate changes played in determining relative cost competitive positions in the eighties.

Canada's merchandise trade balance with these five countries has been influenced by these relative cost developments, although often after lags of one to two years. For example, the improved cost competitiveness arising from the depreciation of the Canadian dollar, starting in 1985, improved Canada's trade balance with these countries by 1987.

Chart A **Ratio of common currency unit labour cost indexes in manufacturing**

Source: *U.S. Bureau of Labor Statistics*

Recent cost competitiveness developments

Since 1986 Canada has suffered a serious deterioration in its cost competitiveness in the U.S. market. The ratio between the indexes of Canadian and U.S. unit labour costs in common currency (1977=1.0) rose from 92 in 1986 to 1.19 in 1989, a 29% jump. Indeed, the ratio in 1989 was at its highest level since the beginning of the series in 1950, indicating that Canada's cost competitiveness in the U.S. market last year was its worst in nearly 40 years. And as a result, the merchandise trade surplus fell to $13.6 billion in 1988.

Approximately 60% of the increase in relative unit labour costs in Canada vis-à-vis the United States between 1986 and 1989 was due to the appreciation of the Canadian dollar. The remaining 40% was attributable to greater growth in domestic currency unit labour costs in Canada, caused by both faster growth in hourly labour compensation and slower productivity growth.

VIEW ▶ Chart B **Relative unit labour costs in manufacturing, Canada/United States**

Source: *U.S. Bureau of Labor Statistics*

Most current estimates of the purchasing power parity (PPP) value (2) of the Canadian dollar in terms of the U.S. dollar are in the 78 to 80 U.S. range. This suggests that the Canadian dollar was over-priced at the average of 85 U.S. in 1989. Factors behind the disparity between the PPP value and the exchange rate included historically high interest rate differentials between Canada and the United States, and strong investor confidence in the Canadian economy.

This high value of the Canadian dollar is the main reason for the current weakness of Canada's cost competitiveness in the U.S. market. Past experience, however, suggests that exchange rates gravitate towards purchasing power parity levels, although sometimes only after long lags. Since 1950, the ratio between the Canadian and U.S. unit labour cost indexes has never deviated more than 10% from 1.0 for more than three years. This supports the view that the current weakness in cost competitiveness is temporary and will be eliminated when the exchange rate adjusts to its purchasing power parity value.

Relative to Japan and the four major European countries, Canadian manufacturing did not suffer any significant loss in cost competitiveness in 1987 or 1988 (Table 1). This reflects the lack of any significant appreciation of the Canadian dollar vis-à-vis these countries currencies.

VIEW ▶ Table 1 **Trends in international competitiveness and determinants in manufacturing in major OECD countries**

Source: *International Comparisons of Manufacturing Productivity and Labor Costs Trends, 1988, U.S. Bureau of Labor Statistics, June 1989.*

Canadian competitiveness in high-technology products

Within manufacturing, one sector warrants special mention - high-technology products. Essentially two types of criteria exist for evaluating the competitiveness of a country's high-technology sector: (1) indicators showing the capacity to produce high-technology goods (such as research and development expenditure, the number of patent applications and the number of research and development personnel); and (2) indicators reflecting the ability to sell high-technology goods on the world market (such as high-technology trade balances and self-sufficiency ratios). (3)

In 1985 among the seven major OECD countries, Canada had the second lowest ratio of research and development expenditure to GDP. Canada's relative performance was also below that of Switzerland, the Netherlands, Norway, and Finland.

Other indicators of a country's capacity to produce high-technology products also show Canada trailing its major competitors. For example, in 1985, patent applications in Canada on a per capita basis were less than half that of the United States and France, one-third that of the United Kingdom, one-sixth that of Germany, and less than one-eighth that of Japan. According to the OECD, the ratio of research and development personnel was also well below that in the other countries.

VIEW ▶ Chart C **Research and development expenditure, 1985**

Source: *OECD, Paris*

The reasons for Canada's low level of research and development expenditure are vigorously debated. Possible factors include Canada's high level of foreign ownership, with multi-nationals centralizing

research and development at the head office; an industrial structure characterized by a high proportion of industries that traditionally undertake little research and development; and a basic reluctance by Canadian firms to make risky research and development expenditures.

The weakness of our technological effort, not surprisingly, leads to large trade deficits in high-technology products. Indeed, Canada has by far the lowest ratio of exports to imports in high-technology products among the seven major OECD countries.

In 1987, Canada ran a trade deficit of $7.2 billion in the high-technology area, up from $5.4 billion in 1981 (Table 2). This represented about 3% of total trade (exports plus imports), a proportion that has been relatively stable since the late seventies. For specific high-technology products, as defined by Statistics Canada, the largest deficits are in computers, electronic equipment, scientific instruments, electric machinery and non-electrical machinery (Table 3). In two high-technology product areas where Canadian firms are doing significant research and development (telecommunications and aerospace), Canada does not have significant trade deficits. (4)

VIEW ▶ Chart D **Export/import ratios in high technology products, 1985**

Source: *OECD, Paris*

VIEW ▶ Table 2 **Balance of trade in "high-tech" goods**

Source: *Table 72, Science and Technology Indicators, 1988, cat. 88-201, March 1989, Statistics Canada*

VIEW ▶ Table 3 **Balance of trade in "high-tech" products, 1981 and 1987 (millions of dollars)**

Source: *Table 68, Science and Technology Indicators, 1988, cat. 88-201, March 1989, Statistics Canada*

The high-technology deficit manifests itself in machinery, electrical products, and other manufacturing, as indicated by the low self-sufficiency ratios (Table 4). Canada enjoyed large trade surpluses in wood,

paper, and primary metals - industries characterized by homogeneous products and relatively little product innovation.

VIEW ▶ Table 4 **Implicit self-sufficiency rates* in manufacturing**

Sources: *Manufacturing Trade and Measures, 1966-84, Regional Industrial Expansion, 1985 for data for 1966 and 1973; Manufacturing Trade and Measures, 1981-87, Industry, Science and Technology Canada, 1988 for data for 1981 and 1987*

***** *The ratio is defined as total shipments divided by the Canadian market.*

It appears that, relative to its major competitors, Canada is not competitive in high-technology products. However, there are divergent views on whether the weakness in high technology is in fact a general competitiveness problem.

High-technology and competitiveness

A dynamic high-technology sector is viewed by some as being essential to a country's overall ability to compete on world markets. This sector is said to foster new technologies that boost productivity in all sectors of the economy. Some analysts argue that without a strong domestic high-technology sector innovation and productivity advances would be more difficult in the more traditional sectors.

In addition, without innovative high-technology industries to generate new products, a country's potential for growth may be restricted. Future demand growth for high-technology products on world markets is expected to greatly exceed that anticipated for more traditional products, particularly natural resources-based commodities. This reasoning suggests that, without a strong high-technology sector, a country may become a technological backwater, unable to compete in the emerging sectors that are expected to fuel the future growth of the world economy. From this perspective, weakness in high- technology products implies a general lack of international competitiveness.

In contrast, other analysts feel that a weak high-technology sector does not necessarily mean a country has a general competitiveness problem. From this viewpoint, a country can function very well in terms of maintaining a high standard of living for its citizens, and in improving that standard, without being internationally competitive in high-technology products.

Rather, a country can import these products and concentrate on areas, such as natural resources or labour-intensive products, where its basic comparative advantage may lie. Weak high-technology industries do not necessarily mean industries cannot adopt the latest technology. Large, and even growing, high-technology deficits do not indicate any lack of overall competitiveness if there are commensurate surpluses in other areas. From this viewpoint, developments in the overall trade balance and cost structure

are more important than developments in any one sub-aggregate - even the supposedly crucial high-technology sector.

Those sympathetic to the first perspective would consider that Canada's weakness in high-technology products indicates a general competitiveness problem. Those subscribing to the second view would conclude there is no cause for concern.

Canada's ability to increase productivity

A country can in theory maintain and even improve its cost competitiveness through currency depreciation, irrespective of domestic trends in hourly labour compensation and productivity. However, when productivity growth is weak (either in an absolute sense or relative to its major competitors), an exchange rate depreciation reduces the country's standard of living (either in absolute terms or relative to trading partners) because of the increased cost of imports.

For this reason, the proper test of competitiveness may not simply be the ability to sell goods on the world market and achieve balanced trade. Rather, it may be the ability to do so while achieving an acceptable rate of improvement in the standard of living (Hatsopoulos, Krugman and Summers, 1988; and Young, 1988). A key determinant of the rate of improvement in the standard of living is productivity growth. By this criterion, a country's productivity performance is a key factor in its general competitiveness performance.

Canada's productivity growth in manufacturing trailed its major competitors in the eighties. Indeed, between 1981 and 1988, U.S. Bureau of Labor Statistics data show that output per hour in Canadian manufacturing rose 2.3% per year, the lowest rate of increase among the seven major OECD countries (Table 1). OECD data for the 1979-85 period also show that Canada had the worst performance (Table 5) in terms of both the growth rate of output per person employed and total factor productivity. (5)

VIEW ▶ Table 5 **Trends in productivity growth in manufacturing in major OECD countries (average annual percent change)**

Source: *Table 20, OECD Economic Outlook, December, 1987*

Summary and conclusion

This article has examined whether Canadian manufacturing has a general competitiveness problem from three perspectives: cost competitiveness, the performance of the high-technology sector, and the relative

ability to raise productivity. In all three areas a case can be made that Canada has a general competitiveness problem.

Large increases in common currency unit labour costs since 1986 (due to the strong appreciation of the Canadian dollar vis-à-vis the U.S. dollar) have led to a significant deterioration in the cost competitiveness of Canadian manufactured goods in the U.S. market. From a long-term perspective, this competitiveness problem is probably the least serious of the three types of problems discussed. If historical experience is any guide, the exchange rate will eventually adjust towards its purchasing power parity value and restore Canadian cost competitiveness. A key factor in determining the length of time needed for adjustment will be developments in interest rate differentials between Canada and the United States.

Canada's large trade deficits for most high-technology products and its weak capacity to develop new products suggest that it has a general competitiveness problem. Such a conclusion, however, presumes that a country can be considered internationally competitive only if it has a dynamic high-technology sector. This view relies on the belief that the high-technology sector is crucial for the long-term health of the economy (1) because of its role in creating a favourable technological environment for productivity advances in all sectors, and (2) because high-technology products have the greatest growth potential.

If one does not accept this view, then Canada's poor performance in high-technology products is not necessarily indicative of a general competitiveness problem. Canada can still be considered internationally competitive if it continues to be successful in selling products reflecting its comparative advantage. In addition, proponents of this view believe that a weakness in the high-technology sector does not necessarily imply that other products cannot be produced with the latest technology.

Canada's ability to improve its overall productivity level relative to its competitors, however, may indeed indicate a competitiveness problem. In the eighties Canada's productivity growth in manufacturing was the slowest among the major OECD countries. This situation represents the most serious potential competitiveness problem facing Canada, and hence its greatest challenge. Unlike the weak cost competitiveness position, it is a long-term, not a short-term, phenomenon. And, unlike the weakness of its high-technology sector, there is a consensus that this situation could impede Canada's future ability to compete in world markets.

Technical notes

Relative unit labour cost indexes: A cost competitiveness indicator

An historical perspective on cost trends can be obtained by comparing ratios between unit labour cost indexes (in common currency) over time. The indexes are published by the United States Bureau of Labor Statistics. By definition, relative unit labour cost ratios are 1.0 in the chosen base year (1977) since all countries have a unit labour cost index of 100. Country A is more cost competitive relative to 1977 vis-à-vis country B if the ratio of the unit labour cost indexes (with the index of country A as the numerator) is less than 1.0, and less cost competitive if the ratio exceeds 1.0. The year when country A's cost competitiveness relative to country B is greatest is the year with the lowest ratio; the year when it is poorest is the one with the highest ratio.

The manufacturing sector is the focus of attention in competitiveness analysis for several reasons. First, it is this sector that provides the bulk of the goods traded on world markets. Second, data are much more readily available for manufacturing than for other sectors. Finally, cost trends in other sectors generally are similar to those in manufacturing so manufacturing trends are a good proxy for those in the overall trading sector of the economy.

Absolute price levels of manufactured goods would be the preferred measure of competitiveness. However, the availability of data on international prices of manufactured goods is much more limited than labour cost data, so the latter are generally used for international competitiveness comparisons. Costs, either in level form or in rates of change expressed in a domestic currency, are by definition not comparable between countries. Only when expressed in a common currency, usually U.S. dollars, can international comparisons be made for both cost trends and levels in order to assess international cost competitiveness.

Data sources

Data on trends in unit labour costs in manufacturing are from the U.S. Bureau of Labor Statistics (BLS) publication ***International Comparisons of Manufacturing Productivity and Labor Costs Trends, 1988***. This semi-annual publication (released in July and December) provides a long time series on output, employment, hours, productivity, labour compensation and unit labour cost trends in manufacturing for 12 industrial countries (Canada, the United States, the United Kingdom, France, Italy, Germany, Japan, Belgium, Sweden, the Netherlands, Norway and Finland) for the postwar period. Recently, data for Korea and Taiwan have been included. Data are presented in index form whereby all variables for all countries are set at 100 in 1977.

Data on Canada's high technology trade are from the Statistics Canada publication ***Science and Technology Indicators*** (cat. 88-201), which provides a wide range of data on the use of science and technology in Canada. Data on self-sufficiency in manufacturing are from ***Manufacturing: Trade and Measures***, published by Industry, Science and Technology Canada. This source provides data on import penetration, export orientation, trade balances as well as self-sufficiency. Data on science and technology indicators for OECD countries are from the ***OECD Science and Technology Indicator Report*** series, which are the best sources of information for internationally comparable data on a country's performance in the science and technology area.

Notes

Note 1

The data are in index form, so no conclusion can be drawn about the absolute degree of competitiveness. Costs are defined as equalling 100 in a base year, and costs in other years are calculated as a percentage of the base year plus 100. For example, if 1977 is the base year and labour costs in 1987 are 50% higher, then the index for 1987 would be 150.

Note 2

Purchasing power parity (PPP) exists between two countries when a given amount of money expressed in a common currency purchases the same amount of goods in both countries. When parity does not prevail, traders can purchase goods in the cheaper country and sell them in the other. This process in turn affects supply and demand conditions in the two countries and moves the exchange rate towards the purchasing power parity level. The prime determinant of the purchasing power parity exchange rate between two countries is their relative rates of inflation as the PPP rate adjusts so that price levels in the two countries remain constant when measured in a common currency. To keep purchasing power constant between two countries, the country with a higher domestic rate of inflation experiences a depreciation in its nominal exchange rate. In 1989, the OECD estimated that the PPP value of the Canadian dollar vis-à-vis the U.S. dollar was around 80¢ U.S., compared to the actual value of 84¢ U.S.

Note 3

Self-sufficiency ratios provide information on both the absolute level and the trends in a country's competitiveness at both an aggregate and industry level. The greater the ability of a country to supply itself with a particular product, the greater its competitiveness. The ratio is defined as total shipments divided by the Canadian market. A ratio exceeding 1.0 indicates that Canada produces more than it consumes and hence enjoys a trade surplus in that area; a ratio less than 1.0 means Canada consumes more than it produces and has a trade deficit.

Note 4

Canada does have a significant trade surplus in automotive products, considered by some analysts to be a high-technology product, although not defined as such in official definitions of high technology. This surplus reflects Canada's cost competitiveness in this area vis-à-vis the United States, which has led the auto companies to increase Canada's share of the North American market.

Note 5

Total factor productivity is calculated by dividing an index of total factor input into an output index. The growth rates of factor inputs, generally labour and capital but sometimes also raw materials, are combined

into a total factor input growth rate by weighting the factors by their income share, assuming that these shares reflect the factor's relative contribution to output.

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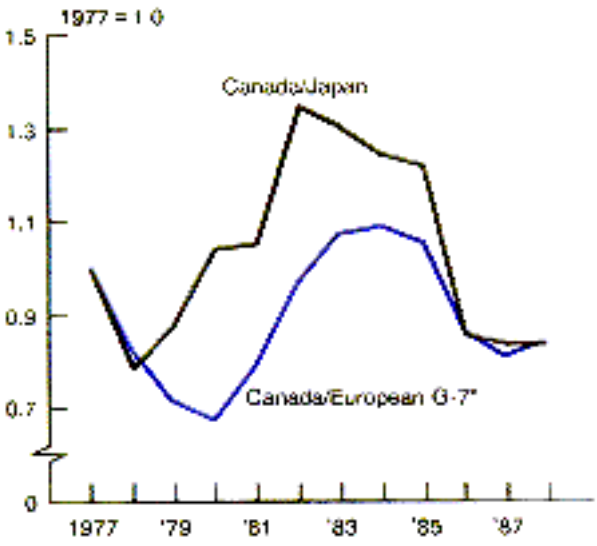
Ratio of common currency unit labour costs indexes in manufacturing

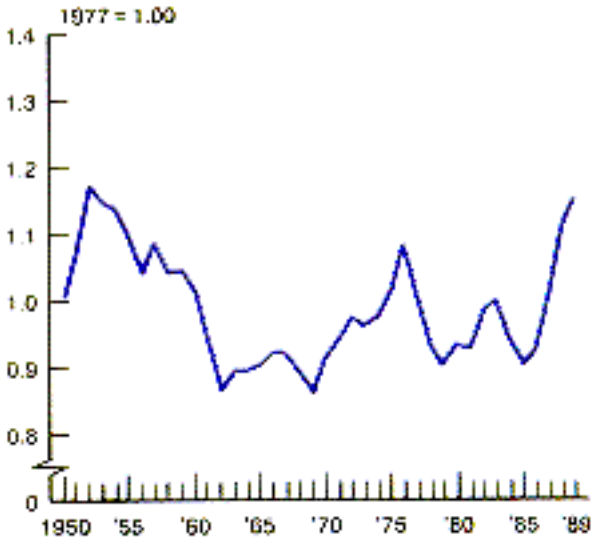
In the early and mid-80s Canada's relative unit labour costs were rising more rapidly than those of Japan or Europe.



Source: U.S. Bureau of Labor Statistics
** Average of France, Italy, U.K. and West Germany (trade weighted)*

Relative unit labour costs in manufacturing, Canada/United States

Since 1950 the ratio of unit labour cost indexes has never deviated more than 10% from unity for more than three years.



Source: U.S. Bureau of Labor Statistics

Table 1

Trends in international competitiveness and determinants in major OECD countries

	Unit labour costs ($U.S.)	Exchange rate (versus $U.S.)	Unit labour costs* (domestic currency)	Hourly labour compensation	Output per hour
Average annual rate of change, 1981-88			%		
Canada	3.0	-0.4	3.4	5.8	2.3
U.S.	0.4	-	0.4	4.3	4.0
Japan	6.2	8.1	-1.7	4.0	5.9
Germany	5.4	3.6	1.7	4.7	2.9
France	3.4	-1.3	4.8	8.4	3.4
U.K.	0.1	-1.8	1.9	7.4	5.4
Italy	4.7	-1.9	6.7	11.2	4.2
Unweighted average	3.3	1.1	2.5	6.5	4.1
Annual rate of change, 1987					
Canada	8.2	4.7	3.3	5.1	1.7
U.S.	-1.0	-	-1.0	2.7	3.7
Japan	10.4	16.4	-5.1	2.3	7.8
Germany	23.8	20.7	2.6	3.9	1.3
France	19.0	15.2	3.3	4.6	1.2
U.K.	11.7	11.8	-	6.4	6.4
Italy	19.4	15.0	3.8	6.5	2.5
Annual rate of change, 1988					
Canada	10.9	7.7	3.2	4.9	1.7
U.S.	0.9	-	0.9	3.6	2.7
Japan	10.5	12.8	-2.1	5.4	7.6
Germany	1.8	2.3	-0.5	4.1	4.6

France	-0.8	0.9	-1.6	3.6	5.3
U.K.	11.8	8.6	2.9	8.0	4.9
Italy	2.9	-0.4	3.4	6.4	2.9

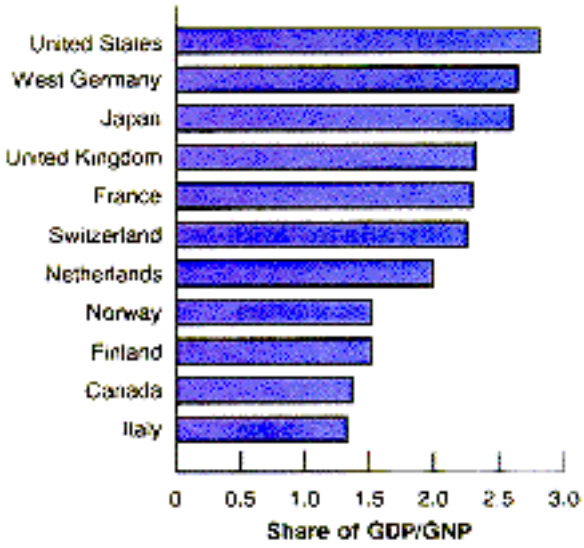
Source: International Comparisons of Manufacturing Productivity and Labor Costs Trends, 1988, U.S. Bureau of Labor Statistics, June 1989.

** Certain relationships exist between the columns. Changes in unit labour costs in domestic currency are determined by the interaction of hourly labour compensation and output per hour trends (column 4 minus column 5).*

Changes in unit labour costs in U.S. dollars in turn are determined jointly by developments in unit labour costs in domestic currency and the exchange rate (column 3 and column 2).

Research and development expenditure, 1985

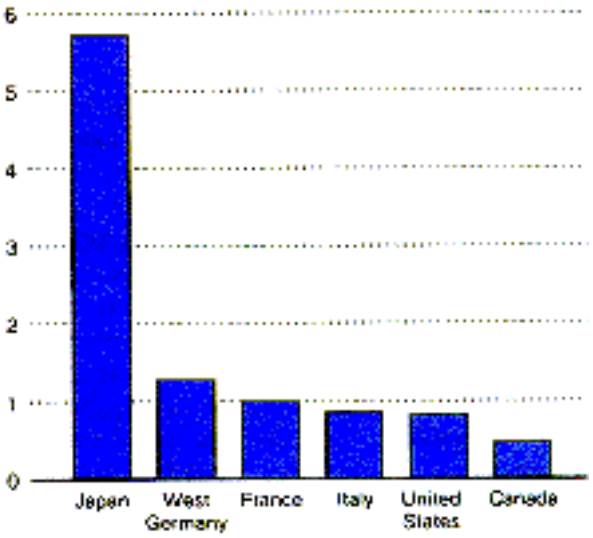
Canada's ratio of R&D expenditure to GDP lagged behind most of the major OECD countries.



Source: OECD, Paris

Export/import ratios in high-technology products, 1985

Overall, Canada is not competitive in high-technology products.



Source: OECD, Paris

Table 2

Balance of trade in “high-tech” goods

	Millions of dollars (current dollars)	Proportion to total merchandise trade (exports + imports)
		%
1978	-2,990	2.9
1979	-3,785	3.0
1980	-4,611	3.2
1981	-5,447	3.4
1982	-4,232	2.8
1983	-5,097	3.1
1984	-6,382	3.2
1985	-6,368	2.9
1986	-7,011	3.1
1987	-7,166	3.0

Source: Table 72, Science and Technology Indicators, 1988, cat. 88-201, March 1989, Statistics Canada

Table 3

Balance of trade in "high-tech" products, 1981 and 1987 (millions of dollars)

	1981	1987
Aerospace	-279	410
Computers	-1,376	-2,680
Electronic equipment	-504	-1,115
Telecommunications equipment	20	-36
Scientific instruments	-1,146	-1,393
Electrical machinery	-537	-669
Non-electrical machinery	-1,490	-1,468
Chemical products	-134	-215
Total	**-5,447**	**-7,166**

Source: Table 68, Science and Technology Indicators, 1988, cat. 88-201, March 1989, Statistics Canada

Table 4

Implicit self-sufficiency rates* in manufacturing

	1966	1973	1981	1987
Food and beverage	103.4	102.3	100.9	102.3
Tobacco	99.4	99.0	107.9	105.1
Rubber and plastics	89.1	85.2	89.2	92.1
Leather	89.6	79.4	71.5	56.9
Textile	78.6	77.9	83.3	85.7
Knitting	90.3	75.2	76.1	68.2
Clothing	97.0	97.2	86.9	77.9
Wood	150.6	168.1	160.1	172.9
Furniture	96.9	95.5	97.9	107.5
Paper	188.7	186.4	218.5	209.5
Printing and publishing	88.9	88.7	88.9	92.9
Primary metals	132.5	137.0	129.2	130.3
Metal fabricating	90.8	89.9	94.2	96.8
Machinery	53.5	52.0	56.5	54.7
Transport equipment	88.6	93.9	88.3	97.8
Motor vehicle	105.1	121.7	123.1	127.8
Motor vehicle parts	57.1	61.9	52.3	68.5
Electrical	86.0	78.9	70.1	67.6
Non-metallic	89.9	92.6	90.4	91.8
Petroleum and coal	90.0	101.0	105.1	99.8
Chemicals	90.0	85.3	97.9	93.4
Other	69.4	59.2	60.2	57.8
Total manufacturing	**97.2**	**97.2**	**97.3**	**98.3**

Sources: Manufacturing Trade and Measures, 1966-84, Regional Industrial Expansion, 1985 for data for 1966 and 1973; Manufacturing Trade and Measures, 1981-87, Industry, Science and Technology Canada, 1988 for data for 1981 and 1987

** The ratio is defined as total shipments divided by the Canadian market.*

Table 5

Trends in productivity growth in major OECD countries (average annual percent change)

	Labour productivity			Total factor productivity*		
	Pre-1973	1973-79	1979-85	Pre-1973	1973-79	1979-85
	%					
Canada	4.5	1.6	1.5	3.0	0.4	0.1
U.S.	3.2	1.3	3.4	2.8	0.3	2.5
Japan	10.9	5.6	6.2	6.5	2.2	4.5
Germany	5.9	4.3	3.1	2.9	2.2	1.5
France	7.1	4.9	3.5	4.9	2.4	1.2
U.K.	4.6	1.2	3.9	2.9	-0.4	1.9
Italy	8.0	3.3	3.3	4.4	1.7	1.3

Source: Table 20, OECD Economic Outlook, December, 1987

** Labour input for total factor productivity is persons employed, and hours worked for labour productivity.*