

# About productivity

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*This article is based on information available as of November 23, 1992. It does not reflect revisions to 1991 data made after that date.*

**F**or many years Canada enjoyed a favourable growth in productivity compared with other countries. Consequently, Canadians experienced a remarkable increase in their standard of living in the post-war period. But since the beginning of the 1980s, this lead has slipped.

Because of its small domestic market, Canada is heavily dependent on exports to sell its products and thus benefits from economies of scale. It must be able to offer its products at competitive prices. This is even more important in a period of freer international trade. To remain competitive and increase - or at least maintain - our standard of living relative to other countries, productivity must continue to grow.

This article discusses the concept of productivity and its measurement. Since productivity and production costs are linked to the competitiveness of a country, unit labour cost and labour compensation are also examined. In addition, productivity trends over the last 30 years are analysed.

## How is it measured?

The economic growth of a country is usually measured by its increase in production or the gross domestic product (GDP), which comes from two sources: a larger quantity of production factors used (inputs) and/or an increase in productivity. Productivity is therefore considered to be a component of growth.

There is an increase in productivity if the quantity of inputs decreases while the quantity of goods and services produced remains constant, or the quantity of goods and services produced increases with the same quantity of inputs. There is also productivity growth if the price of goods and services produced decreases while the price of inputs remains constant ([Figure 1](#)).



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## Figure 1 Productivity growth results from one of these scenarios.

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### Why measure it?

The productivity measure has several purposes. It is used principally to compare the economic performance of one country with that of another. It can also be used as an efficiency indicator; for example, it can help identify which industry sector is losing ground while another is expanding rapidly. Unions use it to justify wage increases; if labour productivity improves, they may claim a part of that increase. (1) Lastly, the productivity measure can be used by company managers to compare their performance with that of competitors or with that of the industry as a whole.

Productivity can be examined in terms of the full range of production factors - capital, labour, and intermediate goods and services (including natural resources) - or a single factor such as labour.

### Labour productivity

Although for a number of years Statistics Canada has produced productivity measures that incorporate all production factors, these are relatively new and considered experimental (see [Multifactor productivity index](#)). The most widely used measure is that of labour productivity. However, it is considered a partial one in that, theoretically, it reflects only the contribution of the labour factor.

Labour productivity is usually calculated by production or real gross domestic product (GDP) (2) per person-hour worked or by production (real GDP) per person employed. (3) This article is concerned only with the first measure.

The productivity index of the largest segment of the economy published by Statistics Canada is that of the business sector, which excludes government administration and non-commercial services (most public education and health services, for example). (4) The service industries which have a productivity measure are: transportation and storage, communication, wholesale and retail trade, and community, business and personal services.

### Labour productivity and the standard of living

A link is often made between an increase in labour productivity and growth in the standard of living. (5) These two variables have, in effect, developed in tandem during the post-war years ([Chart A](#)).



## Chart A Productivity and the standard of living have risen in a similar way in the post-war years.

Source: *Input-Output Division and Consumer Price Index*

The link between labour productivity and the standard of living is established in the following way: an increase in productivity decreases the unit labour cost which leads to a decrease in the price of goods and services produced, a growth in domestic and foreign consumption (therefore more exports), and lastly, an increase in production. Initially, an increase in production will entail a greater use of equipment and, eventually, an increased demand for workers. This would lead to growth in employment and real wages and, consequently, in the standard of living. Within a country, however, there can be disparities in productivity by region, as well as by industry, which can produce differences in the standard of living.

## Factors affecting labour productivity

Because of the method used to calculate the labour productivity index, variations in this measure can hide fluctuations in many factors other than labour. In a closed economy, the most important variables likely to influence the index are those relating to: labour (such as investment in human capital, the type of management and labour relations); capital investments; research and development (R&D); and government regulations ([Tawfik and Chauvel](#), 1980).

In an open economy, other elements enter the equation. If the value of a country's currency is high - as seen these past few years - this can reduce the demand for its products, since the price of its exports increases and that of its imports decreases. Thus, even if its exporting industries register an increase in productivity, this does not necessarily mean a lower price for foreign consumers. On the other hand, a high exchange rate encourages industries to be innovative in order to remain competitive. Some analysts observed this phenomenon in the United States at the beginning of the 1980s. As the exchange rate of the U.S. currency was high, [\(6\)](#) many manufacturers were obliged to rationalize operations and replace equipment to remain competitive internationally ([Economic Council of Canada](#), 1992).

## Two related indices

The productivity index is only one aspect of the economic performance of a country, and it is difficult to approach this topic without touching on the question of unit labour cost (ULC). The ULC is defined as the cost (or compensation) [\(7\)](#) of labour per unit of real output or, alternatively, by the ratio of labour compensation per person-hour worked to labour productivity. [\(8\)](#) ULC growth does not necessarily

damage a country's competitiveness. If the country's currency depreciates vis-B-vis its foreign competitors, the country may remain competitive internationally despite growth in domestic ULC. (9)

Inflation can affect the ULC unless it is widespread and at a similar level in most of the countries that are trading partners. An overall increase in prices is usually followed by rising wage demands, which can lead to inflationary spirals such as those seen in the 1970s and 1980s. Obviously, when compensation is affected, the ULC is also. The ULC reflects both a country's inflation rate (because of its numerator, labour compensation per person-hour) and any improvement in competitiveness through technological change (because of its denominator, labour productivity).

Unless a country has a net advantage over competing countries in the production of a good or service, or can specialize in products or services for which price is less important in the decision to purchase, (10) the ULC will always have a considerable impact on international trade. That is, it affects the sale price of goods and services produced.

## Relationship between the indices

The growth rates of the ULC and labour compensation move inversely to the rate of growth in labour productivity. (11) Thus from 1961 to 1973, while the productivity index grew at an impressive rate ([Chart B](#)), those of the ULC and labour compensation increased at a slower rate ([Chart C](#)). The opposite occurred from 1973 to 1982, and from 1984 to 1989, when large increases in the ULC and compensation indexes were accompanied by more modest increases in the productivity index.



**Chart B Growth in the productivity index has slowed since 1975**

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**Chart C ... while compensation and unit labour cost have progressed rapidly.**

*Source: Input-Output Division*

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But, at the onset of the recent recession, labour productivity dropped 1.2% between 1989 and 1990, the biggest decline since Statistics Canada began estimating this measure in 1946. Labour compensation

growth slowed, while the unit labour cost increased at almost the same pace as the previous year. However, as the recession progressed into 1991, there was a surge of 1.8% in labour productivity, but this time the ULC recorded the lesser increase of the two other measures ([Table 1](#)).



## Table 1 Year-over-year change in the business sector indexes

Source: *Input-Output Division*

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### Long-term trends

Most analysts agree that one of the challenges now facing Canada is to curb the decline of the productivity growth rate in order to re-establish Canada's competitive position in the global market.

If the years between 1961 and 1991 are divided into three distinct periods (1961 to 1975, 1975 to 1982 and 1982 to 1991), a marked drop in the average growth rate of the productivity index during the last two periods (3.3% compared with 1.5% and 1.4%, respectively) is evident. The drop between the first and second periods is often linked to the oil shock of 1973, felt by most industrialized countries. However, this event does not explain the weak average productivity growth rate during the third period (1982 to 1991). In view of these relatively weak growth rates, is Canada losing ground?

The declines observed in net exports between 1988 and 1991 are often cited as a sign of the deterioration in Canada's competitive position ([Chart D](#)). However, several factors besides the decrease in the productivity growth rate are responsible for this. Among them are: the appreciation of the Canadian dollar (more than 21% between 1986 and 1991); the gap between the Canadian and U.S. central bank rates, which reached 4 percentage points in 1991; and the economic slowdown observed in most of the industrialized countries, especially in the United States ([Aggregate productivity measures](#), Statistics Canada, 1992). Without downgrading the impact of the weak productivity growth rate on the competitive position of Canadian business, it is obvious that all these events have not made things any easier.



## Chart D Since 1988, Canada's competitive position appears to have deteriorated.

Source: *Input-Output Division*

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However, the recent growth in productivity together with a slower increase in the ULC may signal an improving situation ([Table 1](#)). Many businesses are giving greater attention to costs and productivity, and are adjusting more quickly to the vagaries of demand. Another encouraging sign is that, in spite of the economic slowdown, public and private investment has hovered around 16% of GDP ([12](#)) since 1988.

## Productivity by sector

Up to this point, the discussion has centred on the business sector as a whole. But what is the situation at a more detailed level?

Historically, the productivity growth rate in the goods sector has always been higher than in the service sector ([Table 2](#)). The gap has nevertheless narrowed since the 1981-82 recession. In the service sector, an increase in productivity often results in an improvement in quality as opposed to a growth in quantity. But existing statistics do not permit a measurement of the value of an improvement in quality in certain industries. For example, automated banking machines have improved some of the services offered by the banking system in recent years. But since some aspects of these services have no direct costs, it is difficult to determine their value.

From 1961 to 1991, the four industries with the highest average annual growth rates were communication (5.8%), agriculture (3.9%), transportation and storage (2.8%) and manufacturing (2.7%). Although manufacturing places fourth, a slowdown in the growth rate of its productivity can be seen after the first period ([Table 2](#)). The size of this industry in proportion to the total GDP is such that it could affect the productivity growth rate for the entire business sector. As well, this industry produces the largest part of Canada's exports (from 75% to 80%).



### Table 2 Average annual variation in the labour productivity index in the business sector\*

*ISource: Input-Output Division*

\* *Averages are geometric means.*

However, manufacturing showed an improvement in its productivity growth rate between the second and third periods (1.5% and 2.2%, respectively). But even though Canada had a period of economic growth during most of the 1980s, the productivity growth rate has stalled since 1985 ([Chart E](#)).



## Chart E Since the mid-1980s, the productivity index for manufacturing has stalled.

Source: *Input-Output Division*

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### Labour productivity during the recent recession

The decline in labour productivity experienced by the business sector between 1989 and 1990 was due to the 2.0% drop in the service sector. In the goods-producing sector, there was a slight improvement of only 0.4% that year. But encouraging signs in 1991 show a growth of 1.4% in the service-producing sector and a full 3.1% increase for the goods-producing sector.

Manufacturing seems to have adjusted rather fast to the recent recessionary conditions that have depressed demand for its products. In 1990, the labour productivity index showed a slight improvement over 1989 (0.9%) followed by a relatively high increase of 1.3% between 1990 and 1991. These increases contrast with movements generally seen in periods of recession, and are most likely due to a greater decrease in employment (-5.9%) than in real GDP (-5.1%) between 1989 and 1990, and similar declines of 7.8% and 6.6%, respectively, the following year. [\(13\)](#)

Certain factors appear to indicate an imminent improvement in manufacturing. For example, capital investments have grown during the last three years in spite of the recession, and R&D expenditures almost doubled in real terms between 1981 and 1991.

## Summary

Labour productivity is a broad concept, but it remains a valuable tool for analysis. It is often considered a component of economic growth and is used for establishing Canada's position among its international competitors. Labour productivity affects many aspects of our economy, one of which - and by no means the least - is the standard of living. It varies according to many economic factors that are sometimes hard to isolate. Among these are elements relating to labour, capital investment, research and development, and government regulations.

During the 1980s, the average annual rate of growth of productivity held at around 1.4%. This contrasted with the 1961 to 1975 period, when the growth rate was more than twice as high. However, the estimated improvement in 1991 due to a moderate increase in unit labour cost indicates that productivity is a greater concern for Canadian businesses faced with high competition in the global market.

Furthermore, the manufacturing industry shows encouraging signs in that it continued to make capital expenditures and invest in research and development, despite the recessionary climate.

# Multifactor productivity index

The multifactor productivity index, also known as total factor productivity, includes factors such as labour, capital, materials, and services used as inputs in the production of goods and services.

The multifactor productivity index may be the best indicator economists have of technical progress. However, it also reflects other factors that influence productivity - economies of scale, for example. For more information on the concept of multifactor productivity, see [Aggregate productivity measures](#) (Statistics Canada, 1992).

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## Notes

### *Note 1*

However, an improvement in labour productivity is not solely attributable to a greater effort by the workforce. This could also result from the introduction of new technology which increases the quantity each worker produces. On the other hand, wage increases following productivity increases - for whatever reason - can be justified on the principle of the redistribution of profits resulting from increased productivity ([Gunderson](#), 1980).

### *Note 2*

Real gross domestic product (GDP) by industry is a measure representing the contribution of each industry to the total value of production in the economy; it is the value added by the industry's labour and capital to the intermediate inputs (in constant prices) used in production.

### *Note 3*

Production (or real gross domestic product) per person employed has certain limitations, as the number of hours worked per week varies over a period of time. For example, with the growth of part-time jobs, the number of persons employed increased more rapidly than the number of hours worked, so that production per person employed increased less than production per person-hour worked. In addition, when making international comparisons, the measure of production per person employed also poses certain problems since the number of hours normally worked per week differs from one country to another. Production per person-hour worked is not subject to such considerations.

**Note 4**

Unlike the business sector which produces goods and services with a market price, the value of production in the excluded sectors is difficult to quantify. Therefore, Statistics Canada does not publish a productivity measure for the economy as a whole.

**Note 5**

In this article, the standard of living is estimated as labour compensation per person-hour worked adjusted for inflation throughout the period.

**Note 6**

From 1982 to 1986, the value of the American dollar in Canadian dollars remained between \$1.23 and \$1.39.

**Note 7**

Compensation includes wages and salaries, non-wage benefits and social benefits paid by the employer (contributions to Unemployment Insurance, the Canada and Quebec Pension Plans, Workers' Compensation and taxes for health care in Quebec and Ontario).

**Note 8**

The unit labour cost (ULC) is calculated according to the following formula:

$$\text{ULC} = \frac{\text{total labour compensation}}{\text{real gross domestic product (GDP)}}$$

Since

$$\text{labour productivity} = \frac{\text{real GDP}}{\text{person - hours worked}}$$

therefore, real GDP = labour productivity \* person-hours worked.

The ULC can also be written as follows:

$$\text{ULC} = \frac{\left[ \frac{\text{total labour compensation}}{\text{person-hours worked}} \right] * \text{person-hours worked}}{\text{labour productivity} * \text{person-hours worked}}$$

And lastly:

$$\text{ULC} = \frac{\text{labour compensation per person-hour worked}}{\text{labour productivity}}$$

**Note 9**

Within the same country, two factors affect the ULC: labour productivity which, when it increases, decreases the ULC, and labour compensation which varies in the same direction as the ULC. For more information, consult [Aggregate productivity measures](#) (Statistics Canada, 1992), pp. 77-79.

**Note 10**

When the price has little importance in the decision to purchase a good or service, this good (or service) is considered to have a low price elasticity. This can be the case for utilitarian goods, luxury goods, or goods having only one producer.

**Note 11**

The ULC being the ratio of labour compensation per person-hour worked to labour productivity, an increase in the latter signifies an increase in the denominator of the ULC, and, all things being equal, a decrease in the ULC. As labour compensation per person-hour worked is the numerator of the ULC, its increase, all things being equal, causes a rise in the ULC. The ULC and labour compensation per person-hour worked are therefore inversely proportional to productivity. For more information, consult [Aggregate productivity measures](#) (Statistics Canada, 1992), pp. 77-79.

**Note 12**

See Statistics Canada, 1991 and 1989. Residential construction investments and inventories are subtracted from total GDP in this calculation.

**Note 13**

For a discussion on output per employee (a proxy for labour productivity) in manufacturing on a monthly basis, see the supplement, "The labour market: year-end review," in this issue ([Cross](#), 1993).

# Acknowledgements

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# Source

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 HIGHLIGHTS

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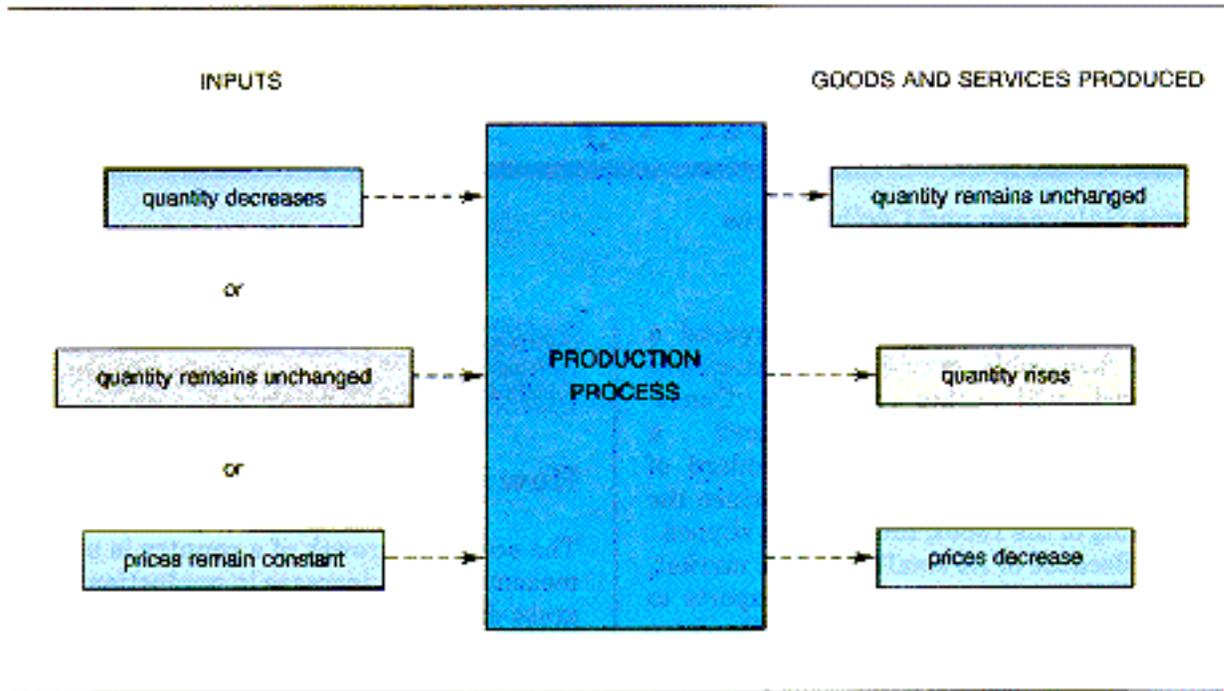
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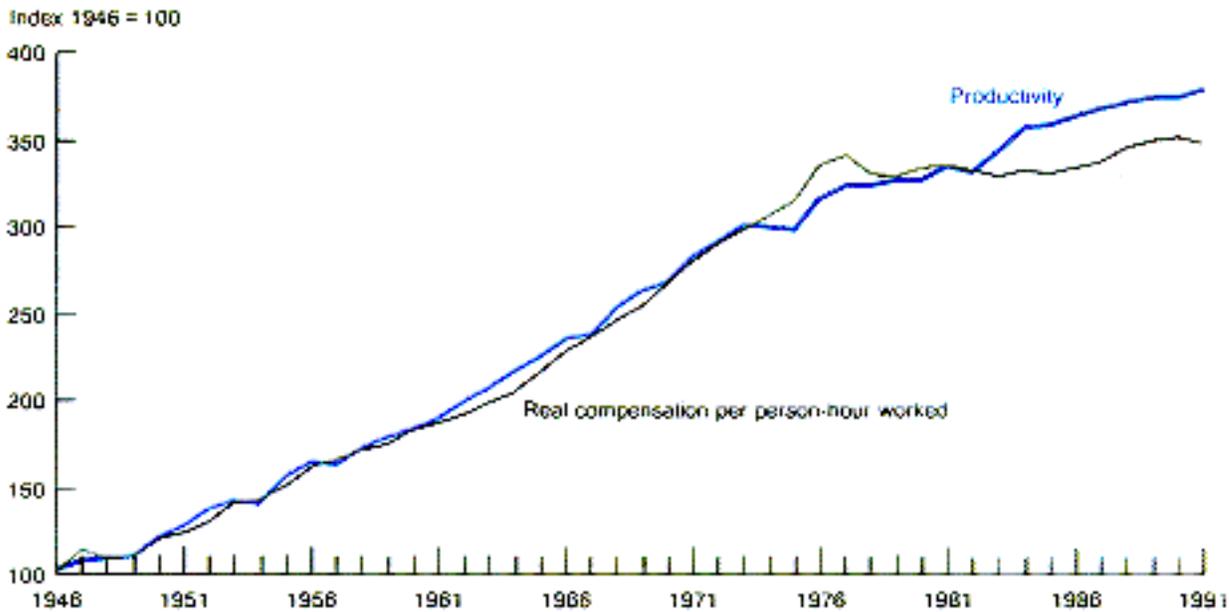


Figure 1  
Productivity growth results from one of these scenarios.



### Chart A

**Productivity and the standard of living have risen in a similar way in the post-war years.**

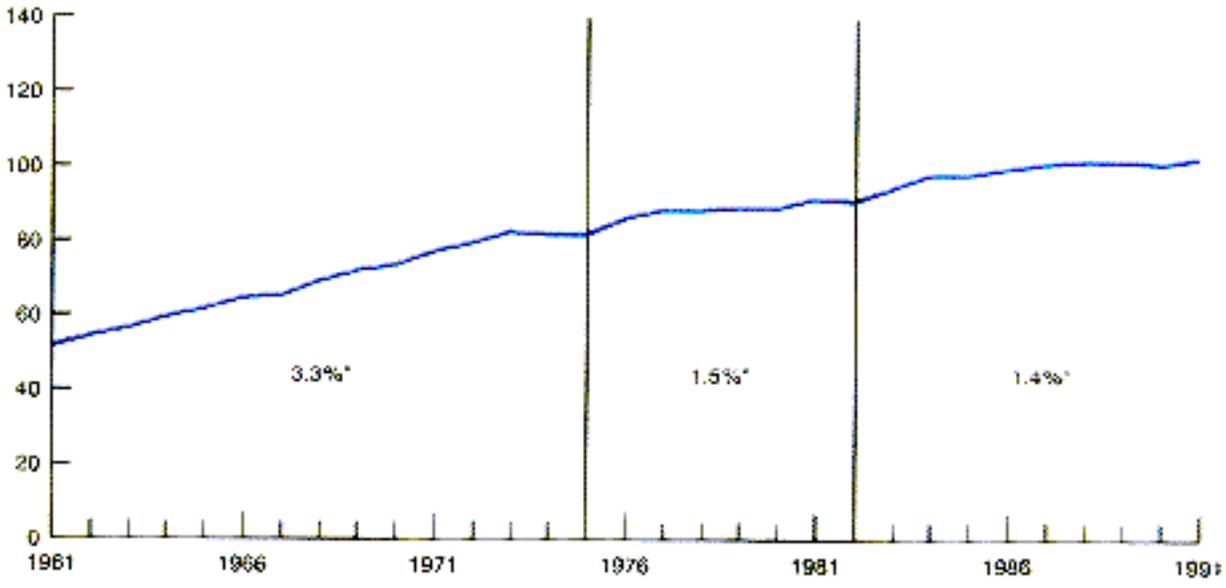


Sources: *Input-Output Division and Consumer Price Index*

Chart B

**Growth in the productivity index has slowed since 1975 ...**

Index 1986 = 100

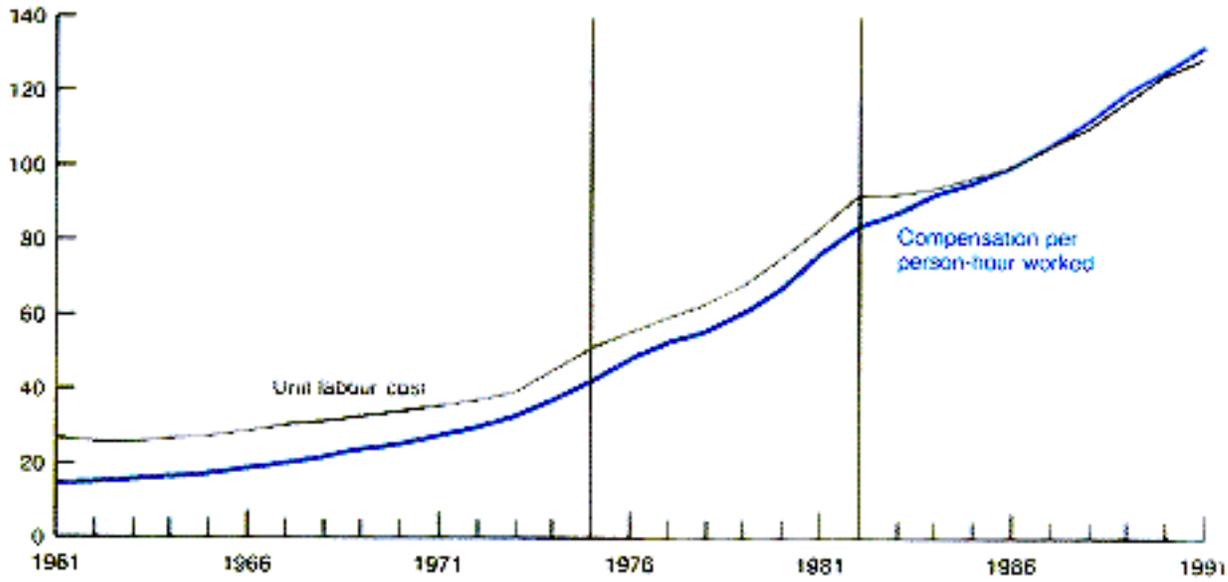


\* Average year-over-year % change - see Table 2.

### Chart C

... while compensation and unit labour cost have progressed rapidly.

Index 1985 = 100



Source: Input-Output Division

Table 1

**Year-over-year change in the business sector indexes**

	Labour productivity*	Compensation per person-hour	Unit labour cost
	%		
1981-82	-0.9	10.0	10.9
1982-83	4.0	4.8	0.7
1983-84	3.5	5.1	1.5
1984-85	0.5	3.7	3.1
1985-86	1.6	4.8	3.2
1986-87	1.0	5.7	4.7
1987-88	0.9	6.3	5.4
1988-89	0.4	6.6	6.2
1989-90	-1.2	4.7	6.0
1990-91	1.8	5.6	3.7

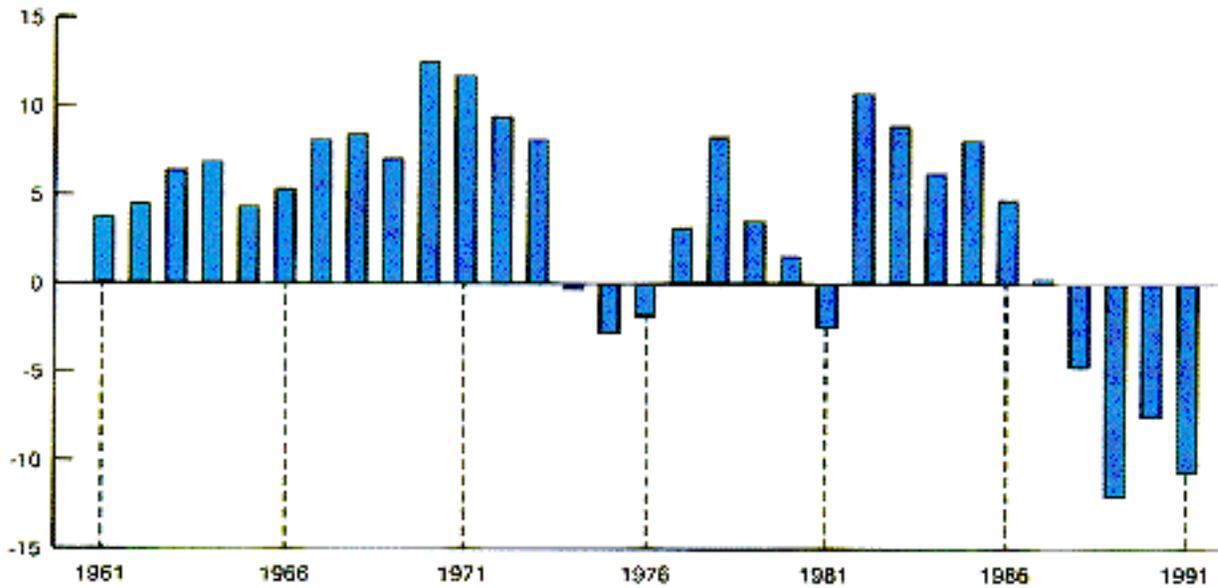
*Source: Input-Output Division*

*\* Real GDP per person-hour worked.*

Chart D

Since 1988, Canada's competitive position appears to have deteriorated.

Net exports (1988 dollars, in billions)



Source: Input-Output Division

Table 2

**Average annual variation in the labour productivity index in the business sector\***

	1961-1991	1961-1975**	1975-1982	1982-1991	Proportion of GDP (1989)
	%				
<b>Business sector</b>	<b>2.3</b>	<b>3.3</b>	<b>1.5</b>	<b>1.4</b>	<b>100.0</b>
<b>Goods</b>	<b>3.0</b>	<b>4.0</b>	<b>2.5</b>	<b>1.8</b>	<b>47.2</b>
Agriculture	3.9	5.0	4.0	2.0	2.7
Manufacturing	2.7	3.7	1.5	2.2	25.4
Construction	1.4	0.9	5.0	-0.6	8.5
Other	..	..	..	..	10.6
<b>Services</b>	<b>1.7</b>	<b>2.5</b>	<b>0.7</b>	<b>1.3</b>	<b>52.8</b>
Transportation and storage	2.8	4.5	0.2	2.1	5.8
Communication	5.8	6.2	5.1	5.7	4.5
Wholesale and retail trade	1.9	2.6	0.1	2.3	15.7
Community, business and personal services	0.5	1.2	0.6	-0.5	16.4
Other	..	..	..	..	10.4

*Source: Input-Output Division*

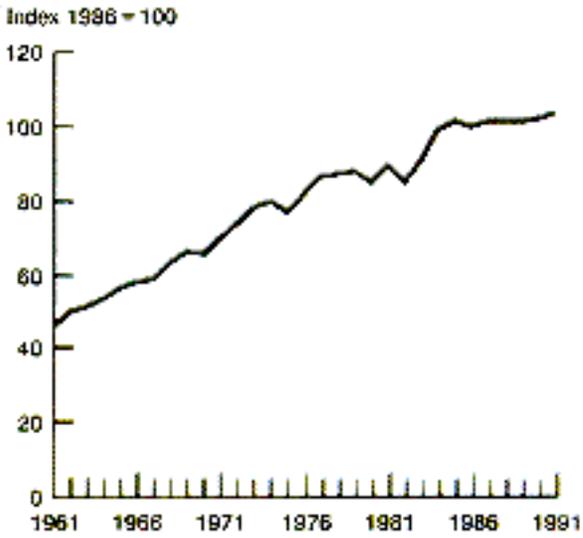
*\* Averages are geometric means.*

*\*\* Productivity growth rates are measured from the beginning to the end of each period; the last year of a period is also the first year of the next period.*

Chart E

**Since the mid-1980s, the productivity index for manufacturing has stalled.**

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Source: Input-Output Division