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System of National Accounts

Aggregate Productivity Measures

1991

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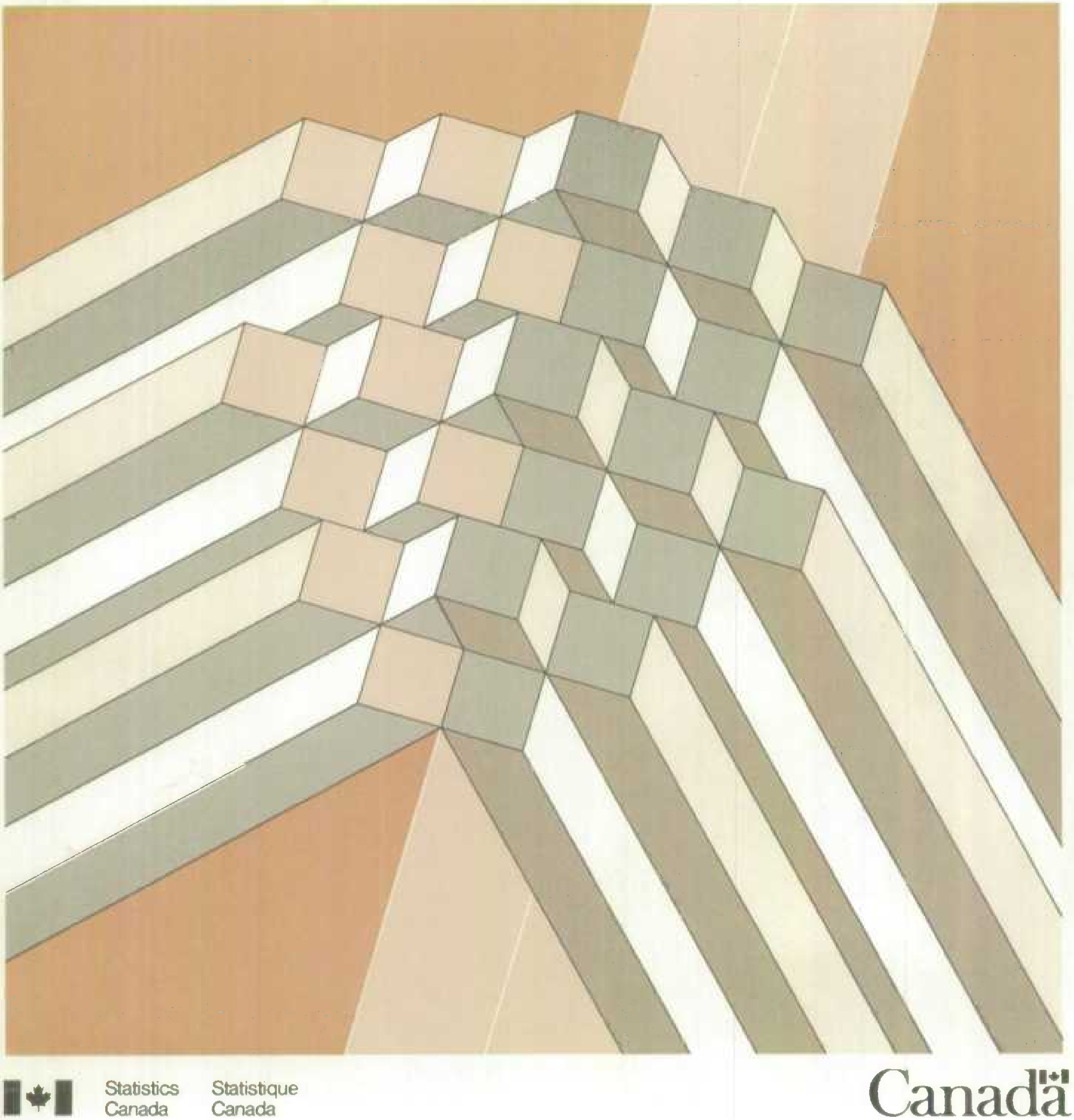
- Canada–U.S. Comparisons
- Multifactor Productivity based on Hours Worked



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Note of Appreciation

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The following standard symbols are used in Statistics Canada publications:

.. figures not available.

... figures not appropriate or not applicable.

- nil or zero.

-- amount too small to be expressed.

p preliminary figures.

r revised figures.

x confidential to meet secrecy requirements of the Statistics Act.

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The System of National Accounts

In Canada, the National Accounts have been developed since the close of the Second World War in a series of publications relating to their constituent parts. These have now reached a stage of evolution where they can be termed a "System of National Accounts". For purposes of identification, all publications (containing tables of statistics, descriptions of conceptual frameworks and descriptions of sources and methods) which make up this System carry the term "System of National Accounts" as a general title.

The System of National Accounts in Canada consists of several parts. The annual and quarterly Income and Expenditure Accounts (included with Catalogue Nos. carrying the prefix 13) were, historically speaking, the first set of statistics to be referred to with the title "National Accounts" (National Accounts, Income and Expenditure). The Balance of International Payments data (Catalogue Nos. with prefix 67), are also part of the System of National Accounts and they, in fact, pre-date the Income and Expenditure Accounts.

Greatly expanded structural detail on industries and on goods and services is portrayed in the Input-Output Tables of the System (Catalogue Nos. with prefix 15). The Catalogue Nos. carrying the prefix 15 also provide measures of the contribution of each industry to total Gross Domestic Product at factor cost as well as Productivity Measures.

Both the Input-Output tables and estimates of Gross Domestic Product by industry use the establishment as the primary unit of industrial production. Measures of financial transactions are provided by the Financial Flow Accounts (Catalogue Nos. with prefix 13). Types of lenders and financial instruments are the primary detail in these statistics and the legal entity is the main unit of classification of transactors. Balance sheets of outstanding assets and liabilities are published annually.

The System of National Accounts provides an overall conceptually integrated framework in which the various parts can be considered as interrelated sub-systems. At present, direct comparisons amongst those parts which use the establishment as the basic unit and those which use the legal entity can be carried out only at highly aggregated levels of data. However, Statistics Canada is continuing research on enterprise-company-establishment relationships; it may eventually be feasible to reclassify the data which are on one basis (say the establishment basis) to correspond to the units employed on another (the company or the enterprise basis).

In its broad outline, the Canadian System of National Accounts bears a close relationship to the international standard as described in the United Nations publication: A System of National Accounts (Studies in Methods, Series F, No. 2 Rev. 3, Statistical Office, Department of Economic and Social Affairs, United Nations, New York, 1968).

Notes to Users

Productivity estimates reported in this publication have been the subject of the following improvements:

1. In addition to the multifactor productivity estimates which are based on employment as the measure of labour input, multifactor productivity estimates based on hours worked have now been developed and are presented for the first time in this issue. A feature article in this publication describes the sources, concepts, and methods used to develop the estimates of hours worked and analyses the impact of the new measure of labour input on multifactor productivity estimates.

2. Employment growth estimates for the total economy used in labour and multifactor productivity measures have been reconciled with the total employment growth from the Labour Force Survey for the years 1988 through 1991.

3. Multifactor productivity estimates are now available for 110 industries instead of 109 as a result of the development of separate productivity estimates for the retail trade and wholesale trade industries.

4. Capital stock estimates used in the calculation of multifactor productivity have been revised to reflect new estimates of asset lives. Capital stock estimates now fully incorporate the average asset lives from five annual surveys taken from 1985 to 1989. The previous capital stock series only reflected the results of the first three years of the survey. As the capital stock series are based on an interpolation of asset lives between the 1947 survey estimates and the more recent survey results, the change from the three-year to the five-year average therefore has an impact on the capital stock series over the entire time period.

5. In last year's issue of *Aggregate Productivity Measures*, comparisons with the United States productivity estimates were not made because of upcoming major revisions in the American statistics. Revisions to the estimates for the major sectors of the economy are still in process and so major sector comparisons are still not possible at this time. However, this year, comparisons with the United States multifactor productivity estimates for detailed manufacturing industries are presented in a feature article in this publication. As the U.S. estimates used in the study are not based on the same data sources as the major sector measures, they will not be affected by the upcoming revisions.

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Introduction

This is the second issue of the *Aggregate productivity Measures* publication for the year 1991. During the course of the year, many important changes were brought to the multifactor productivity program. The main purpose of this second issue is to present multifactor productivity estimates based on hours worked instead of persons at work. Hours worked have now been estimated at the lowest level of aggregation of the multifactor productivity database since 1961 and are available upon request.

In addition, this issue includes preliminary estimates for 1990 and 1991 which have been the subject of revisions since the last issue. More complete estimates are now available for 1989 as preliminary estimates of the input-output tables have been released for that year. Revised input-output tables for 1988 also became available, resulting in revisions to both labour and multifactor productivity estimates for that year.

This issue contains two feature articles. The first presents the results of a study on the comparability of two-digit manufacturing multifactor productivity estimates for Canada and the United States. The regular comparative analysis of large aggregate productivity estimates for Canada and United States is still not possible pending U.S. revisions. These revisions will not affect the two-digit manufacturing comparisons as the estimates at this level of aggregation are not based on the same data sources as the large aggregates. A second feature article reports on sources, concepts and methods associated with the new estimates of hours worked. Until now, Canadian multifactor productivity estimates were based on persons at work as the measure of labour input whereas the U.S. estimates were based on hours worked. The development of Canadian multifactor productivity estimates based on hours worked, therefore, not only improves the quality of the estimates, but it eliminates one difference between Canadian and U.S. multifactor productivity measures.

As usual, Part 1 of the publication presents the labour productivity estimates while Part 2 presents the experimental multifactor productivity indices for the business sector of the Canadian economy. This is the fourth release of the multifactor productivity estimates. Readers who are not familiar with multifactor productivity measures would benefit from reading the accompanying technical appendices as they explain the basic concepts needed to interpret the statistical tables. In particular, Appendix 1 in Part 2 describes several multifactor productivity measures. All of these multifactor productivity measures use the same mathematical formula but they differ with respect to the outputs and the inputs to which they are applied. Distinct productivity measures are defined for industries, groups of industries, groups of commodities, and for the aggregate business sector.

Multifactor productivity estimates, while coming closer to measuring efficiency gains than labour productivity does, are not exempt of problems of their own. Productivity estimates, in principle, measure increases in efficiency associated with technical progress and economies of scale but, in practice, they also reflect the impact of various factors associated in particular with cyclical fluctuations as well as many potential biases due to errors in the data. For instance, some inputs are not accounted for. This is presently the case with natural resources whose quantity and quality, which are not yet available, are potentially crucial for primary industries' productivity estimates. This explains why productivity estimates for important industries such as forestry and mining are not made available at the present time. As research on the measurement of these resources proceeds, more primary industry estimates will be published.

Similarly, productivity estimates for several service industries show unsatisfactory results for many possible reasons, one of which is the deflation of their output. Their productivity estimates are withheld until further progress is made on that front. Over-deflation of output in service industries on the basis of input prices, as is often the case, leads to an underestimation of productivity growth. To the extent that service industries supply goods-producing industries, the service inputs of the latter are underestimated. This tends to create an upward bias in the productivity gains of the goods-producing industries. At the aggregate level, these biases tend to cancel out (provided that final sales of services are not biased) as aggregate productivity relates only to final demand deliveries which are net of intermediate inputs.

Estimates for other industries include biases which have changed over the historical period as the methods used to estimates their outputs and inputs have changed. For example, the output in construction industries has generally been deflated with an average of input prices before 1971, therefore limiting productivity gains in those industries. After 1971, several construction activities have been deflated with more appropriate price indices, contributing to an improvement of their productivity estimates. Still, further progress is needed in the measurement of output deflators for construction industries.

FOR FURTHER READING

Selected publications from Statistics Canada

The labour and multifactor productivity indexes presented in this publication are obtained mainly from a set of integrated industry and commodity statistics within the System of National Accounts (SNA). The integration ensures consistency of definition over time and across industry and commodity classifications and the information may therefore differ from other Statistics Canada data. Publications with a catalogue number prefix 15 contain SNA integrated data and are available under the following titles:

- Gross Domestic Product by Industry, cat. 15-001.
- The Input-Output Structure of the Canadian Economy, cat. 15-201.
- The Input-Output Structure of the Canadian Economy in Constant Prices, cat. 15-202.
- The Input-Output Structure of the Canadian Economy, 1961-81, cat. 15-510, occasional.
- The Input-Output Structure of the Canadian Economy in Constant Prices, 1961-81, cat. 15-511, occasional.

Highlights

Recent productivity and unit labour cost developments in Canada have raised some concerns about Canadian competitiveness, in particular with respect to its largest trading partner, the United States. The various measures presented in this publication, such as labour productivity, multifactor productivity, unit labour cost and labour compensation, represent key indicators of competitiveness. The following overview focuses on these measures, bringing together the information they provide to describe trends in productive efficiency in Canada since 1961 and in particular, during the last two business cycles. The last section will then turn to comparative productivity developments in Canadian and American manufacturing industries, where competitiveness is paramount because of the importance of international trade in this area.

Labour Productivity Measures

Preliminary estimates of labour productivity in the business sector, as measured by GDP per person-hour, indicate a 1.8% growth in 1991. This is a noticeable comeback compared to the 1.2% decline in 1990.

The fall in labour productivity experienced by the business sector in 1990 occurred mainly in services industries, with the exception of the communications industries, where productivity growth continues to be strong. However, service industry labour productivity resumed its growth in 1991, posting a rate of 1.4%.

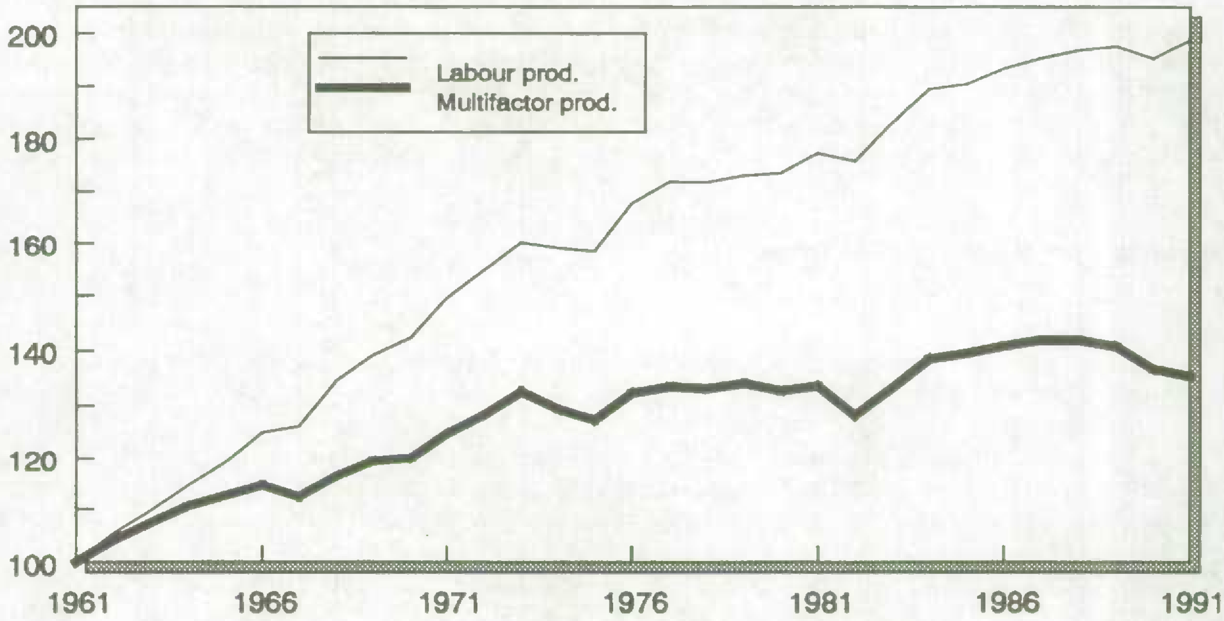
Preliminary estimates indicate that labour productivity in manufacturing industries is showing continued improvement in comparison to 1989, growing by 0.9% in 1990 and by 1.3% in 1991. This rise in labour productivity occurred at a time when manufacturing industries were faced with weakening demand. The estimates show that manufacturing industries reduced both employment and hours rapidly to adjust to a decreasing demand.

Over the 1982-1991 economic cycle, business sector labour productivity grew by an average annual rate of 1.4%. This increase is comparable to the average rate of 1.5% measured over the 1975-1982 cycle, yet it is much weaker than the rate of 3.3% observed over the 1961 to 1975 period. In manufacturing, the average annual increase of 2.2% in productivity from 1982 to 1991 was stronger than the increase from 1975 to 1982 (1.5%). However, it was much weaker than the 3.7% growth observed over the 1961-1975 period. Over the current cycle, labour productivity growth in manufacturing industries has been stronger than that of the total business sector and of services industries. Despite this improvement in manufacturing, business sector productivity growth shows a persistent decrease over the long term.

Economic performance as measured by labour productivity must however be interpreted carefully as these estimates reflect changes in the capital-labour ratio in addition to the growth in productive efficiency. When the capital-labour ratio increases, that is, when the relative contribution of capital to output growth increases, labour productivity grows faster than multifactor productivity and vice-versa. Over the last two business cycles, there was a deceleration in the rate of growth of productive capital stock from an average growth of 4.5% in 1975-1982 to 2.4% in 1982-1991, while employment grew at the same pace as before (1.8% versus 1.9%). As a result, the growth rate of the capital-labour ratio shrunk from an average of 2.6% in 1975-1982 to only 0.6% in 1982-1991 bringing the two productivity growth rates closer together in this period. However, for most of the past thirty years, the capital-labour ratio has increased, causing labour productivity to grow faster than multifactor productivity, as can be seen in figure 1. To assess Canada's performance, it is therefore more relevant to look at changes in multifactor productivity estimates as this measure reflects more accurately the efficiency with which commodities are produced.

Figure 1

Labour productivity and multifactor productivity indices for the Canadian business sector, 1961-1991



Multifactor Productivity Measures

In 1991, the productivity outlook was worse when looking at the multifactor measure[1] than when considering labour productivity. In fact, preliminary estimates indicate that business sector multifactor productivity fell for three consecutive years, in 1989 (-0.8%), in 1990 (-2.8%), and in 1991 (-1.0%) as the economy reached the end of a long expansionary cycle that began in 1982. Such a fall in productivity is characteristic of all business cycle downturns. The decline in multifactor productivity was more gradual than was the case during the last recession when it dropped by 4.1% in 1982 and bounced back the following year.

Capital stock grew at a stronger pace in 1989, 1990, and 1991 as a result of strong investments undertaken towards the end of the long expansion period. When these investments translated into a larger capital stock, the economy had already started to slow down; the new assets therefore added to the excess capacity. In fact, capital stock has been growing faster than GDP in real terms since 1989. On the other hand, person-hours have been growing slower than real output for most of the 1980s, except in 1990 when

[1] *Multifactor productivity measures based on hours worked as the measure of labour input are presented for the first time in this publication. These measures reflect changes in productive efficiency more accurately than multifactor productivity based on employment as average hours worked have declined through time. An article in this publication describes the methodology used to develop the estimates of person-hours and analyses the impact of the new measure of labour input on multifactor productivity estimates.*

the drop in real production was sharper than that of hours worked. This explains the fall in multifactor productivity as well as the gap between this measure and the labour productivity measure. In 1982, the growth of capital stock was also remarkably strong (at 7.0%) but the recovery in 1983 was strong enough to return productivity to positive growth rates. Productivity may be expected to regain its strength in the coming years, when the economy returns to higher capacity utilization rates.

Although multifactor productivity in manufacturing industries has grown more over the present business cycle than either service industries or the business sector, most of the increase took place during the initial years of expansion. In the last four years, manufacturing productivity experienced sharper annual declines than the overall business sector. This is attributable to manufacturing industries having invested in fixed capital at a much greater rate than non-manufacturing industries and having experienced a slower output growth in 1989 and a more severe decline in output in 1990 and 1991.

As Canada's competitiveness and future prosperity are among the top concerns in many circles, more than ever, Canada's performance must be assessed from an international perspective. As emphasized in last year's highlights, manufacturing industries are an important group in the economy in terms of their contribution to total business sector productivity. Moreover, it is particularly subject to international competition as Canadian trade consists mostly of trade in manufactured goods. In the next section, the overview of the manufacturing industries will therefore be done in comparative terms with their U.S. counterparts.

Multifactor Productivity Growth in Canadian Manufacturing Industries Relative to the United States

i - Aggregate Trends

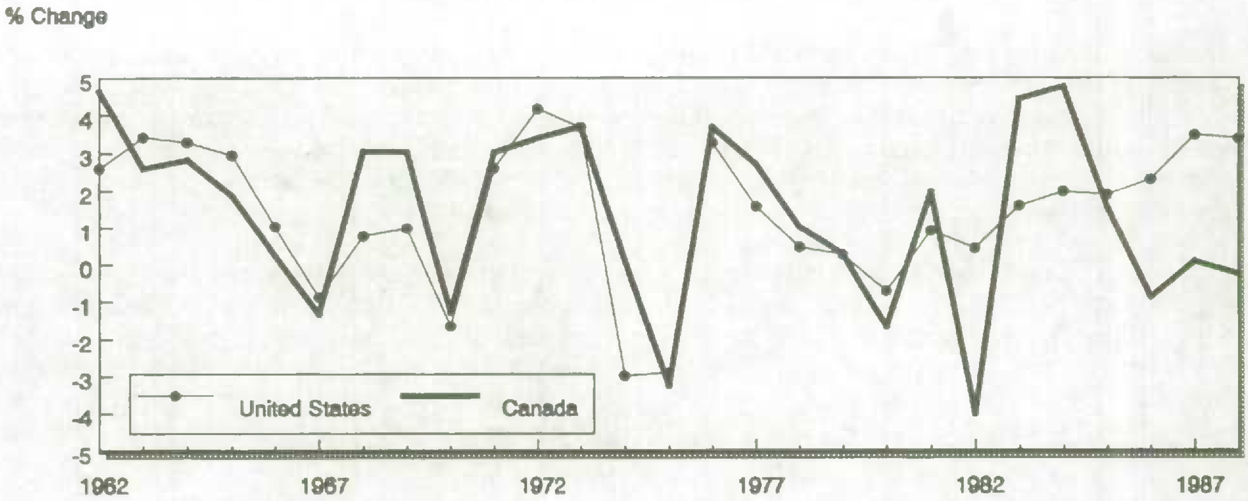
Over the 1961 to 1988[2] period, multifactor productivity growth based on gross output net of intra-industry sales in Canadian and American manufacturing industries exhibited very similar trends. The United States manufacturing industries posted a marginally higher average annual growth rate over the twenty seven year period at 1.4%, compared with Canadian manufacturing at 1.3%. The difference, however, may not be significant given the normal range of uncertainty surrounding any estimate. Behind this seemingly comparable long-term performance of total manufacturing in Canada and the U.S lie many differences across industries and through time that must be examined in order to gain a better understanding of the situation.

Manufacturing industries in the United States had a comparatively poorer performance than in Canada in the pre-1975 period, exhibiting a weaker productivity growth than their long-term average. Although the recession of the mid-70s appears to have inflicted a more severe blow to manufacturing productivity in the United States compared to Canada, productivity growth reached the same peak in both countries during the subsequent recovery. In contrast, multifactor productivity declined much more in Canada than in the United States during the 1982 recession, resulting in a stronger 1975-1982 average annual growth of 0.9% in the United States compared with a 0.5% average growth in Canada. Although the initial recovery was more vigorous in Canada, the United States' average annual productivity performance in the 1980s exceeded that of Canada by almost a full percentage point. In particular, since 1985, Canada's manufacturing multifactor productivity has exhibited slower growth in comparison to its southern neighbour as can be seen in figure 2.

[2] *The last year for which this comparison is possible is 1988 due to U.S. data availability.*

Figure 2

Multifactor Productivity Growth in Canadian and U.S. Manufacturing Industries, 1962-1988



These findings are consistent with the history of business cycles in the two countries as the United States experienced a more severe and prolonged recession in the mid-70s compared to Canada whereas Canada's economy took a much more severe blow in 1982 compared to the United States.

In brief, if we consider the 1961-1988 annual average growth as the norm, Canada's manufacturing productivity did return to "normal" rates of growth after the 1982 recession but comparatively, the United States has experienced greater than "normal" productivity gains over the same period.

ii - Comparative Performance of Individual Industries

Over the 1961-1988 period, Canada's multifactor productivity grew at a relatively faster pace than that of the United States in nine of the thirteen manufacturing industries for which estimates are comparable. In most cases however, as shown in Text table 1, the difference in growth rates is marginal. The two largest average growth differentials in favour of Canada were found in the primary metal industries and in printing, publishing & allied industries. During this period, Canada lagged behind in four industries: by an average of 1.2 percentage points in the machinery, electrical and electronic group, by an average of 0.9 point in the paper and allied products industry, by an average of 0.4 percentage point in the furniture and fixture industries, and only marginally in the food and beverage industries.

Prior to 1975, Canadian manufacturing industries exhibited a stronger growth in productivity in all but three cases, that is, in wood and logging, paper and allied products, and machinery, electrical and electronic products industries. Moreover, Canadian industries generally led the U.S. by a wider margin in the 1961-1975 period compared to the full 1961-1988 period.

Text table 1

Average Annual Growth Rate of Multifactor Productivity in Selected Manufacturing Industries: 1961-1988

Industry Name	Canada	United States
Food and beverage industries	0.4	0.5
Plastic, rubber, leather & allied products industries	1.3	1.0
Textile, textile products & clothing industries	1.8	1.6
Wood , logging & forestry industries	2.0	1.8
Furniture & fixture industries	0.2	0.7
Paper & allied products industries	0.2	1.1
Printing, publishing & allied industries	0.7	0.0
Primary metal industries	0.7	-0.2
Machinery, electrical & electronic products industries	1.4	2.5
Transportation equipment industries	1.5	1.1
Non-metallic mineral products	0.9	0.5
Refined petroleum & coal products	0.7	0.2
Chemical & chemical products industries	1.4	1.3
Total manufacturing industries	1.3	1.4

The 1975-1982 period was characterized by a general slowdown in productivity growth in both countries. Despite the U.S. manufacturing group posting a higher average annual growth in productivity than Canada during this period, Canada increased its lead in four out of thirteen industries. However, the slower growth experienced in Canada in recent years seems to be widespread, appearing in all thirteen industries selected in the comparison.

Canada's printing, publishing and allied industries performed better than its U.S. counterpart over long term periods whereas the Canadian paper and allied products industries was behind in most periods. Differences in age and capacity utilization rates of plant and equipment between Canada and the United States are among the factors that could explain this trend. The group encompassing machinery, electrical and electronic products in Canada has also ranked second after the United States in most years However, as the latter is an aggregate of fairly heterogeneous industries, machinery industries and electrical and electronic products taken individually could have a different ranking. In fact, the electrical and electronic products industry in Canada has been performing very well, ranking among the top contributors to business sector multifactor productivity growth over the last three decades.

iii - Contributions of Industries to Total Manufacturing Productivity Growth

The ranking of the Canadian and U.S. manufacturing industries depends on two things:

1) the relative performance of individual industries, and
2) the composition of the manufacturing group in both countries.

The performance and relative size of manufacturing industries together determine the contribution that each of them will bring to the performance of total manufacturing in any given year. In turn, these contributions allow us to trace the origins of productivity growth in the manufacturing group back to specific industries, thus giving more meaning to the aggregate measure.

Figure 3

Average annual contribution of Canadian industries to total manufacturing multifactor productivity growth, 1961-1988

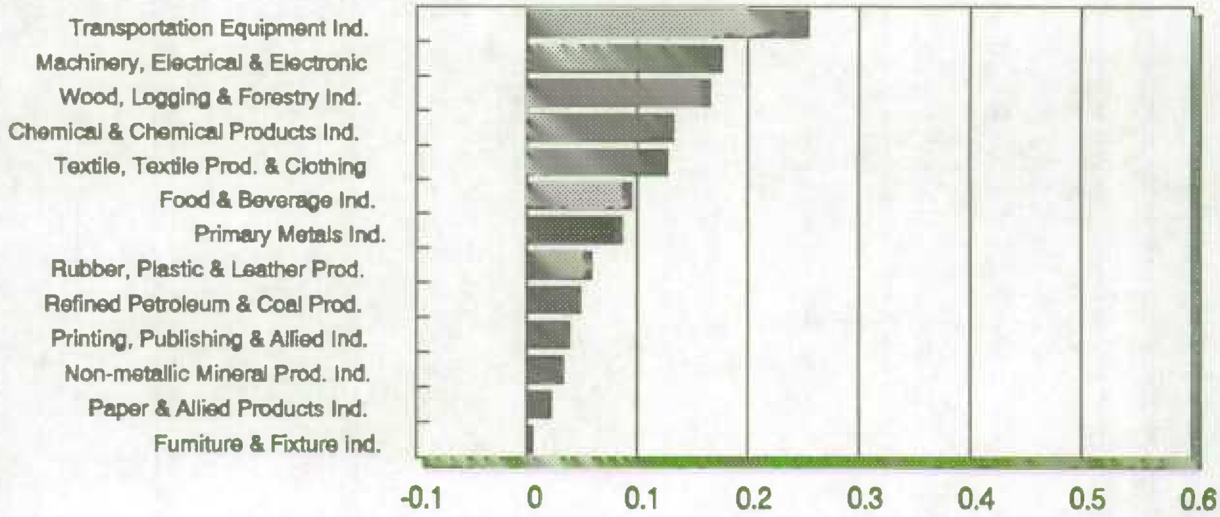
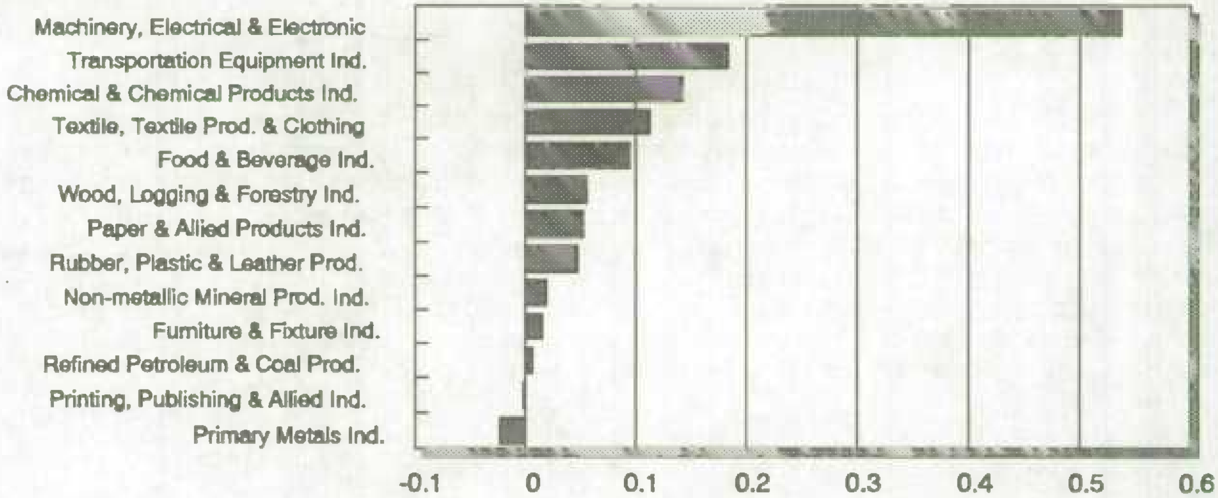


Figure 4

Average annual contribution of U.S. industries to total manufacturing multifactor productivity growth, 1961-1988



Canada

As illustrated in figure 3, the largest contributor to Canadian manufacturing productivity growth over the 1961 to 1988 period was the transportation equipment industry. Machinery, electrical and electronic products industries came in second, followed by wood, logging and forestry industries and by chemical and chemical products industries. The transportation equipment industry was also the largest contributor during the 1961 to 1973 period, but fell to fifth place from 1973 to 1988. The machinery group holds the third and second rank respectively over those same time spans. The most noteworthy change before and after 1973 took place in the food and beverage industries: this group held the second place from 1961 to 1973 in contrast with an eleventh position from 1973 to 1988, contributing negatively to manufacturing productivity growth in this latter period.

United States

The distribution of contributions to U.S. manufacturing productivity growth over the 1961 to 1988 period as shown in figure 4 is much more dispersed than in Canada. The contribution of the machinery, electrical and electronic products group stands out above all other industries. This group also dominates its Canadian counterpart in terms of productivity growth in all periods considered. The second largest contributor is the transportation equipment industry, followed by chemical and chemical products industries and textile, textile products, and clothing industries. These three U.S. industries came in second after Canada in terms of productivity growth. Although the second, third and fourth largest contributors were weaker than their Canadian counterparts, the growth of productivity in total manufacturing was slightly stronger in the U.S. than in Canada for that period mainly due to the relative size and good performance of the machinery, electrical and electronic products group. The five largest contributors are the same in the pre-1973 period, where the U.S. trails Canada in terms of its manufacturing productivity growth, as in the post-1973 period where the positions are reversed. However, in contrast with the United States, many industries in Canada changed relative positions from one period to the other.

NOTE TO USERS:

*In last year's issue of **Aggregate Productivity Measures**, comparisons with the United States productivity estimates were not made because of upcoming major revisions in the American statistics. Revisions to the estimates for the major sectors of the economy are still in process; therefore, major sector comparisons are still not possible at this time. The overview of the Canada-U.S. comparison presented above is based on the results of a study entitled **Comparability of Multifactor Productivity Estimates in Canada and the United States** which is presented in this publication. The article explains how various methodological and classification problems encountered in making the comparisons were solved and presents the full set of multifactor productivity estimates for total manufacturing and thirteen of its industries for Canada and the United States. As the U.S. estimates for detailed manufacturing industries are not based on the same data sources as the major sector measures, they will not be affected by the revisions mentioned above.*

FEATURE ARTICLE 1

Comparability of Multifactor Productivity Estimates in Canada and the United States

By Marie Allard-Saulnier[3]

Introduction

Canada's competitive position depends on many factors such as a healthy macroeconomic environment, investments in upgrading skills and technology, the size, location and organization of markets, and the trade policy environment in which Canada must do business. However, the key to competitiveness lies in a country's ability to maintain a high level and a stable growth in productivity. International comparability in productivity measures is therefore crucial in the assessment of Canada's competitive position. It is particularly important to have adequate tools to assess Canada's performance relative to its largest trading partner, the United States. In 1991, 76% of Canada's exports were destined to the U.S. market and 69% of the goods and services that were imported into Canada came from the United States. Imports from the U.S. not only compete with Canadian goods and services for Canadians' consumption dollars but also with intermediate inputs going into the production of Canadian commodities. The advent of free trade between Canada and the United States (and possibly Mexico) has raised the stakes of maintaining and improving productivity not only to keep Canada's share of the domestic market but also to respond to the challenge and opportunities arising from the opening of a new and large market south of the border.

Traditionally, international productivity comparisons have been based on labour productivity estimates which are limited in scope. These estimates reflect more than just the increase in the efficiency of the production process; they also include the increase in production due to a more intensive use of other inputs such as capital. In contrast, this article will focus on multifactor (or total factor) productivity measures that evaluate the increase in production not accounted for by the growth of all measured inputs. In addition, productivity comparisons have often limited to the major sectors of the economy. In order to give meaning to these aggregate measures, a look at comparative productivity for more homogeneous groups of industries is in order. In a first attempt to respond to the need for more detailed comparisons, this paper presents comparable multifactor productivity measures for thirteen groups of manufacturing industries in Canada and the United States.

The text will begin with an overview of official multifactor productivity estimates from the U.S. Bureau of Labor Statistics and Statistics Canada. The second section will underscore three issues that must be considered when making international comparisons of productivity: the distinction between comparisons

[3] *I wish to thank all the members of the Productivity Measures Section who have contributed directly or indirectly to this study. In particular, I would like to thank Aldo Diaz and René Durand for their input and feedback. I am also grateful to Séan Burrows, Ken Young of Industry Division, Daniel April and Jack Bailey of Standards Division, and Nicole Richer for their invaluable assistance.*

of levels and growth rates, methodological issues, and comparability of classifications. All too often, international comparisons are made without regard to these issues, casting doubt on the conclusions derived from such comparisons. The discussion of these issues delineates the terms and conditions of comparability between the official statistics of these two countries to ensure that comparisons are made in a systematic manner. The next section presents estimates of multifactor productivity growth in Canada and the United States. Concluding remarks can be found in the final section, followed by an appendix describing in more detail the methodology for assessing the comparability of classifications.

Official Multifactor Productivity Statistics in Canada and the United States

Statistics Canada's annual estimates of multifactor productivity (MFP) are described at length in the appendices in Part 2 of this publication. Therefore, they will not be discussed in great detail here. In brief, four multifactor productivity measures are available: MFP *industry* measures on value-added, on gross output (also called the neoclassical index), and on gross output net of intra-industry sales, and the *interindustry* MFP index, which measures the productivity of the economy in producing groups of commodities, taking into account the contribution of all industries directly or indirectly involved in producing these commodities.

Statistics Canada's estimates are available at four different levels of aggregation. First, estimates are produced for the total business sector. The next level of detail available (called the "PS" level) comprises twelve non-manufacturing industries along with total manufacturing. At a more detailed level ("PM"), the manufacturing total can be broken down into nineteen industries groups. Finally, the most detailed level ("PL") comprises 110 industries, of which 83 are part of the manufacturing group. The estimates for the four measures at all levels of aggregation are constructed using the Törnqvist index number formula for both outputs and inputs[4].

[4] *The purpose of the index number is to summarize in a single quantitative indicator, several individual measures for which there is no common physical unit of measurement. This is done by choosing a weighting scheme which permits variations in non-additive quantities to be evaluated at a global level. The Törnqvist index is one of many ways to do this. In contrast with the Laspeyres volume index, which is a fixed-weighted arithmetic average of quantity ratios, the Törnqvist volume index is a geometric average of these ratios weighted with average prices of successive years.*

$$\textit{Tömqvist volume index: } Q_1/Q_0=\prod_{i=1}^{n}\left(\frac{Q_{1i}}{Q_{0i}}\right)^{w_i}$$

which can also expressed as:

$$\ln\left(\frac{Q_1}{Q_0}\right)=\sum_{i=1}^{n} w_i*\ln\left(\frac{Q_{1i}}{Q_{0i}}\right)$$

where i = commodities 1 through n

and w_i = average value shares at time 0 and 1

Moreover, indices can differ from one another by the manner in which consecutive changes are combined through time. In the case of the chained Törnqvist, the formula is applied to each consecutive pair of years and the results are chained through multiplication.

Multifactor productivity estimates for the United States are produced by the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor[5]. There are three distinct multifactor productivity programs at the BLS.

Productivity measures for major sectors are produced and published quarterly on the basis of value-added using the *National Income and Product Accounts*[6] as the source for the measure of production. The inputs therefore include only labour (hours worked) and capital services. These measures are available for the following aggregates: total private business sector, manufacturing, farm, and non-farm non-manufacturing. The measures are based on Laspeyres fixed-weighted volume indices for production and inputs.

Annual productivity indices for two-digit manufacturing industries[7] are based on a somewhat different methodology. First, the measure of production used is gross output net of intra-industry sales. Consequently, the combined inputs include capital services, labour inputs, energy, materials and purchased services (hence the name "KLEMS"), which are also net of intra-industry transactions. In general, inputs and outputs are measured with chained Törnqvist indices.

The MFP measures on the basis of gross output net of intra-industry sales are also available for detailed industries. The calculations are also done using the Törnqvist index number formula for inputs and outputs. They are published for six industries at the three- and four-digit levels of the 1987 U.S. Standard Industrial Classification. The industries are: blast furnace and basic steel products (SIC 331); motor vehicles and equipment (SIC 371); footwear, except rubber (314); tires and inner tubes (3011); farm and garden machinery (352); and railroads, line-haul operating (4011).

Productivity comparisons for the major sectors of the economy can only be made with caution as the index number formula used to calculate the volume of outputs and inputs differ between the two countries. As stated above, the Törnqvist index formula is used in the Canadian estimates whereas the BLS uses Laspeyres fixed-weighted volume indices in the case of the major sector measures. Differences in the index number formula create artificial differences in the growth of the series being compared.

Comparisons will therefore be based on U.S. multifactor productivity measures for two-digit manufacturing industries and the Canadian estimates of multifactor productivity on gross output net of intra-industry sales at the "PM" level. The choice of measures used in the comparison was based on several considerations. First, for practical reasons, this study was limited to comparisons with existing U.S. estimates. Second, the two sets of estimates are the most comparable in methodology as will be described in more detail below. Finally, this choice made it possible to make comparisons that covered the manufacturing group (which is particularly exposed to international competition) while still maintaining some detail by industry.

What are Meaningful Comparisons?

This section describes the various issues that should be kept in mind while constructing comparable productivity estimates and while interpreting the results of the comparisons. Although these issues are important, they are often overlooked. It is necessary to answer the following questions in order to put in context the results of the comparisons which are presented in a subsequent section. Are the estimates

[5] *We would like to express our gratitude to William Gullickson of the Bureau of Labor Statistics for providing the necessary data.*

[6] *The National Income and Product Accounts are produced by the Bureau of Economic Analysis of the U.S. Department of Commerce.*

[7] *From the 1972 U.S. Standard Industrial Classification.*

comparable in level or in terms of growth? Are the estimates constructed using a similar methodology? Do the industries represent similar production activities or similar commodity outputs?

i - Growth Rate Versus Level Comparisons

There are two different ways to compare productivity measures: in terms of growth or levels. When using the first approach, it is important to understand that comparing the *change* in productivity for two countries does not give any information on which of the two countries is more productive, but only which of the two has increased its productive efficiency more between two given points in time. This approach is more easily implemented as it requires less information. When comparing productivity gains for two countries, inputs and outputs are evaluated at prices of the same year but using the price structure of each country, in their respective currency. In other words, the value of inputs and outputs are deflated in such a way as to make their volumes comparable from year to year within each country but not comparable between countries.

In contrast, bilateral *level* comparisons require that inputs and outputs of both countries be expressed in the same price structure in order to ensure that the volume of these inputs and outputs are comparable for the two countries. This is done separately for each component with special conversion factors called purchasing power parities (PPP's).[8] Purchasing power parities take into account differences in relative prices of commodities across countries and are defined in such a way as to convert values expressed in one country's currency and price structure into the other country's currency and price structure, thus making it possible to isolate differences in the volume of commodities produced or purchased in both countries.

Constructing PPP's for purposes of productivity comparisons with the United States would involve the collection of prices in Canada and the U.S. for very specific commodity outputs and inputs with equivalent characteristics in order to isolate the "pure" volume difference. The calculation of purchasing power parities on final demand components for several countries has already been undertaken by the Organization for Economic Cooperation and Development (OECD). However, the availability of specific input prices is particularly problematic as this may pose confidentiality problems. Level comparisons for multifactor productivity would require a great deal of cooperation between participating countries to make the data available, to agree on standard definitions and methodology and to deal with the complexities of collecting and processing the data. Comparisons based on official statistics are therefore limited to productivity gains for the time being[9].

ii - Methodology

Since the Bureau of Labor Statistics has three different multifactor productivity programs as described above, methodological differences with Statistics Canada's estimates depend on which U.S. estimates are considered. In the case of the two-digit KLEMS index which is the focus of this paper, methodological differences with Statistics Canada's productivity estimates on gross output net of intra-industry sales are minor.

First, Statistics Canada's hours worked at the level of 19 manufacturing industry groups are weighted averages of hours worked at the most detailed level where MFP estimates are calculated (i.e. 83

[8] *For more information on the use of purchasing power parities in making international comparisons, see Schultz (1992).*

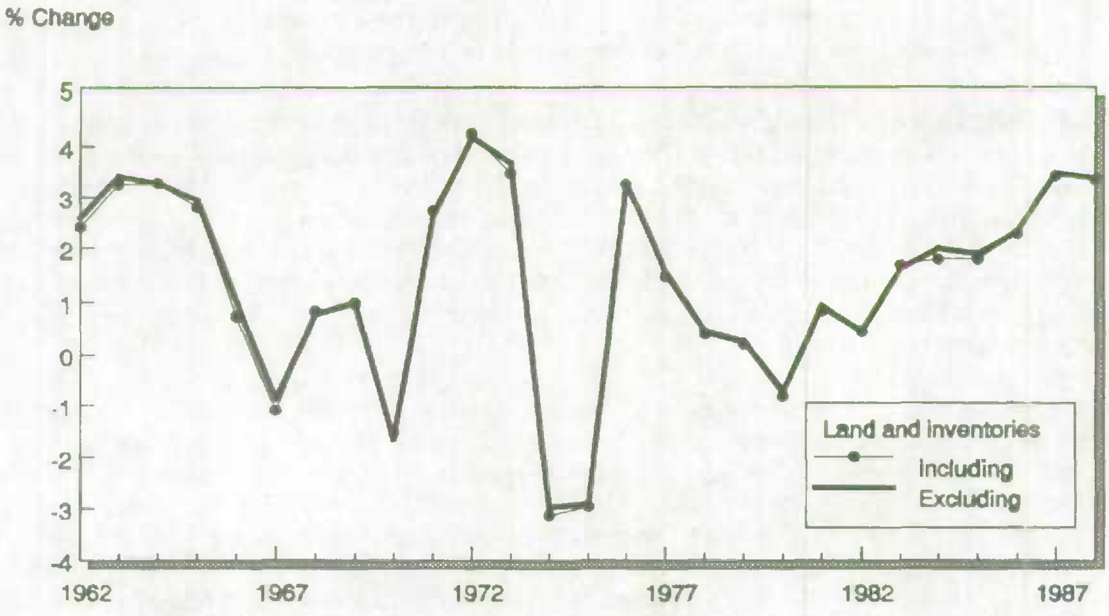
[9] *Productivity level comparisons for manufacturing industries in Canada, Japan and the United States can be found in Denny et al (1992). However, the comparisons were based on the authors' own estimates of purchasing power parities for the United States - Canada comparison.*

manufacturing industries) with hourly wages used as weights. In contrast, the BLS uses the sum of hours worked for two-digit industries as the measure of labour input. In other words, the BLS considers hours worked to be homogeneous within each two-digit industry group whereas Statistics Canada takes into account differences in returns to labour between the industries included in each of the 19 groups. A further difference is found in the calculation of capital inputs. In both countries, the cost of capital services is calculated residually for each industry as the difference between the value of gross output net of intra-industry sales and the cost of inputs other than capital, that is, labour costs and the cost of intermediate inputs. However, the BLS distributes this residual capital cost by type of asset and industry according to an estimated rental cost, whereas no distinction is presently made between asset types in Canada.

Second, capital services are estimated from a net capital stock based on delayed depreciation in the U.S. estimates as opposed to geometric depreciation in the Canadian estimates. The BLS tested the sensitivity of multifactor productivity and capital input measures to the assumption about the form of the efficiency function. Their conclusion was that "it is evident that the method selected has little effect on the final measure of multifactor productivity, for year-to-year changes or over a long time period."[10] In fact, for the private business sector, the difference between MFP estimates derived from the two types of depreciation never exceeds two tenths of a percentage point in any given year between 1949 and 1981 and is never more than one tenth of a percentage point over longer periods. From a practical point of view, differences in the choice of efficiency functions are not sufficiently important to justify the recalculation of either country's productivity estimates to conform with the other's.

Figure 1

Comparative Measures of Multifactor Productivity Growth for U.S. Manufacturing Industries



[10] *From Trends In Multifactor Productivity 1948-1981, U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 2178, September 1983, p. 57.*

A further difference in the measure of capital inputs is the inclusion of land and inventories by the BLS in addition to fixed capital whereas Statistics Canada presently includes only the latter in its measure. The BLS estimates used in this study have been recalculated without land and inventories in the measure of capital inputs to eliminate this methodological difference.

In removing land and inventories from the U.S. estimates to make the measures more comparable to ours, it was possible to test the sensitivity of the productivity estimates to the inclusion of these two assets in the measure of capital services. As can be seen in figure 1, this methodological difference has no significant impact on the multifactor productivity measure for total manufacturing. Looking at more detailed estimates, the impact is also practically imperceptible, leaving the Canada-U.S. ranking unchanged in any of the periods considered.

In future comparisons, the KLEMS indices from the Bureau of Labor Statistics can therefore be used "as is", that is without excluding land and inventories from capital inputs, in making comparisons with the relevant Canadian industry groups. This will significantly cut down on the preparatory work needed to make the estimates comparable.

iii - Comparability of Industrial Classifications

The concordance between industrial classifications is important to keep in mind in the context of international productivity comparisons. It may be tempting to dismiss this problem as being empirically insignificant but comparisons may have little meaning when they do not pertain to similar activities.

The definition of Canadian and U.S. industries in their respective industrial classifications differ for two basic reasons:

a- because of differences in the size and structure of the two economies
b- because of differences in the criteria used in developing the classifications

In order to compare any industrial statistics for the two countries, it is therefore necessary to establish a correspondence, where possible, between the two classifications. A conceptual concordance between the 1980 Canadian Standard Industrial Classification (SIC) and its 1987 U.S. counterpart was developed jointly by Statistics Canada and officials from various agencies of the U.S. government[11]. This concordance does not offer a quantitative measure of the comparability of industry groups. Rather, it provides a list of comparable industry groups on the basis of the commodities that they produce or the activities in which they engage, as well as a list of descriptions of the goods and services (or activities) not common to the two groups in question.

Drawing from the results of work in progress in other areas of Statistics Canada, it was possible to go beyond the conceptual concordance and to assign a measure of the degree to which industry groups are comparable. By assigning U.S. industry codes to Canadian establishments, it was possible to express Canadian establishment data (in this case, shipments) in both classification structures, that is, in the Canadian SIC and the U.S. SIC. In brief, comparable industries or groups of industries in both classifications were selected in a manner such that the two industry definitions overlap by at least 90% in terms of the 1988 value of Canadian shipments. The comparability measures are described in further detail in the appendix.

[11] *U.S. Bureau of the Census and Statistics Canada, Concordance between the Standard Industrial Classifications of Canada and the United States: 1980 Canadian SIC - 1987 United States SIC, Statistics Canada catalogue no. 12-574E, February 1991.*

Comparability measures can be used to evaluate the concordance at various levels of aggregation. On the basis of these measures, in the case of the twenty U.S. manufacturing industries for which the KLEMS index is available, nine industries were found to have a directly comparable Canadian industry at the "PM" level, (i.e. a one-to-one equivalence), as can be seen in text table 1 below. It was necessary to aggregate the Canadian logging and forestry industry ("PL3") which is outside of Canadian manufacturing to the Canadian wood industry to conform with the definition of the lumber and wood products industry of the U.S. manufacturing group. At the same time, this bridges the gap between the Canadian and the American manufacturing group definitions. After other aggregations, comparisons could be established for fourteen groups of industries. The remaining industries are not reasonably comparable as the U.S. definitions differ from ours to the point where only a full aggregation would allow meaningful comparisons to be made.

Text table 1

Concordance between Canadian industries at the PM level and 2-digit U.S. industries

Canadian Industries at the PM Level Codes PM	Industry Name	U.S. 2-digit industries
5+6	Food and beverage industries	20
7	Tobacco products industries	21
8+9	Plastic, rubber, leather & allied products industries	30+31
10	Textile, textile products & clothing industries	22+23
11+PL3	Wood , logging & forestry industries	24
12	Furniture and fixture industries	25
13	Paper & allied products industries	26
14	Printing, publishing & allied industries	27
15	Primary metal industries	33
17+19	Machinery, electrical & electronic products industries	35+36
18	Transportation equipment industries	37
20	Non-metallic mineral products industries	32
21	Refined petroleum & coal products	29
22	Chemical & chemical products industries	28
PM 5 to 23 + PL 3	Total manufacturing	20 to 39

Productivity Growth in Canada and the United States

Comparisons of productivity growth for a given year are not particularly meaningful as establishments in the two countries may be operating at different levels of capacity utilization for various reasons. One of these reasons may be the timing and amplitude of the business cycles. For this reason, comparisons are usually done on the average annual growth over a full business cycle or over long time spans. These long-term comparisons are more meaningful in that they are less sensitive to temporary fluctuations in productivity due to adjustments to changes in the economic environment.

When comparing productivity growth over business cycles, we must bear in mind that although the timing of business cycles is very similar in Canada and the United States, the amplitude and the breadth of contractions and expansions in economic activity may be very different in the two countries. Over the period covered by this study, Canada experienced recessions in 1970, in 1975, in 1980 (only a minor slowdown), and in 1982. In the United States, the troughs in the business cycles were in 1970, in 1974-75, in 1980, and in 1982. In addition to these "official" recessions, there were other minor slowdowns in economic activity in both countries such as the one in 1967. The two economies also experienced slower growth in the mid-80s.

During a recession, not all industries suffer from the slowdown to the same extent and at the same time. Estimates of the growth of real output net of intra-industry sales by industry since 1961 (not shown here) indicate that, in fact, most peaks and troughs in activity have been concurrent for corresponding industries in both countries. Moreover, the output cycles in most industries followed those in the general economic activity. However, there are differences in the amplitude of production cycles that may explain differences in productivity growth rates over the periods we have chosen to present.

Table 1 below presents the multifactor productivity indices based on gross output net of intra-industry sales for thirteen manufacturing industries and total manufacturing in Canada and the United States. Although comparisons could be done for fourteen industries or groups of industries, only thirteen are presented and analyzed in this paper. Estimates for the U.S. tobacco products industry are not shown because input shares used in the calculation of the estimates have exhibited unexplained variations over the 1961-1988 period. The base year was set to 1961 to facilitate growth comparisons between the two sets of estimates. The bar chart shown below table 1 depicts the average annual growth rate in productivity by country from 1961 to 1988 for each of the industries in the table.

I - Aggregate Trends

Over the 1961 to 1988 period, estimates of productivity growth in Canadian and American manufacturing exhibited very similar trends. The United States' manufacturing industries posted a marginally higher average annual growth rate over the twenty seven year period at 1.4%, compared with Canadian manufacturing at 1.3%. The difference, however, may not be significant given the normal range of uncertainty surrounding any estimate. Behind this seemingly comparable long term performance of the manufacturing group in Canada and the U.S. lie many differences across industries and through time that must be examined in order to gain a better understanding of the situation.

On average from 1961 to 1975, productivity in Canadian manufacturing fared better than its long term average, growing by 1.6% annually. The 1975 to 1982 cycle was characterized by poor productivity growth in these industries. After 1982, productivity growth rebounded to an average annual growth of 1.6% which was slightly higher than the 1961-1988 average. This recovery was characterized by strong growth in 1983 and 1984 followed by a modest growth in the following years.

Manufacturing industries in the United States had a comparatively poorer performance than in Canada in the pre-1975 period, exhibiting a weaker growth than their long-term average. Although the recession of the mid-70s appears to have inflicted a more severe blow to manufacturing productivity in the United States compared to Canada, productivity growth reached the same peak in both countries during the subsequent recovery. In contrast, multifactor productivity declined much more in Canada than in the United States during the 1982 recession, resulting in a stronger 1975-1982 average annual growth of 0.9% in the United States compared with a 0.5% average growth in Canada. Although the initial recovery was more vigorous in Canada, the United States' average annual productivity performance in the 1980s exceeded that of Canada by almost a full percentage point.

These findings are consistent with the history of business cycles in the two countries as the United States experienced a more severe and prolonged recession in the mid-70s compared to Canada whereas Canada's economy took a much more severe blow in 1982 compared to the United States.

In brief, if we consider the 1961-1988 annual average growth as the norm, Canada's manufacturing productivity did return to "normal" rates of growth after the 1982 recession but comparatively, the United States has experienced greater than "normal" productivity gains over the same period.

II - Comparative Performance of Individual Industries

Canada's multifactor productivity grew at a relatively faster pace than that of the United States in nine of the thirteen industries over the 1961-1988 period as shown in table 1. In most cases however, the difference in growth rates is marginal. The two largest average growth differentials in favour of Canada were found in the following industries:

- primary metal industries (0.8 percentage point gap)
- printing, publishing & allied industries (0.7 percentage point gap)

During this period, Canada lagged behind in four industries: by an average of 1.2 percentage points in the machinery, electrical and electronic group, by an average of 0.9 points in the paper and allied products industry, by an average of 0.4 percentage point in the furniture and fixture industries, and only marginally in the food and beverage industries.

Prior to 1975, Canadian manufacturing industries exhibited a stronger growth in productivity in all but three cases, that is, in wood and logging, in paper & allied products, and in machinery, electrical and electronic products industries. Moreover, Canadian industries generally led the U.S. by a wider margin in the 1961-1975 period compared to the full 1961-1988 period.

As indicated above, the 1975-1982 period was characterized by a general slowdown in productivity growth in both countries. Despite the U.S. manufacturing group posting a higher average annual growth in productivity than Canada between 1975 and 1982, Canada increased its lead in four out of thirteen industries.

During the recovery of the 1980s, the gap widened in favour of the United States at the total manufacturing level. However, at the detailed level, in eleven out of thirteen industries, either the gap between the two countries' growth rate narrowed in comparison with the 1975-1982 period (in four cases) or the comparative ranking was reversed (in seven cases), indicating that the relative positions of industries tend to change through time.

Since 1985, Canada's manufacturing multifactor productivity has exhibited slower growth in comparison to its southern neighbour. The slower growth experienced in Canada in recent years seems to be widespread, appearing in all thirteen industries selected in the comparison.

Text table 2 highlights some features that are consistent throughout the period. Canada's printing, publishing and allied industries come in first in all periods considered. The Canadian paper and allied products industries is behind in all five periods. Differences in age and capacity utilization rates of plant and equipment between Canada and the United States are among the factors that could explain this trend. The group encompassing machinery, electrical and electronic products in Canada has also come in second after the United States in all periods considered. However, as the latter is an aggregate of fairly heterogeneous industries, machinery industries and electrical and electronic products taken individually could have a different ranking. In fact, the electrical and electronic products industry in Canada has been performing very well, posting the second highest average annual contribution to multifactor productivity growth in the Canadian business sector from 1961 to 1988. These two groups cannot be examined separately since their definitions in the Canadian and the U.S. industrial classifications overlap one another considerably.

Text table 2

Comparative Rankings of Productivity Growth in Manufacturing Industries: Canada (C) and United States (US)*

Industry name	1961-88		1961-75		1975-82		1982-88		1961-73		1973-88	
	C	US	C	US	C	US	C	US	C	US	C	US
Total manufacturing	2	1	1	2	2	1	2	1	1	2	2	1
Food and beverage industries	2	1	1	2	2	1	2	1	1	2	2	1
Plastic, rubber, leather & allied prod. ind.	1	2	1	2	1	2	2	1	1	2	2	1
Textile, textile products & clothing ind.	1	2	1	2	2	1	1	2	1	2	1	2
Wood, logging & forestry industries	1	2	2	1	1	2	1	2	2	1	1	2
Furniture and fixture industries	2	1	1	2	2	1	2	1	1	2	2	1
Paper & allied products industries	2	1	2	1	2	1	2	1	2	1	2	1
Printing, publishing & allied industries	1	2	1	2	1	2	1	2	1	2	1	2
Primary metal industries	1	2	1	2	2	1	1	2	1	2	1	2
Machinery, electrical & electronic products ind.	2	1	2	1	2	1	2	1	2	1	2	1
Transportation equipment industries	1	2	1	2	1	2	2	1	1	2	2	1
Non-metallic mineral products industries	1	2	1	2	2	1	1	2	1	2	2	1
Refined petroleum & coal products	1	2	1	2	1	2	2	1	1	2	1	2
Chemical & chemical products industries	1	2	1	2	2	1	1	2	2	1	1	2

* A value of 1 (or 2) indicates the country in which the industry exhibited the higher (or lower) productivity growth.

iii - Correlation of the Estimates

Over the 1961 to 1988 period, in six out of thirteen industries, Canada's productivity growth estimates are correlated with their U.S. counterpart[12]. Productivity growth estimates for total manufacturing in both countries naturally show a stronger correlation than most component industry considered individually as conflicting movements in the individual industries' productivity growth estimates tend to cancel out as they are aggregated together. The refined petroleum and coal products industry is displaying the weakest correlation with its U.S. counterpart whereas chemical & chemical products industries show the strongest correlation. If we compare the 1961-1973 period to the 1974-1988 period, a structural change seems to have taken place. In the first period, the Canadian and U.S. estimates for total manufacturing are strongly correlated, whereas after 1973, the correlation falls slightly below 0.5. In the 1961-1973 period, seven Canadian industries are correlated with their U.S. counterparts. In contrast, only three industries are correlated when considering the 1974-1988 period.

[12] *For purposes of this analysis, estimates are considered to be correlated if the correlation coefficient exceeds 0.5.*

Table 1 - Multifactor Productivity Indices for Selected Manufacturing Industries in Canada and the United States, (1986=100), continued...

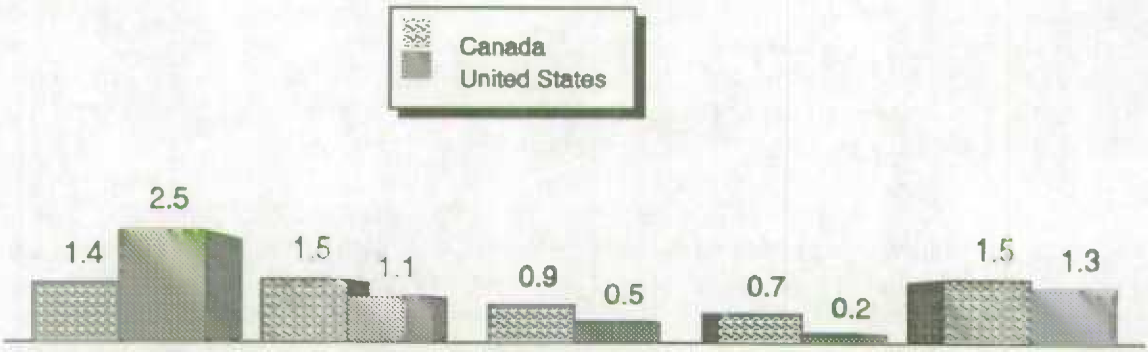
	Total manufacturing industries		Food and beverage industries		Plastic, rubber leather & allied products		Textile, textile products & clothing	
Year	Canada	U.S.	Canada	U.S.	Canada	U.S.	Canada	U.S.
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	104.6	102.6	101.6	101.0	105.7	102.6	105.6	102.6
1963	107.3	106.1	102.2	102.1	107.6	103.9	109.0	104.5
1964	110.3	109.6	103.2	102.3	110.6	105.9	109.7	106.3
1965	112.4	112.8	104.5	104.8	111.4	107.0	109.1	107.9
1966	112.7	113.9	105.0	105.9	113.3	106.6	109.0	109.9
1967	111.2	112.9	106.2	105.1	112.5	106.7	107.7	112.0
1968	114.6	113.8	105.8	104.5	117.2	107.5	113.3	111.0
1969	118.0	114.9	106.5	105.1	119.7	109.1	115.8	112.5
1970	116.5	113.0	107.1	105.7	117.7	105.9	114.9	115.2
1971	120.0	116.0	109.9	107.3	119.9	109.6	120.0	118.1
1972	124.1	120.8	110.4	108.7	121.6	111.5	125.4	124.2
1973	128.7	125.3	112.4	109.4	125.2	114.2	128.3	125.0
1974	128.8	121.5	111.9	105.3	120.8	110.8	128.4	122.4
1975	124.6	118.0	109.5	106.2	117.2	109.7	130.5	123.1
1976	129.2	121.9	112.7	107.5	122.8	110.1	135.1	128.0
1977	132.7	123.8	114.4	105.3	128.2	110.7	140.0	135.5
1978	134.1	124.4	114.3	106.3	133.0	110.4	147.3	134.2
1979	134.5	124.7	114.5	107.2	136.4	109.1	151.9	136.8
1980	132.2	123.8	113.2	108.2	133.5	110.3	152.2	140.2
1981	134.8	124.9	112.9	109.6	135.4	117.3	155.2	140.0
1982	129.4	125.5	112.9	112.0	132.6	118.1	147.5	142.6
1983	135.1	127.5	112.0	112.8	138.8	120.0	154.0	145.7
1984	141.5	130.0	113.1	112.8	146.1	121.8	157.2	145.3
1985	143.7	132.5	114.3	114.2	147.0	125.2	159.9	146.6
1986	142.5	135.5	113.5	114.4	141.7	124.9	164.4	150.9
1987	142.6	140.3	113.3	113.9	142.9	129.3	164.7	154.0
1988	142.3	145.0	111.3	114.3	140.7	129.3	161.0	154.5

Table 1 - Multifactor Productivity Indices for Selected Manufacturing Industries in Canada and the United States, (1986=100), continued...

	Wood, logging & forestry industries		Furniture & fixture industries		Paper & allied prod. industries		Printing, publishing & allied industries		Primary metal industries	
Year	Canada	U.S.	Canada	U.S.	Canada	U.S.	Canada	U.S.	Canada	U.S.
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	103.0	101.5	102.0	98.9	100.2	100.5	101.7	96.3	102.4	100.2
1963	108.3	109.6	104.8	102.0	101.7	101.7	102.0	99.0	103.3	102.8
1964	109.7	121.2	104.5	103.4	104.1	104.2	101.5	102.4	105.5	105.7
1965	109.1	124.7	107.7	105.8	102.6	104.7	101.0	102.5	107.8	106.2
1966	110.1	124.3	109.1	105.8	101.8	104.4	102.0	103.5	107.3	107.7
1967	110.3	130.0	108.9	105.2	97.4	102.2	102.1	103.1	104.4	104.6
1968	116.2	133.5	110.6	105.4	98.2	105.5	102.8	102.1	108.3	102.0
1969	118.9	128.9	113.7	107.5	101.1	108.3	103.5	103.1	109.3	100.8
1970	120.5	134.3	110.5	104.3	101.0	105.9	102.2	98.9	108.5	98.3
1971	121.2	134.6	112.1	105.4	100.8	108.8	103.2	99.5	108.0	99.3
1972	122.4	141.1	119.7	111.4	104.1	113.8	106.6	101.6	109.9	101.6
1973	123.1	140.6	123.6	112.6	107.6	120.6	110.8	103.5	112.4	106.1
1974	122.1	142.0	112.7	111.0	110.0	118.0	110.5	102.4	113.4	104.0
1975	117.5	143.2	111.1	109.8	97.1	109.9	111.8	101.0	110.4	92.9
1976	124.4	142.7	117.1	113.5	104.1	114.2	118.3	102.0	107.1	93.3
1977	129.7	139.9	118.1	115.2	103.8	116.1	122.6	102.5	111.3	90.6
1978	129.6	136.5	123.1	117.6	106.0	117.8	125.2	101.9	112.9	92.1
1979	129.5	140.6	120.1	117.0	107.3	116.7	124.6	101.2	107.9	90.9
1980	135.1	146.1	118.4	117.9	105.8	113.7	124.5	99.4	105.4	91.3
1981	137.9	140.7	119.7	117.1	105.5	116.0	125.5	101.5	109.3	92.5
1982	136.0	133.8	107.5	118.0	98.5	120.7	119.3	100.5	102.6	88.0
1983	146.8	138.9	114.5	117.9	103.5	125.8	122.9	100.2	109.0	84.6
1984	158.0	144.1	117.0	119.1	105.0	123.9	126.4	99.4	113.7	87.7
1985	163.8	142.4	118.1	119.5	105.2	124.3	126.4	99.2	117.9	88.8
1986	167.4	147.1	115.7	118.9	105.5	128.6	125.0	98.6	116.8	89.5
1987	172.4	159.2	110.0	121.6	107.2	130.0	121.7	100.2	119.9	90.7
1988	170.8	163.3	106.8	119.6	105.0	133.0	120.8	98.9	119.9	95.4

Table 1 - Multifactor Productivity Indices for Selected Manufacturing Industries in Canada and the United States, (1986=100), concluded.

Year	Machinery, electrical & electronic products industries		Transportation equipment industries		Non-metallic mineral products industries		Refined petroleum & coal products		Chemical & chemical products industries	
	Canada	U.S.	Canada	U.S.	Canada	U.S.	Canada	U.S.	Canada	U.S.
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	107.2	104.6	104.6	102.9	107.2	100.6	105.4	100.9	103.4	103.0
1963	108.9	107.3	109.2	108.2	108.5	104.3	106.4	102.0	106.6	106.2
1964	113.5	112.0	110.4	111.2	112.5	105.9	108.8	103.2	111.1	110.5
1965	115.8	115.6	115.2	116.0	114.4	106.3	111.2	102.9	113.3	112.8
1966	117.0	116.9	113.1	114.8	115.2	104.9	113.1	103.0	114.2	112.5
1967	112.9	116.5	118.2	113.2	108.2	103.4	108.4	103.5	112.0	108.7
1968	114.9	116.7	120.9	115.3	113.0	104.4	110.6	105.2	112.8	111.7
1969	118.5	118.9	127.5	114.5	115.1	104.9	109.0	105.7	114.8	112.9
1970	116.6	118.5	122.7	109.2	113.4	102.4	109.3	107.4	114.2	113.4
1971	113.6	119.3	129.6	116.5	121.8	103.3	109.8	108.3	118.7	117.0
1972	118.2	125.8	134.0	117.3	131.2	107.2	109.6	109.1	121.8	123.0
1973	122.8	130.8	139.6	121.4	124.0	109.0	113.9	110.4	127.9	128.4
1974	123.3	128.7	140.9	120.1	118.8	105.7	113.3	109.9	127.9	122.3
1975	120.1	125.1	144.0	120.4	115.0	104.3	114.1	108.1	119.8	115.1
1976	123.6	130.6	145.8	125.3	116.3	107.0	113.4	108.3	125.5	119.6
1977	127.7	137.8	146.8	126.3	115.0	106.2	117.0	108.7	124.8	122.5
1978	127.7	140.6	147.1	125.2	117.0	106.3	114.4	108.5	128.9	122.7
1979	135.5	143.9	146.9	122.6	117.6	105.2	112.8	107.3	132.5	123.7
1980	137.7	147.5	138.2	117.6	110.5	103.4	113.3	107.6	128.2	117.4
1981	137.3	151.3	140.2	112.7	109.9	102.5	115.9	105.8	133.1	121.9
1982	129.4	153.1	138.9	114.5	102.5	102.5	118.6	104.5	124.3	123.3
1983	128.7	155.8	143.2	119.4	109.7	104.7	120.4	103.6	135.3	128.3
1984	138.6	159.2	148.8	122.5	115.5	106.5	121.1	104.9	140.7	127.9
1985	140.6	166.7	150.4	123.9	120.8	108.5	119.7	105.1	142.2	127.5
1986	142.0	172.5	148.4	125.7	123.2	110.8	118.4	105.7	142.8	134.4
1987	141.6	184.0	145.7	130.1	125.9	111.2	119.3	105.7	145.6	137.8
1988	144.6	196.2	148.2	133.0	125.9	113.7	119.7	106.3	148.3	143.4



iv - Contributions of Industries to Total Manufacturing Productivity Growth

The ranking of the Canadian and U.S. manufacturing aggregates depends on two things:

1) the relative performance of individual industries as was presented in the section above, and
2) the composition of total manufacturing in both countries.

The performance and relative size of manufacturing industries together determine the contribution that each of them will bring to the overall performance of the group in any given year. In turn, these contributions allow us to trace the origins of productivity growth in total manufacturing back to specific industries, thus giving more meaning to the aggregate measure.

Canada

As illustrated in figure 2, the largest contributor to Canadian manufacturing productivity growth over the 1961 to 1988 period was the transportation equipment industry. Machinery, electrical and electronic products industries came in second, followed by wood, logging and forestry industries and by chemical and chemical products industries. The distribution of contributions is less dispersed for Canada than for the United States, ranging from 0.25 percentage point for transportation equipment to almost zero for the furniture and fixture industries. The transportation equipment industry was also the largest contributor during the 1961 to 1973 period, but fell to fifth place from 1973 to 1988. The machinery group holds the third and second rank respectively over those same time spans. The most dramatic change before and after 1973 takes place in the food and beverage industries: this group holds the second place from 1961 to 1973 in contrast with an eleventh position from 1973 to 1988, contributing negatively to manufacturing productivity growth in this latter period.

United States

The distribution of contributions to U.S. manufacturing productivity growth over the 1961 to 1988 period as shown in figure 3 is much more dispersed than in Canada. The contribution of the machinery, electrical and electronic products group stands out above all other industries. This group also dominates its Canadian counterpart in terms of productivity growth in all periods considered. The second largest contributor is the transportation equipment industry, followed by chemical and chemical products industries and textile, textile products and clothing industries. These three U.S. industries came in second after Canada in terms of productivity growth. Although the second, third and fourth largest contributors were weaker than their Canadian counterparts, the growth of productivity in total manufacturing was slightly stronger in the U.S. than in Canada for that period mainly due to the relative size and good performance of the machinery, electrical and electronic products group. The five largest contributors are the same in the pre-1973 period, where the U.S. trails Canada in terms of its manufacturing productivity growth, as in the post-1973 period where the positions are reversed. However, in contrast with the United States, many industries in Canada changed relative positions from one period to the other.

The average annual contributions of the thirteen component industries cannot fully explain changes in total manufacturing productivity as they do not represent a full coverage of the manufacturing group. As can be inferred from text table 1, there are three U.S. industries which are not covered by this study because of inadequate comparability. They are: fabricated metal products industries (SIC 34), instruments and related products (SIC 38), and miscellaneous manufacturing (SIC 39). The Canadian manufacturing industries for which this study presents no comparable estimates are fabricated metal products (PM 16) and other manufacturing industries (PM 23). In addition, as stated above, no comparison is made for the tobacco products industry due to unexplained trends in the U.S. estimates. Productivity growth in these industries is nevertheless implicitly included in the estimates for total manufacturing. We must bear this in mind when using a contribution analysis to explain total manufacturing productivity growth.

Figure 2

Average annual contribution of Canadian industries to total manufacturing multifactor productivity growth, 1961-1988

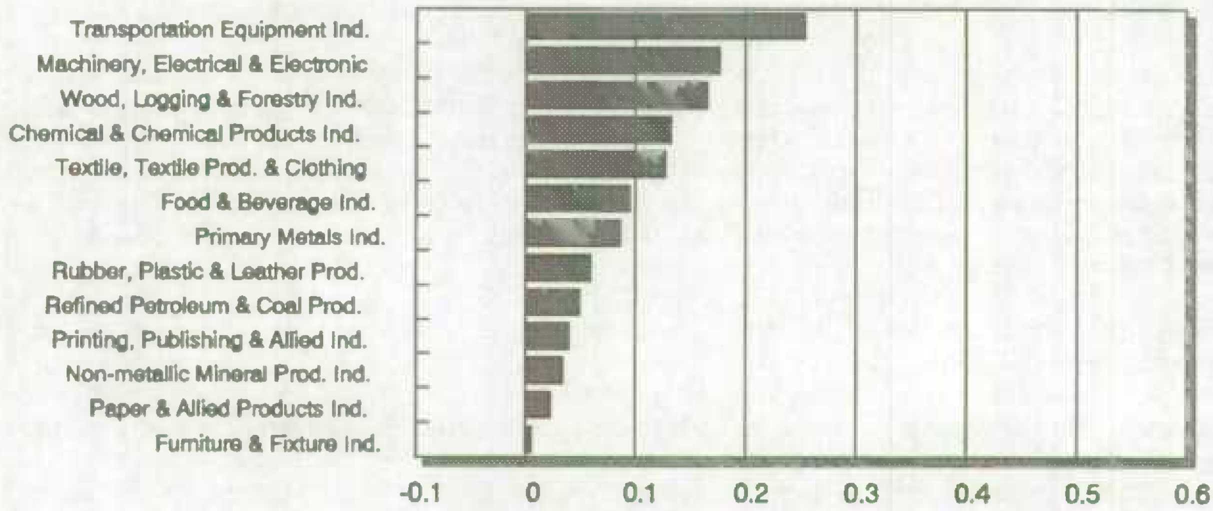
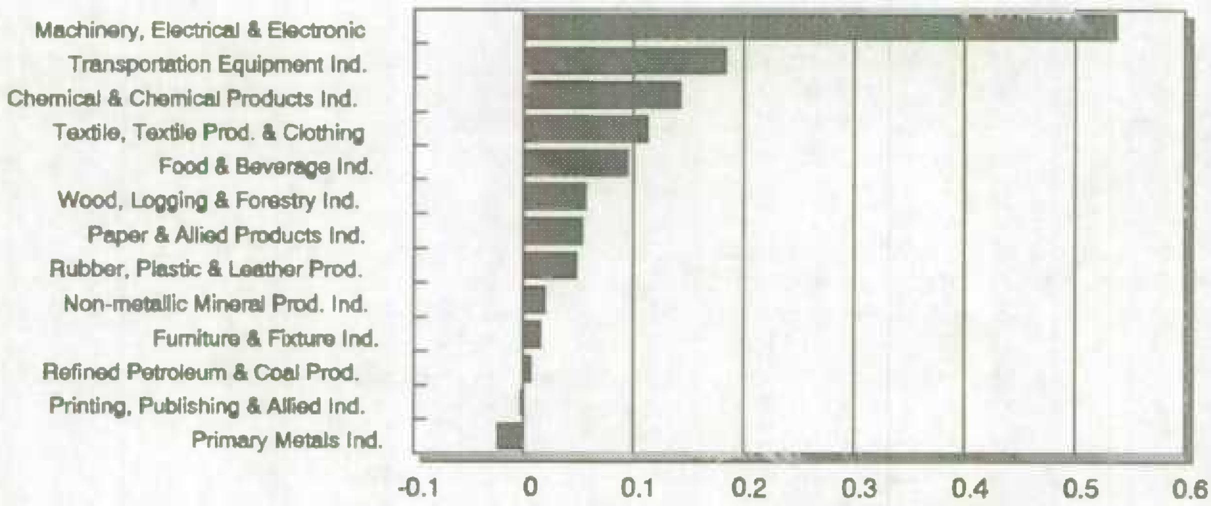


Figure 3

Average annual contribution of U.S. industries to total manufacturing multifactor productivity growth, 1961-1988



Conclusion

International productivity comparisons are an important element in assessing Canada's competitiveness at home and abroad. Making these comparisons is not always straightforward as many factors must be taken into account. Differences in methodologies and classifications must be identified and if possible, eliminated, in order to make meaningful comparisons. Aside from informing the readers of the many issues to consider in making productivity comparisons, the main contribution of this study was to present estimates of multifactor productivity *for comparable sets of production activities* in both countries based on the quantitative measures of comparability of industrial classifications presented in the appendix below.

The comparisons described in the paper were restricted to the industries for which U.S. multifactor productivity indices were already available. The methodology described in the appendix could be used to find comparable Canadian and U.S. industry groups at various levels of aggregation. In fact, comparability measures have been calculated for the most detailed level at which Statistics Canada produces multifactor productivity estimates for manufacturing, that is, for 83 industries. Fifty-three of these industries have comparable groups of four-digit U.S. industries. The industries for which there is no correspondence will be the subject of further research in the near future.

Unfortunately, multifactor productivity estimates for the United States are not readily available for the combinations of U.S. four-digit industries that were found to be comparable to 53 Canadian manufacturing industries. The collection of the appropriate U.S. statistics needed to construct these estimates, an exercise of sizeable proportions, could be undertaken if there was sufficient interest in these estimates.

The overall conclusion stemming from the results of the comparisons is that manufacturing productivity growth in Canada and the United States has evolved in a very similar way over the last three decades. In the last few years of the comparison, the situation in Canada seems to have deteriorated, and this, in most industries covered by the study. Perhaps, this is a temporary phenomenon but nevertheless, it has raised some concerns in many circles. As the data becomes available, it will be interesting to see if this trend persists over the current years.

Appendix

As explained above, differences in industrial classifications must be resolved in order to be able to make meaningful comparisons of productivity on an international level. In fact, this is the case with international comparisons of any industrial statistics. The purpose of this appendix is to describe in greater detail the approach taken to measure the degree of comparability of industrial classifications and on this basis, how the best match of Canadian and U.S. industries was found.

The development of a quantitative concordance was based on a project involving the reclassification of large Canadian manufacturing establishments to the U.S. Standard Industrial Classification. Generally, the method for recoding establishments can be summarized in two steps:

1) each commodity produced by a Canadian manufacturing establishment was linked to the relevant U.S. four-digit industry class

2) the establishment was then assigned the U.S. code corresponding to the largest share of its output (on the basis of 1988 shipments of Canadian establishments)

This recoding makes it possible to express Canadian manufacturing establishment data in either the Canadian or the U.S. classification structure. The criteria used to assign U.S. codes to Canadian establishments results in a concordance that defines comparability on the basis of similarity of commodity outputs. Comparable groups of industries from both U.S. and Canadian classifications are selected on the basis of 1988 Canadian shipments data, as illustrated below.

As the comparability measures are based on Canadian shipments data, the implicit assumption being made is that the U.S. commodity distribution is the same as the Canadian distribution. If the comparability measures were recalculated on the basis of U.S. shipments data rather than on Canadian data, it may generate different results. The difference between the two resulting concordances will be a function of the degree to which the industrial structures of the two countries differ. Because of limited data availability, it would be difficult to implement this methodology with U.S. data as this would require repeating the recoding exercise described above in the other direction (i.e. assigning Canadian codes to U.S. establishment data). Furthermore, the quality of the concordance should, in principle, be assessed at different points in time if this method is to be used to compare statistics over several years. When interpreting the results it is therefore important to keep in mind that the resulting concordance is representative of the *1988* structure of the Canadian economy.

Measures of comparability

The results of the recoding exercise described above were used to develop comparability measures between the two-digit U.S. manufacturing industries and Statistics Canada's multifactor productivity industry classes.

As explained at the beginning of the article, Statistics Canada's multifactor productivity estimates are produced at different levels of aggregation: total business sector and levels "PS", "PM", and "PL". The first step in measuring comparability was to aggregate 1988 shipments data for Canadian manufacturing establishments to the 19 manufacturing industry classes ("PM"). The second step involved the cross-tabulation of Canadian shipments data by Canadian PM industries and two-digit U.S. industries. The resulting shipments matrix thus contained the current dollar shipment value of the intersection between all possible pairs of Canadian and U.S. groups.

To illustrate how comparability was measured, let us define this matrix as **S**, with the 19 Canadian industries across the top and U.S. two-digit industries along the side. In the simple example depicted below, the **S** matrix shows the value of the intersections between Canadian industries (d,e,f,g,h,i,j) and U.S. industries (k,l,m,n,o,p,q).

Shipments(S)

$$
\begin{array}{cc}
 & \underline{PL} \\
 & \begin{array}{ccccccc} d & e & f & g & h & i & j \end{array} \\
\underline{USSIC} & \begin{array}{c} k \\ l \\ m \\ n \\ o \\ p \\ q \end{array}
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 2 & 0 & 0 & 0 & 0 & 0 \\
0 & 3 & 0 & 0 & 0 & 0 & 0 \\
0 & 4 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 5 & 4 & 4 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 8 & 2 \\
0 & 0 & 0 & 0 & 0 & 10 & 0
\end{bmatrix}
\end{array}
$$

In order to understand how this matrix can be used to measure the quality of the concordance, it is helpful to consider the four possible cases that occur when comparing two classifications:

1) the *one-to-one* case: when there is a reciprocal correspondence between one group in each classification structure; in the example shown above, Canadian industry d and U.S. industry k fall under this category.

2) the *one-to-many* case: when one Canadian industry corresponds to a group of U.S. industries; Canadian industry e and U.S. industries l, m, and n are an example of a one-to-many case.

3) the *many-to-one* case: when a group of Canadian industries corresponds to a unique U.S. class; in the **S** matrix above, Canadian industries f, g, and h correspond exactly to industry o from the U.S. classification.

4) the *many-to-many* case: when a group of Canadian industries corresponds to a group of U.S. industries; industries i and j from the Canadian classification correspond to industries p and q in the U.S. classification.

The presence of non-zero values in off-diagonal elements of the shipments matrix **S** makes it possible to distinguish between the four occurrences described above. In reality, the vast majority of cases are "many-to-many" situations. In theory, industries should be aggregated together until all cases are reduced to one-to-one cases (i.e. 100% comparability). For example, the **S** matrix shown above indicates that by aggregating Canadian industries i and j together and by aggregating U.S. industries p and q together, the comparison of the two groups is equivalent to a one-to-one situation. In practice, the classification structures are so different that in most cases, it is not possible to arrive at a one-to-one case without having to aggregate all manufacturing industries together and even in that case, as will be explained below, the two manufacturing groups are not perfectly comparable.

The choice to aggregate industries in order to achieve comparability was based on the following decision rules: for each Canadian industry, U.S. classes are selected and aggregated together in a way that these U.S. classes have at least 90% of their *combined* shipments in common with the Canadian class[13]. In turn, if the U.S. industries that are chosen make up more than 90% (taken together) of the Canadian industry, then the groups of industries are considered to be reasonably comparable.

The example below illustrates how the aggregation decisions were made. The shipments matrix **S** below is a subset of the shipments matrix above and shows the value of shipments of goods and services common to both Canadian industries i and j and U.S. industries p and q. Let us define the vectors of marginal totals: **c** being the summation of shipments over all U.S. industry groupings (i.e. sum of all rows or total Canadian shipments by Canadian industry) and **u** being the summation of shipments over all Canadian PM's (i.e. sum of all columns or total Canadian shipments distributed by U.S. industry class).

[13] *Any U.S. industry (however small) having more than 80% of its shipments classified to a given Canadian industry class was assigned to that class even if the 90% coverage of the Canadian industry could be achieved without including it.*

Shipments(S)

$$\begin{array}{cc} & \begin{array}{cc} i & j \end{array} \\ \begin{array}{c} p \\ q \end{array} & \begin{bmatrix} 8 & 2 \\ 10 & 0 \end{bmatrix} \begin{bmatrix} 10 \\ 10 \end{bmatrix} \boldsymbol{u} \\ & \begin{bmatrix} 18 & 2 \end{bmatrix} \\ & \boldsymbol{c} \end{array}$$

Canadian share(A) *U.S. share(B)*

$$\begin{array}{cc} & \begin{array}{cc} i & j \end{array} \\ \begin{array}{c} p \\ q \end{array} & \begin{bmatrix} .44 & 1 \\ .56 & 0 \end{bmatrix} \end{array} \qquad \begin{array}{cc} & \begin{array}{cc} i & j \end{array} \\ \begin{array}{c} p \\ q \end{array} & \begin{bmatrix} .8 & .2 \\ 1 & 0 \end{bmatrix} \end{array}$$

Let us also define matrices **A** and **B** which contain the comparability measures:

→the Canadian share matrix (**A**) is defined as the ratio between the shipments in each cell of the **S** matrix and the total shipments by Canadian industry in vector **c**; for a given Canadian industry, the columns of matrix **A** show the distribution of the Canadian industry's shipments across U.S. industry classes.

→the U.S. share matrix (**B**) was defined as the ratio between the shipments in each cell of the **S** matrix and the total shipments by U.S. industry found in vector **u**; the rows of the resulting U.S. share matrix **B** represent the distribution of shipments belonging in a given U.S. industry over all Canadian industry groups.

To find the U.S. industry that corresponds to Canadian industry i, the matrix **S** shows that the ten shipment units classified to q are also classified to i (i.e. the share in matrix **B** is 1). The i and q combination therefore satisfies the 90% criteria in the U.S. dimension. However, the definition of U.S. industry q covers only slightly more than half of the production classified to Canadian industry i (see matrix **A**). Therefore, the two industries are not comparable. Looking at industry p, matrix **B** shows that only 80% of its production belongs in industry i in the Canadian classification. But taken together, 90% of the shipments classified to industries p and q also belong in industry i as can be seen in matrix **S** (i.e. (8+10)/(10+10) = 0.9). Moreover, this combination of U.S. industries covers 100% of industry i as can be seen in matrix **A** (i.e. 0.44 + 0.56).

To preserve the maximum amount of detail in the Canadian estimates, preference was given to aggregating U.S. groups together to achieve a concordance rather that grouping Canadian industries together. If it was impossible to achieve a 90% coverage of the Canadian industry by grouping U.S. industries without jeopardizing the U.S. share criteria, then the only solution was to aggregate Canadian groups together. Of course, there are cases where the definition of U.S. industries cross so many Canadian industry definitions, that the only way to find a comparable industry would be to aggregate together all manufacturing industries. This option is not used as all the detail of the comparison would be lost.

Since the recoding was done for Canadian manufacturing establishments only, the shipments of any Canadian establishment that is outside the Canadian manufacturing group but would theoretically belong in the U.S. manufacturing group are excluded from the shipments matrix. When this occurs, the comparability measure (i.e. the U.S. share) is biased upwards because the total Canadian shipments distributed over U.S. industry classes is underestimated by the value of shipments from non-manufacturing establishments which were not part of the recoding exercise. This occurs in three instances but only in one case is the impact significant: the Canadian logging and forestry industry (Canadian SIC 04) is a non-manufacturing industry in Canada but belongs in U.S. SIC 24 (Lumber and wood products) of the U.S. manufacturing group. To correct this problem, the logging and forestry industry was combined with the wood industries in the Canadian estimates, making this group comparable to the U.S. lumber and wood products industry. At the same time, this bridges the gap between the Canadian and the American manufacturing group definitions.

In the final analysis, it was found that ten out of nineteen Canadian manufacturing industries could be compared to one or many two-digit U.S. industries. For the remaining industries, aggregation on the Canadian dimension resulted in four additional "matches". There are two Canadian industries for which there is no reasonably comparable U.S. industry: the fabricated metal industry (PM 16) and other manufacturing industries (PM 23).

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FEATURE ARTICLE 2

Hours Worked: A New Measure of Labour Input for Multifactor Productivity Estimates

By Jean-Pierre Maynard[14]

Introduction

Although it is preferable to base the measure of multifactor productivity on estimates of person-hours worked for reasons that will be explained below, until now, productivity estimates have been based on the number of persons at work. Estimates of person-hours worked were developed in the framework of recent research on improvements into the quality of multifactor productivity measures.

In the framework of multifactor productivity, the productivity indices are first calculated at the most disaggregated level of industries, and then aggregated to the desired level following well-established rules. Despite the fact that estimates of hours worked were produced as part of the framework of labour productivity measurement, they were available only at higher levels of aggregation and could not therefore be of use in the calculation of multifactor productivity indices. The goal of this research, the results of which are presented here, consists in the disaggregation of the existing hours data to a detailed level of industries.

Ideally, labour input should represent the quantity of effort rendered by all persons participating in the production process, irrespective of whether such effort is physical or intellectual in nature. As there is no precise measure of human effort in a work environment, approximations such as the number of employees or the number of person-hours are generally utilized.

The use of the number of persons at work as a labour input measure relies on the assumption that human effort is proportional to the number of workers. It is possible to refine this measure by taking into account the number of hours worked per person. The number of person-hours worked is more appropriate since it takes into account the fact that the number of hours worked per person changes over time and across industries. For example, we have observed over time a reduction in the standard work week and an increase in part-time work. Another advantage resides in the improvement of Canada-United States comparisons of multifactor productivity, given that the U.S. estimates are already based on the hours concept.

The article that follows begins with an overview of the evolution of hours worked per person in Canada since 1961, for the business sector and component industries. It is followed by a discussion of sources and methods employed to produce hours worked for the 110 industries of the multifactor productivity series.

[14] *The author wishes to thank the staff from Productivity Measures that contributed to this project. In particular, the author wishes to thank Monique Larose, Séan Burrows, Vere Clarke, and Stéphane Maynard for their important contribution to the development of these estimations as well as Aldo Diaz, Marie Allard-Saulnier, and René Durand for their valuable comments on earlier drafts of this paper.*

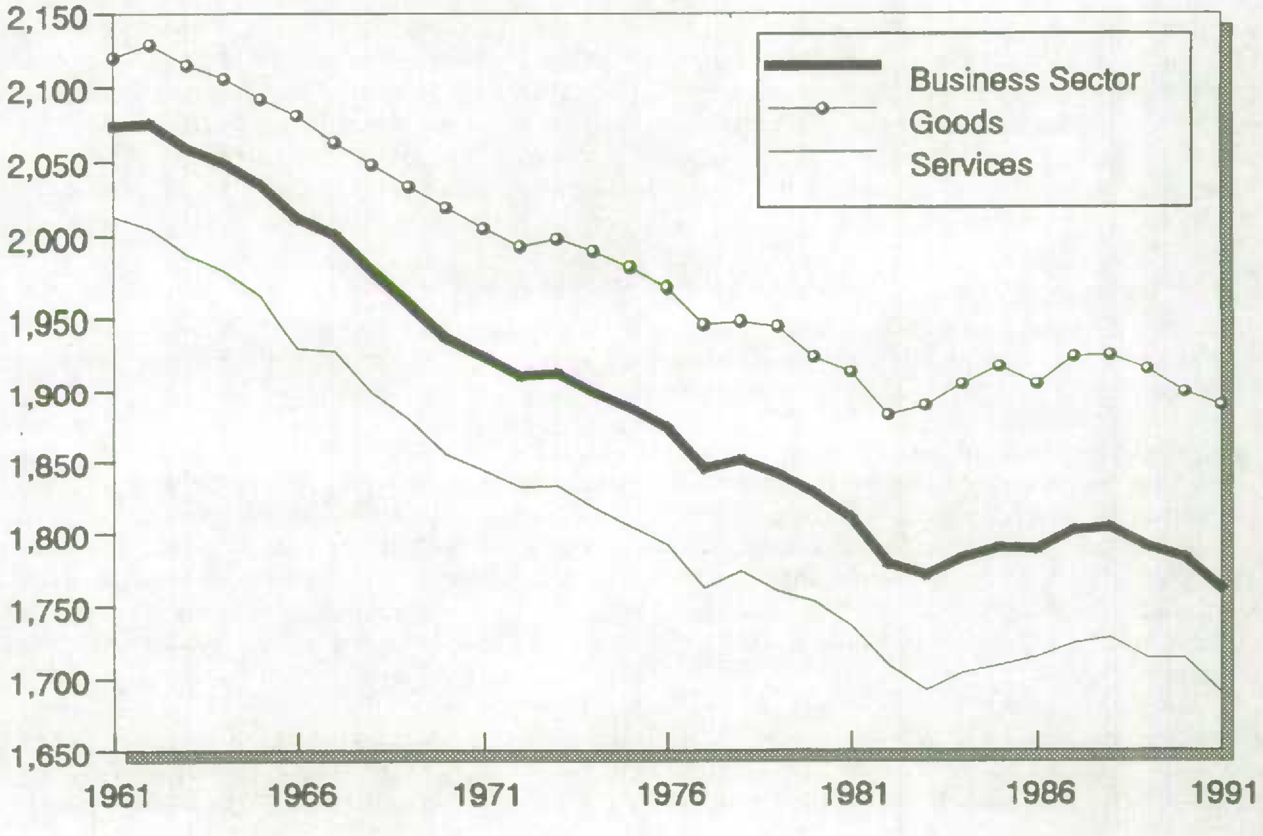
To the extent possible, the methodology is consistent with that used to produce the person-hours estimates at the aggregate level of industrial divisions for labour productivity. Finally, the article undertakes a comparison of multifactor productivity based on hours worked with those based on persons at work.

The Evolution of Hours Worked During the Last Thirty Years

Since the beginning of the 1960's, there has been an increase in leisure time as part of the general rise in living standards. Working conditions over the last thirty years improved considerably when measured in terms of number of hours worked per person. This reduction in hours per person is the result of gains in social benefits obtained by the work force such as increases in the length of vacation time, additional holidays, increases in paid leave for reasons of sickness or for personal reasons, or simply due to a generalized reduction in the standard work week. Figure 1 shows the downward trend in annual hours worked per person in the business sector as well as in the goods and services industries of the business sector.

Figure 1

Evolution of annual hours worked per person since 1961



It is of interest to note that the rate at which annual hours per person decreases has slowed considerably at the beginning of the 1980's. This observation is confirmed by the comparison of growth rates for different sub-periods presented in Text table 1. In fact, beginning with the 1982 recession, the decline in hours per person stops, and in fact increases between 1983 and 1988, only to decline starting in 1989. The reduction in the number of hours per person observed between recessions (1982 and 1990-1991) compensates for the rise which took place during the years of expansion (1983 to 1988).

Text table 1

Hours worked per person per year between 1961 and 1991 and selected sub-periods

Period	Business Sector	Business Sector Goods	Business Sector Services
1961-1975	-0.7%	-0.5%	-0.8%
1975-1982	-0.8%	-0.7%	-0.8%
1982-1991	-0.1%	0.0%	-0.1%
1961-1991	-0.5%	-0.4%	-0.6%

Annual hours worked per person show a net tendency to decline during the period of study, indicating that multifactor productivity estimates would be sensitive to the use of person-hours as labour input.

Concepts and Definitions

The concept of hours worked that is of interest to us represents the total number of hours that a person devotes to work, whether these hours are paid or not. Generally, this includes normal hours plus overtime, including coffee breaks, on-the-job training as well as time lost due to unanticipated interruptions in production. Time lost due to strikes or lockouts, to statutory holidays, vacations, illness, maternity leave or personal reasons is not included in hours worked.

Statistics Canada's Input-Output Division currently maintains a detailed database of employment statistics which distinguishes between paid workers and other-than-paid workers. Some surveys collecting data on employment usually differentiate between production and other salaried employees (administrative personnel, office workers, sales representatives, etc.). The other-than-paid workers class can also be broken down into two types: self-employed workers, including working owners and active associates, and unpaid family workers. The latter type is mostly found in industries where family businesses are prevalent, such as the agriculture industry and the retail trade industry. Text table 2 shows the classes of workers used in this study.

Text table 2

Diagram of classes of workers used to estimate labour input for the calculation of productivity

Persons at Work	
• Paid Workers	• Other-than-paid Workers
• Production Workers	• Self-employed Workers
• Other Salaried Employees	• Unpaid Family Workers

For the purposes of this project, estimates of person-hours worked were produced for the relevant classes of workers from 1961 to the present and for 110 industries. The person-hours worked concept can be visualized as the product of hours worked per person as defined above, and the average number of persons at work. As the number of persons at work is already available in a database, the project consisted of producing estimates of annual hours worked per person which would be representative of all classes of workers in each industry.

Description of Sources and Methods

At Statistics Canada, there is no single source of information which would allow the estimation of hours worked per person for all industries and for the full period under consideration. Time series on annual hours worked per person were therefore constructed from four main sources:

1) the Annual Survey of Manufactures
2) the Labour Force Survey
3) the Census of Mines
4) the Annual Survey of Working Conditions

For most industries, more than one source is available. Notwithstanding the fact that the data must be compatible with the concept of hours worked used for multifactor productivity, we privileged data sources that: 1) were considered to be the most reliable; 2) were available for the entire period; 3) were already used in the employment estimates.

1 - Manufacturing Industries

In the case of manufacturing industries, the main source for person-hours worked was the Annual Survey of Manufacturing[15]. In 1989, these data were collected annually using three different methods. All large establishments including head offices are surveyed by means of a fully detailed questionnaire. Small establishments are surveyed on a rotating basis by means of a simplified questionnaire and by means of

[15] *For more information concerning this survey, see Manufacturing Industries of Canada: national and provincial areas, Statistics Canada, catalogue no. 31-203 annual.*

administrative records. Only large establishments are asked specific questions on hours paid and hours worked and this, only for production workers. This questionnaire also included additional questions on the hourly wage rate, on the normal number of hours worked, as well as on the annual average number of paid holidays for total paid workers. This survey uses the additional information obtained on the number of paid holidays and hours paid data to derive the number of hours at work. However, data on normal hours for other salaried employees were not collected prior to 1983.

As for the complement of small establishments, person-hours are estimated from declared wages and salaries. *Paid* person-hours are then obtained by dividing wages and salaries by average hourly earnings estimated from the data on large establishments in the same industry. The number of person-hours *worked* is calculated by the ratio of person-hours *worked* to person-hours *paid* for a given industry. The estimates of hours worked for small establishments are of a lower quality; however, these establishments only accounted for a small proportion of the total shipments of manufacturing industries in 1989[16] .

The Annual Survey of Manufactures provides the necessary hours worked information at the detailed level in the case of production workers[17]. Data on person-hours worked at the major group level (level "PM")[18] for the four classes of workers are already produced in the framework of the labour productivity program. Annual hours worked per person for other salaried employees, self-employed and unpaid family workers were available only at the PM level for the entire period. Estimates of hours worked for these three groups at the detailed PL level were produced on the assumption that within each PM group, all employees worked the same number of hours on average. This means that differences found in the number of hours worked per person at the PL level within manufacturing strictly reflect differences in the hours worked by production workers[19].

2 - Non-Manufacturing Industries

For non-manufacturing industries, the number of hours worked per person are taken at least in part from the Labour Force Survey. As in the case of manufacturing, the estimates are constructed separately for paid workers and other-than-paid workers, that is, self-employed workers and unpaid family workers. Statistics on hours worked for the two classes of workers and for most of the 110 industries at the PL level are available starting in 1975, when the survey underwent a major redesign. Previously, the industrial coding of this survey was limited to industrial divisions (PS level). Another source was used for the years 1961 to 1975 for most industries.

The definition of five of the 110 industries coincide with the industrial divisions for which estimates of hours worked are produced in the framework of the labour productivity measures. These industries are: Agricultural and Related Services, Fishing and Trapping, Logging and Forestry, Construction, and Finance, Insurance and Real Estate. Therefore, the time series on hours worked for these industries are taken directly from the labour productivity program.

[16] *According to detailed information from the 1989 Annual Survey of Manufactures large establishments represented 90% or more of the industry shipments in 48 of the 83 groups. In addition, this number reached 77 (93%) when we consider establishments representing at least 70%. Only six industries had a share of small establishments that was greater than 30%.*

[17] *The 1986-1987 growth rate of Labour Force Survey data was used to estimate the level of paid workers in manufacturing for 1987, the data on hours worked from the 1987 Annual Survey of Manufactures having not been edited.*

[18] *For more information on industrial aggregates as defined in the multifactor productivity measures, see Appendix 3 in Part 2 of this publication.*

[19] *For more information on the methodology used to estimate hours for other salaried employees and other-than-paid workers, see Appendix 2 in Part 1 of this publication.*

Statistics on hours collected by the Labour force survey refer to a specific week in each month; usually the week of the 15th of the month. This survey includes a series of questions on the number of hours worked which are asked to any respondent having worked during the reference week. These questions pertain to usual hours, overtime, hours actually worked, as well as hours lost and reasons for absences from work. This information facilitates the verification of each element of information on hours worked for consistency and allows the estimation of the total annual number of hours worked. As the statistics from this survey pertain to a specific week of the month, the annual data only represent the twelve weeks of the year that were surveyed. In order to produce annual data that would be representative of the hours actually worked during all weeks of the year, the Productivity Measures Section developed a methodology. The purpose of this methodology is to adjust the hours actually worked as reported by the survey to account for two random factors; the statutory holidays that may or may not fall in the reference weeks in a given year and the impact of days lost due to labour disputes[20].

The method used to produce the annual estimates of hours worked from Labour Force Survey data can be summarized in four steps[21].

1 - The first consists of adding to the estimates of hours worked for the survey week, the hours lost due to a statutory holiday or to a labour dispute. The result is therefore an estimate of hours worked under the assumption of no statutory holidays or labour disputes. These data are then interpolated between the survey weeks in order to produce the estimates for the fifty-two weeks of the year.

2 - The second step consists of adjusting, if necessary, the hours worked in the year for time lost due to statutory holidays. When the holidays are in the survey week, the estimates for hours worked are taken directly from the survey data, otherwise, they are estimated using the following method. The main statutory holidays in Canada were identified and classified in three categories: (1) Major (Christmas Day, New Year's Day, Good Friday, Canada Day, Labour Day, and Thanksgiving; (2) Major-Minor (Victoria Day, Boxing Day); and (3) Minor (Easter Monday, St-Jean Baptiste, August Civic Holiday, and Remembrance Day)[22]. This classification reflects the fact that most employees are entitled to the major holidays whereas a smaller proportion are granted the other holidays. The number of working hours lost for the three categories of holidays is estimated from the hours lost in survey weeks for the corresponding category of holidays.

3 - Thirdly, all hours lost due to labour disputes are removed from the estimates of hours worked.[23] Only the hours worked by paid workers are adjusted for this type of absence.

4 - Finally, annual hours worked per person per week are calculated as the average of the weekly values adjusted for strikes and holidays. The number of hours worked per year is simply the weekly average multiplied by the number of weeks in the year. The number of weeks in the year is not taken as constant, but reflects the variations in the calendar. A calendar year

[20] *The employment concept of the Labour Force Survey includes as employees, any respondents that did not work during survey week due to labour disputes.*

[21] *For a complete description of this methodology, see Maryanne Webber, "Estimating Total Annual Hours Worked from the Canadian Labour Force Survey", Input-Output Division, Technical Series number 51, April 1983.*

[22] *The classification of statutory holidays in order of importance comes from data collected by the Pay Research Bureau, a service of the Public Service Staff Relations Board of the Federal Public Service.*

[23] *For more information concerning this survey, refer to Collective Bargaining Review, Labour Canada, monthly.*

includes 52 complete weeks plus one day (two in leap years). If these extra days fall on a normal day of rest, the year is considered to have 52 weeks even. If not, the number of weeks is greater. Calendar year variations account for up to 0.4% in the year-to-year change in hours worked.

Using this method, estimates of hours worked per person were produced for paid workers, except for Mining Industries and Manufacturing Industries, and for other-than-paid workers for all industries with the exception of Manufacturing.

As mentioned, the data on hours actually worked from the Labour Force Survey did not exist prior to 1975 at the level of aggregation needed. For the years prior to 1976, data from the Survey on Working Conditions[24] were used. This survey, cancelled in 1984, was an annual survey which covered all establishments of twenty or more employees in Canada with the exception of the Agricultural and Related Services Industries, Fishing and Trapping, and Construction. The purpose of this survey was to collect information on the working conditions in establishments. The survey collected, among other things, information of normal work hours, paid statutory holidays, annual leave, and sick leave. This information was produced for most industries that were needed and distingued between production workers ("non-office employees") and other salaried employees ("office employees").

From this information, annual data on normal working hours were derived, from which hours paid for statutory holidays and annual leave were deducted. Data on working conditions for paid annual leave were shown according to specific eligibility criteria. For example, for a given industry, the statistics were tabulated by the number of years of service required to be eligible for three weeks instead of two weeks of annual leave. In order to produce estimates of average hours on holidays for each industry, this information was combined with the estimates of job tenure from the Labour Force Survey[25].

Since the estimates of hours worked per person by paid workers were obtained from the Labour Force Survey starting in 1976 and from the Survey of Working Conditions up to 1975, the two time series had to be linked together. The series originating in the latter survey was multiplied by the average of the difference between the two series for the years 1975 to 1978. Then, since the hours obtained from the Survey of Working Conditions did not correspond exactly to our concept of hours worked[26], they were linked to the corresponding estimates for paid workers at the industry division level (PS) that are presently used in the calculation of labour productivity estimates.

The data on hours worked for each of the four mining industries were produced using a different methodology. The total person-hours worked for the Mining (including milling), Quarrying and Oil Well Industries used in labour productivity was allocated to the four industries according to the distribution of hours paid from the Census of Mines. These statistics cover the entire period but represent only production workers. Since these are estimates of hours paid, paid holidays (statutory and annual leave) estimated from the Survey of Working Conditions were subtracted from them. This survey having been cancelled in 1984, the estimates of paid holidays were extrapolated along a linear trend until 1989. In order to reflect all paid workers in this industry, the total person-hours for this division was used as a benchmark for the entire period and distributed according to the value share of each component estimated from the person-hours of the Census of Mines.

[24] *For more information on this survey, see the technical notes in annual reports from Working Conditions in Canadian Industry, Labour Canada, 1961-1984.*

[25] *For further details on the "job tenure" variable, see User's Guide to the Labour Force Survey Data, catalogue no. 71-528, Statistics Canada, 1992, pp. 13 and 36.*

[26] *In contrast with the Labour Force Survey which is a household survey, most establishment surveys only collect information on standard working hours for the non-production classes of workers.*

For the paid workers of the Pipeline Transport Industry, the Educational Services and Other Health Services industries, there was simply no data before 1976. We therefore used the growth of hours per person from industries exhibiting similar trends from 1976 to 1991. In the case of Pipeline Transport, hours worked per person from the Crude Petroleum and Natural Gas Industries were used. The hours worked per person in Hospitals were used to estimate the two other industries.

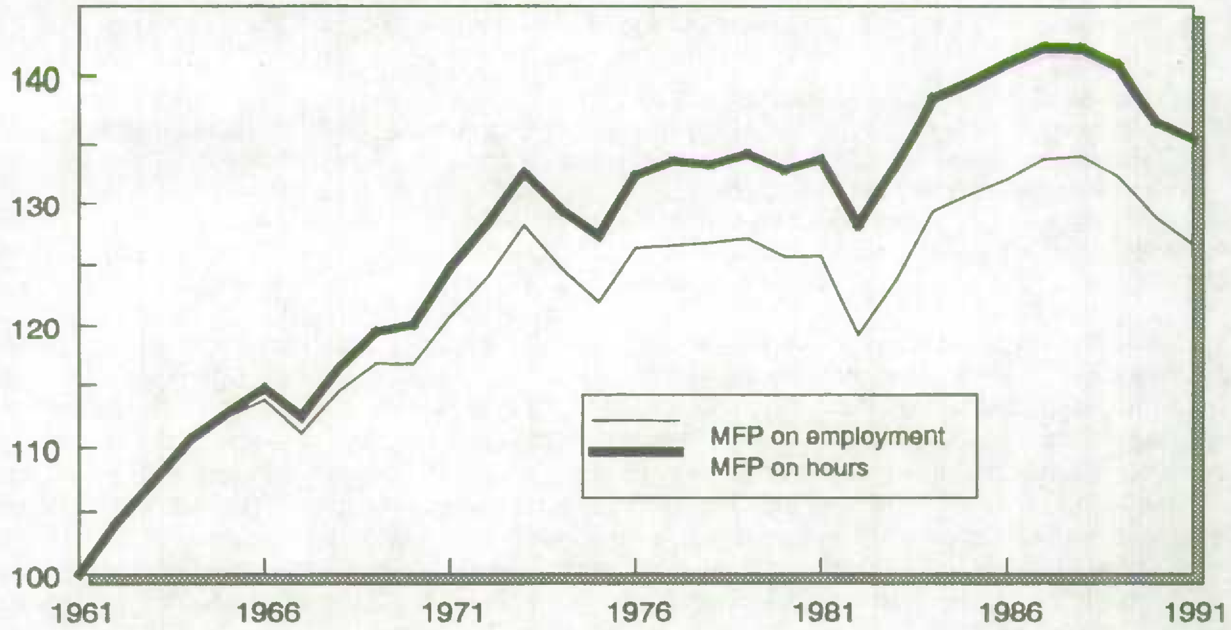
Since the Labour Force Survey is the only source available to produce estimates on other types of workers for all non-manufacturing industries, there are no detailed data prior to 1976. The share of hours worked to self-employed and unpaid family workers were therefore estimated for each industry using backward linear extrapolation of the Labour Force Survey data from 1976 to 1991. The results obtained were then reconciled with the person-hours estimates at the corresponding industry division level (PS).

The use of aggregate data (PS level) for person-hours from the labour productivity measures program also allows us to ensure the consistency of the results from the various productivity measures produced.

Impact of Hours Worked on the Measurement of Multifactor Productivity

Figure 2

Comparison between multifactor productivity indices based on person-hours worked and persons at work, business sector, 1961-1991



The use of hours worked instead of persons at work as the measure of labour input has the effect of increasing multifactor productivity based on value-added for the business sector by an average of 0.2% per year during the 1961-1991 period (see Figure 2). In other words, the use of hours worked increases multifactor productivity growth by about 30% over the three decades. However, the impact of person-hours worked on productivity estimates changes considerably from period to period and across industries.

Estimates of productivity growth rates[27] corresponding to person-hours worked and to persons at work are shown in Text table 3 for different sub-periods determined by the cyclical troughs of the multifactor productivity index for the business sector. The use of the number of persons as labour input instead of the more precise person-hours measure is shown to have the effect of underestimating business sector multifactor productivity growth by 0.2% between 1961 and 1967 and by 0.4% between 1967 and 1982. It should be noted that the negative performance observed when persons is used between 1975 and 1982 turns to a slightly positive growth with the use of hours worked. As expected, given little change in hours worked per person during the 1982-1991 cycle, multifactor productivity based on hours worked is exhibiting a slightly lower growth rate compared to the rate based on persons at work during the period. In fact, as Figure 3 shows, the growth rate of multifactor productivity based on hours worked was lower than that on persons at work in six out of the last ten years. The same phenomenon occurred just three times between 1962 and 1982: in 1962, 1973, and 1978.

Text table 3

Comparison between multifactor productivity growth rates based on person-hours worked and persons at work, business sector, 1961-1991

Period	Persons at work	Person-hours worked	Differences
1961-1991	0.8%	1.0%	0.2
1961-1967	1.8%	2.0%	0.2
1967-1975	1.2%	1.6%	0.4
1975-1982	-0.3%	0.1%	0.4
1982-1991	0.7%	0.6%	-0.1

Figure 4 shows a very different impact across industrial divisions when hours worked are used instead of persons at work. With the exception of the Finance, Insurance and Real Estate Industry, all service industries show an increase in productivity larger than 0.1% when calculated on hours worked, with Retail Trade showing the largest impact. At lower aggregation levels, the Railway Transportation Industry, Road, Highway and Bridge Maintenance Industry, Pipeline Transportation, and the Telecommunications Industry show little productivity improvements when calculated on hours worked.

27 *Given the methodology to estimate multifactor productivity, the labour input measure which should be used in analysis is not the sum of hours or employment but rather the weighted average of hours or employment calculated using the Törnqvist index number formula.*

Among the goods-producing industries of the business sector, Agriculture, Fishing and Trapping as well as Logging and Forestry show a net productivity improvement when based on hours. Few improvements were recorded in the Mining Industries, in Total Manufacturing, and in the Construction Industry. In addition, a detailed analysis of individual manufacturing industries shows significant long term differences in only 13 of 83 cases. In all other manufacturing industries, the impact was less than 0.1%, whether negative or positive. Nine of the industries for which the impact was significant exhibited a substantial improvement in productivity. This is the case in the following industries:

- Construction, Shipbuilding and Repair Industry;
- Aircraft and Aircraft Parts Industry;
- Wool Yarn and Woven Cloth Industry;
- Clay Products Industry;
- Cement Industry;
- Non-Ferrous Smelting and Refining;
- Carpet, Mat and Rug Industry and;
- Other Electrical and Electronic Products.

Otherwise, the other four industries exhibit a deterioration in multifactor productivity growth. This occurred in Office, Store and Business Machines, Platemaking, Typesetting and Bindery, Iron Foundries and Record Players, Radio and T.V. Receivers.

Figure 3

Annual growth of multifactor productivity for the business sector

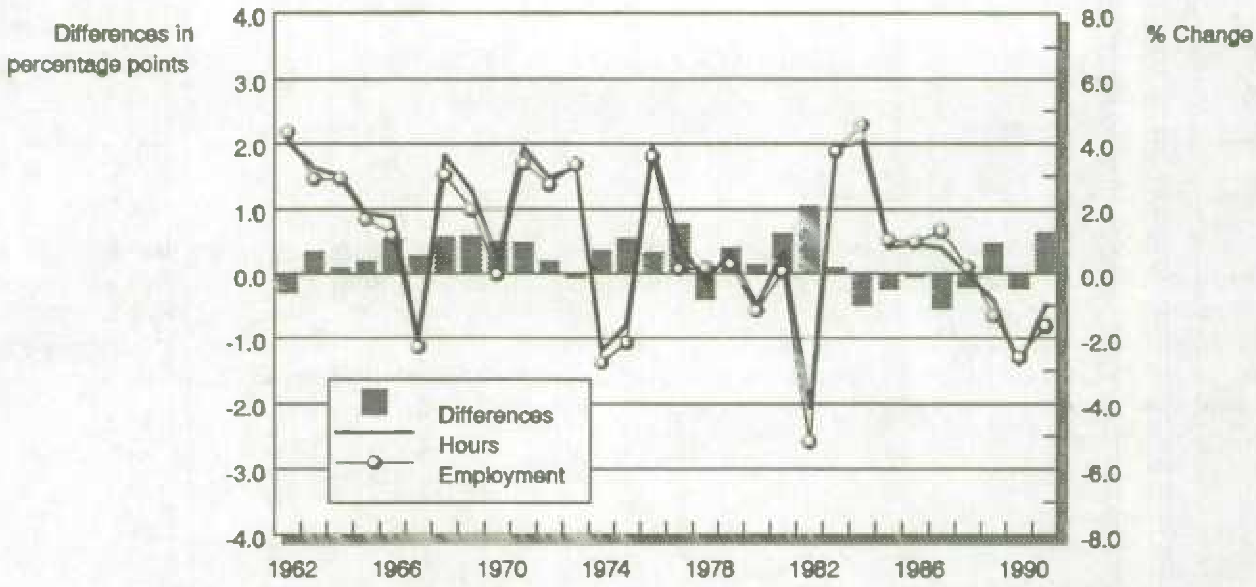
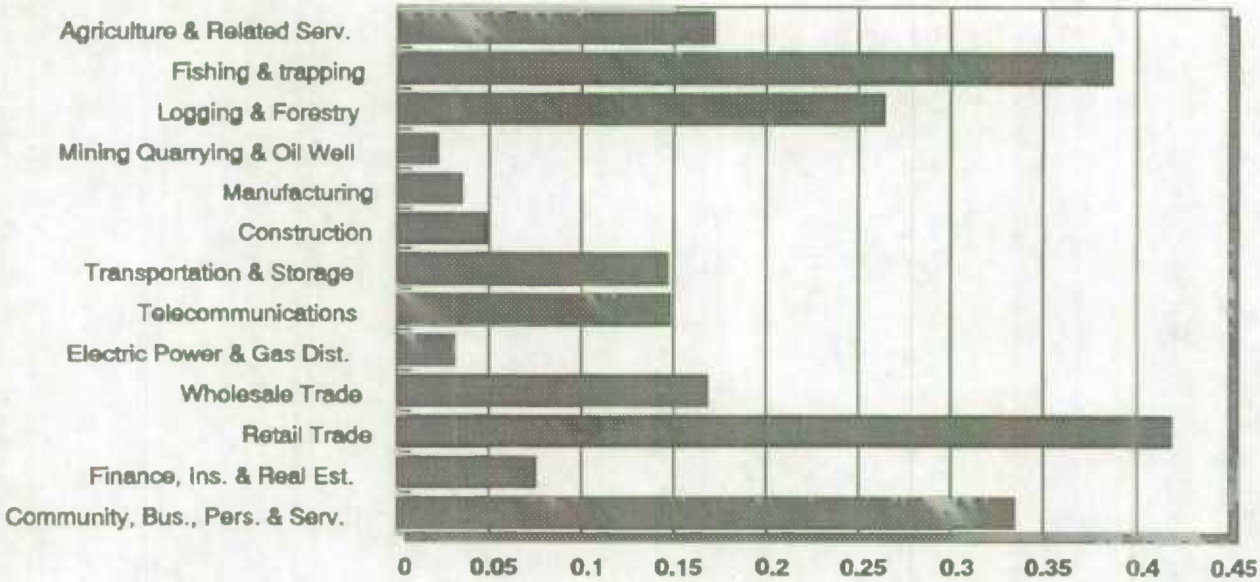


Figure 4

Differences between productivity growth rates based on hours worked and on employment, by industry, 1961-1991



In summary, the use of the more precise hours worked measure of labour input results in a thirty percent increase in the long term growth rate of business sector multifactor productivity. The estimates for total manufacturing are less sensitive, showing an increase of only 6% over thirty years. For the business sector and most of its industries, the impact took place entirely in the 1961-1982 period; the new data has no impact on the estimates for the 1982-1991 cycle as compared to the employment-based measures.

PART 1

Labour Productivity

Labour Compensation

Unit Labour Cost

Table 1 - Indices of labour productivity and unit labour cost, business sector industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	57.7	69.4	74.6	20.0	83.1	77.3	28.8	26.8	34.7
1972	61.2	71.6	76.5	22.2	85.5	80.0	31.1	29.1	36.3
1973	66.7	75.3	80.5	25.9	88.6	82.8	34.4	32.2	38.9
1974	69.0	79.0	83.9	30.8	87.3	82.2	38.9	36.7	44.6
1975	69.3	80.2	84.6	35.4	86.4	81.9	44.1	41.8	51.0
1976	74.0	81.5	85.3	40.7	90.8	86.7	50.0	47.7	55.0
1977	76.4	83.3	85.9	45.1	91.7	88.9	54.2	52.5	59.1
1978	78.9	85.9	88.9	49.2	92.0	88.8	57.3	55.4	62.3
1979	82.4	89.5	92.1	55.5	92.1	89.5	62.1	60.3	67.4
1980	83.8	91.4	93.5	62.8	91.7	89.7	68.7	67.2	74.9
1981	87.5	94.2	95.4	72.4	92.8	91.7	76.8	75.9	82.8
1982	82.6	91.3	90.9	75.8	90.4	90.9	83.0	83.5	91.8
1983	85.5	91.3	90.4	79.1	93.7	94.6	86.6	87.5	92.5
1984	91.5	93.7	93.4	85.9	97.7	98.0	91.7	92.0	93.9
1985	96.6	98.1	98.1	93.6	98.5	98.5	95.5	95.4	96.9
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.0	103.2	104.0	109.9	101.7	101.0	106.5	105.7	104.7
1988	110.1	107.2	108.2	121.6	102.7	101.8	113.4	112.4	110.4
1989	112.3	109.7	109.9	131.7	102.4	102.2	120.0	119.8	117.2
1990	111.0	110.3	109.9	137.9	100.7	101.0	125.1	125.5	124.2
1991	108.5	107.2	105.5	139.9	101.3	102.8	130.5	132.5	128.9

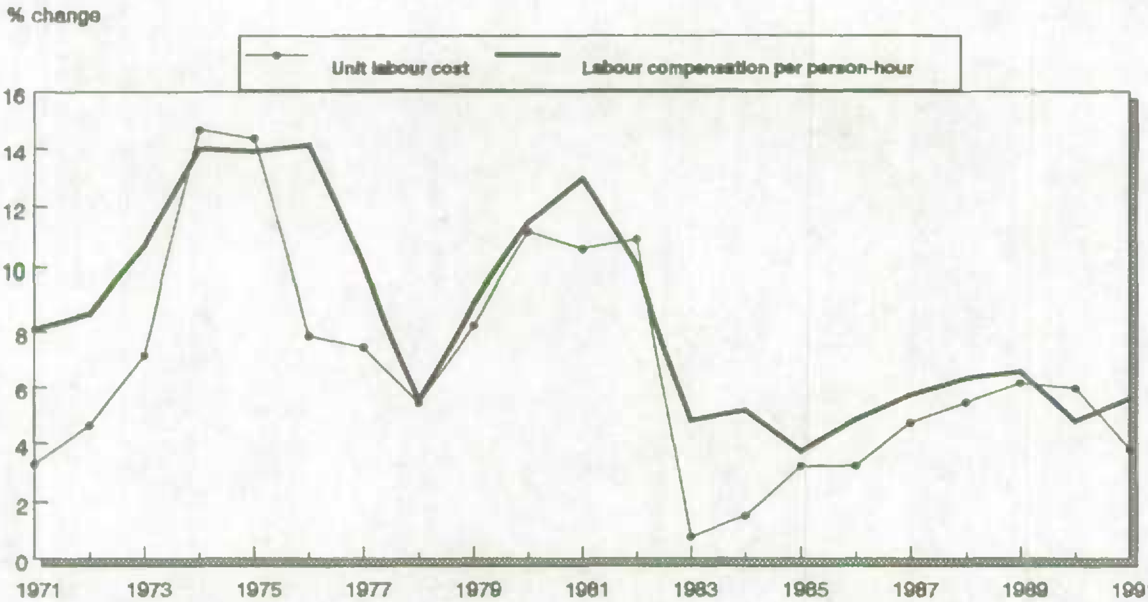


Table 2 - Indices of labour productivity and unit labour cost, business sector-excluding agricultural & related services industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	56.8	67.4	71.6	19.9	84.3	79.3	29.5	27.7	35.0
1972	60.9	70.1	74.3	22.2	86.8	82.0	31.6	29.8	36.4
1973	66.3	74.2	78.6	25.8	89.3	84.4	34.7	32.8	38.8
1974	68.9	78.1	82.1	30.6	88.3	83.9	39.2	37.3	44.5
1975	68.9	79.0	82.3	35.2	87.3	83.7	44.6	42.8	51.2
1976	73.6	80.5	83.4	40.7	91.4	88.2	50.5	48.8	55.3
1977	76.1	82.5	84.5	45.1	92.2	90.0	54.7	53.4	59.3
1978	78.8	85.0	87.6	49.1	92.6	90.0	57.7	56.0	62.3
1979	82.6	88.8	90.9	55.5	93.0	90.9	62.5	61.1	67.2
1980	83.9	90.9	92.7	62.8	92.3	90.5	69.1	67.8	74.9
1981	87.4	93.8	94.7	72.3	93.2	92.3	77.1	76.4	82.8
1982	82.0	90.9	90.1	75.7	90.2	91.1	83.3	84.1	92.3
1983	85.2	90.6	89.6	79.0	94.0	95.1	87.1	88.2	92.7
1984	91.6	93.2	92.8	85.9	98.3	98.7	92.1	92.5	93.7
1985	97.1	97.9	97.8	93.5	99.3	99.4	95.6	95.7	96.3
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.5	103.5	104.4	110.2	101.9	101.0	106.4	105.5	104.5
1988	111.0	108.0	109.3	121.9	102.8	101.5	112.9	111.5	109.8
1989	113.0	110.8	111.3	132.1	102.0	101.5	119.2	118.6	116.9
1990	111.3	111.3	111.2	138.3	100.0	100.1	124.3	124.4	124.3
1991	108.7	108.1	106.5	140.2	100.6	102.0	129.7	131.6	128.9

Table 3 - Indices of labour productivity and unit labour cost, business sector-services, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	50.5	56.4	60.7	17.5	89.5	83.2	31.0	28.8	34.6
1972	54.2	59.6	63.6	19.8	91.0	85.2	33.2	31.1	36.5
1973	58.3	63.4	67.7	22.9	92.1	86.2	36.1	33.8	39.2
1974	61.8	67.7	71.8	27.4	91.2	86.0	40.4	38.2	44.3
1975	64.4	70.1	73.8	32.0	91.9	87.3	45.7	43.4	49.7
1976	68.0	71.6	74.8	37.0	94.9	90.8	51.6	49.4	54.4
1977	70.0	74.9	77.0	41.2	93.5	91.0	55.0	53.6	58.9
1978	73.7	78.1	80.8	45.2	94.4	91.2	57.9	56.0	61.4
1979	77.9	81.7	83.8	51.5	95.3	92.9	63.0	61.4	66.1
1980	81.3	84.9	86.8	59.1	95.7	93.7	69.6	68.0	72.6
1981	84.8	88.9	90.0	67.6	95.4	94.2	76.1	75.1	79.7
1982	81.0	88.5	88.2	73.3	91.6	91.9	82.9	83.2	90.5
1983	83.3	89.1	88.0	77.2	93.4	94.7	86.6	87.7	92.6
1984	89.2	92.3	91.7	84.9	96.6	97.2	92.0	92.6	95.2
1985	94.6	97.6	97.2	93.0	97.0	97.3	95.3	95.7	98.3
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.8	103.6	104.2	110.9	102.1	101.5	107.0	106.5	104.8
1988	111.6	107.7	108.5	122.6	103.6	102.8	113.9	113.0	109.9
1989	114.9	110.7	110.7	133.6	103.8	103.9	120.7	120.7	116.3
1990	114.9	113.0	112.9	142.6	101.7	101.8	126.3	126.3	124.1
1991	114.1	112.2	110.5	148.4	101.7	103.2	132.3	134.3	130.0

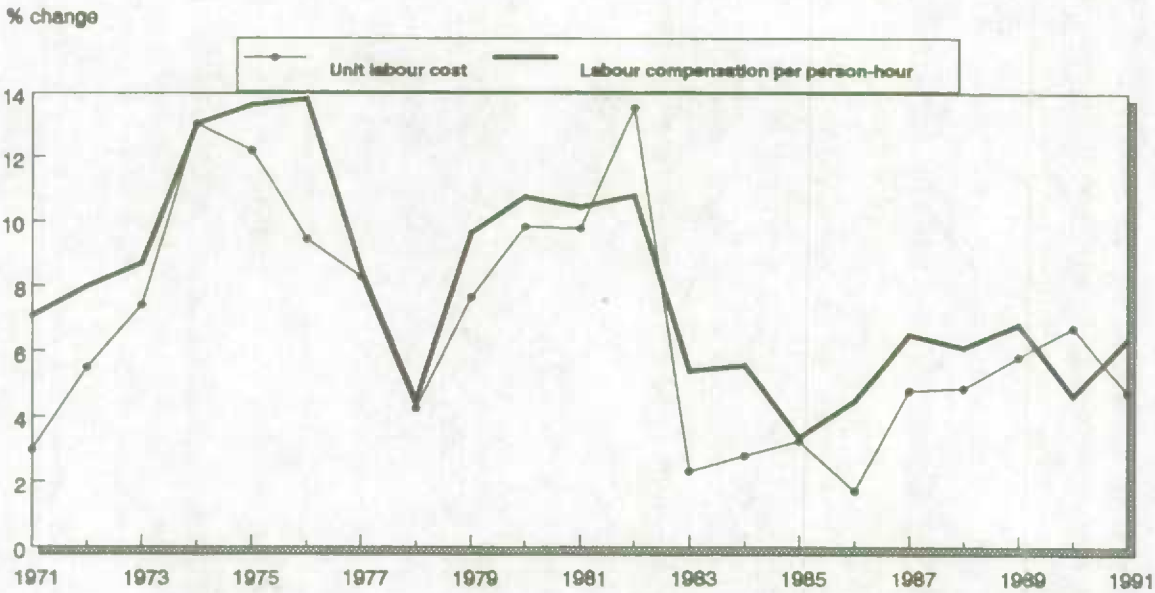


Table 4 - Indices of labour productivity and unit labour cost, business sector-goods, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	65.7	89.8	94.6	23.2	73.2	69.5	25.8	24.5	35.3
1972	69.1	90.7	94.9	25.4	76.2	72.8	28.0	26.8	36.8
1973	76.2	94.3	98.9	29.8	80.8	77.0	31.6	30.2	39.1
1974	77.0	96.9	101.2	35.1	79.4	76.1	36.2	34.7	45.6
1975	74.6	96.3	100.0	39.7	77.5	74.6	41.2	39.7	53.2
1976	80.6	97.1	100.3	45.5	83.0	80.4	46.9	45.4	56.4
1977	83.5	96.7	98.8	50.2	86.3	84.5	51.9	50.8	60.1
1978	84.6	98.1	100.3	54.3	86.2	84.3	55.3	54.1	64.1
1979	87.3	101.9	104.0	60.7	85.7	83.9	59.6	58.4	69.6
1980	86.2	101.8	102.9	67.5	84.7	83.8	66.4	65.6	78.3
1981	90.0	102.7	103.2	78.5	87.6	87.2	76.5	76.1	87.3
1982	84.0	95.9	94.7	79.0	87.7	88.8	82.4	83.4	94.0
1983	87.5	94.6	93.8	81.5	92.5	93.3	86.1	86.9	93.1
1984	93.7	95.8	95.8	87.3	97.8	97.8	91.0	91.1	93.1
1985	98.5	98.8	99.4	94.5	99.7	99.0	95.6	95.0	95.9
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.1	102.6	103.6	108.6	101.5	100.4	105.9	104.8	104.4
1988	108.6	106.6	107.7	120.4	101.9	100.9	113.0	111.8	110.8
1989	109.6	108.2	108.8	129.2	101.3	100.7	119.4	118.7	117.9
1990	106.8	106.0	105.6	131.8	100.8	101.1	124.4	124.8	123.4
1991	102.5	99.2	98.4	128.9	103.3	104.2	129.9	131.0	125.7

Table 5 - Indices of labour productivity and unit labour cost, agricultural & related services industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1971	84.8	101.6	114.1	24.5	83.5	74.4	24.1	21.5	28.9
1972	72.2	95.6	105.7	25.0	75.5	68.3	26.1	23.6	34.6
1973	79.3	92.9	105.7	32.4	85.4	75.0	34.9	30.6	40.8
1974	69.6	94.1	107.5	35.3	74.0	64.8	37.6	32.9	50.8
1975	81.3	100.3	114.5	40.1	81.0	71.0	40.0	35.0	49.3
1976	88.5	97.9	110.3	41.8	90.4	80.2	42.7	37.9	47.3
1977	87.5	96.8	105.0	46.1	90.4	83.3	47.6	43.9	52.6
1978	83.8	99.1	105.8	53.5	84.6	79.2	54.0	50.6	63.9
1979	77.0	100.8	108.7	56.9	76.3	70.8	56.4	52.4	73.9
1980	81.5	100.3	103.9	60.3	81.3	78.5	60.2	58.0	74.0
1981	88.9	101.9	105.2	75.3	87.2	84.5	73.9	71.6	84.8
1982	94.5	97.5	101.0	80.0	96.9	93.5	82.1	79.2	84.7
1983	91.7	101.7	101.1	82.9	90.2	90.7	81.5	82.0	90.4
1984	88.8	101.5	100.9	88.6	87.4	88.0	87.3	87.8	99.8
1985	85.1	101.4	103.2	98.7	83.9	82.5	97.3	95.7	116.1
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	90.1	98.1	97.9	99.1	91.9	92.1	100.9	101.2	109.9
1988	85.5	95.4	92.7	109.8	89.6	92.2	115.2	118.5	128.5
1989	91.8	92.5	90.9	115.0	99.3	100.9	124.3	126.4	125.2
1990	102.3	93.5	93.3	121.8	109.4	109.6	130.3	130.6	119.1
1991	102.5	92.3	92.1	126.7	111.1	111.3	137.3	137.6	123.6

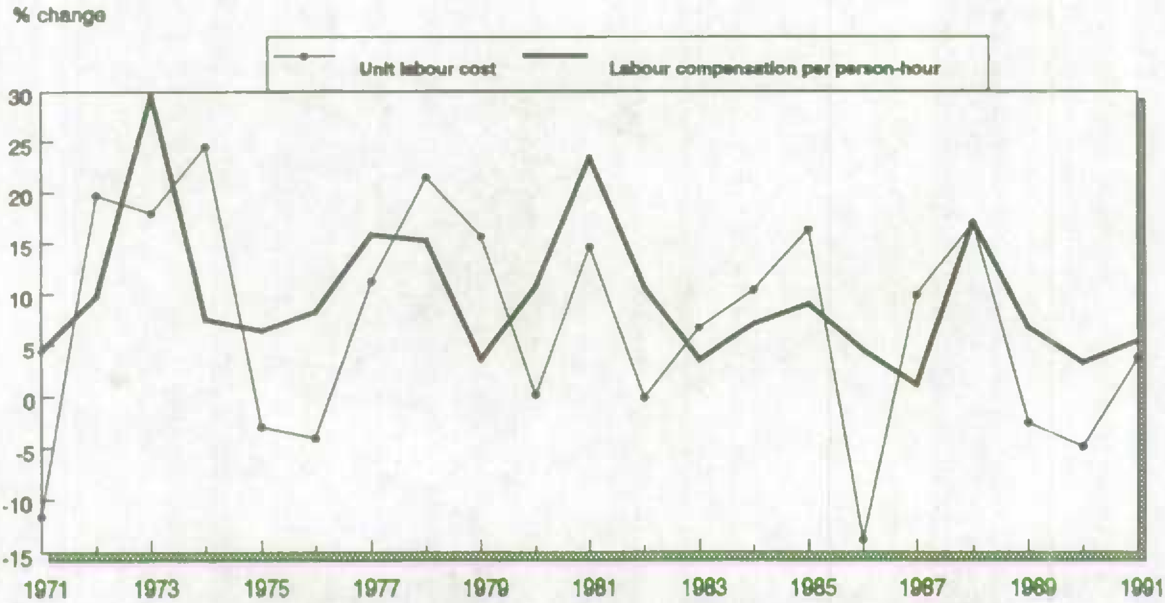


Table 6 - Indices of labour productivity and unit labour cost, manufacturing industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	65.3	90.7	93.4	23.8	72.0	69.9	26.2	25.4	36.4
1972	70.6	93.5	96.3	26.3	75.5	73.3	28.2	27.3	37.3
1973	78.2	97.8	100.3	29.7	79.9	77.9	30.4	29.6	38.0
1974	80.5	99.8	101.7	34.6	80.7	79.2	34.7	34.1	43.0
1975	75.1	97.5	98.3	38.3	77.1	76.5	39.3	38.9	50.9
1976	80.6	97.9	98.6	43.9	82.3	81.8	44.8	44.6	54.5
1977	83.6	95.9	96.8	47.7	87.1	86.3	49.8	49.3	57.1
1978	87.4	98.9	100.1	53.2	88.3	87.3	53.7	53.1	60.8
1979	90.6	102.5	102.9	60.2	88.4	88.1	58.7	58.5	66.4
1980	86.6	102.2	102.2	66.2	84.7	84.7	64.8	64.8	76.4
1981	89.8	102.2	101.0	75.3	87.8	88.9	73.7	74.5	83.9
1982	78.2	94.3	92.2	75.9	82.9	84.8	80.6	82.4	97.1
1983	83.2	92.4	91.5	79.9	90.1	91.0	86.6	87.4	96.1
1984	94.0	95.2	95.2	87.2	98.7	98.7	91.6	91.5	92.8
1985	99.3	97.6	97.7	94.1	101.7	101.6	96.4	96.3	94.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.8	103.0	103.9	107.0	101.7	100.9	103.8	103.0	102.0
1988	110.2	107.5	108.7	116.8	102.4	101.4	108.6	107.5	106.1
1989	110.4	108.8	109.3	123.7	101.4	101.0	113.7	113.2	112.1
1990	104.7	103.6	102.8	123.9	101.1	101.9	119.6	120.6	118.3
1991	97.8	95.6	94.7	121.8	102.3	103.2	127.4	128.5	124.5

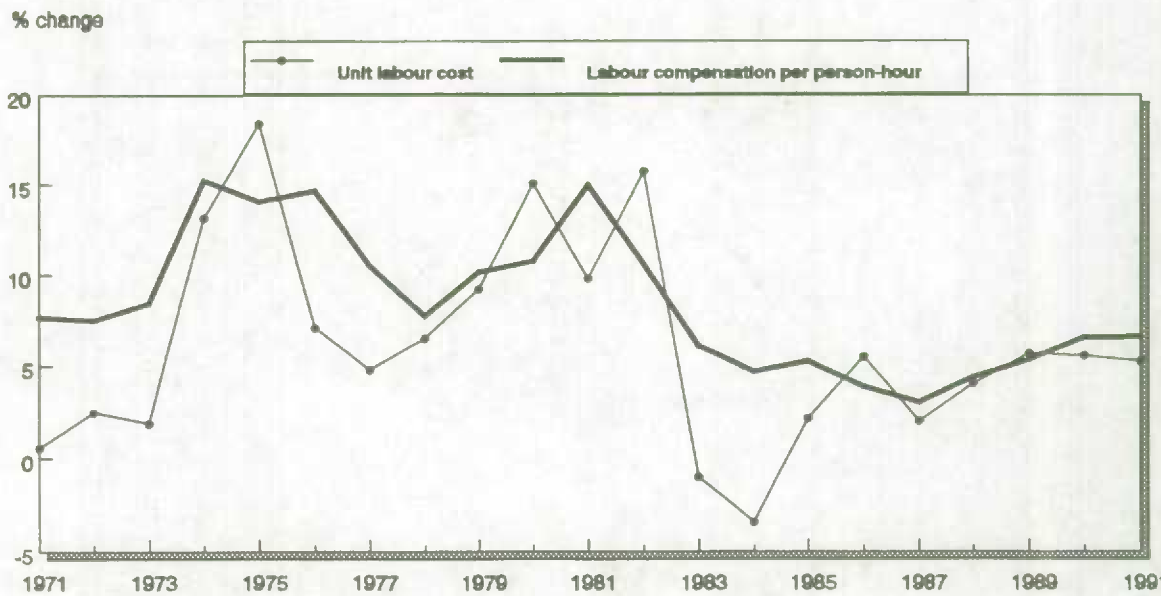


Table 7 - Indices of labour productivity and unit labour cost, construction industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	61.7	83.9	87.1	24.0	73.5	70.8	28.7	27.6	39.0
1972	61.7	85.8	89.4	26.2	71.9	69.0	30.5	29.3	42.5
1973	63.5	91.4	95.6	32.7	69.5	66.5	35.8	34.2	51.5
1974	65.5	96.4	100.8	39.6	68.0	65.0	41.1	39.3	60.5
1975	72.7	94.8	98.5	47.1	76.7	73.8	49.7	47.8	64.8
1976	81.9	99.9	102.8	54.6	82.0	79.6	54.7	53.1	66.7
1977	86.1	101.4	101.7	60.5	84.9	84.6	59.7	59.5	70.3
1978	81.8	98.5	100.0	59.7	83.0	81.8	60.6	59.7	73.0
1979	82.6	103.2	105.4	63.7	80.1	78.4	61.7	60.4	77.0
1980	86.8	101.5	104.3	72.7	85.5	83.3	71.7	69.8	83.8
1981	96.7	103.2	105.0	88.4	93.7	92.1	85.6	84.2	91.4
1982	96.8	96.7	93.0	84.9	100.1	104.0	87.9	91.3	87.8
1983	95.1	93.3	91.0	83.4	101.9	104.4	89.4	91.7	87.8
1984	89.1	91.4	90.6	84.6	97.5	98.3	92.6	93.4	95.0
1985	96.0	98.4	99.3	92.0	97.6	96.7	93.5	92.7	95.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.7	105.8	109.5	117.6	99.9	96.5	111.1	107.4	111.2
1988	109.7	113.6	118.9	134.8	96.6	92.3	118.7	113.4	122.9
1989	114.5	120.0	124.8	150.7	95.4	91.8	125.6	120.8	131.6
1990	115.1	122.5	123.7	157.6	94.0	93.1	128.7	127.4	136.9
1991	110.1	112.2	111.3	147.6	98.1	98.9	131.5	132.6	134.0

Table 8 - Indices of labour productivity and unit labour cost, transportation & storage industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	62.3	79.9	82.6	21.4	77.9	75.4	26.8	25.9	34.3
1972	66.2	81.7	83.7	24.1	81.0	79.1	29.5	28.8	36.4
1973	70.6	84.5	86.8	27.1	83.6	81.3	32.1	31.2	38.4
1974	73.7	89.6	91.8	32.4	82.3	80.3	36.2	35.3	44.0
1975	72.6	88.6	89.4	37.7	81.9	81.2	42.5	42.1	51.9
1976	72.1	87.8	88.6	42.1	82.1	81.4	48.0	47.5	58.4
1977	75.2	93.2	93.0	47.9	80.7	80.9	51.4	51.5	63.7
1978	79.0	95.2	96.1	53.0	83.0	82.2	55.7	55.2	67.1
1979	88.4	98.2	98.4	59.3	90.0	89.8	60.4	60.2	67.1
1980	85.3	102.7	103.7	66.9	83.0	82.3	65.1	64.5	78.4
1981	84.3	104.2	103.0	75.8	80.9	81.8	72.8	73.6	89.9
1982	79.6	98.7	96.8	79.8	80.6	82.2	80.8	82.4	100.2
1983	85.5	94.1	90.7	81.9	90.8	94.2	87.0	90.3	95.8
1984	95.6	96.4	95.3	89.3	99.1	100.3	92.7	93.8	93.5
1985	97.6	97.0	96.5	95.3	100.6	101.1	98.2	98.7	97.6
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	106.9	102.5	105.9	104.9	104.3	101.0	102.3	99.1	98.1
1988	112.4	102.3	106.2	111.6	109.8	105.8	109.1	105.1	99.3
1989	108.8	103.4	106.6	118.6	105.3	102.1	114.7	111.2	109.0
1990	107.5	105.5	108.0	125.7	101.9	99.5	119.1	116.3	116.9
1991	104.9	104.4	105.6	130.1	100.5	99.3	124.5	123.1	124.0

Table 9 - Indices of labour productivity and unit labour cost, communication industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	32.8	73.0	75.2	17.0	44.9	43.6	23.2	22.6	51.7
1972	35.8	75.4	76.8	19.1	47.5	46.6	25.3	24.9	53.3
1973	39.8	80.5	82.2	22.5	49.4	48.4	28.0	27.4	56.6
1974	44.9	86.4	88.0	26.8	51.9	51.0	31.0	30.5	59.8
1975	50.6	86.6	86.7	31.5	58.4	58.4	36.4	36.4	62.3
1976	55.7	93.2	93.1	38.2	59.8	59.8	41.0	41.0	68.6
1977	59.1	96.3	95.3	44.6	61.4	62.0	46.4	46.8	75.5
1978	64.8	95.0	95.5	49.1	68.3	67.9	51.7	51.4	75.7
1979	71.2	96.7	96.6	55.5	73.6	73.7	57.4	57.5	78.0
1980	77.9	99.3	99.8	62.4	78.4	78.1	62.9	62.6	80.2
1981	84.0	102.0	101.0	73.4	82.3	83.2	72.0	72.7	87.4
1982	83.9	103.8	101.7	81.5	80.9	82.5	78.5	80.1	97.1
1983	86.1	102.3	99.0	86.3	84.1	86.9	84.3	87.2	100.3
1984	90.2	101.4	100.2	93.6	88.9	90.0	92.2	93.3	103.7
1985	95.4	101.3	100.7	98.4	94.1	94.8	97.1	97.8	103.2
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	106.7	102.7	102.1	106.2	103.9	104.5	103.4	104.0	99.5
1988	114.9	103.7	103.2	110.1	110.8	111.4	106.2	106.7	95.8
1989	127.5	104.7	103.9	116.6	121.8	122.7	111.4	112.3	91.5
1990	137.5	107.1	106.6	125.5	128.3	128.9	117.1	117.7	91.3
1991	143.0	105.5	105.0	130.5	135.6	136.2	123.7	124.3	91.2

Table 10 - Indices of labour productivity and unit labour cost, wholesale and retail trade industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	57.3	64.2	69.0	20.2	89.2	83.1	31.5	29.3	35.3
1972	61.5	67.6	72.3	22.7	91.0	85.1	33.6	31.4	36.9
1973	65.1	71.4	76.3	25.7	91.2	85.3	36.0	33.6	39.5
1974	67.0	75.5	79.9	30.7	88.7	83.9	40.6	38.4	45.8
1975	69.8	77.8	81.6	36.7	89.7	85.6	47.2	45.1	52.6
1976	74.0	78.7	81.6	41.7	94.0	90.7	53.0	51.2	56.4
1977	73.5	80.2	82.2	45.6	91.6	89.4	56.8	55.5	62.0
1978	74.9	84.1	86.0	49.0	89.1	87.1	58.2	56.9	65.3
1979	77.0	86.8	88.3	55.6	88.8	87.2	64.0	62.9	72.1
1980	78.8	88.5	89.7	62.2	89.0	87.9	70.3	69.4	79.0
1981	81.4	93.0	93.7	70.4	87.5	86.8	75.7	75.1	86.5
1982	76.8	90.0	89.0	74.2	85.3	86.3	82.5	83.4	96.7
1983	82.1	89.1	87.1	77.4	92.1	94.2	86.8	88.8	94.3
1984	87.6	94.1	92.9	85.7	93.1	94.3	91.0	92.2	97.8
1985	95.0	98.1	97.3	93.2	96.9	97.7	95.0	95.8	98.1
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	106.7	102.3	102.1	109.6	104.3	104.5	107.1	107.4	102.7
1988	112.1	105.3	104.9	120.7	106.4	106.8	114.6	115.0	107.6
1989	114.7	108.2	107.1	130.4	106.1	107.1	120.6	121.8	113.7
1990	112.5	108.7	108.0	136.7	103.5	104.2	125.8	126.6	121.5
1991	110.8	107.1	104.6	139.9	103.5	106.0	130.7	133.8	126.3

Table 11 - Indices of labour productivity and unit labour cost, community, business, personal services industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1971	43.9	42.3	46.2	15.4	103.8	94.9	36.5	33.4	35.1
1972	47.4	45.3	49.0	17.4	104.7	96.6	38.4	35.5	36.7
1973	52.7	49.0	53.3	20.4	107.7	98.9	41.7	38.3	38.8
1974	57.2	53.0	57.1	24.4	108.0	100.2	46.0	42.7	42.6
1975	59.9	56.1	60.5	27.6	106.8	99.0	49.1	45.5	46.0
1976	64.6	58.6	62.8	33.0	110.1	102.8	56.3	52.6	51.1
1977	66.3	62.4	65.0	36.3	106.2	102.0	58.1	55.8	54.7
1978	70.9	65.9	69.7	40.4	107.6	101.7	61.3	57.9	56.9
1979	73.6	70.7	73.9	45.6	104.0	99.5	64.5	61.7	62.0
1980	81.0	75.4	78.0	54.2	107.3	103.8	71.8	69.5	66.9
1981	87.6	80.2	82.5	62.8	109.2	106.2	78.2	76.1	71.7
1982	86.3	82.9	83.5	70.1	104.1	103.4	84.5	83.9	81.1
1983	85.1	86.6	86.4	74.3	98.3	98.5	85.7	85.9	87.2
1984	90.1	88.6	88.7	82.1	101.7	101.6	92.7	92.6	91.1
1985	93.6	97.0	97.4	91.7	96.5	96.1	94.5	94.2	98.0
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.7	105.2	106.3	113.0	100.5	99.4	107.4	106.3	106.9
1988	113.7	111.1	113.1	127.4	102.3	100.5	114.7	112.6	112.1
1989	119.1	115.2	116.1	141.4	103.3	102.6	122.7	121.8	118.7
1990	121.3	119.5	120.6	154.3	101.5	100.6	129.1	128.0	127.3
1991	117.1	119.5	118.8	162.2	98.0	98.6	135.7	136.5	138.5

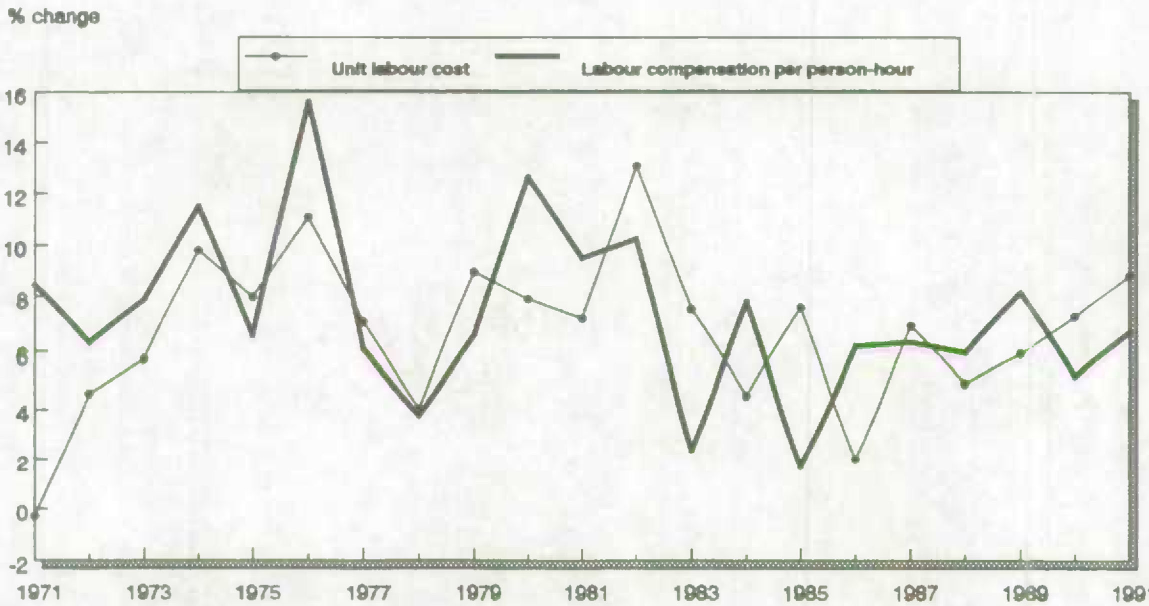


Table 12 - Indices of labour productivity and unit labour cost, food industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	78.0	96.1	101.3	24.9	81.1	77.0	25.9	24.6	31.9
1972	79.3	97.6	101.5	27.1	81.2	78.1	27.8	26.7	34.2
1973	83.0	98.4	101.8	29.5	84.3	81.5	30.0	29.0	35.6
1974	82.2	96.9	100.2	33.8	84.8	82.0	34.8	33.7	41.1
1975	76.3	96.6	100.2	39.4	79.0	76.2	40.8	39.4	51.6
1976	84.6	96.4	99.9	44.9	87.8	84.7	46.6	45.0	53.1
1977	89.3	98.0	100.6	49.6	91.2	88.8	50.7	49.3	55.6
1978	90.6	100.1	102.6	54.4	90.5	88.3	54.3	53.0	60.0
1979	93.7	101.1	103.4	60.5	92.7	90.7	59.8	58.5	64.5
1980	91.3	102.4	103.5	67.2	89.1	88.1	65.6	64.9	73.6
1981	92.0	101.1	101.1	75.9	90.9	91.0	75.0	75.1	82.5
1982	91.9	98.2	97.5	80.7	93.6	94.3	82.2	82.8	87.8
1983	90.3	95.9	97.4	84.9	94.2	92.7	88.5	87.2	94.0
1984	94.4	96.0	97.9	88.4	98.3	96.4	92.1	90.4	93.7
1985	100.6	98.6	99.0	93.8	102.1	101.6	95.2	94.7	93.2
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.7	101.1	102.2	106.1	99.6	98.6	104.9	103.9	105.3
1988	100.3	102.7	104.6	113.4	97.7	95.8	110.4	108.4	113.1
1989	97.9	103.6	104.4	118.2	94.5	93.8	114.0	113.2	120.7

Table 13 - Indices of labour productivity and unit labour cost, beverage industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	106.0	97.4	103.0	23.5	108.8	103.0	24.1	22.8	22.2
1972	109.5	97.1	101.3	25.3	112.8	108.2	26.1	25.0	23.1
1973	119.6	99.1	102.8	28.1	120.7	116.4	28.4	27.4	23.5
1974	121.0	102.7	106.5	33.1	117.9	113.7	32.2	31.0	27.3
1975	116.3	103.0	107.2	38.4	112.9	108.5	37.3	35.9	33.1
1976	112.7	103.3	107.3	44.2	109.1	105.0	42.8	41.2	39.3
1977	118.3	104.4	107.5	48.9	113.3	110.1	46.9	45.5	41.4
1978	115.7	103.2	106.0	52.0	112.2	109.2	50.4	49.1	45.0
1979	118.3	105.0	107.6	58.4	112.7	109.9	55.6	54.2	49.3
1980	114.0	102.0	103.4	64.0	111.7	110.2	62.8	61.9	56.2
1981	113.4	103.1	103.3	72.0	110.0	109.8	69.8	69.7	63.5
1982	103.3	100.6	100.1	78.5	102.7	103.2	78.0	78.4	76.0
1983	99.3	98.7	98.9	84.2	100.6	100.4	85.3	85.1	84.8
1984	103.8	99.9	97.5	89.7	103.9	106.5	89.8	92.0	86.4
1985	105.4	100.6	100.9	94.8	104.9	104.5	94.2	93.9	89.9
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.7	98.8	100.1	103.7	102.9	101.5	104.9	103.6	102.0
1988	105.1	99.2	102.1	106.8	105.9	102.9	107.6	104.6	101.6
1989	103.8	87.4	86.2	99.9	118.8	120.4	114.4	115.9	96.2

Table 14 - Indices of labour productivity and unit labour cost, tobacco products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	131.1	137.1	154.5	28.5	95.6	84.8	20.7	18.4	21.7
1972	138.8	135.5	151.3	30.4	102.5	91.7	22.5	20.1	21.9
1973	142.1	133.7	146.7	32.6	106.3	96.9	24.4	22.2	22.9
1974	152.9	136.5	147.6	36.4	112.0	103.6	26.7	24.7	23.8
1975	154.4	138.2	151.0	43.9	111.7	102.2	31.8	29.1	28.5
1976	146.8	129.7	142.1	47.2	113.2	103.3	36.4	33.2	32.1
1977	168.4	127.4	136.0	52.2	132.2	123.9	41.0	38.4	31.0
1978	142.6	124.8	133.7	53.8	114.3	106.7	43.2	40.3	37.8
1979	147.5	123.7	133.0	58.3	119.2	110.9	47.2	43.9	39.6
1980	149.6	120.8	127.2	63.9	123.8	117.6	52.9	50.3	42.7
1981	153.4	124.2	132.5	77.4	123.5	115.7	62.3	58.4	50.4
1982	149.6	123.7	128.7	84.0	121.0	116.2	67.9	65.3	56.1
1983	135.2	115.0	120.0	89.2	117.6	112.6	77.6	74.3	66.0
1984	128.3	109.1	113.3	91.9	117.6	113.2	84.2	81.1	71.6
1985	105.9	101.5	107.6	96.2	104.3	98.4	94.7	89.4	90.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	106.5	85.1	87.5	94.8	125.1	121.6	111.4	108.3	89.1
1988	108.6	78.7	81.3	89.6	138.0	133.5	113.9	110.2	82.5
1989	100.8	73.7	75.1	92.3	136.7	134.3	125.1	122.9	91.6

Table 15 - Indices of labour productivity and unit labour cost, rubber products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	58.3	80.2	83.5	21.0	72.7	69.8	26.2	25.2	36.0
1972	64.2	87.6	91.1	25.0	73.4	70.6	28.6	27.5	38.9
1973	74.5	97.0	100.0	29.2	76.8	74.5	30.1	29.2	39.2
1974	66.9	95.2	96.1	31.2	70.3	69.6	32.8	32.4	46.6
1975	64.0	96.4	97.0	35.9	66.4	66.0	37.3	37.1	56.2
1976	79.3	100.8	102.1	41.9	78.6	77.6	41.6	41.0	52.8
1977	90.9	101.1	102.0	45.9	89.8	89.1	45.4	45.0	50.5
1978	94.6	102.9	104.0	49.9	92.0	91.0	48.6	48.0	52.8
1979	107.6	105.7	109.6	60.1	101.8	98.2	56.9	54.9	55.9
1980	92.7	102.2	103.1	63.4	90.7	90.0	62.0	61.5	68.3
1981	88.0	103.3	105.1	73.5	85.2	83.7	71.2	70.0	83.6
1982	76.7	97.3	98.5	76.4	78.8	77.9	78.5	77.6	99.6
1983	89.6	97.6	99.0	81.4	91.8	90.5	83.4	82.3	90.9
1984	112.9	99.3	100.5	90.6	113.7	112.3	91.2	90.1	80.3
1985	114.5	98.4	99.9	93.4	116.3	114.6	94.8	93.4	81.5
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.7	94.1	94.6	97.0	111.3	110.8	103.1	102.6	92.6
1988	110.0	101.6	103.4	109.1	108.2	106.3	107.4	105.6	99.3
1989	104.4	99.4	101.5	111.0	105.0	102.9	111.7	109.4	106.3

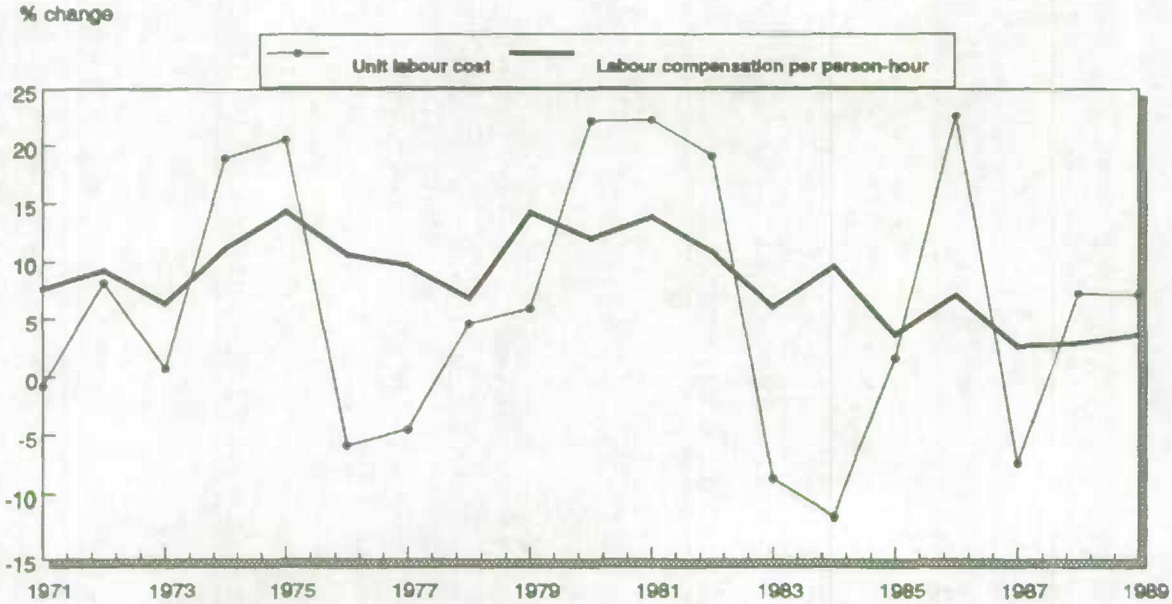


Table 16 - Indices of labour productivity and unit labour cost, plastic products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	36.9	50.4	51.9	13.9	73.3	71.2	27.6	26.9	37.7
1972	46.9	57.5	59.1	17.1	81.4	79.3	29.7	28.9	36.5
1973	54.4	63.9	65.1	20.3	85.1	83.5	31.7	31.2	37.3
1974	52.7	66.7	66.6	24.3	79.0	79.1	36.4	36.5	46.1
1975	47.9	65.5	65.1	26.7	73.1	73.6	40.8	41.0	55.7
1976	53.5	68.7	68.8	32.1	77.9	77.8	46.7	46.6	59.9
1977	56.2	69.6	69.3	35.7	80.7	81.0	51.3	51.5	63.6
1978	63.7	76.1	76.0	42.0	83.7	83.8	55.2	55.2	65.9
1979	73.7	80.0	82.0	48.1	92.1	90.0	60.2	58.7	65.3
1980	73.5	82.4	82.1	54.6	89.2	89.5	66.2	66.5	74.3
1981	75.5	81.6	82.0	61.6	92.5	92.0	75.5	75.1	81.6
1982	68.8	76.4	76.4	62.6	90.1	90.1	82.0	82.0	91.0
1983	78.7	76.3	77.2	67.4	103.1	101.9	88.3	87.3	85.6
1984	90.1	85.4	85.6	77.9	105.5	105.3	91.2	91.1	86.5
1985	99.6	92.3	93.4	89.1	107.9	106.7	96.5	95.4	89.4
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	112.3	108.0	108.8	111.8	104.0	103.2	103.5	102.7	99.5
1988	115.1	122.2	123.5	133.3	94.2	93.2	109.1	107.9	115.8
1989	117.4	127.6	130.9	144.9	92.0	89.7	113.6	110.7	123.5

Table 17 - Indices of labour productivity and unit labour cost, leather & allied products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	85.4	127.5	134.7	36.7	67.0	63.4	28.8	27.2	42.9
1972	82.5	124.7	131.8	38.2	66.1	62.6	30.6	29.0	46.3
1973	83.8	124.0	129.2	41.0	67.6	64.8	33.1	31.7	48.9
1974	86.8	121.0	128.2	46.6	71.7	67.7	38.5	36.4	53.7
1975	87.2	121.7	125.2	52.6	71.7	69.7	43.2	42.0	60.3
1976	95.9	120.4	124.9	59.7	79.6	76.8	49.6	47.8	62.3
1977	88.9	107.7	112.0	58.6	82.5	79.3	54.4	52.3	65.9
1978	101.7	110.9	114.5	66.0	91.7	88.8	59.5	57.6	64.9
1979	103.1	115.8	120.4	75.6	89.0	85.6	65.3	62.8	73.4
1980	98.5	113.2	115.9	78.6	87.0	84.9	69.4	67.8	79.8
1981	103.5	117.3	120.1	91.5	88.2	86.2	78.0	76.2	88.4
1982	90.2	101.2	104.6	85.2	89.1	86.2	84.2	81.5	94.5
1983	95.2	101.9	102.5	89.3	93.5	92.9	87.7	87.2	93.8
1984	104.3	104.1	105.6	96.7	100.2	98.7	92.9	91.5	92.7
1985	100.1	98.6	99.9	97.0	101.6	100.2	98.5	97.1	97.0
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	92.6	92.9	91.1	96.1	99.7	101.6	103.4	105.5	103.8
1988	86.2	86.3	85.5	92.0	99.9	100.9	106.6	107.7	106.7
1989	84.5	79.1	81.9	87.7	106.9	103.3	110.9	107.1	103.7

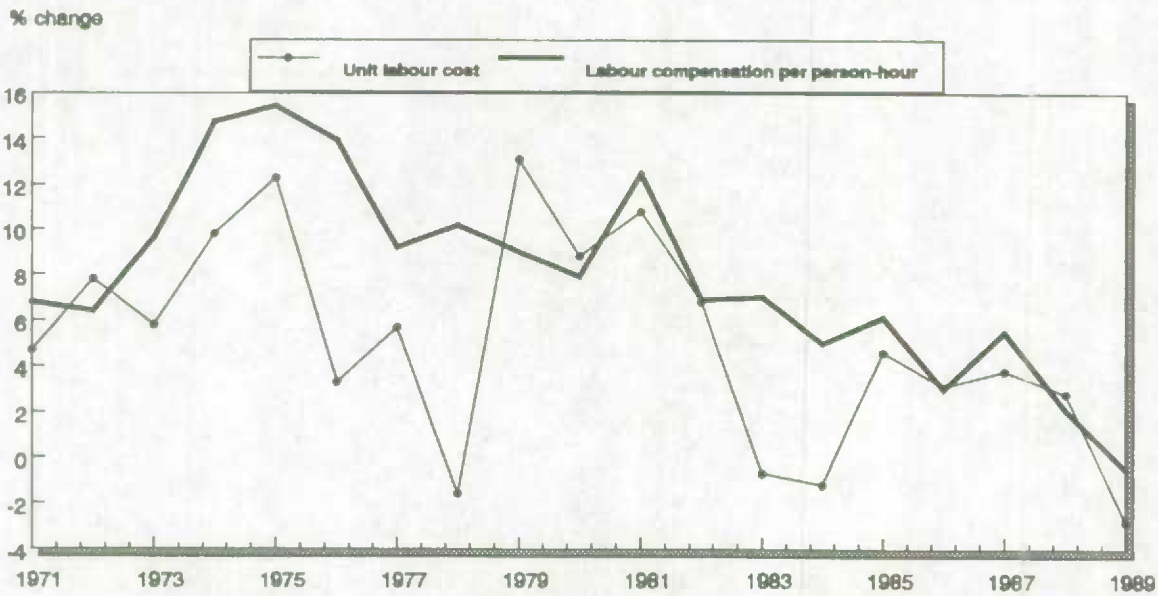


Table 18 - Indices of labour productivity and unit labour cost, primary textile & textile products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1971	56.6	116.0	121.7	30.9	48.8	46.5	26.6	25.4	54.5
1972	67.0	123.8	129.4	34.9	54.1	51.8	28.2	27.0	52.1
1973	71.4	128.8	133.7	38.7	55.5	53.4	30.1	29.0	54.2
1974	72.1	128.7	132.4	43.9	56.0	54.4	34.1	33.1	60.9
1975	70.8	121.0	123.9	46.3	58.5	57.2	38.2	37.3	65.3
1976	72.0	113.3	115.3	50.4	63.5	62.4	44.5	43.7	70.0
1977	75.8	106.2	107.2	52.6	71.4	70.8	49.5	49.0	69.3
1978	83.4	108.1	109.3	58.3	77.2	76.3	53.9	53.3	69.9
1979	90.6	112.1	113.2	67.0	80.8	80.0	59.8	59.2	74.0
1980	88.1	111.3	111.1	73.5	79.1	79.3	66.0	66.1	83.4
1981	91.8	109.6	110.3	80.9	83.8	83.2	73.8	73.3	88.1
1982	71.2	96.4	97.7	75.7	73.9	72.9	78.5	77.5	106.3
1983	91.6	102.7	103.1	86.8	89.2	88.9	84.5	84.2	94.7
1984	91.1	101.5	101.1	90.3	89.7	90.1	89.0	89.3	99.2
1985	90.4	97.8	96.2	93.9	92.5	94.0	96.1	97.7	103.9
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	102.9	102.6	103.0	108.2	100.3	99.9	105.5	105.0	105.2
1988	101.2	104.5	105.4	113.7	96.8	96.0	108.8	107.8	112.3
1989	98.6	100.7	103.8	114.8	97.9	95.0	114.0	110.6	116.4

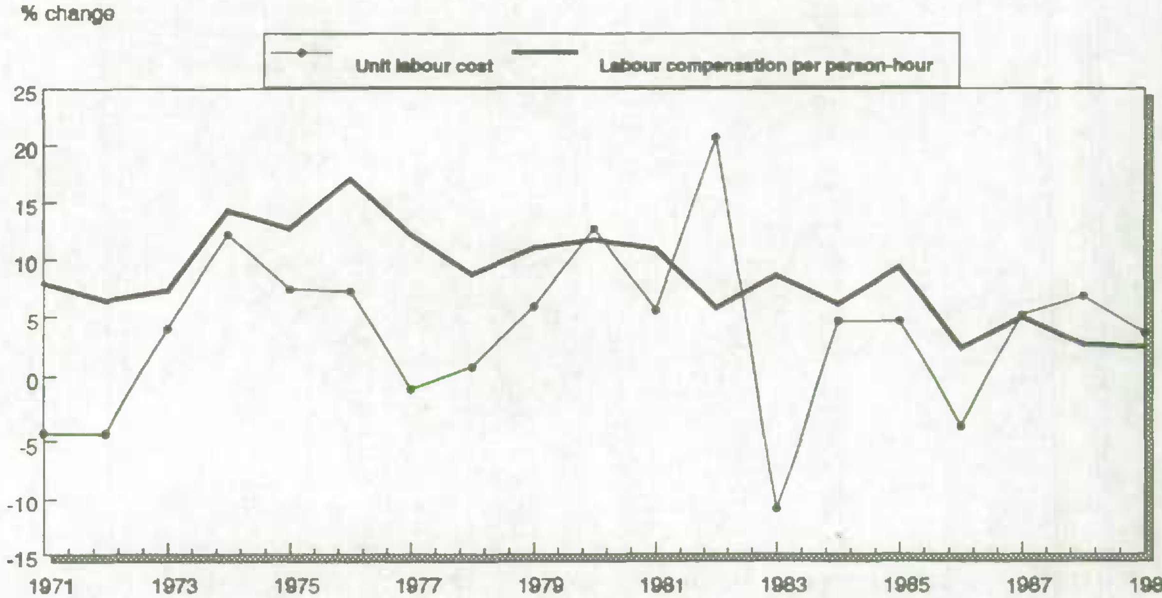


Table 19 - Indices of labour productivity and unit labour cost, clothing industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	68.3	105.7	108.1	31.3	64.7	63.2	29.6	28.9	45.7
1972	73.0	109.4	111.6	34.7	66.8	65.5	31.7	31.1	47.5
1973	78.3	111.7	112.0	38.1	70.1	69.8	34.1	34.0	48.6
1974	78.9	109.0	109.9	42.9	72.4	71.8	39.4	39.0	54.3
1975	81.8	107.9	109.1	49.4	75.8	74.9	45.7	45.2	60.4
1976	87.2	109.4	110.2	56.7	79.7	79.1	51.9	51.5	65.1
1977	85.7	101.9	102.0	58.4	84.2	84.1	57.3	57.2	68.1
1978	92.9	102.6	102.5	64.1	90.6	90.6	62.5	62.5	68.9
1979	99.7	103.8	103.9	71.7	96.1	96.0	69.1	69.0	71.9
1980	94.1	99.9	98.3	75.7	94.1	95.7	75.8	77.1	80.5
1981	96.9	99.7	96.9	82.2	97.3	100.0	82.5	84.8	84.8
1982	86.1	94.0	89.9	80.3	91.6	95.7	85.5	89.3	93.3
1983	86.2	96.6	95.8	85.3	89.2	90.0	88.3	89.1	99.0
1984	92.8	97.3	97.3	90.1	95.4	95.4	92.6	92.6	97.1
1985	95.8	97.5	96.9	93.3	98.2	98.9	95.7	96.3	97.4
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	103.6	98.5	102.2	105.9	105.2	101.4	107.5	103.6	102.2
1988	101.4	101.6	103.2	112.8	99.8	98.3	111.0	109.2	111.2
1989	100.2	98.7	99.6	116.8	101.6	100.7	118.4	117.3	116.6

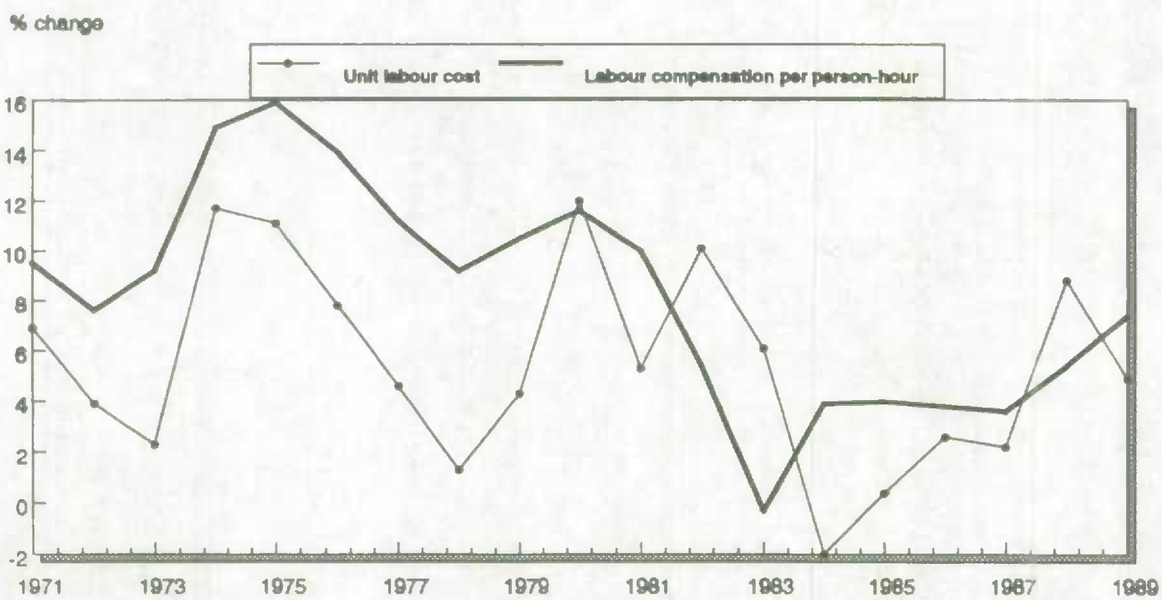


Table 20 - Indices of labour productivity and unit labour cost, wood industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	55.0	83.6	87.8	21.4	65.8	62.6	25.6	24.4	39.0
1972	55.6	93.5	96.8	25.9	59.5	57.5	27.7	26.8	46.6
1973	61.3	101.5	105.0	31.3	60.3	58.4	30.8	29.8	51.1
1974	63.5	97.2	99.4	35.0	65.3	63.9	36.0	35.3	55.1
1975	56.4	89.3	90.9	36.6	63.2	62.1	41.0	40.3	64.9
1976	68.4	97.6	100.1	46.8	70.1	68.4	47.9	46.7	68.3
1977	75.9	100.0	101.8	54.1	75.9	74.6	54.1	53.1	71.2
1978	76.2	107.3	108.5	62.3	71.0	70.2	58.1	57.4	81.7
1979	76.4	110.2	111.5	70.9	69.4	68.5	64.4	63.6	92.8
1980	81.5	106.0	106.4	75.7	76.8	76.6	71.4	71.1	92.9
1981	78.3	101.7	97.0	79.4	77.0	80.7	78.1	81.9	101.4
1982	63.3	87.8	80.2	72.4	72.1	79.0	82.5	90.3	114.4
1983	78.3	92.0	89.0	83.6	85.0	88.0	90.9	94.0	106.9
1984	87.8	92.9	91.8	88.0	94.5	95.6	94.7	95.8	100.2
1985	99.7	97.0	96.8	95.3	102.8	103.0	98.3	98.5	95.6
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	115.5	109.4	110.0	116.3	105.6	105.0	106.4	105.8	100.8
1988	117.7	111.5	114.2	123.3	105.5	103.1	110.6	108.0	104.8
1989	116.1	111.3	113.7	127.9	104.3	102.1	114.9	112.5	110.2

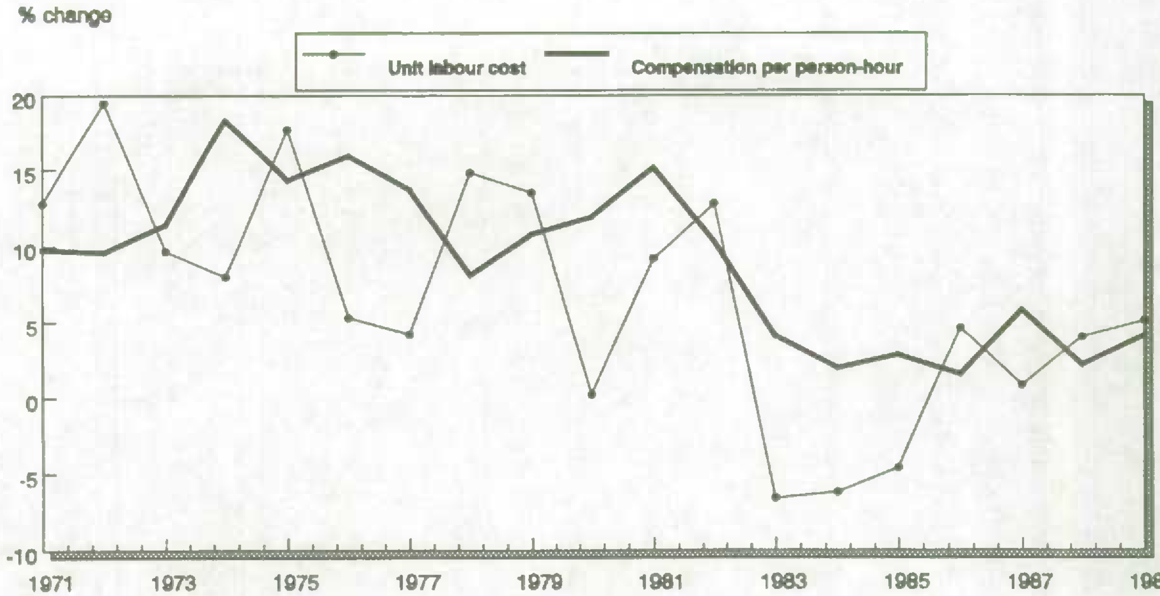


Table 21 - Indices of labour productivity and unit labour cost, furniture & fixture industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1971	72.3	74.3	77.1	21.3	97.4	93.8	28.7	27.6	29.4
1972	88.2	81.1	84.3	25.2	108.7	104.6	31.0	29.8	28.5
1973	97.3	84.3	87.4	28.3	115.4	111.3	33.6	32.4	29.1
1974	85.2	88.6	92.2	33.8	96.1	92.4	38.2	36.7	39.7
1975	80.6	86.5	89.4	37.1	93.2	90.2	42.9	41.4	46.0
1976	88.2	83.7	87.2	41.7	105.4	101.2	49.8	47.9	47.3
1977	81.9	76.5	79.3	41.6	107.1	103.3	54.4	52.4	50.7
1978	89.7	78.7	81.1	45.8	114.0	110.6	58.2	56.5	51.1
1979	88.5	85.9	89.5	53.0	103.0	98.9	61.7	59.2	59.9
1980	82.3	85.6	87.7	58.4	96.2	93.9	68.2	66.6	70.9
1981	91.7	88.5	90.2	69.8	103.6	101.6	78.8	77.3	76.1
1982	69.9	79.8	80.8	64.9	87.6	86.5	81.4	80.4	92.9
1983	79.0	78.8	77.7	69.4	100.3	101.6	88.2	89.3	87.9
1984	85.0	81.6	81.4	76.0	104.2	104.5	93.1	93.4	89.4
1985	94.7	89.9	89.5	87.1	105.4	105.9	97.0	97.4	92.0
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.8	110.9	111.4	111.8	90.0	89.5	100.9	100.4	112.1
1988	97.3	112.2	112.6	121.8	86.7	86.4	108.6	108.2	125.3
1989	98.1	114.1	110.0	129.2	86.0	89.2	113.3	117.5	131.7

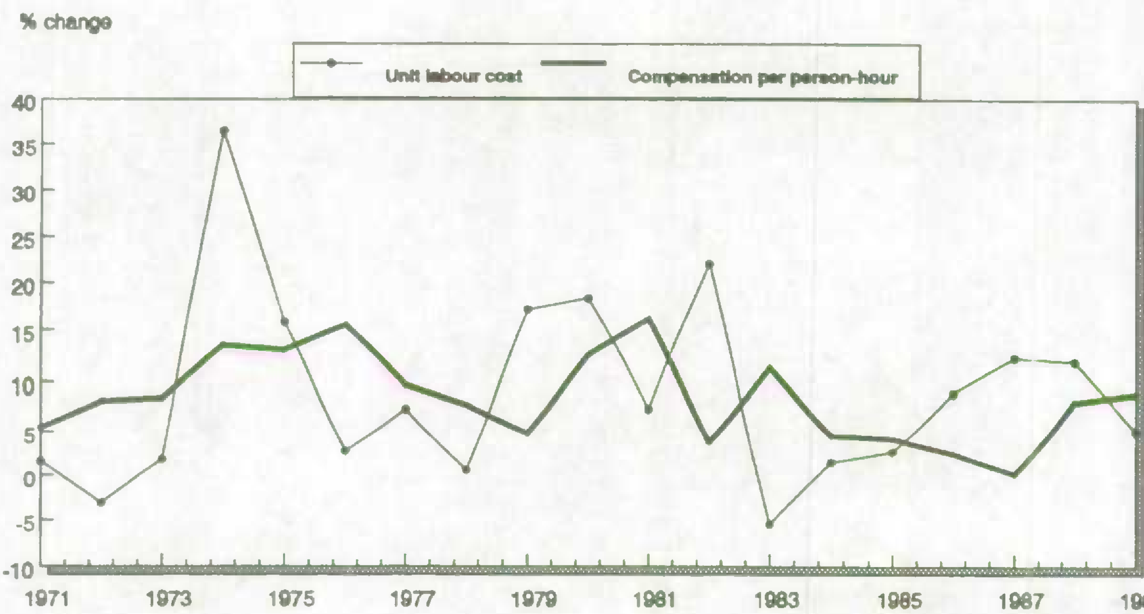


Table 22 - Indices of labour productivity and unit labour cost, paper & allied products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	85.3	100.3	104.2	24.2	85.0	81.9	24.1	23.2	28.4
1972	92.8	101.1	105.6	26.4	91.7	87.8	26.1	25.0	28.5
1973	100.3	103.1	106.7	28.8	97.2	94.0	27.9	27.0	28.7
1974	108.6	109.9	113.1	35.6	98.8	96.0	32.4	31.5	32.8
1975	77.3	106.5	99.6	36.6	72.5	77.6	34.3	36.7	47.4
1976	95.3	109.1	107.6	45.9	87.4	88.6	42.1	42.7	48.2
1977	94.2	104.0	106.0	49.3	90.6	88.8	47.5	46.5	52.4
1978	104.1	105.5	113.2	54.3	98.7	91.9	51.4	47.9	52.1
1979	102.8	106.9	108.1	59.3	96.2	95.1	55.4	54.8	57.6
1980	100.7	107.8	115.0	66.1	93.4	87.6	61.3	57.4	65.6
1981	96.7	107.6	108.1	75.4	89.9	89.5	70.1	69.8	78.0
1982	82.9	100.5	100.2	78.0	82.5	82.7	77.7	77.9	94.2
1983	92.8	97.6	97.7	82.1	95.0	94.9	84.1	84.0	88.5
1984	96.1	98.9	99.2	86.6	97.2	96.9	87.6	87.3	90.1
1985	94.9	97.5	97.9	92.8	97.3	96.9	95.1	94.8	97.7
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	106.0	102.0	101.7	105.4	104.0	104.3	103.4	103.7	99.4
1988	106.4	103.1	103.8	112.0	103.2	102.5	108.6	107.9	105.3
1989	103.0	101.8	102.8	116.5	101.1	100.1	114.4	113.2	113.1

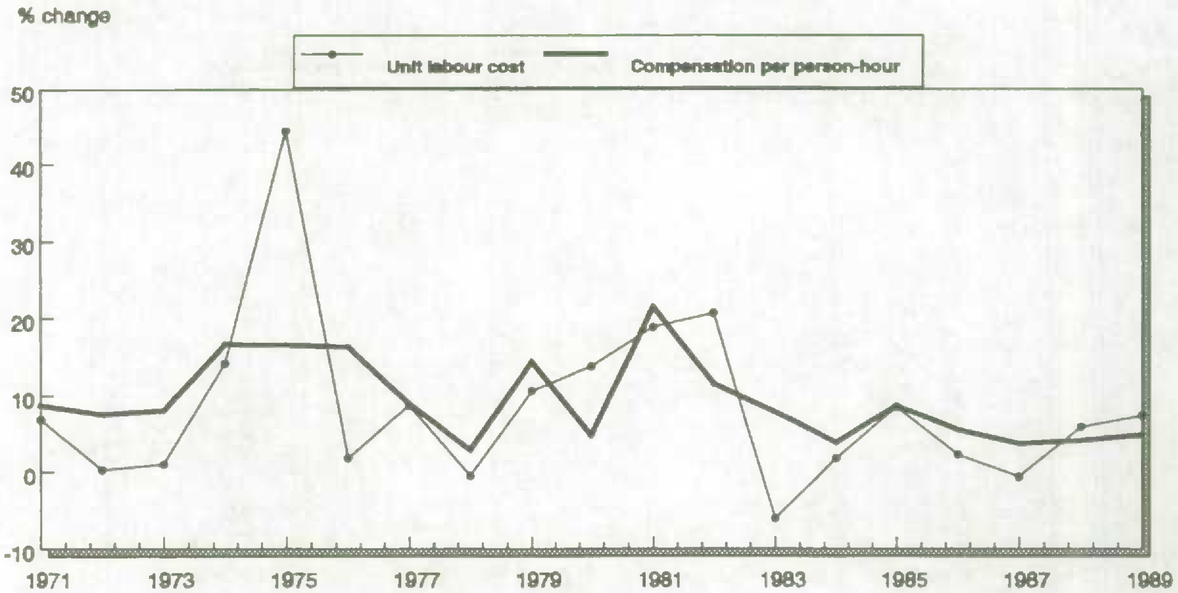


Table 23 - Indices of labour productivity and unit labour cost, printing, publishing & allied industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1971	54.6	71.9	76.2	19.6	75.9	71.7	27.2	25.7	35.8
1972	58.8	73.3	77.5	21.5	80.2	75.9	29.3	27.7	36.5
1973	65.0	77.4	80.9	24.2	84.0	80.4	31.3	30.0	37.3
1974	65.5	78.4	81.3	27.9	83.5	80.5	35.6	34.3	42.6
1975	66.4	78.7	81.2	31.6	84.3	81.7	40.1	38.9	47.6
1976	72.9	79.3	81.1	35.9	92.0	89.9	45.3	44.2	49.2
1977	76.5	78.1	79.3	38.7	97.9	96.4	49.5	48.7	50.6
1978	82.3	81.7	83.7	43.2	100.7	98.4	52.8	51.6	52.5
1979	84.1	85.4	86.6	48.7	98.4	97.1	57.0	56.2	57.9
1980	88.8	89.3	91.6	56.2	99.4	96.9	62.9	61.4	63.3
1981	91.0	89.7	90.2	64.2	101.3	100.8	71.6	71.2	70.6
1982	83.4	89.4	90.1	69.2	93.2	92.5	77.4	76.8	83.0
1983	86.3	89.3	89.1	75.5	96.6	96.8	84.5	84.7	87.5
1984	93.2	92.1	92.5	82.1	101.2	100.7	89.2	88.8	88.2
1985	97.6	95.0	95.0	90.3	102.7	102.8	95.0	95.1	92.5
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.8	103.4	103.7	107.2	96.5	96.2	103.6	103.3	107.4
1988	104.6	108.2	109.5	121.2	96.6	95.5	111.9	110.7	115.9
1989	105.2	114.1	115.2	134.1	92.3	91.4	117.6	116.4	127.4

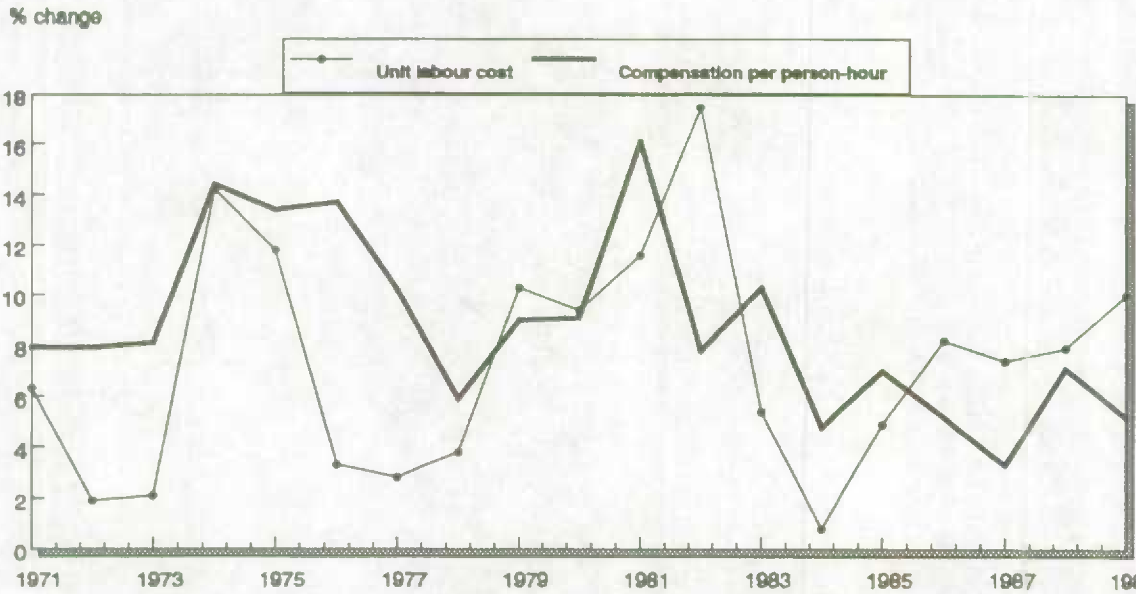


Table 24 - Indices of labour productivity and unit labour cost, primary metal industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	86.5	110.5	114.9	25.6	78.3	75.3	23.1	22.3	29.6
1972	91.4	110.0	115.4	27.8	83.1	79.2	25.3	24.1	30.4
1973	100.3	112.9	118.9	31.0	88.8	84.3	27.4	26.0	30.9
1974	107.6	118.4	124.9	36.9	90.9	86.1	31.1	29.5	34.3
1975	98.0	116.6	118.1	41.4	84.1	83.0	35.5	35.0	42.2
1976	90.2	113.7	115.0	45.4	79.3	78.4	39.9	39.5	50.3
1977	98.9	115.5	117.4	50.5	85.6	84.2	43.7	43.0	51.0
1978	104.1	118.3	120.6	55.9	88.0	86.3	47.3	46.4	53.7
1979	94.8	122.9	126.8	63.7	77.2	74.8	51.8	50.2	67.2
1980	87.3	124.5	128.4	72.2	70.1	67.9	58.0	56.2	82.7
1981	94.5	120.9	122.7	81.2	78.2	77.0	67.2	66.2	85.9
1982	71.0	109.8	110.0	84.1	64.7	64.5	76.6	76.4	118.4
1983	80.1	102.5	102.5	85.0	78.2	78.2	82.9	82.9	106.1
1984	98.0	105.3	109.4	95.6	93.1	89.5	90.8	87.3	97.5
1985	103.7	103.2	102.6	98.9	100.5	101.1	95.9	96.5	95.4
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	110.5	100.7	101.0	104.6	109.8	109.4	103.8	103.6	94.6
1988	116.4	105.1	107.4	114.3	110.7	108.4	108.7	106.5	98.2
1989	113.9	102.5	102.4	118.1	111.2	111.2	115.3	115.3	103.7

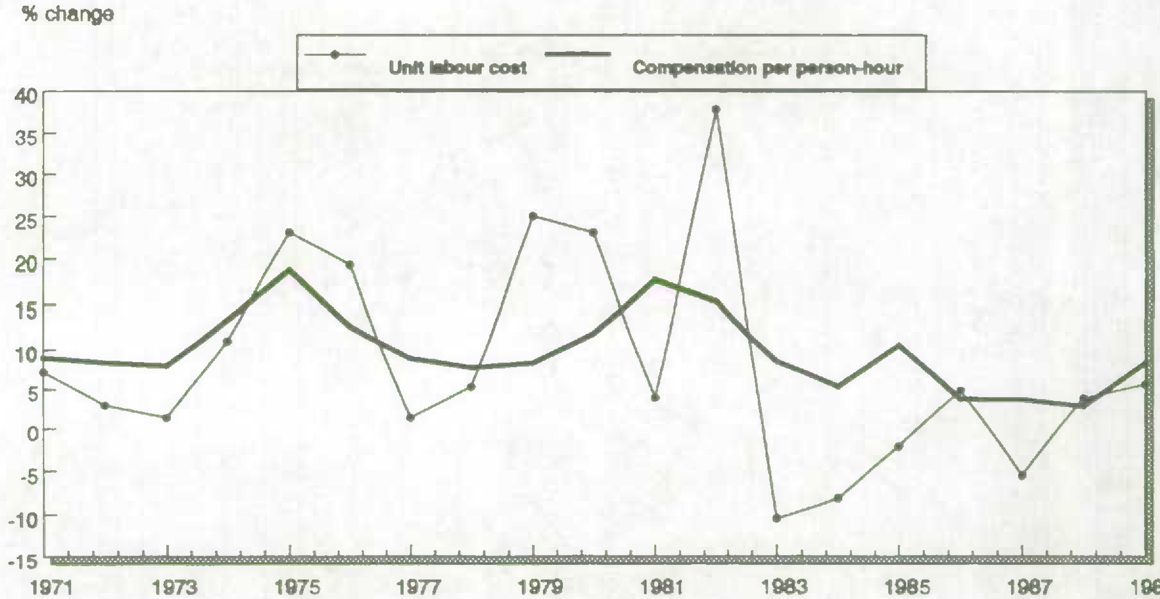


Table 25 - Indices of labour productivity and unit labour cost, fabricated metal products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	81.1	93.9	97.4	27.9	86.3	83.2	29.7	28.7	34.4
1972	85.1	95.2	98.7	30.4	89.5	86.3	32.0	30.8	35.7
1973	92.5	99.9	102.9	34.5	92.6	89.9	34.6	33.5	37.3
1974	100.4	106.1	107.8	41.7	94.6	93.1	39.3	38.7	41.5
1975	91.4	104.7	106.2	46.7	87.3	86.1	44.6	44.0	51.1
1976	97.6	106.1	107.5	53.1	92.0	90.8	50.0	49.4	54.4
1977	95.9	103.1	104.5	56.4	93.0	91.7	54.7	53.9	58.8
1978	99.0	105.8	108.0	61.9	93.6	91.7	58.5	57.3	62.5
1979	102.3	110.4	110.9	70.4	92.6	92.2	63.8	63.5	68.9
1980	102.4	109.0	109.6	76.7	93.9	93.5	70.3	70.0	74.9
1981	100.6	106.1	106.4	84.3	94.8	94.6	79.4	79.2	83.8
1982	85.5	94.2	93.1	82.2	90.8	91.8	87.2	88.2	96.1
1983	80.7	87.6	86.0	81.2	92.1	93.8	92.7	94.4	100.6
1984	86.9	87.4	86.8	83.9	99.4	100.0	96.0	96.7	96.6
1985	97.6	94.5	95.1	93.3	103.3	102.7	98.8	98.2	95.6
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.9	106.5	106.8	108.2	99.5	99.1	101.6	101.3	102.1
1988	108.3	114.0	115.0	122.7	95.0	94.1	107.6	106.7	113.3
1989	111.6	121.8	122.7	137.1	91.7	91.0	112.6	111.7	122.8

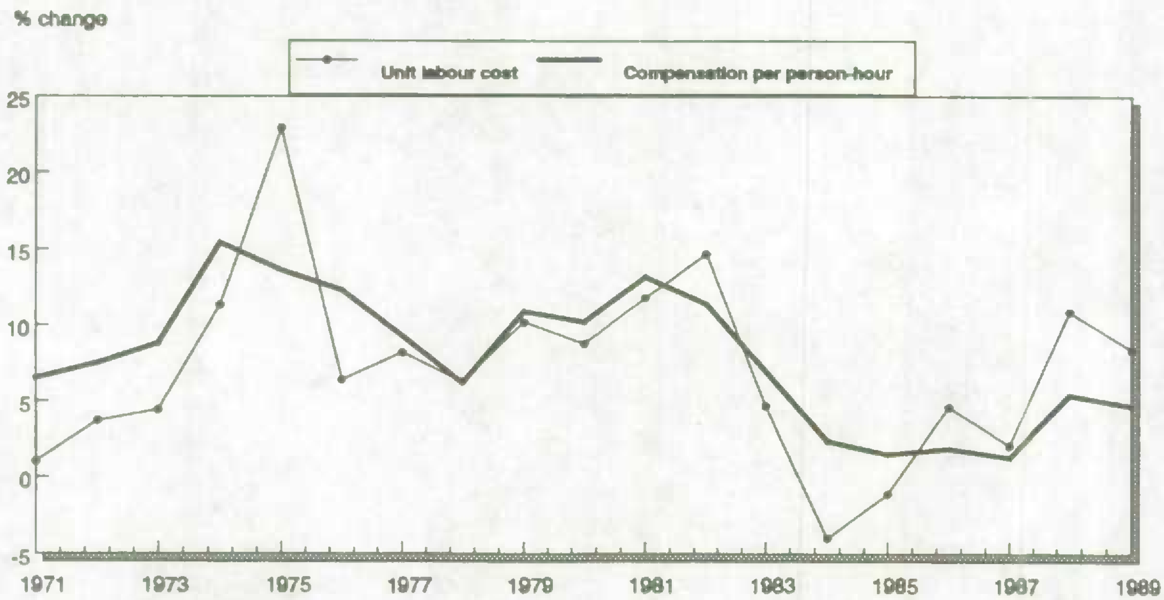


Table 26 - Indices of labour productivity and unit labour cost, machinery industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	71.4	80.5	82.6	23.6	88.8	86.5	29.3	28.6	33.0
1972	77.5	87.2	89.4	27.2	88.9	86.8	31.2	30.4	35.1
1973	85.0	91.8	93.5	30.6	92.6	90.9	33.3	32.7	36.0
1974	96.7	100.9	101.6	38.1	95.8	95.1	37.8	37.5	39.4
1975	96.2	107.7	108.0	45.3	89.4	89.0	42.1	41.9	47.1
1976	97.2	104.0	104.4	49.1	93.4	93.1	47.2	47.0	50.5
1977	99.5	103.5	102.3	53.7	96.2	97.3	51.9	52.5	54.0
1978	105.0	105.7	105.9	59.8	99.3	99.1	56.6	56.5	57.0
1979	120.6	114.7	114.4	71.2	105.1	105.4	62.1	62.2	59.0
1980	122.4	121.4	120.5	83.2	100.8	101.6	68.5	69.0	68.0
1981	118.4	118.7	116.9	93.5	99.7	101.3	78.7	80.0	78.9
1982	88.2	100.4	98.1	86.2	87.9	89.9	85.9	87.9	97.8
1983	78.0	89.1	87.4	78.7	87.6	89.3	88.4	90.1	100.9
1984	94.5	93.1	92.7	86.3	101.5	102.0	92.8	93.2	91.4
1985	96.5	95.5	95.2	92.3	101.0	101.3	96.6	96.9	95.7
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	98.0	105.5	106.7	106.5	92.9	91.9	101.0	99.9	108.7
1988	109.4	116.7	116.8	122.9	93.8	93.7	105.3	105.2	112.3
1989	111.7	121.1	121.2	134.0	92.3	92.2	110.7	110.6	119.9

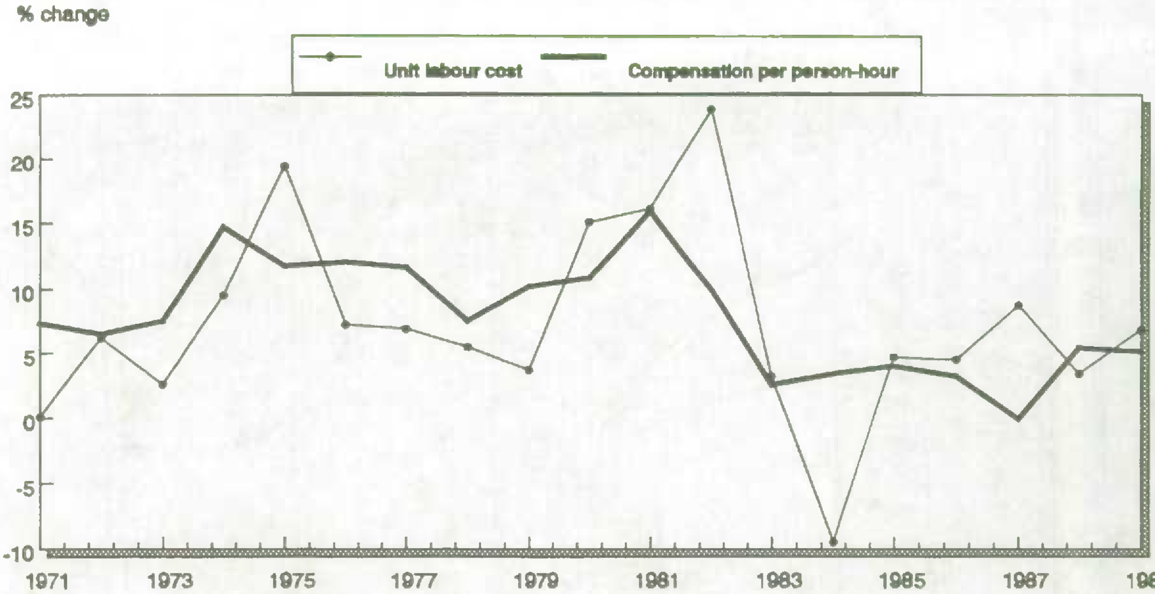


Table 27 - Indices of labour productivity and unit labour cost, transportation equipment industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	52.6	74.1	71.9	19.4	71.0	73.2	26.2	27.0	36.9
1972	59.9	78.3	77.4	22.1	76.5	77.5	28.2	28.6	36.9
1973	70.5	86.2	85.2	26.1	81.8	82.8	30.3	30.6	37.0
1974	70.7	85.0	82.6	28.8	83.2	85.7	33.9	34.9	40.8
1975	72.4	79.1	77.1	30.1	91.6	94.0	38.1	39.1	41.6
1976	78.4	82.0	79.0	35.7	95.6	99.1	43.5	45.1	45.5
1977	81.5	83.0	81.5	40.4	98.3	100.0	48.7	49.6	49.5
1978	84.2	88.6	84.8	46.7	95.0	99.3	52.7	55.0	55.4
1979	84.3	93.7	87.6	52.3	90.0	96.3	55.9	59.8	62.1
1980	65.3	87.9	81.6	53.4	74.2	80.0	60.8	65.4	81.8
1981	72.0	87.9	82.3	62.3	81.9	87.5	70.9	75.7	86.5
1982	66.0	80.2	73.9	61.0	82.3	89.3	76.1	82.6	92.5
1983	75.7	80.9	77.2	67.5	93.6	98.1	83.5	87.5	89.2
1984	95.9	91.3	89.9	82.7	105.0	106.7	90.6	92.0	86.2
1985	102.6	98.4	97.4	94.6	104.2	105.3	96.1	97.2	92.2
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.6	101.9	103.2	105.5	97.7	96.4	103.6	102.2	106.0
1988	118.1	108.6	108.9	117.0	108.8	108.4	107.8	107.4	99.1
1989	123.5	112.4	108.8	125.1	109.9	113.5	111.3	115.0	101.3

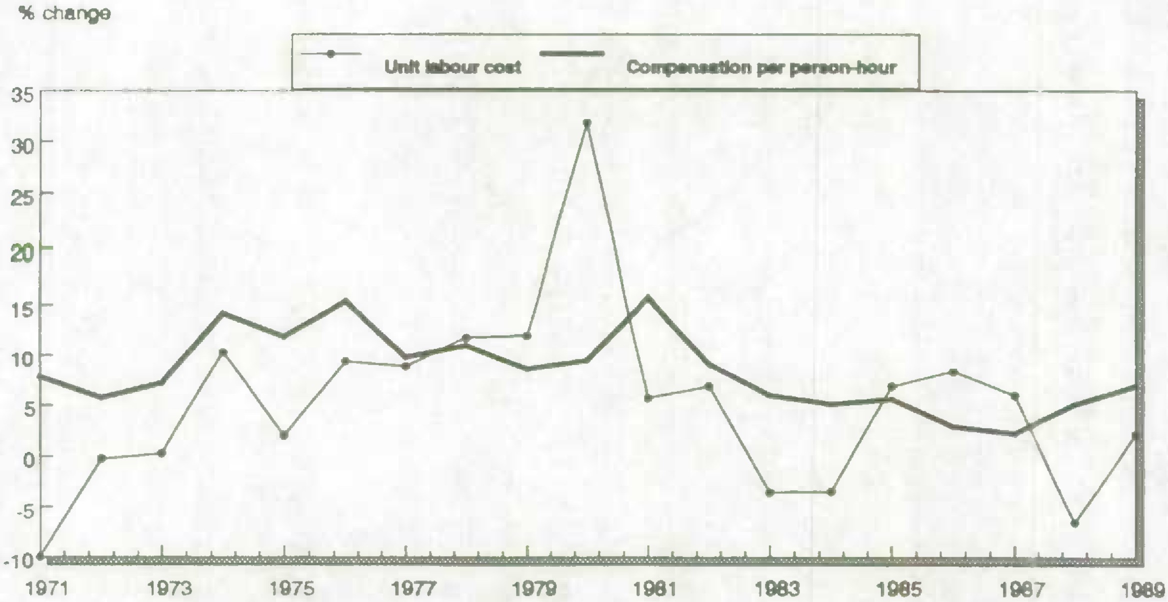


Table 28 - Indices of labour productivity and unit labour cost, electrical & electronic products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	36.9	98.9	101.0	25.9	37.3	36.6	26.1	25.6	70.0
1972	41.5	98.8	101.3	27.5	42.0	40.9	27.9	27.2	66.4
1973	47.5	104.6	107.5	31.0	45.4	44.2	29.6	28.8	65.2
1974	49.4	109.1	111.5	36.7	45.3	44.3	33.6	32.9	74.3
1975	44.6	102.4	104.1	39.3	43.5	42.8	38.4	37.7	88.1
1976	47.4	99.4	100.2	43.1	47.7	47.3	43.3	43.0	90.8
1977	47.5	90.8	91.3	43.3	52.3	52.0	47.6	47.4	91.1
1978	47.7	92.9	94.1	47.6	51.3	50.6	51.3	50.6	99.9
1979	57.4	98.6	99.3	56.5	58.3	57.9	57.3	56.9	98.4
1980	64.2	101.9	101.9	63.9	63.0	63.0	62.7	62.7	99.6
1981	72.2	107.7	107.6	75.7	67.1	67.1	70.3	70.4	104.8
1982	66.6	99.3	99.0	77.9	67.1	67.3	78.5	78.7	116.9
1983	66.9	94.6	94.8	80.7	70.8	70.6	85.4	85.2	120.6
1984	86.3	100.5	99.7	90.0	85.8	86.5	89.5	90.3	104.3
1985	95.7	101.4	102.7	96.5	94.4	93.2	95.2	94.0	100.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	110.7	106.4	107.4	111.0	104.1	103.1	104.3	103.4	100.2
1988	119.4	111.3	111.2	120.6	107.3	107.4	108.4	108.4	101.0
1989	122.4	111.9	112.0	127.3	109.4	109.3	113.8	113.7	104.0

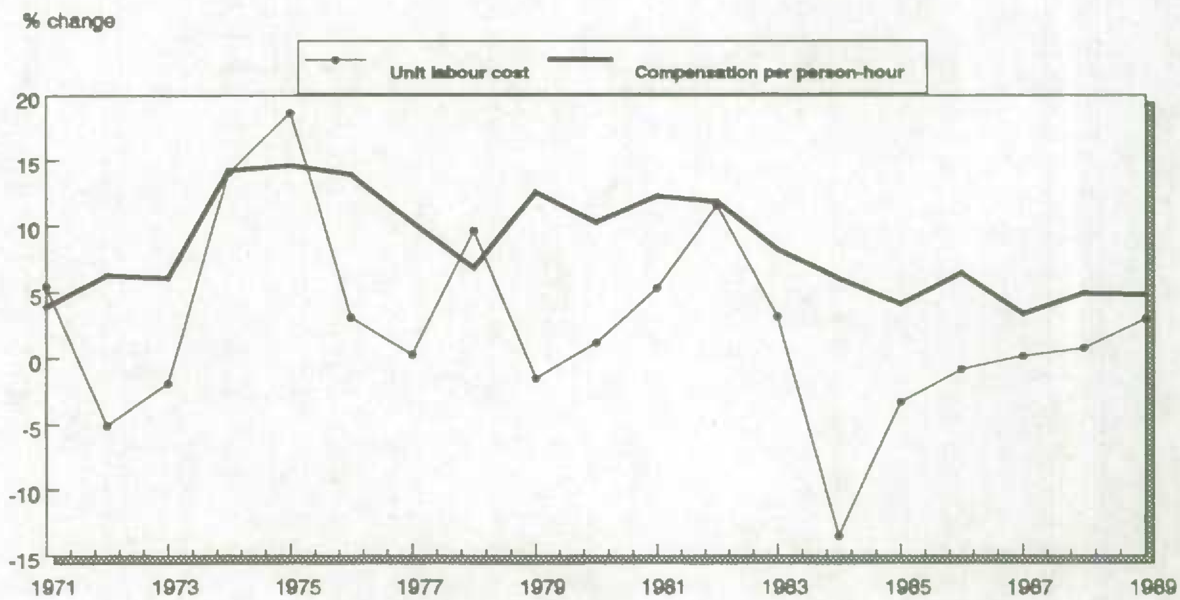


Table 29 - Indices of labour productivity and unit labour cost, non-metallic mineral products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	86.3	97.4	102.7	25.7	88.5	84.0	26.4	25.0	29.8
1972	98.3	101.0	106.1	29.1	97.4	92.7	28.8	27.4	29.6
1973	107.1	106.6	110.8	32.9	100.5	96.7	30.9	29.7	30.7
1974	109.4	110.2	113.5	38.8	99.3	96.4	35.2	34.1	35.4
1975	101.9	107.5	110.7	43.5	94.8	92.1	40.5	39.3	42.7
1976	104.8	106.4	108.4	49.1	98.4	96.6	46.1	45.3	46.8
1977	100.8	102.0	104.0	52.5	98.8	96.9	51.4	50.4	52.1
1978	108.1	104.6	106.4	57.9	103.4	101.6	55.3	54.4	53.5
1979	111.8	106.6	108.0	64.8	104.9	103.5	60.8	60.0	58.0
1980	98.2	105.0	104.0	69.2	93.5	94.4	65.9	66.6	70.5
1981	94.5	104.5	102.9	77.9	90.4	91.8	74.6	75.7	82.5
1982	72.4	90.7	88.2	73.8	79.8	82.1	81.4	83.7	102.0
1983	80.2	88.9	88.0	77.1	90.2	91.1	86.7	87.6	96.1
1984	87.8	91.4	91.2	82.6	96.0	96.3	90.4	90.6	94.1
1985	95.8	94.6	94.2	90.9	101.2	101.7	96.1	96.6	94.9
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	109.6	106.2	107.8	109.7	103.2	101.7	103.3	101.7	100.1
1988	111.3	108.1	110.5	116.6	103.0	100.7	107.9	105.5	104.7
1989	109.7	107.2	110.1	120.8	102.3	99.6	112.7	109.7	110.1

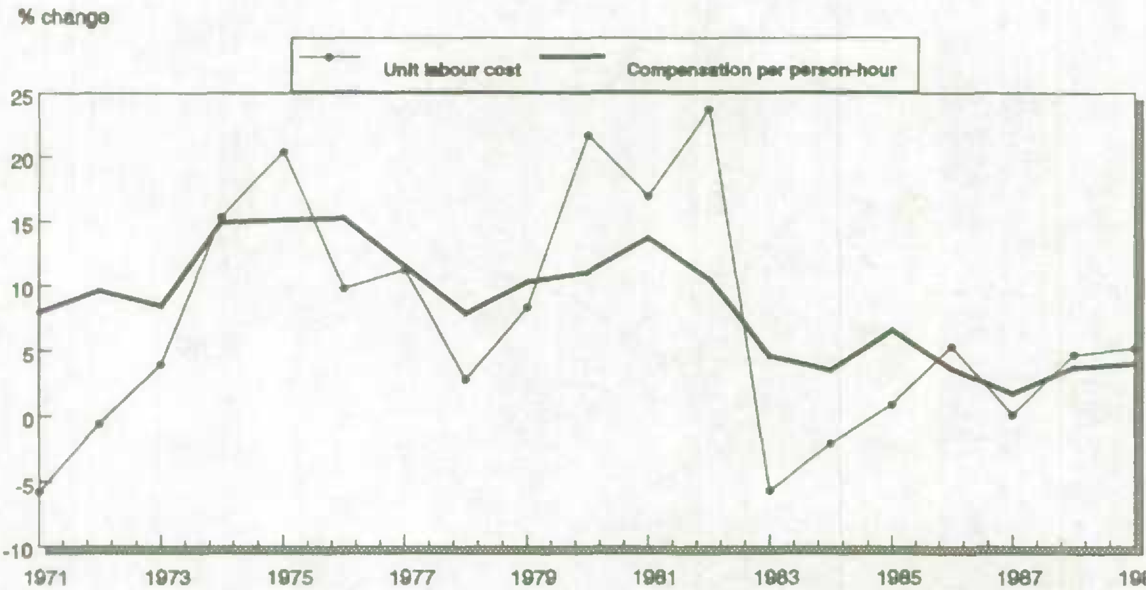


Table 30 - Indices of labour productivity and unit labour cost, refined petroleum & coal products industries, (1986=100)

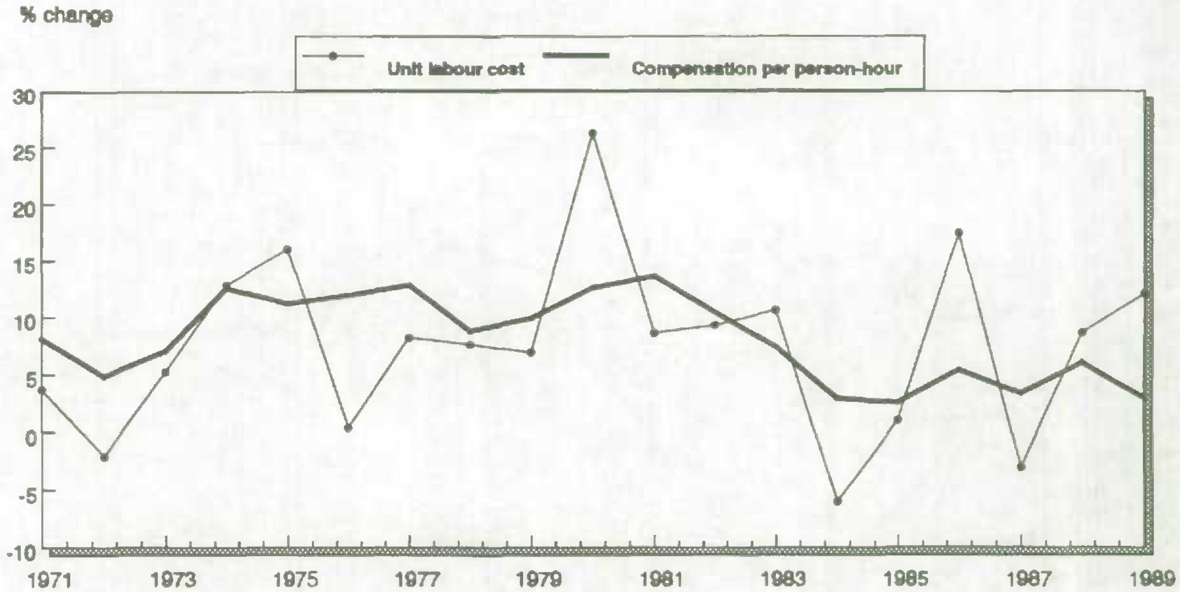
Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1971	72.7	101.3	102.5	23.6	71.8	70.9	23.3	23.0	32.5
1972	70.3	99.5	99.7	25.2	70.7	70.5	25.3	25.3	35.8
1973	103.2	104.3	103.1	28.4	98.9	100.1	27.2	27.5	27.5
1974	105.0	115.0	113.2	35.4	91.3	92.8	30.8	31.3	33.7
1975	113.4	113.0	108.4	41.6	100.4	104.7	36.8	38.4	36.7
1976	106.0	112.4	107.0	46.5	94.3	99.1	41.3	43.5	43.9
1977	132.2	119.9	113.7	54.6	110.3	116.3	45.5	48.0	41.3
1978	118.9	137.2	131.1	64.6	86.6	90.6	47.0	49.2	54.3
1979	97.9	126.5	122.2	65.6	77.3	80.1	51.8	53.7	67.0
1980	96.1	131.8	125.9	75.4	72.9	76.3	57.2	59.9	78.5
1981	111.3	153.1	146.9	100.7	72.7	75.8	65.8	68.5	90.5
1982	103.2	146.4	137.5	116.1	70.5	75.0	79.3	84.5	112.6
1983	102.7	125.7	126.5	111.6	81.6	81.2	88.8	88.3	108.8
1984	103.5	114.5	116.1	107.7	90.4	89.2	94.1	92.8	104.0
1985	100.8	111.9	114.9	107.5	90.1	87.8	96.0	93.6	106.6
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.3	98.4	100.5	104.8	107.1	104.8	106.6	104.3	99.5
1988	108.0	101.8	100.4	107.7	106.1	107.6	105.8	107.3	99.7
1989	111.4	111.7	110.2	124.3	99.7	101.1	111.2	112.8	111.5

Table 31 - Indices of labour productivity and unit labour cost, chemical & chemical products industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compensation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
1971	54.8	89.9	91.2	22.8	60.9	60.0	25.4	25.0	41.6
1972	56.6	87.0	88.0	23.8	65.1	64.3	27.3	27.0	42.0
1973	64.3	90.2	91.2	26.3	71.3	70.5	29.2	28.9	41.0
1974	65.3	93.1	93.5	30.7	70.1	69.8	33.0	32.9	47.1
1975	58.5	93.6	94.3	34.9	62.5	62.0	37.3	37.0	59.6
1976	64.7	92.8	89.0	38.7	69.7	72.7	41.6	43.5	59.8
1977	70.5	95.3	96.0	44.1	74.0	73.5	46.3	46.0	62.5
1978	78.7	96.7	97.6	48.4	81.3	80.6	50.1	49.6	61.6
1979	84.4	99.9	99.2	54.7	84.4	85.0	54.8	55.2	64.9
1980	79.4	99.5	98.5	61.4	79.8	80.6	61.7	62.4	77.4
1981	85.9	102.6	101.1	72.5	83.8	85.0	70.6	71.7	84.3
1982	76.4	101.3	98.7	78.5	75.4	77.4	77.5	79.5	102.8
1983	89.9	100.1	100.0	82.9	89.8	89.9	82.8	82.9	92.2
1984	98.4	100.2	100.4	89.1	98.2	98.0	88.9	88.7	90.5
1985	99.5	99.8	99.5	93.7	99.8	100.0	93.9	94.1	94.1
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	107.1	101.7	101.1	106.4	105.2	105.9	104.6	105.3	99.4
1988	114.5	107.4	108.1	115.5	106.6	105.9	107.6	106.9	100.9
1989	114.9	108.6	109.8	122.1	105.7	104.6	112.4	111.2	106.3

Table 32 - Indices of labour productivity and unit labour cost, other manufacturing industries, (1986=100)

Year	Real gross domestic product	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1971	76.0	82.9	87.2	24.4	91.7	87.1	29.5	28.0	32.1
1972	84.6	86.8	90.7	26.6	97.5	93.3	30.7	29.4	31.5
1973	88.7	90.2	93.4	29.3	98.3	94.9	32.5	31.4	33.1
1974	92.5	94.0	97.8	34.5	98.4	94.6	36.7	35.3	37.3
1975	88.3	94.2	97.3	38.2	93.7	90.7	40.6	39.3	43.3
1976	98.7	95.9	97.7	42.9	102.9	101.1	44.8	44.0	43.5
1977	96.2	89.9	91.2	45.3	107.0	105.4	50.4	49.6	47.1
1978	99.3	92.0	93.2	50.3	108.0	106.6	54.6	54.0	50.6
1979	105.1	94.3	95.8	56.8	111.5	109.7	60.3	59.3	54.1
1980	93.0	94.3	95.2	63.6	98.6	97.8	67.4	66.8	68.3
1981	100.9	97.8	98.6	74.8	103.2	102.3	76.6	75.9	74.2
1982	93.9	91.2	90.8	76.1	102.9	103.4	83.4	83.8	81.1
1983	91.0	90.4	90.7	81.6	100.7	100.3	90.3	90.0	89.7
1984	103.7	93.2	94.4	87.5	111.3	109.9	93.9	92.6	84.3
1985	109.4	95.9	98.1	93.1	114.1	111.5	97.2	94.9	85.2
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.6	99.4	98.0	101.3	105.2	106.6	101.9	103.3	96.9
1988	109.7	106.9	105.3	115.3	102.6	104.1	107.9	109.5	105.2
1989	105.6	108.5	110.4	124.4	97.3	95.7	114.6	112.7	117.8



APPENDIX 1

About the Measures

1 - Labour Productivity

Ideally, a productivity index would take into account all resources that are used as inputs to the production process. A comprehensive measure, such as this, is called a *total factor*, or, alternatively, a *multifactor* productivity index. This is the focus of Part 2 of this publication. The only resource that is taken into account in producing *labour productivity* is labour input. Although labour input is an important determinant in the level of output, it is not the only one. Therefore, labour productivity is considered to be a *partial productivity measure*.

Although the partial productivity indices described above are appropriate for many analytical uses, they do not describe the sources of economic growth. This is the case because measured changes in output per unit of labour input are not necessarily attributable to the contribution of labour alone, but also to the contribution of other productive resources and to the effectiveness with which all are combined and organized for production.

Due to the fact that there are two alternative measures of labour input, there are, correspondingly, two measures of labour productivity. When labour input is measured in terms of persons at work, the labour productivity measure is *real GDP per person at work*; when it is measured in terms of hours worked the labour productivity measure is *real GDP per person-hour*. Both of these partial productivity indicators are constructed as a ratio of real output to labour input, and are presented in index number form. Real GDP per person-hour may be the more appropriate measure for most applications since it incorporates changes in the average number of hours worked per week, which has a tendency to decline.

2 - Output

The concept of output used in labour productivity measurement is constant price Gross Domestic Product at factor cost by industry (excluding Government royalties on natural resources and rents of Owner-occupied dwellings). The output measures are calculated with 1961 prices for the period 1961 to 1971, with 1971 prices for the years 1971 to 1981 and with 1981 prices for the years 1981 to 1986. Estimates in subsequent years are calculated with 1986 prices. These series were then rescaled to correspond to a 1986 reference year (i.e. 1986=100) for convenience, as 1986 is the base year currently in effect. The rates of growth in the original series are not affected by the choice of reference year. A more complete description of the output measures is found in *The Input-Output Structure of the Canadian Economy 1961-1981* (Catalogue 15-510) and in *The Input-Output Structure of the Canadian Economy in Constant Prices, 1961-1981* (Catalogue 15-511).

The productivity measures pertain to business sector industries only[28]. The output of non-business sector industries is difficult to measure because it is not normally sold on the market. This means that in general, output prices are not available for this sector. The conventional measure of real output for non-business sector industries is therefore constructed by deflating the value of output with input prices. Such an approach, however, does not allow a meaningful measurement of productivity to be calculated.

3 - Labour Input

In principle, labour input should cover all labour services expended to produce a given output. This report presents two measures of labour services: persons at work and person-hours worked. Neither of these measures takes into account the changing quality of labour input.

Persons at work denote all *paid* and *other-than-paid* persons engaged in the production of output. Other-than-paid workers include self-employed workers and unpaid family workers.

Person-hours worked is the sum of person-hours spent at the place of employment by persons at work, and therefore differs from a measure of "person-hours paid" by excluding vacation time, holidays, time lost due to illness, accidents, etc.

4 - Labour Compensation

Labour compensation is a measure of the value of labour services engaged in the production process. It includes all payments in cash or in kind by domestic producers to persons at work as remuneration for work, including wages, salaries and supplementary labour income of paid workers, plus an imputed labour income for self-employed workers. Statistics on labour compensation reported here represent the most comprehensive labour cost data available for all industries at the present time since they include both cash payments and supplements and cover all remunerated persons at work.

The estimate of the value of labour services of self-employed persons is an imputed value. The imputation is based on the assumption that the value of an hour worked by a self-employed person is the same as the value of an hour worked by an average paid worker in the same industry. This assumption is based on the premise that labour services are contracted on a temporal basis, and a measure of labour compensation should not reflect returns on investment or risk taking. An adjustment is made in the case of self-employed persons such as doctors, dentists, lawyers, accountants and engineers. In these cases, the average earnings of paid workers in the same industry tend to be lower than the earnings of the self-employed workers. Although self-employed workers are in majority in the industry, the imputation of eamings for these workers at the average rate in the industry tends to underestimate the income of the self-employed. In this case, direct evidence on average labour income of these workers is introduced.

Unpaid family workers, while not directly recompensed for their services, are not a free resource, and their contribution is reflected in the net income of the firm where they are employed. However, no labour income is imputed to unpaid family workers. There is no valid basis for measuring the value of their services, and it is judged that less error is generated by their exclusion from measures of labour compensation than by

[28] *Further detail on the industry coverage of the productivity measures in this publication can be found in Appendix 3 of Part 1.*

imputing labour income to them at the same rate as paid workers. The number of unpaid family workers is insignificant in most industries.

5 - Unit Labour Cost

Unit labour cost is the ratio of labour compensation to real GDP. It is a measure of the cost of labour per unit of real output. Unit labour cost can also be viewed as the ratio of average compensation to labour productivity; thus, unit labour cost will increase when average compensation grows more rapidly than labour productivity.

6 - Absolute Values

All time series in this report are presented as indices taking a value of 100 in 1986. This form emphasizes relative change, as opposed to levels, as being important in the construction of productivity measures and related cost series. One can reconstruct the absolute values underlying the indices of persons at work, person-hours, real gross domestic product and labour compensation. These absolute values are of some interest as they indicate the level of those series. Nevertheless, the growth rate of the series is the same whether it is calculated from the index or the absolute values.

Text table 1 gives the absolute values underlying the indices for the year 1986. To calculate the absolute values corresponding to the published indices the following procedure can be followed:

$$\frac{\text{Index}}{100} \times \text{1986 value from Text table 1.}$$

The measurement of employment, output, and the other series mentioned above are subject to some, usually indeterminate, margin of error. These errors usually have a larger impact on the level of the estimates than on their growth rates. While such statistical errors will also have some effect on measures of relative change, it can be expected that their effect will be more serious when comparisons of absolute levels are attempted.

Text table 1

Absolute values of labour productivity and unit labour cost, 1986

Industry Title	Real gross domestic product	Persons at work	Person-hours	Labour compen-sation
	$'000,000	'000	000,000	$'000,000
Business sector industries	335,673	8,553	15,298	225,727
Business sector - excluding agricultural and related services industries	324,616	8,059	14,216	220,196
Business sector - services	173,374	5,244	8,993	126,868
Business sector - goods	162,299	3,309	6,305	98,859
Agricultural and related services industries	11,057	493	1,082	5,531
Manufacturing industries	86,789	1,804	3,341	56,919
Construction industries	28,082	673	1,242	23,449
Transportation and storage industries	20,254	459	856	14,857
Communication industries	13,248	200	372	7,628
Wholesale and retail trade industries	51,581	1,991	3,409	41,443
Community, business and personal services industries	52,119	1,990	3,286	41,921

APPENDIX 2

Sources of Data

1 - Output

The output data used to calculate the indices of labour productivity and unit labour cost are the estimates of constant price Gross Domestic Product at factor cost by industry. The following sources are utilized: *Indexes of Real Domestic Product by Industry, 1961 Base*, (Catalogue 61-506), for the years 1946-1961. For these years, only index values of output are available. For the years 1961 to 1981, *The Input-Output Structure of the Canadian Economy in Constant Prices 1961-1981* (Catalogue 15-511); for the years 1982 to 1989, *The Input-Output Structure of the Canadian Economy in constant prices* (Catalogue 15-202); for the years 1990 and 1991 *Gross Domestic Product by Industry* (Catalogue 15-001) is used. The data on real GDP in the Finance, insurance and real estate industries excludes real GDP of Government royalties on natural resources and rents of Owner occupied dwellings.

2 - Labour Input

This appendix presents two measures of labour input: the annual average number of persons at work and the number of person-hours worked by these persons at work. The data sources for both of these measures are given below.

An explanation of the data sources for the labour input measures for the years 1946 to 1961 can be found in: *Indexes of Output Per Person Employed and Per Man-hour in Canada, Commercial Non-agricultural Industries, 1947-1963* (Catalogue 14-501).

i) Benchmark Data Up to 1989[29]

Persons at work. Persons at work are made up of two groups: *paid workers* and *other-than-paid workers.* The other-than-paid workers include self-employed and unpaid family workers.

Paid workers. The number of paid workers in agriculture, fishing and trapping industries for all years is taken from the Labour Force Survey (Catalogue 71-001). Multiple job holders are added from 1975.

[29] *For further details the reader is referred to: Karnail S. Gill and Monique Larose, "Sources and Methods of Estimating Employment by Input-Output Industries 1961-1989" Input-Output Division Technical Series, #47, 1991.*

Estimates of Employees by Province and Industry, 1961-1976 (Catalogue 72-516), and monthly Catalogue 72-008 are the sources for the years up to 1982 for the following industries:

Logging and forestry industries;
Construction industries;
Transportation and storage industries;
Communication industries;
Other utility industries;
Wholesale and retail trade industries;
Finance, insurance and real estate industries;
Community, business and personal services.

For the period after 1982 up to 1987, the publication *Employment Earnings and Hours* (Catalogue 72-002) was the data source used for the above industries. In addition, other sources of information are used as follows:

In transportation and storage industries the following publications were used to derive the number of paid workers: *Air Carrier Operations in Canada* (Catalogue 51-002), *Rail Transport* (Catalogue 52-212; 52-215 and 52-216), *Gas Utilities: transportation and distribution systems* (Catalogue 57-205) and *Oil Pipeline Transport* (Catalogue 55-201), *Passenger Bus and Urban Transit Statistics* (Catalogue 53-215).

In communication industries, paid workers data were obtained from: *Radio and Television Broadcasting* (Catalogue 56-204); *Cable Television* (Catalogue 56-205), and *Canada Post Corporation Annual.*

For 1988 and 1989, the data source for logging and forestry industries, other utility industries and finance, insurance and real estate industries remained *Employment, Earnings and Hours* (Catalogue 72-002) while year-to-year change from Labour Force Survey was applied to 1987 absolute values for construction industries and community, business and personal services (excluding educational service industries and hospitals). For the wholesale and retail trade industries, the sources for 1988 is *Employment, Earnings and Hours* (Catalogue 72-002); for 1989, the year-to-year change from Labour Force Survey was applied to 1988 absolute value. The data sources for transportation and storage industries and the communication industries remained unchanged.

Out of the above list of industries, the construction industries need a special mention. In Input-Output concept all paid workers in construction activity taking place in other sector or industry is rerouted to the construction industries of the Business Sector. Thus, the number of paid workers engaged in construction activity in these other industries is calculated as the ratio between own-account construction and the average wage of the industry in which the activity took place.

The mining, quarrying and oil well industries are broken down into four major groups according to the 1980 SIC:

1. Mining industries;
2. Crude petroleum and natural gas industries;
3. Quarry and sand pit industries;
4. Service industries incidental to mineral extraction.

The primary data source used for the first three groups for 1961-1989 is the *General Review of the Mineral Industries*, (Catalogue 26-201). The only exception to this is the oil sands industry, which falls into the second major group, crude petroleum and natural gas industries. This industry is not covered in the *General Review of the Mineral Industries*, and therefore the data used for this industry are taken from the *Survey of Employment Payroll and Hours*. The last major group, service industries incidental to mineral extraction, includes three industries according to the 1970 SIC: Contract Drilling for Petroleum, Other Contract Drilling and Miscellaneous Services Incidental to Mining. For the years up to 1976 the number of paid workers in the first two industries is obtained from *Contract Drilling for Petroleum and Other Contract Drilling* (Catalogue 26-207). Beginning in 1977 the number of paid workers in other contract drilling is published in Catalogue 26-201 and the number of paid workers in contract drilling for petroleum is estimated from other information pertaining to the industry up to the year 1982. After that, Catalogue 72-002 has been used. The remaining part of the mining, quarrying and oil wells industries is measured using decennial census and the Catalogue 72-002 from 1983-1989.

The source of the number of paid workers in manufacturing for 1961-1989 is *Manufacturing Industries of Canada: National and Provincial Areas* (Catalogue 31-203) a publication from the annual survey of manufactures. These data are adjusted for improved coverage in the 1970's.

Other-than-paid workers. For manufacturing industries the number of other-than-paid workers is derived from the series on working owners and partners in *Manufacturing Industries of Canada: National and Provincial Areas* (Catalogue 31-203). The numbers reported for the 1970's were adjusted to effect consistency with output data. For all other industries *Labour Force Survey* (Catalogue 71-001) is used. The number of self-employed doctors and dentist (Homes for personal and nursing care and other health and social services, part of community business and personal services) are obtained from *Taxation Statistics*, Revenue Canada Taxation (Catalogue no. RV 44-1991) since 1961.

Starting with 1988, an important change was introduced in the methodology of employment estimation used in productivity measures. The persons at work level obtained from the aggregation of industry estimates derived from different sources is reconciled to the growth rate of total persons at work from the *Labour Force Survey*. Thus, the growth rate from this survey is used as the benchmark. When a difference occurs between the two estimations, the difference is prorated between trade industries and community business and personal industries (excluding educational service industries and hospitals) as the emloyment data for these industries are considered less reliable. The same methodology applies to the preliminary data below.

ii) Preliminary Data - 1990 and 1991

For the paid workers, the year-to-year change from *Labour Force Survey* (LFS) and *Survey of Employment Payroll and Hours* (SEPH) was applied to the 1989 absolutes values. For other-than-paid workers, the data were obtained from *Labour Force Survey*.

Person-hours worked. With the exception of manufacturing industries the number of person-hours worked in each industry is obtained as the product of the number of persons at work and the average number of hours worked in each year.

In manufacturing, the basic source is the *Annual Survey of Manufactures*, supplemented by other survey results as noted. Distinct calculations are made for production workers and for salaried employees, total person-hours worked being obtained as the sum of the two elements. The adjustments effected to the published levels of persons at work in the 1970's also operate on person-hours worked. For production workers, the number of person-hours worked is obtained from tabulations of returns to the *Annual Survey of Manufactures*. For salaried employees, the methodology for estimating hours worked is slightly different in the early part of the period, up to 1969. The discontinuance of the survey *Earnings and Hours of Work in Manufacturing* at that time necessitated a different technique in the later period. This survey yielded a value of average hourly earnings applicable to the earnings of salaried employees. With hourly earnings, payroll values are converted into estimated hours paid. The survey of *Labour Costs in Canada* covers the manufacturing industry in selected years, and this provides a basis for converting hours *paid* to hours *worked*. For the years after 1969, the occasional surveys of *Labour Costs in Canada* provide the basis for estimating hours worked by salaried employees. From 1983 onwards the *Annual Survey of Manufactures* provides tabulations from which it is possible to estimate average hours worked per week for salaried employees.

Due to the fact that the 1987 entries on person-hours worked in the *Annual Survey of Manufactures* were captured but were not edited, in-house estimates of person-hours were made in order to maintain the continuity of the labour productivity time series. These estimations cover the major group level (M level). The estimates of person-hours by industry were derived either from the *Survey of Labour Force* (LFS) or the *Survey of Employment, Payroll and Hours* (SEPH) for each of the 21 manufacturing major groups. The resulting hours estimates for the total of manufacturing were reconciled with average hours worked from the LFS for total manufacturing since, historically, the level of hours of the *Annual Survey of Manufactures* is very close to the level of hours given by LFS at this level of aggregation. Hours worked by working owners and partners were estimated for 1987 at the M level on the assumption that its growth rate with respect to 1986 equals that for paid workers. For 1988 person-hours worked for the paid workers were derived mostly from the Survey of Manufacturers (15 major groups) from SEPH (4 major groups) and (2 major groups) from L.F.S. For all years up to 1986 and the year 1988 average hours worked by working owners and partners in manufacturing are based on the hours worked of salaried employees. In 1989, hours worked by both categories of workers were drawn from the *Annual Survey of Manufactures* for all major groups.

For recent years, when the *Annual Survey of Manufactures* is not yet available, the average hours worked for the paid workers and working owners and partners in manufacturing is based on the growth rate of average hours worked from LFS, calculated as explained below.

Average hours worked for industries other than manufacturing are calculated from tabulations of the *Labour Force Survey*. Estimates are made independently for paid workers and other-than-paid workers; from 1975 the latter class is further divided into self-employed workers and unpaid family workers. Multiple job holders are included from 1975.

Monthly data from the *Labour Force Survey* refer only to the survey week. The survey week can be taken as representative of other weeks in the month except for holidays and strikes[30]. The procedure is to first adjust the survey weeks for the effect of strikes and holidays falling in that week. This yields a nominal value of the hours worked in that week if there were no strikes or holidays. The survey generates the data required to make these corrections. Corresponding nominal values for non-survey weeks are estimated by interpolation. These nominal values for each week of the year are then adjusted by the known impact of strikes and/or holidays on that week. The necessary data on strikes are tabulated by Labour Canada. Only the paid worker series is adjusted for strikes. The holiday adjustment is based on statutory holidays and studies of employment practices in industries. Average annual hours worked per week are calculated as the average of the weekly values adjusted for strikes and holidays. The number of hours worked per year is simply the weekly average multiplied by the number of weeks in the year. The number of weeks in the year is not taken as constant, but reflects the vagaries of the calendar. A calendar year encompasses 52 complete weeks plus one, or in leap years, two extra days. If these extra day(s) fall on a normal day of rest the year is considered to have 52 weeks even. If not, the number of weeks is greater. There can be a slight variation in the year-to-year change in hours worked on this account.

[30] *For a complete description of this methodology, see: Maryanne Webber, "Estimating Total Annual Hours Worked from the Canadian Labour Force Survey", Input-Output Division Technical Series, #51, Statistics Canada, April 1983.*

3 - Labour Compensation

There are two components to labour compensation: labour income of paid workers and an imputed labour income of self-employed workers. The labour income of paid workers is taken from the following sources: *The Input-Output Structure of the Canadian Economy 1961-1981* (Catalogue 15-510), the same publication for 1982 and following years (Catalogue 15-201) except for the two most recent years where it is taken from the *Estimates of Labour Income* (Catalogue 72-005) after adjustments are made to reroute own-account construction to construction industries of the business sector.

Labour income of other-than-paid workers. In addition to the labour income of paid workers, labour compensation includes an imputed labour income for all other-than-paid workers except unpaid family workers. The imputation is based on the assumption that the hourly income for the labour of self-employed persons is the same as that of paid worker in the same year and the same industry.

For the years to 1975 the hours worked of self-employed workers were estimated as the ratio of self-employed persons to other-than-paid workers times the hours worked by other-than-paid workers. From 1975, as noted above, the hours worked by self-employed persons are estimated directly.

An adjustment is made in the case of some professional persons, such as doctors, dentists, lawyers, accountants and engineers. These occupations are largely self-employed, but the average earnings of paid workers in the same industry division underrepresent the earnings of these occupations. In these cases data on the number of self-employed professional persons and their average labour income back to 1961 are obtained from *Taxation Statistics*, Revenue Canada Taxation, (Catalogue No. RV 44-1991), for the year 1989 and similar publications for other years.

APPENDIX 3

Aggregation Parameters for Labour Productivity Measures

The statistics presented in this publication refer to business sector industries, as defined in the Canadian System of National Accounts. There are no corresponding statistics for non-business sector industries due to difficulties in the measurement of real output in this sector, as explained in Appendix 1.

The most detailed account of the business sector is defined in terms of individual industries from the *Standard Industrial Classification* (SIC). Aggregation of SIC industries generates 154 link (L) level industries (excluding the fictive industries), 47 medium (M) level industries and 13 small (S) level industries.

There are a total of 32 statistical tables on labour productivity appearing in Part 1 of this publication. Tables 1 to 4 are produced for special aggregates of business sector industries. Tables 5 to 11 correspond to selected S level business sector industries (except for Table 10 for which two S level industries have been combined). The remaining tables, 12 to 32, are associated with the M level manufacturing industries.

The following text tables show the concordance between the classification of industries in the Canadian System of National Accounts and the Canadian Standard Industrial Classification.

Text table 1

Concordance between "S" level industry codes, standard industrial classification codes (SIC's) and link codes

S Level Industries

S Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
1	Agricultural & related services ind.	011-017, 021-023	001-021	001-021	1
2	Fishing & trapping industries	031-033	041-047	041-047	2
3	Logging & forestry industries	0411, 0412, 0511	031, 039	031, 039	3
4	Mining, quarrying & oil well industries	0611-0617, 0619, 0621-0625, 0629, 063, 071 081, 082, 091, 092	051-052 057-059, 061, 064, 071-073, 079, 083 087, 096, 098, 099	051-059 061, 063-066, 071, 073, 077, 079, 083 087, 092-099	4-13
5	Manufacturing industries	(See M level below)			14-108
6	Construction industries	401-449	404-421	404-421	109-117
7	Transportation & storage industries	451-459 461, 471 479, 996 9991	501-509 512, 515-517, 519 524, 527	501, 502 504-509 512, 519 515-517 524-527	118-128
8	Communication industries	481-483 4841	543-545 548	543-545 548	129-131
9	Other utility industries	491, 492 499	572, 574 579	572, 574 579	132-134
10,11	Wholesale and retail trade industries	501-599 601-692	10722,2611 602-629 631-699	1292, 2611 602-629 631-699	135-136
12	Finance, insurance & real estate	701-705 709, 711-729, 731-733, 741-743, 7499 7511, 7512 759, 761	7011-7016 7019, 703, 705, 707 715, 7211, 7212, 735, 7371	702, 704 7311, 7312 735, 7371	137-139
13	Community, business, personal services	771-777, 779, 851-859, 861 8621, 863 865, 866 8671, 8679 868, 8691-8693, 8699 911-914, 921 922, 961-966, 969 971, 972 973, 979 982, 983 991-995 9999,4842	801-809 821-827 841-845 849, 851-855, 861-864, 866 867, 869 871, 872 874, 876 877, 879 881-886 891, 8931 894-899	801-809 821,823-827, 851 853-859 861, 862 864, 866 869, 871 872, 874-879, 891 8931. 894-899	142-154

Text table 2

Concordance between "M" level industry codes, standard industrial classification codes (SIC's) and link codes

M Level Industries - Manufacturing

M Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
8	Food industries	1011, 1012 102-104 1051-1053 106, 1071 1072, 1081-1083, 109	101-108	101, 103 105, 107 111, 112 123-125 128, 1291 131, 133 135, 139	14-24
9	Beverage industries	111-114	109, 145, 147	141, 143	25-28
10	Tobacco products industries	121, 122	151, 153	151, 153	29
11	Rubber products industries	151-159	1623, 1629	163, 169	30
12	Plastic products industries	161-169	1651, 27332	27332, 3851	31
13	Leather & allied products industries	1711, 1712 1713, 1719	1624, 172 174, 179	161, 172 174, 179	32,33, 34
14	Primary textile & textile products industries	181-183 191-193 199	181-187, 189, 2391	183, 193, 197, 201 211-216 218, 221 223, 2292, 2299,2391	35-40
15	Clothing industries	243-245, 249	175, 231 2392, 243-249	175, 231 2392, 242-249	41, 42
16	Wood industries	251, 252 254, 256 258, 259	251, 252 254, 256 258, 259	251, 252 254, 256 258, 259	43-47
17	Furniture & fixture industries	261, 264 269	2619, 264 266	2619, 264 266	48-50
18	Paper & allied products industries	271-273 279	271, 272 2731, 2732 27331, 274	271, 272 2731, 2732 27331, 274	51-54
19	Printing, publishing & allied industries	281-284 8932	286-289, 8932	286-289,	55, 56
20	Primary metal industries	291, 292 294-297 299	291, 292 294-298	291, 292 294-298	57-63
21	Fabricated metal products industries	301-309	301-309	301-309	64-71
22	Machinery industries	311, 312 319	311, 315 316	311, 315 316	72-74
23	Transportation equipment industries	321, 323-329	1652, 188 321, 323-329	2291, 321 323-329 3852	75-81
24	Electrical & electronic products	331-339	268, 318 3399 331-336, 338, 3391	268, 318 331, 332 334-339	82-89

Text table 2

Concordance between "M" level industry codes, standard industrial classification codes (SIC's) and link codes (concluded)

M Level Industries - Manufacturing

M Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
25	Non-metallic mineral products industries	351, 352 354-359	351, 352 353-359	341, 343 345, 347 348, 351- 357, 359	90-95
26	Refined petroleum & coal products	361, 369	365, 369	365, 369	96
27	Chemical & chemical products industries	371-377 379	372-379	371-379	97-103
28	Other manufacturing industries	391-393 397, 399	391-393 397, 399	219, 381- 384, 393, 395, 397- 399	104-108

Special Aggregations

Industry Title	S code
Business sector industries	1-13
Business sector - goods	1-6, 9
Business sector - services	7-8, 10-13
Business sector - excluding agricultural & related services	2-13

APPENDIX 4

Quality of Labour Productivity Estimates and Related Data

Like other components of the Canadian System of National Accounts (CSNA), the labour productivity and unit labour cost measures presented in this publication are derived from a variety of sources and subjected to various adjustments. Assessing the quality of the data thus raises difficulties similar to those pointed out in other CSNA publications. The labour productivity and related data presented in this publication are derived from:

(1) input-output tables, and real gross domestic product by industry, and,

(2) various surveys and censuses containing information on employment, hours worked, and labour income.

Quality ratings presented in text tables 1 and 2 are provided for the latest benchmark year noted on the table. Data quality ratings for previous years may be found in preceding issues of this publication; data for the period following the benchmark year are deemed to be of lesser quality although no quality rating is provided.

In rating various data our main interest lies more in year-to-year changes than in the levels of various constructs. No attempt will be made to establish a cardinal rating of various constructs used in productivity. However, based on an informed opinion, an ordinal rating will be attempted. The rank of 1 means most reliable, the rank of 2 means reliable and the rank of 3 means acceptable. Any series which do not support a rank of 3 is not published. Ratings are provided for the following series:

(i) Real GDP at factor cost;
(ii) Persons at work;
(iii) Person-hours worked;
(iv) Labour compensation;
(v) Real GDP per person at work;
(vi) Real GDP per person-hour;
(vii) Compenstion per person at work;
(viii) Compenstion per person-hour;
(ix) Unit labour cost.

Real GDP. The quality ratings of real GDP have been taken from Appendix A of the publication: *The Input-Output Structure of the Canadian Economy, 1989* (Catalogue 15-201).

Persons at work. For these data the rankings have been determined as follows: in general, a rank of 1 has been assigned to the most reliable estimates that are based completely on censuses[31], surveys or administrative records with minimum adjustments for coverage, valuation and classification. A rank of 2

[31] *See Appendix 2 of Part 1 for a full description of data sources.*

has been assigned to less reliable census and survey data with adjustments for coverage. A rank of 3 has been assigned to all other sources, for example, household surveys (*Labour Force Survey*), and decennial censuses, unless experience indicates otherwise. The main reason that household surveys or decennial censuses have been given this ranking is because of lack of precision of the responses in household surveys or population censuses to questions related to industrial classification as compared to establishment-based censuses or surveys. However, the quality rating of series taken from sample surveys, like the *Labour Force Survey*, also depends on the size of the sample. Aggregate series may, therefore, have higher ratings than disaggregated series. Likewise, at a given level of aggregation, large industries may have a better quality rating than small industries.

According to these criteria, the employment data from the Annual Survey of Manufactures at the S level of aggregation in 1989 carry a ranking of 2. The reason it has been assigned a ranking of 2 and not 1 is because in the revised data for 1989, 19.4% of the paid workers data are taken from tax returns and the small forms. Out of that percentage 14.2% are estimated from tax files where employment is not reported: data on wages and salaries are used to estimate the number of paid workers in this portion of the universe. For 1989, the following criteria has been used for ranking the employment data for various industries at M level of aggregation in Manufacturing. A ranking of 1 has been assigned where less than 10.0% of the employment data are taken from the tax returns. A ranking of 2 has been assigned to data where more than 10.0% but less than 20.0% of the data is from the tax returns. A ranking of 3 has been assigned where more than 20.0% data are from the tax returns.

The employment data for the agriculture industry are taken from the Labour Force Survey, which is a household survey. For this industry, it is the only source of employment estimates. Also, in the agriculture industry, 60.8% of the workers are "other-than-paid" where the quality of data is expected to be slightly lower than for "paid workers". The employment data for the agriculture industry, therefore, has been assigned a ranking of 3. For the remaining industries in the business sector of the economy, the employment data for paid workers originates from either establishment-based surveys (*Estimates of employees* up to 1982 and *Survey of Employment, Payroll and Hours* from 1983 onwards) or from a variety of other surveys. The employment data for the other-than-paid workers is obtained from the *Labour Force Survey*. Therefore, in the case of all remaining industries for which productivity and unit labour cost data are published at the S level of aggregation, the quality rating of the employment data is determined as follows: a ranking of 1 has been assigned to the industry where up to 10.0% of the persons at work are other-than-paid. For industries where this ratio is between 10.0% and 20.0%, the ranking is 2. For industries where this ratio is greater than 20.0%, the ranking of 3 has been assigned to the employment data. However, at the aggregate business sector level, errors tend to cancel out and it is felt that a quality rating of 1 could be attributed to the data.

Person-hours worked. The number of person-hours worked in each industry except manufacturing is obtained as the product of the number of person at work and the average number of hours worked in each year. Average hours data from the *Labour Force Survey* are good quality data and where comparisons are possible e.g. in manufacturing, average hours from both sources show very similar year-to-year changes. As a separate construct, the average hours worked data have a quality rating of 2. Since person-hours worked data are a product of the number of persons at work and the average number of hours worked, the quality rating of person-hours is the rounded average of the two variables. In manufacturing, the person-hours worked data come from the Annual Survey of Manufactures where distinct calculations are made for production workers and for salaried employees, total person-hours worked being obtained as the sum of two elements. However, even for production workers, the person-hours worked are mostly estimated from person-hours paid. For salaried employees, it is derived using average standard work week and vacation weeks paid. Since the hours worked data at the S level of aggregation in manufacturing are simply a sum of the hours worked data at the M level of aggregation (there being no compensating errors) the quality rating of person-hours worked data at both S and M level of aggregation has been set at 2. Aggregate business sector hours have been attributed a rating of 1 because of compensating errors.

Labour compensation. Labour compensation is the sum of labour income of paid workers and the imputed labour income of self-employed workers. Since the estimates of labour income in the benchmark year come from tax data and have been subjected to various Input-Output adjustments, these have a rating of one. However, in some industries (for example Agriculture, Construction, Retail Trade) there is a large number of self-employed workers for whom there is no direct measure of labour income and an imputation is made on the assumption that the hourly compensation of self-employed workers equals that of paid workers. Therefore, at aggregation level S the following rating criteria has been used. For industries, where the ratio of self-employed workers to persons at work is less than 10.0% the rating of labour compensation data is 1, where this ratio is more than 10.0% but less than 20.0% the rating is 2. For a ratio greater than 20.0% a rating of 3 has been assigned. According to these criteria compensation data for all manufacturing industries at M level of aggregation have been assigned a quality rating of 1.

Labour productivity and *other ratios.* The quality ratings of ratios like real GDP per person at work, real GDP per person-hour and unit labour cost have been calculated as the rounded weighted average of the ratings for the two variables. For example, if the rating for real GDP is 1, and employment is 2, then the rating for real GDP per person at work is 2.

Text table 1

Quality ratings of labour productivity and related data at aggregation level S and business sector, 1989

Industry title	Real GDP	Persons at work	Person-hours	Labour Compen-sation	Real GDP per person	Real GDP per person-hour	Compen-sation per person	Compen-sation per person-hour	Unit Labour Cost
Agricultural & related services ind.	2	3	3	3	3	3	3	3	3
Manufacturing industries	1	2	2	1	2	2	2	2	1
Construction industries	3	2	2	2	3	3	2	2	3
Transportation & storage industries	2	2	2	2	2	2	2	2	2
Communication industries	2	1	2	1	2	2	1	2	2
Wholesale and retail trade industries	3	2	2	2	3	3	2	2	3
Community, business, personal services industries	2	2	2	3	2	2	3	3	3
Business sector	1	1	1	2	1	1	2	2	2

Text table 2

Quality ratings of labour productivity and related data for manufacturing industries at aggregation level M, 1989

Industry title	Real GDP	Persons at work	Person-hours	Labour Compen-sation	Real GDP per person	Real GDP per person-hour	Compen-sation per person	Compen-sation per person-hour	Unit Labour Cost
Food	1	1	2	1	1	2	1	2	1
Beverage	2	1	2	1	2	2	1	2	2
Tobacco	2	1	2	1	2	2	1	2	2
Rubber	1	1	2	1	1	2	1	2	1
Plastic	1	3	2	1	2	2	2	2	1
Leather & allied	1	2	2	1	2	2	2	2	1
Primary textile & text. prod.	1	2	2	1	2	2	2	2	1
Clothing	1	1	2	1	1	2	1	2	1
Wood	2	2	2	1	2	2	2	2	2
Furniture & fixture	1	3	2	1	2	2	2	2	1
Paper & allied	1	1	2	1	1	2	1	2	1
Printing, publishing & allied	2	3	2	1	3	2	2	2	2
Primary metal	1	1	2	1	1	2	1	2	1
Fabricated metal	1	3	2	1	2	2	2	2	1
Machinery	1	3	2	1	2	2	2	2	1
Transp. equip.	2	1	2	1	2	2	1	2	2
Electrical & electronic	2	2	2	1	2	2	2	2	2
Non-metallic mineral prod.	1	2	2	1	2	2	2	2	1
Refined petroleum & coal prod.	2	1	2	1	2	2	1	2	2
Chemical & chemical prod.	2	1	2	1	2	2	1	2	2
Other manufacturing	2	3	2	1	3	2	2	2	2

APPENDIX 5

Algebraic Presentation of Indices

1 - Productivity Index

The basic formula of labour productivity used throughout this report may be expressed as follows:

$$\textit{Index of Productivity} = \frac{\textit{Real GDP index}}{\textit{Labour input index}} \; X\ 100$$

or, in algebraic form:

$$P_t = \left[\frac{Q_t\,/Q_o}{L_t\,/L_o}\right] X\ 100$$

Where ***P*** is the index of labour productivity, and ***Q*** and ***L*** are constant price output (Real Domestic Product) and the volume of labour input respectively, at the appropriate level of aggregation, and the subscripts ***o*** and ***t*** refer to the base year and any other year.

2 - Unit Labour Cost Index

Similarly, the index of unit labour cost may be expressed as follows:

$$\textit{Unit Labour Cost Index} = \frac{\textit{Labour Compensation Index}}{\textit{Real GDP Index}} \; X\ 100$$

or, in algebraic form:

$$U_t = \left[\frac{C_t\,/C_o}{Q_t\,/Q_o}\right] X\ 100$$

By dividing both the numerator and the denominator of the unit labour cost expression by the labour input index, the unit labour cost index can also be expressed as a ratio of the average labour compensation index to the labour productivity index. That is:

$$U_t = \frac{\textit{Average Labour Compensation Index}}{\textit{Productivity Index}} \; X\ 100$$

Where U is the unit labour cost index, C is labour compensation; Q and L and the subscripts were defined above.

3 - Labour Productivity, Unit Labour Cost and Average Labour Compensation

The definitions of P, Q, L, U and C were given above, but expressed here as absolutes. If W is denoted as average labour compensation, then by definition:

$$P = Q/L$$

$$W = C/L$$

$$U = C/Q \text{ or}$$

$$U = W/P$$

The growth in these variables can be presented as

$$P_t = P_o\,(1 + p)^n$$

$$W_t = W_o\,(1 + w)^n$$

$$U_t = U_o\,(1 + u)^n$$

Where the lower case letters refer to the rates of growth and the subscripts o and t and superscript n refer to time. P_o, W_o and U_o represent the values in the initial year o and P_t, W_t and U_t represent the values of P, W and U in the year t with n being the time interval in years between the year t and the year o. In the year t:

$$U_t = W_t\,/P_t$$

Substituting the preceding three relationships into the above equation yields

$$U_o (1 + u)^n = \frac{W_o (1 + w)^n}{P_o (1 + p)^n}$$

which simplifies to

$$U_o (1 + u)^n = U_0 \left[\frac{1 + w}{1 + p}\right]^n$$

$$1 + u = \frac{1 + w}{1 + p}$$

or, solving for u

$$u = \frac{w - p}{1 + p}$$

Thus the growth rate in unit labour cost is inversely related to the labour productivity growth rate. The last equation can be expressed as

$$p = \frac{w - u}{1 + u}$$

If unit labour cost grows more quickly than average labour compensation, the labour productivity growth rate is negative.

APPENDIX 6

Labour Productivity, Unit Labour Cost and Related Data in CANSIM

	CANSIM Matrices
Labour Productivity	
Indices since 1946	
Persons at work	7922
Paid workers	7923
Person-hours worked of persons at work	7924
Person-hours worked of paid workers	7925
Real GDP per person at work	7926
Real GDP per person-hour worked of persons at work	7927
Labour compensation of persons at work	7934
Labour compensation per person at work	7935
Labour compensation per person-hour worked of persons at work	7936
Unit labour cost	7937
Real GDP	7938
Absolute values since 1961	
Number of persons at work	7916
Number of paid workers	7917
Number of person-hours worked of persons at work	7918
Number of person-hours worked of paid workers	7919
Real GDP per person at work	7920
Real GDP per person-hour worked of persons at work	7921
Average hours worked per week of persons at work	7928
Average hours worked per week of paid workers	7929
Labour compensation of persons at work	7930
Labour compensation per person at work	7931
Labour compensation per person-hour worked of persons at work	7932
Unit labour cost	7933

PART 2

Multifactor Productivity

Experimental Data

Table 1 - Indices of multifactor productivity, business sector, (1986=100)

Year	Industry measures: Value-added: Persons at work	Industry measures: Value-added: Person-hours	Interindustry measures: Persons at work	Interindustry measures: Person-hours
1961	75.8	71.0	79.1	74.9
1962	79.1	73.8	82.0	77.5
1963	81.4	76.2	84.0	79.6
1964	83.8	78.5	86.1	81.6
1965	85.2	80.0	87.4	83.0
1966	86.2	81.4	88.3	84.2
1967	84.2	79.8	86.5	82.8
1968	86.8	82.6	88.8	85.3
1969	88.5	84.8	90.2	87.1
1970	88.5	85.2	90.2	87.5
1971	91.5	88.5	92.8	90.3
1972	94.0	91.1	94.9	92.5
1973	97.1	94.1	97.6	95.1
1974	94.5	91.8	95.3	93.2
1975	92.4	90.4	93.7	92.0
1976	95.7	93.9	96.4	94.9
1977	95.9	94.8	96.5	95.7
1978	96.0	94.5	96.7	95.5
1979	96.3	95.2	96.9	96.0
1980	95.2	94.2	96.0	95.2
1981	95.3	94.9	96.0	95.7
1982	90.3	91.0	92.1	92.6
1983	93.7	94.5	94.9	95.5
1984	98.0	98.3	98.4	98.6
1985	99.0	99.1	99.2	99.3
1986	100.0	100.0	100.0	100.0
1987	101.3	100.8	101.1	100.6
1988	101.5	100.7	101.2	100.6
1989	100.2	99.9	100.2	99.9
1990	97.6	97.1	98.0	97.6
1991	96.0	96.1	96.7	96.8

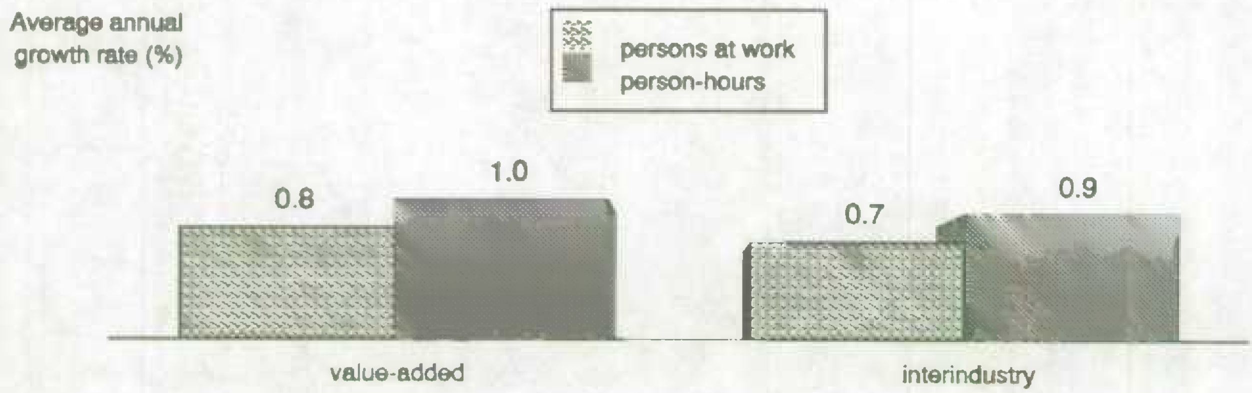


Table 2 - Indices of multifactor productivity, agricultural & related services industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	72.2	69.1	70.0	66.8	63.0	59.3
1962	83.4	80.1	81.3	77.7	73.7	69.6
1963	90.1	86.8	88.0	84.5	80.5	76.3
1964	85.0	82.3	82.9	79.9	76.9	73.2
1965	87.5	85.0	85.4	82.7	79.6	76.1
1966	94.3	91.2	92.2	88.9	86.6	82.6
1967	82.5	80.1	80.3	77.7	74.9	71.7
1968	85.2	83.2	83.0	80.8	78.4	75.6
1969	88.9	86.6	86.8	84.3	82.3	79.3
1970	84.3	82.4	82.1	80.0	77.9	75.4
1971	92.9	90.7	90.9	88.5	87.1	84.3
1972	87.3	85.6	85.1	83.3	82.3	80.0
1973	91.1	88.7	89.0	86.4	86.1	83.0
1974	81.6	79.4	79.4	77.0	77.5	74.7
1975	87.5	85.1	85.3	82.8	83.0	80.1
1976	92.5	90.2	90.4	87.9	88.3	85.6
1977	90.3	88.8	88.2	86.5	85.8	84.1
1978	88.2	87.1	86.0	84.8	83.5	82.1
1979	84.2	83.0	82.0	80.6	79.7	78.2
1980	86.3	85.7	84.1	83.4	81.4	80.6
1981	90.9	90.3	88.8	88.1	85.8	85.2
1982	93.6	93.0	92.1	91.4	87.6	87.0
1983	92.7	92.8	91.0	91.2	88.4	88.7
1984	93.1	93.2	91.5	91.7	90.3	90.6
1985	92.1	91.8	90.3	89.9	89.8	89.4
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	98.5	98.5	98.1	98.2	98.9	98.9
1988	98.3	98.9	97.9	98.7	99.2	99.8
1989	104.0	104.4	104.9	105.4	105.9	106.3

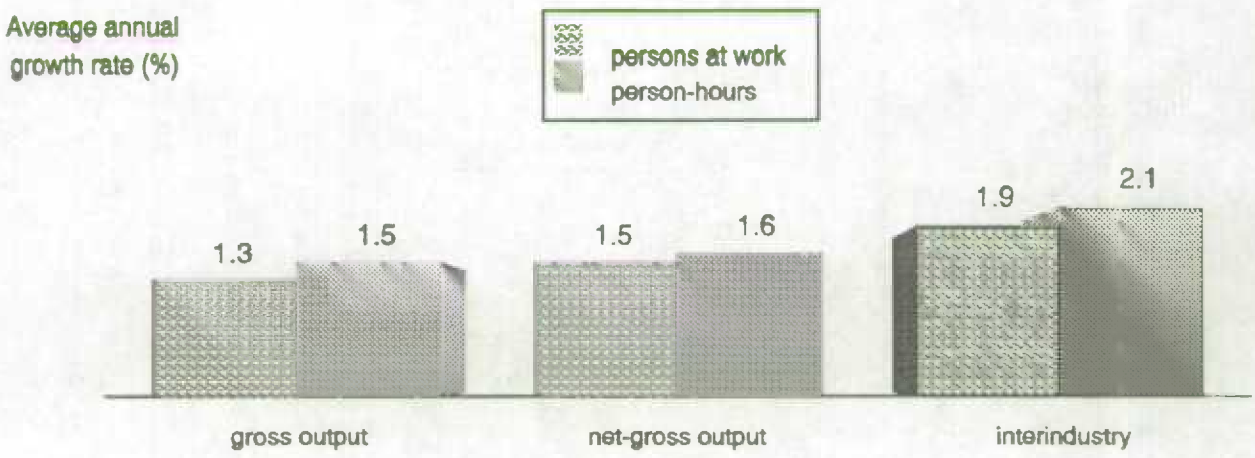


Table 3 - Indices of multifactor productivity, manufacturing industries, (1986=100)

Year	Industry measures						Interindustry measures	
	Gross output		Net-gross output		Value-added			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	81.4	80.5	76.1	75.0	56.1	54.5	71.1	68.8
1962	84.0	83.0	79.4	78.1	61.2	59.0	75.4	72.6
1963	85.4	84.3	81.1	79.7	63.8	61.4	78.0	75.4
1964	87.0	85.8	83.2	81.7	67.2	64.6	80.2	77.4
1965	88.2	87.0	84.8	83.3	69.7	67.0	82.0	79.2
1966	88.2	87.2	84.8	83.4	69.7	67.3	82.7	80.2
1967	87.4	86.4	83.7	82.5	67.9	65.8	80.9	78.7
1968	88.9	87.9	85.7	84.4	71.2	68.9	83.3	81.1
1969	90.4	89.4	87.6	86.4	74.4	72.2	86.2	84.1
1970	89.4	88.6	86.3	85.3	72.2	70.4	84.9	83.1
1971	90.8	90.1	88.1	87.2	75.4	73.7	87.6	86.1
1972	92.7	92.0	90.5	89.7	79.7	78.0	90.4	88.9
1973	94.8	94.2	93.3	92.6	84.9	83.4	94.8	93.2
1974	94.8	94.3	93.2	92.7	84.7	83.5	93.1	91.8
1975	92.5	92.3	90.3	90.1	78.8	78.5	89.6	88.9
1976	94.5	94.4	92.9	92.7	84.1	83.7	93.1	92.4
1977	96.2	96.0	95.1	94.8	88.6	88.0	94.7	94.0
1978	96.9	96.6	96.0	95.6	90.6	89.7	95.4	94.6
1979	96.9	96.8	96.0	95.9	90.5	90.2	95.6	95.2
1980	95.7	95.7	94.5	94.4	87.2	87.1	93.3	93.1
1981	96.6	96.8	95.6	95.9	89.8	90.5	93.5	93.7
1982	94.0	94.5	92.3	92.8	82.3	83.4	89.4	90.0
1983	96.7	96.8	95.7	95.9	89.9	90.3	93.3	93.7
1984	99.6	99.5	99.5	99.4	98.7	98.6	98.5	98.6
1985	100.6	100.6	100.8	100.7	101.8	101.7	100.1	100.1
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.3	100.2	100.4	100.2	101.0	100.5	101.0	100.7
1988	100.2	100.0	100.3	100.1	100.7	100.1	101.5	101.1
1989	99.4	99.3	99.2	99.1	98.1	98.0	100.3	100.2
1990	..	..	..	..	93.0	93.6	..	..
1991	..	..	..	..	89.9	90.6	..	..

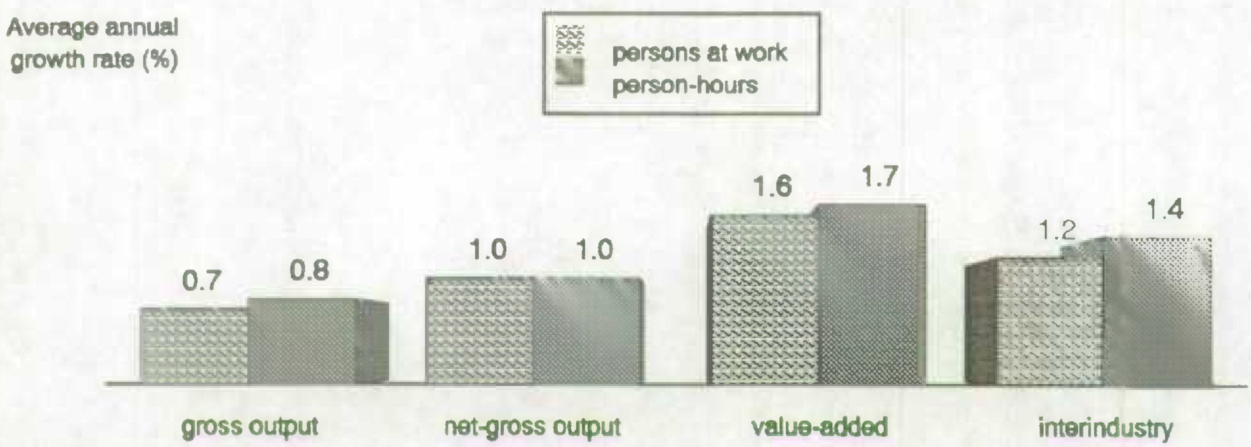


Table 4 - Indices of multifactor productivity, construction industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	90.1	87.8	90.1	87.7	77.0	73.5
1962	91.6	88.5	91.6	88.5	80.5	76.1
1963	91.6	88.5	91.6	88.5	81.7	77.4
1964	92.0	88.8	92.0	88.7	84.5	79.8
1965	91.7	88.5	91.7	88.5	85.2	80.5
1966	90.7	87.6	90.7	87.5	84.8	80.3
1967	91.6	88.8	91.6	88.8	84.2	80.3
1968	93.3	90.8	93.3	90.8	87.4	83.8
1969	92.1	90.2	92.1	90.2	87.1	84.2
1970	92.7	90.9	92.7	90.9	87.5	84.9
1971	93.4	92.1	93.4	92.1	89.6	87.4
1972	92.8	91.4	92.8	91.3	90.6	88.4
1973	91.9	90.4	91.9	90.4	90.9	88.6
1974	90.9	89.4	90.9	89.4	88.9	86.8
1975	94.8	93.4	94.8	93.4	90.7	89.0
1976	97.5	96.4	97.5	96.4	94.4	92.9
1977	98.3	98.2	98.3	98.2	95.2	95.0
1978	96.9	96.3	96.9	96.3	94.4	93.6
1979	95.5	94.8	95.5	94.8	93.6	92.7
1980	97.8	96.9	97.8	96.9	95.4	94.4
1981	101.4	100.8	101.4	100.8	98.5	98.0
1982	103.3	104.6	103.3	104.6	96.9	98.4
1983	103.4	104.2	103.4	104.2	99.2	100.2
1984	101.2	101.5	101.2	101.5	99.9	100.2
1985	99.2	98.9	99.2	98.9	99.3	99.0
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.3	99.1	100.3	99.1	101.1	99.8
1988	99.2	97.7	99.2	97.7	100.5	98.7
1989	98.7	97.4	98.7	97.4	99.1	97.7

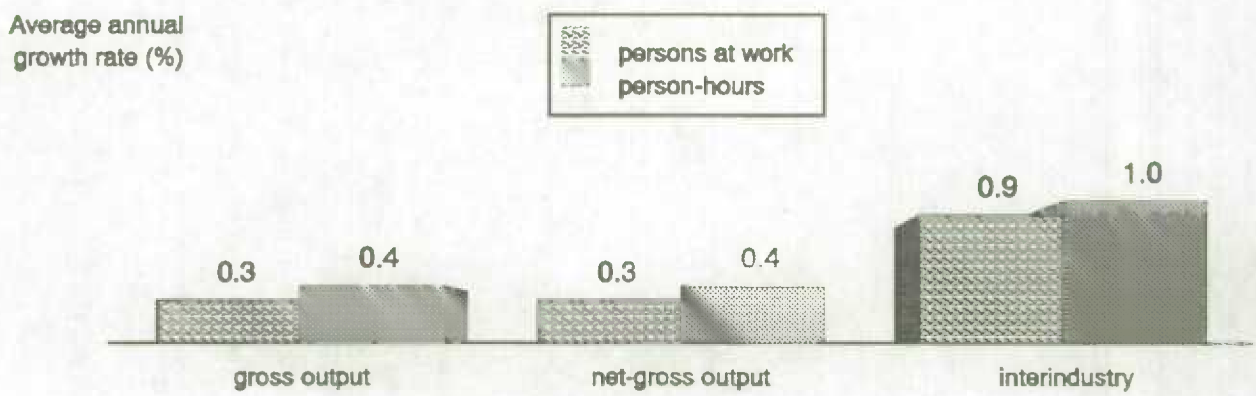


Table 5 - Indices of multifactor productivity, transportation & storage industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	68.2	65.1	65.5	62.2	65.8	61.6
1962	68.2	65.3	65.6	62.4	66.3	62.3
1963	72.3	69.2	69.9	66.6	70.7	66.4
1964	76.2	72.9	74.0	70.4	75.4	70.8
1965	77.0	73.9	74.8	71.5	76.4	72.0
1966	79.2	77.0	77.1	74.8	78.9	75.5
1967	79.0	76.5	76.9	74.3	78.1	74.5
1968	80.8	78.7	78.8	76.5	80.6	77.3
1969	84.4	82.5	82.7	80.6	84.6	81.5
1970	87.5	85.8	86.1	84.2	88.1	85.4
1971	88.0	86.5	86.7	85.0	89.1	86.6
1972	90.1	89.0	89.0	87.7	92.2	90.2
1973	91.5	90.3	90.5	89.1	94.6	92.5
1974	90.5	89.4	89.4	88.2	92.9	91.0
1975	89.6	89.0	88.4	87.8	90.9	89.7
1976	89.6	89.2	88.4	87.9	91.1	90.0
1977	90.2	90.1	89.1	88.9	91.7	91.2
1978	92.4	91.9	91.5	91.0	93.7	92.7
1979	96.8	96.5	96.4	96.1	98.5	97.9
1980	93.3	92.8	92.5	92.0	94.2	93.3
1981	92.4	92.7	91.5	91.7	92.8	92.9
1982	90.8	91.4	89.7	90.3	89.7	90.3
1983	95.2	96.3	94.6	95.9	95.2	96.6
1984	99.1	99.6	98.9	99.5	99.2	99.9
1985	99.4	99.7	99.3	99.7	99.7	100.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	103.1	102.2	103.6	102.5	103.7	102.5
1988	106.3	105.2	107.2	106.0	107.2	105.9
1989	104.3	103.6	104.9	104.1	104.5	103.8

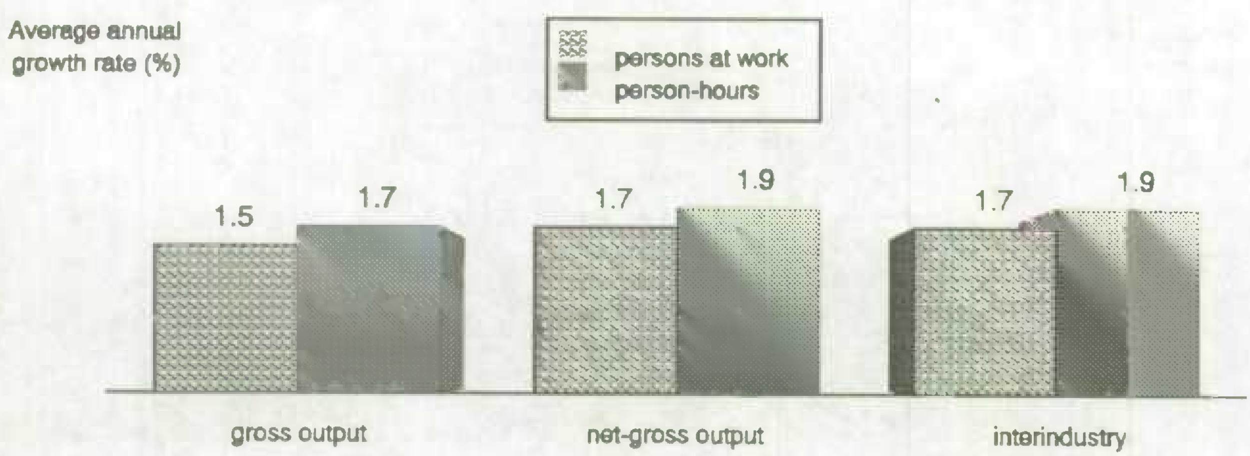


Table 6 - Indices of multifactor productivity, telecommunication industries, (1986=100)

Year	Industry measures: Gross output: Persons at work	Industry measures: Gross output: Person-hours	Industry measures: Net-gross output: Persons at work	Industry measures: Net-gross output: Person-hours	Interindustry measures: Persons at work	Interindustry measures: Person-hours
1961	38.4	37.0	37.4	36.0	36.8	35.1
1962	39.5	38.2	38.5	37.1	38.1	36.4
1963	40.4	39.0	39.4	38.0	39.0	37.3
1964	41.8	40.3	40.8	39.3	40.6	38.8
1965	44.4	42.9	43.4	41.9	43.3	41.5
1966	44.9	43.9	43.9	42.9	43.8	42.5
1967	46.8	45.7	45.8	44.6	45.6	44.1
1968	49.5	48.6	48.5	47.6	48.4	47.1
1969	52.3	51.3	51.3	50.3	51.2	50.0
1970	55.0	54.2	54.0	53.2	54.0	52.9
1971	56.1	55.5	55.2	54.5	55.3	54.4
1972	58.7	58.2	57.8	57.3	58.2	57.4
1973	61.5	60.9	60.6	60.0	61.2	60.4
1974	64.8	64.3	63.9	63.4	64.4	63.6
1975	69.3	69.2	68.6	68.5	68.9	68.5
1976	71.3	71.2	70.6	70.5	71.1	70.8
1977	72.4	72.6	71.7	71.9	72.1	72.2
1978	76.4	76.2	75.8	75.6	76.3	75.9
1979	81.0	81.0	80.5	80.5	81.1	80.8
1980	86.9	86.7	86.6	86.3	87.2	86.8
1981	89.3	89.6	89.0	89.3	89.6	89.8
1982	86.2	86.8	85.8	86.4	85.6	86.2
1983	88.1	89.1	87.7	88.7	87.5	88.6
1984	92.8	93.2	92.6	93.0	92.8	93.2
1985	96.1	96.4	96.0	96.3	96.0	96.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.0	104.2	104.1	104.4	104.1	104.3
1988	106.0	106.1	106.2	106.3	106.0	106.0
1989	112.4	112.7	112.8	113.1	112.2	112.4

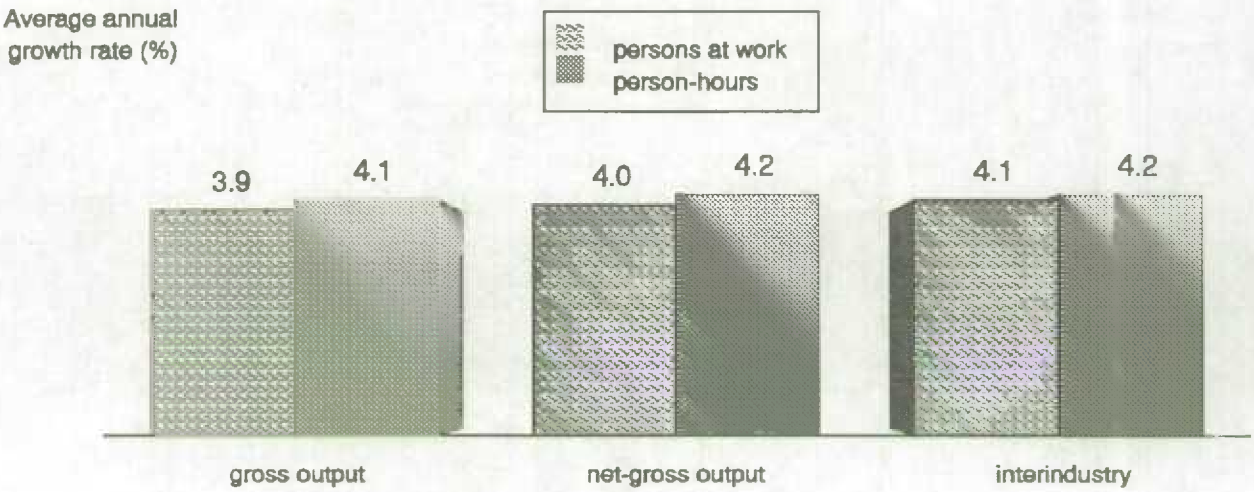


Table 7 - Indices of multifactor productivity, wholesale trade industries, (1986=100)

Year	Industry measures: Gross output, Persons at work	Industry measures: Gross output, Person-hours	Industry measures: Net-gross output, Persons at work	Industry measures: Net-gross output, Person-hours	Interindustry measures: Persons at work	Interindustry measures: Person-hours
1961	70.1	67.4	69.7	66.9	66.6	63.1
1962	72.5	69.6	72.0	69.1	69.0	65.3
1963	73.4	70.8	73.0	70.3	70.3	66.9
1964	76.2	73.5	75.8	73.1	73.7	70.1
1965	76.5	74.1	76.2	73.7	74.3	71.0
1966	79.4	77.3	79.1	76.9	77.4	74.5
1967	81.4	78.8	81.1	78.5	78.9	75.6
1968	81.7	79.7	81.4	79.4	79.7	77.0
1969	82.9	81.4	82.6	81.1	81.3	79.1
1970	85.2	83.8	84.9	83.5	83.8	81.8
1971	87.3	86.4	87.1	86.2	86.2	84.7
1972	89.2	88.0	89.0	87.8	88.8	87.0
1973	90.3	88.0	90.2	87.9	90.5	87.7
1974	89.3	88.2	89.1	88.0	89.2	87.6
1975	89.1	88.6	89.0	88.4	88.4	87.5
1976	90.9	90.4	90.8	90.2	90.5	89.6
1977	86.8	87.0	86.6	86.8	86.4	86.4
1978	85.4	85.0	85.2	84.8	85.1	84.4
1979	88.4	88.6	88.2	88.4	88.4	88.3
1980	92.5	92.4	92.4	92.3	92.2	91.9
1981	92.9	93.0	92.8	92.9	92.4	92.4
1982	89.2	89.8	89.0	89.6	87.4	88.0
1983	91.9	93.0	91.7	92.9	90.5	91.8
1984	92.9	94.0	92.8	93.9	92.6	93.7
1985	96.4	97.3	96.4	97.3	96.2	97.1
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.6	101.6	101.6	101.7	101.9	101.9
1988	103.8	103.9	103.9	103.9	104.2	104.1
1989	103.3	104.0	103.4	104.1	103.3	104.0

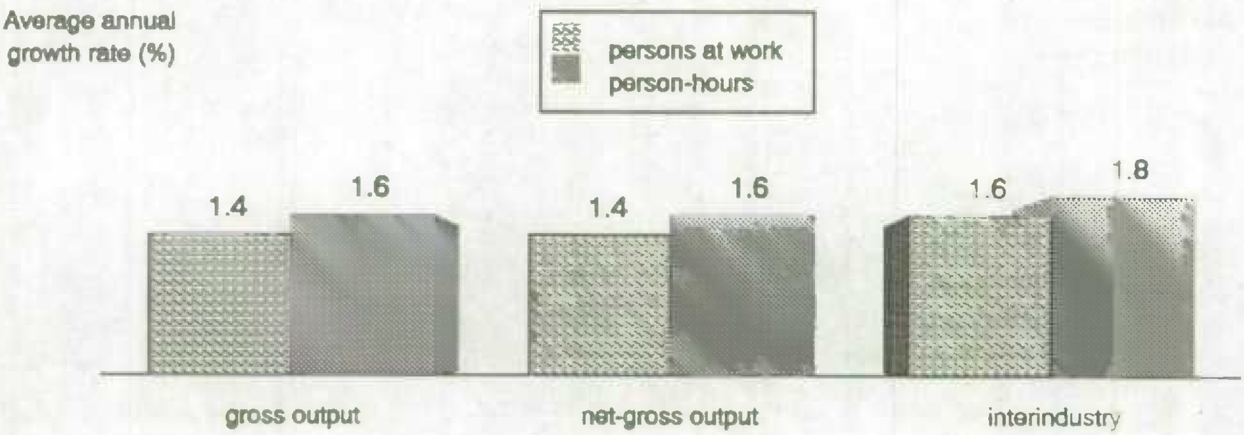


Table 8 - Indices of multifactor productivity, retail trade industries, (1986=100)

Year	Industry measures: Gross output: Persons at work	Industry measures: Gross output: Person-hours	Industry measures: Net-gross output: Persons at work	Industry measures: Net-gross output: Person-hours	Interindustry measures: Persons at work	Interindustry measures: Person-hours
1961	78.1	70.0	77.9	69.8	74.7	66.2
1962	80.8	72.6	80.7	72.5	78.2	69.4
1963	82.2	74.3	82.1	74.1	80.0	71.5
1964	84.4	76.6	84.3	76.4	82.5	73.9
1965	87.0	79.0	86.9	78.9	85.4	76.7
1966	89.2	81.4	89.1	81.3	88.0	79.6
1967	90.6	83.0	90.5	82.9	88.4	80.2
1968	91.0	84.2	91.0	84.1	89.5	82.1
1969	91.5	85.2	91.4	85.2	90.3	83.4
1970	92.4	86.9	92.4	86.8	91.3	85.2
1971	93.7	88.5	93.6	88.4	93.1	87.4
1972	96.3	91.5	96.3	91.4	96.3	90.9
1973	96.5	92.1	96.5	92.1	97.0	92.1
1974	94.8	90.8	94.8	90.7	94.7	90.2
1975	95.8	92.2	95.8	92.1	95.2	91.2
1976	99.0	96.2	99.0	96.2	99.0	95.7
1977	98.8	96.6	98.8	96.5	98.6	96.1
1978	97.6	95.8	97.6	95.8	97.5	95.4
1979	96.5	94.8	96.5	94.8	96.5	94.5
1980	94.3	93.0	94.3	93.0	94.1	92.5
1981	92.8	91.9	92.8	91.8	92.5	91.4
1982	91.9	92.2	91.8	92.1	90.2	90.5
1983	98.0	99.2	98.0	99.2	96.6	97.9
1984	98.8	99.3	98.8	99.3	98.3	98.9
1985	99.7	100.0	99.7	100.0	99.4	99.7
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	103.1	103.3	103.1	103.4	103.2	103.4
1988	103.1	103.6	103.1	103.6	103.1	103.4
1989	102.3	103.0	102.3	103.0	101.9	102.6

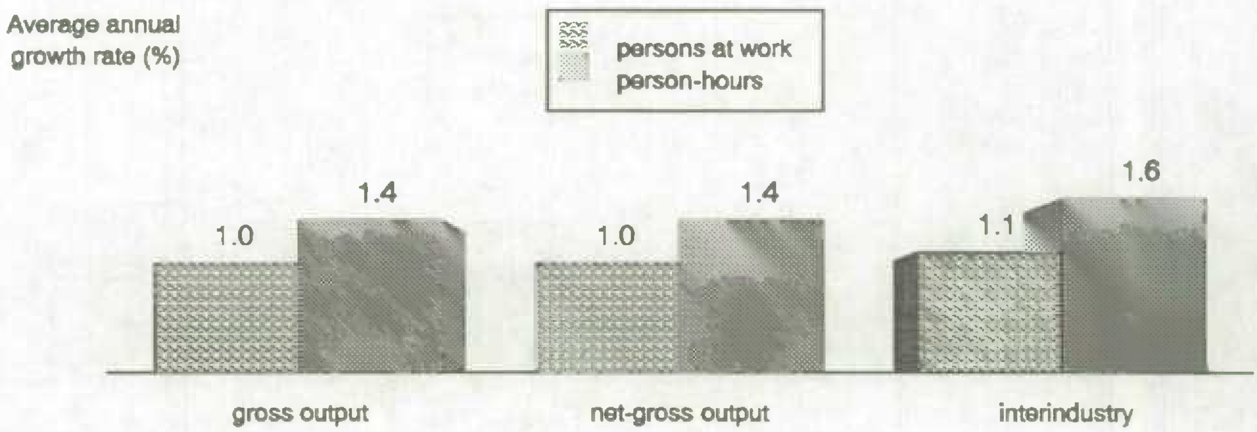


Table 9 - Indices of multifactor productivity, food industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	91.4	90.2	90.1	88.6	72.6	68.8
1962	92.6	91.3	91.5	90.0	78.8	74.7
1963	92.5	91.3	91.3	89.9	81.6	77.6
1964	93.3	92.0	92.2	90.7	81.4	77.5
1965	94.2	93.0	93.2	91.8	83.7	80.0
1966	93.6	92.5	92.5	91.3	85.8	82.2
1967	94.5	93.4	93.6	92.3	81.9	78.5
1968	94.8	93.5	93.9	92.4	83.9	80.6
1969	94.7	93.6	93.8	92.6	85.8	82.7
1970	95.0	94.0	94.1	93.0	85.0	82.2
1971	97.2	96.3	96.7	95.7	91.2	88.4
1972	97.3	96.7	96.8	96.1	90.2	87.9
1973	98.2	97.7	97.9	97.3	94.2	91.6
1974	98.0	97.5	97.7	97.1	88.7	86.4
1975	96.5	95.9	95.8	95.1	88.0	85.7
1976	99.1	98.6	99.0	98.3	94.0	91.7
1977	100.0	99.7	100.1	99.6	94.4	92.7
1978	100.0	99.7	100.0	99.6	93.7	92.1
1979	100.0	99.8	100.1	99.8	91.9	90.5
1980	98.8	98.8	98.6	98.5	90.5	89.8
1981	98.4	98.5	98.1	98.2	92.0	91.6
1982	98.7	98.9	98.5	98.6	92.1	92.0
1983	98.4	98.2	98.1	97.9	92.9	92.8
1984	99.3	99.0	99.2	98.8	95.5	95.3
1985	100.5	100.4	100.6	100.5	97.1	97.0
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.8	99.7	99.8	99.6	99.6	99.4
1988	98.0	97.7	97.7	97.4	97.5	97.3
1989	96.7	96.7	96.2	96.1	97.8	97.8

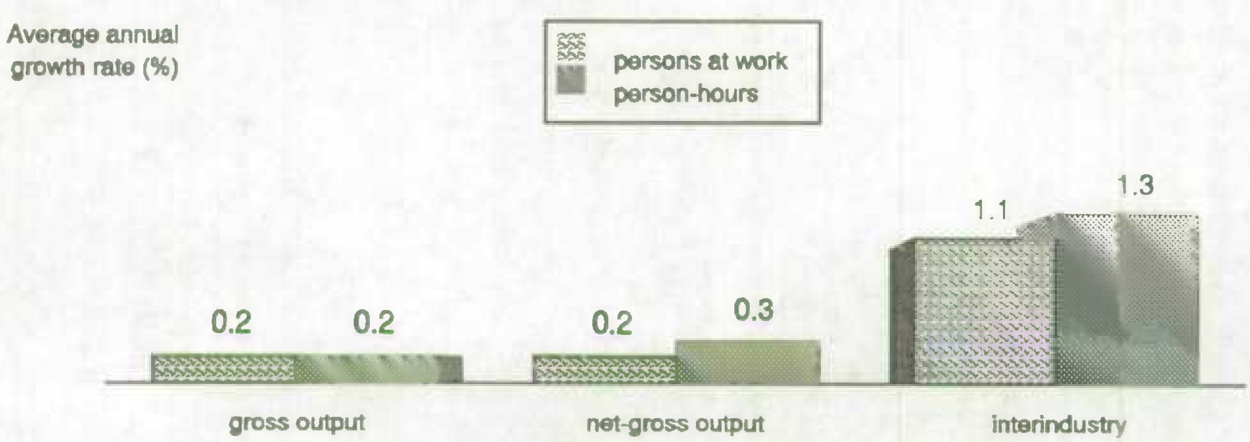


Table 10 - Indices of multifactor productivity, beverage industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	87.1	85.8	86.7	85.4	78.5	75.5
1962	88.9	87.5	88.6	87.1	81.3	78.0
1963	92.8	91.4	92.7	91.2	85.6	82.4
1964	94.2	92.7	94.1	92.5	87.9	84.4
1965	96.2	94.6	96.1	94.5	90.4	86.9
1966	102.2	100.7	102.5	100.8	96.9	93.4
1967	104.3	102.6	104.6	102.9	97.8	94.3
1968	101.1	99.3	101.3	99.3	95.6	92.1
1969	103.6	102.1	103.9	102.3	99.0	95.8
1970	104.9	103.4	105.2	103.7	100.3	97.4
1971	105.5	104.2	105.9	104.5	102.0	99.3
1972	106.1	105.0	106.5	105.4	104.1	101.7
1973	110.6	109.6	111.2	110.2	110.6	108.2
1974	108.8	107.8	109.3	108.3	107.4	105.2
1975	106.3	105.3	106.7	105.6	103.2	101.2
1976	106.0	105.0	106.4	105.4	105.1	103.2
1977	108.8	108.0	109.3	108.5	107.9	106.3
1978	108.0	107.3	108.5	107.7	107.9	106.4
1979	108.4	107.8	108.9	108.2	108.2	106.8
1980	107.8	107.5	108.3	108.0	106.8	105.8
1981	107.2	107.2	107.7	107.6	106.5	106.1
1982	104.2	104.3	104.5	104.6	101.1	101.1
1983	103.6	103.5	103.8	103.8	102.1	102.0
1984	103.8	104.4	104.1	104.7	104.3	104.8
1985	102.3	102.2	102.4	102.3	102.9	102.7
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.5	101.3	101.7	101.3	102.0	101.5
1988	103.3	102.6	103.5	102.8	104.0	103.0
1989	104.5	104.8	104.8	105.1	104.9	105.0

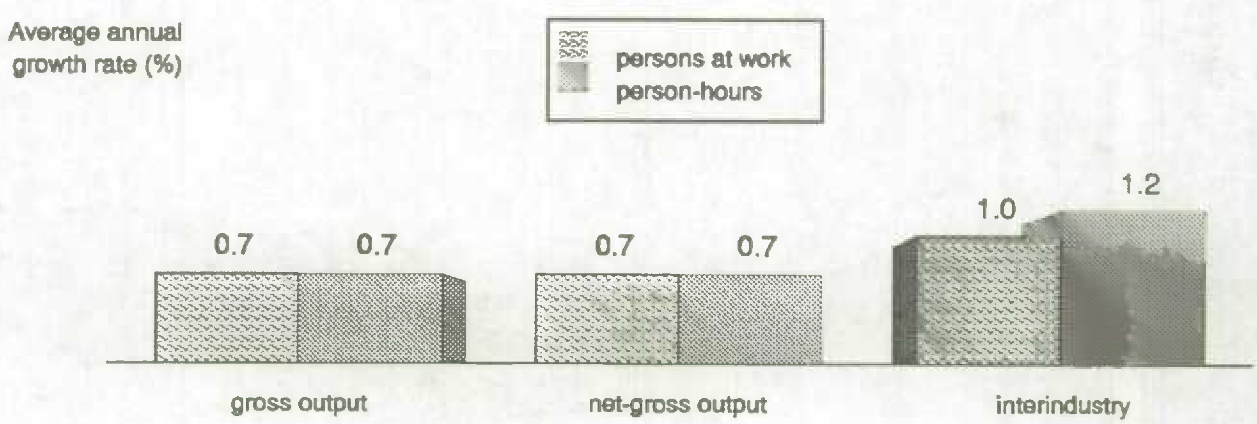


Table 11 - Indices of multifactor productivity, tobacco products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	93.9	90.9	92.1	88.6	76.3	71.2
1962	92.6	90.0	90.6	87.5	79.6	74.6
1963	95.3	92.9	93.8	91.0	85.1	80.4
1964	96.9	94.8	95.8	93.3	86.7	82.2
1965	99.2	96.5	98.5	95.3	90.2	85.1
1966	96.2	93.4	94.8	91.5	89.5	84.3
1967	94.1	91.5	92.3	89.3	82.4	78.0
1968	93.2	90.9	91.2	88.5	83.2	79.3
1969	96.7	94.7	95.5	93.1	89.2	85.4
1970	98.4	96.2	97.6	95.0	89.8	86.0
1971	102.4	100.4	102.4	100.1	98.0	94.3
1972	104.8	102.9	105.3	103.1	100.2	96.8
1973	106.2	104.6	107.0	105.1	103.8	100.4
1974	109.0	107.6	110.5	108.8	103.7	100.7
1975	107.6	106.0	108.8	106.9	102.9	100.0
1976	106.5	104.9	107.5	105.6	104.3	101.4
1977	114.0	112.8	116.7	115.2	112.6	110.4
1978	108.7	107.4	110.2	108.7	106.2	103.9
1979	109.6	108.2	111.2	109.7	106.4	104.1
1980	110.3	109.3	112.1	111.0	107.6	105.8
1981	109.8	108.6	111.6	110.2	108.4	106.6
1982	109.5	108.7	111.2	110.3	106.5	105.5
1983	106.5	105.7	107.7	106.7	104.7	104.0
1984	105.2	104.5	106.1	105.3	104.7	104.0
1985	100.5	99.5	100.6	99.4	99.3	98.1
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.7	105.2	106.5	106.0	106.6	105.9
1988	110.1	109.5	111.5	110.8	111.5	110.8
1989	108.9	108.6	110.1	109.7	110.6	110.1

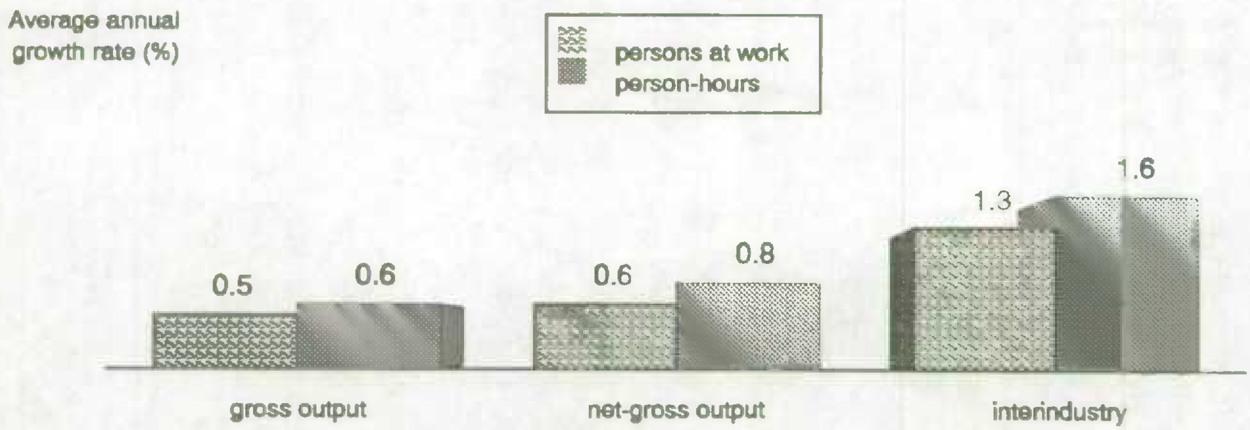


Table 12 - Indices of multifactor productivity, plastic products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	66.1	65.8	65.2	64.9	56.6	55.7
1962	66.9	66.2	66.0	65.3	58.9	57.5
1963	69.5	68.9	68.7	68.0	62.2	61.0
1964	72.6	71.4	71.8	70.6	67.0	65.1
1965	73.7	72.9	73.0	72.2	68.2	66.6
1966	75.0	74.0	74.4	73.4	69.7	68.1
1967	74.5	73.4	73.8	72.7	68.7	66.8
1968	84.8	83.5	84.3	83.1	79.3	77.3
1969	88.2	87.2	87.9	86.8	83.6	81.7
1970	85.8	85.0	85.4	84.6	81.2	79.9
1971	88.3	87.7	88.0	87.3	84.5	83.2
1972	93.2	92.6	93.0	92.3	90.9	89.7
1973	94.9	94.5	94.8	94.3	94.9	94.0
1974	90.2	90.3	89.8	89.9	89.3	88.9
1975	86.1	86.3	85.7	85.9	82.4	82.4
1976	87.1	87.1	86.6	86.6	84.3	84.3
1977	88.7	88.8	88.3	88.4	85.4	85.5
1978	92.2	92.3	91.9	92.0	89.8	89.8
1979	96.1	95.6	95.9	95.4	95.9	95.4
1980	93.9	93.9	93.6	93.7	91.8	92.0
1981	97.8	97.7	97.7	97.6	96.1	96.2
1982	96.6	96.6	96.4	96.4	91.2	91.7
1983	101.0	100.7	101.0	100.7	98.3	98.5
1984	103.2	103.2	103.4	103.3	103.1	103.2
1985	103.7	103.4	103.9	103.6	103.4	103.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.3	99.2	99.3	99.1	100.6	100.4
1988	96.5	96.3	96.4	96.1	98.9	98.7
1989	94.8	94.2	94.5	94.0	96.8	96.4

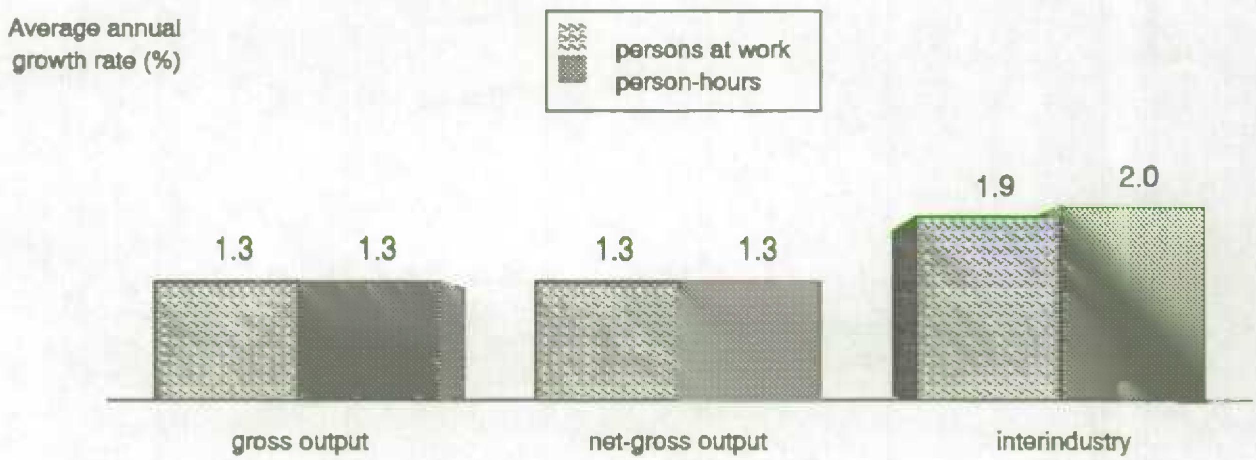


Table 13 - Indices of multifactor productivity, rubber, leather & allied products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	75.3	74.2	73.6	72.5	65.5	63.5
1962	80.6	78.9	79.3	77.5	71.8	69.1
1963	81.2	79.6	80.0	78.4	73.3	70.7
1964	83.2	81.4	82.2	80.3	76.4	73.5
1965	83.1	81.6	82.1	80.5	76.6	74.1
1966	84.4	82.9	83.5	81.9	78.1	75.7
1967	84.0	82.4	83.0	81.4	77.3	74.8
1968	84.6	82.8	83.7	81.8	78.8	76.2
1969	85.3	83.7	84.4	82.8	80.2	77.9
1970	84.1	82.8	83.2	81.7	79.2	77.2
1971	85.0	83.7	84.1	82.7	81.0	79.1
1972	84.5	83.2	83.6	82.2	81.7	79.8
1973	86.8	85.7	86.0	84.9	85.0	83.4
1974	84.5	83.6	83.6	82.6	82.3	80.8
1975	82.5	82.1	81.5	81.0	78.8	78.1
1976	88.5	87.7	87.8	87.0	85.6	84.7
1977	93.3	92.6	92.9	92.1	90.6	89.7
1978	96.2	95.5	96.0	95.3	94.2	93.4
1979	98.2	97.1	98.2	96.9	97.5	96.2
1980	95.4	94.8	95.1	94.5	93.3	92.7
1981	94.9	94.2	94.6	93.9	93.2	92.6
1982	92.4	91.7	91.9	91.2	88.2	87.8
1983	96.2	95.9	96.0	95.6	93.6	93.5
1984	103.2	102.7	103.4	102.9	102.6	102.3
1985	104.1	103.6	104.4	103.8	104.0	103.6
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	102.5	102.7	102.6	102.9	103.1	103.2
1988	103.5	103.3	103.7	103.4	104.6	104.2
1989	103.6	102.6	103.8	102.8	104.4	103.3

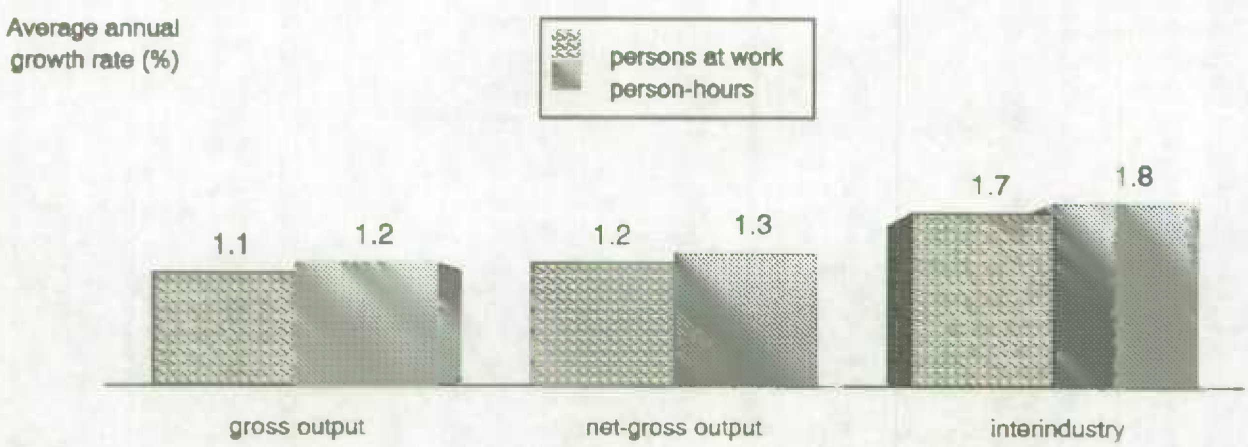


Table 14 - Indices of multifactor productivity, textile, textile products & clothing industries, (1986=100)

Year	Industry measures: Gross output: Persons at work	Industry measures: Gross output: Person-hours	Industry measures: Net-gross output: Persons at work	Industry measures: Net-gross output: Person-hours	Interindustry measures: Persons at work	Interindustry measures: Person-hours
1961	69.6	68.5	62.1	60.8	60.1	58.3
1962	72.9	71.4	66.0	64.2	64.1	61.7
1963	74.9	73.1	68.4	66.3	66.7	63.9
1964	75.3	73.4	68.9	66.7	67.6	64.8
1965	74.8	73.2	68.4	66.4	67.3	64.7
1966	74.6	73.1	68.0	66.3	67.3	65.1
1967	74.0	72.5	67.4	65.5	66.5	64.1
1968	76.7	75.2	70.8	68.9	69.9	67.6
1969	78.0	76.4	72.3	70.4	71.4	69.1
1970	77.4	76.0	71.6	69.9	71.1	69.1
1971	79.5	78.5	74.2	73.0	74.0	72.4
1972	82.1	81.1	77.5	76.3	77.3	75.7
1973	83.2	82.5	78.9	78.0	79.0	77.8
1974	83.3	82.6	78.9	78.1	78.9	77.7
1975	84.2	83.6	80.1	79.3	79.7	78.7
1976	86.2	85.8	82.7	82.2	82.7	81.9
1977	88.5	88.2	85.4	85.1	85.1	84.6
1978	92.0	91.8	89.8	89.6	89.8	89.2
1979	94.2	94.0	92.7	92.4	92.8	92.3
1980	93.9	94.1	92.3	92.6	92.2	92.3
1981	95.2	95.6	94.0	94.4	93.6	93.9
1982	91.4	91.9	89.1	89.7	87.6	88.4
1983	95.0	95.0	93.7	93.6	92.1	92.2
1984	96.6	96.5	95.7	95.6	95.3	95.3
1985	97.6	97.8	96.9	97.3	96.8	97.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.9	100.1	101.1	100.2	101.6	100.5
1988	98.7	98.4	98.4	97.9	98.7	98.1
1989	98.3	97.9	97.8	97.3	98.2	97.4

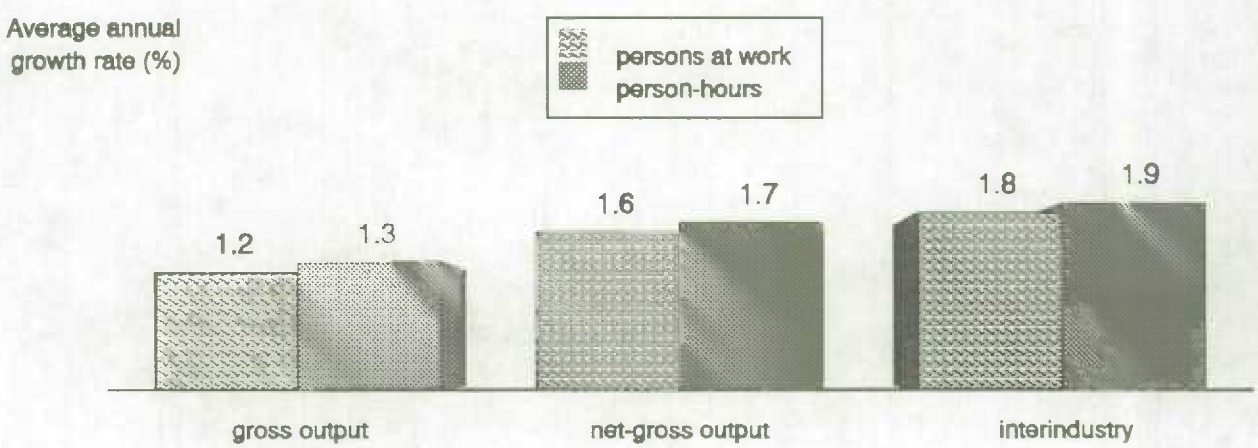


Table 15 - Indices of multifactor productivity, wood industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	75.5	74.8	73.3	72.5	55.7	52.8
1962	78.2	76.8	76.2	74.7	59.0	55.3
1963	81.1	79.5	79.4	77.6	62.8	59.3
1964	82.3	80.5	80.7	78.7	65.1	61.0
1965	82.7	80.9	81.2	79.1	65.4	61.2
1966	82.6	81.1	81.1	79.4	65.4	61.7
1967	84.1	82.0	82.7	80.4	66.0	61.9
1968	86.6	84.9	85.4	83.5	70.2	66.4
1969	86.5	85.0	85.4	83.7	71.4	68.2
1970	86.6	85.4	85.4	84.1	72.4	69.4
1971	85.6	84.2	84.3	82.8	71.7	69.0
1972	82.9	81.9	81.3	80.3	70.8	68.7
1973	83.4	82.4	81.9	80.8	71.5	69.3
1974	83.3	82.7	81.8	81.1	71.5	69.7
1975	81.7	81.1	80.0	79.3	67.5	66.1
1976	84.9	84.1	83.6	82.6	72.5	70.7
1977	87.3	86.7	86.3	85.6	75.0	73.8
1978	86.1	85.7	84.9	84.4	74.4	73.3
1979	86.0	85.6	84.8	84.3	74.5	73.9
1980	88.8	88.6	87.9	87.6	78.1	77.7
1981	89.1	90.3	88.2	89.4	78.0	79.1
1982	87.0	89.4	85.9	88.5	75.4	77.8
1983	92.2	93.0	91.5	92.4	84.2	85.3
1984	96.6	96.9	96.3	96.6	93.2	93.5
1985	100.0	100.1	100.0	100.1	98.0	97.9
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	102.6	102.4	102.9	102.6	105.7	104.5
1988	101.5	100.8	101.7	100.9	106.1	104.4
1989	99.7	99.0	99.7	98.9	103.1	101.9

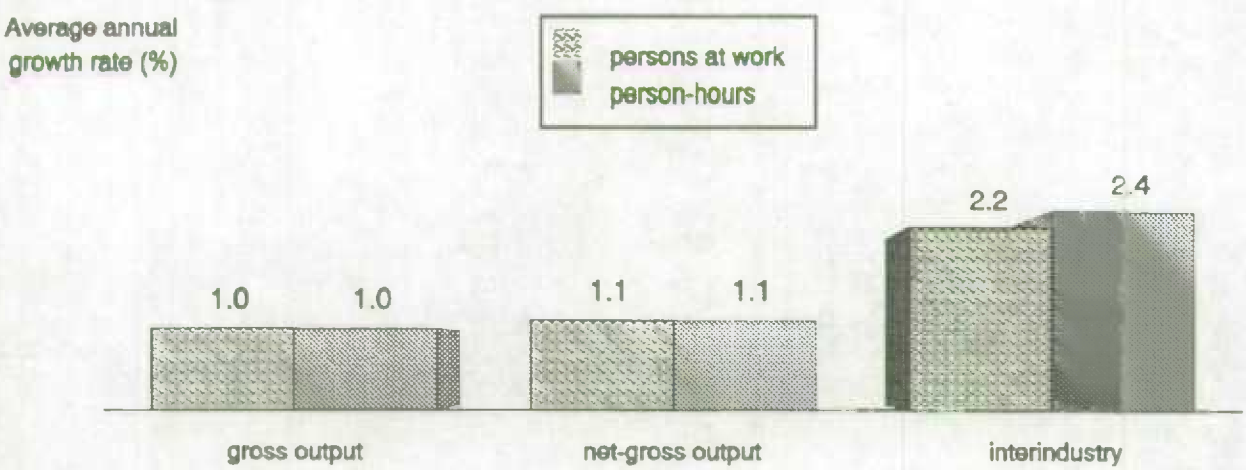


Table 16 - Indices of multifactor productivity, furniture & fixture industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	87.6	86.7	87.3	86.4	74.1	72.0
1962	89.8	88.4	89.6	88.2	77.7	74.8
1963	92.1	90.8	91.9	90.6	81.0	78.2
1964	91.9	90.5	91.7	90.3	82.4	79.4
1965	94.5	93.2	94.4	93.0	84.9	82.1
1966	95.7	94.4	95.6	94.3	86.2	83.6
1967	95.2	94.3	95.1	94.1	85.4	83.1
1968	96.4	95.7	96.4	95.6	88.1	86.1
1969	98.8	98.2	98.8	98.2	91.4	89.6
1970	96.1	95.6	96.0	95.5	89.0	87.5
1971	97.5	96.9	97.4	96.9	91.1	89.6
1972	103.8	103.3	103.9	103.4	98.5	97.0
1973	107.0	106.6	107.2	106.8	103.0	101.6
1974	97.8	97.5	97.8	97.4	93.5	92.4
1975	96.2	96.1	96.2	96.0	89.7	89.0
1976	101.5	101.1	101.6	101.2	96.2	95.2
1977	102.4	102.0	102.5	102.1	97.5	96.7
1978	106.4	106.2	106.6	106.4	102.2	101.4
1979	104.2	103.7	104.4	103.8	100.8	99.8
1980	102.3	102.2	102.4	102.3	98.7	98.2
1981	103.4	103.4	103.6	103.5	99.8	99.7
1982	93.5	93.1	93.3	92.9	87.2	87.0
1983	98.5	99.0	98.5	99.0	94.8	95.4
1984	101.0	101.0	101.0	101.1	99.7	99.6
1985	101.8	101.9	101.9	102.0	101.6	101.7
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	95.5	95.3	95.3	95.1	96.1	95.8
1988	92.8	92.6	92.4	92.3	93.5	93.0
1989	92.2	93.4	91.8	93.1	92.2	93.4

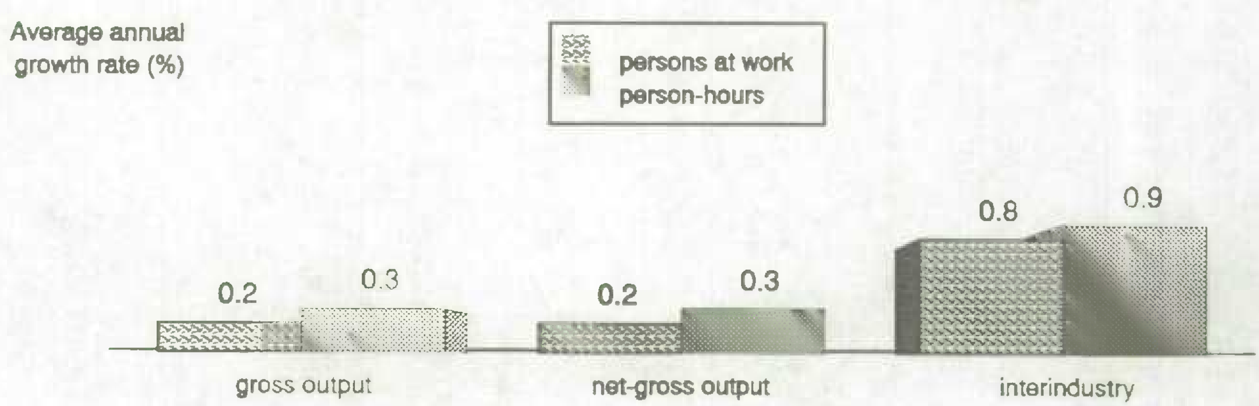


Table 17 - Indices of multifactor productivity, paper & allied products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	96.8	95.4	96.4	94.8	83.3	79.4
1962	97.1	95.6	96.8	95.0	83.8	79.8
1963	98.2	96.7	98.0	96.4	86.1	82.5
1964	100.5	98.8	100.7	98.7	89.9	85.6
1965	99.0	97.5	98.9	97.2	87.9	84.1
1966	98.2	96.9	98.1	96.5	87.6	84.1
1967	94.4	93.3	93.7	92.4	82.3	79.4
1968	94.9	93.9	94.2	93.0	84.4	81.8
1969	97.5	96.3	97.2	95.8	88.4	85.8
1970	96.9	96.2	96.6	95.8	88.3	86.3
1971	96.4	96.1	96.0	95.6	88.2	87.0
1972	99.3	98.7	99.3	98.6	92.9	91.6
1973	101.9	101.6	102.3	102.0	96.9	95.9
1974	103.8	103.6	104.5	104.3	98.4	97.5
1975	90.8	92.9	89.7	92.0	81.2	83.5
1976	98.1	98.8	97.8	98.7	90.9	91.5
1977	98.8	98.6	98.6	98.4	91.9	91.7
1978	102.1	100.5	102.4	100.5	96.0	93.9
1979	101.5	101.5	101.7	101.7	95.8	96.1
1980	101.6	100.3	101.8	100.3	95.6	94.2
1981	99.9	100.0	99.8	100.0	93.1	93.9
1982	94.1	94.1	93.3	93.4	84.9	85.3
1983	98.4	98.4	98.2	98.1	92.5	92.7
1984	99.7	99.6	99.6	99.5	97.2	97.2
1985	99.9	99.7	99.9	99.7	98.7	98.4
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.3	101.4	101.4	101.6	103.5	103.4
1988	99.8	99.6	99.8	99.6	102.5	101.7
1989	95.6	95.4	95.0	94.8	96.7	96.0

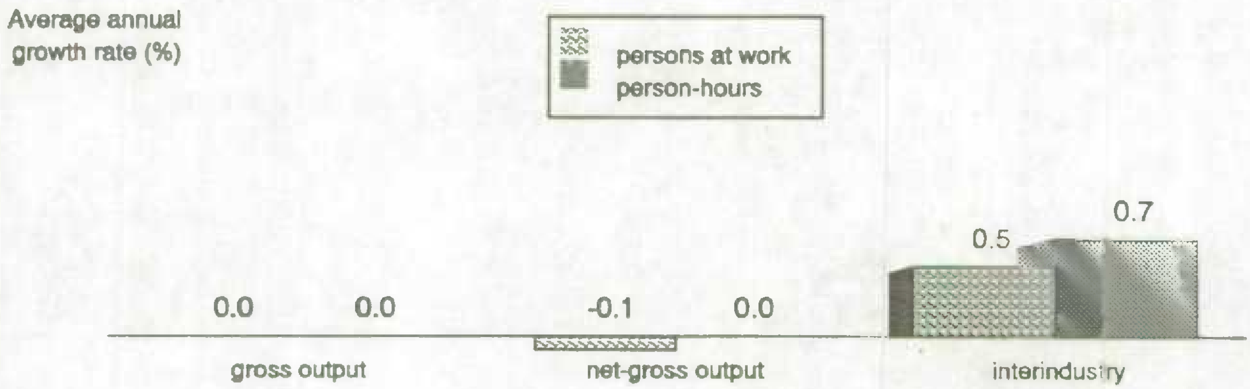


Table 18 - Indices of multifactor productivity, printing, publishing & allied industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	83.9	81.2	82.9	80.0	76.4	72.6
1962	85.4	82.5	84.5	81.4	78.1	74.1
1963	85.7	82.7	84.8	81.6	78.9	75.0
1964	85.1	82.3	84.2	81.2	79.4	75.6
1965	84.7	81.9	83.8	80.8	78.9	75.3
1966	85.3	82.7	84.4	81.6	79.6	76.2
1967	85.5	82.8	84.6	81.7	78.7	75.4
1968	86.1	83.3	85.3	82.3	80.1	76.8
1969	86.9	83.8	86.1	82.8	81.7	78.1
1970	85.9	82.9	85.0	81.8	80.9	77.6
1971	86.2	83.6	85.4	82.6	81.7	78.8
1972	88.8	86.2	88.1	85.3	85.4	82.4
1973	91.7	89.3	91.1	88.6	89.3	86.7
1974	91.1	89.1	90.5	88.4	88.7	86.5
1975	92.0	90.1	91.5	89.5	86.5	85.1
1976	96.6	94.9	96.4	94.6	93.1	91.6
1977	99.7	98.2	99.7	98.1	96.3	95.1
1978	101.9	100.2	102.1	100.2	99.8	97.7
1979	101.1	99.7	101.1	99.7	99.1	97.9
1980	101.4	99.6	101.5	99.6	99.4	97.5
1981	101.4	100.3	101.5	100.4	98.9	98.3
1982	96.8	95.7	96.6	95.4	91.9	91.3
1983	98.8	98.4	98.7	98.3	96.2	96.1
1984	101.6	101.1	101.7	101.1	100.7	100.4
1985	101.2	101.1	101.3	101.2	100.9	100.7
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	97.8	97.5	97.6	97.3	98.4	98.0
1988	97.6	96.9	97.4	96.7	98.2	97.3
1989	95.3	94.7	94.9	94.3	94.6	93.9

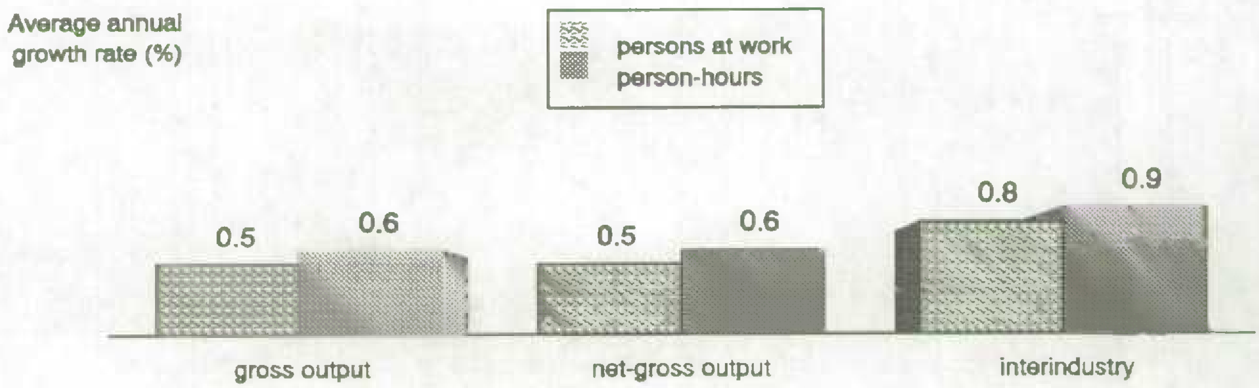


Table 19 - Indices of multifactor productivity, primary metal industries, (1986=100)

Year	Industry measures: Gross output: Persons at work	Industry measures: Gross output: Person-hours	Industry measures: Net-gross output: Persons at work	Industry measures: Net-gross output: Person-hours	Interindustry measures: Persons at work	Interindustry measures: Person-hours
1961	88.7	87.6	86.9	85.6	82.5	78.2
1962	90.8	89.4	89.2	87.7	83.5	79.1
1963	91.6	90.1	90.2	88.4	84.2	80.0
1964	93.4	91.7	92.2	90.3	89.3	85.1
1965	95.1	93.5	94.1	92.3	91.3	86.4
1966	94.5	93.1	93.5	91.9	89.3	85.2
1967	92.1	91.0	90.7	89.4	87.8	83.3
1968	95.0	93.8	94.1	92.7	89.9	86.0
1969	95.6	94.5	94.8	93.6	90.2	87.0
1970	95.1	93.9	94.1	92.9	88.7	85.5
1971	94.6	93.6	93.6	92.5	85.2	82.7
1972	96.3	95.0	95.6	94.1	87.6	85.0
1973	98.3	96.9	97.8	96.3	95.1	91.0
1974	99.1	97.6	98.7	97.1	90.4	86.9
1975	96.0	95.4	95.2	94.5	85.7	83.9
1976	93.5	92.9	92.4	91.7	85.1	83.7
1977	96.7	96.0	96.0	95.3	88.0	85.6
1978	98.1	97.3	97.7	96.7	91.4	88.7
1979	94.6	93.5	93.7	92.4	87.2	84.8
1980	92.6	91.6	91.4	90.2	86.2	83.5
1981	95.2	94.6	94.3	93.6	85.6	83.5
1982	89.8	89.6	88.0	87.8	81.0	81.3
1983	94.5	94.3	93.6	93.3	87.1	87.2
1984	98.6	97.7	98.4	97.4	96.9	96.3
1985	100.8	100.8	100.9	101.0	100.8	100.6
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	102.4	102.3	102.8	102.7	107.1	106.5
1988	102.7	102.3	103.2	102.6	108.2	107.4
1989	103.1	102.9	103.6	103.4	106.1	105.2

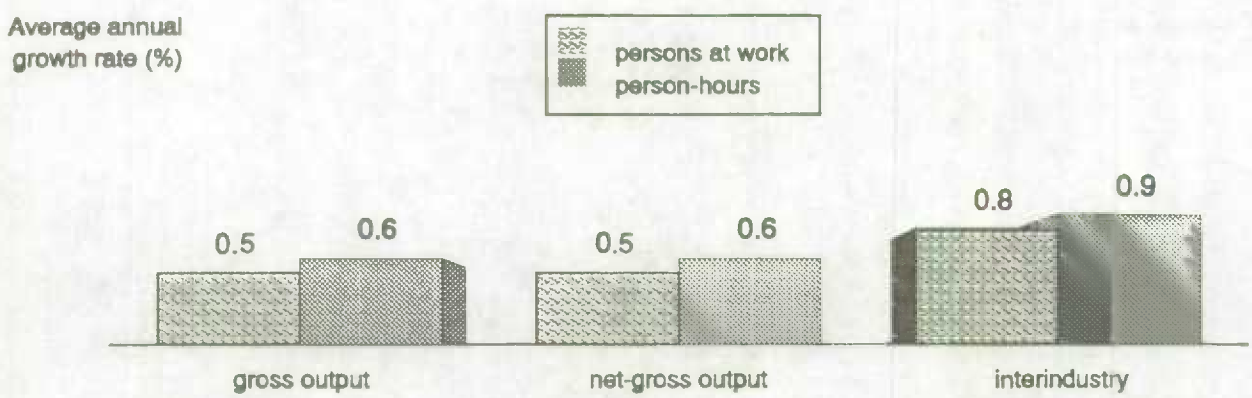


Table 20 - Indices of multifactor productivity, fabricated metal products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	79.6	78.7	77.9	77.0	71.6	69.9
1962	83.5	82.3	82.1	80.9	77.1	75.0
1963	85.3	83.7	84.1	82.4	79.7	77.1
1964	88.5	86.9	87.6	85.8	84.3	81.7
1965	91.1	89.5	90.5	88.7	87.5	84.9
1966	91.3	89.7	90.6	88.9	87.7	85.3
1967	90.1	88.6	89.3	87.7	85.8	83.7
1968	91.9	90.4	91.3	89.6	88.8	86.6
1969	92.3	90.9	91.7	90.2	90.2	88.3
1970	90.7	89.5	90.0	88.7	88.7	87.0
1971	92.9	91.6	92.3	91.0	90.5	89.1
1972	94.6	93.4	94.2	92.9	93.0	91.4
1973	97.0	95.9	96.8	95.6	97.7	96.4
1974	98.0	97.4	98.0	97.2	98.2	97.3
1975	94.5	93.9	94.1	93.5	91.9	91.3
1976	96.3	95.7	96.0	95.4	93.9	93.2
1977	96.8	96.2	96.6	96.0	94.8	94.4
1978	97.4	96.6	97.2	96.4	95.7	95.1
1979	94.4	94.1	94.0	93.7	92.8	92.4
1980	95.5	95.1	95.2	94.8	92.3	92.1
1981	97.2	97.0	97.1	96.9	93.9	94.2
1982	94.8	94.8	94.5	94.5	88.1	88.4
1983	96.1	96.4	95.8	96.1	92.4	93.0
1984	99.6	99.7	99.6	99.6	99.7	99.7
1985	101.4	101.3	101.5	101.4	102.4	102.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.5	99.5	99.5	99.4	100.2	99.9
1988	99.2	99.1	99.1	99.1	99.3	98.9
1989	98.8	98.7	98.7	98.6	98.3	98.3

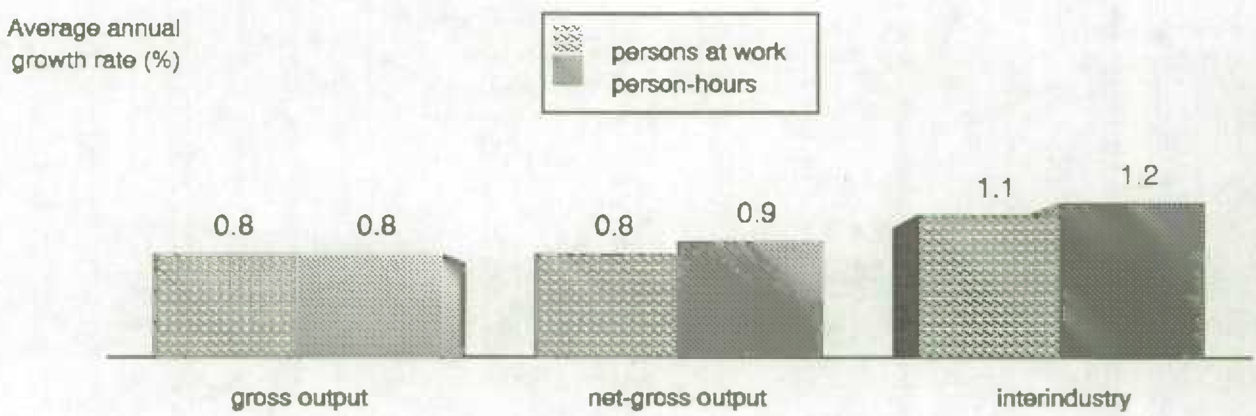


Table 21 - Indices of multifactor productivity, machinery industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	82.5	82.4	81.9	81.7	74.1	73.2
1962	86.8	86.0	86.2	85.5	79.2	77.4
1963	89.2	88.2	88.7	87.7	83.3	81.0
1964	93.2	92.0	92.9	91.6	88.6	86.0
1965	94.0	92.5	93.8	92.1	89.8	87.0
1966	95.3	93.9	95.1	93.6	91.2	88.7
1967	93.9	92.8	93.6	92.5	88.8	86.8
1968	93.0	91.9	92.7	91.5	89.1	87.1
1969	95.5	94.6	95.3	94.4	92.0	90.4
1970	94.4	93.7	94.2	93.4	91.3	90.0
1971	96.4	95.6	96.2	95.4	93.6	92.2
1972	97.3	96.6	97.2	96.4	95.6	94.2
1973	99.1	98.7	99.0	98.6	99.2	98.1
1974	100.2	100.2	100.2	100.2	100.3	99.6
1975	96.7	96.8	96.5	96.6	94.7	94.3
1976	97.2	97.3	97.1	97.2	95.8	95.5
1977	98.7	99.2	98.6	99.2	97.4	97.8
1978	100.9	101.0	101.0	101.0	99.7	99.5
1979	104.3	104.5	104.5	104.8	103.5	103.5
1980	102.6	103.0	102.8	103.2	101.1	101.3
1981	100.0	100.6	100.0	100.6	98.7	99.2
1982	92.2	92.9	91.7	92.5	88.3	89.0
1983	91.0	91.5	90.4	91.0	88.3	89.0
1984	98.3	98.4	98.2	98.3	97.4	97.5
1985	99.6	99.7	99.6	99.7	99.4	99.6
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	97.8	97.5	97.7	97.4	98.3	97.8
1988	99.0	99.0	99.0	98.9	99.9	99.6
1989	98.2	98.2	98.1	98.1	98.9	99.0

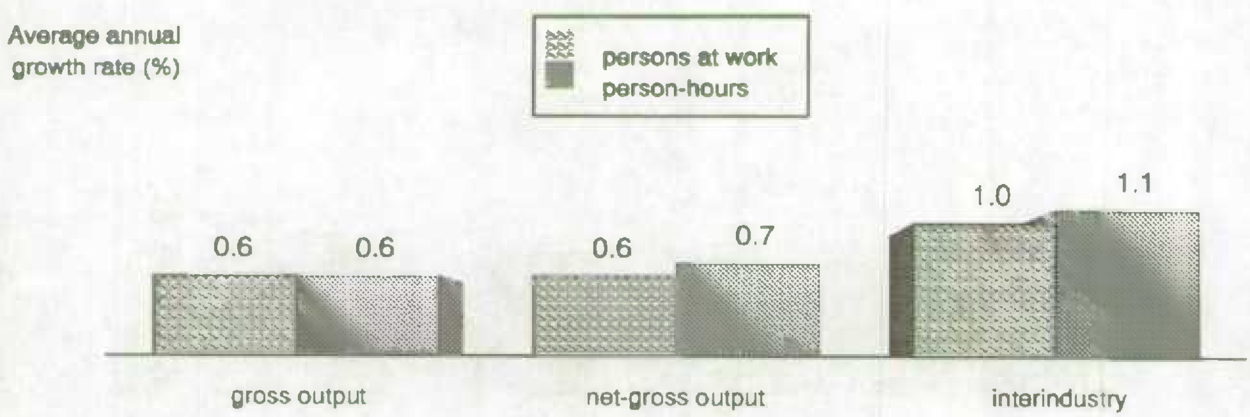


Table 22 - Indices of multifactor productivity, transportation equipment industries, (1986=100)

Year	Industry measures: Gross output, Persons at work	Industry measures: Gross output, Person-hours	Industry measures: Net-gross output, Persons at work	Industry measures: Net-gross output, Person-hours	Interindustry measures: Persons at work	Interindustry measures: Person-hours
1961	70.7	70.6	67.5	67.4	61.4	60.6
1962	73.9	73.3	71.2	70.5	65.7	64.4
1963	76.8	76.0	74.5	73.6	69.5	67.8
1964	77.3	76.7	75.0	74.4	70.8	69.5
1965	80.2	79.5	78.4	77.7	74.5	73.0
1966	78.7	78.3	76.7	76.2	73.2	72.0
1967	81.4	81.3	79.7	79.7	75.9	75.2
1968	83.5	83.0	82.0	81.5	78.8	77.6
1969	87.3	86.9	86.3	85.9	83.4	82.5
1970	83.8	84.0	82.4	82.7	79.7	79.5
1971	88.1	88.3	87.1	87.4	84.5	84.4
1972	91.1	91.1	90.3	90.3	88.6	88.1
1973	94.7	94.6	94.2	94.1	93.5	93.0
1974	95.1	95.4	94.6	95.0	93.6	93.7
1975	97.0	97.3	96.6	97.0	94.4	94.6
1976	98.0	98.5	97.8	98.3	96.0	96.3
1977	99.1	99.1	98.9	98.9	97.2	97.2
1978	98.8	99.3	98.6	99.1	97.1	97.6
1979	98.2	99.2	97.9	99.0	96.8	97.7
1980	92.5	93.7	91.9	93.2	90.4	91.7
1981	94.0	94.9	93.5	94.5	92.0	93.2
1982	92.7	94.1	92.1	93.6	89.1	90.7
1983	95.9	96.8	95.6	96.5	93.9	95.0
1984	99.9	100.3	99.9	100.3	99.5	99.9
1985	101.0	101.3	101.1	101.4	101.1	101.4
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	98.6	98.3	98.5	98.2	98.8	98.5
1988	100.0	99.9	100.0	99.9	100.7	100.5
1989	99.7	100.3	99.7	100.3	100.1	100.7

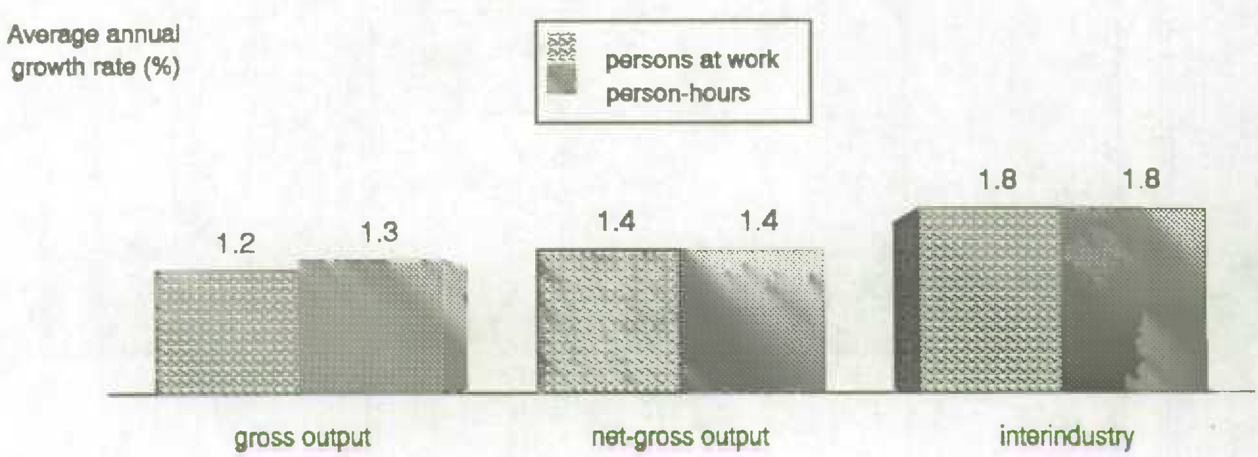


Table 23 - Indices of multifactor productivity, electrical & electronic products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	66.7	66.7	64.1	64.0	54.6	54.2
1962	71.6	71.6	69.3	69.3	60.3	59.6
1963	72.1	72.2	69.9	70.0	61.0	60.5
1964	74.9	74.8	72.9	72.8	64.1	63.5
1965	76.6	76.7	74.8	74.9	66.3	65.7
1966	77.5	77.1	75.7	75.4	67.6	66.7
1967	73.7	73.9	71.6	71.9	63.6	63.3
1968	75.8	76.1	73.9	74.2	65.8	65.6
1969	77.9	78.2	76.2	76.5	68.5	68.4
1970	77.1	76.9	75.4	75.1	67.3	66.6
1971	73.6	73.4	71.6	71.3	65.1	64.7
1972	77.4	77.1	75.6	75.3	70.6	70.1
1973	80.9	80.5	79.4	78.9	75.1	74.4
1974	80.6	80.3	79.1	78.7	75.2	74.4
1975	79.0	78.9	77.3	77.2	72.7	72.4
1976	82.0	82.1	80.6	80.7	76.4	76.4
1977	84.8	85.1	83.6	83.9	79.1	79.7
1978	84.1	84.1	82.8	82.8	78.4	78.2
1979	90.0	90.1	89.2	89.3	85.9	85.9
1980	93.3	93.6	92.8	93.1	90.3	90.4
1981	94.3	94.7	93.9	94.3	91.4	92.0
1982	90.9	91.1	90.2	90.5	87.2	87.6
1983	91.2	91.2	90.6	90.6	88.5	88.6
1984	97.1	97.4	96.9	97.2	96.8	97.3
1985	99.1	98.8	99.0	98.7	98.9	98.7
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.2	100.9	101.2	100.9	101.9	101.5
1988	103.1	103.1	103.3	103.3	104.4	104.1
1989	103.7	103.6	103.9	103.9	104.9	104.7

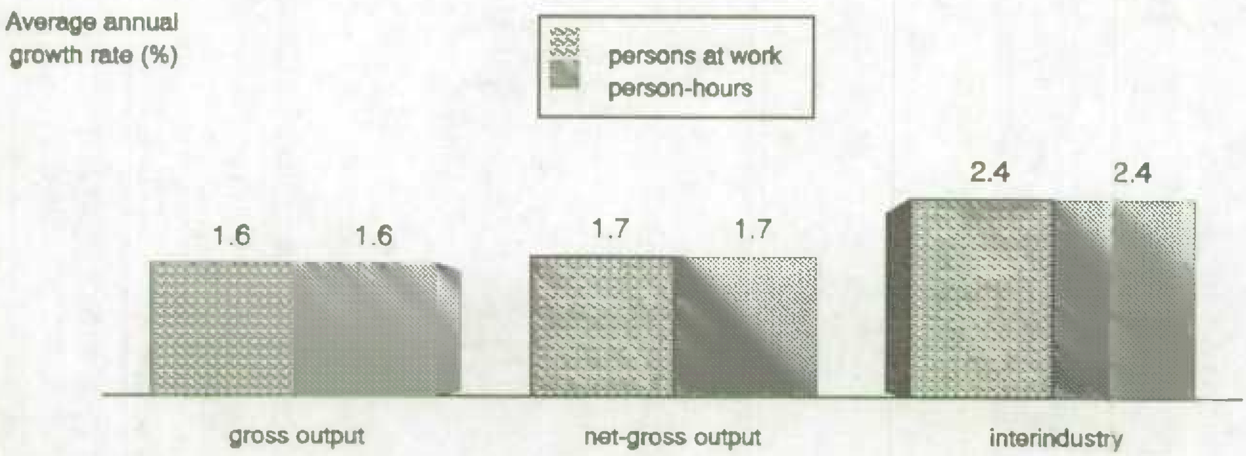


Table 24 - Indices of multifactor productivity, non-metallic mineral products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	84.9	82.9	83.5	81.2	64.4	61.6
1962	90.5	88.2	89.5	87.0	69.6	66.6
1963	91.2	89.2	90.4	88.0	70.9	67.8
1964	94.5	92.1	94.0	91.3	75.7	72.0
1965	96.3	93.5	96.0	92.8	79.0	75.0
1966	96.4	94.1	96.2	93.5	78.8	75.0
1967	91.0	89.0	90.1	87.8	76.6	72.7
1968	94.4	92.4	93.8	91.7	79.9	76.3
1969	96.0	94.0	95.7	93.4	82.4	78.8
1970	94.3	92.8	93.7	92.0	80.1	78.2
1971	100.3	98.8	100.6	98.8	85.2	83.1
1972	107.1	105.6	108.2	106.5	92.6	90.0
1973	101.5	100.4	101.9	100.6	96.3	93.9
1974	97.5	96.7	97.4	96.4	94.9	93.0
1975	94.7	93.8	94.2	93.3	91.8	90.4
1976	95.5	94.8	95.1	94.4	94.2	93.2
1977	94.6	93.8	94.1	93.3	92.5	91.3
1978	96.0	95.3	95.7	94.9	95.5	94.2
1979	96.4	95.7	96.2	95.4	96.6	95.2
1980	90.7	90.6	89.7	89.7	88.6	88.1
1981	90.1	90.2	89.1	89.2	86.6	86.3
1982	84.5	84.8	82.8	83.2	78.9	79.1
1983	90.0	90.1	89.0	89.0	87.3	87.2
1984	94.5	94.4	93.9	93.8	94.3	94.0
1985	98.3	98.2	98.1	98.1	97.6	97.6
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	102.3	102.0	102.6	102.2	105.2	104.4
1988	102.4	101.9	102.6	102.1	106.7	106.1
1989	100.5	100.0	100.5	100.0	102.8	102.0

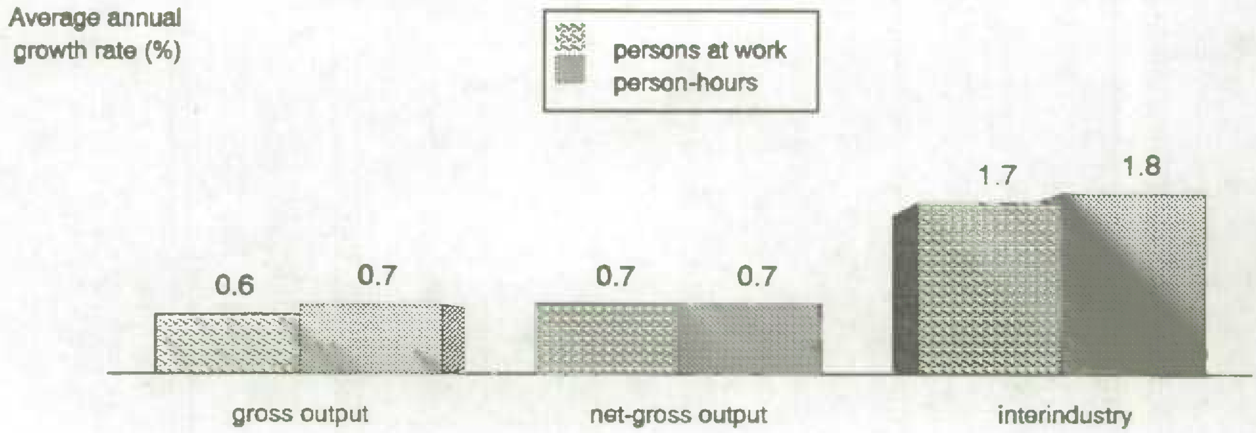


Table 25 - Indices of multifactor productivity, refined petroleum & coal products, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	84.9	84.7	84.6	84.4	97.7	96.2
1962	89.4	89.2	89.2	89.0	104.0	102.3
1963	90.3	90.0	90.2	89.9	106.8	105.3
1964	92.4	92.0	92.2	91.9	111.5	109.9
1965	94.3	94.0	94.2	93.9	114.7	112.9
1966	96.1	95.6	96.0	95.5	118.7	116.8
1967	92.1	91.7	92.0	91.6	114.9	113.2
1968	94.0	93.6	93.9	93.4	120.1	118.3
1969	92.4	92.2	92.2	92.0	119.6	118.6
1970	92.6	92.5	92.4	92.3	123.4	122.3
1971	93.0	92.8	92.9	92.7	125.0	123.8
1972	92.8	92.7	92.6	92.5	130.2	129.1
1973	96.3	96.3	96.2	96.2	138.6	137.8
1974	95.7	95.8	95.7	95.7	134.4	133.6
1975	96.3	96.4	96.2	96.4	127.5	127.1
1976	95.7	95.9	95.6	95.8	122.3	121.9
1977	98.7	98.8	98.6	98.8	123.1	122.8
1978	96.5	96.7	96.4	96.6	114.4	114.2
1979	95.2	95.3	95.1	95.2	114.9	114.6
1980	95.6	95.8	95.5	95.7	106.5	106.2
1981	97.7	97.9	97.7	97.8	102.5	102.2
1982	100.0	100.2	100.0	100.2	101.2	101.0
1983	101.6	101.6	101.7	101.6	103.4	103.2
1984	102.2	102.2	102.3	102.2	105.3	105.1
1985	101.1	101.0	101.2	101.1	104.8	104.3
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.8	100.7	100.9	100.8	105.0	104.9
1988	101.0	101.1	101.0	101.1	110.9	110.7
1989	100.1	100.1	100.1	100.1	109.2	109.2

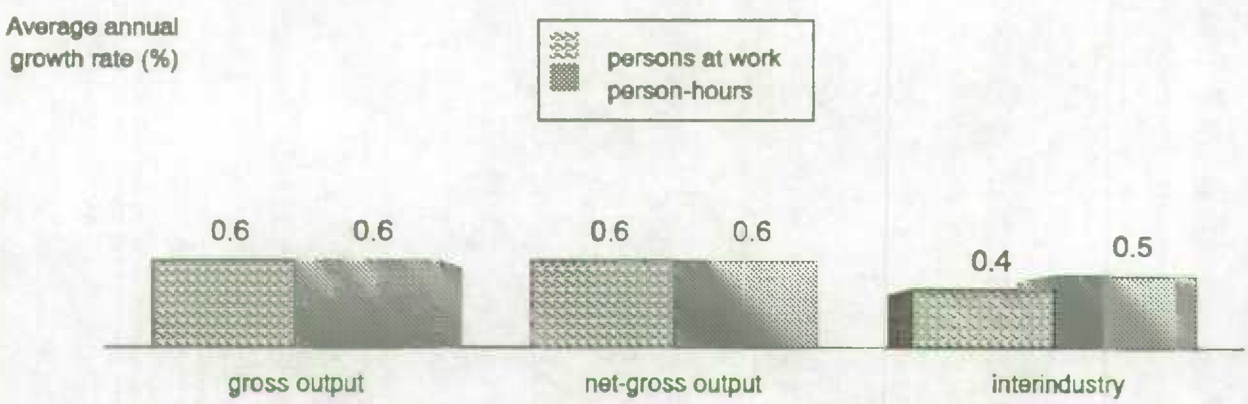


Table 26 - Indices of multifactor productivity, chemical & chemical products industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	73.7	73.5	70.1	70.0	64.0	62.2
1962	75.8	75.7	72.5	72.4	66.7	64.9
1963	77.9	77.8	74.8	74.7	69.9	68.2
1964	80.8	80.6	78.0	77.8	73.3	71.6
1965	82.6	82.0	80.0	79.3	76.0	73.9
1966	82.6	82.6	80.0	80.0	77.2	75.8
1967	81.1	81.1	78.3	78.4	75.1	74.0
1968	81.7	81.7	79.1	79.0	77.0	75.9
1969	83.2	83.0	80.7	80.4	79.6	78.4
1970	82.7	82.6	80.1	80.0	80.3	79.1
1971	85.5	85.4	83.2	83.1	84.7	83.5
1972	87.5	87.4	85.4	85.3	87.2	86.3
1973	91.2	91.2	89.6	89.5	92.2	91.1
1974	91.1	91.2	89.4	89.5	92.1	91.4
1975	86.2	86.3	83.8	83.9	86.1	85.4
1976	88.8	89.8	86.8	87.9	89.4	89.9
1977	89.2	89.3	87.3	87.4	90.8	90.4
1978	91.7	91.8	90.1	90.2	93.1	92.6
1979	93.5	94.0	92.2	92.8	95.4	95.7
1980	91.0	91.5	89.2	89.8	91.3	91.4
1981	93.7	94.3	92.5	93.2	94.5	95.0
1982	88.5	89.2	86.2	87.0	86.9	87.5
1983	95.5	95.7	94.6	94.8	93.7	93.8
1984	98.6	98.8	98.3	98.5	98.3	98.6
1985	99.5	99.7	99.4	99.6	100.1	100.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.6	101.6	101.9	102.0	102.6	102.5
1988	103.1	103.2	103.8	103.8	104.5	104.4
1989	103.3	103.1	103.9	103.8	103.8	103.5

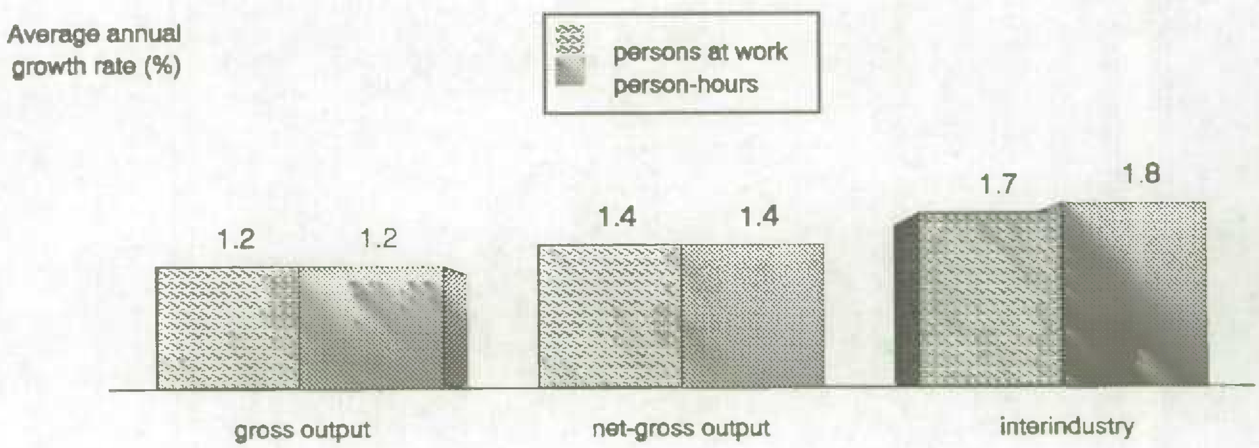
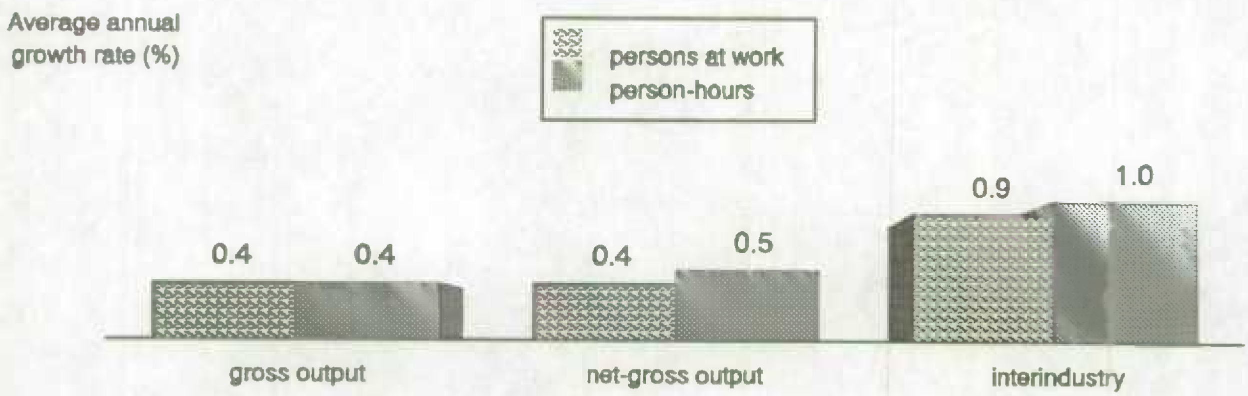


Table 27 - Indices of multifactor productivity, other manufacturing industries, (1986=100)

Year	Industry measures				Interindustry measures	
	Gross output		Net-gross output			
	Persons at work	Person-hours	Persons at work	Person-hours	Persons at work	Person-hours
1961	87.3	85.8	86.9	85.3	77.6	75.3
1962	89.3	87.3	89.0	86.9	80.0	77.0
1963	88.4	86.4	88.0	85.9	80.0	77.0
1964	91.8	89.4	91.5	89.0	84.3	80.7
1965	91.7	89.5	91.4	89.1	84.5	81.0
1966	93.6	91.5	93.4	91.2	86.6	83.4
1967	91.4	89.6	91.1	89.3	83.5	80.6
1968	94.3	92.9	94.1	92.6	87.5	85.0
1969	96.1	94.4	95.9	94.2	90.1	87.4
1970	94.1	92.7	93.9	92.4	88.2	85.8
1971	95.5	94.1	95.3	93.9	90.5	88.2
1972	99.3	98.2	99.2	98.1	96.0	93.9
1973	101.1	100.3	101.1	100.3	99.4	97.5
1974	100.5	99.5	100.5	99.4	97.6	95.7
1975	98.6	97.7	98.6	97.6	94.0	92.6
1976	103.5	103.0	103.6	103.2	100.1	99.1
1977	104.2	103.8	104.4	104.0	100.2	99.4
1978	104.9	104.6	105.2	104.8	101.5	100.6
1979	103.5	103.1	103.7	103.2	100.8	100.0
1980	101.2	101.0	101.3	101.0	98.7	98.2
1981	102.6	102.4	102.7	102.5	100.2	99.7
1982	102.0	102.2	102.1	102.3	97.6	97.7
1983	101.6	101.6	101.7	101.7	98.7	98.6
1984	105.4	105.0	105.7	105.3	104.8	104.2
1985	106.1	105.3	106.4	105.5	105.8	105.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.0	101.3	101.1	101.4	101.9	101.9
1988	98.9	99.4	98.9	99.4	100.7	100.9
1989	97.3	96.8	97.2	96.7	99.0	98.3



APPENDIX 1

Basic Concepts and Methods

1 - Multifactor Productivity in a Nutshell

The multifactor productivity accounts intend to measure the performance of the Canadian economy in production activities. It is assumed that resources are optimally allocated between the various production activities so that the object of the performance indicators is solely to reveal the technical *efficiency* with which the available resources are used in each of these production activities or groups of activities.

These indicators, in contrast with the labour productivity indices regularly presented in this publication, take into account the contribution of all productive factors (inputs) to the growth of outputs. For this reason, they are called *multifactor* or *total* factor productivity indices. The labour productivity measures presented in Part 1 of this publication take into account only the contribution of labour input to the growth of output and, for this reason, constitute *partial* measures of productivity.

In general, productivity gains are defined in a residual fashion as the growth in output not accounted for by the growth in production factors explicitly listed in the chosen formula. Multifactor productivity measures output per unit of all factors of production combined (such as labour, capital, materials and services used as inputs in the production of goods and services). Consequently, multifactor productivity does not reveal the contribution of the production factors but the joint effects of technical progress, economies of scale, and other factors not explicitly taken into account.

This publication presents two complementary categories of multifactor productivity indices. One category takes into account only the direct productivity gains made by an industry without considering the indirect productivity gains made by its suppliers. The other looks at the productivity gains made in the production of the goods and services of an industry by taking into account the productivity gains made by all industries which contributed directly and indirectly to that production. This measure basically consists in a measure of productivity by product category rather than by industry.

The first category of indices, based on the most usual concept of multifactor productivity, measures the productivity gains taking place within an industry, from the point of view of that industry *taken in isolation* from the rest of the business sector of the economy. The index measures the growth in the gross output of an industry unaccounted for by the growth in all of its factors of production; that is, both the inputs called primary, which are the labour and capital inputs, and the intermediate inputs, which are the materials and services purchased from other industries. This index does not take into account the productivity gains which take place in the industries which produce these intermediate inputs[32]. We will refer to this index as the *industry* index.

[32] *Except in some cases for intermediate inputs originating from the industry itself as will be explained below.*

The second category of productivity indices takes into account the productivity gains realized in the upstream supplying industries. It is based on the *interindustry* concept[33] of interdependence which is relatively new in the context of multifactor productivity analysis. This index takes into account both the productivity gains made within an industry and those made by industries supplying directly or indirectly the intermediate inputs. The index measures the growth in the output of an industry unaccounted for by the growth in all its primary inputs as well as by the growth in the primary inputs used in the production of its intermediate inputs by its direct and indirect industry suppliers. In that perspective, the interindustry productivity index takes into account all the primary inputs which have been used in *the business sector as a whole* to produce the goods and services of a given industry. In other words, each industry is viewed as an integrated component of the business sector of the economy rather than as an isolated entity.

Measuring the performance of an *economy* at producing the output coming out of a given industry using the interindustry concept is quite different from measuring the performance of that same *industry* in the traditional way. Both measures are useful. For instance, in an effort to assess the performance of an economy it would be inappropriate to consider the declining industries with low productivity gains without also looking at the performance of the industries supplying them with goods and services. The latter industries, which may benefit from important productivity gains, may also be strongly dependent on the low performance industries for the sale of their output.

2 - The Concept and Measurement of Productivity

The *level* of productivity is a ratio between the level of production of industries and the quantity of inputs they use. Although there may be alternative ways to compute the productivity ratio, all of these consist in combining all the goods and services produced into a single *aggregate output index* and, likewise, all of the production factors used into a single *aggregate input index*. The aggregation of the goods and services produced or used in the production process requires that these goods and services be measured in some common units. Similarly to the weights and measures in physics, index numbers use the relative value of the goods and services at some specific point in time as the common unit of measure. They are in fact weighted averages where each good/service is attributed a weight according to its contribution to the value of the aggregate of which it is a part of. Thus, the greater the nominal value of the good/service, the larger share it will have in the aggregate.[34] The multifactor productivity index *level* is computed as the ratio of the aggregate output index to the aggregate input index. Productivity *growth* is positive if the aggregate output index grows faster than the aggregate input index. Productivity decreases in the opposite case.

For empirical applications, some choices have to be made on how to actually measure inputs and outputs. One criterion which we have used is the inclusion of all production activity taking place in the business sector. This implies that the indices, at the industry level, are defined on a *gross output* measure of their activities. The gross output of an industry is the aggregate volume of all goods and services produced and work done by the industry. Gross output can be defined as either including or excluding intra-industry sales as will be discussed further below. Other investigators have used different definitions of output such as, gross output net of depreciation of the capital stock. The labour productivity indices presented in this publication use a real value-added measure of output.

[33] *The concept and the empirical estimates were first introduced by T.K. Rymes in a previous study done for Statistics Canada. See T.K. Rymes and A. Cas, "On the Feasibility of Measuring Multifactor Productivity in Canada", Statistics Canada, Input-Output Division, 1985. However, contrary to Rymes and Cas, we include the capital stock in the primary inputs rather than in intermediate inputs.*

[34] *This can be established more formally as the Divisia aggregation formula for a twice differentiable linearly homogeneous production function under competitive market conditions and profit maximisation. The time continuous Divisia index is approximated by the chained Tornqvist index..*

Correspondingly, on the input side, the measure of the index has to be inclusive of all used (and measurable) inputs which can be classified into two broad categories: (1) *intermediate* inputs which are comprised of the many goods (raw materials) and services purchased by the industries, and (2) *primary* inputs including labour inputs, capital inputs, and natural resources. More precisely, intermediate inputs are considered to be those inputs which are produced and are consumed during the same period (usually a year) by the business sector. The primary inputs[35] are supplied from other sectors of the economy such as the household sector. As discussed further below, imports and a few other variables can also be included in the set of primary inputs.

In the estimation of the multifactor productivity indices, a more detailed breakdown of both the inputs and outputs by commodity were used as described in Appendix 2 of Part 2. The more disaggregated (and consequently more homogeneous) set of commodities used improves the quality of the measured productivity indices and presents a definite advantage over the more aggregated (and more heterogeneous) set of commodities usually used by other investigators. However, due to statistical limitations, natural resources are not presently included in the input set.

The multifactor productivity indices have an important advantage over the partial labour productivity indices. This advantage stems from the inclusion of all the major factors contributing to the growth of output in the economy. Output growth is thus accounted for by increases in productive capacity, by a greater use of various services and goods purchased by industries (including energy) and by the growth in labour input. Output growth which is not accounted for by the growth of inputs is called productivity. Therefore, the more detailed and inclusive is the list of production factors entering into the estimates, the more growth in output can be "explained".

The inclusion of all production factors in the computation of productivity indices does not preclude the computation of meaningful indices of partial productivity. However, in order to analyze and to explain the partial productivity of any contributing production factor, one must first express its productivity in relation to the contribution of the other production factors. For instance, the index of partial labour productivity may have increased because the quantity of equipment, raw materials, and energy used per unit of labour have increased. Only when the contribution of these other factors have been netted out can the partial labour productivity be meaningfully related to factors such as education and experience. Multifactor productivity presents a net advantage on this count compared to labour productivity, precisely because it allows the decomposition of increased labour productivity between the portion which comes from the contribution of the other production factors, and the portion which comes from other factors explaining the increased efficiency of labour, such as education. The labour productivity indices regularly presented in this publication do not allow such a decomposition.

3 - Which Production Activities?

In the application of the concept of productivity, inputs and outputs must be clearly identified. They may refer to the entire Canadian economy and/or to various components of the economy. These components, in the Canadian System of National Accounts, are either *sectors* or *industries*. The productivity indices refer only to the productivity of the resources used by the *business sector* of the economy. In the Canadian

[35] *Capital goods are commodities produced by the business sector like intermediate inputs. However, they are accumulated only if savings occur. In addition, they are excluded from the intermediate input set on the grounds that they are, by definition, not totally consumed during the period in which they have been produced. Extending the interindustry measure over many periods to cover capital goods leads to the dynamic index number formula proposed in R. Durand and M. Salem, "On a Dynamic Productivity Index Number Formula", Input-Output Division, Statistics Canada, November 1987 (revised February 1990).*

System of National Accounts, the business sector "encompasses that group of transactors who produce goods and services for sale at a price which is calculated to cover costs and yield a profit..."[36]. An industry is defined, in the National Accounts, "as a group of operating units [establishments] engaged in the same or similar kind(s) of economic activity, e.g., coal mines, clothing factories, department stores, laundries"[37]. Industries include both business and non business establishments but can be sectored to include only business establishments. The productivity indices presented in this publication refer only, either explicitly or implicitly, to business establishments.

The productivity of the government sector can not be calculated at this time in the framework of the Canadian System of National Accounts. Indeed, the latter adopts as a convention (for lack of a better alternative) to measure the real output of the government sector as being equal to its primary input use. As a consequence, the growth in output cannot diverge from the growth in inputs as required for a meaningful productivity measure.

In summary, the productivity indices provide an accounting record of the effectiveness with which business establishments make use of the economy's resources through time. To make the interpretation of these indices more precise, we still need to clarify further how they are actually derived. Basically, we need to define in a more detailed way the sets of inputs and outputs used in their compilation both conceptually[38] and empirically (see Part 2 Appendix 2).

4 - Which Resources and How are they Measured?

Unemployed resources are excluded from the computation of productivity. Thus, for example, the labour input is measured with persons at work/hours worked rather than with the available labour force. The productivity indices, consequently, do not measure the performance of the economy as a whole which is often reduced by the non-utilization of available resources. Rather, the productivity indices presented here intend to track the evolution of the technical performance of the production processes which would obviously not be well captured if unemployed resources were taken into account.

On the other hand, resources engaged in the production process may not be fully employed as is often the case in economic downturns. Labour hoarding is a classical example: in response to decreasing demand for its product, an establishment may not lay off its employees for various reasons such as the separation costs and the cost of training new employees.

No adjustment for capacity utilisation of inputs is explicitly made to the multifactor productivity indices with one exception. An adjustment is made to take into account the capacity utilization rate of capital by calculating the cost of capital, that is, its share in the index of combined inputs, in a residual manner rather than by calculating it using the user-cost-of-capital approach (interest rates, depreciation rates, and other variables affecting the price of capital services)[39]. However, this correction does not fully eliminate the cyclical fluctuations of the indices and, consequently, does not reveal the trend followed by technical

[36] *Robert B. Crozier, National Income and Expenditure Accounts, Volume 3, A Guide to the National Income and Expenditure Accounts, Definitions-Concepts-Sources-Methods (catalogue 13-549, 1975, p. 101).*

[37] *The Input-Output Structure of the Canadian Economy, 1961-1981 (catalogue 15-510, p. 18).*

[38] *A more precise though more technical description of the conceptual aspects may be found in R. Durand and M. Salem, op. cit.*

[39] *See Berndt, E.R. and Fuss, M.A., "Productivity Measurement with adjustments for variations in capacity utilization and other forms of temporary equilibrium", Journal of Econometrics 33 (1986) 7-29, North-Hollard.*

progress. The sensitivity of the productivity indices to business cycle fluctuations has its advantages. Many would argue that what counts is the measure of the *actual* efficiency with which business firms use production factors at a given time rather than the *potential* (maximum) efficiency of the production factors, were they fully utilized. Over the long run, that is from peak to peak in economic activity, the indices do in fact reveal the increased productivity associated with technological possibilities, either in the form of technical progress or through a better use of all available technologies.

5 - Alternative Measures of Multifactor Productivity

5.1 Two categories of productivity measures. An industry rarely carries out all of the transformations from basic materials to final products. The automobile industry, for instance, uses steel as an intermediate input, which has been produced by the steel industry. Rarely are automobile producers involved in steel manufacturing. The production of steel is part of the total transformation processes involved in the production of automobiles but it is not part of the transformation processes of the automobile industry itself. Thus, if one is interested in the productivity of all the production processes involved in the production of the output of the automobile industry, one must *integrate*[40] the productivity of activities of all industries having participated in such production. This would embrace the industry directly involved in the manufacturing of automobiles (the automobile industry) as well as those industries indirectly involved in supplying the automobile industry with all the necessary parts, materials and services (all the "upstream" industries, such as the steel industry). The *interindustry* productivity estimates pertain to the productivity of groups of industries linked to each other by the flow of intermediate goods and services. Since this measure covers all industries, it can be considered as the productivity of the economy in producing a given bundle of goods or as a product group index of productivity.

From the point of view of the industry, the sources of inputs, whether intermediate or primary, do not matter. From that perspective, inputs are considered as given to the industry although for the economy as a whole these resources had to be either (1) produced by other industries, (2) imported or (3) supplied by households in the form of capital and labour. From that point of view, the industry, *as an isolated entity*, is the universe over which productivity is computed. This is the essence of the *traditional view* on productivity.

The new *interindustry* perspective on productivity is equivalent to the perspective of an observer whose concern lies in the efficiency with which the scarce resources of the *economy as a whole* are being used. One may, in particular, be interested in the efficiency with which an industry, as a component of the business sector rather than as an isolated entity, uses the scarce primary resources available to the business sector of the economy, whether directly or indirectly, by purchasing goods and services from other industries. The latter industries use both primary and intermediate inputs but the intermediate inputs they use also originate from upstream industries so that, going through all interindustry transactions, all intermediate inputs can ultimately be accounted for by uses of primary inputs.

In the example of the automobile industry, the inputs are capital and labour and the intermediate inputs it purchases, such as steel. The inputs of the steel industry include capital and labour inputs and the intermediate inputs it purchases, such as steel ingots. In turn, the steel ingot industry uses its own inputs including capital, labour, as well as iron ore from a mine it owns. When considering the interindustry set of inputs, we know that it takes capital and labour in the ingot industry to extract the ore and to produce ingots, and that it takes the capital and labour of the steel industry to transform the ingots into steel.

[40] *For a full discussion of the concept of integration in relation to productivity measurement, see Durand R., "Aggregation, Integration and Productivity Analysis: An Overall Framework", Aggregate Productivity Measure, 1989, Statistics Canada, (catalogue 15-204), pp. 107-118.*

Downstream, the automobile industry also needs capital and labour to transform the steel into automobiles. Thus, the set of inputs in the interindustry measure of productivity now includes the capital and labour services used directly and indirectly in the production of automobiles. In this perspective, the interindustry concept *integrates* the contribution of upstream industries to the production of its output bundle.

The real degree of vertical integration of industries is constantly changing through the years. It is also quite different from one country to another. Therefore, the comparisons of productivity growth through time or across countries based on the conventional industry indices are always limited by the changing degree of integration through time or the varying degree of integration across countries. At a very disaggregated level, this statistical instability of the traditional productivity measures may become important. Indeed, the industries' establishments may not only be more or less vertically integrated but they can also migrate from one industry to another as their output mix changes through time. By vertically integrating all industries in their calculation, the interindustry productivity indices become insensitive to such "statistical" influences, given these indices an advantage over the industrial measures. Indeed, they measure the productivity of the same production processes whatever the industries in which these processes took place.

From the point of view of the individual interested in the global performance of the business sector as a whole *in the production of some group of commodities*, in particular for international trade studies, the interindustry measure may prove to be more interesting than the traditional industry measure. Indeed, it takes into account not only the efficiency with which various inputs are combined within some industry to produce a given group of outputs but also the efficiency of the industries supplying the intermediate inputs. Thus, to take the example of the motor vehicle industry, this measure takes into account not only the efficiency of the assembly plants, but also the efficiency of the plants producing the auto parts and other raw materials, even including the production of basic minerals and other industries' output located far upstream in the chain of production. The national economy may possess very efficient assembly plants as compared to foreign plants but still remain disadvantaged on the international automobile market because of the relative inefficiency of the industries which "feed" its motor vehicle industry.

In fact, it seems advantageous to use both measures of productivity as they provide complementary information. The industry measure isolates the efficiency of the motor vehicle industry segment in the production of automobiles. The joint use of both measures allows the analysis of the overall efficiency of production processes (vertically integrated industries) as well as the efficiency of each of its (isolated industry) segments.

5.2 Two concepts of gross output. As mentioned above, in addition to the standard gross output measure derived from the input-output tables, one may adopt another production concept for the purpose of estimating multifactor productivity: the gross output net of all intra-industry flows. According to Gullickson and Harper[41],"...removing intra-industry transactions assures that changes in vertical integration through time in the census data do not bias the estimates." This advantage refers only to intra-industry integration while the interindustry measure introduced above possesses the same advantage over both intra- and interindustry sales.

The concept of net-gross output[42] has the further advantage of smoothing the aggregation process. According to the traditional approach, the concept of gross output is maintained at all levels of aggregation except at the total business sector level where the productivity measure based on value-added is considered. Even for broad aggregates such as goods industries and services industries, multifactor

[41] *W. Gullickson and M.J. Harper, "Multifactor Productivity Measurement for Two-Digit Manufacturing Industries", paper presented at the 1986 meeting of the Western Economic Association in San Francisco, July 1-5, 1986.*

[42] *For a full discussion of the net-gross output concept of productivity, see Diaz, A. "Alternative Concepts of Output and Productivity", Aggregate Productivity Measures 1989, Statistics Canada, catalogue 15-204, pp. 97-106.*

productivity measures are defined on gross output while productivity of the business sector is defined on value-added. The measure of output is therefore abruptly changed from gross output for broad aggregates to value-added for the total. In contrast, the net-gross output measure converges gradually towards value-added as, when moving to broader aggregates, intermediate inputs are progressively reclassified from *interindustry* sales to *intra-industry* sales and subtracted from gross output.

6 - Aggregate Business Productivity

The discussion of the various concepts has hitherto been made with reference to the industry as the main subject. What about multifactor productivity measures for the total business sector? What impact has the aggregation level on the definition of output and inputs? The answers to these questions are the main focus of this section.

If we wish to measure the productivity of the business sector in producing goods and services to be sold outside the sector, the industrial measure of multifactor productivity based on gross output is inadequate. The sum of the gross outputs of all industries in the business sector corresponds to much more than the outbound production as it includes all goods and services bought by other industries and used as intermediate inputs in the production of other goods and services. This is why the aggregate productivity index on gross output is not calculated in the framework of Statistics Canada's productivity program.

The question is now: what are the appropriate measures of productivity at the aggregate level? First, let us consider the net-gross output model, where intra-industry sales are netted out from both output and inputs. In this model, the output includes the production of goods and services delivered outside the sector and the inputs include all the resources available to the business sector, that is its primary inputs (labour and capital) and the inputs originating from the other sectors of the economy and from outside the economy (imports). On the other hand, the interindustry measure takes into account the direct and indirect primary inputs (capital, labour, and inputs originating outside the sector) used in domestic production. For the total business sector, the index based on net-gross output is equal to the interindustry index as both measures refer to the same inputs and output.

The two preceding measures are based on an approach that treats the business sector as an entity which is isolated from the rest of the economy and of the world. In this perspective, what matters is only the production delivered outside the sector and the inputs not produced by the business sector, whether they are imported or originating from other sectors (capital, labour). These measures statistically integrate the production activities within the business sector, but not with the rest of the economy or the world.

In contrast, the multifactor productivity measure based on value-added reflects the real degree of integration between the business sector and the rest of the world. From the perspective of the world economy, goods and services exchanged between countries are intermediate inputs. The fabricated inputs coming from outside the business sector (such as imports of goods and services) must not be counted in the inputs. The output therefore corresponds to the value-added of the business sector while the inputs include only capital and labour. Since the business sector is then considered as being integrated with the world economy, transactions with other parts of the world economy are deemed to be intraindustrial.

In summary, there are two measures which are relevant for the total business sector. First, there is the measure based on net-gross production and the interindustry measure which are equal, and second, there is the productivity measure based on value-added. The net-gross measure is sensitive to changes in the integration of the domestic economy with the rest of the world whereas the value-added measure is not because it already treats the inputs and outputs as if the domestic economy were completely integrated with the world economy.

In practice, productivity measures for the total business sector are constructed by aggregating the more detailed measures. This is done using aggregation weights. These weights vary according to the production model considered.

7 - Usefulness of Productivity Indices in Economic Analysis

As indicated above, the main purpose of the multifactor productivity measures is to separate the observed growth in industrial production into increases in the economic resources employed by industries and increases in overall efficiency. This step allows a more complete accounting of the sources of economic growth than the partial measures presented in the framework of the Canadian System of National Accounts. Time series of multifactor productivity by industry also allow analysts to measure trends and detect shifts in competitive advantages among various Canadian industries vis-a-vis similar industries in the rest of the global economy. By showing how industries' evolution has been influenced by their technical performance, the assessment of multifactor productivity helps analysts and policy makers to address such issues as domestic industrial policy and international industrial strategy. Similarly, businesses and other private organizations observe productivity movements to evaluate the long-term viability of various industries and make more informed investment decisions.

In addition, proper growth accounting opens the way to a better understanding of the sources of productivity growth. The latter can be conceptually decomposed into three components: economies of scales, technical progress and measurement errors due to omitted factors. Growth accounting paves the way to further analysis of the sources of economies of scale and technical progress. Taking technical progress as an example, it could be defined as the general advance in knowledge. If we accept this definition, then, over the long run, technical progress is the only source of *permanent and sustained* improvement in productivity. Indeed, at any point in time, the level of education of workers may be raised only to a certain limit through investments in education. Similarly, the diffusion of the best known technologies through investments in physical equipment has a limit as well as the best use of existing technical possibilities through economies of scale. Only investments in fundamental research in both human and natural sciences and investments in applied research and development can lead to a better and more educated labour force and better equipment over the very long run. Measuring the contribution of technical progress to the growth in output helps in understanding the importance of society's investment in such research.

APPENDIX 2

Description of the Multifactor Productivity Database

1 - Introduction

In order to derive multifactor productivity indices, prices and volumes of outputs and inputs are estimated from various sources. For outputs and intermediate inputs by industry, the data are obtained from the current and constant price Canadian input-output tables[43]. Some transformations of these data are required to obtain better conceptual measures for the purpose of estimating multifactor productivity. These transformations are summarized in this appendix. Some of them were suggested by Rymes and Cas in an earlier study[44]. Primary input costs are also taken from input-output tables while their volumes are estimated from other sources. Labour input data are taken from the labour productivity program in the case of employment while estimates of hours worked were developed specifically for the multifactor productivity program. Capital input data are described in a technical note which is summarized below[45]. The industry coverage of the business sector used for multifactor productivity estimates differs slightly from the usual definition of the national accounts in both Canada and United States as explained in further detail in Appendix 3.

2 - Input-Output Commodity Data

The input-output tables are estimated at both *producers'* and *purchasers'* prices. Producers' prices are the prices received by the sellers at the boundary of their establishment. Purchasers' prices correspond to the market prices at the point of delivery and include various margins which are not taken into account in the producers' prices. Some of these margins are paid to business sector enterprises in exchange of real services such as retail and wholesale services and transportation services. Commodity indirect tax margins, on the other hand, represent a pure transfer without any real counterpart.

As the proposed productivity measures are derived under the assumption of competitive market behaviour, it can be argued that outputs of industries should be valued at producers' prices while their inputs should be valued at purchasers' prices. The *Divisia* index of productivity growth, which is used here, rests on the assumption of profit maximization behaviour of firms in competitive markets. This implies that the marginal product of each input be equated to its real price defined as the purchasing cost of the input including all margins divided by the net selling price of the output, excluding all margins. But as real margins represent real inputs which can be substituted for other inputs over the long run, they were considered as distinct

[43] *For informations on data sources and concepts, refer to The Input-Output Structures of the Canadian Economy, 1961-1981 (Revised Data), Statistics Canada, Catalogue no. 15-510, Input-Output Division, 1987, pp. 1-127.*

[44] *Rymes T.K. and A. Cas, "On the Feasibility of Measuring Multifactor Productivity in Canada", Input-Output Division, Statistics Canada, 1985.*

[45] *For a detailed documentation on capital input, see Documentation of Capital Input and Capital Cost Time Series for Multifactor Productivity Measures, by M. Salem, R. Fortin and Y. Sabourin, Statistics Canada, Input-Output Division, December 1990.*

inputs rather than included in the physical volumes of the other inputs. Tax margins were excluded from the input set. All commodity input and output volumes were therefore taken from the producers' prices input-output tables. In current prices, commodity taxes paid were added to the value of commodities purchased.

Conceptually, operating subsidies can be considered as negative indirect taxes. Therefore, they were distributed over the input and output commodities to which they apply. Some subsidies, however, could not be attributed to specific commodities and were treated as non commodity indirect taxes (see below).

Royalties were considered as taxes levied on industries' outputs in the productivity accounts. They were subtracted from the producers' prices of outputs to estimate the net prices received by producers. Royalties are considered as a rental income on natural resources received by the business sector industry *Government Royalties on Natural Resources* in the input-output tables. However, this is an improperly defined industry for productivity analysis as it has no inputs except for the *Other operating surplus* which is equated to the royalties perceived. The industry was also excluded on the grounds that it appeared doubtful that governments act as a real monopoly in natural resources industries.

Since govemment goods and services cannot be substituted by other business industry supplies, they are added to primary inputs. As well, unallocated imports and exports of commodities are considered as part of the primary inputs. In general, all commodities which are not produced by the business sector are considered as primary commodities. This is the case, for instance, of postal services.

Dummy industries have been removed from the input-output tables. Corresponding dummy commodity inputs have been transformed into real inputs on the basis of the input structure of dummy industries.

3 - Labour Input at Current and Constant Prices

As in the case of labour productivity, the estimates of multifactor productivity will be calculated, from now on, with two different measures of labour input: the average annual number of persons at work and the number of hours devoted to work. The first includes employment of paid workers and employment than other-than-paid workers (self-employed and unpaid family workers). The employment estimates are the same as those used to calculate labour productivity. The data sources for employment are described in Appendix 2 of Part 1 of this publication. The measure of hours worked is presented in detail in the feature article entitled *Hours Worked: A New Measure of Labour Input for Multifactor Productivity.*

The labour income of self-employed workers is an imputation based on the assumption that, in most industries, self-employed workers earn the same hourly rate as the paid workers. However, in the case of industries where professional self-employed workers are numerous (doctors, dentists, lawyers, accountants, engineers), since the average earnings of paid workers in the same industry division underrepresent the earnings of these occupations, tax data on average labour income was used. Consequently, labour income of the self-employed is afterward deducted from net income of unincorporated businesses to preserve the balance in the accounting system.

4 - Capital Input at Current and Constant Prices

The input of capital services for a given year is assumed to be proportional to net capital stock in constant prices at the end of the previous year. The choices of a net rather than a gross capital stock measure or of a delayed rather than a geometric depreciation curve are still open issues which will require further research[46]. The capital stock excludes investment done during the current year as the latter are generally not productive at that stage.

Two particular problems occur when using the net capital stock figures from the Investment and Capital Stock Division: first, these data are based on the 1970 SIC while the input-output tables are on the 1980 SIC; secondly, these data are estimated for industries including all establishments, not only for the business industries like in the case of input-output tables. Capital assets for industry segments have been estimated, removed from some industry groups and reclassified to others so as to maximize the number of concordant industry classes. Non-business industry capital stock was estimated and removed from the industries where significant sectoring differences were known to exist: namely, in non-metal mines, chemical and chemical products industries, miscellaneous manufacturing industries, railway transport and related service industries, and other utility industries.

The principal difficulty in estimating the price of capital input is that, unlike intermediate commodities, it cannot be observed from market transactions except in the case of leases. The price is therefore imputed on the basis of what the industry would charge itself for using its own capital assets, which is the income generated from capital services: the sum of other operating surplus and net income of unincorporated business net of labour income of self-employed workers. Non-commodity indirect taxes (subsidies) are also added (subtracted) to the capital cost as they are associated with the industry's ownership and use of capital assets. Prices are obtained by dividing the generated income by net capital stock of the previous year in constant prices.

[46] *In Canada U.S. comparisons, one must note that, in the Canadian measure of the capital stock, a more accelerated depreciation pattern is being used. For a more technical description of the new capital asset series, see Fixed Capital Flows and Stocks, Methodology, Investment and Capital Stock Division, Statistics Canada, May 1990.*

APPENDIX 3

Aggregation Parameters for Multifactor Productivity Measures

For the purpose of deriving multifactor productivity growth rates, the inputs in goods and services were taken from the input-output tables at their most disaggregated level[47] (about 600 commodities). However, it was not possible to use the inputs or outputs by industry at their most disaggregated level (154 industries for the business sector at the link level of the input-output tables) mainly because capital stock series were not available for some industries. Input-output tables have been aggregated to a special level of aggregation -- identified as PL -- required for the multifactor productivity measures which consists of 110 business sector industries (excluding Postal Services for which no capital data are available). For analytical purposes, two other aggregation levels were built: 33 industries (level PM) and 13 industries (level PS). These levels were determined to be as close as possible to the M and S levels of industry classification of the input-output tables. It is hoped that further developments of the capital database will eventually allow multifactor productivity estimates to be produced at the M and S levels of the input-output tables and that these developments will extend the PL level closer to the L level.

The industrial coverage of the business sector departs slightly from the current definition of the Canadian System of National Accounts as some components were excluded. These are Postal Services (L 131), Other Utility Industries nec (L 134), and Government Royalties on Natural Resources (L 140), and Owner Occupied Dwellings (industry L 141). Owner Occupied Dwellings and Government Royalties on Natural Resources were considered to be improperly defined industries for productivity analysis while capital stock data were not available for the Postal Service Industry and Other Utility Industries.

Text tables 1 through 3 establish the concordance between the input-output L level and the multifactor productivity database PL, PM and PS levels of aggregation. The concordance for the PM level pertains only to manufacturing industries as industries outside this group are essentially the same as those at the PS level. In a few cases, again because of capital stock data limitations, multifactor productivity estimates refer to a somewhat different group of industries from those regularly published in the labour productivity section: as shown in Text table 3, at the PM level within manufacturing industries, Leather & Allied Products Industries were grouped with Rubber Products Industries, and Clothing Industries were grouped with Primary Textiles & Textile Products Industries.

[47] *Empirically, it was impossible, at this stage, to include a measure of natural resources such as land used as inputs. Natural resources are important mostly for primary industries but play only a minor role in other industries.*

Text table 1

Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
1	Agricultural & related services ind.	011-017 021-023	001-021	001-021	1
2	Fishing & trapping industries	031-033	041-047	041-047	2
3	Logging & forestry industries	0411,0412 0511	031,039	031,039	3
4	Metal mines	0611-0617 0619	051-052 057-059	051-059	4-6
5	Non-metal mines	0621,0622- 0625,0629, 063	061,071- 073,079	061,071 073,077 079	7-10
6	Crude petroleum & natural gas	071	064	063-066	11
7	Quarrying, sand pits & mining serv.	081,082 091,092	083,087 096,098 099	083,087 092,099	12-13
8	Meat & poultry products	1011-1012	1011-1012	101,103	14-15
9	Fish products industry	102	102	111	16
10	Fruit and vegetables industries	103	103	112	17
11	Dairy products industries	104	104	105,107	18
12	Feed industry	1053	106	123	19
13	Misc. food products industries	106,109 1051-1052 1081-1083	105 1081-1083 1089	124,125 131,133 135,139	20,23,24
14	Biscuit, bread & other bakery prod.	1071-1072	1071,10721	128,1291	21,22
15	Beverage industries	111-114	1091-1094	141,143 145,147	25-28
16	Tobacco products industries	121,122	151,153	151,153	29
17	Rubber & footwear products ind.	151-159 1712	1623,1624 1629,174	161,163 169,174	30,33
18	Plastic products industries	161-169	1651,27332	27332,3851	31
19	Leather tanneries	1711	172	172	32
20	Misc. leather & allied prod. ind.	1713,1719	179	179	34

Text table 1

Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
21	Man-made fibre yarn & woven cloth	181,1829	181,183	183,201	35
22	Wool yarn & woven cloth industry	1821	182	193,197	36
23	Misc. textile products industries	191,193 1991-1995 1999	184,1851 1852,1871 1872,1891- 1894,1899	211-215 218	38-39
24	Carpet, mat & rug industry	192	186	216	40
25	Clothing industries exc. hosiery	183,243- 245,2491- 2493,2495 2499	175,2391 2392,243- 249	175,2391- 2392,242- 249	37,41
26	Hosiery industry	2494	231	231	42
27	Sawmills, planing & shingle mills	251	251	251	43
28	Veneer and plywood industries	252	252	252	44
29	Sash, door & other millwork ind.	254	254	254	45
30	Wooden box & coffin industries	256,258	256,258	256,258	46
31	Other wood industries	259	259	259	47
32	Household furniture industries	261	2619	2619	48
33	Office furniture industries	264	264	264	49
34	Other furniture & fixture ind.	269	269	266	50
35	Pulp & paper industries	271	271	271	51
36	Asphalt roofing industry	272	272	272	52
37	Paper box & bag industries	273	2731,2732 27331	2731,2732 27331	53
38	Other converted paper products ind.	279	274	274	54
39	Printing & publishing industries	281,283 284	286,288 289	286,288 289	55
40	Platemaking, typesetting & bindery	282	282	287,8932	56
41	Primary steel industries	291	291	291	57

Text table 1

Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries					
PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
42	Steel pipe & tube industry	292	292	292	58
43	Iron foundries	294	294	294	59
44	Non-ferrous smelting & refining ind.	295	295	295	60
45	Aluminum rolling casting, extruding	296	296	296	61
46	Copper rolling casting & extruding	297	297	297	62
47	Other metal rolling, casting etc.	299	299	298	63
48	Power boiler & struct. metal ind.	301,302	301,302	301,302	64
49	Ornamental & arch. metal prod. ind.	303	303	303	65
50	Stamped, pressed & coated metals	304	304	304	66
51	Wire and wire products industries	305	305	305	67
52	Hardware, tool & cutlery industries	306	306	306	68
53	Heating equipment industry	307	307	307	69
54	Machine shops industry	308	308	308	70
55	Other metal fabricating industries	309	309	309	71
56	Agriculture implement industry	311	311	311	72
57	Commercial refrigeration equipment	312	316	316	73
58	Other machinery & equipment ind.	319	315	315	74
59	Aircraft & aircraft parts industry	321	321	321	75
60	Motor vehicle industry	323	323	323	76
61	Truck, bus body & trailer industry	324	324	324	77
62	Motor vehicle parts & accessories	325	1652,188 325	2291,325 3852	78
63	Railroad rolling stock industry	326	326	326	79
64	Shipbuilding and repair industry	327	327	327	80
65	Misc. transportation equipment ind.	328,329	328,329	328,329	81

Text table 1

Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
66	Small electrical appliance industry	331	331	331	82
67	Major appliances (elec & non-elec.)	332	332	332	83
68	Record players, radio & tv receiver	334	334	334	84
69	Electronic equipment industries	335	335	335	85
70	Office, store & business machines	336	318	318	86
71	Communications, energy wire & cable	338	338	338	87
72	Other elect. & electronic products	333,337 3391-3399	268,333 336,3391 3399	268,336- 337,339	88-89
73	Clay products industry	351	351	351	90
74	Cement industry	352	352	341	91
75	Concrete products industry	354	354	347	92
76	Ready-mix concrete industry	355	355	348	93
77	Glass & glass products industries	356	356	356	94
78	Non-metallic mineral products n.e.c.	357-359	353,357- 359	343,345 352-355 357,359	95
79	Refined petroleum & coal products	361,369	365,369	365,369	96
80	Industrial chemicals industries n.e.c.	371	371	378	97
81	Plastic & synthetic resin industry	373	373	373	98
82	Pharmaceutical & medicine industry	374	374	374	99
83	Paint & varnish industry	375	375	375	100
84	Soap & cleaning compounds industry	376	376	376	101
85	Toilet preparations industry	377	377	377	102
86	Chemical & chemical products n.e.c.	372,379	372,379	371-372 379	103
87	Jewellery & precious metal ind.	392	392	382	104

Text table 1

Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
88	Sporting goods & toy industries	393	393	393	105
89	Sign and display industry	397	397	397	106
90	Other manufacturing industries n.e.c.	391,3991- 3994,3999	391,3991- 3994,3999	381,383 384,395 398,399	107-108
91	Construction industries	401-449	404-421	404-421	109-117
92	Air transport & services incidental	451,452	501-502	501-502	118
93	Railway transport & rel. services	453	503	506	119
94	Water transport & rel. services	454,455	504,505	504,505	120
95	Truck and other transport ind.	456,4572- 4575,4589 4592,4599 996,9991	506-508 517,519	507-508 517,519	121,123 125
96	Urban transit system industry	4571	509	509	122
97	Highway & bridge maintenance ind.	4591	516	516	126
98	Pipeline transport industries	461	515	515	127
99	Storage & warehousing industries	471,479	524,527	524-527	128
100	Telecommunication broadcasting ind.	481	543	543	129
101	Telecommunication carriers & other	482,483	544,545	544,545	130
102	Electric power systems industry	491	572	572	132
103	Gas distribution systems industry	492	574	574	133
104	Wholesale trade industries	501-599	602-629	602-629	135
105	Retail trade industries	601-692	10722,2611 631-699	1292,2611 631-699	136
106	Finance, insurance & real est. ind.	701-705 709,711- 729,731- 733,741- 743,7499 7511,7512 759,761	7011-7016 7019,703 705-707 715,7211 7212,735 7371	702,704 7311,7312 735,7371	137-139

Text table 1

Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
107	Service industries	771-777 779,911- 914,921 922,961 962,963- 969,971- 973,979 982,983 991-995 9999,4842 4581	841-845 849,851- 855,861- 864,866 867,869 871,872 874,876 877,879 881,886 891-8931 894-899 512	851,853- 859,861 862,864 866,869 871,872 874-879 891,8931 894-899 512	142-144 148-154 124
108	Educational service industries	851-859	801-809	801-809	145
109	Hospitals	861	821	821	146
110	Other health services	8621,863 865,866 8671,8679 868,8691- 8693,8699	822-827	823-827	147

Text table 2

Concordance between the PS aggregation level and the input-output link aggregation level.

PS Level Industries PS Codes	Industry Title	Link Code	PL Code
1	Agricultural & related services ind.	1	1
2	Fishing & trapping industries	2	2
3	Logging & forestry industries	3	3
4	Mining, quarrying & oil well ind.	4-13	4-7
5	Manufacturing industries	14-108	8-90
6	Construction industries	109-117	91
7	Transportation & storage industries	118-123 125-128	92-99
8	Telecommunication industries	129,130	100-101
9	Electric power & gas dist. ind.	132,133	102,103
10	Wholesale trade industries	135	104
11	Retail trade industries	136	105
12	Finance, insurance & real est. ind.	137-139	106
13	Community, business, person. serv. ind.	124,142-154	107-110

Text table 3

Concordance between the PM aggregation level and the input-output link aggregation level.

PM Level Manufacturing Industries PM Codes	Industry Title	Link Code	PL Code
5	Food industries	14-24	8-14
6	Beverage industries	25-28	15
7	Tobacco products industries	29	16
8	Plastic products industries	31	18
9	Rubber, leather & allied prod. ind.	30,32-34	17,19,20
10	Textile, textile products & clothing ind.	35-42	21-26
11	Wood industries	43-47	27-31
12	Furniture & fixture industries	48-50	32-34
13	Paper & allied products industries	51-54	35-38
14	Printing, publishing & allied ind.	55,56	39,40
15	Primary metal industries	57-63	41-47
16	Fabricated metal products industries	64-71	48-55
17	Machinery industries	72-74	56-58
18	Transportation equipment industries	75-81	59-65
19	Electrical & electronic products	82-89	66-72
20	Non-metallic mineral products ind.	90-95	73-78
21	Refined petroleum & coal products	96	79
22	Chemical & chemical products industries	97-103	80-86
23	Other manufacturing industries	104-108	87-90

APPENDIX 4

Quality of Multifactor Productivity Estimates and Related Data

The multifactor productivity estimates presented in this publication are assigned quality ratings in order to provide an overall assessment of their relative quality. Data quality assessment is a subjective process which depends on a large number of factors. One is whether the basic data are obtained from a census or a sample survey. The quality of these sources is affected by factors such as questionnaire design, response rate, editing and the degree of imputation. In the case of survey data, quality is further dependent on sample design and sample size. In addition, some statistical information is derived residually while some other is estimated.

Quality ratings are provided for the last benchmark year as noted on the following tables. Data quality ratings for previous years may be found in preceding issues of this publication; data for the period following the benchmark year are deemed to be of lesser quality although no quality rating is provided.

The quality rating for multifactor productivity at all levels of aggregation relies on the quality rating for gross output, intermediate inputs, capital, and labour, except for that of the business sector which depends on the quality rating for value-added, for capital, and for labour.

Intermediate inputs and gross output in current and constant prices and gross domestic product (GDP) carry the quality ratings described in Appendix A of *The Input-Output Structure of the Canadian Economy*, catalogue number 15-201. Capital input data quality is based on the ratings of business investment as given in the above mentioned publication. The quality ratings of employment, person-hours and labour compensation are discussed in Appendix 4 of Part 1 of this publication.

The quality ratings of basic data at the PS and PM aggregation levels (refer to Appendix 3 for more information on aggregation levels) are obtained by weighting the disaggregated quality ratings using value shares as weights. The quality assessment of multifactor productivity estimates is then based on the combined quality ratings of outputs, labour inputs, capital inputs, and, if applicable, intermediate inputs, according to their respective value shares. Quality ratings of basic data shown in text tables 1 and 2 of this appendix are rounded to the nearest highest rating to account for the quality-increasing effect of aggregation.

Text table 1

Quality ratings for the components of multifactor productivity estimates by industry at aggregation level PS and for the total business sector, 1989

Industry Title	Gross Output		Labour Inputs			Capital Inputs		Intermediate Inputs		GDP		MFP Index	
	C$	K$	C$	Pers.*	Pers. Hrs**	C$	K$	C$	K$	C$	K$	Pers.*	Pers.-Hrs.**
Agricultural & related services ind.	2	2	3	3	3	2	2	2	2	2	2	2	2
Manufacturing industries	1	1	1	2	2	1	2	1	1	1	1	1	1
Construction industries	2	3	2	2	2	2	3	3	3	3	3	3	3
Transportation & storage ind.	1	2	2	2	2	1	2	2	2	2	2	2	2
Telecommunication industries	1	1	1	1	2	2	2	2	2	1	2	2	2
Wholesale trade	1	2	2	2	2	2	2	3	3	3	3	3	3
Retail trade	1	2	2	2	2	2	2	3	3	3	3	3	3
Business sector	...	...	1	1	1	1	2	...	...	1	1	1	1

* Persons at work ** Person-hours worked

Text table 2

Quality ratings of the components of multifactor productivity estimates by manufacturing industry at aggregation Level PM, 1989

Industry Title	Gross Output		Labour Inputs			Capital Inputs		Intermediate Inputs		MFP Index	
	C$	K$	C$	Pers.*	Pers.-Hrs.**	C$	K$	C$	K$	Pers.*	Pers.-Hrs.**
Food industries	1	1	1	1	2	1	2	1	2	1	2
Beverage industries	1	1	1	1	2	1	2	2	2	1	2
Tobacco products industries	1	1	1	1	2	1	2	1	1	1	1
Plastic products industries	1	1	1	3	2	1	2	1	1	1	1
Rubber & leather	1	1	1	2	2	1	2	1	1	1	1
Textile, textile prod. & clothing ind.	1	1	1	2	2	1	2	1	1	1	1
Wood industries	1	1	1	2	2	1	2	1	2	2	2
Furniture & fixture industries	1	1	1	3	2	1	2	1	1	1	1
Paper & allied products industries	1	1	1	1	2	1	2	1	1	1	1
Printing, publishing & allied ind.	1	2	1	3	2	1	2	2	2	2	2
Primary metal industries	1	1	1	1	2	1	3	1	2	1	2
Fabricated metal product industries	1	1	1	3	2	1	3	1	1	1	1
Machinery industries	1	1	1	3	2	1	3	1	1	1	1
Transportation equipment industries	1	1	1	1	2	1	2	1	2	1	1
Electrical & electronic products	1	2	1	2	2	1	2	1	2	2	2
Non-metallic mineral products	1	1	1	2	2	1	2	1	1	1	1
Refined petroleum & coal products	1	1	1	1	2	1	3	1	2	1	2
Chemical & chemical products ind.	1	1	1	1	2	1	3	2	2	2	2
Other manufacturing industries	1	1	1	3	2	1	2	1	1	1	1

* Persons at work ** Person-hours worked

APPENDIX 5

Multifactor Productivity Estimates in CANSIM

	CANSIM Matrices
Indices since 1961	
Gross output productivity based on hours worked	7896
Net-gross output productivity based on hours worked	7897
Value-added productivity based on hours worked	7898
Interindustry productivity based on hours worked	7899
Gross output productivity based on employment	7900
Net-gross output productivity based on employment	7901
Value-added productivity based on employment	7902
Interindustry productivity based on employment	7903

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