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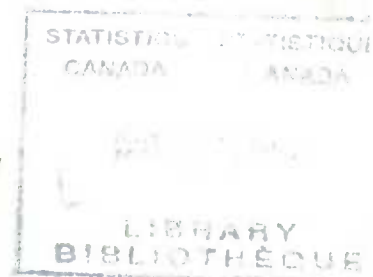
System of National Accounts

Aggregate Productivity Measures

1992

Feature Articles:

- A KLEMS Database: Describing the Input Structure of Canadian Industry
- Analysing Canadian Manufacturing Using the KLEMS

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Published by authority of the Minister
responsible for Statistics Canada

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April 1994

Price: Canada: \$40.00

United States: US\$48.00

Other Countries: US\$56.00

Catalogue No. 15-204E

ISSN 0317-7882

Ottawa

Version française de cette publication disponible sur demande
(n° 15-204F au catalogue).

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- .. 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 paper used in this publication meets the minimum requirements of American National Standard for Information Sciences - Permanence of Paper for Printed Library Materials, ANSI Z39.48 - 1984.



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).

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Introduction

This issue of *Aggregate Productivity Measures* introduces a number of changes to the presentation of the estimates. Multifactor productivity indices, being a more comprehensive measure of productive efficiency, are now published in the first section of the publication, followed by labour productivity and related data in the second section. The change in the order of presentation is intended to provide a new perspective to users of this publication, conveying the notion that overall, or multifactor, productivity measures are a superior alternative relative to labour productivity as indicators of overall productive efficiency. This, of course, does not detract from the usefulness of labour productivity as a partial productivity indicator. It simply points out that labour productivity, like other partial productivity ratios that can be calculated, reflect not only the productivity of the work force but also the effect of other factors, such as the capital intensity of production. Its use as an overall efficiency indicator should be made only after acknowledging the influence of these other factors.

Multifactor productivity, labour productivity and related data now incorporate revisions due to completion of 1989 final and 1990 preliminary input-output benchmark tables, as well as consequent revisions to 1989-1992 compensation and real GDP data.

The multifactor productivity estimates now include two new industries, for a total of 112 business sector industries. These new industries are disaggregations of previously existing ones. The Rubber and Footwear Industry was split into the Rubber Products Industry and the Footwear Industry. Similarly, the Clothing Industries excluding Hosiery now excludes the Broad Knitted Fabric Industry which is shown separately. The industry breakdown was made in order to have as many industries in the multifactor productivity database as in the Input-Output tables. As a result, and for the manufacturing industries only, the aggregation level PM in multifactor productivity now agrees with aggregation level M in the Input-Output tables. In addition to these, some other changes were made. The Labour Productivity estimates now includes a breakdown of the Wholesale and Retail Trade Industries into its two components, the Wholesale Trade Industry and the Retail Trade Industry.

Because labour and multifactor productivity share many common elements, appendices describing definitions, sources of data, data quality, aggregation parameters and Cansim matrix numbers that appeared separately for labour and for multifactor productivity indices in previous publications are now combined. The new presentation facilitates comparisons between the estimates, eliminates duplication and it shortens the publication.

Besides the Highlights section which appears in every issue of this publication, this issue also includes two feature articles. One describes the new KLEMS database which has been developed in order to facilitate analytical uses of the multifactor productivity database. Although the database itself is not part of the feature article, it is made available to users on a cost recovery basis. At the most disaggregated level, the data includes current price and constant price KLEMS inputs and output for 112 business sector industries as well as implicit input prices. These statistics are also aggregated to the PS and PM levels of aggregation (see Appendix 3 for details of aggregation levels and correspondence between levels).

The choice of five input categories in the KLEMS database (capital, labour, energy, materials and services) can be useful, for instance, to the analysis of factor intensity of production, the estimation of partial productivity ratios and the analysis of the contribution of production factors to output growth. The second feature article illustrates some possible uses of this database by looking at the Canadian manufacturing industry during the period between 1961 and 1990. The article uncovers important changes in the manufacturing industries that took place during this 30 year period as well as during each of the three decades separately.

The indices of multifactor productivity presented in Part I are calculated under two alternative activity concepts: industry productivity and interindustry productivity. The estimates of industry productivity are produced under alternative output concepts while the concept of output used in the interindustry measure is industry gross output. The output concepts used in industry productivity are gross output, net-gross output and value-added (the reader may consult Appendix 1 for definitions of these concepts). However, not all output concepts are used at all levels of aggregation. For example, at the most disaggregated level and at the PM and PS levels of aggregation, multifactor productivity is calculated on gross output and net-gross output. Business sector multifactor productivity is calculated only for value-added output while manufacturing productivity is calculated based on the three output concepts.

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

The concerns we raised last year about relative trends in productivity and unit labour cost in Canada and the United States remain despite a net improvement in this area. In 1992, productivity improved in Canada with the start of the economic recovery. Reinforced by reduced wage inflation, this improvement in productivity led to a substantial slow-down in unit labour cost growth. Moreover, revisions made to U.S. data also contributed to improve Canada's relative position. Nevertheless, a reduction in the exchange rate was the principal cause in an improved competitive position of Canada relative to the United States.

The following paragraphs examine these recent trends within the framework of the last decade for the Canadian business sector and manufacturing industries successively.

1 - Business Sector

1.1 - Highlights for 1991 and 1992

According to revised estimates, business sector multifactor productivity improved in 1992, showing a 0.4% gain. Even if modest, it was the first gain since 1987. This favorable upturn coincident with a minor recovery in economic activity, has been mainly achieved through a drop of 1.0% in the labour input.

Furthermore, labour productivity (real GDP per hour worked) increased from 1.7% in 1991 to 2.1% in 1992, while inflation in hourly compensation declined significantly from 5.1% to 3.8%. This increase in labour productivity and decline in hourly compensation contributed to a substantial decline in the growth of unit labour costs from 3.4% in 1991 to 1.7% in 1992. The growth rate of unit labour cost continued on a downward trend that began in 1989, reaching the lowest growth rate since 1984, when it increased by 1.5%.

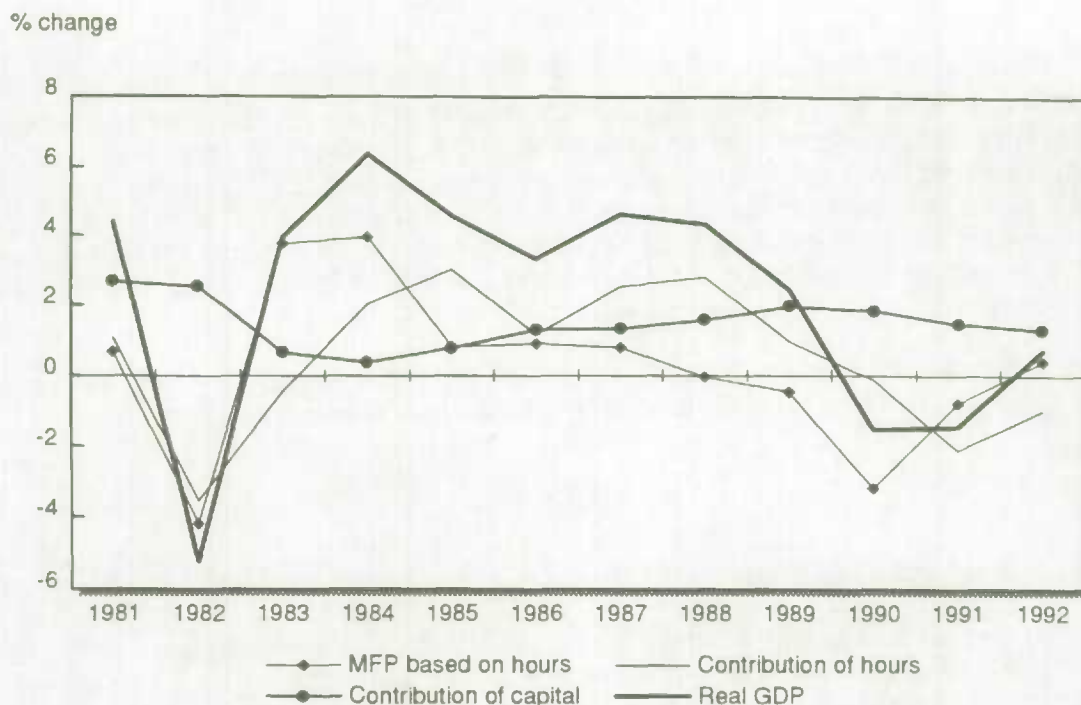
1.2 - Trends During the 1982-1992 Period

Taking a long run perspective, figure 1 traces the sources of growth (capital, labour and multifactor productivity) of the business sector real value added over the course of the last 11 years. During that period, output grew by 30.5% with labour contributing one third towards this growth, and capital and productivity contributing respectively 45% and 22%.

However, the contribution of productivity to output growth was partially hidden by important cyclical fluctuations over that period as output grew short of its potential. While the fluctuations in hours worked were synchronized with those of real GDP, the cyclical movement of the capital stock exhibited a lag of about one year compared to real GDP. The continuous increase in capital during the trough and slow-down in GDP growth had a negative impact on the measure of multifactor productivity during this period which would be reversed if the recovery were to gain strength and output were to come closer to its potential.

Figure 1

Sources of the growth in business sector real GDP, 1981-1992



1.3 - Canada-United States Comparison of Labour Productivity and Unit Labour Cost¹

When expressed in their own currencies, the growth of unit labour cost in Canada was identical, at 1.7%, to that in the U.S. in 1992. This result comes from better U.S. productivity performance (3.3%) relative to Canada (2.1%) and from milder wage inflation in Canada (3.8%) than in the U.S. (5.1%).

However, in order to analyze the competitiveness of Canadian products on foreign markets, it is more appropriate to examine unit labour cost in a common currency because it takes into account variations in relative currency values². The 5.2% depreciation of the Canadian dollar in relation to the U.S. in 1992 resulted in the first improvement of the competitiveness of the Canadian business sector in the North American market since 1986. Indeed, expressed in U.S. dollars, unit labour costs in the Canadian business sector declined 3.6% while its U.S. counterpart increased 1.7%.

1. As in recent years, the highlights intend to compare the relative performance of Canada with that of the United States. Unfortunately, this comparison remains limited to labour productivity data; the Americans have not yet completed the in-depth revisions to their multifactor productivity estimates. U.S. data are published by the Bureau of Labor Statistics.
2. A measure based on the purchasing power parity of industries' gross outputs would be preferable but, unfortunately, it is only available for final demand at this time.

The 1992 improvement occurred after five annual increases in the unit labour cost of Canadian products relative to that of U.S. products. During that period, the gap between these rates of increase in costs varied between 7.3% in 1987 and 1.5% in 1991, reaching a peak of 10.3% in 1988.

Figure 2

Annual growth in business sector unit labour cost in Canada and the United States, 1981-1992

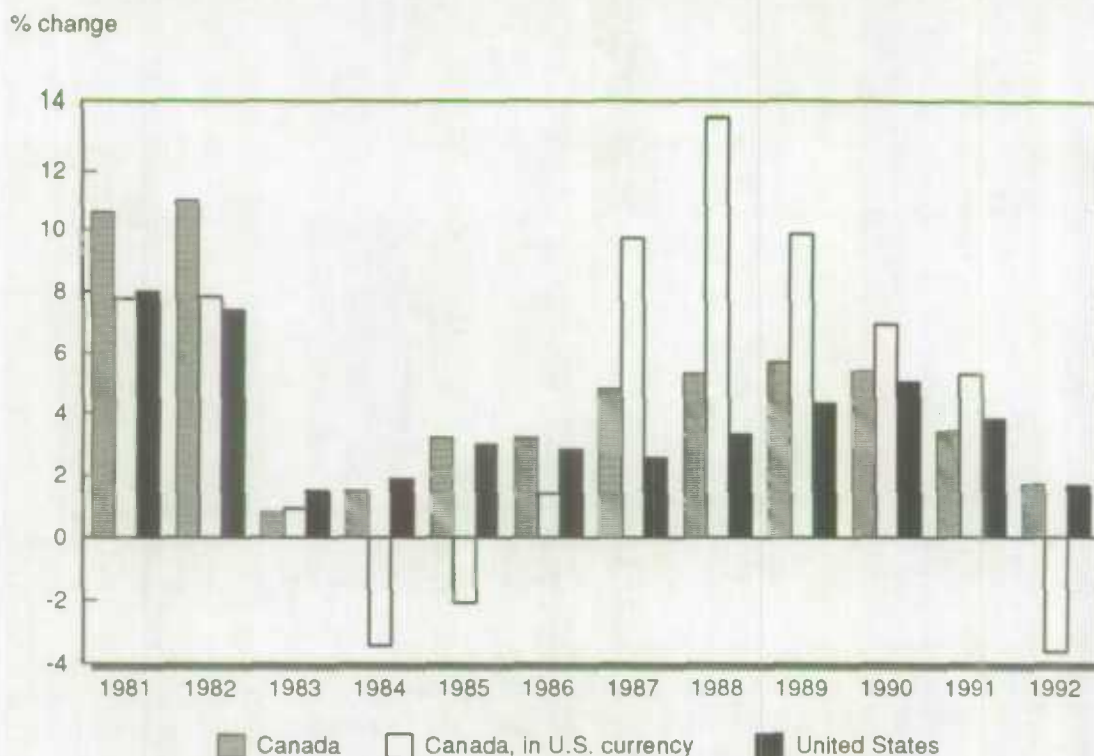
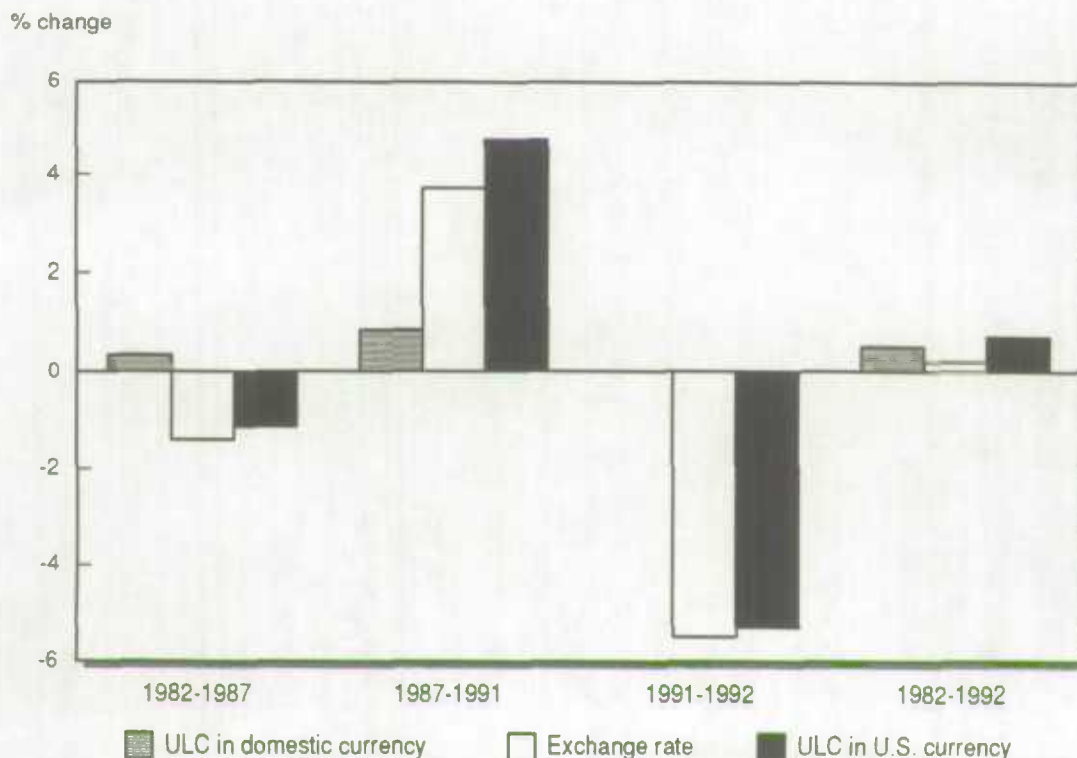


Figure 3 shows the differences between the growth of unit labour costs of Canada and United States over the period 1982-1992 in domestic and U.S. currency. This time frame has been divided into three periods marked by the two turning points in relative unit labour cost in 1987 and 1992. It appears from the figure that fluctuations in the exchange rate during each of these periods were the main, if not the only, factor influencing the gap between the unit labour costs of Canada and the United States.

It is interesting to note that, during the period spanning 1982-1992, labour productivity increased at 1.5% annual rate in both countries. The annual growth in unit labour costs was slightly higher in Canada by 0.7%. To a large extent, wage rates determined the relative evolution of unit labour costs between the two countries, given that the 1992 exchange rate was close to the 1982 rate. Hence, even though the variations in the exchange rate had only a minor impact over the longer term, they have been a dominant factor in the relative unit labour costs between Canada and the U.S. over the short term.

Figure 3

Differences in the growth of business sector unit labour cost between Canada and the United States



As can be seen in Figure 4, in addition to the recession that has also affected the United States, the relative rise in unit labour costs appears to have had a negative impact on Canadian exports to the U.S. The share of Canadian exports in GDP gradually increased on average by 8.1% per year between 1982 and 1985, declined by 3.5% annually between 1986 and 1991 and grew by 11.5% in 1992. Given that 75% of Canadian exports are shipped to the U.S., this decline in exports to the U.S. implied a slow-down in the foreign demand for Canadian products between 1986 and 1991.

2 - Manufacturing Industries

2.1 - Highlights for 1991 and 1992

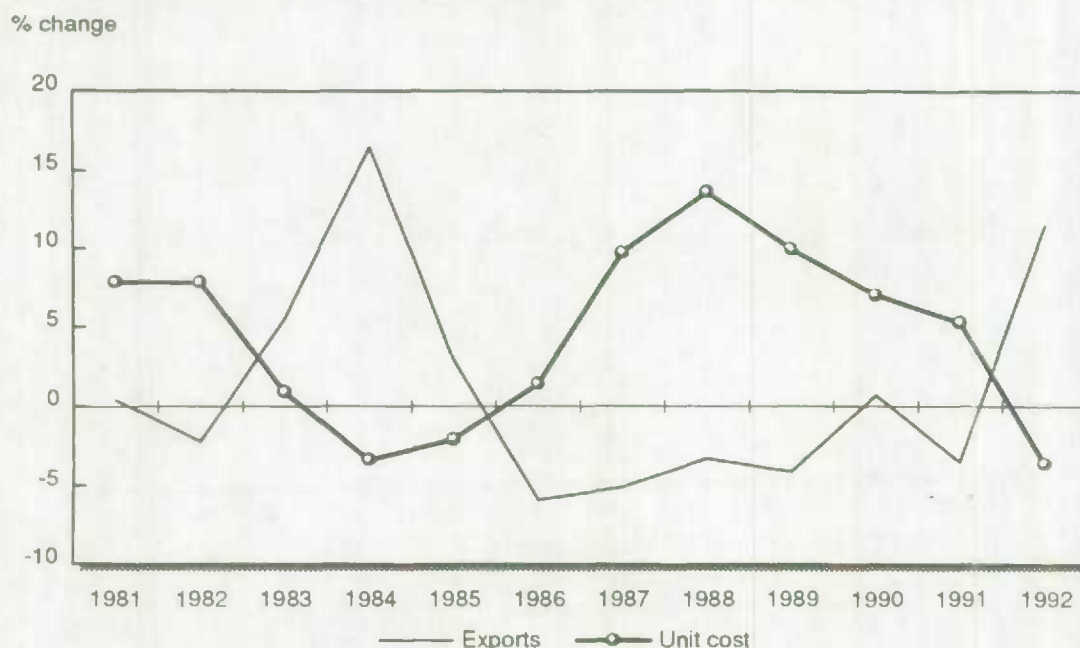
Multifactor productivity increased 1.6% in 1992 after declining 2.8% in 1991. The 1992 productivity gain was due mainly to a rationalization of inputs, which declined 1.4% while output increased 0.2%. Despite this recovery, the level of productivity in 1992 was only slightly above the 1983 level.

Similar to the business sector, there were favorable changes in labour productivity and wage inflation in manufacturing industries in 1992. Labour productivity increased 3.8% in 1992, a substantial improvement over the 1.5% gain recorded in 1991 and the largest since 1984. In the same vein, the 6.6% increase in hourly compensation in 1991 subsided somewhat in 1992 to

5.1%. Supplementary labour income accounted for 35% of the increase in wage inflation in 1992, even though it represented only 14% of labour compensation.

Figure 4

Annual percentage change in merchandise exports to the U.S. as a percentage of GDP and Canadian unit labour cost in U.S. currency, 1981-1992



2.2 - Trends During 1982-1992 Period

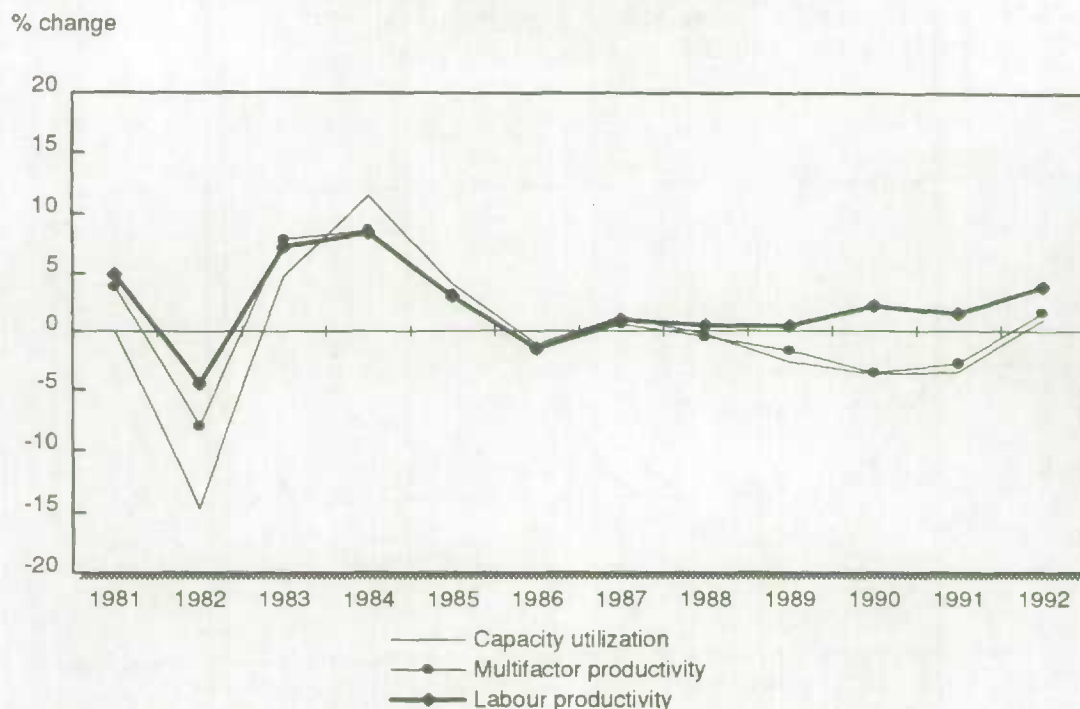
The analysis of multifactor productivity estimates for the manufacturing industries tend to confirm the fact that Canada began to feel the effect of a strong slow-down in the demand for its products beginning in 1986-1987. Indeed, multifactor productivity in these industries declined for the first time in 1986, increased slightly in 1987 (0.6%) and then declined for four consecutive years before advancing 1.6% in 1992.

As figure 5 demonstrates, the indicator of industrial capacity utilization shows that the productivity decline observed since 1986 coincides with significant underutilization of productive capacity. This figure also shows that the multifactor productivity measure remains particularly sensitive to economic cycles, more so than that of labour productivity. This occurs despite the correction to capital input, made solely for changes in capacity utilization. The slow-down in machinery and equipment investment observed after 1989 suggests a slower growth for the capital stock in the next few years and a recovery in multifactor productivity. This can already be observed from the upturn of productivity in 1992.

This phenomenon is due to the different behaviour of labour and capital in the short term. The cyclical variation in labour productivity are less pronounced simply because the labour input is relatively less fixed over the short run than capital. It follows that labour productivity did not decline except in 1986, that it increased slightly between 1987 and 1989 and that it increased at a rate resembling its long term rate after the beginning of the 1990 recession.

Figure 5

Annual growth in multifactor productivity, labour productivity and in the rate of utilization of industrial capacity - manufacturing industries, 1981-1992



It is interesting to compare the performance of the manufacturing industries during the last recession with that of the 1982 recession. After growing by 4.3% in 1981, real GDP declined by 5.6% in 1982. This abrupt reduction in a short period of time led to the sharp decline in the two productivity measures, as companies did not have sufficient time to adjust their inputs. In contrast, the more recent output decline was much more gradual, allowing manufacturing companies enough time to reduce their labour inputs in proportion to the reduction in their output. The adjustment on the side of capital needs was delayed but began to appear in the early 1990s.

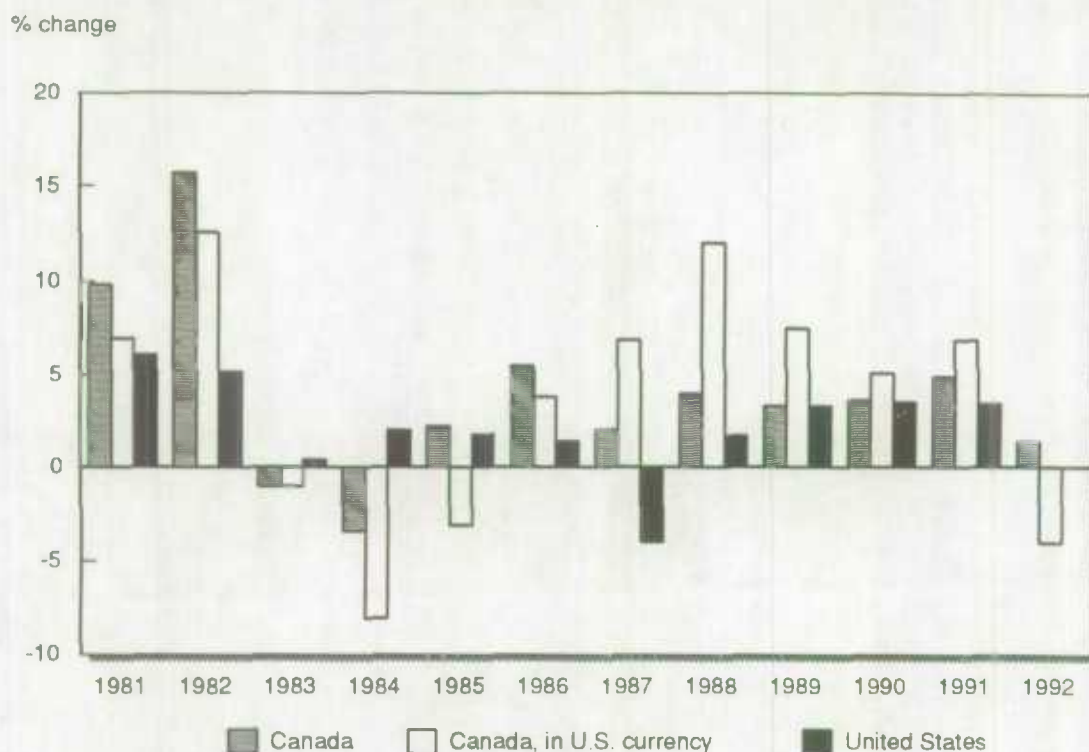
2.3 - Canada-United States Comparison of Labour Productivity and in Unit Labour Cost

Due to the depreciation of the Canadian dollar in 1992, manufacturing businesses improved their unit labour costs in relation to those of the United States. Indeed, the unit labour cost index calculated in U.S. dollars decreased by 4 percentage points in Canada while remaining unchanged in the U.S. However, measured in own currency, Canadian unit costs showed an increase of 1.2%.

The stability of unit labour cost in the United States stemmed from more favorable changes in U.S. productivity and labour income. Labour productivity growth while strong at 3.8% in Canada, still fell short of that in the U.S. at 4.3%. Similarly, although Canadian average hourly compensation slowed down to 5.1% in 1992, it increased only 4.4% achieved south of the border.

Figure 6

Annual growth in manufacturing unit labour cost in Canada and the United States, 1981-1992



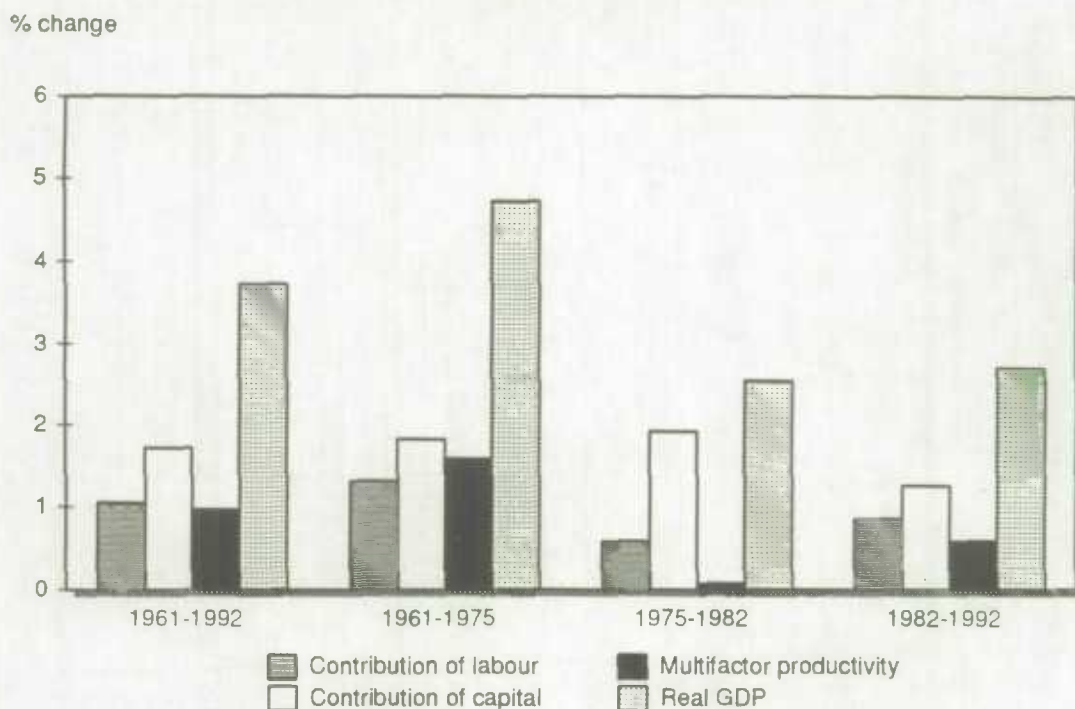
As in the business sector, the improvement in unit labour cost for manufacturing industries in Canada relative to the U.S. was a welcome relief after six years of deterioration of the competitive capacity of Canadian manufacturers. During the 1986-1991 period, a unit labour costs gap developed in favor of the U.S., growing approximately 4.0% a year.

3 - Conclusion

Given that the manufacturing industries contributed about 55% of business sector multifactor productivity growth, it is not surprising to find that aggregate productivity evolved in a similar fashion to manufacturing productivity during the last 10 years. Thus, the decline in manufacturing productivity that was first discernible in 1986, only became clear with a one year lag at the aggregate business sector level. The latter reached a peak in 1986, slowed down slightly in 1987, before declining over the next four years between 1988 and 1991. Similarly, the progress made in manufacturing industries in 1992 contributed to the overall business sector multifactor productivity gains.

Figure 7

Contribution of labour, capital and multifactor productivity to the growth of real GDP, business sector, 1961-1992



The 1982-1992 period has been characterized by two important recessions, an abrupt but short-lived slow-down in GDP in 1986 and substantial volatility in the exchange rate with respect to the U.S. currency. All these fluctuations forced businesses to continually adjust their production levels and this likely had a negative impact on their degree of technical efficiency. Figure 7 demonstrates this reduction in technical efficiency by showing a 50% reduction in the annual average growth rate of multifactor productivity during the 1982-1992 period in relation to an annual average growth of 1.0% observed during the 1961-1992 period. Furthermore, one can observe that real GDP growth, after 1975, was 45% below its average growth between the years 1961-1975. This relatively low growth in production was accompanied by a retraction in multifactor productivity.

FEATURE ARTICLE 1

A KLEMS Database: Describing the Input Structure of Canadian Industry

by Joanne Johnson¹

1 - Introduction

Industrial restructuring, globalized trade, capital intensity, labour hoarding, energy crises, technological advance; these are terms commonly used in newspapers, business seminars, and political debates. They share the common theme of describing industry: how it works, the shocks it sustains, how it adapts to a changing environment. All of these terms are related to the question: What is the make-up of the industrial sector? This question falls naturally into two parts: What does the business sector produce? And what does the business sector use?

This paper describes the KLEMS database - industry data on total output, total input, and major categories of inputs: capital (K), labour (L), energy (E), material (M) and service (S) - that is being offered to illustrate what the business sector uses. Information on industries' output and inputs according to these broad categories affords the opportunity for analysing many attributes of business' input make-up and efficiency in the use of those inputs.

The KLEMS database is useful because it enables users to manipulate a manageable amount of data which covers the range of costs faced by businesses. The Input-Output tables provide detailed commodity information, which is useful for gaining an understanding of the inputs and outputs for individual industries, but is too detailed to permit an evaluation of industry structure through time or across industries with relative ease. Similarly, summary capital and labour input estimates, while certainly less cumbersome to deal with, account for less than half of businesses costs. Intermediate input costs make up the bulk of businesses costs. While the types of intermediate inputs are quite varied, they can be classified into three relatively homogeneous groups: energy, materials and services. This affords one the opportunity to work with a reasonably small amount of data, while still preserving many of the distinctive features of these inputs.

This database permits in-depth answers to questions on the structure and adaptation of industry. For example, do increases in capital primarily result in decreases in labour, or are they more often energy saving? Similarly, increased globalized trade, and the corresponding reduction in tariffs and quotas, begs the question of how the make-up of inputs have changed: have reductions in tariffs on U.S. steel led to the substitution of imported steel for Canadian workers? How do industries adapt to relative price changes, both in the short run and in the long run, such as those of the energy crises in 1973 and 1979 and the drastic fall in energy prices in 1986? To

1. I would like to thank all members of the Productivity Section who assisted in this study. I would especially like to thank Aldo Diaz and René Durand for their extensive assistance, and Jean-Pierre Maynard, Erik Poole and Jody Proctor for their helpful comments. Finally, I would like to thank Nicole Richer for her extensive time and help in the preparation of this article.

answer these questions and gain a complete understanding of the input structure of Canadian industry one must ask: How much, in terms of quantity and value, is being used of various types of inputs and how have the relative prices of these inputs changed through time?

In addition to providing a better basic understanding of use of inputs by industry, information on critical inputs would permit a more sophisticated analysis of the efficiency of that use. Multifactor productivity (MFP) estimates are useful for analysing the performance of industry as a whole, but they do not provide insight on the underlying growth in inputs associated with changes in MFP. Data on energy, materials and service inputs would permit analysis of productivity growth similar to that in the U.S. For example, Norsworthy² has suggested that slower capital formation has been responsible for a slowdown in productivity from 1973 to 1981 in the U.S. Jorgenson³ also asserts that higher material prices tend to be associated with increases in productivity growth, but high energy prices lead to productivity decline and were responsible for the slowdown. However, Olson⁴ has pointed out that energy cost shares are very small and not likely to account for a large portion of the slowdown. Thus, in order to determine the forces that affect productivity, a richer set of data pertaining to the production function - one that includes energy, materials and service inputs - is necessary.

Another major asset of this database is that it enables a better understanding of labour productivity estimates. Labour productivity estimates, which are valuable for determining how much is produced by workers in Canada, can be misleading if the user is not fully cognizant of the fact that this ratio may increase for a variety of reasons completely unrelated to workers' abilities and efforts. Partial productivity estimates for each category of inputs would provide an indication of some of the causes of changes in labour productivity, i.e. changes in the use of capital, energy, materials or services in production. Thus, partial productivity estimates by broad input categories afford the opportunity for a better understanding of labour productivity and MFP estimates.

The purpose of this paper is to describe how the KLEMS database is generated and what is available to users. Section 1 describes data sources and input commodity classifications. Section 2 explains the various types of estimates available (ie. quantity, price and productivity estimates generated according to the Törnqvist, Laspeyres, Paasche and Fisher index formulas). Section 3 reviews the industry coverage and the differences in the treatment of industries that users should be aware of. Finally, some potential uses of the KLEMS database are cited.

2 - Data Sources

The KLEMS database is derived entirely from the multifactor productivity database. Conceptually, the two databases are the same; output values represent the amount paid to firms and thus include subsidies but exclude taxes, while input costs represent the full cost - including all applicable taxes and subsidies - of using each commodity. All input and output values are given in both current and constant prices. The only difference between the two databases is that the productivity database includes detailed commodity data (602 commodities prior to 1987 and

2. Norsworthy, et. al., "The Slowdown in Productivity Growth." *Brookings Papers on Economic Activity*. 1979:2.

3. Jorgenson, D. W., "Energy Prices and Productivity Growth." *Productivity Prospects for Growth*. J. M. (ed.) New York: Von Nostrand Reinhold, 1981.

4. Olson, M., "The Productivity Slowdown, the Oil Shocks and the Real Cycle." *Journal of Economic Perspectives*. Fall, 1988.

485 thereafter), whereas in the KLEMS database, output commodities are combined into one series and input commodities are grouped into five broad categories.

The current price productivity database is derived from the current price Input-Output tables, which delineate the inputs used and outputs sold by each industry. These values are generated by combining elements of the Input-Output tables to calculate the full cost (including all taxes and subsidies for inputs and subsidies only for outputs) of each of the commodities⁵. Readers should note that the current price capital input (as derived from the Input-Output tables) is an estimation based on what the industry would charge itself for using its own capital assets. This is assumed to be the income generated from those capital services, which is the residual income after paying for all other input costs. For further details on how this transformation is performed refer to the appendices at the back of this publication.

The second type of values in the productivity database, the constant price values, serve as estimates of the quantities, since they are calculated as the value of commodities, after removing the effects of nominal price changes. The constant price values of intermediate inputs and all outputs are taken from the Input-Output tables, as in the case of current price values. However, the quantity estimates for capital and labour input are derived from other sources. The constant price values of capital input are derived from data on capital stock owned by industries. In contrast to the measurement of output and other inputs, labour hours are used as quantity estimates rather than constant price values. Labour hours are derived from a combination of surveys⁶. Once again, the sources and manipulation of the data are explained in greater detail in the appendices in this publication.

The KLEMS database is generated from this productivity database. The first component of the KLEMS, gross output, is produced by aggregating all output commodities. The next two components, capital and labour inputs, are single elements in the productivity database, and are taken as such. The last three categories, the intermediate inputs, are generated by combining elements of the productivity database into three groups.

Intermediate commodities are allocated among three classifications of inputs: energy, materials, and services. Energy commodities are fuel and electricity consumed by the establishment for energy purposes only. Any fuel purchased as an input material or for any other non-energy purpose is included in the materials category. In general, material inputs are commodities that can be held in inventory by the producer, while service inputs correspond to actions performed by producers. For example, a producer can hold an inventory of ingots, but can not hold an inventory of laundry, cleaning and pressing services; it can only perform the service of cleaning and pressing the laundry. For an explicit mapping of commodities to categories, refer to the appendix of this article.

5. The Input-Output tables are available at both producer and purchaser prices. Producer prices are the prices received by the sellers at the boundary of their establishment. Purchaser prices correspond to the market price at the point of delivery. This market price valuation includes two components in addition to the price of the commodity bought: taxes and margins. Margins are payments for other real services, such as retail, wholesale and transportation services that were distinct from the purchased commodity. Given that these margins are distinct from the commodity, the producer price values are used to generate the MFP database.

6. For a detailed description of how the estimates of hours worked were generated, refer to Jean-Pierre Maynard, "Multifactor Productivity based on Hours Worked" *Aggregate Productivity Measures*, second 1991 edition, Catalogue 15-204E., pp. 39-49.

3 - Calculation of the Estimates

The KLEMS database contains four series of estimates for each industry: current price values, volume indices, price indices and productivity indices.

The *current price values* for each of the categories are calculated by summing the current price values for all the commodities of each category.

Volume indices are estimates of the growth in the quantities of some group of commodities. In order to satisfy the needs of various users, the KLEMS data are presently generated using four different formulas for calculating a volume index: the Törnqvist, the Laspeyres, the Paasche and the Fisher Ideal. Each of these formulas are presented in the box to the right.⁷

The Törnqvist volume index is generated in several steps. First, the growth of each commodity within each component of the KLEMS is calculated. Second, these growth rates are weighted according to each commodity's average value share within that component, and summed together. Third, these estimates of the quantitative growth of each component are transformed into indices with base year values set equal to one hundred.

The Laspeyres volume index is calculated by dividing the value of all inputs used in the current year, measured in the previous years prices, by the value of inputs in the previous year, also measured in the previous years prices. On the other hand, the Paasche index is generated by calculating the value of goods in the current and previous year in the current years' prices. The Fisher Ideal index is simply a geometric average of the two.

QUANTITY INDICES

The Törnqvist volume index is a geometric weighted average of the ratios of the current and previous year's quantities

$$T_Q = \prod_{i=1}^n (Q_{1i}/Q_{0i})^{w_i}$$

which can also be expressed as

$$\ln(T_Q) = \sum_{i=1}^n w_i \ln(Q_{1i}/Q_{0i})$$

where i = commodities 1 through n

w_i = average value shares at time 0 and 1

The Laspeyres volume index is an index of the growth in quantities valued in the previous year's prices

$$L_Q = \frac{\sum_{i=1}^n (P_{0i} Q_{1i})}{\sum_{i=1}^n (P_{0i} Q_{0i})}$$

The Paasche volume index is an index of the growth in quantities valued in the current year's prices

$$P_Q = \frac{\sum_{i=1}^n (P_{1i} Q_{1i})}{\sum_{i=1}^n (P_{1i} Q_{0i})}$$

The Fisher Ideal volume index is a geometric mean of the Paasche and Laspeyres indexes

$$F_Q = (L_Q * P_Q)^{1/2}$$

PRICE INDICES

Value, volume and price indexes are related by the identity

$$V_1/V_0 = \frac{P_1}{P_0} \frac{Q_1}{Q_0}$$

Hence, all price indexes are implicitly defined as

$$P_1/P_0 = \frac{V_1}{V_0 (Q_1/Q_0)}$$

7. For a description of the properties of index numbers, see W. E. Diewert, *Index Numbers*, The Palgrave Dictionary of Economics, John Eatwell, et. al. (ed.) London: The MacMillan Press Limited, 1987. pp. 766-779.

The Törnqvist index formula has been used in the MFP estimates. One of the most attractive features of the Törnqvist formula is that it corresponds exactly to the translog production function, which is a general functional form (i.e. it does not require any restrictive assumptions about factor shares, whereas the Laspeyres and Paasche do).

All volume indices are calculated in a bottom-up fashion; they are initially estimated at the most disaggregated industry level, then weighted according to their contribution to the aggregated industry, and finally summed together⁸.

All the *price indices* are derived implicitly from the volume indices and the current price values. To begin, an estimate of the constant price value of each component is computed. This is arrived at by multiplying the base year current price value by the volume index. This produces an estimate of the annual quantities in base year prices. The price indices are subsequently derived by dividing current price values by the constant price values.

The price of capital services is peculiar in the sense that it is a residual ex post (after the fact) price - rather than an ex ante (before the fact) price. Hence, the volume of capital services are assumed to be proportional to the stock of capital given by the net-end-of-previous-year capital stock, valued in constant prices. The value of capital services, on the other hand is assumed to be equal to the residual income generated from capital services. Prices are obtained by dividing current price values by constant price values; thus, the price of capital is the generated income, divided by the real capital stock.

Output/input ratios, or *partial productivity* estimates, are also available for total inputs and each of the five input categories. These are ratios of the output volume index to the input volume index for each input category, or, equivalently, the difference between the growth of output and the growth of each category of inputs.

4 - Industry Coverage and Differences

The KLEMS data are available at the same three levels of industrial aggregation as the MFP estimates: the PS level (13 industries), the PM level (35 industries) and the PL level (112 industries). The KLEMS inputs are the inputs used by all the establishments in each industry; thus, the value of total inputs in current prices sums to the value of gross outputs in current prices.

The concept and/or the method of calculation of inputs and gross output is quite different for some service industries. For most industries, gross output is equal to the value of sales of goods and services *produced*, corrected for changes in inventories, plus any wholesale or retail margins earned on goods purchased for resale. These margins account for the better part of gross output in wholesale and retail trade (and to a lesser extent community business and personal services) industries, but only a small portion in other industries. Hence, while for most industries gross output and total sales corrected for inventory changes are very close, large margins imply a

8. Note that the Törnqvist index, as it is a geometric average, will vary if calculated in a different number of stages. Thus, the single stage Törnqvist of all inputs will not equal exactly the two stage Törnqvist of all inputs, calculated by weighting the Törnqvist indices for each of the five categories of inputs. This difference, however, is marginal. For a discussion of this topic, see W. E. Diewert, *Superlative Index Numbers and Consistency in Aggregation*, *Econometrica*, Vol. 46, No. 4 (July 1978).

concept of gross output in wholesale and retail trade industries which is closer to value added. Thus, readers should use caution when comparing these industries to others.

Gross output and inputs are also calculated differently in the financial industries. Operating surplus for all industries, except for financial industries, refers only to operating revenue. Thus, capital gains and interest earned on investments are not included in this surplus, but interest paid on borrowing is included as an expense. However, this treatment of interest payments and earnings is inappropriate for financial institutions as the interest differential is a primary source of income for these industries⁹. Hence, for financial industries, interest paid is removed as an expense, and interest earned, net of interest paid, is included in revenues received. Consequently, readers must be careful when comparing these industries to other industries that would be less affected by developments in the financial sector.

The final industries that undergo special treatment are the construction industries. All other industries are comprised of establishments engaging primarily in the same or similar types of activities¹⁰. However, for the Input-Output definition of the construction industry, construction activity is separated from all industries and transferred to the construction industry. Construction estimates further differ from other estimates in that gross output is calculated net of intra-industry sales. Therefore, the estimates for construction industries correspond only to inter-industry and final demand construction sales. In consequence, these measures are not subject to changes in the vertical integration of establishments within the industry as are those of other industries.

Readers should note that the exact concept of output has significant implications for productivity estimates. The measure of MFP in the KLEMS - gross output productivity - is estimated as the growth of gross outputs minus the growth of all inputs. In this case, the more firms buy inputs from other establishments, the more they push upstream the productivity gains associated with the production of their output. Hence, productivity gains of establishments are associated with production processes they cover. The larger this coverage (the less establishments buy from other establishments) the greater the productivity gains that accrue to them¹¹.

5 - Some Applications Using the KLEMS Database

The KLEMS data are suitable for examining a wide variety of issues. The KLEMS database is useful for demonstrating the typical costs faced by firms. For example, one can discern that over 50% of manufacturing costs are material input costs, and almost one quarter are attributable to labour. One can also see how various shocks affect the costs faced by firms. For example, continuing increases in the price of energy have pushed the share of energy costs up from 1.6% in the 1960s to 1.7% in the 1970s and 2.3% in the 1980s.

One can also use the KLEMS data to break down the changing value of inputs into quantity and price effects. For example, we can see that the constant price value of capital inputs has grown

9. For a detail explanation of how the input-output estimates are calculated for the service industries, see *Service Industries in the Canadian Input-Output Accounts*, Statistics Canada, catalogue 15-601, No. 2.

10. For a detailed explanation of how industries are classified, see the *Standard Industrial Classification, 1980*, Statistics Canada, catalogue 12-501.

11. For more details on the sensitivity of productivity measures to output, see Aldo Diaz, "Alternative Concepts of Output and Productivity", *Aggregate Productivity Measures*, 1989, Catalogue 15-204, pp. 97-106, and René Durand, "Aggregation, Integration and Productivity Analysis: An Overall Framework", *Aggregate Productivity Measures*, 1989, Catalogue 15-204, pp. 107-118.

at more than twice the rate of labour inputs, while the price of labour has grown at almost double the rate of capital. We can use the estimates of quantity and price growth rates to estimate substituting effects among inputs.

We can also use the KLEMS to gain some insight on the growth of inputs. Productivity growth implies that firms are becoming more efficient at using their inputs. Hence, the growth of each type of input can grow slower relative to output. Recalling that intermediate inputs are themselves outputs of other firms, productivity growth also implies that intermediate inputs can be offered at lower prices in times of strong productivity growth. This leads to a fall in their prices relative to the price of labour, and thus, may induce a substitution effect.

Changing levels of vertical integration in producing any given output are also evident from the KLEMS data. Thus, we may find that labour and capital inputs grow slower than output even in times of slow productivity growth, as firms continually specialize their production process.

The KLEMS data also enable one to estimate the correlation of the growth of each input with respect to productivity growth. This affords the opportunity to relate changes in productivity growth to changes in the input make-up of firms.

6 - Conclusion

This article has presented a description of the KLEMS database that is now available to users, as well as some potential uses and limitations that users should be aware of. The database contains industry data on total output, total input and each of the five input categories. The data cover the entire 1961 to 1990 time frame and will be updated annually following the release of the MFP data.

Price, quantity, value and partial productivity estimates are available at three industrial aggregation levels. User can choose estimates generated according to any of the four index formulas: the Törnqvist, the Laspeyres, the Paasche or the Fisher Ideal. The alternative indices, calculated according to these formulas, offer the user a great deal of flexibility in choosing the measures they require.

Given that the KLEMS database is generated from the database used to produce the MFP numbers, the two databases are conceptually the same. Inputs and outputs are thus valued in a fashion which is most appropriate for production analysis. Hence, the KLEMS database is suitable for analysing a wide range of issues in any business sector industry.

APPENDIX

The following table presents the commodity classifications for the energy, material and service input categories. In general, material inputs are commodities that could be held in inventory by the producer, while services are actions performed by a producer. Energy inputs are commodities such as fuel and electricity consumed by the establishment for energy purposes only.

For most industries, energy commodities are used only as a source of energy. However, in some manufacturing industries, certain energy commodities such as coal, natural gas and heavy fuel oil may be used as material inputs, rather than as a source of energy. Thus, in order to generate a KLEMS database based on use of inputs, energy commodities are allocated to either energy or material use.

The input-output commodity estimates for manufacturing industries are derived from the annual Census of Manufacturers survey. The use of energy commodities is identified on this questionnaire, and thus, is used to estimate the its use as a material or energy input. This allocation is performed in two stages. First, for the 1972 to 1990 period, the detailed responses to this survey are used to calculate the value of fuels used as energy, versus material inputs. This proportion is then applied to the input-output estimate for each energy commodity.

For the 1961 to 1971 period, the detailed responses to the Census of Manufacturers survey are not available. However, estimates for total energy commodities devoted to energy use, and total material commodities, by industry, are available from this survey. This information can be used to estimate the total energy and total material use of energy commodities. This was accomplished by calculating the total value of energy commodities from the input-output tables. Then, the proportion of inputs used for energy purposes (from the Census of Manufacturers survey) was applied to this total input-output estimate. This energy use estimate was then subtracted from the input-output total to arrive at an estimate of the total material inputs. The non-energy material commodities are then subtracted from this estimate of material inputs. Thus, what remains is the total energy use of all energy commodities and the total material use of all energy commodities. This provides the breakdown for both types of use for energy inputs. The total use of each energy commodity is provided by the input-output estimate of energy inputs. With these two pieces of information, it is possible to make a reliable estimate of the proportion between energy and material use of each energy commodity.

Commodity type	Use of fuel		
	e_1	m_1	t_1
	e_2	m_2	t_2
	.	.	.
	T_e	T_m	T

This estimate was arrived at by setting up the following matrix, where the row totals (total energy use for each commodity, from the input-output tables) and the column totals (use of total fuels as energy or material inputs, from the Census of Manufacturing Survey) are known. The breakdown of use by commodity was estimated by first putting in the known proportions of energy and

material use from 1972 and 1973. Then each of the cells were recalculated such that the proportion that each commodity contributes to each type of use remained constant, but they summed to the column (use) totals. Then, the cells were recalculated such that the proportionate use of each commodity was maintained, but that these uses summed to the row (commodity) totals. This process was repeated iteratively (25 times) to arrive at a final estimate of the energy and material use of each energy commodity.

Readers will note that repair construction input commodities are classified as services, as opposed to material commodities. This is because when a firm purchases repair construction, it is purchasing the services of those in the construction industry, to fix something they own. The firm is not purchasing an existing structure held in inventory by the producer.

Historical Link Commodities (485 level)¹²

Energy Commodities

- 31 Coal
- 33 Natural gas
- 322 Gasoline
- 323 Diesel & fuel oil, aviation fuel
- 326 Other liquid petroleum gases
- 430 Electric power
- 432 Coke

Material Commodities

- 1 Cattle & calves
- 2 Hogs
- 3 Poultry
- 4 Other live animals
- 5 Wheat, unmilled
- 6 Corn, barley, other grains
- 7 Fluid milk, unprocessed
- 8 Eggs in the shell
- 9 Honey & beeswax
- 10 Fresh fruit, excl tropical
- 11 Vegetables, fresh or chilled
- 12 Hay & straw
- 13 Seeds, excl oil seeds
- 14 Nursery stock, etc
- 15 Soybeans, canola & oth oil seeds
- 16 Raw tobacco
- 17 Mink skins, ranch undressed
- 18 Raw wool
- 19 Serv incidental to agric. & forestry
- 20 Logs, poles, pilings, bolts, etc
- 21 Pulpwood
- 22 Fuelwood & other crude wood
- 23 Custom forestry
- 24 Fish & seafood, fresh, chilled
- 25 Hunting & trapping products
- 26 Gold & alloys in primary forms
- 27 Radioactive ores & concentrates
- 28 Iron ores & concentrates
- 29 Bauxite & alumina
- 30 Other metal ores & concentrates
- 31 Coal
- 32 Crude mineral oils
- 33 Natural gas
- 34 Sulphur, crude & refined
- 35 Asbestos, crude & milled
- 36 Gypsum
- 37 Salt
- 38 Peat
- 39 Clays

- 40 Natural abrasives & indust. diamonds
- 41 Other crude minerals
- 42 Sand (excl silica) & gravel
- 43 Stone, crude
- 44 Services incidental to mining
- 45 Meat, fresh, chilled, frozen
- 46 Cured meat
- 47 Prepared meat products
- 48 Animal fat & lard
- 49 Margarine & shortening
- 50 Sausage casings
- 51 Feeds from animal by products
- 52 Raw animal hides & skins
- 53 Animal by products for industrial use
- 54 Custom work, meat & food
- 55 Poultry, fresh, chilled, frozen
- 56 Milk & other dairy products
- 57 Fresh cream
- 58 Butter
- 59 Cheese
- 60 Ice cream
- 61 Mayonnaise, salad dressing & mustard
- 62 Fish products
- 63 Fruit & products, frozen, preserved
- 64 Fruit & jam in airtight cont.
- 65 Vegetables, frozen, preserved
- 66 Vegetables & juice, in airtigh cont.
- 67 Soups in airtight containers
- 68 Infant & junior foods, canned
- 69 Sauces, pickles, etc
- 70 Vinegar
- 71 Pre-cooked & frozen products, etc
- 72 Feed supplements and premixes
- 73 Complete feeds
- 74 Feeds from grain by products
- 75 Feeds from vegetable by product
- 76 Pet feeds
- 77 Wheat flour
- 78 Starches
- 79 Breakfast cereal products
- 80 Biscuits
- 81 Plain bread & rolls
- 82 Other bakery products
- 83 Cocoa & chocolate
- 84 Nuts
- 85 Confectionery
- 86 Sugar
- 87 Oil-cake feeds
- 88 Crude vegetable oils
- 89 Nitrogen function compounds
- 90 Other flours & processed grain
- 91 Maple sugar, syrup & oth syrup

¹² The Historical Link Commodity Coding Structure is used to Reconciliate the 1961-1987 (602) and 1987-1990 (627) Commodity Code Classifications

92 Prepared cake & other mixes	149 Wood chips
93 Dehydrated soup mixes & bases	150 Lumber, treated wood
94 Roasted coffee	151 Wood waste
95 Tea	152 Custom wood work & millwork
96 Potato chips & flakes	153 Plywood & veneer
97 Other food preparations & ice	154 Wood const. prod., excl. prefab. build
98 Soft drink concentrates	155 Wood prefabricated buildings
99 Carbonated soft drinks	156 Wood containers
100 Distilled alc. beverages, incl. coolers	157 Caskets & coffins
101 Beer, incl. coolers	158 Other wood products
102 Wine, incl. coolers	159 Household furniture
103 Unmanufactured tobacco	160 Office furniture
104 Cigarettes	161 Commercial, instit. & oth. furniture
105 Other tobacco products	162 Portable lighting fixtures
106 Waterproof footwear	163 Pulp
107 Passenger car tires	164 Newsprint paper
108 Truck, bus & off-highway tires	165 Other paper
109 Other tires, tubes & repair material	166 Tissue & sanitary paper stock
110 Conveyor & transmission belting	167 Wrapping & sack paper
111 Other rubber products	168 Paper board, incl. boxboard
112 Hose & tubing, mainly rubber	169 Building board & asphalt build. prod.
113 Plastic containers & closures	170 Paper & textile hygiene prod.
114 Other plastic products	171 Vanillin
115 Leather & misc. leather goods	172 Paper waste & scrap
116 Footwear, excl. waterproof	173 Vinyl floor & wall covering
117 Leather gloves	174 Paper bags, boxes, plastic bags
118 Luggage	175 Coated paper prod., incl. wallpaper
119 Handbags, wallets, etc.	176 Backed aluminum foil
120 Cotton yarn	177 Paper containers for commercial use
121 Cotton woven fabric	178 Stationery & photographic paper
122 Tire cord fabric	179 Paper end products, incl. household
123 Bedding, towels & cloths	180 Newspapers, magazines & periodicals
124 Wool & wool mix yarn & thread	181 Books, greeting cards, maps, etc.
125 Wool & wool mix woven fabric	182 Banknotes, cheques, stamps, etc.
126 Felt	183 Other printed matter
127 Man-made staple fibres	184 Advertising in print media
128 Polyamide resins, incl. nylon	185 Specialized publishing service
129 Yarn, filament & staple fibres	186 Printing plates, type, etc.
130 Tire yarn	187 Ferro-alloys
131 Fabrics, excl. cotton	188 Iron & steel ingots, billets, etc.
132 Cotton thread	189 Steel castings
133 Man-made thread	190 Steel bars & rods
134 Rope & twine	191 Flat iron & steel, incl. galv. tinplate
135 Narrow fabrics, incl. lace	192 Iron & steel railway const. material
136 Textile floor covering	193 Tar & pitch
137 Textile dyeing & finishing serv.	194 Carbon & graphite products
138 Awnings, tarpaulins, etc.	195 Oil & gas casing & drill pipe
139 Tents, sleeping bags, sails, etc.	196 Oil & gas line pipe
140 Other household textile products	197 Other iron & steel pipes & tubes
141 Other textile products	198 Other cast iron products
142 Hosiery	199 Iron & steel pipe fittings
143 Knitted fabrics	200 Nickel in primary forms
144 Knitted clothing	201 Copper primary forms
145 Clothing, excl. knitted	202 Lead in primary forms
146 Dressed furs	203 Zinc in primary forms
147 Fur apparel, incl. artificial	204 Aluminum in primary forms
148 Custom tailoring	205 Tin in primary forms & fabric. mat.

206	Precious met. in prim. forms excld gold	263	Vending machines
207	Other non-ferrous base metals	264	Computers, office mach. excl photo & fax
208	Other inorg. bases & metal. oxides	265	Aircraft
209	Metal scrap	266	Aircraft engines
210	Aluminum & alum. alloy fabricated mat.	267	Aircraft parts & equipment
211	Copper fabricated materials	268	Aircraft services & repairs
212	Copper alloy fabricated materials	269	Automobiles, incl vans
213	Lead & lead alloy fabricated mat.	270	Trucks, road tractors & chassis
214	Nickel & nickel alloy fabricated mat.	271	Buses & chassis
215	Zinc & zinc alloy fabricated mat.	272	Motor homes, motorcycles, off-hwy veh.
216	Soldering rods & wire	273	Mobile homes
217	Fabricated steel plate	274	Trailers & semi-trailers
218	Tanks	275	Truck & bus bodies
219	Power boilers	276	Motor vehicle engines & parts
220	Iron & steel structural materials	277	Motor vehicle electric equip
221	Prefab. metal bldgs & structures	278	Other motor vehicle parts
222	Other metal building products	279	Locomotive & railway rolling stock
223	Flat iron & steel, alloy, oth coated	280	Urban transit rolling stock
224	Corrugated metal culvert pipe	281	Parts for rlwy&u. trans. rollin
225	Iron & steel stampings	282	Ships, boats & parts, excl pleasure
226	Metal roofing, siding, ducts, etc	283	Ship repairs
227	Metal containers & closures	284	Snowmobiles
228	Iron & steel wire & cable	285	Pleasure & sporting craft
229	Iron & steel wire fencing & screen	286	Small hhold appliances, incl microwave
230	Chain, excl motor veh. & power trans.	287	Electric furnace&oth elect. heat equip
231	Welding rods & wire electrodes	288	Household refrigerators & freezers
232	Kitchen utensils & wire products	289	Hhold cooking equip, excl microwave
233	Hardware	290	Radio, TV, stereo, VCR & unrec. tape
234	Machine tools & accessories	291	Telephone & rel. equip, incl facsimile
235	Hand & measuring tools	292	Broadcasting & radio comm. equip
236	Scissors, razor blades, ind. cutl., etc	293	Radar & radio navigation equip
237	Hhold equip. excl range, microw. refrig.	294	Electronic equipment components
238	Other heating equipment	295	Electronic alarm & signal syst
239	Non-elect. furnaces & heat equip	296	Welding machinery & equipment
240	Oil & gas burners, etc	297	Power gen. & marine prop. eq. elect. moto
241	Commercial cooking equipment	298	Transformers, ballast & converters
242	Custom metal working	299	Industrial electric equipment
243	Iron & steel forgings	300	Batteries
244	Valves	301	Wire & cable, insulated, excl alum.
245	Plumbing fixtures & fittings	302	Aluminum wire & cable
246	Gas & water meters	303	Wiring materials & electrical meters
247	Fire fight. & traffic contr. equip	304	Lighting fixtures, bulbs & tubes
248	Control panels, regulators, etc	305	Cement
249	Firearms & military hardware	306	Lime
250	Bulldozers, farm & garden tractors	307	Concrete products, incl sand & lime
251	Other agricultural machinery	308	Ready-mix concrete
252	Bearings & power trans. equip	309	Bricks & other clay bldg. products
253	Pumps, compressors & blowers	310	Porcelain insulators
254	Conveyors, elevators & hoist. mach.	311	Ceramic household products
255	Ind. trucks & mat. handlings equip	312	Refractory products
256	Fans & air circ. units, not indust.	313	Natural stone building products
257	Pkg., air pur. & oth gen. purp. mach.	314	Gypsum building products
258	Industrial furnaces, kilns & ovens	315	Mineral wool building products
259	Industry specific machinery	316	Asbestos products
260	Power driven hand tools	317	Other non-met. mineral basic prod.
261	Refrigeration & air cond. equip	318	Glass & other glass products
262	Scales & balances	319	Gass containers

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|---|---|
| 320 Mirror & glass household products | 377 Crude vegetable materials & extracts |
| 321 Abrasive products | 378 Insecticides & herbicides |
| 322 Gasoline | 379 Adhesives |
| 323 Diesel & fuel oil, aviation fuel | 380 Catalysts |
| 324 Lubricating oils & greases | 381 Metal working industrial chemicals |
| 325 Benzene, toluene & xylene | 382 Printing & other inks |
| 326 Other liquid petroleum gases | 383 Polish, cream & wax products |
| 327 Naphtha | 384 Other oils, fats & waxes |
| 328 Asphalt & products | 385 Aircraft & naut. navig. instr., excl. radio |
| 329 Petrochemical feed stock | 386 Scient., measuring & medical instr. |
| 330 Fertilizers, excl. nitrogenous | 387 Industrial safety equipment |
| 331 Polymers | 388 Watches, clocks, etc. |
| 332 Cellulosic plastic film & sheet | 389 Photographic & photocopy equip. & film |
| 333 Monoethylene glycol | 390 Jewelry, metal tableware, etc. |
| 334 Pharmaceuticals | 391 Brooms, brushes, mops, etc. |
| 335 Paints & related products | 392 Bicycles, baby carriages & strollers |
| 336 Refined vegetable oils | 393 Recreational equipment |
| 337 Oral care products | 394 Toys & games, incl. electronic |
| 338 Soaps, detergents & oth. cleaning prod. | 395 Impregnated & coated fabrics |
| 339 Other industrial chemical prep. | 396 Floor & wall covering, excl. vinyl |
| 340 Pers. care prod., bleach, fabric soft. | 397 Advertising goods |
| 341 Chlorine | 398 Shades & blinds |
| 342 Oxygen | 399 Fur dressing & dyeing services |
| 343 Phosphorous | 400 Custom work, miscellaneous |
| 344 Other chemical elements | 401 Animal hair, feathers, etc. |
| 345 Sulphuric acid | 402 Other metal end products |
| 346 Other inorg. acids & oxygen comp. | 403 Sewing needs |
| 347 Ammonia | 404 Recordings, musical instr. & art. supply |
| 348 Caustic soda | 405 Art & decor. goods, misc. end prod. |
| 349 Sodium chlorate | 430 Electric power |
| 350 Sodium phosphates | 432 Coke |
| 351 Sodium carbonate | 433 Water, waste disp. & other utilities |
| 352 Other metallic salts & peroxy salts | 464 Spare parts & maint. suppl. mach. & equip. |
| 353 Other inorganic chemicals | 465 Office supplies |
| 354 Ethylene | 466 Cafeteria supplies |
| 355 Butylenes | 468 Laboratory equipment & supplies |
| 356 Butadiene | 471 Raw cotton |
| 357 Styrene | 472 Natural rubber & gums |
| 358 Vinyl chloride | 473 Raw sugar |
| 359 Other hydrocarbons & derivatives | 474 Cocoa beans |
| 360 Methyl alcohol | 475 Coffee, not roasted |
| 361 Other alcohols & derivatives | 476 Tropical fruit |
| 362 Others, alcohol peroxides, etc. | |
| 363 Other phenols, aldehydes & ket. | |
| 364 Organic acids & derivatives | |
| 365 Organic-inorganic compounds | |
| 366 Other organic chemicals | |
| 367 Titanium dioxide | |
| 368 Carbon | |
| 369 Pigments & dyes | |
| 370 Nitrogenous fertilizers | |
| 371 Synthetic rubber | |
| 372 Antifreezing preparations | |
| 373 Additives & automobile chemicals | |
| 374 Rubber & plastic compounding agents | |
| 375 Explosives & non-military ammo. | |
| 376 Military ammo. & ordinance | |
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- | | |
|----------------------------|---------------------------------------|
| Service Commodities | |
| 406 | Repair construction |
| 407 | Residential construction |
| 408 | Non-residential building construction |
| 409 | Road, highway & airport construction |
| 410 | Gas & oil facility construction |
| 411 | Dams & irrigation projects |
| 412 | Railway & telecommunications const. |
| 413 | Other engineering construction |
| 414 | Air transportation |
| 415 | School bus & other transport |
| 416 | Other serv. incidental to transport |

417	Water transportation	445	Education services
418	Serv incidental to water transort	446	Hospital services
419	Railway transportation	447	Other health & social services
420	Truck transportation	448	Motion picture prod., dist. & exhibit.
421	Bus transport, interurban & rural	449	Other recreational services
422	Urban transit	450	Professional serv to bus. management
423	Taxicab transportation	451	Advertising services
424	Pipeline transportation	452	Laundry, cleaning & pressing services
425	Highway and bridge maintenance	453	Accommodation services
426	Storage	454	Food services
427	Radio & television broadcasting	455	Serv margin on alcoholic beverages
428	Telephone & other telecommunications	456	Personal services, incl childcare
429	Postal services	457	Photographic services
431	Gas distribution	458	Services to buildings & dwellings
434	Wholesaling margins	459	Computer services
435	Repair service for mach & equip	460	Other services to business & persons
436	Rental of office equipment	461	Rental of automobiles & trucks
437	Retailing margins	462	Trade association dues
438	Imputed service, banks	463	Rental, oth mach & equip incl const.
439	Other finance & real estate services	467	Transportation margins
440	Insurance & workers' compensation	469	Travelling and entertainment
442	Cash residential rent	470	Advertising & promotion
443	Other rent		

FEATURE ARTICLE 2

Analysing Canadian Manufacturing Using the KLEMS

by Joanne Johnson¹

1 - Introduction

Industrial restructuring has become a common place phrase in recent literature. It refers to the organization of business; their input make-up, the business size, and the range of their production processes. This paper utilizes the KLEMS database (industry data on total output, and capital, labour, energy, material and service inputs) to examine how the structure of manufacturing industries has changed over the past thirty years, as plants have adapted their input mix in response to various short run shocks and long run trends².

More specifically, we will attempt to illustrate the typical costs faced by establishments engaged in manufacturing. We will also discuss the real growth of output, productivity and each of the inputs, and demonstrate the inter-relation between fluctuating output growth, varying rates of technological progress, and changing relative prices, with respect to the quantitative growth of each of the inputs. In addition to discussing the use and change therein of each of the inputs, we will attempt to give the reader a picture of the nature of the inputs - fixed versus variable - used by establishments. The final element to the discussion of change and adaptation is the homogeneity of these phenomena among manufacturing industries.

2 - Input Value Shares

Material inputs dominated input costs, accounting for slightly more than half of all manufacturing costs during the 1961 to 1990 period, as Figure 1 illustrates. Labour input costs, at almost 23% were the next largest contributor. Service and capital inputs each accounted for approximately one eighth of total costs, while energy inputs made up the smallest proportion at less than two percent.

Material shares, while highest among all input shares in all but one of the 21 Canadian manufacturing industries, varied considerably among industries, ranging from a high of 77% in the refined petroleum and coal products industries to a low of 29.2% in the printing, publishing and allied industries. Similarly, labour shares stretched across a broad spectrum, reaching as

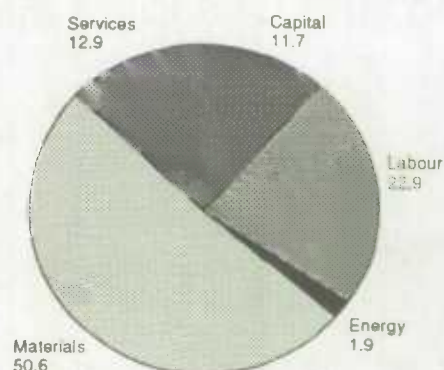
1. I would like to thank all members of the Productivity Section who assisted in this study. I would especially like to thank Aldo Diaz and René Durand for their extensive assistance, and Jean-Pierre Maynard, Erik Poole and Jody Proctor for their helpful comments. Finally, I would like to thank Nicole Richer for her extensive time and help in the preparation of this article.

2. The KLEMS database is described in detail in J. Johnson, "A KLEMS Database: Describing the Input Structure of Canadian Industry" in this publication, p. 19. The article will use the quantity, price and partial productivity estimates derived using the Törnqvist index formula.

high as 39.0% in the printing, publishing and allied industries and as low as 5.6% in the refined petroleum and coal products industries. Capital shares varied much less among industries, extending between 26.9% (beverage industries) and 4.8% (refined petroleum and coal products industries). Service shares were constrained across a narrow band of 17.9% to 10.9% in the chemical and chemical products and food industries, respectively. Finally, energy shares were the most consistent of all input shares among industries, reaching a meagre high of just 5.9% in the paper and allied products industries and a low of 0.5% in the tobacco products industries³.

Figure 1

Average input value shares for manufacturing industries over 1961-1990



3 - Three Decades of Growth: the 60s, the 70s and the 80s

While these value shares serve as a first step towards gaining a general picture of these industries, they mask real changes in economic activity. In order to see these real changes, we must examine the quantitative growth of output, productivity and inputs. The box on next page describes a simple production function that relates output growth to productivity and input growth, and an identity relating output values to input values, which serve as the basis for analysing manufacturing industries.

3.1 - Output Growth

Manufacturing industries achieved their strongest output growth rate of the last three decades in the 1960s, an average annual compound rate of 6.0%. Growth slowed considerably in the 1970s to 3.5% and was weakest in the 1980s at 1.8%. Throughout the entire period, output growth averaged 3.7%

The strongest decade for output growth, the 1960s, was also the period of mildest inflation, where prices crawled upward at an annual rate of 1.9%. In contrast, the 1970s were marked by extremely rapid inflation, as output prices bounded ahead at an average annual rate of 9.5%. Output inflation subsided considerably in the 1980s, falling by more than half to just 4.5% annually.

To facilitate comparisons of input and output growth rates across decades, Figure 2 illustrates the quantitative growth rates of output, productivity and each of the inputs in the 1960s, 1970s and 1980s, while both the quantity and price growth rates are presented in Table 1.

3. Energy uses refer only to energy purchased. Energy shares may be biased downward in some industries which, like the pulp and paper and aluminum industries, produce part of the electricity they use. Own account energy use is not recorded as such but rather appears distributed in the cost of inputs used for its production.

Analytical Framework

In this simple model, firms' output (Q) is dependent upon the inputs they use (K, L, E, M, S) and the technology available to them (f), as illustrated in the following equation:

$$Q = f(K, L, E, M, S; t)$$

Output growth may be satisfied by additional use of inputs or more efficient production processes. The latter effect, productivity growth, cannot be observed directly. However, we can reasonably hypothesize that output growth that is not attributable to input growth must be a result of increased efficiency in the use of those inputs, and hence *productivity growth* may be determined residually as the growth of output not accounted for by the growth of all inputs.¹

The value of output is equal to the value of all inputs, as expressed in the following identity:

$$PQ = r_k K + wL + p_e E + p_m M + p_s S$$

where P, r_k, w, p_e, p_m, p_s are the prices of output, capital, labour, energy, materials and services, respectively. This equality allows us to calculate the value of capital services, $r_k K$ residually as the difference between the value of output and other inputs. This is an intuitively appealing measure of capital services as it is the income generated from using that capital.²

This identity has strong implications for relative input and output prices. In the case in which productivity growth occurs, the same volume of output can be produced with fewer resources. Given the above identity, this implies that the same amount of revenue is distributed among fewer inputs, and hence, input prices rise relative to output prices. Thus, one can measure productivity growth as the growth of output quantities minus the growth of input quantities, or as the growth of input prices less the growth of output prices. This means that inflation in input prices is partly absorbed by productivity gains.

Substitution effects are also of major importance in this analytical framework. These effects refer to the substitution of one input for another, in response to a relative price change. Given that other factors which have an impact on the use of inputs are continually changing, we cannot exactly measure this effect. However, we can infer it by measuring the changes in prices and quantities relative to the average for all inputs. This does not imply that a rise in the relative price of an input is the sole cause of a reduction in its use; these may both be the result of a third factor: technological progress. This is particularly likely to be true in the case of labour. Labour saving technological progress may reduce the need for additional labour units while increasing the marginal product of labour and consequently its wage rate. Hence, these numbers suggest only correlation, not causation.

Finally, the present model enables us to generate a measure of *upstream vertical integration*. Upstream vertical integration refers to the span of production processes that a given firm is involved in,

1. Note that inaccurate measures of either output or input growth lead to biased productivity estimates. This problem is quite serious for the natural resource industries where it is unlikely that all inputs are accurately measured. Measuring real growth in certain service industries may also be problematic, as it is difficult to distinguish between price and quantity increases in their output values. Conversely, these problems are relatively minor in industries such as manufacturing, as the natural resources they use are typically purchased from other establishments, and thus have a market value, while deflation is less problematic given that their outputs are quantifiable goods.

2. Once again, as in the case of productivity estimates, incorrect measures of inputs or outputs will lead to biased estimates of capital services.

Analytical Framework

with respect to its output. The more processes it covers, the more upstream vertically integrated it is. Alternatively, the more intermediate inputs it purchases from other firms, the less upstream vertically integrated it is. Thus, it reflects a decision on the part of the company to purchase an input rather than produce it itself. We can measure upstream vertical integration as the amount spent on production within the establishment (the amount spent on capital and labour), as a share of total input costs³.

Output growth, productivity growth, upstream vertical integration, and substitution effects; these are the measures that we use to analyze absolute and relative input growth. These phenomena, while affected by other independent factors, are inter-related. For example, output growth may affect productivity growth by increasing the intensity of economic activity, and subsequently stimulate establishments to strive for greater productivity gains.

While productivity growth reduces the growth of all inputs necessary for attaining a certain output growth rate, it may affect these differentially if substitution effects are brought about. To see this, recall that productivity growth, the excess of output growth over input growth, must be matched by a rise in input prices relative to output prices. Recognizing that intermediate inputs are outputs of other establishments, and are thus subject to these productivity gains and downward pressure on prices, relative input to output price increases must generally, and over the long run, accrue to primary inputs. As a result of this rise in primary input prices, firms are likely to conserve on them and use more intermediate inputs. Hence, productivity gains should lead to increasing use of intermediate inputs and rising returns to primary inputs, although some substitution also occurs among intermediate or primary inputs. As a result of these effects, productivity growth may or may not change input shares. It is said to be neutral when input shares remain constant.

If substitution effects are strong enough, they may encourage establishments to spend relatively more on purchasing outputs of other establishments; hence, they may change the level of upstream vertical integration. Clearly, in this case productivity growth would not be neutral.

In summary then, output growth has positive impacts, *ceteris paribus*, on the use of all inputs. Productivity growth, on the other hand, reduces the need for any given input. However, productivity growth raises the relative price of primary inputs and thus, through substitution effects typically increases the quantitative growth of intermediate inputs. To the extent that these substitution effects are neutral or not, they may also affect the integration of industries.

Finally, it must be acknowledged that while output growth, productivity growth, changing relative prices and upstream vertical integration are inter-related, they are also affected by other factors. Output growth is affected by the degree of international trade, productivity growth is affected by expenditures on research and development, relative prices are affected by supply and demand conditions, and the degree of vertical integration is affected by factors such as the desire on the part of firms to monopolize inputs. Consequently, there are elements of endogeneity and exogeneity in each of these phenomena.

3. Upstream vertical integration refers only to the production process supplying that industry. Downstream vertical integration refers to the activities that bring an establishment's product closer to final demand. It can be measured as the ratio of final sales to total sales. Composite vertical integration refers to the combination of the terms. As estimates of downstream vertical integration, and hence, composite vertical integration, require final demand estimates, they are beyond the scope of the KLEMS database, and thus are not presented here.

Figure 2

Average annual percentage growth of manufacturing output, inputs and productivity over the last three decades

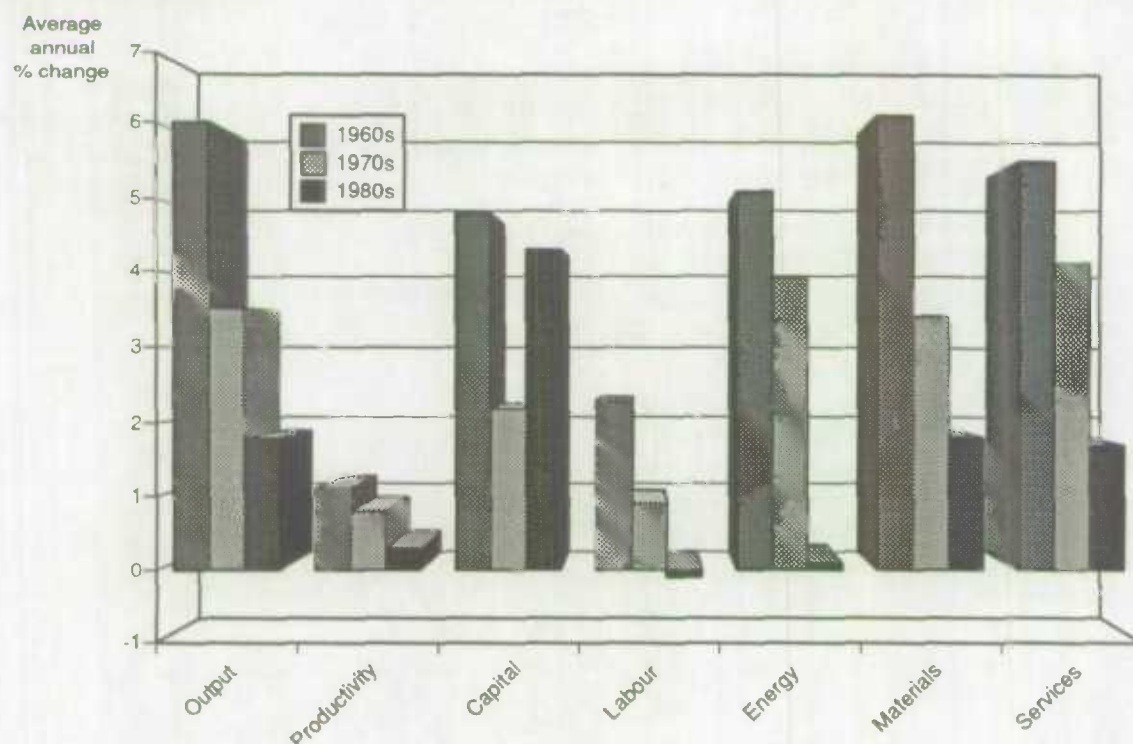


Table 1

Average Annual % Change of Quantities and Prices in Manufacturing

	1960s		1970s		1980s	
	Quantities	Prices	Quantities	Prices	Quantities	Prices
Output	6.0	1.9	3.6	9.5	1.8	4.5
Productivity	1.1	1.1	0.8	0.8	0.3	0.3
All Inputs	4.9	2.9	2.8	10.3	1.6	4.8
Input Categories	Growth in quantities relative to all inputs	Growth in prices relative to all inputs	Growth in quantities relative to all inputs	Growth in prices relative to all inputs	Growth in quantities relative to all inputs	Growth in prices relative to all inputs
Capital	-0.1	0.4	-0.6	-0.2	2.7	-1.0
Labour	-2.6	2.7	-1.9	0.0	-1.7	2.0
Energy	0.2	-2.2	1.1	2.6	-1.4	1.3
Materials	1.2	-1.0	0.6	0.5	0.2	-1.1
Services	0.6	-0.3	1.3	-2.4	0.1	1.2

3.2 - Productivity Growth

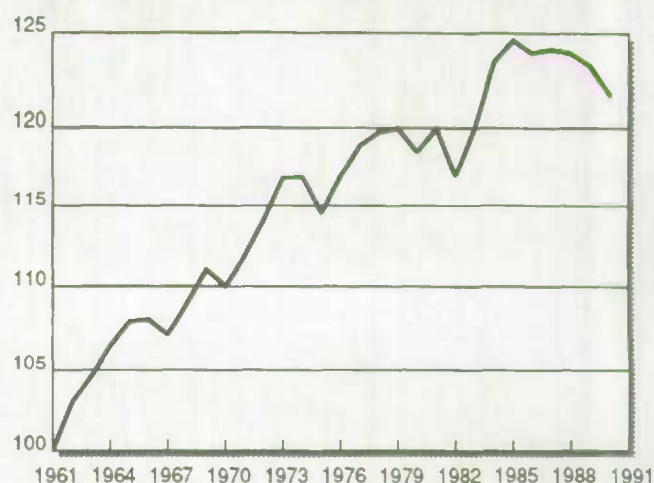
One important determinant of output growth is productivity growth⁴. It followed a pattern similar to that of output, peaking in the 1960s at a rate of 1.1%, falling to 0.8% in the 1970s, reaching a low of 0.3% in the 1980s, and averaging 0.7% for the whole period under study.

This tendency for productivity growth to mimic output growth was also found at a more disaggregated industry level. The four industries with the highest growth rates of output had among the five highest productivity growth rates. Similarly, of the ten highest output growth industries, 70% had above average productivity growth.

Figure 3 demonstrates that productivity growth follows a pro-cyclical path. This is due to the quasi-fixed nature of some inputs. For instance, capital input growth lags output growth, leading to pro-cyclical capacity utilization. Hence, when output declines, capital growth is still just peaking, causing productivity to temporarily fall back. The productivity measure does partially correct for changes in capacity utilization. Productivity growth is calculated by measuring the growth in the quantities of all outputs and inputs, weighting these growth rates by their value shares, and summing them. The value of capital services - income generated by capital services - falls in recessionary periods, thus reducing the estimated contribution of capital. However, this weighting does not remove all the effects of changing capacity utilization.

Figure 3

Multifactor productivity in manufacturing industrie



Some of the cyclical nature of productivity is also due to the stickiness of labour input. Labour is somewhat fixed over the short run because of costs associated with temporarily reducing labour input such as training and hiring. Thus, rather than lay off workers during recessionary periods, employers often keep them on.

We can also see that while the general trend for productivity growth was upward, the 1973-1981 period was characterized by particularly poor productivity growth. The causes of this productivity growth decline have been heavily debated, and are probably the result of a combination of factors, a reduction in net capital accumulation and the energy crises being at the forefront of these.

3.3 - Input Growth

Turning to input growth, we can see that average input quantities grew in a fashion similar to output growth; fastest in the 1960s, at 4.9% annually, less in the 1970s at 2.8% and slowest in

4. Multifactor productivity growth estimates on gross output used in this article are available for total manufacturing and the 21 major groups in the tables of Part 1 of this publication. Quantity and price indices for total manufacturing output and the major KLEMS input categories are provided in the Appendix to this article.

the 1980s at 1.6%. While the growth of inputs slowed through time; declining productivity growth prevented it from falling as much as output growth.

We will now turn to the make-up of input growth and explain some of the relative changes. The relative growth rates of each input, calculated simply as the growth in its quantity minus the average input growth rate, along with the relative inflation rates, are presented in Table 1 above. These relative growth rates indicate which inputs industries favour by using more of, as well as which are becoming relatively more expensive.

Growth of Primary and Intermediate Inputs

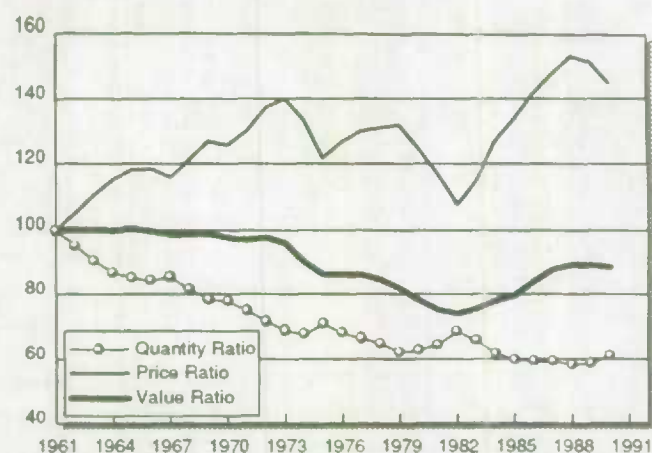
Before examining the individual KLEMS input categories, it is interesting to note the increased reliance on intermediate inputs relative to primary inputs over the past three decades. Establishments increased the quantities of intermediate inputs (energy, materials and services) at more than double the rate of primary inputs (capital and labour), and reduced the value share of primary inputs from 37.1% in the 1960s to 32.5% in the 1980s⁵.

The growth in relative intermediate input quantities appear to be primarily driven by productivity growth. The effects of rapid productivity growth in the 1961-1973 period are clear: as the price of primary inputs raced ahead of intermediate inputs, firms continually substituted less costly intermediate inputs for primary inputs. Technical progress was neutral during that period, given that value shares declined only very slightly beginning in the late 1960s. Productivity declines induced increasing relative use of primary inputs, coincident with a fall in their real returns in the 1974/1975 and the 1979/1982 periods, leading to a slackening of intermediate input growth over the 1974 to 1990 time frame. The fall in real returns to primary inputs and slight but continual substitution of intermediate inputs for primary inputs led to upstream vertical de-integration. Hence, technical progress was not neutral during the latter period.

The continuing productivity growth and upstream vertical integration support our hypothesis that these phenomena are related. However, it is interesting to note that the most rapid upstream vertical de-integration occurred in a period of extremely weak productivity growth, from 1973 to 1981. Thus, it is obvious that other factors were impacting on the degree of integration. The oil crises likely was one of these factors, as it increased transportation and hence intermediate input costs, resulting in a change in the integration measure.

Figure 4

Primary/intermediate inputs, quantity, price and value ratios



5. Intermediate inputs are those goods and services which are produced and consumed in a given year by the business sector of the economy. In an open economy such as Canada, imports may be viewed as primary inputs. However, in the context of the KLEMS database, this would be inappropriate and hence imports have been allocated to their appropriate intermediate input classification.

We will now turn to an analysis of how output growth affected the use of all inputs, as well as how productivity growth, changing levels of integration and changing relative prices affected the demand for specific types of inputs.

Growth of Capital Inputs

The average annual growth rate of capital matched that of output growth, at 3.7% over the entire 1961-1990 time frame, almost one quarter more than the average of all inputs. Capital input growth peaked in the 1960s, at 4.8%, declined in the 1970s to 2.2% and made a strong recovery in the 1980s, clipping along at a healthy pace of 4.3% annually. It was the only input whose pattern of growth diverged from output growth and was greater in the 1980s than in the 1970s.

As Figure 5 illustrates, capital input growth relative to average input growth appeared to be quite sensitive to its relative price. Table 1 and the accompanying graph relating capital input growth to the growth of all inputs illustrate that capital growth was strongest in relative terms in the 1980s, when its relative inflation rate was most favorable.

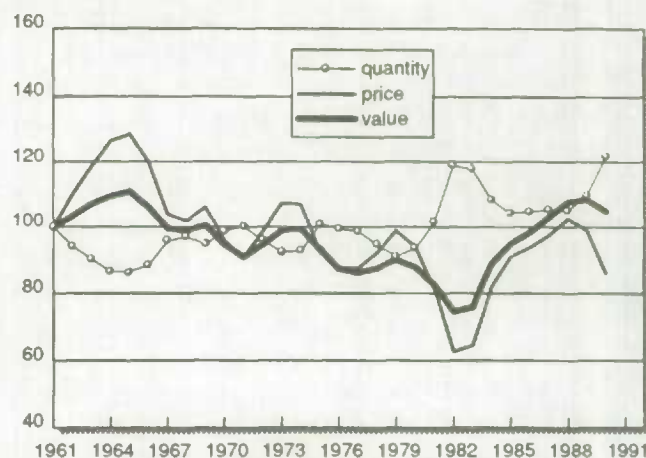
Falling relative returns, unaccompanied by sufficiently rapid capital formation, depressed capital's share of revenues during the 1965 to 1982 period. Rising capital prices in the mid 1980s and rapid real investment in the latter part of the decade reversed this trend and pushed capital shares up to levels not seen since the 1960s.

The fluctuating relative capital input quantity, price and value ratios were due to a combination of productivity growth and substitution between capital and other inputs. As discussed previously, strong productivity gains in the 1961 to 1973 period permitted primary, and subsequently capital inputs, to realize higher relative returns and encouraged intermediate input substitution for them. Declining productivity growth thereafter reduced the relative return to capital and negated the many of the benefits of substitution.

The long term effect of productivity growth is quite different than the short term effect previously discussed. Capital goods are in fact produced outputs of establishments. Hence, they are subject to the same productivity gains and reduced prices over the long run as intermediate inputs over the short run. The difference in effect arises because capital goods are used up over a much longer time frame and hence it takes longer for productivity growth to affect the quantity and price of capital goods. Consequently, capital growth while varying with respect to output growth over the short run, approximated output growth over the entire 30 year period.

Substitutions between capital and materials and capital and services were also observed during the short run, although each of the inputs quantities and prices grew at about the same rate over the long run. In contrast, capital goods persistently replaced labour, as establishments

Figure 5
Capital/all inputs, quantity, price and value ratios



continually automated their production processes. These substitution effects will be discussed in greater detail in the sections of the respective substitutes.

Growth in Labour Input

Labour input experienced the lowest average annual growth rate out of the five types of inputs, only 1.0%, over the entire period under study. Growth in labour input was strongest in the 1960s, at 2.3%, marginal in the 1970s at 0.9% and negative in the 1980s at -0.1%.

Figure 6 demonstrates that a strong negative correlation existed between the growth in the quantity and the price of labour, relative to those of average inputs. This was more of a long-run phenomena than was the case with other inputs, as the growth of labour input consistently fell short of that of all inputs while wage increases surpassed average increases in a cyclical manner. The difference in relative growth rates was most marked in the 1960s, where the growth of labour fell short of average input growth by 2.6%, and wages grew by 2.7% more. Due to these extremely low relative growth rates, that were not compensated for by wage increases, labour shares dropped over the 1961 to 1990 period, falling from 24.4% in the 1960s to 23.6% in the 1970s to 21.1% in the 1980s.

Figure 6

Labour/all inputs, quantity, price and value ratios

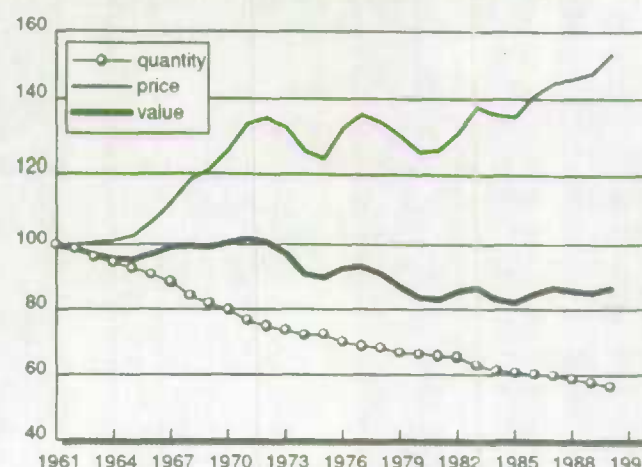
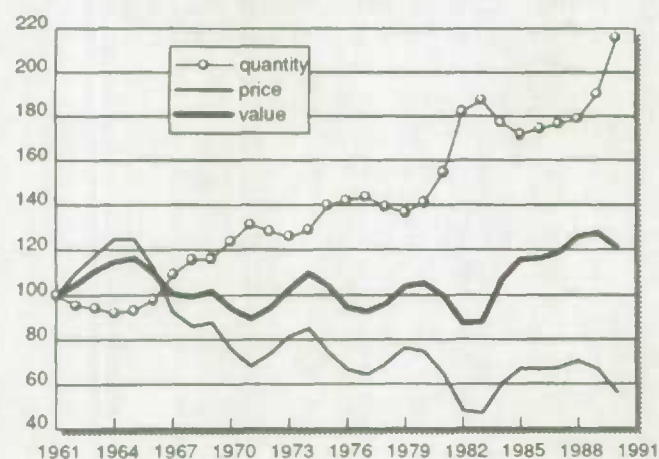


Figure 7

Capital/labour quantity, price and value ratios



Declining labour input growth, while in part a result of falling output growth, was due largely to increasing substitution of capital, materials and services for labour. Had it not been for these substitutions of other inputs for labour input, falling productivity growth would have necessitated relatively higher labour growth.

Figure 7 illustrates that the capital/labour ratio increased considerably from 1961 to 1970 (23.9%), was much flatter in the 1970s, increasing only 13.8%, and exploded by 53.2% in the 1980 to 1990 period. Conversely, increases in the price of labour exceeded those of capital by 78.0% during this entire time frame, almost offsetting the

increase in the quantity ratio and maintaining an almost constant share of payments to labour out of primary inputs. The burgeoning capital/labour ratio was likely to have been an effect of both labour saving technological progress, and relative increases in the price of labour. These effects reinforce each other: as the capital/labour ratio increases, the productivity of labour, and thus the wage rate increases and, as the price of labour relative to capital rises, further increases in the substitution of capital for labour are brought about.

Growth in Material Inputs

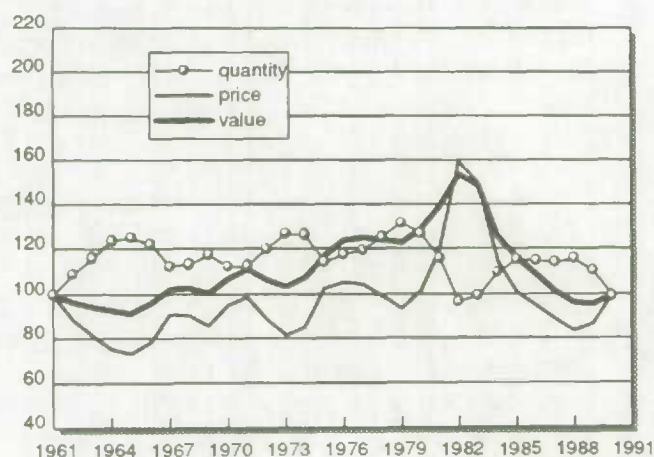
Material inputs in the manufacturing sector grew at a strong pace of 3.7% throughout the 1961 to 1990 period. As Figure 2 illustrates, this growth was highest in the 1960s and declined sharply through time. In addition, material inputs achieved their highest growth relative to average inputs in the 1960s, concurrent with their lowest relative inflation rate, as Figure 8 shows. Materials also achieved higher relative growth rates and lower relative inflation rates than the average in the latter two decades.

Given the rapid relative quantitative growth of material inputs, material shares generally increased over the 1961 to 1990 period. The average material input share climbed from 48.4% in the 1960s to 50.6% in the 1970s and finally to 52.2% in the 1980s.

The declining growth in material input, while partially due to depressed output growth, was also due to declining productivity growth and subsequently diminishing returns to substitution. Negative productivity growth from 1973 to 1975 and again from 1979 to 1982 caused material prices to surge ahead of average input prices and suffer falling relative growth rates.

Figure 9

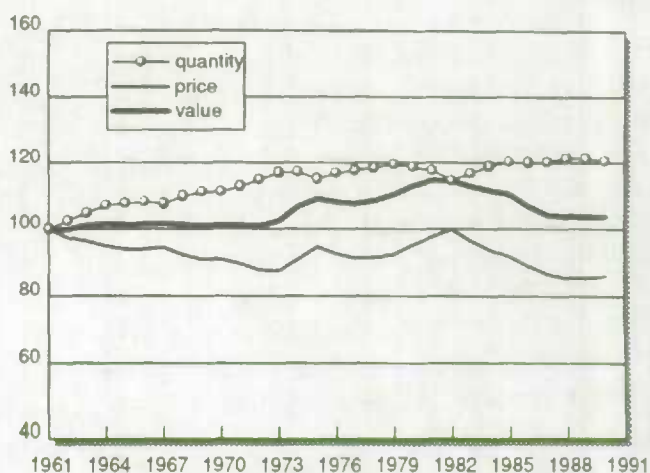
Materials/capital quantity, price and value ratios



substituted for labour, rather than trading off as was the case with materials and capital. The increasing use of materials dominated relative wage gains and hence, the value of materials relative to labour rose.

Figure 8

Materials/all inputs, quantity, price and value ratios



Substitution effects between material and labour inputs, and material and capital inputs also appeared clear throughout the entire period. Figure 9 illustrates that the relative growth of material and capital inputs varied inversely with their relative prices up until 1973, maintaining a relatively constant value ratio between them. The exception to this was the late 1970s and early 1980s, in which rising material prices were not fully offset by declines in their use.

Substitution effects between materials and labour input were more visible than those for capital and materials as changes in relative growth rates and prices were more pronounced. They were also uni-directional, that is, materials were increasingly

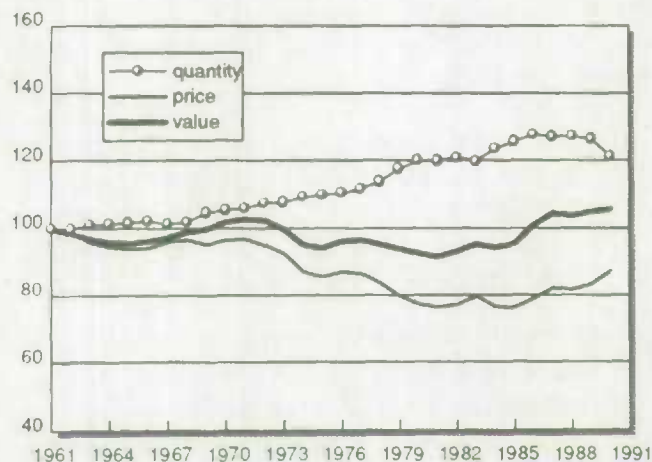
It should be noted that this rise in the value of materials relative to labour inputs, given an overall constant ratio of material and service values to capital values, was a manifestation of decreasing upstream vertical integration. Given that other value shares remained constant and that the share of primary inputs as a whole fell, the decline was accounted for solely by a decline in labour's share.

Growth in Service Inputs

The average growth in real service inputs across all manufacturing industries was 3.7%, the same rate as that of output and capital and material inputs. As was the case with most other inputs, the growth in demand for service inputs declined from each decade to the next. Figure 11 illustrates that, in contrast to its absolute growth rate, services grew strongest relative to average inputs in the 1970s, the decade in which its relative inflation rate was lowest. The service input share for all manufacturing industries was remarkably stable throughout the period under study, at 12.8% in the first two decades and rising slightly to 12.9% in the 1980s.

Figure 11

Services/all inputs, quantity, price and value ratios

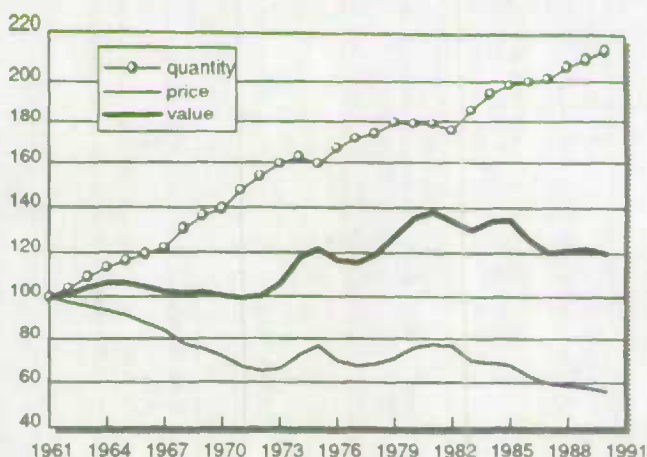


Growth in Energy Inputs

Energy inputs were similar to other inputs in the sense that they achieved their maximum average decade growth rate in the 1960s (5.5%) and their minimum average decade growth rate in the 1980s (0.2%). Energy prices were much more volatile than other inputs, creeping up by less than

Figure 10

Materials/labour, quantity, price and value ratios



As was the case with material and capital inputs, ongoing substitution between capital and services occurred during the 1961 to 1990 period. With the exception of the drastic fall in the relative return to capital in the early 1980s, the relative quantity and price changes were basically offsetting, thus rendering constant value shares. These substitution effects were short run phenomena only, as the quantity, price and value ratios in 1990 were exactly those observed in 1961.

While material inputs supplanted labour in somewhat of a cyclical fashion, service inputs did so continually. As in the case of material substitution for labour, this was also a manifestation of decreasing upstream vertical integration.

three quarters of a percent annually in the 1960s, and exploding to 12.9% annually in the 1970s - more than doubling between 1973 and 1977 alone. The early part of the 1980s were also marked by massive increases in the price of energy, but deflation in the latter part of the 1980s depressed the average during the 1980 to 1990 period to 6.1%.

The growth in quantities of energy relative to all inputs appeared to be considerably less responsive to relative changes in its price than other inputs. In fact, similar movements in these rates were frequently observed (1962/63, 1967/68, 1972/73, 1976/78 and 1985/90) throughout the

period. Furthermore, the highest growth of energy inputs relative to other inputs occurred in conjunction with its highest relative inflation rate, in the 1970s.

The 1973 oil crisis did lead to a drop in the relative quantities of energy used. However, the decline was only temporary. This weak response of energy use to the energy crisis was likely to have been a result of the fact that while international prices rose, Canadian oil prices were held down by the National Energy Program. Furthermore, energy input shares of total costs, at less than two percent, may also have been too insignificant to incite strong substitution effects in response to relative price changes. Consequently, the relative quantity of energy use increased in 1975 and continued to grow until 1980.

The effects of the oil price shock of 1979 were also muted in Canada by the National Energy Program until 1981. This latter energy shock sustained lasting effects in manufacturing, leading to continuing absolute declines in the quantities until 1984, and an almost uninterrupted decline in the growth of energy inputs relative to total inputs up to 1990.

Figure 12

Energy/all inputs, quantity, price and value ratios

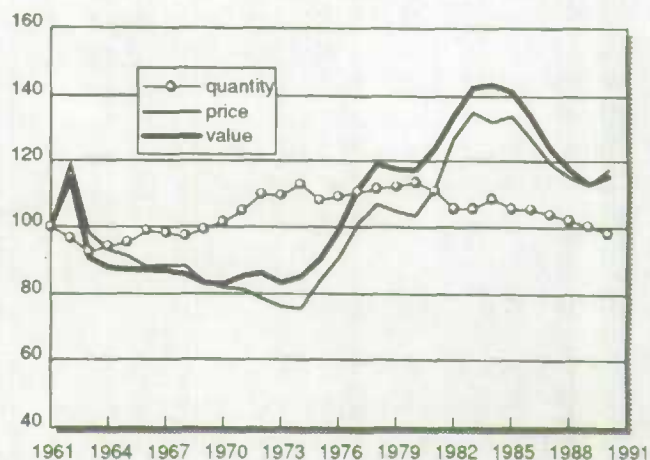
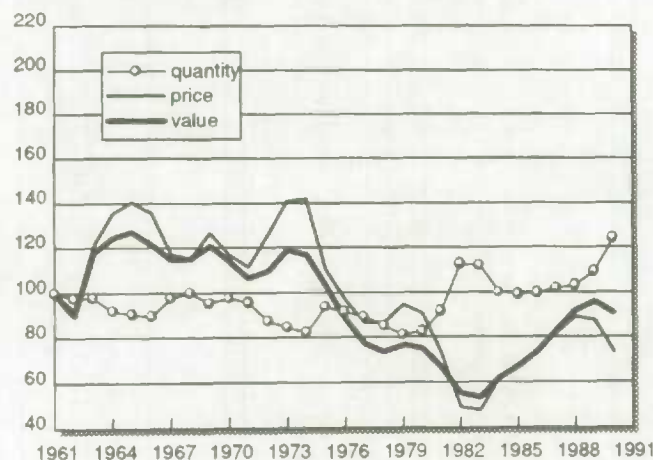


Figure 13

Capital/energy, quantity, price and value ratios



Due to the drastic rise in the relative price of energy, energy shares experienced the greatest increase of all inputs, rising from 1.6% in the 1960s to 1.7% in the 1970s and finally to 2.3% in the 1980s.

Energy inputs, in contrast to other inputs, have generally been thought to be complements in production to capital. This does appear to be the case, particularly in the 1961-1973 period, in which the relative use of capital/energy was only weakly responsive to the relative price ratios. However, taking a longer term perspective, we can see that the price of capital relative to energy fluctuated randomly between 1961 and 1973 and declined thereafter. On the other hand, the quantity ratio fluctuated until

1979 and increased in subsequent years. Therefore, there does appear to be a long term substitution effect. In addition to this substitution, the unusually rapid capital accumulation that began after the second oil crisis may have been an attempt to adopt energy saving capital.

4 - Fixed Versus Variable Inputs

In addition to looking at average growth rates through time, it is also useful to examine the relative fixity or variability of inputs. Figures 14 and 15 illustrate that all inputs, except for capital, generally followed a common pattern: they all declined in recessionary periods and increased in times of strong economic growth. Capital input growth lagged output growth and rarely fell as much as other inputs in times of weakening output growth.

The variance of the ratio between output and input growth for each input category illustrates the degree to which firms harmonized their input growth with their output growth. The higher the variance, the more sticky the input.

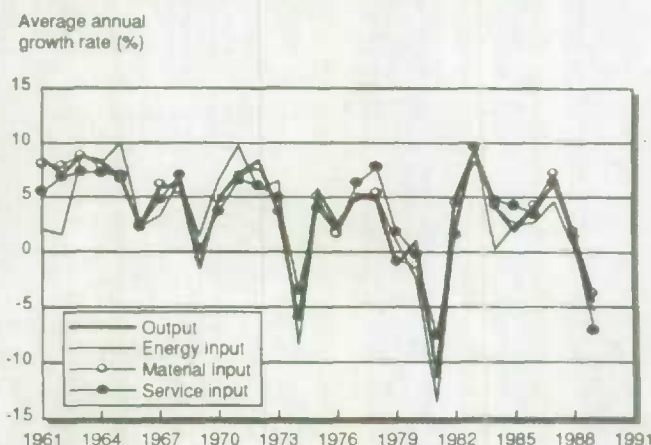
The variance of the output/input growth rate was highest for capital inputs, at 44.3/100, and lowest for materials and services at 0.5/100 and 3.5/100 respectively. This illustrates the strong relative fixity of capital inputs. Material inputs were almost perfectly harmonized with output growth. This is to be expected as input measures correspond to inputs used, rather than purchased. Any input not used in the reference year accumulates in the inventories, and inventory stocks are not included in the input estimates used for productivity measures. Material inputs can be stored; hence their use, after purchase, can be adjusted relative to demand for the establishment's output⁶.

While the variance of the output/energy input ratio, at 6.1/100, was higher than that for labour at 5.7/100, throughout the 1961 to 1990 period, labour input growth was more volatile in the 1970s and the 1980s. Thus, the moderately high variance of the labour partial productivity growth rate does suggest some fixity of labour input as well. This could be due to labour hoarding or a high degree of administrative labour. Clearly, however, labour input growth was much more synchronized with output growth than capital inputs.

Firms appeared to adjust their use of materials and services more rapidly than they adjusted their use of labour or capital. This flexibility of intermediate input use suggests that capital intensive or value-added industries are likely to have higher variability in their multifactor productivity (MFP)

Figure 14

Growth in output, energy, material and services



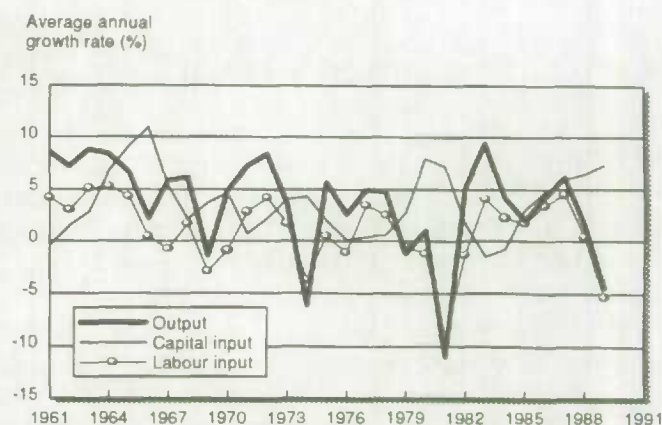
6. Note that in comparing the variance of partial productivity growth rates for each input category, it is implicitly assumed that technology affects all inputs in the same degree. It could be argued that the entire thirty year period is a sufficiently long time to afford the opportunity for technology to affect the levels of the partial productivity growth rates disproportionately. For example, if technological progress is primarily labour saving, then the partial productivity growth rate would increase through time, and other things equal, would lead to a higher variance in the partial productivity growth rate. However, even on a decade basis, the above assertions, regarding the relative fixity of inputs, hold.

growth rates, than industries that use more intermediate inputs. This hypothesis is supported by the high variance of MFP growth rates of industries which are highly capital or capital and labour intensive. Of the industries with the ten highest variances in MFP growth (weighted by the average MFP growth rate for that industry), seven also placed in the top ten of industries ranked according to capital input share and six placed in the top ten industries ranked according to primary input shares.

This quasi-fixed nature of capital and labour input may also be an additional factor in explaining the increasing specialization of industries through time: a higher intermediate input shares allows firms to adjust their inputs more quickly in response to market conditions.

Figure 15

Growth in output, capital and labour



5 - Industry Breakdown

Turning to a summary of the industry breakdown, there were five strong growth industries throughout the 1961 to 1990 period: plastic products, transportation equipment, electrical and electronic products, machinery and chemical and chemical products industries. Transportation equipment and electrical and electronic products industries generally broke with the trend in manufacturing and increased their inputs most in the first and last decade, rather than having growth rates that steadily declined through time.

There were two declining industries - tobacco products and leather and allied products industries, and a third consistently low growth industry, primary textile and textile products industries. Input growth was also low in the refined petroleum and coal products industries in the 1960s and the 1980s, but was second highest of all industries in the 1970s.

There appeared to be a set pattern of growth among industries. They typically behaved in a consistent fashion across their use of inputs; that is, if a particular industry's annual average growth rate for one category of inputs was above the manufacturing average, then the average growth rate for the rest of its inputs was also likely to have been above the average. While the rankings of these growth rates were very similar, the values varied significantly across industries.

Price indices are available for each industry - given that industries use different types and combinations of inputs within each category of inputs, and thus, face different aggregate prices. However, the growth of most prices, excluding those of capital, varied little among individual industries. Furthermore, the direction of the changes in the average growth rates from one decade to the next were almost unanimous among industries for labour, energy, materials and services. Indeed, there was not a single industry in which the growth in the price of any of these inputs was higher in the 1960s than in the 1970s. With respect to the 1970s and the 1980s, the services category was the only input which had higher growth rates of prices in the 1980s than in the 1970s, although this only occurred in four of the 21 industries.

The growth of the price of capital did display some variation across industries, ranging from a high of 8.9% in the plastic products industries to a low of zero percent in the refined petroleum and coal products industries. Similarly, there was some variation in the direction of the changes in these growth rates; there were five industries that had higher growth rates of capital input prices in the 1960s than in the 1970s, and there were five industries again in the 1980s that had higher growth rates of capital input prices in the 1980s than in the 1970s.

6 - Summary

This article reviews the structure, growth and adaptation in Canadian manufacturing from 1961 to 1990, using the KLEMS database. Output and productivity growth in the manufacturing sector were most rapid in the 1960s, concurrent with the lowest inflation rate observed among the three decades. The 1970s, with ballooning energy prices and other business costs commenced the decline of output growth and productivity growth that only worsened in the 1980s.

Manufacturing industries became increasingly upstream vertically de-integrated throughout the 1961 to 1990 period. This may have been, in part, a result of the benefits of specialization and economies of scale, coupled with increasingly complex production processes and globalized trade.

Manufacturing industries were sensitive to relative price changes, substituting capital, material and service inputs for each other over the short run and for labour inputs over the short and long run. Energy input growth was only mildly dented by the 1973 oil crisis, likely because energy input shares accounted for less than two percent of total costs. However, the second oil shock seems to have brought about relative declines in the use of energy. The fear of impending massive increases in energy costs instigated by these crises may have been partially responsible for rapid capital formation in the 1980s, as firms may have sought to adopt energy saving capital.

The strong productivity growth of the 1961 to 1973 period raised efficiency and hence the relative return to primary inputs, thereby stimulating substitution of intermediate inputs for them. Declining productivity growth in subsequent years continually mitigated differences in relative returns, and consequently reduced the growth differentials. Productivity growth over the entire period, however, resulted in falling capital prices and capital formation matching output growth. Thus, the long run effect of productivity growth was to raise real wages and encourage substitution of other inputs for labour.

Capital, and to a lesser extent labour inputs, were relatively fixed factors in production. Energy input growth was more volatile relative to output growth in the 1960s but was closely synchronized with output growth in the 1970s and the 1980s. Material inputs were almost perfectly harmonized with output growth. This relative fixity of primary inputs, in particular capital, may be an additional contributing factor to the de-integration of industries, as they attempted to achieve an input mix that could be more responsive to fluctuations in the demand for their output.

This article has illustrated changes in Canadian manufacturing industries, and provided some insight on why these developments occurred. Further work in this area, with the use of econometric techniques, would enable more concrete conclusions about price elasticities, sensitivities of factor input to technological progress as well as factor contribution to productivity growth, and the relation between productivity growth and upstream vertical integration.

Table 2

The KLEMS data for Canadian manufacturing industry 1961-1990, index levels, 1961=100

Year	Output		Capital		Labour		Energy		Materials		Services	
	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	109.0	101.2	99.6	117.7	104.3	103.0	102.1	100.6	108.4	102.4	105.6	101.6
1963	117.1	102.3	101.1	127.6	107.5	106.9	103.7	102.5	117.4	103.6	113.2	102.2
1964	127.9	103.6	104.0	141.4	113.1	111.2	113.3	102.2	128.4	104.7	121.8	103.7
1965	139.2	105.0	111.2	145.6	119.3	117.0	122.9	103.7	139.0	106.4	131.1	106.7
1966	148.7	107.5	121.8	133.6	124.5	126.2	136.0	102.7	148.7	109.6	140.6	109.7
1967	152.1	109.9	136.0	120.1	125.0	133.7	139.2	104.2	152.7	111.1	143.8	114.3
1968	161.3	112.1	143.5	125.8	124.2	144.2	143.9	106.9	162.5	112.7	150.8	118.8
1969	171.6	115.7	146.5	137.2	126.3	155.5	153.6	105.3	171.9	116.4	161.9	123.1
1970	169.2	118.9	152.0	116.5	122.7	167.6	155.9	108.8	171.1	119.4	162.4	128.1
1971	177.7	122.1	159.3	127.4	121.6	180.8	166.6	112.3	179.4	121.9	168.6	131.7
1972	190.9	127.5	160.4	145.3	125.1	194.8	183.8	114.6	192.4	127.7	180.1	138.4
1973	207.6	140.3	164.1	181.0	130.4	210.6	194.5	121.0	207.9	145.4	191.4	148.6
1974	215.2	169.4	170.9	207.7	132.6	241.7	207.5	155.4	215.8	184.5	201.2	168.9
1975	202.4	191.9	178.5	195.0	127.7	277.1	190.7	187.3	203.5	208.1	194.4	189.4
1976	214.4	202.0	182.1	203.2	128.4	316.5	199.7	228.8	214.1	217.4	202.4	208.2
1977	220.0	216.9	182.3	227.5	127.0	347.8	204.2	274.2	217.6	236.0	206.4	221.6
1978	231.3	237.9	183.0	264.5	131.5	373.9	215.3	308.0	228.9	262.6	219.8	237.4
1979	242.6	272.0	184.1	329.3	134.8	413.0	226.8	335.0	241.7	304.5	237.8	258.2
1980	239.8	308.4	189.2	330.1	134.2	456.0	229.2	384.6	239.8	352.5	242.4	281.9
1981	242.2	345.9	204.9	330.6	132.5	525.4	223.7	480.8	237.0	407.1	241.8	313.8
1982	216.9	368.7	220.3	247.1	121.1	580.1	195.4	574.2	212.4	429.5	224.1	342.7
1983	228.3	379.8	224.1	322.3	119.6	618.5	200.4	625.6	222.2	435.8	227.7	360.3
1984	250.7	395.9	220.6	421.3	124.6	647.1	220.5	640.9	241.7	457.4	250.8	372.2
1985	261.6	402.5	218.9	461.0	127.4	683.1	221.2	668.3	252.3	456.8	263.3	386.5
1986	266.9	399.5	225.6	475.9	129.6	714.1	226.7	600.4	258.6	430.0	275.0	407.1
1987	278.4	412.5	236.6	509.7	134.0	738.3	232.9	596.3	269.9	442.5	284.9	419.8
1988	296.0	429.0	251.1	558.1	140.3	770.7	243.9	596.4	290.3	453.2	303.8	432.5
1989	300.6	440.8	268.0	528.5	140.8	800.4	245.1	603.7	296.1	464.8	308.2	457.1
1990	287.7	446.4	288.3	457.5	133.5	844.6	232.4	658.2	285.4	465.9	286.9	470.5

PART 1

Multifactor Productivity

Experimental Data

Table 1

Indices of multifactor productivity, business sector industries (1986=100)

Year	Industry measures		Interindustry measures	
	Value-added			
	Persons at work	Person-hours	Persons at work	Person-hours
1972	94.0	91.1	94.9	92.6
1973	97.2	94.1	97.6	95.1
1974	94.5	91.9	95.4	93.2
1975	92.5	90.4	93.7	92.0
1976	95.8	93.9	96.4	94.9
1977	95.9	94.8	96.5	95.7
1978	96.1	94.6	96.7	95.5
1979	96.3	95.2	96.9	96.0
1980	95.2	94.3	96.0	95.2
1981	95.3	94.9	96.0	95.7
1982	90.3	91.0	92.0	92.5
1983	93.7	94.5	94.8	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	100.6	100.3	100.5	100.2
1990	97.2	97.1	97.7	97.6
1991	96.1	96.4	96.8	96.5
1992	96.1	96.8	96.8	96.9

Average annual growth rate (%) 1972-1992



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		
1972	87.3	85.6	85.1	83.3	82.4	80.1
1973	91.1	88.7	89.0	86.4	86.1	83.1
1974	81.6	79.4	79.4	77.0	77.5	74.8
1975	87.5	85.1	85.3	82.8	83.0	80.2
1976	92.5	90.2	90.4	87.9	88.3	85.6
1977	90.3	88.8	88.1	86.5	85.9	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	88.6
1984	93.1	93.2	91.5	91.7	90.3	90.5
1985	92.1	91.8	90.3	89.9	89.8	89.5
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	98.5	99.2	98.2	99.0	99.5	100.1
1989	104.3	104.7	105.3	105.7	106.4	106.7
1990	111.3	111.2	113.6	113.6	113.9	113.8

Average annual growth rate (%) 1972-1990

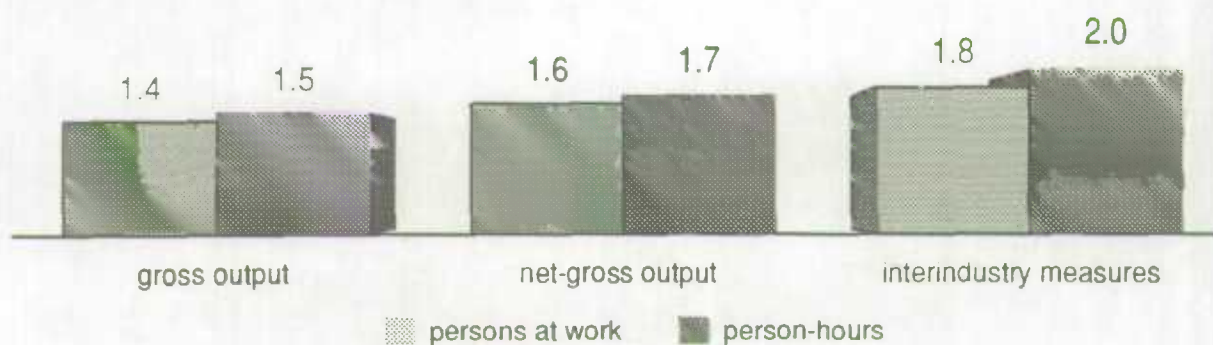


Table 3

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		
1972	92.7	92.1	90.6	89.8	79.9	78.3	90.5	89.1
1973	94.9	94.3	93.4	92.7	85.0	83.6	94.8	93.4
1974	94.8	94.4	93.3	92.8	84.9	83.8	93.2	92.0
1975	92.5	92.4	90.3	90.2	78.9	78.7	89.6	89.0
1976	94.5	94.5	92.9	92.8	84.2	83.9	93.1	92.5
1977	96.2	96.0	95.1	94.9	88.7	88.2	94.7	94.2
1978	96.9	96.7	96.0	95.7	90.7	90.0	95.4	94.7
1979	96.9	96.9	96.0	96.0	90.6	90.5	95.6	95.3
1980	95.7	95.7	94.5	94.5	87.3	87.3	93.3	93.2
1981	96.6	96.9	95.6	96.0	89.9	90.7	93.6	93.8
1982	94.0	94.5	92.3	92.9	82.3	83.6	89.4	90.1
1983	96.7	96.9	95.7	96.0	89.9	90.5	93.3	93.8
1984	99.6	99.6	99.5	99.4	98.7	98.6	98.5	98.6
1985	100.6	100.6	100.8	100.7	101.8	101.8	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	100.3	101.0	100.6	101.0	100.7
1988	100.2	100.0	100.3	100.0	100.7	100.1	101.5	101.1
1989	99.5	99.4	99.3	99.2	98.5	98.3	100.6	100.5
1990	98.2	98.2	97.7	97.7	94.9	94.9	98.6	98.6
1991	..	..	..	..	92.1	92.2	..	..
1992	..	..	..	..	93.4	94.1	..	..

Average annual growth rate (%) 1972-1990

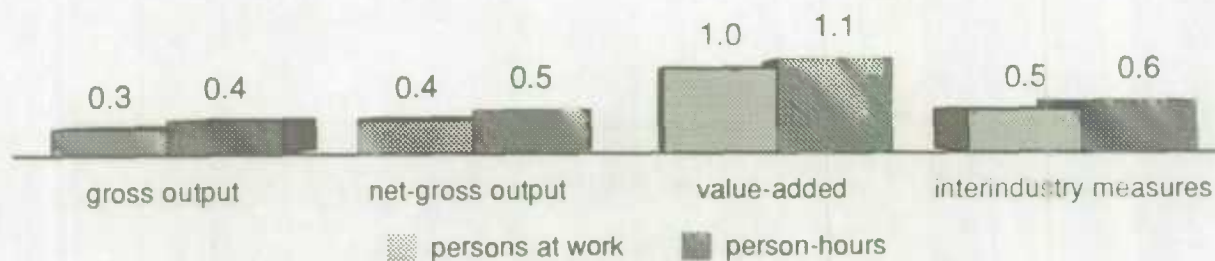


Table 4

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		
1972	92.8	91.4	92.8	91.3	90.7	88.3
1973	91.9	90.4	91.9	90.4	91.0	88.4
1974	90.9	89.4	90.9	89.4	88.9	86.7
1975	94.8	93.4	94.8	93.4	90.8	88.9
1976	97.5	96.4	97.5	96.4	94.4	92.8
1977	98.3	98.2	98.3	98.2	95.3	94.8
1978	96.9	96.3	96.9	96.3	94.5	93.4
1979	95.5	94.8	95.5	94.8	93.6	92.6
1980	97.8	96.9	97.8	96.9	95.4	94.2
1981	101.4	100.8	101.4	100.8	98.6	97.9
1982	103.3	104.6	103.3	104.6	96.9	98.3
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	98.6
1989	99.2	97.9	99.2	97.9	99.7	98.3
1990	97.9	97.7	97.9	97.6	97.1	96.6

Average annual growth rate (%) 1972-1990

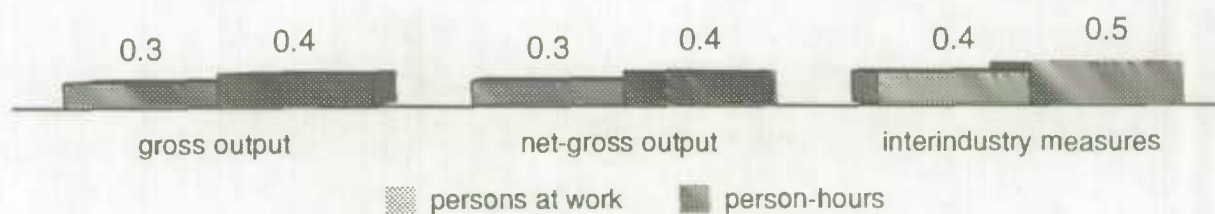


Table 5

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		
1972	90.1	89.0	89.0	87.7	92.2	90.3
1973	91.5	90.3	90.5	89.1	94.7	92.6
1974	90.5	89.4	89.4	88.2	92.9	91.1
1975	89.6	89.0	88.4	87.8	90.9	89.8
1976	89.7	89.2	88.4	87.9	91.1	90.1
1977	90.2	90.1	89.1	88.9	91.7	91.3
1978	92.4	91.9	91.5	90.9	93.7	92.8
1979	96.8	96.5	96.4	96.1	98.6	98.0
1980	93.3	92.8	92.5	92.0	94.2	93.4
1981	92.5	92.6	91.5	91.7	92.9	93.0
1982	90.8	91.4	89.7	90.3	89.7	90.4
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	100.3
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	104.8	104.2	105.5	104.8	105.3	104.6
1990	103.9	103.3	104.5	103.7	103.2	102.5

Average annual growth rate (%) 1972-1990

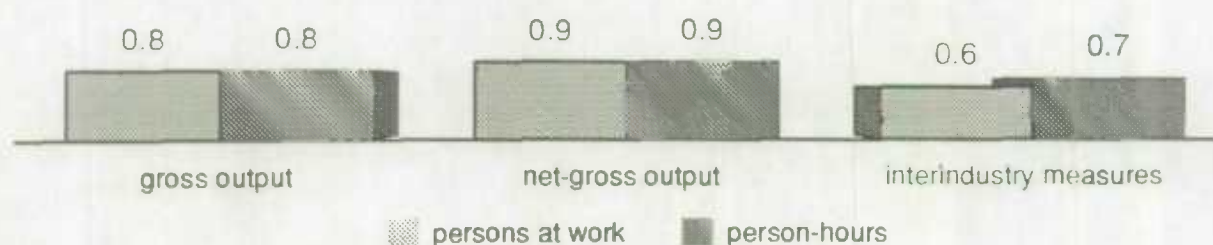


Table 6

Indices of multifactor productivity, telecommunication 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		
1972	58.7	58.2	57.7	57.2	58.1	57.4
1973	61.4	60.9	60.5	60.0	61.1	60.3
1974	64.7	64.2	63.9	63.4	64.4	63.6
1975	69.3	69.2	68.5	68.4	68.8	68.5
1976	71.3	71.2	70.5	70.5	71.1	70.8
1977	72.3	72.5	71.6	71.8	72.1	72.2
1978	76.4	76.2	75.8	75.6	76.3	75.9
1979	81.0	81.0	80.5	80.4	81.0	80.8
1980	86.9	86.7	86.6	86.3	87.2	86.8
1981	89.3	89.6	89.0	89.2	89.6	89.8
1982	86.2	86.8	85.8	86.4	85.6	86.2
1983	88.0	89.0	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	104.3	104.1	104.4	104.1	104.3
1988	106.0	106.1	106.2	106.3	106.0	106.0
1989	110.8	111.1	111.1	111.4	110.4	110.5
1990	111.7	111.9	112.1	112.3	110.2	110.3

Average annual growth rate (%) 1972-1990

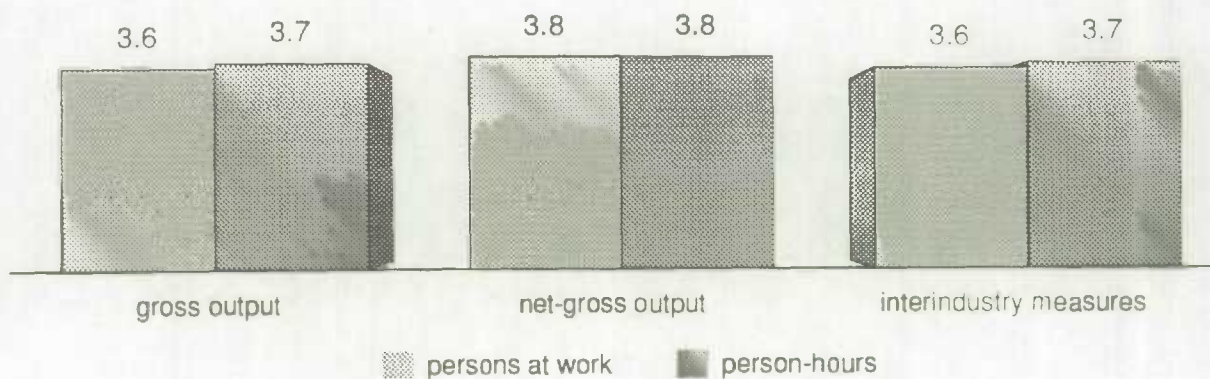


Table 7

Indices of multifactor productivity, wholesale trade 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		
1972	89.4	88.1	89.2	87.9	89.0	87.2
1973	90.5	88.2	90.3	88.0	90.7	87.9
1974	89.4	88.3	89.2	88.2	89.3	87.8
1975	89.2	88.7	89.0	88.5	88.5	87.6
1976	91.0	90.5	90.9	90.3	90.6	89.7
1977	86.9	87.1	86.7	86.9	86.4	86.5
1978	85.5	85.0	85.3	84.8	85.2	84.4
1979	88.5	88.6	88.3	88.4	88.5	88.4
1980	92.6	92.5	92.4	92.4	92.3	92.0
1981	92.9	93.1	92.8	92.9	92.4	92.5
1982	89.2	89.8	89.1	89.7	87.5	88.1
1983	91.9	93.0	91.8	92.9	90.6	91.8
1984	93.0	94.0	92.8	93.9	92.6	93.7
1985	96.4	97.3	96.4	97.3	96.2	97.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.6	101.6	101.6	101.6	101.9	101.8
1988	103.8	103.8	103.9	103.9	104.2	104.1
1989	104.5	105.1	104.6	105.2	104.5	105.2
1990	101.0	101.1	101.1	100.9	100.2	100.0

Average annual growth rate (%) 1972-1990

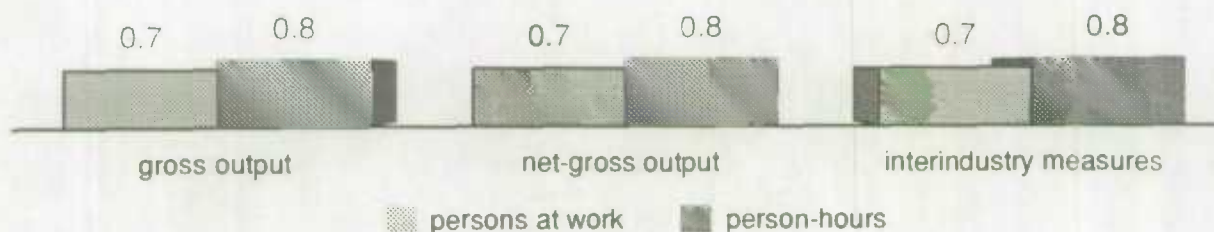


Table 8

Indices of multifactor productivity, retail trade 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		
1972	96.3	91.4	96.2	91.4	96.2	90.8
1973	96.4	92.1	96.4	92.0	97.0	92.1
1974	94.7	90.7	94.7	90.7	94.7	90.2
1975	95.8	92.1	95.8	92.1	95.2	91.2
1976	99.0	96.1	99.0	96.1	98.9	95.7
1977	98.8	96.5	98.8	96.5	98.6	96.1
1978	97.6	95.8	97.6	95.7	97.5	95.4
1979	96.5	94.8	96.5	94.8	96.5	94.6
1980	94.3	92.9	94.2	92.9	94.0	92.5
1981	92.7	91.8	92.7	91.8	92.4	91.5
1982	91.8	92.1	91.8	92.1	90.2	90.5
1983	97.9	99.1	97.9	99.1	96.6	97.9
1984	98.8	99.3	98.8	99.3	98.3	98.8
1985	99.6	99.9	99.6	99.9	99.3	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	103.3	104.0	103.3	104.1	102.9	103.6
1990	101.0	99.3	101.0	101.3	99.5	99.7

Average annual growth rate (%) 1972-1990

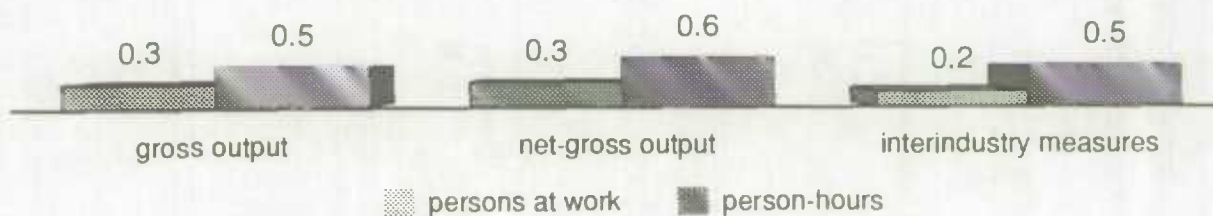


Table 9

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		
1972	97.3	96.7	96.8	96.2	90.2	88.1
1973	98.2	97.7	97.9	97.3	94.2	91.7
1974	98.0	97.6	97.7	97.1	88.7	86.5
1975	96.5	96.0	95.8	95.3	88.0	85.9
1976	99.1	98.6	99.0	98.4	94.0	91.9
1977	100.0	99.7	100.0	99.6	94.5	92.9
1978	100.0	99.7	100.0	99.6	93.7	92.3
1979	100.0	99.8	100.0	99.7	91.9	90.6
1980	98.8	98.7	98.6	98.5	90.5	89.9
1981	98.4	98.5	98.1	98.2	92.0	91.7
1982	98.7	98.9	98.5	98.6	92.1	92.1
1983	98.4	98.2	98.1	97.9	92.9	92.9
1984	99.3	99.1	99.2	98.9	95.5	95.4
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	97.6	97.4
1989	96.5	96.3	95.9	95.8	97.7	97.7
1990	96.2	95.8	95.6	95.2	98.8	98.3

Average annual growth rate (%) 1972-1990

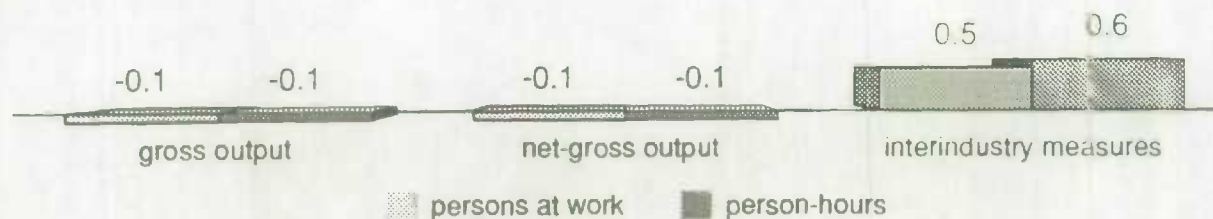


Table 10

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		
1972	106.1	105.0	106.5	105.4	104.2	102.0
1973	110.6	109.6	111.2	110.2	110.6	108.5
1974	108.8	107.8	109.3	108.3	107.4	105.5
1975	106.3	105.3	106.7	105.6	103.2	101.5
1976	106.0	105.0	106.4	105.4	105.2	103.5
1977	108.8	108.0	109.3	108.5	107.9	106.7
1978	108.0	107.3	108.5	107.7	107.9	106.6
1979	108.4	107.8	108.9	108.2	108.2	107.1
1980	107.8	107.5	108.3	108.0	106.8	106.1
1981	107.2	107.2	107.7	107.6	106.5	106.4
1982	104.2	104.3	104.5	104.6	101.1	101.4
1983	103.6	103.5	103.8	103.8	102.1	102.2
1984	103.8	104.4	104.1	104.7	104.3	104.9
1985	102.3	102.2	102.4	102.3	102.9	102.8
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.5	101.3	101.7	101.3	102.0	101.6
1988	103.3	102.6	103.5	102.8	104.0	103.1
1989	105.1	105.3	105.4	105.6	105.6	105.7
1990	106.7	106.7	107.1	107.1	106.3	106.1

Average annual growth rate (%) 1972-1990

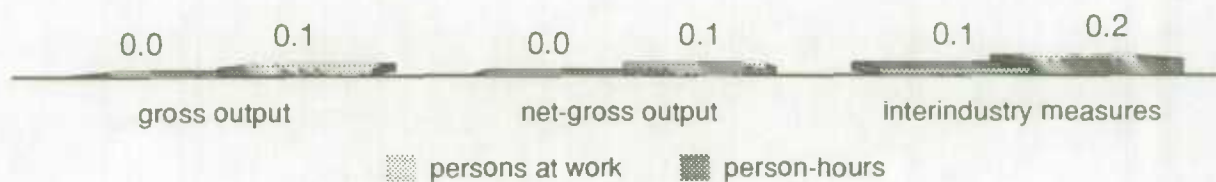


Table 11

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		
1972	104.8	102.9	105.3	103.1	100.2	96.8
1973	106.2	104.6	107.0	105.1	103.8	100.5
1974	109.0	107.6	110.5	108.8	103.7	100.8
1975	107.6	106.0	108.8	106.9	102.9	100.1
1976	106.5	104.9	107.5	105.6	104.3	101.4
1977	114.0	112.8	116.7	115.2	112.6	110.5
1978	108.7	107.4	110.2	108.7	106.2	104.0
1979	109.6	108.2	111.2	109.7	106.4	104.2
1980	110.3	109.3	112.1	111.0	107.6	105.9
1981	109.8	108.6	111.6	110.2	108.4	106.8
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	104.8	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	111.6	110.8
1989	108.3	107.9	109.4	108.9	110.0	109.4
1990	106.1	105.5	106.8	106.1	107.5	106.7

Average annual growth rate (%) 1972-1990

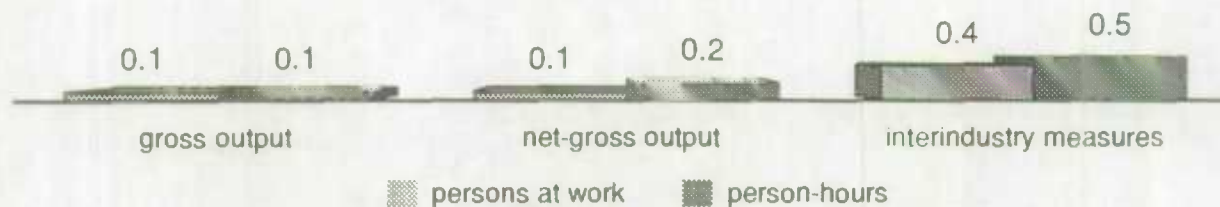


Table 12

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		
1972	96.6	96.0	96.5	95.9	94.4	93.1
1973	98.0	97.6	97.9	97.5	98.1	97.0
1974	92.6	92.6	92.3	92.4	91.7	91.3
1975	88.1	88.3	87.7	87.9	84.3	84.2
1976	88.9	88.9	88.5	88.5	86.1	86.0
1977	90.4	90.5	90.1	90.2	87.1	87.1
1978	93.8	93.8	93.5	93.6	91.4	91.2
1979	97.4	96.9	97.3	96.8	97.3	96.6
1980	95.0	95.1	94.8	94.9	93.0	93.0
1981	98.9	98.8	98.9	98.7	97.2	97.1
1982	97.4	97.5	97.3	97.4	92.0	92.3
1983	101.8	101.5	101.8	101.5	99.2	99.1
1984	104.0	103.9	104.1	104.1	103.8	103.9
1985	104.1	103.8	104.2	103.9	103.8	103.6
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.2	99.0	99.1	99.0	100.4	100.2
1988	96.2	96.0	96.0	95.8	98.6	98.1
1989	95.0	94.5	94.8	94.2	97.4	96.8
1990	92.9	92.7	92.6	92.4	93.9	93.6

Average annual growth rate (%) 1972-1990

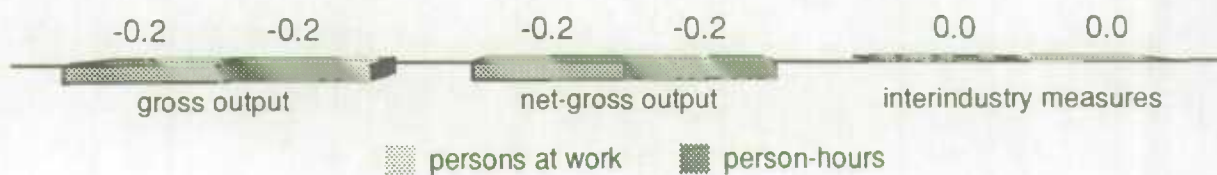


Table 13

Indices of multifactor productivity, rubber 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		
1972	86.7	85.7	86.4	85.3	84.7	83.1
1973	89.5	88.6	89.2	88.3	88.7	87.2
1974	85.0	84.7	84.6	84.3	83.7	83.0
1975	82.0	81.9	81.6	81.4	79.0	78.6
1976	88.7	88.3	88.4	88.0	86.1	85.5
1977	95.2	95.0	95.1	94.8	92.6	92.2
1978	97.0	96.6	96.8	96.5	95.1	94.4
1979	100.8	99.7	100.8	99.6	100.3	99.0
1980	97.1	96.9	97.0	96.8	95.1	94.7
1981	95.0	94.5	94.8	94.3	93.5	92.9
1982	91.5	91.2	91.3	90.9	87.1	86.9
1983	96.7	96.3	96.6	96.2	94.0	93.7
1984	105.5	105.1	105.7	105.2	104.7	104.4
1985	106.5	106.0	106.6	106.1	106.2	105.7
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.0	103.8	104.1	103.9	104.8	104.6
1988	104.0	103.3	104.0	103.4	105.4	104.5
1989	103.0	102.5	103.0	102.5	104.2	103.6
1990	102.5	102.4	102.5	102.5	102.5	102.3

Average annual growth rate (%) 1972-1990

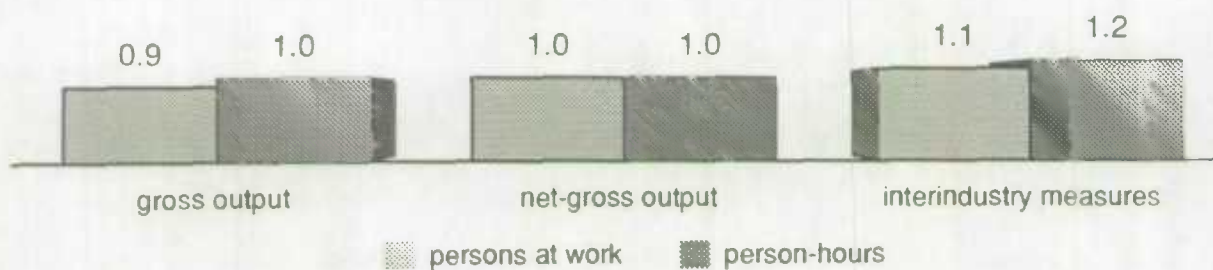


Table 14

Indices of multifactor productivity, 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		
1972	86.6	85.0	85.4	83.7	82.2	80.0
1973	87.2	86.0	86.1	84.8	83.7	81.8
1974	88.6	86.9	87.6	85.8	84.5	82.2
1975	87.5	86.7	86.5	85.6	82.2	81.1
1976	92.2	91.1	91.5	90.3	88.9	87.4
1977	93.2	92.0	92.7	91.3	90.3	88.8
1978	98.5	97.5	98.5	97.4	96.3	94.9
1979	97.6	96.4	97.5	96.1	96.6	95.0
1980	96.1	95.3	95.8	94.9	93.7	92.6
1981	97.2	96.4	97.0	96.1	95.2	94.2
1982	95.0	94.0	94.5	93.4	91.1	90.1
1983	97.2	97.1	97.0	96.8	94.8	94.7
1984	100.0	99.5	99.9	99.4	99.6	99.1
1985	100.0	99.5	99.9	99.4	99.6	99.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.6	100.2	99.6	100.2	99.7	100.3
1988	101.1	101.4	101.1	101.5	100.7	100.9
1989	103.3	102.3	103.5	102.4	102.9	101.7
1990	100.5	99.9	100.5	99.9	99.3	98.5

Average annual growth rate (%) 1972-1990

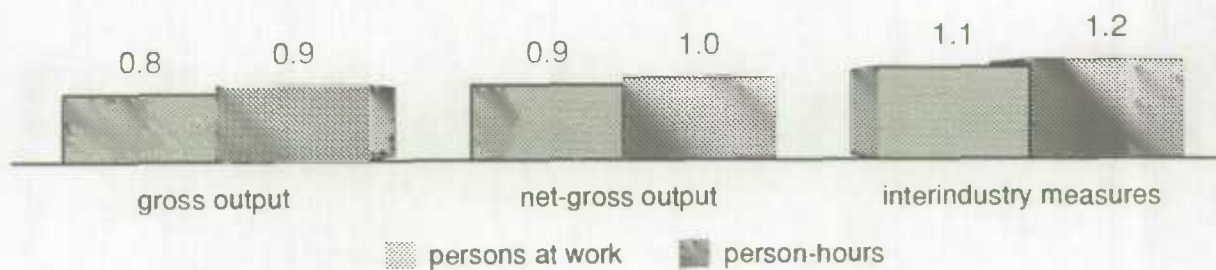


Table 15

Indices of multifactor productivity, primary textile & textile 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		
1972	79.1	78.2	74.9	73.8	78.0	76.5
1973	79.8	79.0	75.7	74.8	79.1	77.7
1974	79.8	79.2	75.7	75.0	78.4	77.3
1975	79.9	79.4	75.8	75.2	77.3	76.5
1976	81.9	81.5	78.1	77.7	80.4	79.8
1977	84.8	84.6	81.6	81.3	83.5	83.2
1978	88.4	88.1	85.9	85.5	87.7	87.2
1979	90.9	90.6	88.9	88.6	91.0	90.6
1980	90.8	90.8	88.8	88.9	90.1	90.0
1981	93.1	92.9	91.6	91.4	92.2	92.0
1982	88.6	88.3	86.1	85.7	85.4	85.2
1983	95.6	95.6	94.7	94.6	94.5	94.5
1984	95.9	96.0	95.0	95.2	96.0	96.1
1985	96.7	97.1	96.0	96.5	96.5	97.1
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.0	99.9	99.9	99.9	100.3	100.1
1988	98.4	98.2	98.0	97.8	98.5	98.1
1989	97.4	96.9	96.8	96.2	97.9	97.1
1990	95.9	95.9	95.1	95.0	95.5	95.3

Average annual growth rate (%) 1972-1990

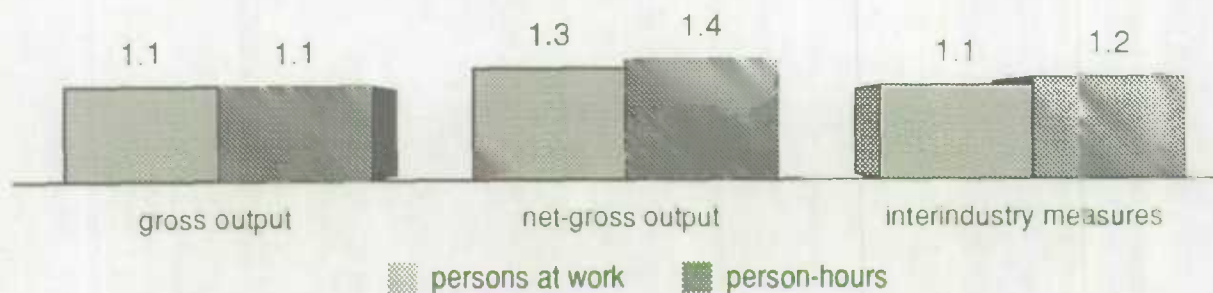


Table 16

Indices of multifactor productivity, clothing 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		
1972	85.1	84.5	84.5	83.9	77.3	76.1
1973	86.5	86.4	86.0	85.9	79.3	78.5
1974	86.7	86.5	86.2	86.0	79.4	78.6
1975	88.2	87.9	87.8	87.4	80.5	79.7
1976	90.5	90.2	90.1	89.9	83.5	82.9
1977	92.2	92.2	91.9	91.8	85.9	85.7
1978	95.6	95.6	95.4	95.4	90.7	90.3
1979	97.6	97.6	97.5	97.5	93.7	93.4
1980	96.8	97.4	96.7	97.2	93.0	93.3
1981	97.4	98.3	97.2	98.2	94.2	95.0
1982	94.2	95.6	93.9	95.4	88.5	89.9
1983	94.3	94.6	94.1	94.3	91.3	91.6
1984	97.2	97.2	97.1	97.1	95.1	95.2
1985	98.5	98.7	98.4	98.6	96.9	97.3
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.7	100.6	101.8	100.6	102.0	100.8
1988	99.0	98.5	99.0	98.5	98.7	98.1
1989	99.0	98.8	99.0	98.7	98.5	98.1
1990	98.7	98.1	98.6	98.0	96.9	96.2

Average annual growth rate (%) 1972-1990

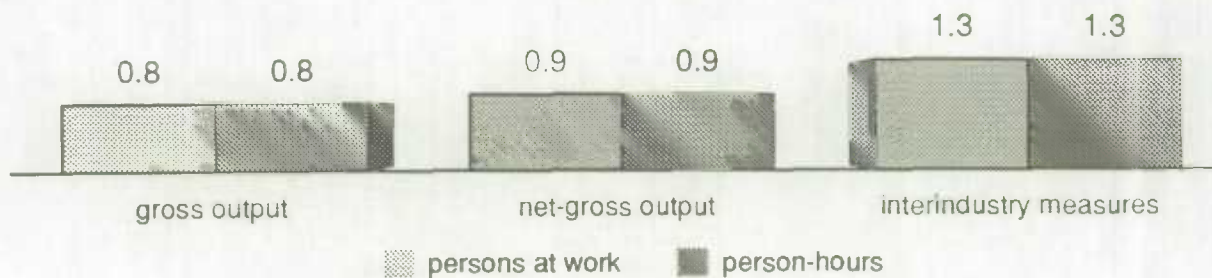


Table 17

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		
1972	82.9	82.0	81.3	80.3	70.8	69.0
1973	83.4	82.5	81.9	80.9	71.5	69.6
1974	83.3	82.7	81.8	81.2	71.5	70.1
1975	81.7	81.2	80.0	79.4	67.5	66.5
1976	84.9	84.2	83.6	82.8	72.5	71.2
1977	87.3	86.8	86.3	85.6	75.0	74.4
1978	86.1	85.7	84.9	84.5	74.4	73.6
1979	86.0	85.6	84.8	84.3	74.5	74.1
1980	88.8	88.6	87.9	87.7	78.1	78.0
1981	89.1	90.4	88.2	89.5	78.0	79.4
1982	87.0	89.5	85.9	88.6	75.4	78.1
1983	92.2	93.1	91.5	92.4	84.2	85.6
1984	96.6	96.9	96.3	96.7	93.2	93.8
1985	100.0	100.1	100.0	100.1	98.0	98.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	102.6	102.6	102.9	102.8	105.7	105.3
1988	101.5	101.0	101.7	101.1	106.1	104.9
1989	99.3	99.0	99.2	98.9	103.8	103.3
1990	97.8	97.8	97.6	97.5	102.0	101.7

Average annual growth rate (%) 1972-1990

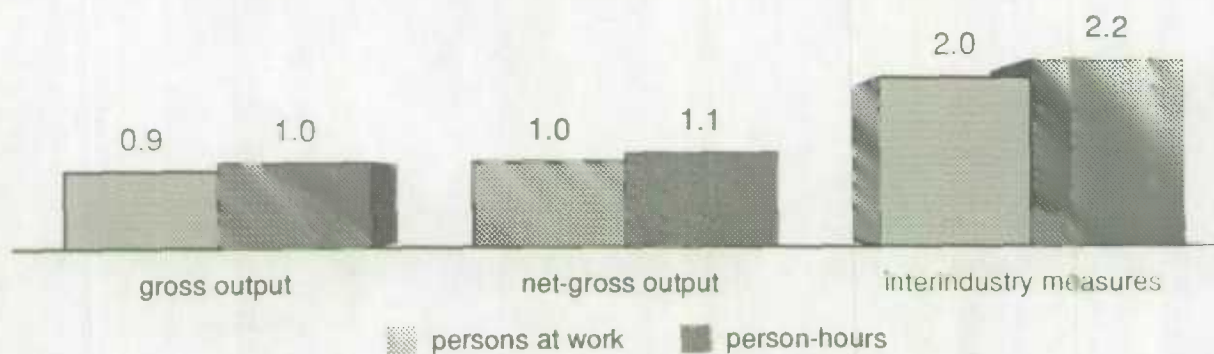


Table 18

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		
1972	103.8	102.5	103.9	102.6	98.5	96.2
1973	107.0	105.7	107.2	105.9	103.0	100.7
1974	97.8	96.6	97.8	96.5	93.5	91.6
1975	96.2	95.2	96.2	95.1	89.7	88.2
1976	101.5	100.2	101.6	100.2	96.2	94.4
1977	102.4	101.2	102.5	101.3	97.5	96.0
1978	106.4	105.3	106.6	105.5	102.1	100.6
1979	104.2	102.8	104.4	102.9	100.8	99.1
1980	102.3	101.5	102.4	101.6	98.6	97.5
1981	103.4	102.8	103.6	102.9	99.8	99.1
1982	93.5	93.1	93.3	92.9	87.1	87.0
1983	98.5	98.9	98.5	98.9	94.8	95.5
1984	101.0	101.0	101.1	101.1	99.7	99.8
1985	101.8	102.0	101.9	102.1	101.6	101.8
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	92.7	92.5	92.4	93.5	93.1
1989	91.4	92.5	91.0	92.2	91.6	92.7
1990	91.4	91.9	91.0	91.6	90.6	91.0

Average annual growth rate (%) 1972-1990

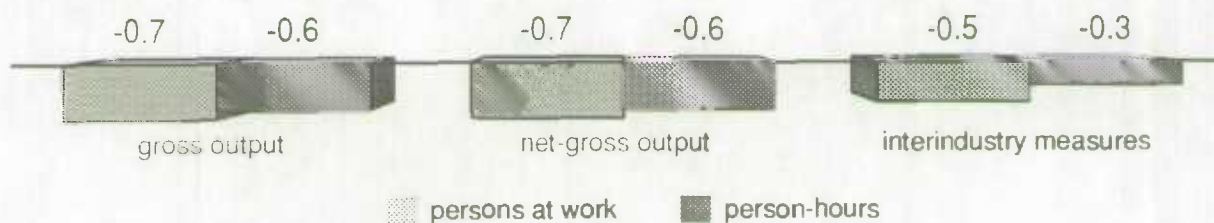


Table 19

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		
1972	99.1	98.4	99.1	98.3	92.9	91.5
1973	101.7	101.3	102.1	101.6	96.9	95.6
1974	103.6	103.3	104.3	103.9	98.4	97.3
1975	90.7	92.6	89.6	91.7	81.2	83.0
1976	98.0	98.6	97.7	98.4	90.9	91.2
1977	98.7	98.4	98.5	98.2	91.9	91.5
1978	102.1	100.3	102.3	100.3	96.0	93.5
1979	101.5	101.2	101.7	101.4	95.8	95.5
1980	101.6	100.1	101.8	100.1	95.6	93.7
1981	99.8	99.8	99.8	99.7	93.1	93.2
1982	94.0	94.1	93.2	93.3	84.9	85.4
1983	98.4	98.4	98.2	98.1	92.5	92.8
1984	99.7	99.6	99.6	99.5	97.2	97.3
1985	99.9	99.7	99.8	99.7	98.7	98.5
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.3	101.3	101.5	101.5	103.5	103.3
1988	99.9	99.7	99.8	99.6	102.5	101.8
1989	95.4	94.9	94.7	94.2	96.6	95.7
1990	91.8	91.7	90.7	90.5	91.3	90.9

Average annual growth rate (%) 1972-1990

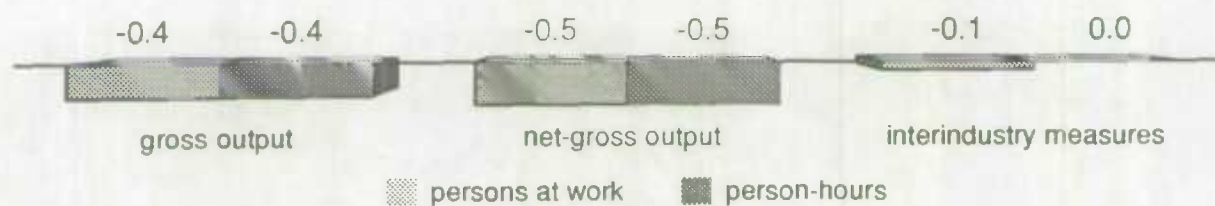


Table 20

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		
1972	88.8	86.9	88.1	86.1	85.4	82.9
1973	91.7	90.1	91.1	89.5	89.3	87.1
1974	91.1	89.8	90.5	89.2	88.7	86.9
1975	92.0	90.9	91.5	90.3	86.5	85.4
1976	96.6	95.7	96.4	95.5	93.1	92.1
1977	99.6	99.1	99.6	99.0	96.3	95.5
1978	101.9	101.0	102.1	101.1	99.8	98.2
1979	101.1	100.6	101.1	100.6	99.1	98.4
1980	101.4	100.5	101.5	100.5	99.4	98.0
1981	101.4	101.2	101.5	101.3	98.9	98.7
1982	96.8	96.5	96.6	96.3	91.9	91.8
1983	98.8	98.9	98.7	98.8	96.2	96.5
1984	101.6	101.4	101.7	101.5	100.7	100.7
1985	101.2	101.2	101.3	101.3	100.9	100.9
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	97.7	97.6	97.5	97.4	98.3	98.1
1988	97.6	97.2	97.4	96.9	98.1	97.5
1989	96.1	95.8	95.7	95.5	95.5	95.0
1990	93.2	92.7	92.6	92.1	91.0	90.4

Average annual growth rate (%) 1972-1990

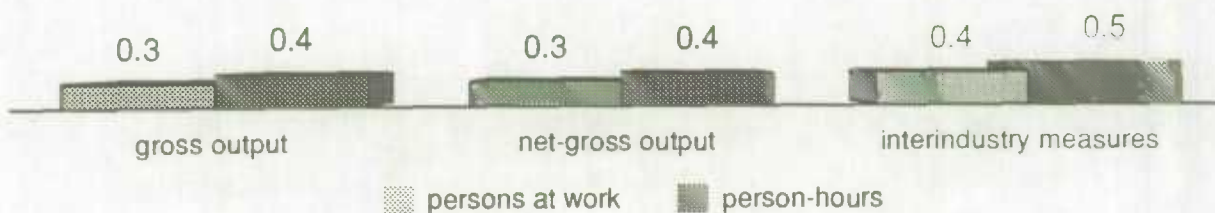


Table 21

Indices of multifactor productivity, primary metal 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		
1972	96.3	95.3	95.6	94.5	87.6	86.4
1973	98.3	97.2	97.8	96.6	95.1	93.3
1974	99.1	97.9	98.7	97.4	90.5	88.9
1975	96.0	95.7	95.2	94.9	85.7	85.1
1976	93.5	93.3	92.4	92.1	85.1	84.8
1977	96.7	96.3	96.0	95.6	88.0	87.4
1978	98.1	97.7	97.7	97.1	91.4	90.7
1979	94.6	94.0	93.7	92.9	87.2	86.5
1980	92.6	92.0	91.4	90.7	86.2	85.5
1981	95.2	94.9	94.3	93.9	85.6	85.1
1982	89.8	89.7	88.0	88.0	81.0	81.3
1983	94.5	94.5	93.6	93.6	87.1	87.1
1984	98.6	97.8	98.4	97.4	96.9	96.1
1985	100.8	100.9	100.9	101.1	100.8	100.8
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	102.4	102.4	102.8	102.8	107.1	106.7
1988	102.7	102.3	103.2	102.7	108.2	107.3
1989	102.5	102.4	102.9	102.8	104.9	104.1
1990	101.0	100.3	101.2	100.4	101.8	100.4

Average annual growth rate (%) 1972-1990

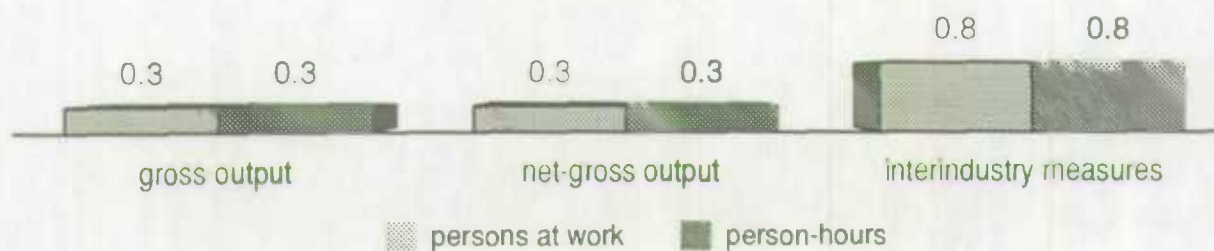


Table 22

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		
1972	94.6	93.6	94.2	93.1	93.0	91.1
1973	97.0	96.1	96.8	95.8	97.8	96.0
1974	98.0	97.6	98.0	97.5	98.2	96.9
1975	94.5	94.1	94.1	93.7	91.9	91.1
1976	96.3	95.9	96.0	95.6	93.9	93.1
1977	96.8	96.4	96.6	96.2	94.8	94.1
1978	97.4	96.7	97.2	96.5	95.7	94.7
1979	94.4	94.2	94.0	93.8	92.8	92.2
1980	95.5	95.3	95.2	95.0	92.3	91.9
1981	97.2	97.1	97.1	97.0	93.9	93.7
1982	94.8	95.1	94.5	94.7	88.1	88.6
1983	96.1	96.6	95.8	96.3	92.4	93.2
1984	99.6	99.8	99.6	99.8	99.7	99.8
1985	101.4	101.3	101.5	101.4	102.4	102.4
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	99.5	99.4	99.5	99.4	100.2	99.9
1988	99.2	99.0	99.1	98.9	99.3	98.8
1989	98.7	98.9	98.6	98.8	98.6	98.8
1990	98.9	99.1	98.8	99.0	97.7	97.7

Average annual growth rate (%) 1972-1990

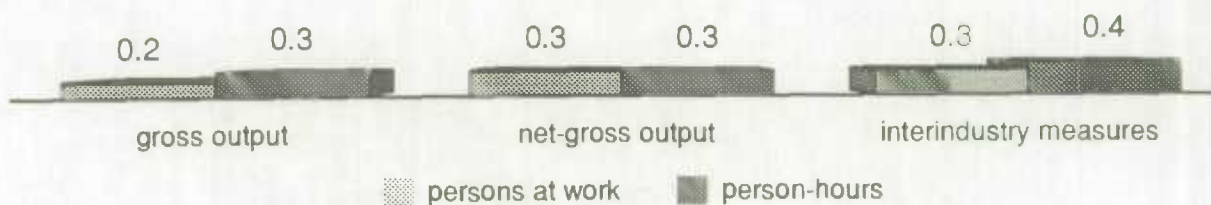


Table 23

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		
1972	97.3	96.6	97.2	96.4	95.6	94.1
1973	99.1	98.5	99.0	98.4	99.2	97.9
1974	100.2	100.0	100.2	100.0	100.3	99.3
1975	96.7	96.5	96.5	96.4	94.7	94.1
1976	97.2	97.1	97.1	97.0	95.8	95.3
1977	98.7	99.0	98.6	99.0	97.4	97.6
1978	100.9	100.9	101.0	100.9	99.7	99.4
1979	104.3	104.4	104.5	104.6	103.6	103.4
1980	102.6	102.9	102.8	103.1	101.1	101.1
1981	100.0	100.5	100.0	100.5	98.7	99.1
1982	92.2	92.8	91.7	92.4	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	99.5	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	97.9
1988	99.0	99.0	98.9	98.9	99.9	99.7
1989	97.8	97.9	97.7	97.8	98.6	98.7
1990	96.6	96.4	96.4	96.2	96.7	96.4

Average annual growth rate (%) 1972-1990

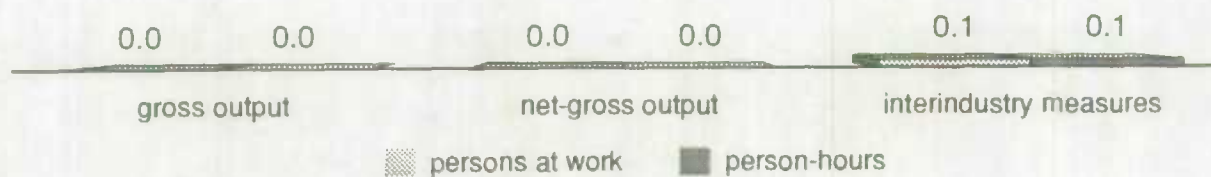


Table 24

Indices of multifactor productivity, transportation equipment 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		
1972	91.0	91.2	90.3	90.4	88.6	88.1
1973	94.6	94.7	94.1	94.2	93.5	92.9
1974	95.0	95.5	94.5	95.1	93.6	93.6
1975	96.9	97.3	96.6	97.1	94.3	94.4
1976	97.9	98.6	97.7	98.4	95.9	96.3
1977	99.0	99.3	98.8	99.2	97.1	97.3
1978	98.7	99.6	98.5	99.5	97.1	97.7
1979	98.1	99.4	97.9	99.3	96.7	97.9
1980	92.5	93.8	91.9	93.4	90.4	91.7
1981	93.9	95.2	93.4	94.8	92.0	93.3
1982	92.6	94.2	92.1	93.7	89.0	90.7
1983	95.8	96.7	95.5	96.5	93.8	94.9
1984	99.8	100.1	99.8	100.2	99.5	99.8
1985	101.0	101.3	101.1	101.3	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	98.9	98.5
1988	99.9	99.8	100.0	99.8	100.7	100.4
1989	99.8	100.4	99.8	100.4	100.2	100.8
1990	97.6	98.6	97.3	98.5	97.0	98.1

Average annual growth rate (%) 1972-1990

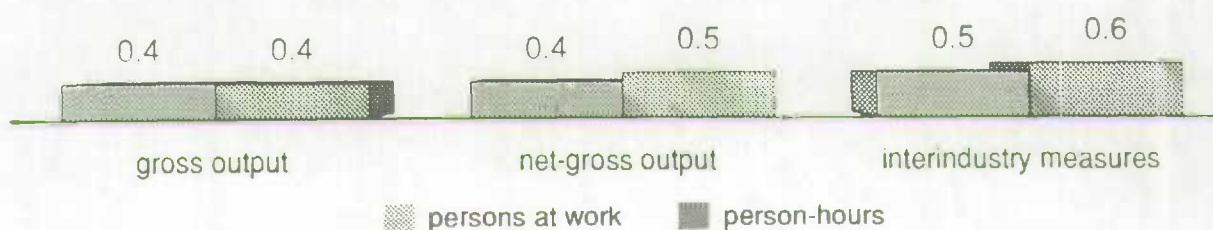


Table 25

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		
1972	77.4	76.8	75.6	74.9	70.7	69.6
1973	80.9	80.2	79.4	78.6	75.1	74.0
1974	80.6	80.0	79.1	78.4	75.2	74.2
1975	79.0	78.6	77.3	76.9	72.7	72.0
1976	82.0	81.8	80.6	80.3	76.4	76.0
1977	84.8	84.6	83.6	83.4	79.1	78.8
1978	84.1	83.7	82.8	82.5	78.4	77.8
1979	90.0	89.7	89.2	88.9	85.9	85.5
1980	93.3	93.3	92.8	92.8	90.3	90.1
1981	94.3	94.3	93.9	93.9	91.4	91.4
1982	90.9	90.9	90.2	90.2	87.2	87.4
1983	91.2	91.1	90.6	90.5	88.5	88.5
1984	97.1	97.4	96.9	97.2	96.8	97.2
1985	99.1	98.7	99.0	98.6	98.9	98.6
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	104.4
1989	104.8	104.6	105.2	105.0	106.5	106.3
1990	106.2	105.9	106.7	106.4	107.5	107.1

Average annual growth rate (%) 1972-1990

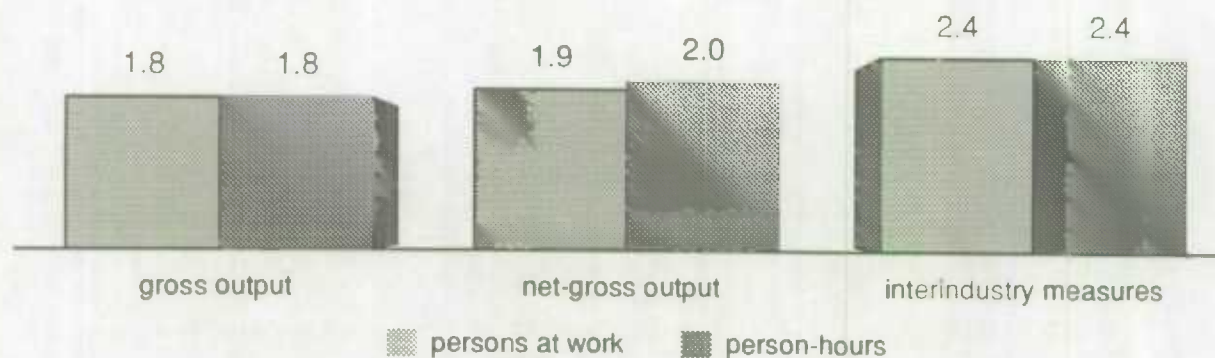


Table 26

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		
1972	107.1	105.6	108.2	106.5	92.6	90.6
1973	101.5	100.4	101.9	100.7	96.3	94.4
1974	97.5	96.7	97.4	96.5	94.9	93.5
1975	94.7	94.0	94.2	93.4	91.8	90.6
1976	95.5	95.0	95.1	94.6	94.2	93.5
1977	94.6	94.1	94.1	93.6	92.5	91.9
1978	96.0	95.6	95.7	95.2	95.5	94.8
1979	96.4	96.0	96.2	95.7	96.6	96.0
1980	90.7	90.9	89.7	90.0	88.7	88.8
1981	90.1	90.5	89.1	89.5	86.7	86.9
1982	84.5	85.1	82.8	83.5	78.9	79.6
1983	90.0	90.3	89.0	89.2	87.3	87.6
1984	94.5	94.5	93.9	94.0	94.3	94.4
1985	98.3	98.4	98.1	98.2	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	104.6
1988	102.4	101.8	102.6	102.0	106.7	105.7
1989	100.2	99.6	100.2	99.5	103.0	102.4
1990	95.0	94.7	94.5	94.2	96.8	96.5

Average annual growth rate (%) 1972-1990

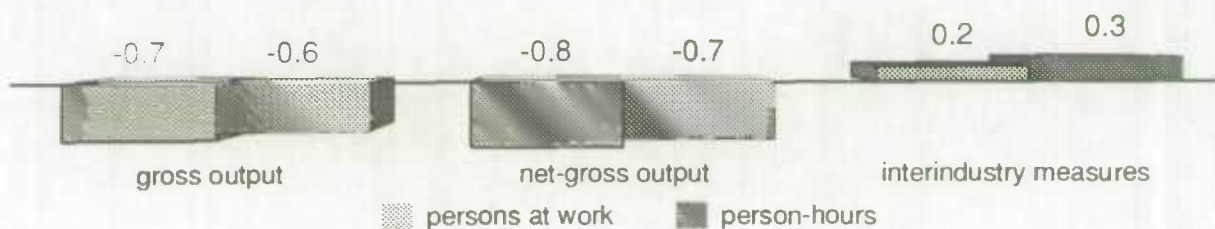


Table 27

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		
1972	92.8	92.7	92.6	92.5	130.2	129.2
1973	96.3	96.3	96.2	96.2	138.7	137.9
1974	95.7	95.8	95.7	95.7	134.4	133.7
1975	96.3	96.4	96.2	96.4	127.5	127.2
1976	95.7	95.9	95.6	95.8	122.3	121.9
1977	98.7	98.8	98.6	98.8	123.1	123.1
1978	96.5	96.7	96.4	96.6	114.4	114.4
1979	95.2	95.3	95.1	95.2	115.0	114.8
1980	95.6	95.8	95.5	95.7	106.5	106.4
1981	97.7	97.9	97.7	97.8	102.5	102.4
1982	100.0	100.2	100.0	100.2	101.2	101.1
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	104.5
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.8	100.7	100.9	100.8	105.0	104.8
1988	101.0	101.1	101.0	101.1	110.9	110.6
1989	100.8	100.8	100.8	100.8	109.6	109.3
1990	101.8	101.8	101.9	101.9	111.3	111.0

Average annual growth rate (%) 1972-1990

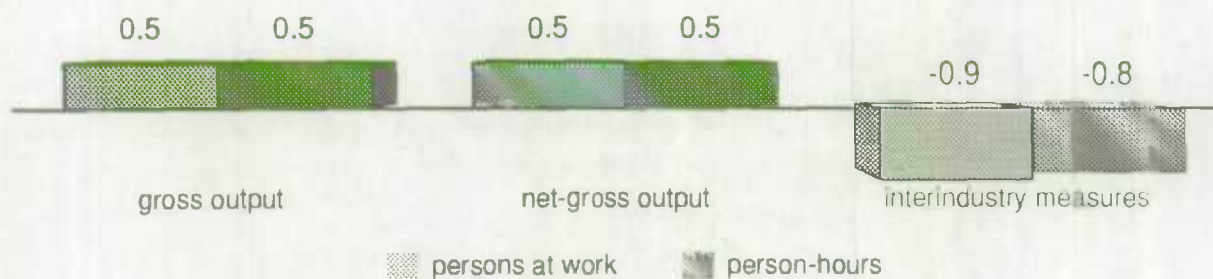


Table 28

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		
1972	87.5	87.3	85.4	85.2	87.2	86.2
1973	91.2	91.1	89.6	89.4	92.2	91.2
1974	91.1	91.1	89.4	89.4	92.1	91.4
1975	86.2	86.1	83.8	83.7	86.1	85.5
1976	88.8	89.7	86.8	87.8	89.4	89.9
1977	89.2	89.2	87.3	87.2	90.8	90.5
1978	91.7	91.6	90.1	89.9	93.1	92.6
1979	93.5	93.7	92.2	92.4	95.5	95.3
1980	91.0	91.2	89.2	89.5	91.3	91.2
1981	93.7	94.0	92.5	92.9	94.5	94.7
1982	88.5	88.9	86.2	86.7	86.9	87.5
1983	95.5	95.6	94.6	94.6	93.7	93.9
1984	98.6	98.6	98.3	98.3	98.3	98.4
1985	99.5	99.6	99.4	99.5	100.1	100.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.6	101.7	101.9	102.0	102.6	102.6
1988	103.1	103.0	103.8	103.7	104.5	104.1
1989	104.6	104.4	105.6	105.3	105.5	105.2
1990	103.3	103.1	104.0	103.8	103.1	102.7

Average annual growth rate (%) 1972-1990

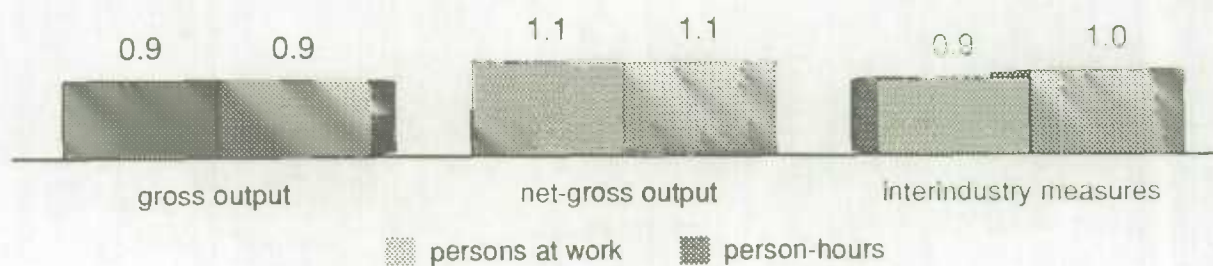
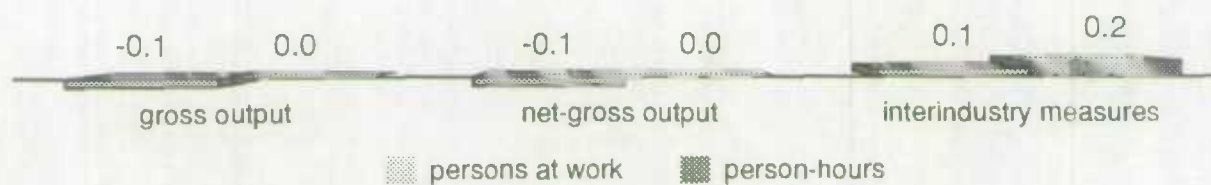


Table 29

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		
1972	99.3	98.0	99.2	97.9	96.0	94.0
1973	101.1	100.1	101.1	100.1	99.3	97.6
1974	100.5	99.4	100.5	99.3	97.6	95.9
1975	98.6	97.7	98.5	97.6	94.0	92.7
1976	103.5	103.0	103.6	103.1	100.0	99.2
1977	104.2	103.8	104.4	104.0	100.2	99.5
1978	104.9	104.6	105.2	104.8	101.5	100.8
1979	103.5	103.1	103.7	103.3	100.8	100.1
1980	101.2	101.0	101.3	101.0	98.7	98.3
1981	102.6	102.4	102.7	102.5	100.1	99.8
1982	102.0	102.2	102.1	102.3	97.5	97.8
1983	101.6	101.6	101.7	101.6	98.7	98.8
1984	105.4	105.0	105.7	105.3	104.8	104.4
1985	106.1	105.4	106.4	105.6	105.8	105.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.0	101.5	101.1	101.6	101.9	102.2
1988	98.9	99.4	98.9	99.4	100.7	101.0
1989	98.8	98.3	98.8	98.3	100.7	100.1
1990	98.2	97.8	98.2	97.7	98.1	97.5

Average annual growth rate (%) 1972-1990



PART 2

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	38.8
1974	69.0	79.0	83.9	30.7	87.3	82.2	38.9	36.6	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	49.9	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	55.3	62.3
1979	82.4	89.5	92.1	55.5	92.1	89.5	62.0	60.2	67.3
1980	83.8	91.4	93.5	62.7	91.7	89.7	68.6	67.1	74.8
1981	87.5	94.2	95.4	72.4	92.8	91.7	76.8	75.8	82.7
1982	82.6	91.3	90.9	75.8	90.4	90.9	83.0	83.4	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	110.0	101.7	101.0	106.5	105.8	104.8
1988	110.1	107.2	108.2	121.7	102.7	101.8	113.4	112.5	110.4
1989	112.8	109.6	109.7	131.6	102.9	102.8	120.1	120.0	116.7
1990	111.5	109.8	109.8	137.2	101.5	101.5	124.9	124.9	123.0
1991	109.0	106.8	105.6	138.6	102.0	103.2	129.8	131.3	127.2
1992	109.6	105.5	104.1	141.8	103.9	105.3	134.4	136.2	129.4

% change

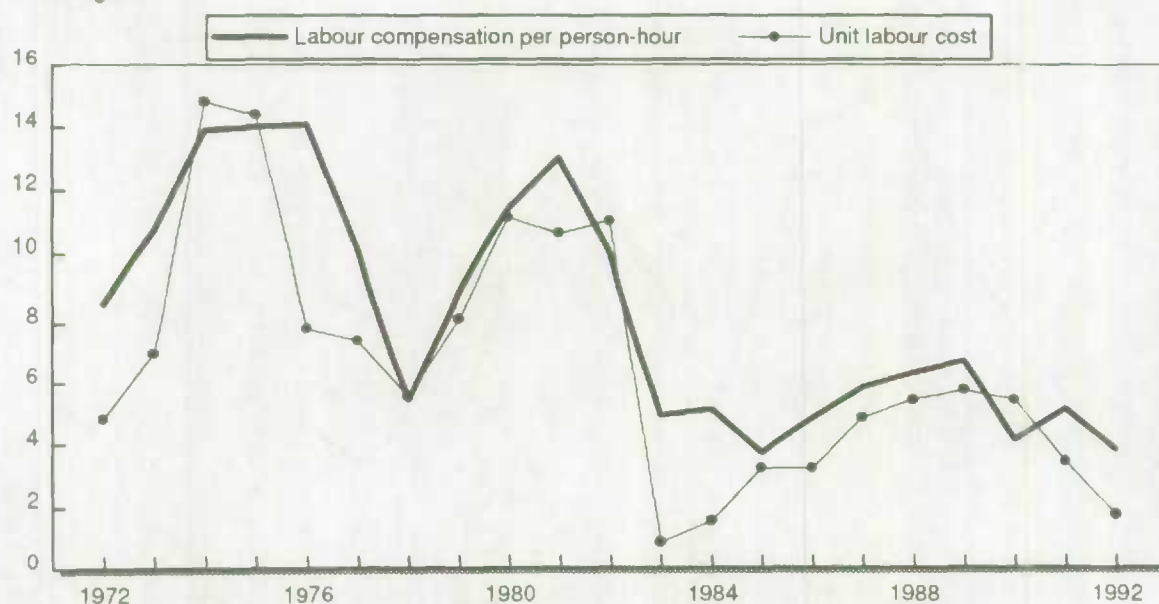


Table 2

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	25.7	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	44.4
1975	68.9	79.0	82.3	35.2	87.3	83.7	44.6	42.8	51.1
1976	73.6	80.5	83.4	40.7	91.4	88.2	50.5	48.7	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	61.0	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	82.7
1982	82.0	90.9	90.1	75.7	90.2	91.1	83.2	84.0	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	106.5	105.6	104.5
1988	111.0	108.0	109.3	121.9	102.8	101.5	113.0	111.5	109.9
1989	113.4	110.6	111.1	132.1	102.6	102.1	119.4	118.8	116.4
1990	111.7	110.9	111.2	137.6	100.7	100.4	124.0	123.7	123.2
1991	109.1	107.7	106.7	139.0	101.3	102.3	129.1	130.3	127.4
1992	110.0	106.5	105.3	142.3	103.3	104.4	133.7	135.2	129.4

% change

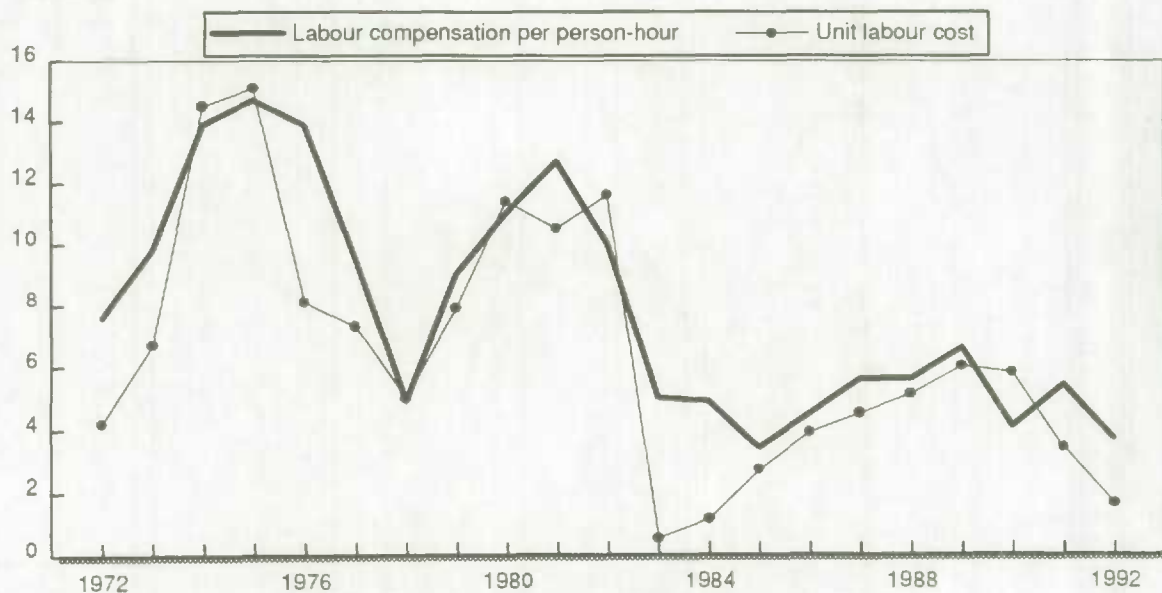


Table 3

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	38.1	44.3
1975	64.4	70.1	73.8	32.0	91.9	87.3	45.6	43.4	49.7
1976	68.0	71.6	74.8	36.9	94.9	90.8	51.6	49.4	54.3
1977	70.0	74.9	77.0	41.2	93.5	91.0	55.0	53.5	58.8
1978	73.7	78.1	80.8	45.2	94.4	91.2	57.9	55.9	61.3
1979	77.9	81.7	83.8	51.4	95.3	92.9	63.0	61.3	66.0
1980	81.3	84.9	86.8	59.0	95.7	93.7	69.5	67.9	72.5
1981	84.8	88.9	90.0	67.5	95.4	94.2	76.0	75.0	79.6
1982	81.0	88.5	88.2	73.3	91.6	91.9	82.9	83.1	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	91.9	92.6	95.2
1985	94.6	97.6	97.2	93.0	97.0	97.3	95.3	95.6	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	111.0	102.1	101.5	107.1	106.5	104.9
1988	111.6	107.7	108.5	122.7	103.6	102.8	113.9	113.0	109.9
1989	115.2	110.5	110.5	134.4	104.3	104.3	121.6	121.7	116.6
1990	114.4	112.8	113.0	142.3	101.5	101.3	126.2	125.9	124.4
1991	113.3	111.6	110.3	146.7	101.6	102.8	131.5	133.0	129.4
1992	115.8	111.6	110.3	151.9	103.7	105.0	136.0	137.6	131.1

% change

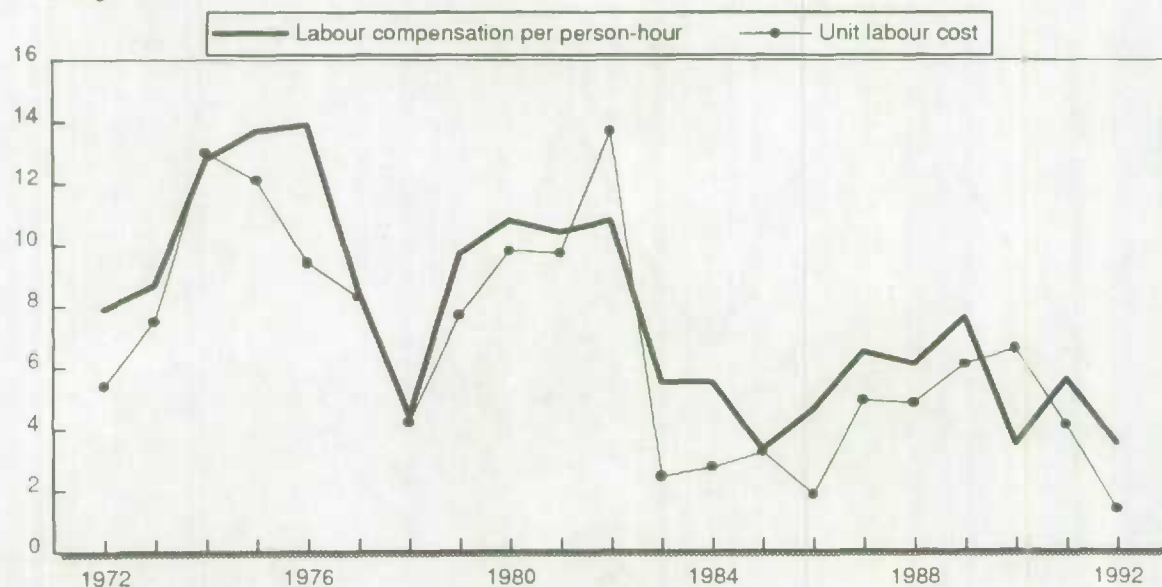


Table 4

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	110.1	108.1	108.6	128.0	101.9	101.4	118.5	117.9	116.3
1990	108.3	105.1	105.3	130.6	103.0	102.9	124.2	124.0	120.5
1991	104.3	99.2	98.9	128.2	105.1	105.5	129.2	129.7	123.0
1992	103.0	95.9	95.2	128.9	107.5	108.3	134.5	135.5	125.2

% change

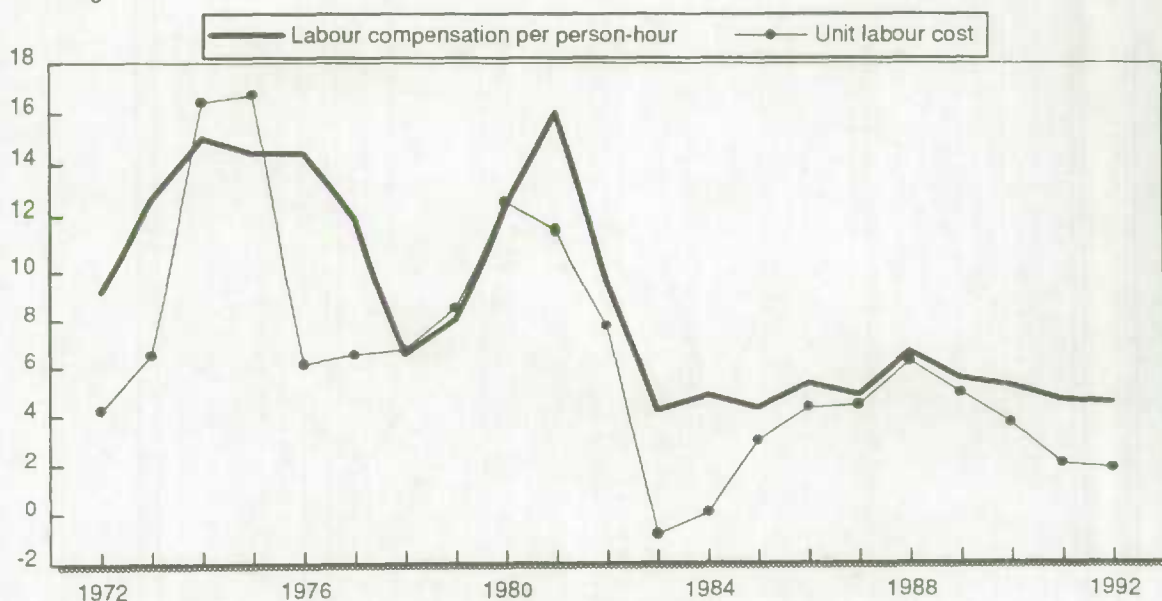


Table 5

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			
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	92.5	92.4	90.9	113.0	100.1	101.8	122.3	124.3	122.2
1990	106.0	91.8	91.7	121.1	115.5	115.6	131.9	132.1	114.3
1991	104.9	91.7	91.5	122.7	114.3	114.6	133.7	134.0	117.0
1992	99.7	89.9	88.3	120.6	110.9	113.0	134.2	136.7	121.0

% change

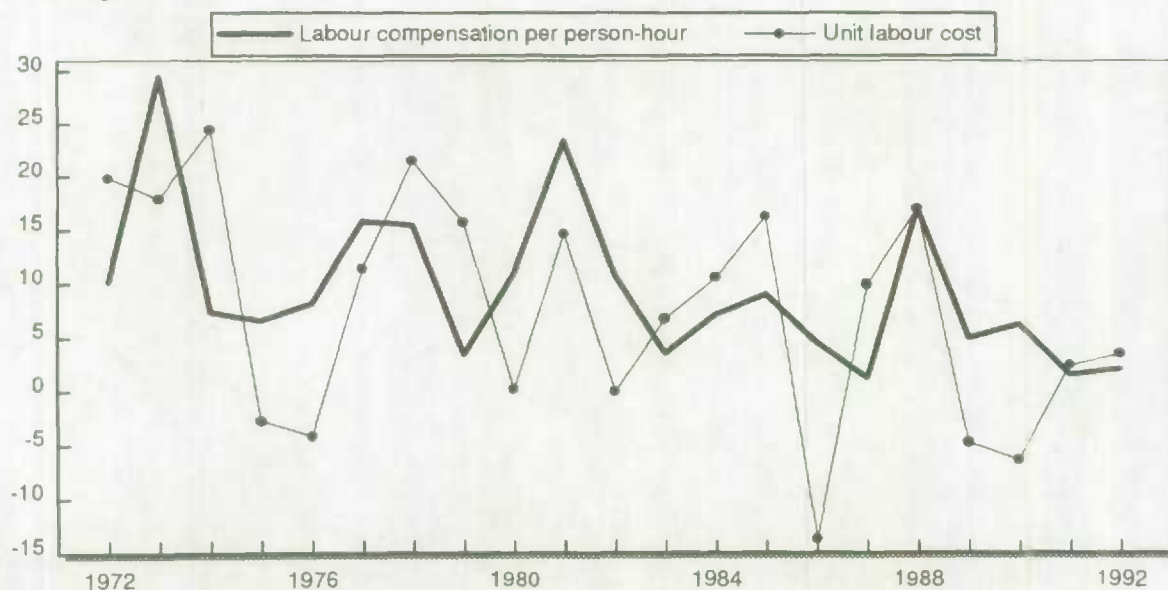


Table 6

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	111.1	108.8	109.2	121.8	102.1	101.8	111.9	111.6	109.6
1990	107.5	103.2	103.4	122.1	104.2	104.0	118.3	118.1	113.6
1991	101.2	95.8	95.9	120.7	105.6	105.5	125.9	125.8	119.2
1992	101.4	91.8	92.6	122.4	110.5	109.5	133.3	132.2	120.7

% change

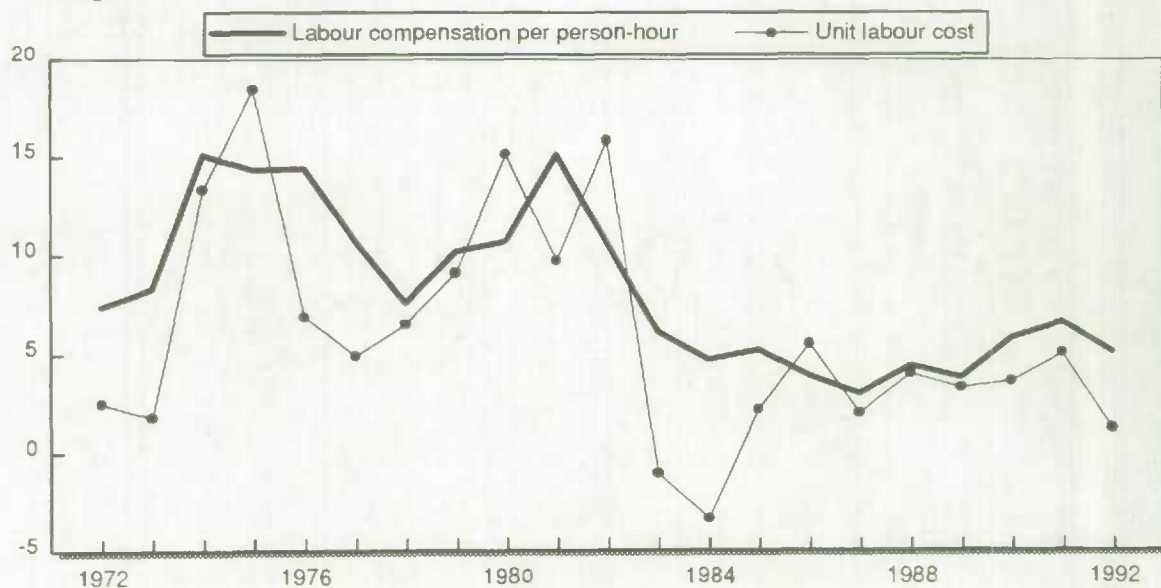


Table 7

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	115.7	119.7	124.4	151.3	96.7	93.0	126.4	121.6	130.7
1990	115.7	121.9	123.1	157.2	95.0	94.0	129.0	127.7	135.8
1991	110.7	113.1	112.2	147.7	97.9	98.7	130.6	131.6	133.4
1992	103.4	111.1	108.3	146.3	93.1	95.4	131.7	135.1	141.5

% change

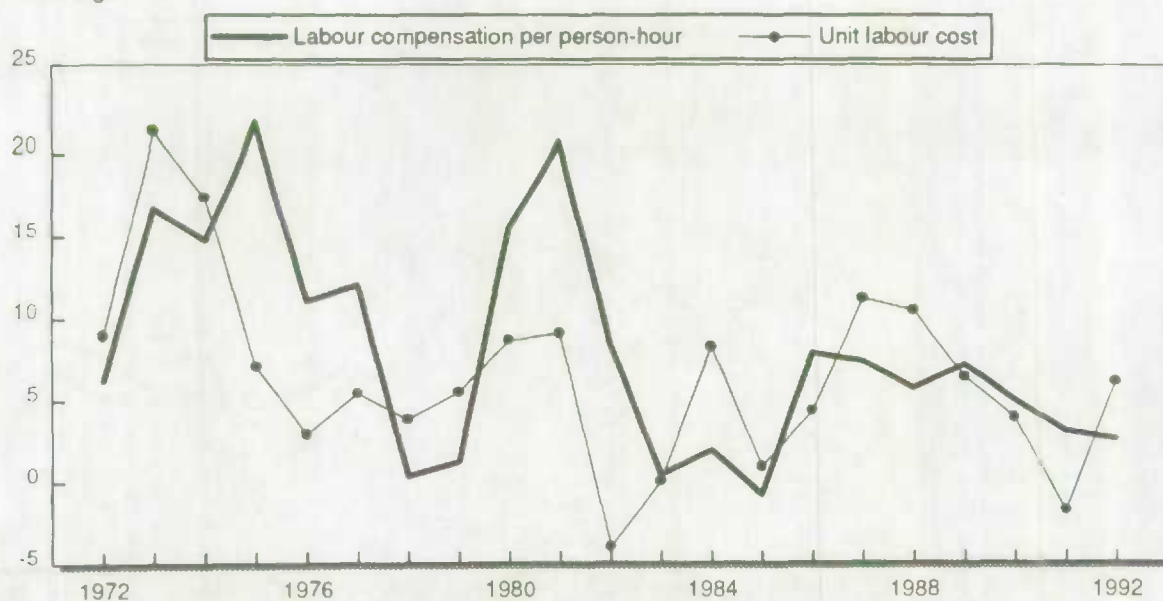


Table 8

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	110.6	103.6	106.8	118.0	106.8	103.6	114.0	110.5	106.7
1990	109.1	103.7	106.1	121.0	105.3	102.8	116.7	114.0	110.8
1991	106.6	102.6	103.8	125.0	103.9	102.7	121.8	120.4	117.2
1992	108.2	101.4	103.7	127.9	106.7	104.3	126.1	123.2	118.2

% change



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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	127.1	104.7	103.9	119.0	121.4	122.3	113.7	114.5	93.6
1990	134.7	104.0	103.5	126.4	129.5	130.2	121.5	122.1	93.8
1991	140.3	102.9	102.4	134.5	136.4	137.0	130.8	131.3	95.9
1992	143.3	104.0	104.0	142.4	137.8	137.9	136.9	136.9	99.3

% change



Table 10

Indices of labour productivity and unit labour cost, wholesale trade 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			
1972	52.7	65.3	67.0	20.6	80.7	78.7	31.6	30.8	39.2
1973	56.4	68.6	72.0	24.1	82.2	78.4	35.1	33.4	42.7
1974	58.5	72.1	73.7	29.1	81.1	79.4	40.3	39.4	49.7
1975	60.2	74.0	74.7	35.4	81.4	80.6	47.9	47.4	58.9
1976	63.8	74.9	75.8	40.2	85.1	84.2	53.6	53.0	63.0
1977	62.2	77.6	77.2	43.0	80.2	80.6	55.4	55.7	69.1
1978	63.5	81.4	82.1	47.5	78.0	77.4	58.3	57.8	74.8
1979	67.3	82.7	82.4	54.0	81.3	81.6	65.2	65.5	80.2
1980	72.1	81.3	81.3	61.1	88.7	88.7	75.2	75.2	84.8
1981	77.0	87.1	86.7	69.8	88.5	88.8	80.2	80.5	90.7
1982	70.6	83.2	82.1	71.4	84.9	86.0	85.8	87.0	101.1
1983	77.0	89.2	87.1	76.1	86.3	88.4	85.4	87.5	98.9
1984	83.0	94.8	92.7	84.8	87.6	89.6	89.5	91.5	102.2
1985	93.4	100.2	98.4	92.9	93.1	94.9	92.6	94.4	99.5
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	107.8	106.0	105.9	113.7	101.7	101.8	107.3	107.4	105.4
1988	115.7	109.7	109.7	125.5	105.4	105.5	114.3	114.4	108.4
1989	120.6	113.1	111.7	137.4	106.6	107.9	121.5	123.0	113.9
1990	120.5	118.1	118.4	150.0	102.0	101.8	126.9	126.7	124.5
1991	120.9	115.7	115.5	151.9	104.5	104.7	131.3	131.5	125.7
1992	129.8	116.7	116.3	159.5	111.2	111.6	136.6	137.1	122.9

% change

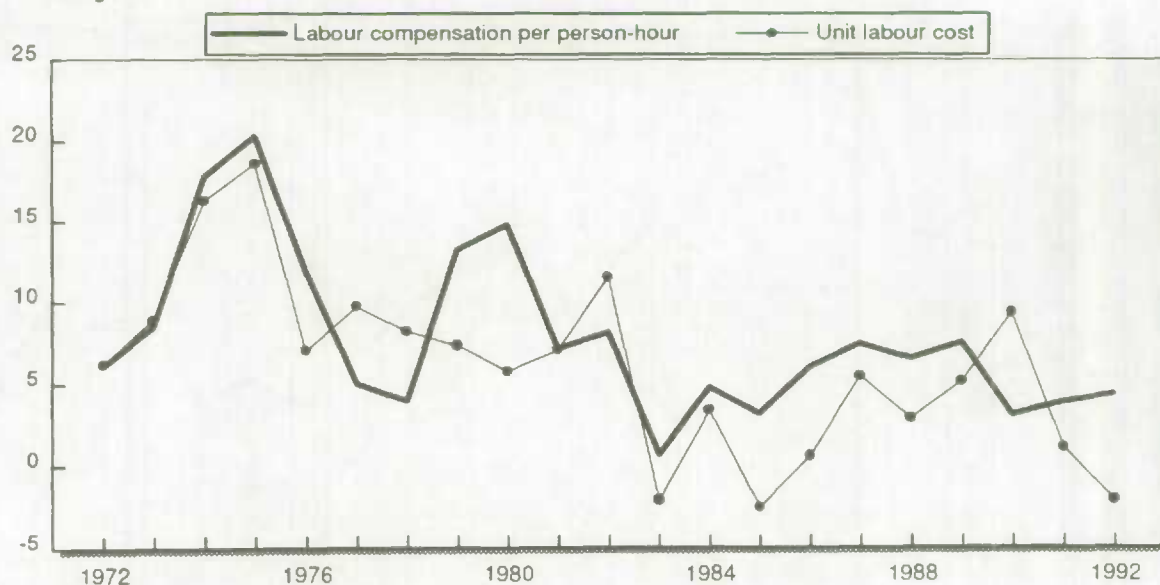


Table 11

Indices of labour productivity and unit labour cost, retail trade 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			
1972	69.5	68.5	74.7	24.1	101.4	93.0	35.2	32.2	34.7
1973	72.9	72.5	78.3	26.8	100.6	93.1	36.9	34.2	36.7
1974	74.7	76.9	82.7	31.8	97.2	90.4	41.3	38.4	42.5
1975	78.4	79.3	84.7	37.6	98.9	92.7	47.4	44.4	47.9
1976	83.1	80.2	84.2	42.8	103.6	98.7	53.3	50.8	51.5
1977	83.5	81.2	84.5	47.4	102.9	98.9	58.4	56.1	56.7
1978	85.1	85.1	87.9	49.9	100.0	96.9	58.6	56.8	58.6
1979	85.8	88.3	91.0	56.4	97.1	94.3	63.9	62.0	65.8
1980	84.9	91.3	93.5	62.6	93.0	90.8	68.6	67.0	73.7
1981	85.5	95.2	96.8	70.3	89.7	88.2	73.8	72.6	82.3
1982	82.5	92.7	92.1	76.0	89.0	89.5	82.0	82.5	92.2
1983	86.8	89.1	87.1	78.2	97.5	99.6	87.8	89.8	90.1
1984	91.9	93.8	93.0	86.1	98.0	98.8	91.7	92.5	93.6
1985	96.8	97.3	96.7	93.3	99.6	100.1	96.0	96.5	96.4
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.9	100.9	100.4	107.1	104.9	105.4	106.2	106.7	101.2
1988	109.1	103.6	102.8	117.6	105.4	106.2	113.5	114.4	107.7
1989	111.8	105.4	104.1	127.6	106.1	107.5	121.1	122.6	114.1
1990	108.4	105.4	104.9	132.3	102.8	103.3	125.6	126.2	122.1
1991	103.9	104.2	101.6	135.1	99.7	102.2	129.6	132.9	130.0
1992	105.8	103.7	102.1	135.2	102.1	103.7	130.5	132.5	127.8

% change

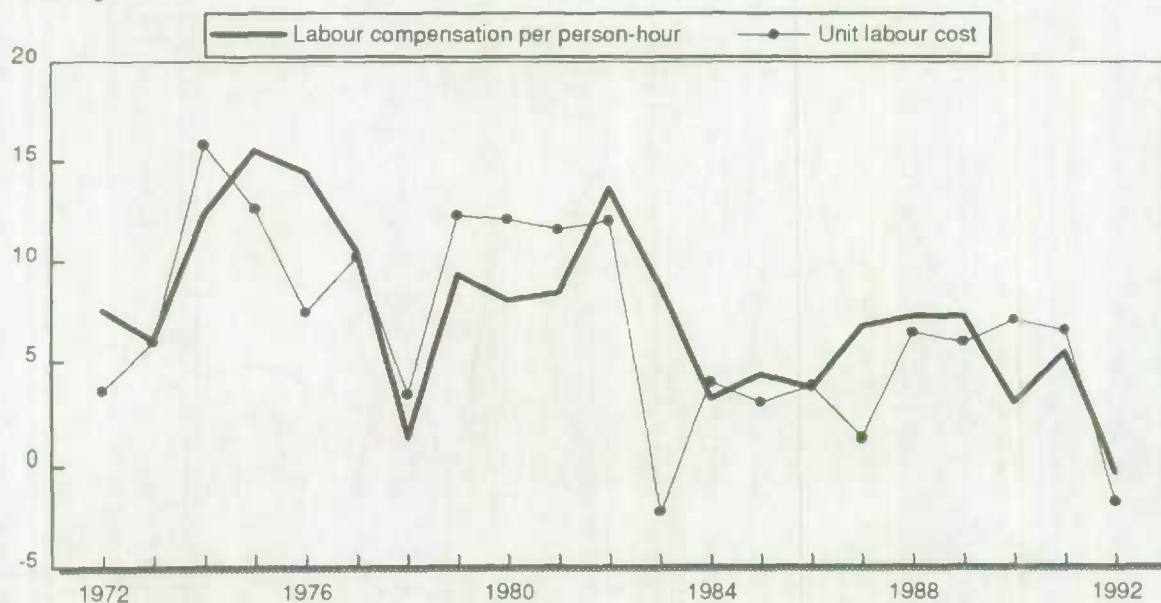


Table 12

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			
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	119.2	115.7	116.5	142.6	103.1	102.3	123.3	122.4	119.6
1990	119.9	119.6	120.7	153.5	100.2	99.3	128.3	127.2	128.1
1991	115.4	118.5	117.9	159.2	97.4	97.9	134.3	135.1	137.9
1992	114.8	119.5	117.1	165.1	96.1	98.0	138.2	141.0	143.9

% change

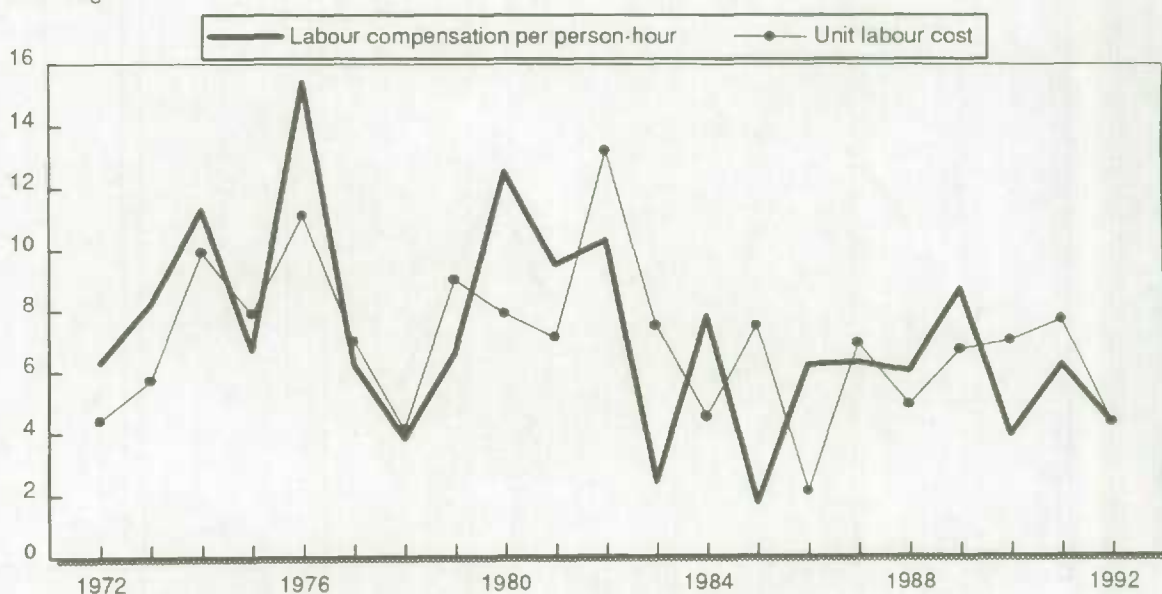


Table 13

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	97.1	103.6	104.5	116.4	93.7	92.9	112.3	111.3	119.9
1990	98.2	101.5	103.7	120.1	96.7	94.6	118.4	115.8	122.4

% change



Table 14

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	106.3	87.4	86.5	98.4	121.6	122.9	112.6	113.8	92.6
1990	103.0	75.2	75.2	91.1	136.9	136.8	121.2	121.1	88.5

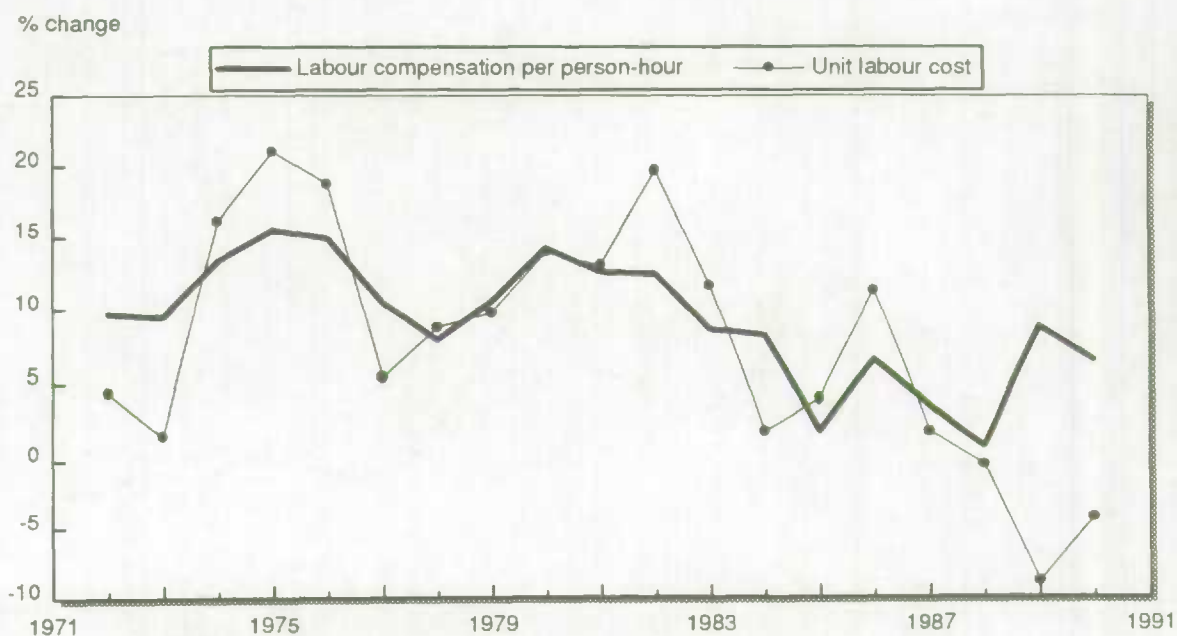


Table 15

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	99.9	73.7	75.2	90.8	135.5	132.8	123.2	120.7	90.9
1990	96.4	70.5	72.9	93.1	136.7	132.1	132.0	127.6	96.6

% change



Table 16

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	106.4	99.4	100.7	109.3	107.1	105.6	110.0	108.5	102.7
1990	104.2	96.3	96.5	113.2	108.2	107.9	117.5	117.2	108.6

% change

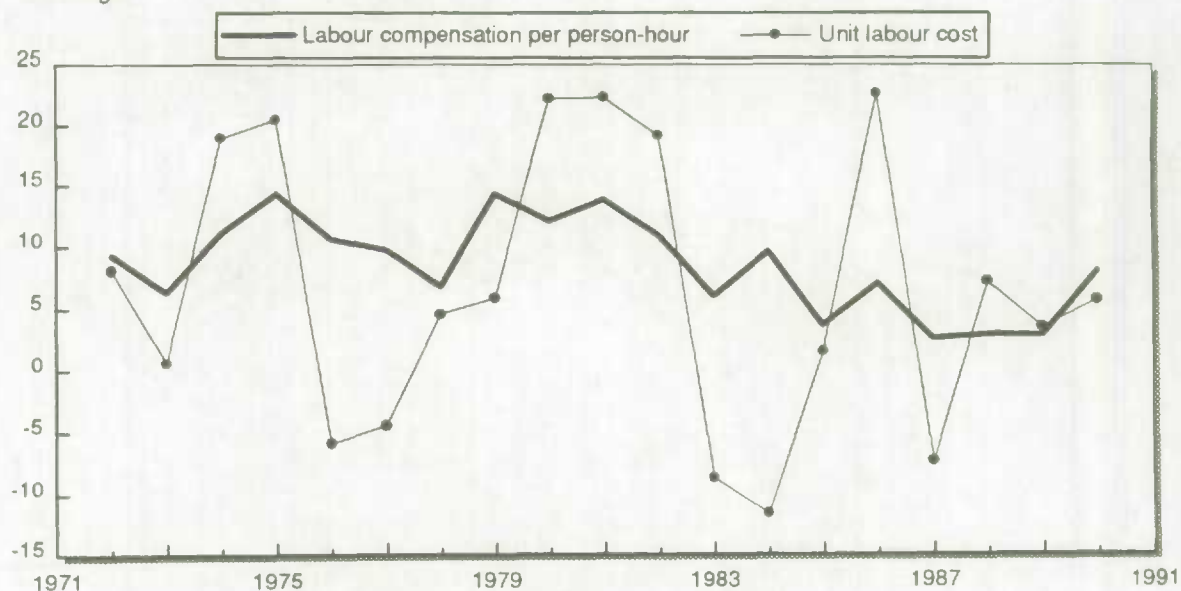


Table 17

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	118.7	127.6	130.6	142.7	93.1	90.9	111.8	109.2	120.2
1990	114.8	125.4	126.6	149.8	91.5	90.7	119.5	118.3	130.4

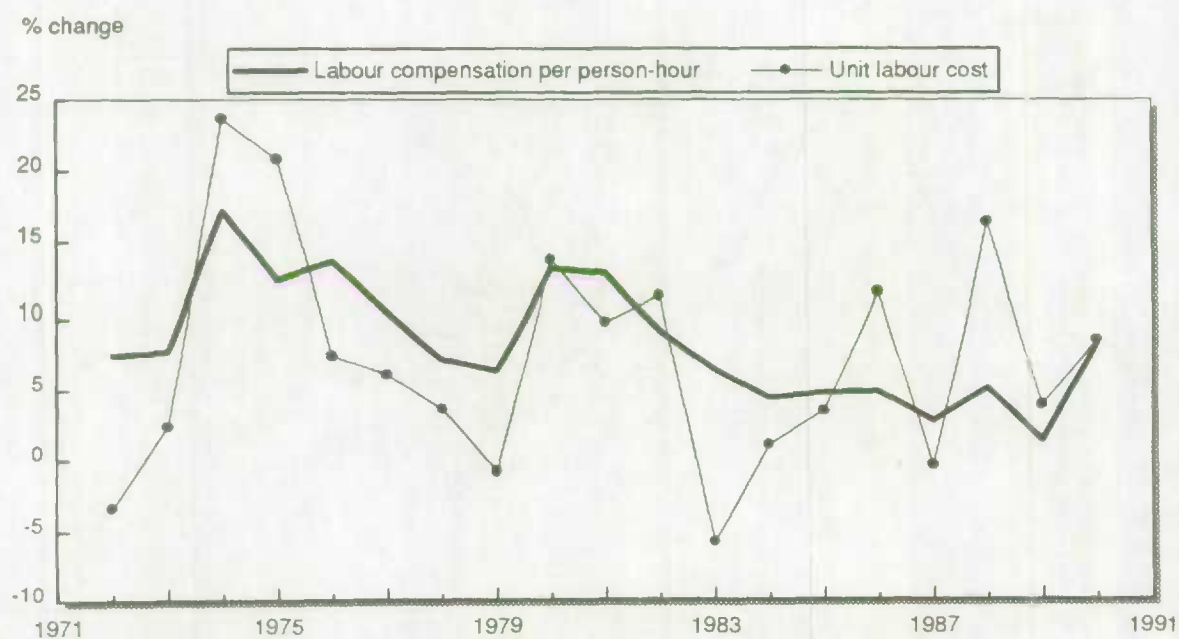


Table 18

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	83.5	79.1	81.8	86.3	105.6	102.0	109.2	105.5	103.4
1990	72.8	70.9	72.5	85.3	102.6	100.4	120.2	117.6	117.2

% change

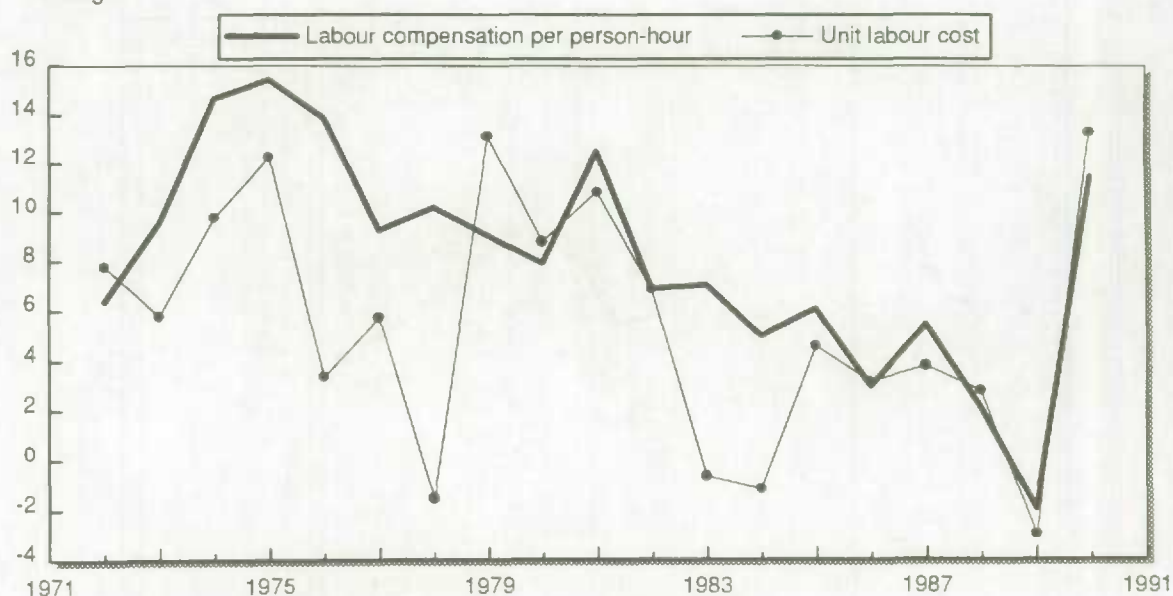


Table 19

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			
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	98.3	100.7	102.9	113.0	97.6	95.5	112.3	109.8	115.0
1990	90.4	94.6	95.0	111.3	95.5	95.1	117.7	117.2	123.2



Table 20

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	115.0	101.5	100.6	116.6	115.6	114.8
1990	95.9	91.0	92.7	111.8	105.4	103.5	122.9	120.6	116.6

% change



Table 21

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	115.4	111.6	112.7	125.9	103.4	102.4	112.8	111.7	109.1
1990	107.2	104.1	104.4	123.6	103.0	102.7	118.7	118.4	115.2

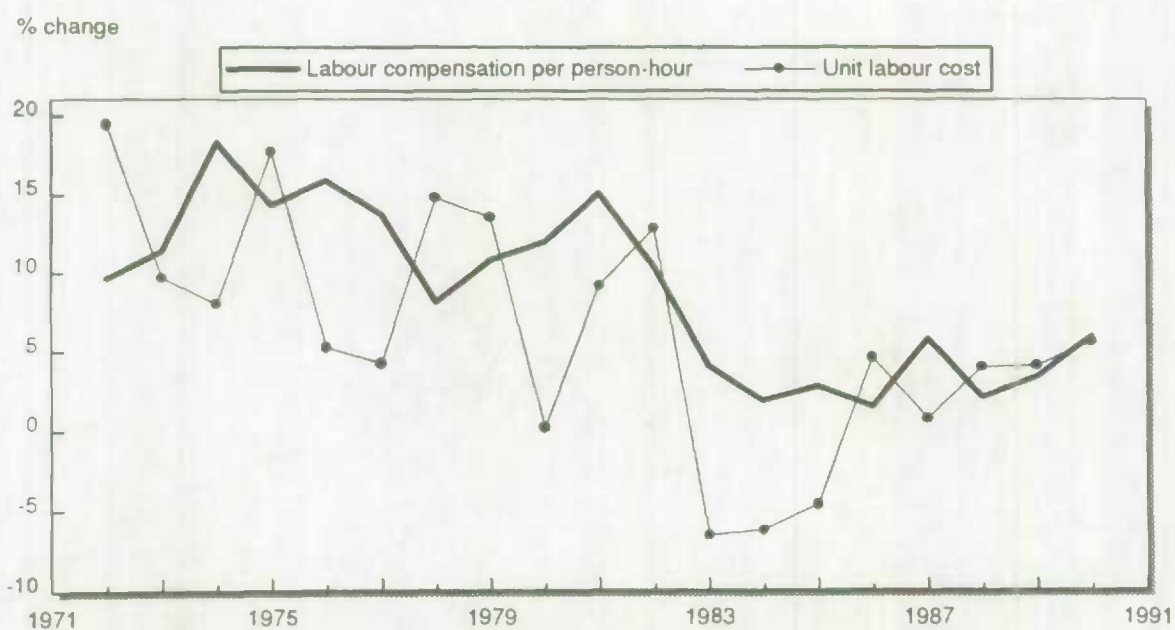


Table 22

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			
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	96.2	114.1	109.9	127.2	84.3	87.6	111.5	115.8	132.3
1990	90.7	106.0	104.6	125.2	85.6	86.7	118.2	119.7	138.1



Table 23

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	102.4	101.8	104.2	114.7	100.6	98.3	112.6	110.1	112.0
1990	100.7	98.0	98.9	116.2	102.8	101.8	118.6	117.5	115.4



Table 24

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			
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	107.4	114.1	114.8	132.0	94.2	93.5	115.8	115.0	123.0
1990	106.3	114.9	116.6	139.4	92.5	91.2	121.3	119.6	131.1

% change

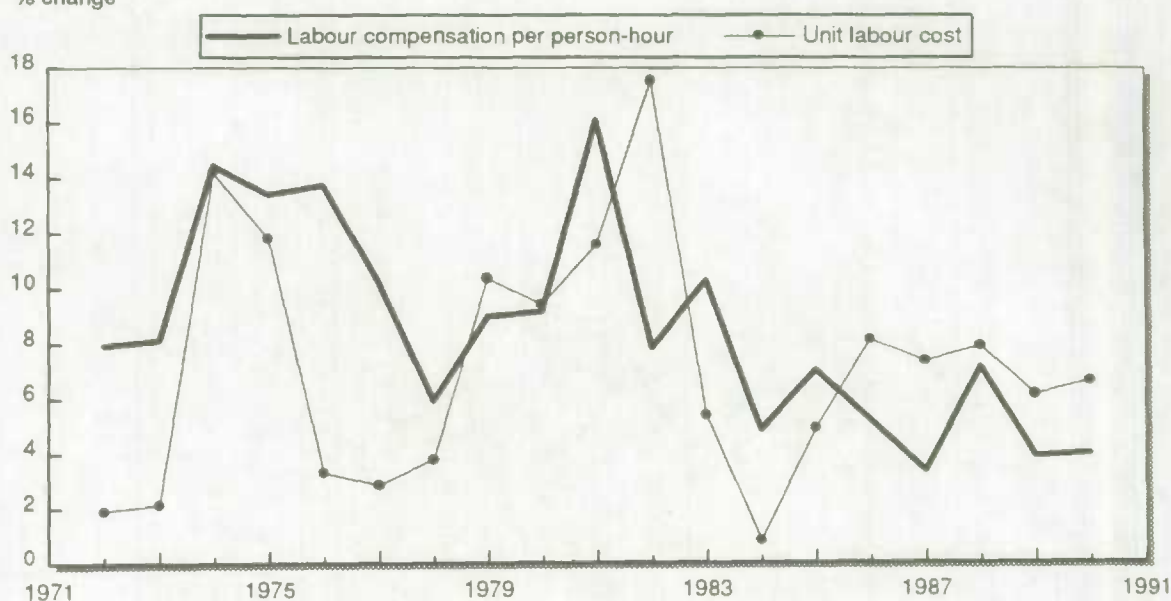


Table 25

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	113.0	102.5	103.1	116.5	110.2	109.6	113.7	113.0	103.1
1990	107.0	93.1	96.0	111.7	114.9	111.4	119.9	116.3	104.4

% change



Table 26

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	112.1	122.1	121.4	135.0	91.8	92.4	110.5	111.2	120.4
1990	105.5	112.7	112.0	134.7	93.6	94.2	119.5	120.2	127.6

% change

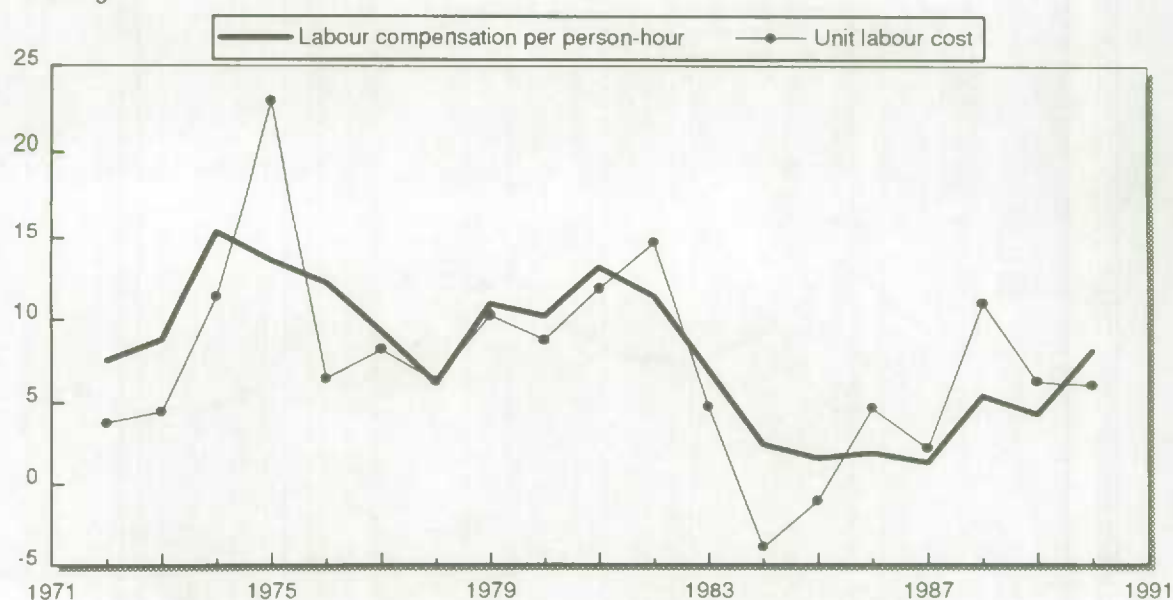


Table 27

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	110.5	121.0	120.6	131.9	91.3	91.7	109.0	109.4	119.4
1990	102.5	109.0	109.8	131.5	94.0	93.4	120.6	119.8	128.3

% change

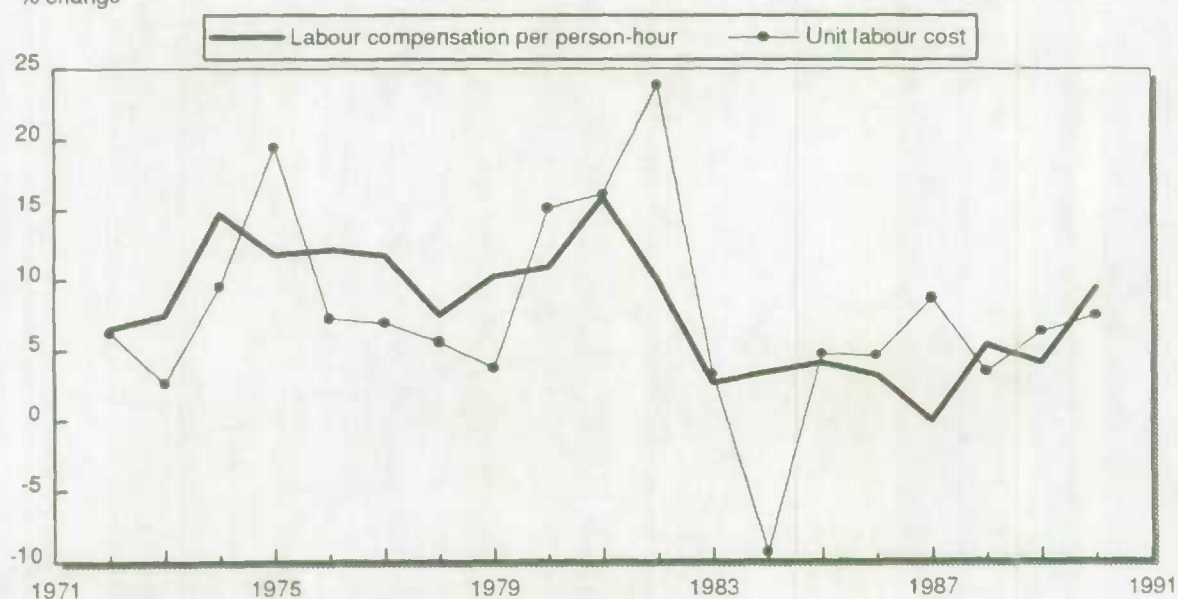


Table 28

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	124.7	112.4	108.7	123.2	111.0	114.8	109.6	113.4	98.8
1990	117.1	105.9	99.7	121.2	110.6	117.4	114.5	121.5	103.5

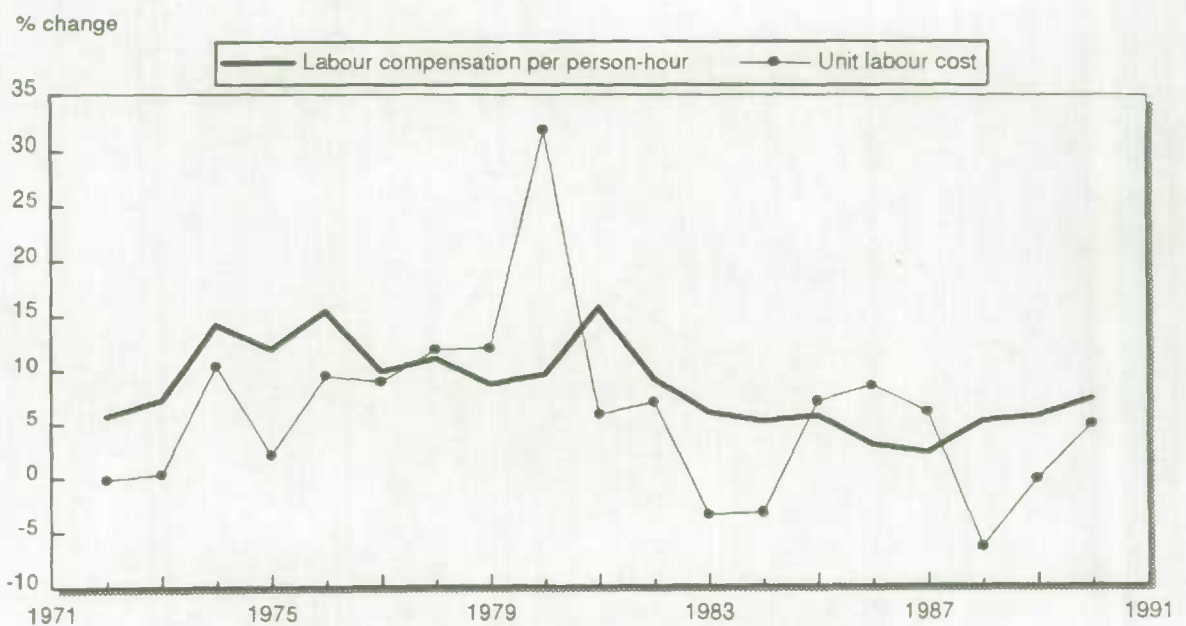


Table 29

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	126.6	111.9	112.7	125.4	113.2	112.4	112.0	111.3	99.0
1990	126.2	104.6	105.6	124.4	120.7	119.5	119.0	117.8	98.6

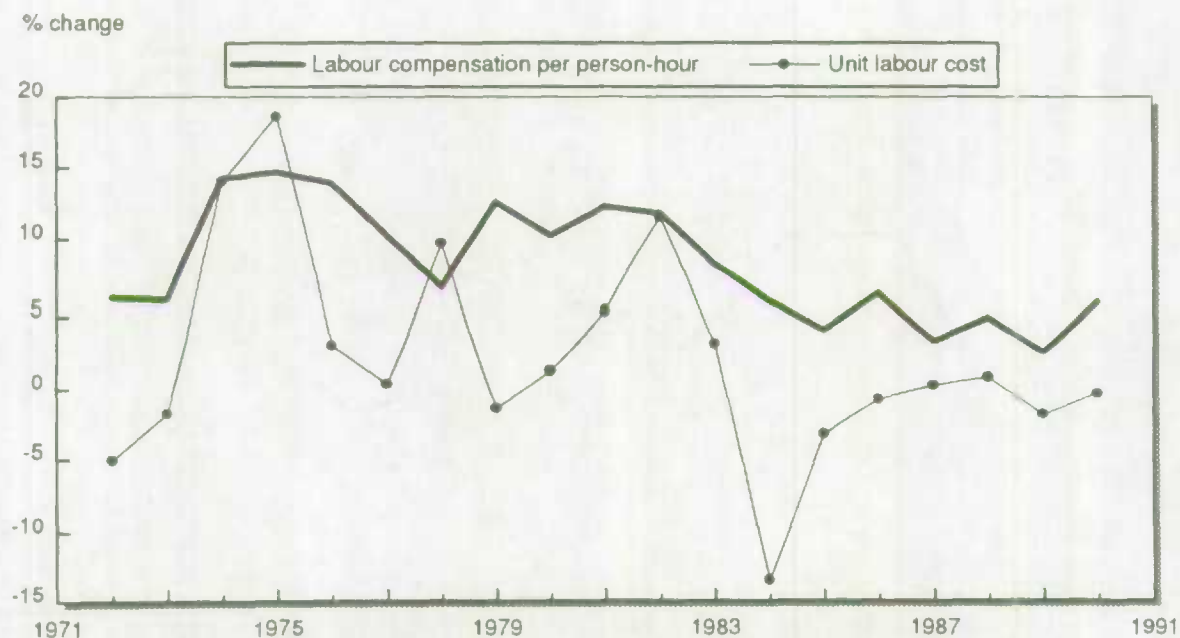


Table 30

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	108.7	107.2	110.0	119.0	101.4	98.8	111.0	108.1	109.4
1990	98.5	102.2	103.7	118.0	96.4	95.0	115.5	113.9	119.8



Table 31

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			
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	112.7	111.6	111.0	122.4	101.0	101.6	109.7	110.3	108.6
1990	120.8	100.7	100.2	114.2	120.0	120.6	113.4	114.0	94.5

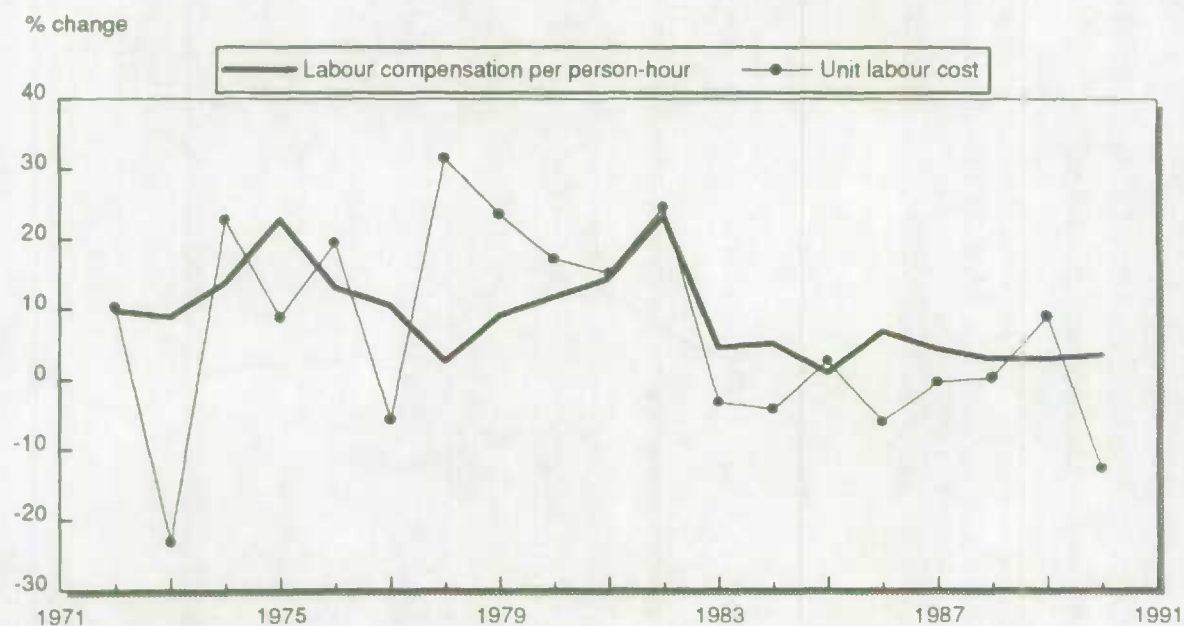


Table 32

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		Compensation per person	Compensation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
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	118.7	108.0	109.2	120.2	110.0	108.7	111.3	110.1	101.2
1990	119.9	107.7	108.7	127.1	111.4	110.3	118.0	116.9	106.0

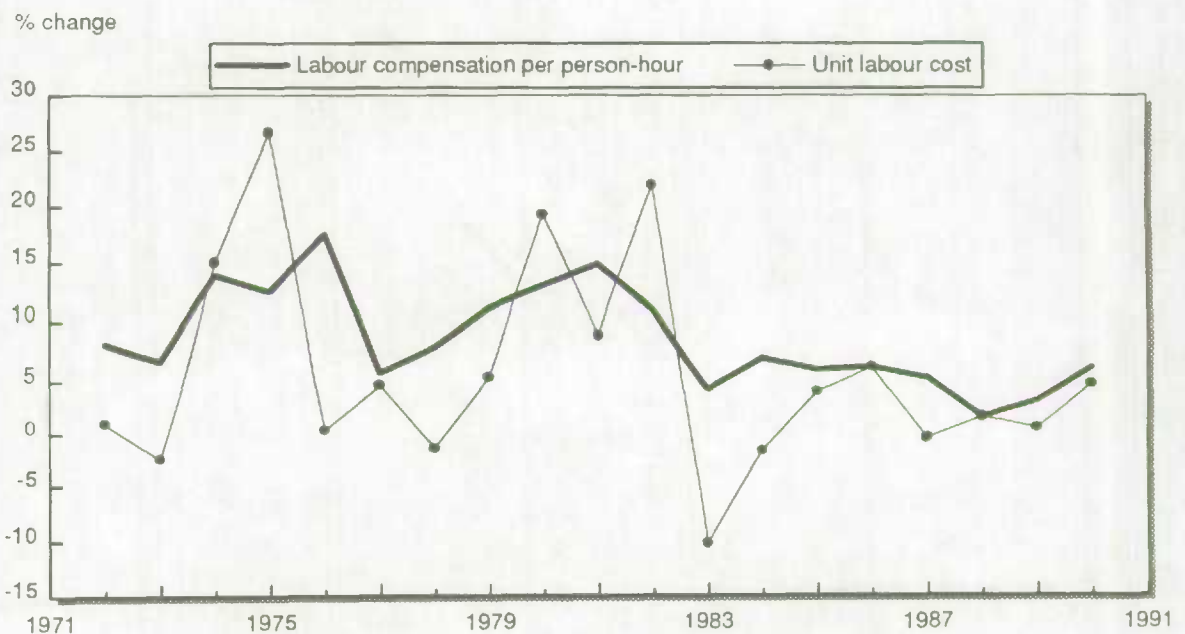
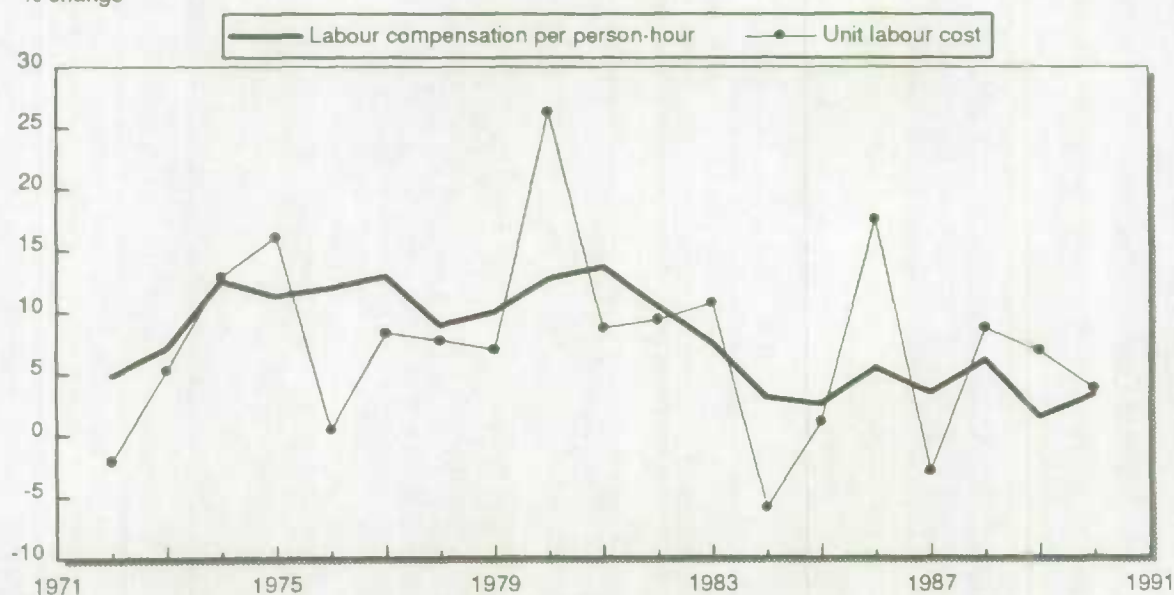


Table 33

Indices of labour productivity and unit labour cost, other manufacturing 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			
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	109.1	108.5	110.3	122.5	100.6	98.9	112.9	111.0	112.2
1990	107.9	107.8	109.7	125.0	100.0	98.4	116.4	114.5	116.4

% change



APPENDIXES

1 - Basic Concepts and Methods

2 - Sources of Data

3 - Aggregation Parameters for Productivity Measures

4 - Quality Rating of Productivity Estimates and Related Data

5 - Productivity and Related Data in CANSIM

APPENDIX 1

Basic Concepts and Methods

Ideally, a productivity index is one that takes into account all paid resources that are used as inputs into 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 1 of this publication. Productivity indices that take into account only a subset of the inputs such as, for instance, labour productivity indices, are called *partial* productivity indices. Labour productivity indices are presented in Part 2 of this publication. Part 2 also includes estimates of unit labour costs by industry.

The labour productivity estimates have a longer history than the rather recent multifactor productivity estimates. Consequently, they were not derived as partial indices of the multifactor productivity indices and they thus require a separate methodological description.

In particular, the labour productivity indices are based on a Laspeyres measure of real gross domestic product by industry which is not used in the multifactor productivity accounts. Hence, this appendix presents separately the basic concepts and methods used in the labour and the multifactor productivity accounts.

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 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..."¹. 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"². Industries include both business and non business establishments but can be sectorised to include only business establishments. Both the labour and the multifactor productivity indices presented in this publication refer, either explicitly or implicitly, to business establishments only.

The productivity of the government sector can not be calculated at this time in the framework of the Canadian System of National Accounts. 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. By convention (for lack of a better alternative), this amounts to measure the real output of

1. 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).

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

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 measure³.

1 - Labour Productivity and Unit Labour Costs

1.1 - Labour Productivity

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 over the long run.

Although labour input is an important determinant in the level of output, it is not the only one. Other inputs also contribute to the production process. Partial productivity indices that do not take these inputs explicitly into account are therefore subject to changes in these inputs as one of the component of the productivity ratio, namely the output level, is partly determined by these other inputs. Hence, a partial productivity index may rise through time either because these other inputs are used in larger quantity or because the efficiency of the production process improves or both. It follows that partial productivity indices such as the labour productivity indices are not precise indicators of overall productive efficiency.

1.2 - Output

The concept of output used in labour productivity measurement is the 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, 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 in the Canadian System of National Accounts. 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).

1.3 - 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 as is the case when measuring multifactor productivity. But the underlying estimates of persons at

3. Further detail on the industry coverage of the productivity measures in this publication can be found in Appendix 3.

work and person-hours are the same in both set of productivity estimates. Thus, the aggregate labour inputs of different classes of labour are obtained by adding the number of persons at work or the number of person-hours across classes.

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

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

1.5 - 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.

1.6 - 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:

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

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 compensation
	\$'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 trade industries	23,312	558	1,066	17,128
Retail trade industries	28,269	1,433	2,343	23,949
Community, business and personal services industries	52,119	1,990	3,286	41,921

2 - Multifactor productivity

2.1 - Multifactor Productivity in a Nutshell

Although the partial labour productivity indices described above are appropriate for many analytical uses, they do not describe exhaustively 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.

On the other hand, the multifactor productivity accounts intend to measure the performance of the Canadian economy in production activities by taking the contributions of all productive resources into account. 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.

In general, productivity gains are measured 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 inputs⁴. We will refer to this index as the industry index. Because the industry index does not account for the productivity gains realized in other industries, it can be viewed as a tool to assess productivity gains in a static partial equilibrium framework.

4. Except in variant of this index 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 industries supplying intermediate inputs⁵. 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. The interindustry indices can thus be considered as estimates of multifactor productivity gains in a static general equilibrium framework.

Both measures of productivity are useful. For instance, in an effort to assess the performance of an economy as a whole in the production of some bundle of goods, 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.

2.2 - The Concept and Measurement of Multifactor Productivity

The *level* of multifactor productivity is a ratio between the level of production of industries and the quantity of all 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 aggregate⁶. 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. The most widespread choice at the industry level is the *gross output* measure. 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.

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

5. The concept and the empirical estimates were first introduced by T.K. Rymes and A. Cas in a study done for Statistics Canada between 1983 and 1985 and published later. See Cas A. and T.K. Rymes (1991), *On Concepts and Measures of Multifactor Productivity in Canada, 1961-1980*, Cambridge University Press, New York. However, contrary to Rymes and Cas, we include the capital stock in the primary inputs rather than in intermediate inputs.

6. 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 maximization. The time continuous Divisia index is approximated by the chained Tornqvist index.

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 inputs⁷ 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 3. 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. It is hoped that natural resources will be included in the future as estimates of their prices and uses become available. It is believed that this data shortage has implications mostly for the **quality of estimates of resources industries but that it has little impact on the estimates of other industries.**

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. As mentioned above, 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 the 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 factors explaining the increased efficiency of labour, such as education. The labour productivity indices presented in this publication do not allow such a decomposition.

7. *Capital goods are commodities produced by the business sector like intermediate inputs. However, they are accumulated only if savings occur. Capital goods are supplied to the business sector at the beginning of each period by the households which are the asset holders of the economy. 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.*

2.3 - 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 or 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 separation costs and the cost of training new employees when operations expand later on.

No adjustment for capacity utilization of inputs is explicitly made to the multifactor productivity indices with one important 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)⁸.

However, this correction does not fully eliminate the cyclical fluctuations of the indices and, consequently, does not reveal the trend followed by technical progress. This may be due to the fact that capital is not the only quasi-fixed factor. We just mentioned above the phenomena of labour hoarding. Short run disequilibrium may also act on the measure as well as scale economies and errors in the data.

However, 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.

2.4 - Alternative Measures of Multifactor Productivity

2.4.1 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*⁹ 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

8. 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-Holland.

9. 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.

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. 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.

2.4.2 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 Harper¹⁰, "...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 output¹¹ 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 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. As a counterpart, the concept of net-gross output has the disadvantage that productivity estimates depend on the level of aggregation as the more aggregated so the more integrated they are. Detailed industry productivity estimated, therefore, cannot be compared to aggregate estimates.

2.5 - Aggregate Business Productivity

The discussion of the various concepts has hitherto been made with reference to the industry or commodity group 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.

10. W. Gullickson and M.H. 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.

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

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.

2.6 - 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

Sources of Data

This Appendix includes a description of data sources employed in the production of labour and multifactor productivity indices. As indicated in Appendix 1, labour productivity indices are not produced as partial multifactor productivity indices. Because both these index types are derived in part from different data sources, we describe their sources separately. More specifically, labour productivity indices are based on Laspeyres indices of Gross Domestic Product while multifactor productivity indices are calculated mainly from Törnqvist indices of gross and net-gross output. In spite of these differences, the measure of labour input, either employment or hours worked, are identical in both productivity measures.

The description of data sources is divided in two categories depending on whether data are preliminary or final. Final data are based on benchmarked data from the Input-Output Accounts as well as on statistics obtained from censuses and surveys, while preliminary data are based on other more up to date but less reliable data.

1 - Description of Labour Productivity Data

1.1 - 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: *The Input-Output Structure of the Canadian Economy in Constant Prices* (Catalogue 15-202) and *Gross Domestic Product by Industry* (Catalogue 15-001) for the years following the benchmark year. 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.

1.2 - Labour Input

The indices of productivity employ two alternative measures of the quantity of labour input used in production. One is the conventional measure of average annual persons at work and the other is the more precise number of hours these persons have worked. The description of sources for the employment and hours estimates applicable to the last four years are presented below¹.

1. For further details about labour input data sources, the reader is referred to *Indexes of Output Per Person Employed and Per Man-hour in Canada, Commercial Non-agricultural Industries, 1947-1963* (Catalogue 14-501) for the years 1946 to 1961 and 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.

1.2.1 - Estimations of Persons at work

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. Up to the year of the preliminary input-output tables, the paid workers and other-than-paid workers estimates are produced at the most detailed level of the System of National Accounts. This represents employment estimates for 216 different industries, including the non-commercial sector.

Beginning in 1988, an important change has been made to the estimates of persons at work used in measures of productivity. The number of persons at work obtained as the average of the aggregation of the estimates of all industries obtained from different sources is reconciled to the employment obtained by applying the growth rate of total employment obtained from the Labour Force Survey to the 1987 employment level. The growth rate of commercial and non-commercial employment obtained from this survey also serves as annual benchmark. Any difference between the estimates is allocated between the trade industries and the Community, Business and Personal Services (excluding education and hospital industries) because employment data for these industries are considered less reliable. The same method is applied to the preliminary data described below.

Benchmark data for 1989 and 1990

Paid workers. The number of paid workers including multiple job holders in agriculture, fishing and trapping industries as well as for wholesale trade, and the accommodation and food industries is taken from the *Labour Force Survey* (Catalogue 71-001).

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 related to mineral extraction.

The primary data source used for the first three groups is the *General Review of the Mineral Industries*, (Catalogue 26-201). The only exception 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, Employment, Earnings and Hours, Catalogue 72-002 has been used.

The source of the number of paid workers in manufacturing is *Manufacturing Industries of Canada: National and Provincial Areas* (Catalogue 31-203) a publication from the annual survey of manufactures.

The publication *Employment, Payroll and Hours* (Catalogue 72-002) is the source for the following industries:

- Logging and forestry industries;
- Construction industries (contract work);
- Transportation and storage industries;

Other utility industries;
Finance, insurance and real estate industries;
Business service Industries;
Educational service industries;
Health and social services industries;
Personal and other service industries;
Non-commercial services.

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 the case of the four 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*.

Among the industries in the above list, the construction industry requires a clarification. The Input-Output concept of the construction industry includes the construction activity contracted out as well as the activity carried out by the work force of all other industries. The latter activity is named Own-Account Construction. Given a lack of data on the employment directly affected to own-account construction, such employment is estimated from data on labour remuneration cost obtained from *Construction in Canada*, (Catalogue 64-201). The volume of labour employed in this activity is obtained as the ratio between own-account construction labour compensation and the average wage in the industry where the activity takes place. These volume is subsequently transferred to the business sector construction industry. In the 1980s, own-account construction activity represented about 25% of total construction activity.

Other-Than-Paid workers. The main data source for other-than-paid workers is the Labour Force Survey. However, the number of self-employed workers, medical doctors and dentists that belong to the Health and Social Services Industries (except hospitals) are obtained from Fiscal Statistics, Revenue Canada Taxation, (Catalogue RV 44).

Preliminary data for 1991 and 1992

Preliminary data is produced only at the "S" level of aggregation of the Input-Output tables. 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 1990 absolutes values. For other-than-paid workers, the data were obtained entirely from the *Labour Force Survey*.

1.2.2 - Estimation of person-hours worked

Person-hours worked. The number of person-hours worked for each industry is obtained by the product between the number of persons at work and the average number of hours worked per person per year. Given the availability of employment data, the estimation of hour worked consist of estimating the average hours worked per year.

Benchmark data for 1989 and 1990²

The estimation of average hours worked per year up to the benchmark year is made at the "PL" aggregation level, i.e., for 112 industries. With the exception of the mining and manufacturing industries, all data on average hours worked are from the Labour Force Survey.

Monthly data from the *Labour Force Survey* refer only to the survey week, usually the week falling on the 15th day of the month. Respondents having worked during the reference week are asked a series of questions on hours worked. The questions concern regular hours, overtime hours, hours effectively worked as well as hours lost and the reason for work absence. This information allows a verification of each element of the response on hours and permits the estimation of total annual hours worked. Given that the statistics refer to a precise week of the month, annual data represent only the observation of hours corresponding to 12 survey weeks during the year. To estimate the effective hours worked during the all weeks of the year, a methodology was developed in the Productivity Measurement Section³. The goal of the methodology is to adjust the hours effectively worked reported by the survey in relation to two factors. One is the effect of holidays falling in the reference week, the other being the effect of time lost due to labour conflicts⁴.

The method used to estimate annual hours worked from data originating in the *Labour Force Survey* has four main stages:

- 1- The first consists of adding estimates of hours lost due to holidays or labour conflict to the estimates of hours worked during the reference week. The result is an estimate of the hours than would have been worked in the absence of conflicts and holidays. These monthly data are then interpolated in order to obtain the estimates for the 52 weeks of the year.
- 2- The second stage is to adjust the estimates of hours worked by the hours lost due to holidays. This information is obtained directly from the *Labour Force Survey* in the case of holidays during the survey week. Those not in the survey week are estimated. This is done by identifying and classifying the main Canadian holidays in three categories 1) Most important (Christmas, New Year, Easter Monday, Canada Day, Labour Day, Thanksgiving), b) Important (Victoria Day, Boxing Day), and 3) less important (Easter Monday, St. Jean Baptiste/Civic Holiday, Remembrance Day)⁵. The classification reflects the fact that most employees have the right to the important holidays and that a smaller proportion have the right to other holidays. The number of hours lost for the three holiday types is estimated based on those of holidays corresponding to the same category falling during the survey week.

2. For further details on hours worked data sources used to measure productivity indices for the years 1961 to 1988, see the feature article entitled "Hours Worked: A New Measure of Labour Input for Multifactor Productivity" by Jean-Pierre Maynard, Catalogue no. 15-204E, 1991.

3. 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.

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

5. 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.

3- the third stage consists of removing hours lost due to labour conflict⁶. It must be noted that only the statistics on paid workers are adjusted for this type of absence.

4- Finally, the average annual weekly hours worked is obtained by the average weekly hours after adjustment for labour stoppage and holidays. The average number of hours worked per year is obtained as the product of the weekly average by the number of weeks in the year. This last component is not constant but follows the vagaries of the calendar. A calendar year comprises 52 full weeks plus one day (two in leap years); if any of these days fall on a non-working day, the year has exactly 52 weeks, and exceeding this in all other cases. As a result, the number of hours worked may change from year to year due to fluctuations in the length of the year.

This method permits the estimation of average hours worked for paid workers with the exception of the mining and manufacturing industries and for the other-than-paid category for all industries, except manufacturing industries.

Data for the manufacturing industries are obtained from the annual Survey of Manufactures as well as from other surveys. The calculation of hour worked by production workers is different from that of salaried workers. The number of hours worked by production workers is obtained directly from the annual Survey of Manufactures. In the case of salaried workers, the survey only collects information on normal work hours and number of vacation days. The average hours worked by this last group are obtained by deducting from normal hours the number of hours not worked due to vacations and holidays. In the case of self-employed workers it is assumed that they work the same average hours as the paid workers in the same industry.

Hours worked data for each of the four mining industries are subject to a special methodology. The estimates for metal mines, non-metal mines and sand and quarrying and sand pits are estimated on the basis of data on hours worked by production workers derived from the *Census of Mines* to which we add the average hours paid of salaried employees from the *Survey on Employment, Payroll and Hours*. The latter are adjusted by means of data on average hours of paid absence calculated as the difference between hours paid and hours worked by production workers. Average hours for the oil and gas industry are obtained directly from the *Labour Force Survey*. Average hours in mining services are obtained from data on hours paid in the *Survey of employment, Payroll and Hours* to which an adjustment is made for time lost. To reflect the total paid workers for this industry, the total hours worked of the *Labour Force Survey* at aggregation level "S" (excluding oil and gas) is used as benchmark and allocated proportional to the share of each component estimated from the different sources described above.

Preliminary data for the years 1991 and 1992

In the case of recent years for which no *Survey of Manufactures* or *Census of Mines* data are available, we project benchmark data by the growth rate of hours worked of the *Labour Force Survey*.

1.3 - 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

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

from *The Input-Output Structure of the Canadian Economy* (Catalogue 15-201), up to and including the year of preliminary tables. Data for the two most recent years are taken from *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.

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 underestimates the earnings of these occupations. In these cases their average labour income are obtained from *Taxation Statistics*, Revenue Canada Taxation, (Catalogue RV 44).

2 - Description of Multifactor Productivity Data

2.1 - Introduction

Prices and volumes for inputs and outputs used in multifactor productivity indices are based on estimates from several sources. For outputs and intermediate inputs by industry, the data are obtained from the current and constant price Canadian input-output tables⁷. Some transformation 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 study⁸. Primary input cost 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. Capital input data are described in a technical note which is summarized below⁹. The industry coverage of the business sector used for multifactor productivity estimates differ slightly from the usual definition of the national accounts as explained in more detailed in Appendix 3.

2.2 - 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 establishments. 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 for 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.

7. 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.

8. A. Cas and T.K. Rymes, "On Concepts and Measures of Multifactor Productivity in Canada, 1961-1980, Cambridge University Press, 1991.

9. For a detailed documentation on capital input, see *Documentation of Capital Input and Capital Cost Time Series for Multifactor Productivity Measures*, by M. Salem, Statistics Canada, Input-Output Division, September 1993.

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 the inputs should be valued at purchasers' prices. The Törnqvist index of productivity growth, which is used here, rests on the assumption of profit maximizing 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 on 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 inputs rather than included in the physical volumes of the other inputs. Tax margins were included in the input set.

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 taxes levied on industries' outputs in the productivity accounts. They were subtracted from the producers' prices of outputs to estimate the net price received by producers. Royalties are considers 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 received. The industry was also excluded on the grounds that it appeared doubtful that government act as a real monopoly on natural resources industries.

Input and output volumes for goods and services were taken from producer price input-output tables without any adjustment. The reason is that in constant prices, commodity indirect taxes represent a fixed proportion of inputs calculated for the base year such that their inclusion does not affect the growth rate of volumes.

Since government goods and services cannot be substituted by other business industry supply, they are added to primary inputs. As well, unallocated import and export commodities are considered as part of 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 the postal services. However, primary inputs other than capital and labour inputs are treated as intermediate inputs in the estimates of value-added productivity.

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.

2.3 - Labour Input at Current and Constant Prices

The employment and hours estimates agree with those used in the estimates of labour productivity. Sources were described in the first part of this appendix.

Labour compensation data are also identical to those used in labour productivity. However, it is important to mention that the imputation of self-employed income is deducted from the net revenue of individual businesses in the industry in order to maintain the accounting balance of the system. In addition, multifactor productivity labour input is weighted by the share of wages while labour productivity labour input is not weighted. Labour productivity labour input will be

weighted once the labour productivity estimates will be obtained from the multifactor productivity estimates. This will recognize the heterogeneity of labour categories.

2.4 - Capital Input at Current and Constant Prices

The input of capital services for a given year is assumed to be proportional to the capital stock in constant prices at the end of the previous year, net of depreciation. Capital stock excludes investments made during the current year because, in general, they are not productive at this stage. Depreciation follows a geometric curve. The choice of a geometric depreciation curve over a delayed one is still an open issue which will require further research¹⁰.

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 business sector ones as is the case of the input-output tables. Capital assets for industry segments have been estimated, removed from some industries 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 differences were known to exist, namely, in non-metal mines, chemicals and chemical products, and other utility industries.

Contrary to the estimates of intermediate and labour inputs, capital input cost is estimated residually. It corresponds to the sum of other operating surplus (that is a residual item in the input-output tables), the net revenue of unincorporated businesses less the labour income of self-employed workers. Indirect taxes other than those on goods and services are added to the cost of capital (subsidies are deducted), because these taxes apply generally to property and the use of capital by the industry. The capital service price is calculated as the ratio between capital cost and the stock of capital of the previous year in constant prices.

10. 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 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.

1 - Aggregation Parameters for Labour Productivity and Related Data

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 33 statistical tables on labour productivity appearing in Part 2 of this publication. Tables 1 to 4 are produced for special aggregates of business sector industries. Tables 5 to 12 correspond to selected S level business sector industries. The remaining tables, 13 to 33, are associated with the M level of the manufacturing industries.

Text tables 1 and 2 show the concordance between the classification of industries in the Canadian System of National Accounts used in labour productivity 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 industries	011-017 021-023	001-0021	001-0021	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	Wholesale trade industries	501-599	602-629	602-629	135
11	Retail trade industries	601-692	10722-2611 631-699	1292,2611 631-699	136
12	Finance, insurance & real estate industries	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 industries	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	32-34
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	286-289 8932	286-289 8932	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
25	Non-Metallic mineral products industries	351,352 354-359	351,352 354-359	341,343 345,347 348,351- 357,359	90-95

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
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

2 - 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 level¹ (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 112 business sector industries. For analytical purposes, two other aggregation levels were built: 21 industries (level PM) for the manufacturing industries 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. With the recent addition of two industries, aggregation level PM now coincides with aggregation level M for the manufacturing industries. 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.

1. It was impossible, at this stage, to include a measure of natural resources such as land used as inputs. Natural resources are believed to be important mostly for primary industries but to play only a minor role in other industries.

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 (industry L 131), Other Utility Industries nec (industry L 134), Government Royalties on Natural Resources (industry 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 3 through 5 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.

Text table 3

Concordance between the PL aggregation level and the link 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 industries	011-017 021-023	001-0021	001-0021	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 products	1071-1072	1071,10721	128,1291	21,22
15	Beverage industries	111-114	1091-1094	141,143 145,147 151,153	25-28
16	Tobacco products industries	121,122	151,153	151,153	29
17	Rubber products industries	151-159	1623,1629	163,169	30
18	Footwear industries	1712	1624,174	161,174	33
19	Plastic products industries	161-169	1651,27332	27332,3851	31
20	Leather tanneries	1711	172	172	32
21	Misc. leather & allied prod. industries	1713,1719	179	179	34
22	Man-made fibre yarn & woven cloth	181,1829	181,183	183,201	35
23	Wool yarn & woven cloth industry	1821	182	193,197	36
24	Misc. textile products industries	191,193 1991-1995 1999	184,1851 1852,1871 1872,1891- 1894,1899	211-215 218	38-39
25	Carpet, mat & rug industry	192	186	216	40
26	Clothing industries exc. hosiery	243-245 2491-2493 2495,2499	175,2392 243-249	175,2392 242-249	41
27	Broad knitted fabric industry	183	2391	2391	37

Text table 3

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

PL Level Industries					
PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
28	Hosiery industry	2494	231	231	42
29	Sawmills, planing & shingle mills	251	251	251	43
30	Veneer and plywood industries	252	252	252	44
31	Sash, door & other millwork ind.	254	254	254	45
32	Wooden box & coffin industries	256,258	256,258	256,258	46
33	Other wood industries	259	259	259	47
34	Household furniture industries	261	2619	2619	48
35	Office furniture industries	264	264	264	49
36	Other furniture & fixture ind.	269	269	266	50
37	Pulp & paper industries	271	271	271	51
38	Asphalt roofing industry	272	272	272	52
39	Paper box & bag industries	273	2731,2732 27331	2731,2732 27331	53
40	Other converted paper products ind.	279	274	274	54
41	Printing & publishing industries	281,283 284	286,288 289	286,288 289	55
42	Platemaking, typesetting & bindery	282	282	287,8932	56
43	Primary steel industries	291	291	291	57
44	Steel pipe & tube industry	292	292	292	58
45	Iron foundries	294	294	294	59
46	Non-ferrous smelting & refining ind.	295	295	295	60
47	Aluminum rolling casting, extruding	296	296	296	61
48	Copper rolling casting & extruding	297	297	297	62
49	Other metal rolling, casting etc.	299	299	298	63
50	Power boiler & struct. metal ind.	301,302	301,302	301,302	64
51	Ornamental & arch. metal prod. ind.	303	303	303	65
52	Stamped, pressed & coated metals	304	304	304	66
53	Wire and wire products industries	305	305	305	67
54	Hardware, tool & cutlery industries	306	306	306	68
55	Heating equipment industry	307	307	307	69
56	Machine shops industry	308	308	308	70
57	Other metal fabricating industries	309	309	309	71
58	Agriculture implement industry	311	311	311	72
59	Commercial refrigeration equipment	312	316	316	73
60	Other machinery & equipment ind.	319	315	315	74
61	Aircraft & aircraft parts industry	321	321	321	75

Text table 3

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

PL Level Industries					
PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
62	Motor vehicle industry	323	323	323	76
63	Truck, bus body & trailer industry	324	324	324	77
64	Motor vehicle parts & accessories	325	1652,188 325	2291,325 3852	78
65	Railroad rolling stock industry	326	326	326	79
66	Shipbuilding and repair industry	327	327	327	80
67	Misc. transportation equipment ind.	328,329	328,329	328,329	81
68	Small electrical appliance industry	331	331	331	82
69	Major appliances (elec. & non-elec.)	332	332	332	83
70	Record players, radio & tv receiver	334	334	334	84
71	Electronic equipment industries	335	335	335	85
72	Office, store & business machines	336	318	318	86
73	Communications, energy wire & cable	338	338	338	87
74	Other elect. & electronic products	333,337 3391-3399	268,333,336 3391,3399	268,336- 337,339	88-89
75	Clay products industry	351	351	351	90
76	Cement industry	352	352	341	91
77	Concrete products industry	354	354	347	92
78	Ready-mix concrete industry	355	355	348	93
79	Glass & glass products industries	356	356	356	94
80	Non-metallic mineral products n.e.c.	357-359	353,357- 359	343,345 352-355 357,359	95
81	Refined petroleum & coal products	361,369	365,369	365,369	96
82	Industrial chemicals industries n.e.c.	371	371	378	97
83	Plastic & synthetic resin industry	373	373	373	98
84	Pharmaceutical & medicine industry	374	374	374	99
85	Paint & varnish industry	375	375	375	100
86	Soap & cleaning compounds industry	376	376	376	101
87	Toilet preparations industry	377	377	377	102
88	Chemical & chemical products n.e.c.	372,379	372,379	371-372,379	103
89	Jewellery & precious metal ind.	392	392	382	104
90	Sporting goods & toy industries	393	393	393	105
91	Sign and display industry	397	397	397	106
92	Other manufacturing industries n.e.c.	391,3991- 3994,3999	391,3991- 3994,3999	381,383 384,395 398,399	107-108

Text table 3

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

PL Level Industries		1980	1970	1960	Link
PL Codes	Industry Title	SIC	SIC	SIC	Code
93	Construction industries	401-409	404-421	404-421	109-117
94	Air transport & services incidental	451,452	501-502	501-502	118
95	Railway transport & rel. services	453	503	506	119
96	Water transport & rel. services	454,455	504,505	504,505	120
97	Truck and other transport ind.	456,4572- 4575,4589 4592,4599 996,9991	506-508 517,519	507-508 517,519	121,123 125
98	Urban transit system industry	4571	509	509	122
99	Highway & bridge maintenance ind.	4591	516	516	126
100	Pipeline transport industries	461	515	515	127
101	Storage & warehousing industries	471,479	524,527	524-527	128
102	Telecommunication broadcasting ind.	481	543	543	129
103	Telecommunication carriers & other	482,483	544,545	544,545	130
104	Electric power systems industry	491	572	572	132
105	Gas distribution systems industry	492	574	574	133
106	Wholesale trade industries	501-599	602-629	602-629	135
107	Retail trade industries	601-692	10722,2611 631-699	1292,2611 631-699	136
108	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
109	Services 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
110	Educational service industries	851-859	801-809	801-809	145
111	Hospitals	861	821	821	146
112	Other health services	8621,863 865,866 8671,8679 868,8691- 8693,8699	822-827	823-827	147

Text table 4

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 industries	1	1
2	Fishing & trapping industries	2	2
3	Logging & forestry industries	3	3
4	Mining, quarrying & oil well industries	4-13	4-7
5	Manufacturing industries	14-108	8-92
6	Construction industries	109-117	93
7	Transportation & storage industries	118-123,125-128	94-101
8	Telecommunication industries	129,130	102,103
9	Electric power & gas dist. industries	132,133	104,105
10	Wholesale trade industries	135	106
11	Retail trade industries	136	107
12	Finance, insurance & real estate industries	137-139	108
13	Community, business, personal services industries	124,142-154	109-112

Text table 5

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	Rubber products industries	30	19
9	Plastic products industries	31	17
10	Leather & allied products industries	32-34	18,20,21
11	Primary textile & textile products industries	35-40	22-25,27
12	Clothing industries	41,42	26,28
13	Wood industries	43-47	29-33
14	Furniture & fixture industries	48-50	34-36
15	Paper & allied products industries	51-54	37-40
16	Printing, publishing & allied industries	55,56	41-42
17	Primary metal industries	57-63	43-49
18	Fabricated metal products industries	64-71	50-57
19	Machinery industries	72-74	58-60
20	Transportation equipment industries	75-81	61-67
21	Electrical & electronic products	82-89	68-74
22	Non-metallic mineral products industries	90-95	75-80
23	Refined petroleum & coal products	96	81
24	Chemical & chemical products industries	97-103	82-88
25	Other Manufacturing industries	104-108	89-92

APPENDIX 4

Quality Rating of Productivity Estimates and Related Data

This appendix provides quality ratings of labour productivity and related data and of multifactor productivity data, including the ratings of the input and output components used to estimate these measures. 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.

1 - Quality Rating of Labour Productivity Estimates and Related Data

Like other components of the Canadian System of National Accounts (CSNA), the labour productivity and related data 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.

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 these 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. 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) Compensation per person at work;
- (viii) Compensation 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, 1990* (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

censuses¹, surveys or administrative records with minimum adjustments for coverage, valuation and classification. A rank of 2 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 a lack of response precision 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 1990 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 1990, 16.6% of the paid workers data are taken from administrative data and the small forms. Out of that percentage, 11.6% are estimated from administrative data 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 1990, 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 administrative data. A ranking of 2 has been assigned to data where more than 10.0% but less than 20.0% of the data is from this source. A ranking of 3 has been assigned above 20.0%.

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, 61.7% 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. The quality rating of person-hours is the rounded average of the number of persons at work and the average number of hours worked. In

1. See Appendix 2 for a full description of data sources.

manufacturing, 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 administrative 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 10.0% and 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 related data. 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, 1990

Industry title	Real GDP	Persons at work	Person-hours	Labour compensation	Real GDP per person	Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
Agricultural & related services industries	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 trade industries	3	1	2	1	2	3	1	2	2
Retail trade industries	3	2	2	2	3	3	2	2	3
Community, business, personal services industries	2	2	2	2	2	2	2	2	2
Business sector industries	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, 1990

Industry title	Real GDP	Persons at work	Person-hours	Labour compensation	Real GDP per person	Real GDP per person-hour	Compensation per person	Compensation per person-hour	Unit labour cost
Food industries	1	1	2	1	1	2	1	2	1
Beverage industries	2	1	2	1	2	2	1	2	2
Tobacco products industries	2	1	2	1	2	2	1	2	2
Rubber products industries	1	1	2	1	1	2	1	2	1
Plastic products industries	1	2	2	1	2	2	2	2	1
Leather & allied products ind.	1	1	2	1	1	2	1	2	1
Primary textile & textile products industries	1	2	2	1	2	2	2	2	1
Clothing industries	1	1	2	1	1	2	1	2	1
Wood industries	2	2	2	1	2	2	2	2	2
Furniture & fixture industries	1	3	2	1	2	2	2	2	1
Paper & allied products ind.	1	1	2	1	1	2	1	2	1
Printing, publishing & allied ind.	2	2	2	1	2	2	2	2	2
Primary metal industries	1	1	2	1	1	2	1	2	1
Fabricated metal products ind.	1	3	2	1	2	2	2	2	1
Machinery industries	1	2	2	1	2	2	2	2	1
Transportation equipment ind.	2	1	2	1	2	2	1	2	2
Electrical & electronic products industries	2	2	2	1	2	2	2	2	2
Non-metallic mineral products industries	1	2	2	1	2	2	2	2	1
Refined petroleum & coal products industries	2	1	2	1	2	2	1	2	2
Chemical & chemical products industries	2	1	2	1	2	2	1	2	2
Other manufacturing industries	2	3	2	1	3	2	2	2	2

2 - Quality Rating of Multifactor Productivity Estimates and Related Data

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 section 1 of this appendix.

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 3 and 4 of this appendix are rounded to the nearest highest rating to account for the quality-increasing effect of aggregation.

Text table 3

Quality ratings for the components of multifactor productivity estimates by industry at aggregation level PS and for the total business sector, 1990

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	1	3	2	2	2	2	3	3	3	3	3	3	3
Transportation & storage ind.	1	1	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 industries	1	2	1	1	2	2	2	3	3	3	3	3	3
Retail trade industries	1	2	2	2	2	2	2	3	3	3	3	3	3
Business sector industries	...	...	2	1	1	1	2	...	...	1	1	1	1

* Persons at work ** Person-hours worked

Text table 4

Quality ratings for the components of multifactor productivity estimates by manufacturing industry at aggregation level PM, 1990

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	1	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	2	2	1	1
Rubber products industries	1	1	1	1	2	1	2	1	1	1	1
Plastic products industries	1	1	1	2	2	1	2	1	1	1	1
Leather & allied products industries	1	1	1	1	2	1	2	1	1	1	1
Primary textile & textile products ind.	1	1	1	2	2	1	2	1	1	1	1
Clothing industries	1	1	1	1	2	1	2	1	1	1	1
Wood industries	1	1	1	2	2	1	2	1	1	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 industries	1	2	1	2	2	1	2	2	2	2	2
Primary metal industries	1	1	1	1	2	1	3	1	1	1	1
Fabricated metal products industries	1	1	1	3	2	1	3	1	1	1	1
Machinery industries	1	1	1	2	2	1	3	1	1	1	1
Transportation equipment industries	1	1	1	1	2	1	2	2	2	2	2
Electrical & electronic products ind.	1	2	1	2	2	1	2	1	1	2	2
Non-metallic mineral products ind.	1	1	1	2	2	1	2	1	1	1	1
Refined petroleum & coal products ind.	1	1	1	1	2	1	3	2	2	2	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	2	2	2	2

* Persons at work ** Person-hours worked

APPENDIX 5

Productivity and Related Data in CANSIM

Multifactor Productivity	Indices since 1961	CANSIM Matrices
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

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

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