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Aggregate Productivity Measures

System of National Accounts
1989

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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.

Contributors

This publication was produced under the direction of Claude Simard, Director, René Durand, Assistant Director and Aldo Diaz, Chief of the Productivity Section, Input-Output Division.

Tables, Graphs & Composition: D. Strangeways, J. Bourgeau, N. Richer

Coordination: T. Markle, Y. Sabourin, W. McLean

Data Analysis and Development: Y. Sabourin, T. Markle, M. Larose

Data Processing: S. Burrows, J. Bourgeau

Highlights and Editing: Y. Sabourin, T. Markle

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The System of National Accounts

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

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

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

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

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

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

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Indexes of labour productivity, unit labour cost, and related data (Part 1).

Indexes of multifactor productivity (Part 2).

1961-1987/89

Introduction

This issue of *Aggregate productivity measures* is divided into two parts. Part 1 presents, as usual, the labour productivity estimates, with accompanying highlights and technical appendices. Part 2 presents new multifactor productivity developments, expanding on those introduced in a feature article of the 1988 issue of this publication[1].

The relationship between labour productivity and multifactor productivity is depicted on the figure next page where both measures are shown for the Canadian business sector. Production is measured by real value added and factor inputs are comprised of capital and labour. Labour productivity grew faster than multifactor productivity over the last decades as it resulted both from the increased contribution of capital to output growth and the increased efficiency of combined capital and labour. Indeed, the capital intensity of production increased over that period as indicated by the positive growth, in most years, of the capital labour ratio, which is depicted on the bottom part of the same figure. This means that, even though there would have been no increase in efficiency, labour productivity would have grown as a result of the larger quantities of equipment used per worker. It is normal to expect an increase in production when workers are better equipped, that is, to expect an increase in their productivity. But this does not mean necessarily an increase in efficiency as more equipments have been used. Efficiency increases only when production increases without increase in inputs. The efficiency component of labour productivity, which is also the efficiency component of the capital productivity, is precisely multifactor productivity. The latter indicates how quickly production could grow each year without increased use of capital and labour.

Although the labour productivity estimates have been, and still are, widely used in many countries, their limitations have been emphasized in each issue of this publication. The major limitation is that labour productivity measures output per unit of labour input instead of output per unit of all inputs combined. Consequently, and as explained in the previous paragraph, the growth in labour productivity reflects the growth in output that results from two sources: 1) the growth of other productive factors relative to the growth in labour; and 2) the improved efficiency of all inputs, including labour. Multifactor productivity estimates take into account the contribution of all inputs so that it can be interpreted as a measure only of increased efficiency.

Part 2 constitutes a progress report on the development of multifactor productivity indicators for the business sector of the Canadian economy. The results achieved so far are experimental[2]. Further analysis, improvements and refinements will eventually lead to the regular publication of multifactor productivity indexes together with the labour productivity indexes which until now have been the main subject of this publication.

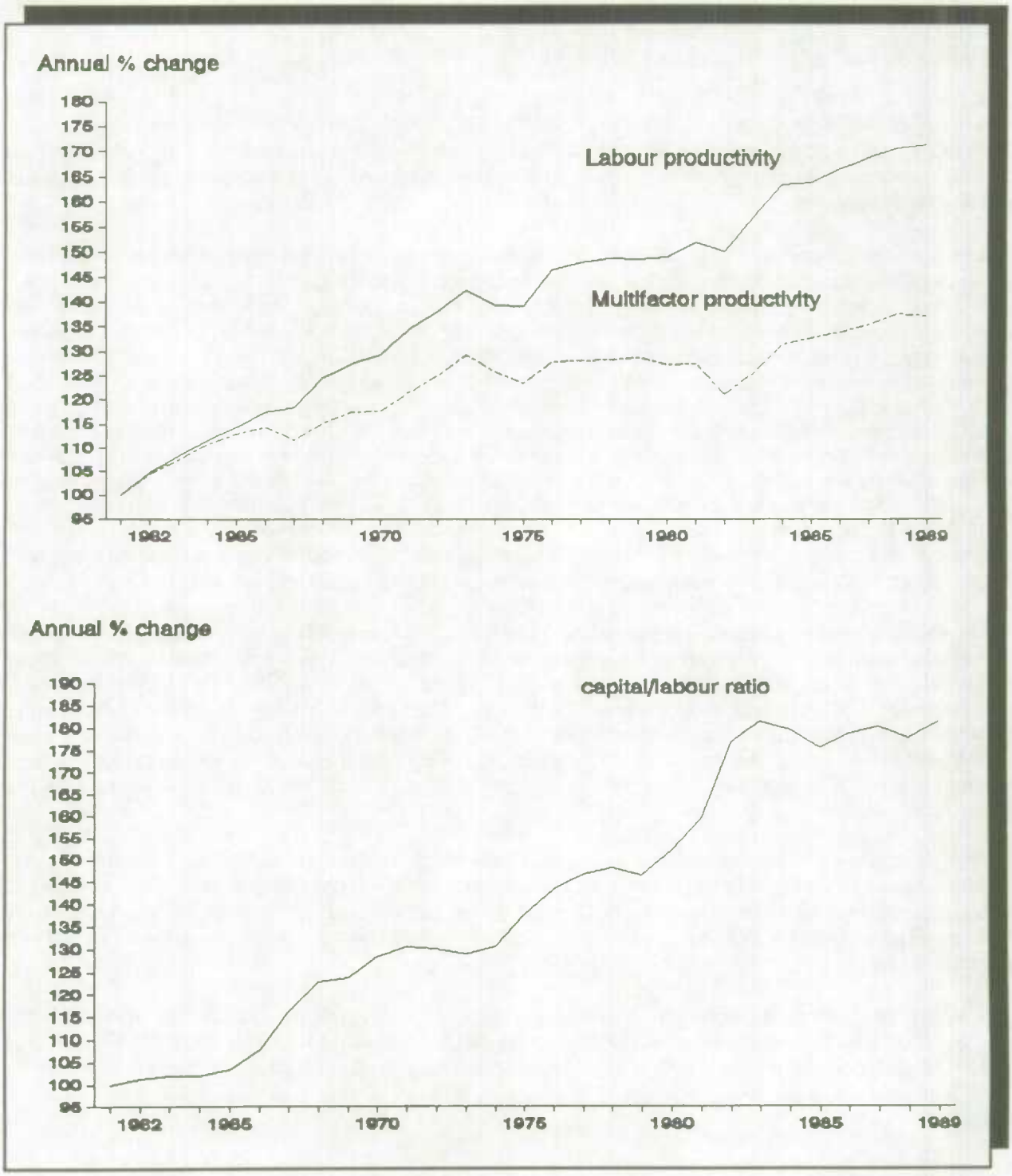
Like Part 1, part 2 includes highlights, data tables and technical appendices. It also includes two feature articles on multifactor productivity. Readers who are not familiar with multifactor productivity measures would benefit from reading the technical appendices first as they explain the basic concepts which must be

[1] *Durand, R.,Salem, M. and D. Hayes,"A New Look at Productivity of Canadian Industries", Aggregate Productivity Measures, Statistics Canada, cat.: no 15-204, June 1990, pp. 7-33.*

[2] *The results are not fully comparable to those published in the previous issue of this catalogue as many data were revised, and as methodological changes were introduced and some errors in the data were corrected.*

Figure 1

Annual percentage change in labour and multifactor productivity for the Canadian business sector, 1961-1989



known to understand the feature articles and interpret correctly the statistical tables which follow. Appendix 1, in particular, describes several multifactor productivity measures. All these multifactor productivity measures use the same mathematical formula but they differ with respect to the outputs and the inputs to which they are applied. Distinct productivity measures are thereby defined for industries and group of industries and a new distinct productivity measure is defined for the aggregate business sector.

The feature articles extend the conceptual developments of Appendix 1 along the same principle which is to modify the definition of outputs and inputs included in the productivity formula. The first feature article deals mainly with two new concepts which extend the multifactor productivity model introduced last year. The first concept introduced is that of gross output net of intraindustry sales as an alternative output measure at the industry level.

The second conceptual innovation is to define the output of the business sector not as value added but as final demand deliveries originating in the business sector. In a closed economy both concepts have identical meaning. In an open economy, however, deliveries to final demand by the business sector are equal to value added plus imports of goods and services used as inputs.

The interindustry multifactor productivity estimates (also introduced last year) are now presented in the context of an open economy model. The open economy concept is extended to include all inputs not produced by the domestic business sector (imports, government supply of goods and services, inventory depletion and other leakages). The aggregate results are also presented on the basis of value added. The second feature article shows that this is the appropriate measure even in the context of an open economy when it is desirable to take productivity gains resulting from international trade into account.

The second feature article, more generally, introduces the idea that productivity estimates depend on vertical integration. Changing vertical integration through time changes measured productivity growth. Data transformations equivalent to vertical integration also have a major impact on the measure of productivity growth. This leads to the development of an overall analytical framework and a classification scheme for the multifactor productivity models presented in the publication which ease the interpretation of their estimates.

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.

PART 1

Labour productivity

Labour compensation

Unit labour cost

HIGHLIGHTS

Labour Productivity, Labour Compensation and Unit Labour Cost

1 - Labour productivity

Real Gross Domestic Product per person-hour for the business sector industries rose 1.7% in 1989, noticeably stronger than the increases of 0.4% and 0.9% recorded in 1988 and 1987. Figure 1 portrays this. The 1989 increase resulted from a 3.2% rise in real GDP and 1.5% in person-hours worked.

Year-over-year changes in labour productivity have more meaning when related to the business cycle, since cyclical variations in GDP, which affect labour productivity growth, are taken into account. Over the current expansionary phase of the business cycle (1982-1989)[3] the labour productivity of business sector industries grew at an average annual rate[4] of 1.7%. The corresponding real GDP, and labour input increases were 4.6% and 2.8% respectively. Gauging from the 1.6% and 1.7% average productivity growth rates registered for the 1974-1980, and the 1982-89 business cycles respectively, there appears to be very persistent productivity growth. However, the level of this growth, of 1.6% on average for 1974-89, is quite discouraging when compared to the average growth of 3.6% that was accomplished over the 1961-74 business cycle.

An interesting fact about the productivity performance of the business sector is found by analyzing its goods vs. services industries. As can be seen in Figure 3, business sector goods showed a 1.0% productivity gain in 1989 after a small loss in 1988. Business sector services showed a much larger productivity increase than business sector goods of 2.2% in 1989, and has been accelerating slowly over the past few years. The higher productivity in the business sector services by comparison to the business sector goods, is at odds with historical performance. Over the 1961-74 business cycle, the average annual productivity increase was 4.5% for goods industries and 2.4% for services. The corresponding average growth rates for the current business cycle so far (1982-89) however, of 1.7% and 1.8%, indicate that services have experienced productivity growth similar to the goods industries, closing the historical gap between the performance of these two sectors.

Figure 2 shows the productivity trend for manufacturing industries, along with trends of other related indicators. The 0.7% productivity growth observed for 1989 for manufacturing industries was very modest, but was noticeably improved when compared to the 1.1% decrease that occurred in 1988.

[3] *The annualized business cycle boundaries (trough to trough) from 1961 are based on monthly dating cyclical fluctuations, and were selected as follows: 1961-1974; 1974-1980; 1980-1982; 1982-1989. For a description of monthly business cycles dating in Canada, see Cross, P., "Special Study: The Business Cycle in Canada 1950-1981", Current Economic Analysis, Statistics Canada, Catalogue 13-004, March 1982.*

[4] *The average annual rate of growth is estimated using the annual compound rate method.*

Figure 1

Year to year changes in indexes of labour productivity and related measures for business sector industries

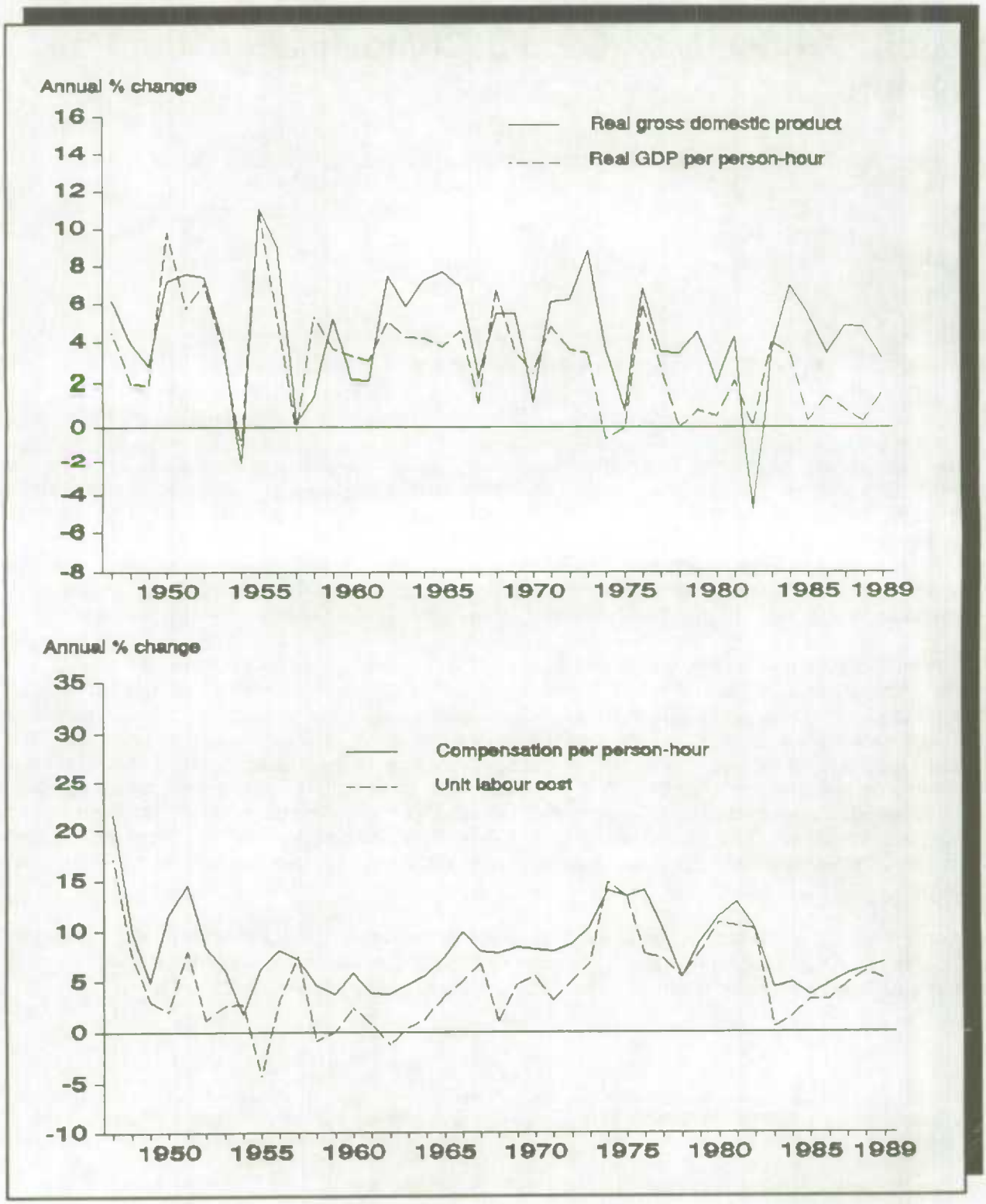


Figure 2

Year to year changes in indexes of labour productivity and related measures for manufacturing industries

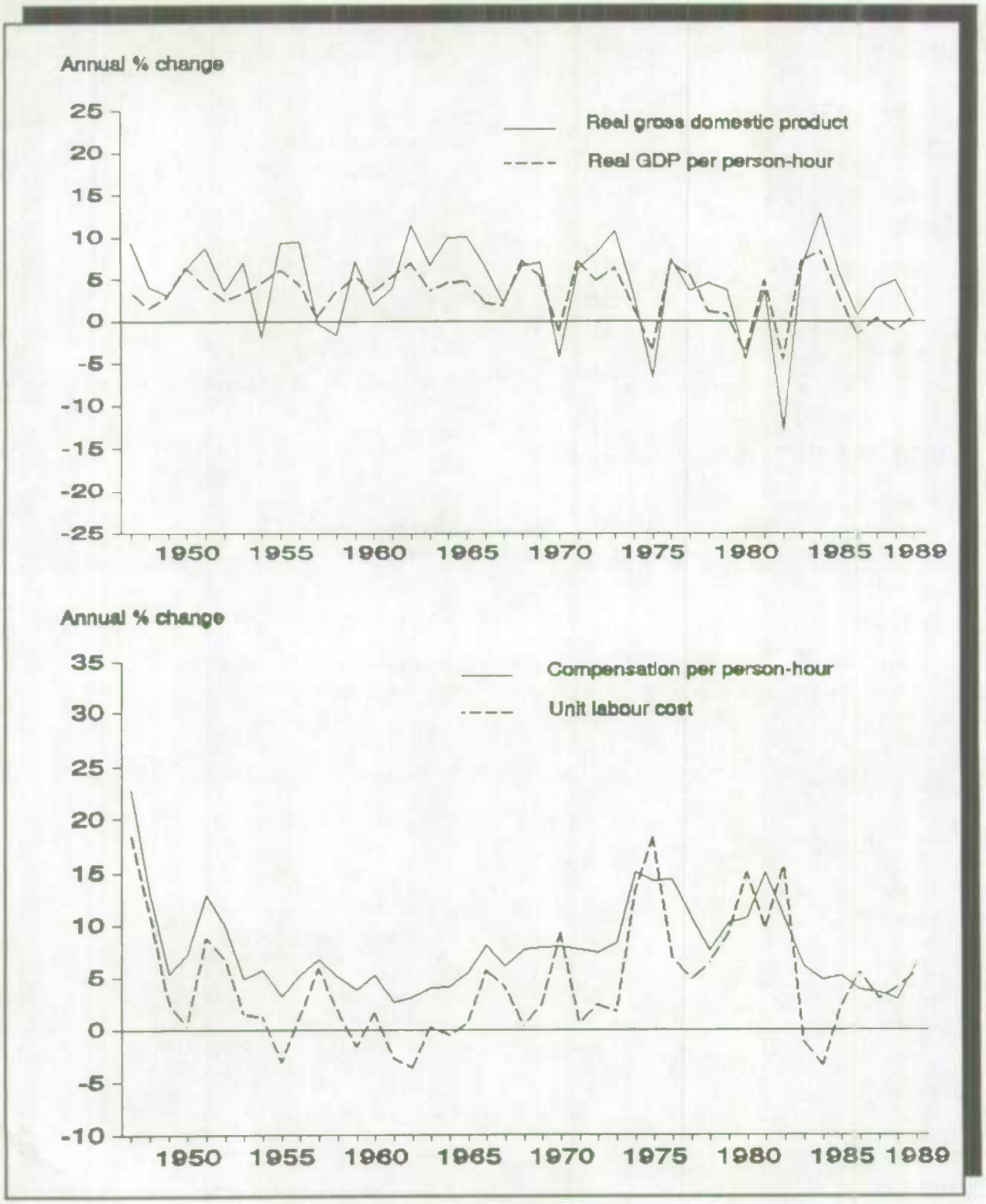
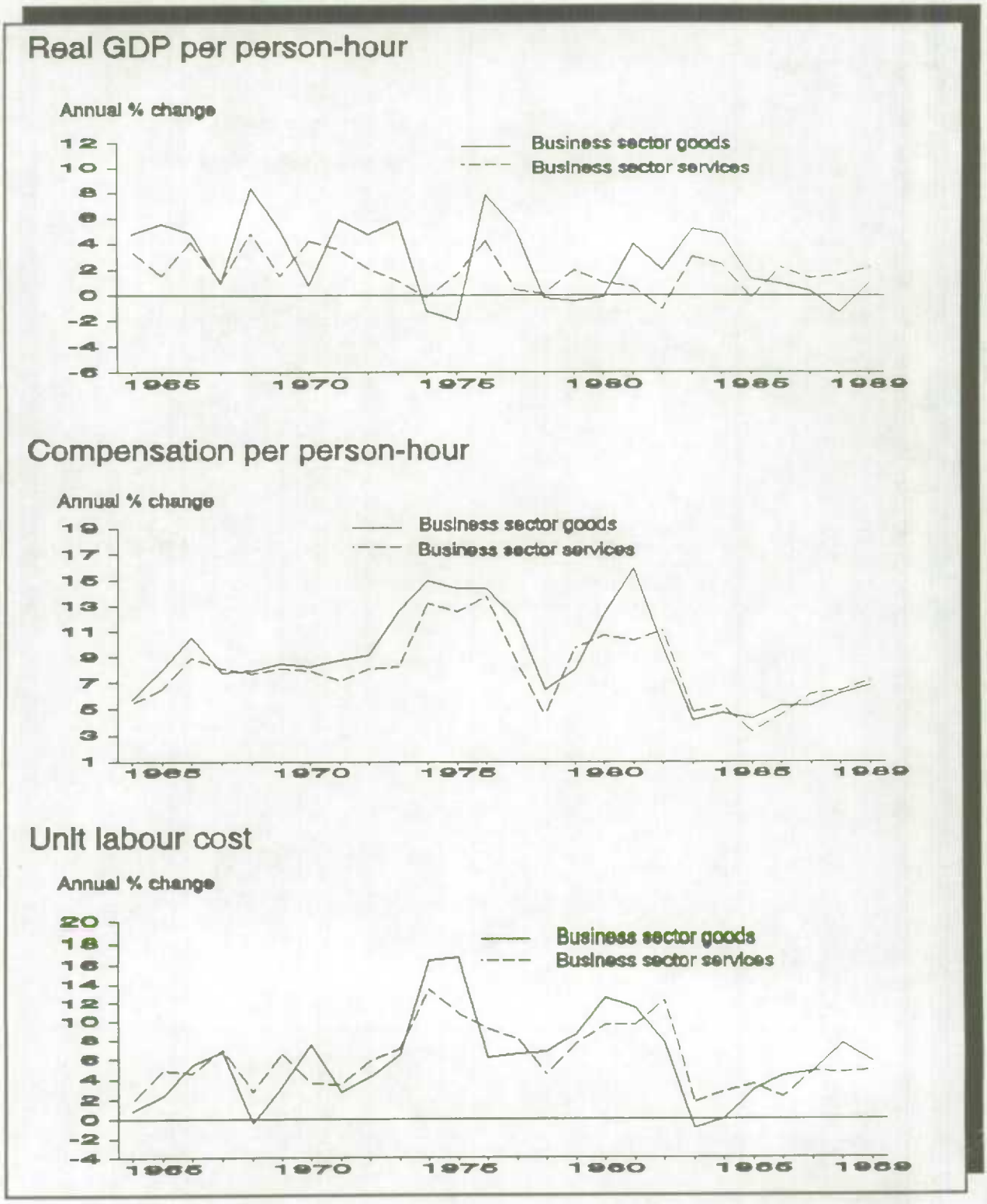


Figure 3

Year to year changes in indexes of labour productivity and related measures for two aggregates of business sector industries



Text table 1 - Average annual per cent change - Labour productivity and related measures. Canada

	1946-89	1961-73	1973-89	1986-87	1987-88[p]	1988-89[p]
Business sector industries						
Real gross domestic product per person-hour	3.1	3.9	1.5	0.9	0.4	1.7
Real gross domestic product	4.5	5.9	3.5	4.8	4.8	3.2
Person-hours	1.3	1.9	2.0	3.9	4.4	1.5
Unit labour cost	4.7	3.5	7.0	4.8	5.9	5.2
Compensation per person-hour	8.0	7.6	8.5	5.7	6.3	7.0
Business sector excluding agriculture*						
Real gross domestic product per person-hour	2.6	3.3	1.4	0.9	0.4	1.2
Real gross domestic product	4.8	6.1	3.6	5.3	5.4	3.0
Person-hours	2.2	2.7	2.2	4.3	5.1	1.7
Unit labour cost	4.7	3.5	6.9	4.6	5.3	5.6
Compensation per person-hour	7.4	6.9	8.4	5.6	5.7	6.9
Business sector - services						
Real gross domestic product per person-hour	1.9	2.6	1.3	1.3	1.6	2.2
Real gross domestic product	4.9	6.1	4.5	5.6	5.7	4.4
Person-hours	3.0	3.4	3.1	4.2	4.0	2.2
Unit labour cost	5.1	4.3	6.8	4.8	4.7	4.9
Compensation per person-hour	7.1	7.0	8.2	6.2	6.4	7.2
Business sector - goods						
Real gross domestic product per person-hour	4.0	5.0	1.6	0.4	-1.3	1.0
Real gross domestic product	4.0	5.7	2.3	3.8	3.5	1.6
Person-hours	0.0	0.6	0.6	3.4	4.9	0.6
Unit labour cost	4.5	2.8	7.2	4.8	7.6	5.7
Compensation per person-hour	8.7	8.0	9.0	5.3	6.2	6.8
Business sector - goods excluding agriculture*						
Real gross domestic product per person-hour	3.3	4.0	1.5	0.2	-1.7	0.0
Real gross domestic product	4.5	6.0	2.4	4.7	5.0	1.0
Person-hours	1.2	2.0	0.9	4.5	6.8	1.0
Unit labour cost	4.3	2.8	7.1	4.5	6.2	6.6
Compensation per person-hour	7.8	7.0	8.7	4.7	4.4	6.6
Business sector - goods excluding agriculture* and manufacturing industries						
Real gross domestic product per person-hour	3.5	3.6	1.1	-0.5	-2.7	-1.5
Real gross domestic product	5.0	5.3	2.8	5.7	5.2	1.6
Person-hours	1.5	1.6	1.6	6.3	8.1	3.1
Unit labour cost	4.2	4.0	7.4	6.8	9.3	8.2
Compensation per person-hour	7.9	7.8	8.6	6.2	6.4	6.6
Agriculture*						
Real gross domestic product per person-hour	3.8	6.4	1.3	-7.0	-15.9	17.0
Real gross domestic product	1.0	2.7	0.3	-8.9	-20.3	14.8
Person-hours	-2.7	-3.5	-1.0	-2.1	-5.2	-1.9
Unit labour cost	4.5	1.4	7.5	8.7	35.2	-10.7
Compensation per person-hour	8.4	7.8	9.0	1.1	13.7	4.5
Manufacturing industries						
Real gross domestic product per person-hour	3.2	4.5	1.6	0.5	-1.1	0.7
Real gross domestic product	4.3	6.7	2.1	4.0	4.9	0.4
Person-hours	1.1	2.1	0.6	3.5	6.1	-0.3
Unit labour cost	4.4	1.9	7.1	3.0	4.1	5.6
Compensation per person-hour	7.7	6.5	8.8	3.5	2.9	6.3

* Agricultural and related services industries

Between 1982 and 1989, real GDP and labour input have increased respectively at the average annual rates of 4.9% and 2.5% per year. The corresponding growth of labour productivity is 2.4% per year, which is more than three times as high as the increase observed in 1989.

Further insight may be gained concerning differences in the productivity of industrial aggregates over time by considering the specific industries underlying these aggregates. For example, the profile for average annual productivity has changed considerably when comparing 1961-74 with 1982-87, the latest period for which data are available. The ranks of the leading and trailing industries and their average annual productivity in each of these periods are given in Text Table 2 below. The industries whose relative positions improved the most include: rubber products ind., wood ind., leather and allied products ind., paper and allied products ind., primary metal ind., electrical and electronic products. Those whose positions worsened include: tobacco products ind., beverage ind., plastic products ind. and transportation equipment ind.

Text table 2 - Industry classification by decreasing rank of labour productivity growth rate

	1961/74		1982/87	
Industry Title	Rank	Annual percentage change	Rank	Annual percentage change
Primary metal industries	14	3.3	1	11.0
Electrical & electronic products	9	4.5	2	8.8
Refined petroleum & coal products	4	5.7	3	7.5
Rubber products industries	11	3.5	4	7.2
Primary textile & textile prod. ind.	3	6.5	5	6.6
Chemical & chemical products ind.	7	4.9	6	6.2
Paper & allied products industries	18	2.4	7	4.7
Wood industries	12	3.3	8	4.6
Non-metallic mineral products ind.	8	4.6	9	4.3
Leather & allied products ind.	19	2.2	10	3.5
Plastic products industries	12	7.4	11	2.3
Clothing industries	20	2.0	12	2.1
Transportation equipment ind.	1	7.5	13	1.4
Fabricated metal products ind.	10	3.8	14	1.4
Machinery industries	16	3.1	15	0.9
Printing, publishing & allied ind.	21	1.5	16	0.9
Food industries	12	3.3	17	0.7
Tobacco products industries	5	5.6	18	0.7
Furniture & fixture industries	17	2.6	19	0.6
Other manufacturing industries	15	3.2	20	0.4
Beverage industries	6	5.2	21	-0.4

2 - Labour Compensation and Unit Labour Cost

Unit labour cost in business sector industries showed an increase of 5,2% in 1989 which is close to the average increase over the previous two years. This indicates how difficult it is to bring inflation down. But more importantly, unit labour cost in manufacturing industries continued to accelerate reaching an increase of 5,6% in 1989. The 1989 increase of 6.3% in compensation per person-hour in manufacturing industries was not offset by 0.7% increase in labour productivity. This relatively rapid increase in labour compensation in front of sluggish productivity gains has become a major concern particularly when compared to contrasting recent developments in United-States.

3 - *Comparison with the United States*

The data that correspond to labour productivity, unit labour cost, and their associated components, for each of Canada and the United States have been summarized and are presented in Text Table 3. Comparisons of Canada's measures with those of the United States should, however, be made with prudence. The measures are influenced by different concepts and techniques of measurement used in the respective countries, as well as by differences in economic environment of these countries, such as a different cyclical behaviour. For example, the real GDP measures for the United States are based on 1982 prices for the whole period whereas in Canada the real GDP measures are based on 1986 prices but the rates of growth for the period 1961 to 1971 (in 1961 prices), 1971 to 1981 (in 1971 prices), and 1981 to 1986 (in 1981 prices) were protected. Among other variables, cognizance should be taken of the effect of changing exchange rates, particularly on an international comparison of costs.

3.1 - Business Sector Industries

Real GDP per person-hour in Canada grew at a rate of 1.7% in 1989. The United States, in contrast, experienced a productivity loss of 0.5%. In the previous year, increases were observed in both countries of 0.4% in Canada and 2.2% in the United States. In 1989, Canada had the larger productivity growth due to a larger real GDP increase and a smaller labour input increase. The increase in person-hours in 1989 was 2.6% in the U.S. and only 1.5% in Canada. Real GDP, on the other hand, increased by 3.2% in Canada and by only 2.1% in the United States. So far, in this business cycle (1982 to 1989), real GDP has increased at an average annual rate of 4.6% in Canada and 4.5% in the United States and labour input increased at an average annual rate of 2.8% in Canada and 2.7% in the United States. Consequently the average labour productivity increase was identical (1.7%) in both countries.

Historically, Canada has shown higher rates of labour productivity growth than the United States. Some relevant comparisons between Canada and the U.S. are as follows: 3.1% vs. 2.3% for 1947-89; 3.9% vs. 2.8% for 1961-73; 1.5% vs. 1.1% for 1973-89. Thus, the labour productivity performance for Canada in 1989 is very close to the average for the period 1973 to 1989 while it is significantly lower in the United States.

Unit labour cost increases during the past three years have been significantly higher in Canada than the United States: 5.2% vs. 3.8% for 1989, 5.9% vs. 2.1% in 1988, and 4.8% vs. 2.6% in 1987. It should be re-emphasized, however, that the labour cost comparisons between the two countries are in national currencies without adjustment for fluctuations in the exchange rate.

Over the longer run, Canada has experienced higher growth rates in both compensation per person-hour and real GDP per person-hour. As a result, unit labour cost, the ratio of these two components, had very similar growth for most of that period in both countries. This can be seen in Figure 4. In the early 1960's the changes in unit labour cost were quite restrained, increasing only 1.0% on average from 1961 to 1965 in Canada and 0.7% in the United States. From 1965 the unit labour cost started rising in both countries and from 1965 to 1973 the rate of increase of unit labour cost was 4.8% in Canada and 4.7% in the United States. Then the inflationary pressure intensified in the post-1973 period and, from 1973 to 1982, the rate of increase of unit labour cost doubled in Canada to 9.8%, while the increase in the United States for the same period was 8.6%. Since then, the rate of increase has started to decline in both countries and for the period 1982 to 1989, the increases in unit labour cost were 3.5% in Canada and 2.4% for the United States. Although following a similar growth path, it must be recognized that unit labour cost increased at a slightly

Text table 3 - Average annual per cent change - Labour productivity and related measures in Canada and United States

	1947-1989[P]		1961-1973		1973-1989[P]		1982-1989[P]	
	Canada	United States	Canada	United States	Canada	United States	Canada	United States
Business sector industries								
Real G.D.P. per person-hour	3.1	2.3	3.9	2.8	1.5	1.1	1.7	1.7
Real gross domestic product	4.5	3.3	5.9	4.2	3.5	2.7	4.6	4.5
Person-hours	1.3	1.0	1.9	1.4	2.0	1.7	2.8	2.7
Unit labour cost	4.5	3.9	3.5	3.3	7.0	5.8	3.5	2.4
Compensation per person-hour	7.7	6.2	7.6	6.2	8.5	6.9	5.3	4.1
Manufacturing industries:								
Real G.D.P. per person-hour	3.2	2.8	4.5	3.4	1.6	2.5	2.4	4.2
Real gross domestic product	4.1	3.3	6.7	5.2	2.1	2.4	4.9	5.6
Person-hours	0.9	0.5	2.1	1.7	0.6	-0.2	2.5	1.3
Unit labour cost	4.0	3.2	1.9	1.9	7.1	4.4	2.2	-0.6
Compensation per person-hour	7.3	6.1	6.5	5.3	8.8	6.8	4.7	3.6

	1986-1987		1987-1988[P]		1988-1989[P]	
	Canada	United States	Canada	United States	Canada	United States
Business sector industries						
Real G.D.P. per person-hour	0.9	1.1	0.4	2.2	1.7	-0.5
Real gross domestic product	4.8	4.1	4.8	5.3	3.2	2.1
Person-hours	3.9	3.0	4.4	3.0	1.5	2.6
Unit labour cost	4.8	2.6	5.9	2.1	5.2	3.8
Compensation per person-hour	5.7	3.7	6.3	4.5	7.0	3.3
Manufacturing industries						
Real G.D.P. per person-hour	0.5	5.3	-1.1	4.5	0.7	0.9
Real gross domestic product	4.0	6.1	4.9	7.7	0.4	1.3
Person-hours	3.5	0.7	6.1	3.0	-0.3	0.3
Unit labour cost	3.0	-2.8	4.1	-1.1	5.6	3.0
Compensation per person-hour	3.5	2.3	2.9	3.3	6.3	3.9

Figure 4

Canada-United States comparisons of year to year changes in indexes of labour productivity and related measures for business sector industries

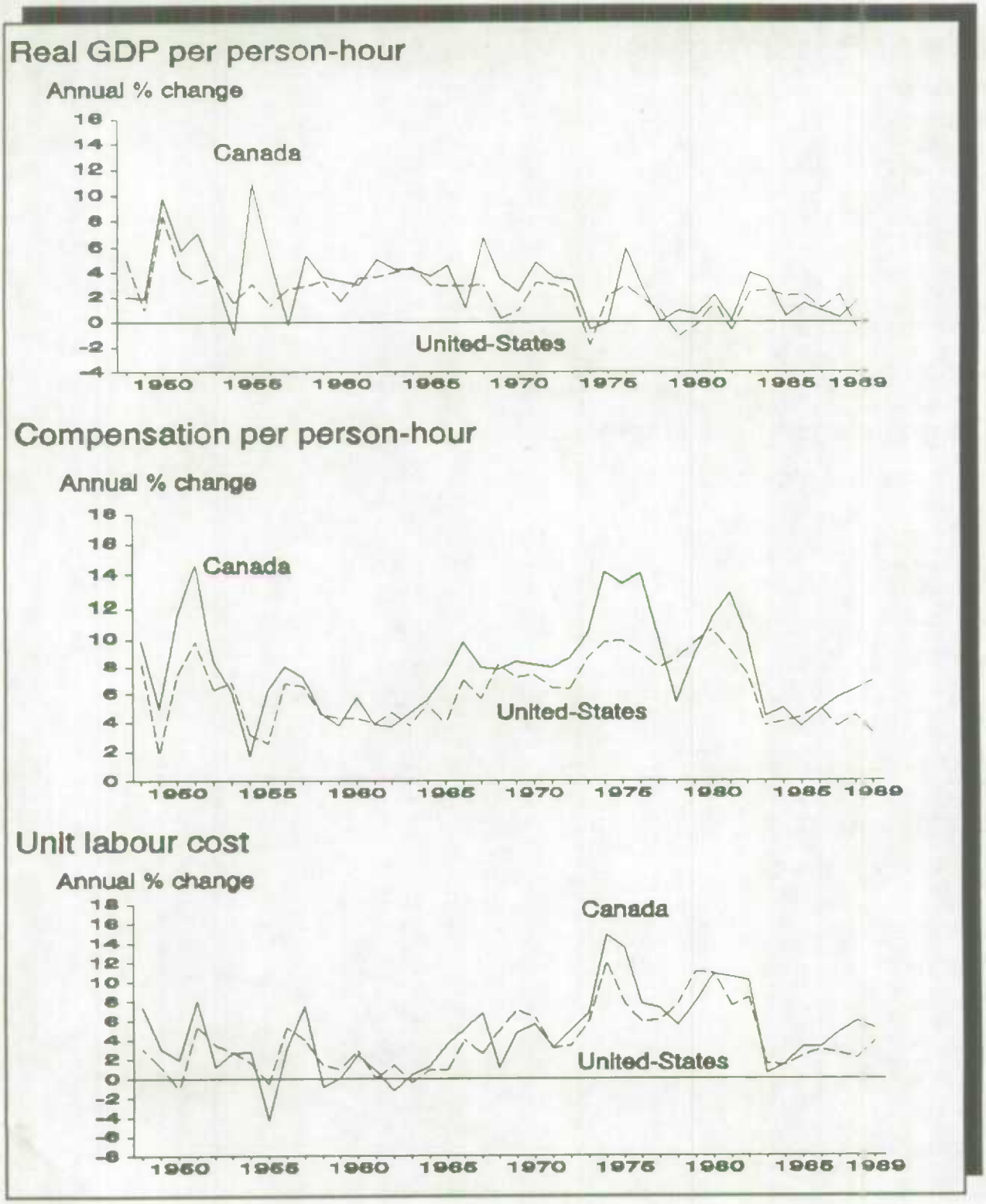
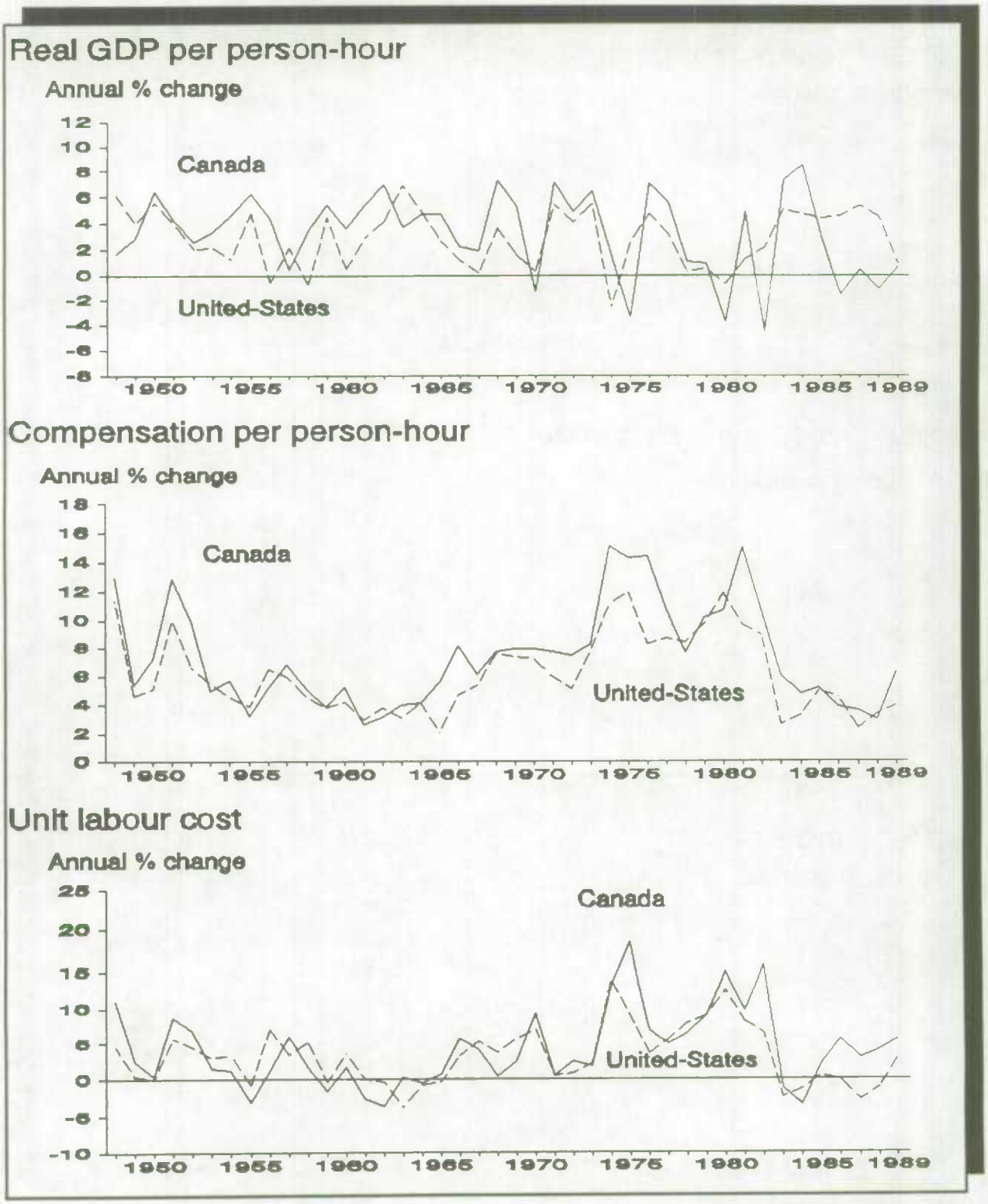


Figure 5

Canada-United States comparisons of year to year changes in indexes of labour productivity and related measures for manufacturing industries



lower rate in the United States than in Canada over all the above sub-periods. The gap widened substantially over the last three years.

3.2 - Manufacturing Industries

As can be seen in Figure 5, manufacturing industries real GDP per person-hour increased 0.7% in Canada and 0.9% in the United States in 1989. In 1988 there was a decrease of 1.1% in Canada and an increase of 4.5% in the United States.

Both countries were just at the beginning of an expansionary phase in 1983 and 1984 and, accordingly, their increases in labour productivity were relatively high those years. For the period 1982 to 1989, labour productivity for manufacturing increased by 2.4% in Canada and 4.2% in the United States. However, in the present phase of the business cycle, the rate of growth of real GDP in the two countries is similar, while the rate of growth of labour input has been higher in Canada than in the United States. Real GDP increased at an average annual rate of 4.9% in Canada and 5.6% in the United States and labour input increased 2.5% in Canada and 1.3% in the United States.

Compensation per person-hour in manufacturing industries has grown more rapidly in Canada than in the United States; 7.3% vs. 6.1% for the 1947-89 period; 6.5% vs. 5.3% for the 1961-73 period; 8.8% vs. 6.8% for the 1973-89 period and 4.7% vs. 3.6% for the 1982-89 period. Initially, higher growth in labour productivity in Canada provided an offset with the result that the increase in unit labour cost for the period 1947 to 1961 was 2.5% in Canada and 2.8% in the United States. For the years 1961 to 1973, these differences disappeared and the rate of increase in unit labour cost was 1.9% in both countries. For 1973 to 1989, the trend was reversed with unit labour cost increasing 7.1% in Canada and 4.4% in the United States. Between 1982 and 1989, unit labour cost increased 2.2% in Canada while United States decreased 0.6%.

Table 1 - Indexes of labour productivity and unit labour cost, business sector industries, 1946-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1946	17.0	47.6	62.3	2.7	35.7	27.4	5.7	4.4	15.9
1947	18.1	49.8	63.6	3.4	36.4	28.6	6.8	5.3	18.7
1948	18.8	50.6	64.6	3.8	37.2	29.1	7.5	5.8	20.1
1949	19.3	51.3	65.0	4.0	37.6	29.7	7.8	6.1	20.7
1950	20.7	51.2	63.6	4.4	40.4	32.6	8.5	6.8	21.1
1951	22.3	52.5	64.7	5.1	42.5	34.5	9.7	7.8	22.8
1952	24.0	52.9	64.9	5.5	45.2	36.9	10.4	8.5	23.0
1953	24.9	53.2	65.2	5.9	46.8	38.3	11.1	9.0	23.6
1954	24.4	52.8	64.4	5.9	46.2	37.9	11.2	9.2	24.3
1955	27.1	53.5	64.7	6.3	50.8	42.0	11.8	9.8	23.2
1956	29.6	55.5	67.0	7.1	53.2	44.2	12.7	10.6	24.0
1957	29.6	56.4	67.3	7.6	52.4	44.1	13.5	11.3	25.7
1958	30.1	54.7	64.8	7.7	54.9	46.4	14.0	11.8	25.5
1959	31.6	55.6	65.7	8.1	56.9	48.1	14.5	12.3	25.5
1960	32.3	55.4	65.1	8.5	58.3	49.7	15.3	13.0	26.2
1961	33.0	55.6	64.5	8.7	59.4	51.2	15.7	13.5	26.4
1962	35.5	56.9	66.0	9.2	62.5	53.8	16.2	14.0	26.0
1963	37.6	58.2	67.0	9.8	64.6	56.1	16.9	14.7	26.1
1964	40.3	60.2	69.0	10.7	67.0	58.5	17.7	15.5	26.5
1965	43.4	63.0	71.6	11.9	69.0	60.7	18.9	16.6	27.4
1966	46.4	65.0	73.2	13.4	71.4	63.5	20.6	18.3	28.8
1967	47.5	66.2	74.0	14.6	71.8	64.2	22.1	19.7	30.8
1968	50.1	66.2	73.1	15.6	75.7	68.5	23.5	21.3	31.1
1969	52.8	68.1	74.6	17.2	77.6	70.8	25.3	23.1	32.6
1970	53.5	68.0	73.6	18.4	78.7	72.6	27.1	25.0	34.4
1971	56.7	69.3	74.6	20.1	81.9	76.1	29.0	27.0	35.5
1972	60.2	71.6	76.5	22.4	84.2	78.8	31.3	29.3	37.2
1973	65.6	75.3	80.5	26.1	87.1	81.5	34.6	32.4	39.8
1974	67.9	79.0	83.9	31.0	86.0	80.9	39.3	37.0	45.7
1975	68.4	80.1	84.5	35.4	85.4	80.9	44.2	41.9	51.8
1976	73.1	81.4	85.3	40.8	89.8	85.7	50.1	47.8	55.8
1977	75.6	83.3	85.9	45.3	90.8	88.0	54.3	52.7	59.9
1978	78.2	85.8	88.8	49.3	91.1	88.0	57.5	55.6	63.1
1979	81.7	89.4	92.0	55.7	91.4	88.8	62.3	60.5	68.2
1980	83.4	91.4	93.4	62.9	91.2	89.3	68.9	67.4	75.5
1981	86.9	94.2	95.3	72.5	92.3	91.2	77.0	76.1	83.4
1982	82.7	91.1	90.6	76.0	90.8	91.3	83.5	83.9	91.9
1983	85.7	91.2	90.3	79.2	94.0	94.9	86.8	87.7	92.4
1984	91.7	93.7	93.4	86.0	97.8	98.1	91.7	92.0	93.8
1985	96.7	98.1	98.1	93.6	98.6	98.5	95.5	95.4	96.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.8	103.2	103.9	109.9	101.6	100.9	106.4	105.7	104.8
1988	109.8	107.3	108.4	121.9	102.4	101.3	113.6	112.4	111.0
1989	113.4	109.8	110.1	132.4	103.2	103.0	120.6	120.3	116.8

[1]Real Gross Domestic Product.

Table 2 - Indexes of labour productivity and unit labour cost, business sector-excluding agricultural and related services industries, 1946-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1946	15.3	35.9	44.3	2.5	42.7	34.6	6.9	5.6	16.2
1947	16.7	39.0	47.7	3.0	42.8	34.9	7.8	6.4	18.2
1948	17.2	40.2	49.2	3.5	42.9	35.0	8.7	7.1	20.2
1949	17.9	41.0	49.7	3.7	43.6	36.0	9.1	7.5	20.8
1950	19.2	41.8	49.8	4.0	45.9	38.4	9.5	8.0	20.8
1951	20.5	44.1	52.3	4.6	46.4	39.1	10.5	8.9	22.7
1952	21.5	45.1	53.2	5.1	47.7	40.5	11.4	9.7	23.9
1953	22.8	45.9	53.7	5.6	49.8	42.4	12.1	10.3	24.4
1954	23.1	45.2	52.4	5.6	51.0	44.0	12.4	10.7	24.4
1955	25.3	46.6	53.8	6.0	54.3	47.1	12.8	11.1	23.6
1956	27.8	49.4	57.1	6.7	56.2	48.6	13.7	11.8	24.3
1957	28.3	50.7	58.2	7.3	55.9	48.6	14.3	12.5	25.7
1958	28.5	49.4	56.3	7.3	57.8	50.5	14.9	13.0	25.8
1959	30.3	50.5	57.8	7.8	59.9	52.3	15.4	13.5	25.8
1960	30.9	50.6	57.5	8.1	61.1	53.7	16.1	14.2	26.5
1961	31.9	50.8	57.1	8.4	62.9	55.9	16.6	14.8	26.4
1962	34.0	52.3	59.1	9.0	64.9	57.4	17.2	15.2	26.4
1963	35.7	53.9	60.6	9.6	66.4	59.0	17.7	15.8	26.7
1964	38.9	56.2	63.2	10.4	69.1	61.5	18.5	16.5	26.8
1965	42.0	59.6	66.7	11.7	70.4	62.9	19.6	17.5	27.9
1966	44.7	62.4	69.2	13.2	71.6	64.6	21.1	19.1	29.5
1967	46.4	63.4	70.0	14.4	73.2	66.4	22.7	20.6	31.0
1968	48.9	63.6	69.4	15.4	77.0	70.4	24.2	22.1	31.4
1969	51.5	65.8	71.1	17.0	78.4	72.5	25.9	23.9	33.0
1970	52.6	65.9	70.5	18.3	79.8	74.5	27.7	25.9	34.7
1971	55.4	67.3	71.5	20.0	82.3	77.5	29.7	28.0	36.1
1972	59.6	70.1	74.2	22.4	85.0	80.3	31.9	30.1	37.5
1973	64.8	74.1	78.5	25.9	87.4	82.6	34.9	33.0	40.0
1974	67.6	78.0	82.0	30.9	86.7	82.5	39.6	37.7	45.7
1975	67.7	78.9	82.2	35.3	85.8	82.4	44.8	43.0	52.2
1976	72.2	80.4	83.3	40.7	89.9	86.7	50.7	48.9	56.4
1977	74.9	82.4	84.4	45.2	90.9	88.8	54.9	53.6	60.4
1978	77.7	84.9	87.5	49.2	91.5	88.9	58.0	56.3	63.4
1979	81.7	88.6	90.7	55.6	92.1	90.0	62.8	61.3	68.1
1980	83.2	90.8	92.5	63.0	91.7	89.9	69.4	68.1	75.7
1981	86.6	93.7	94.5	72.4	92.5	91.6	77.3	76.6	83.7
1982	82.0	90.7	89.8	75.9	90.4	91.3	83.7	84.5	92.6
1983	85.2	90.6	89.5	79.1	94.1	95.2	87.3	88.3	92.8
1984	91.5	93.2	92.8	85.9	98.2	98.6	92.1	92.5	93.8
1985	96.9	97.9	97.8	93.5	99.0	99.1	95.5	95.6	96.5
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.3	103.5	104.3	110.1	101.7	100.9	106.4	105.6	104.6
1988	111.0	108.0	109.6	122.3	102.8	101.2	113.2	111.6	110.2
1989	114.3	110.9	111.5	133.0	103.1	102.5	119.9	119.2	116.4

[1]Real Gross Domestic Product.

Table 3 - Indexes of labour productivity and unit labour cost, business sector-services, 1946-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1946	14.7	23.7	31.1	2.0	62.0	47.2	8.4	6.4	13.6
1947	15.8	25.7	33.4	2.2	61.4	47.4	8.7	6.7	14.2
1948	16.1	26.8	34.8	2.5	60.0	46.3	9.5	7.3	15.8
1949	16.7	27.5	35.5	2.8	60.8	47.3	10.1	7.9	16.6
1950	17.6	28.0	35.3	2.9	63.0	50.1	10.4	8.3	16.5
1951	18.6	29.1	36.2	3.3	64.1	51.4	11.4	9.1	17.7
1952	19.6	30.2	37.5	3.7	65.0	52.4	12.2	9.8	18.7
1953	20.5	31.0	37.9	4.0	66.2	54.1	13.0	10.7	19.7
1954	20.8	31.4	38.3	4.2	66.2	54.3	13.4	11.0	20.2
1955	22.5	32.4	39.2	4.5	69.6	57.5	13.9	11.5	19.9
1956	24.2	34.5	41.8	5.0	70.4	58.1	14.7	12.1	20.8
1957	24.9	36.1	43.5	5.6	68.8	57.0	15.4	12.7	22.3
1958	25.1	36.4	43.5	5.8	69.1	57.9	15.9	13.3	23.0
1959	26.7	37.4	44.7	6.2	71.2	59.7	16.5	13.8	23.1
1960	27.3	37.9	44.9	6.5	71.9	60.8	17.2	14.5	23.9
1961	28.3	38.8	45.5	6.9	73.1	62.3	17.8	15.2	24.4
1962	29.6	40.2	47.0	7.4	73.7	63.0	18.4	15.7	24.9
1963	31.3	41.7	48.3	7.9	75.1	64.8	19.0	16.4	25.3
1964	33.7	43.5	50.2	8.7	77.3	67.1	19.9	17.3	25.8
1965	36.0	46.1	52.8	9.7	77.9	68.1	21.1	18.4	27.0
1966	38.7	48.5	54.6	11.0	79.8	70.9	22.6	20.1	28.3
1967	40.5	50.2	56.5	12.2	80.6	71.7	24.4	21.7	30.3
1968	42.3	50.9	56.3	13.1	83.2	75.1	25.9	23.3	31.1
1969	44.7	53.5	58.7	14.8	83.6	76.3	27.7	25.2	33.1
1970	47.1	54.8	59.2	16.1	85.9	79.4	29.5	27.3	34.3
1971	49.9	56.4	60.6	17.7	88.5	82.3	31.4	29.2	35.5
1972	53.5	59.5	63.6	20.1	89.8	84.1	33.7	31.6	37.6
1973	57.5	63.3	67.6	23.1	90.9	85.0	36.5	34.2	40.2
1974	60.9	67.7	71.7	27.8	90.0	84.9	41.0	38.7	45.6
1975	63.6	70.0	73.7	32.1	90.8	86.3	45.9	43.6	50.5
1976	67.2	71.6	74.8	37.1	93.9	89.9	51.8	49.6	55.1
1977	69.5	74.9	76.9	41.4	92.8	90.3	55.3	53.8	59.6
1978	73.1	78.1	80.8	45.5	93.6	90.5	58.3	56.3	62.2
1979	77.2	81.6	83.7	51.7	94.7	92.3	63.4	61.8	66.9
1980	80.8	84.8	86.7	59.3	95.3	93.2	69.9	68.4	73.4
1981	84.2	88.7	89.8	67.8	95.0	93.8	76.4	75.5	80.5
1982	81.6	88.1	87.8	73.7	92.5	92.9	83.6	83.9	90.4
1983	84.1	89.1	87.9	77.3	94.4	95.6	86.8	87.9	91.9
1984	89.9	92.3	91.7	84.9	97.3	98.0	92.0	92.6	94.5
1985	95.1	97.6	97.3	93.0	97.4	97.8	95.2	95.6	97.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.6	103.7	104.2	110.7	101.9	101.3	106.8	106.2	104.8
1988	111.7	107.6	108.5	122.5	103.8	103.0	113.9	113.0	109.7
1989	116.7	110.8	110.8	134.2	105.3	105.3	121.1	121.1	115.0

[1]Real Gross Domestic Product.

Table 4 - **Indexes of labour productivity and unit labour cost, business sector-goods, 1946-1989, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1946	20.0	86.8	108.3	3.6	23.0	18.4	4.2	3.4	18.2
1947	21.1	89.1	108.0	4.9	23.7	19.6	5.5	4.5	23.0
1948	22.2	89.5	108.5	5.4	24.9	20.5	6.0	4.9	24.1
1949	22.7	90.2	108.3	5.5	25.1	21.0	6.1	5.1	24.4
1950	24.5	89.0	105.1	6.2	27.6	23.4	7.0	5.9	25.3
1951	26.9	90.7	106.5	7.4	29.7	25.3	8.1	6.9	27.3
1952	29.3	89.7	105.0	7.9	32.5	27.9	8.8	7.5	27.0
1953	30.4	89.3	105.1	8.3	34.0	28.9	9.3	7.9	27.3
1954	29.0	87.6	102.5	8.1	33.2	28.3	9.3	7.9	28.0
1955	32.9	87.6	101.8	8.6	37.5	32.3	9.9	8.5	26.3
1956	36.0	89.6	103.7	9.7	40.2	34.7	10.8	9.3	26.9
1957	35.7	89.0	101.6	10.3	40.0	35.1	11.5	10.1	28.8
1958	36.3	84.3	95.6	10.1	43.0	37.9	12.0	10.6	27.9
1959	37.9	84.8	96.1	10.5	44.8	39.5	12.4	10.9	27.7
1960	38.8	83.4	93.9	10.9	46.5	41.3	13.1	11.6	28.1
1961	39.2	82.4	91.7	11.0	47.6	42.8	13.4	12.0	28.0
1962	43.2	83.3	93.2	11.6	51.8	46.4	13.9	12.4	26.8
1963	45.8	84.4	93.7	12.2	54.3	48.9	14.5	13.1	26.7
1964	49.0	86.7	95.8	13.2	56.6	51.2	15.3	13.8	27.0
1965	53.2	89.7	98.5	14.7	59.3	54.0	16.4	14.9	27.6
1966	56.5	91.3	99.8	16.4	61.9	56.7	18.0	16.5	29.1
1967	56.7	91.5	99.1	17.6	62.0	57.2	19.2	17.8	31.1
1968	60.3	90.4	97.2	18.6	66.6	62.0	20.6	19.2	30.9
1969	63.4	91.2	97.3	20.3	69.5	65.2	22.2	20.8	31.9
1970	61.9	88.9	94.2	21.2	69.6	65.6	23.9	22.5	34.3
1971	65.7	89.8	94.6	23.2	73.2	69.5	25.8	24.5	35.3
1972	69.1	90.7	94.9	25.4	76.2	72.8	28.0	26.8	36.7
1973	76.2	94.3	98.9	29.8	80.8	77.0	31.6	30.1	39.1
1974	77.0	96.9	101.2	35.1	79.5	76.1	36.2	34.7	45.6
1975	74.6	96.2	100.1	39.7	77.5	74.5	41.2	39.6	53.2
1976	80.6	97.1	100.3	45.5	83.1	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	54.2	86.2	84.3	55.3	54.1	64.1
1979	87.3	101.8	104.0	60.7	85.7	83.9	59.6	58.4	69.6
1980	86.2	101.7	102.9	67.5	84.8	83.8	66.4	65.6	78.3
1981	90.0	102.9	103.3	78.5	87.5	87.1	76.4	76.1	87.3
1982	84.0	95.8	94.6	79.0	87.8	88.9	82.5	83.5	94.0
1983	87.5	94.5	93.7	81.5	92.6	93.4	86.2	87.0	93.1
1984	93.7	95.8	95.8	87.3	97.8	97.8	91.1	91.1	93.1
1985	98.5	98.8	99.4	94.5	99.7	99.1	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	103.8	102.5	103.4	108.8	101.3	100.4	106.2	105.3	104.8
1988	107.4	106.8	108.4	121.2	100.6	99.1	113.5	111.7	112.8
1989	109.1	108.2	109.1	130.1	100.9	100.1	120.2	119.3	119.2

[1]Real Gross Domestic Product.

Table 5 - Indexes of labour productivity and unit labour cost, business sector-goods, excluding agricultural and related services industries, 1946-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1946	16.5	59.3	67.7	3.1	27.8	24.2	5.3	4.6	19.1
1947	18.1	64.4	73.1	4.1	28.0	24.7	6.4	5.7	22.9
1948	19.1	65.9	74.7	4.8	29.1	25.6	7.3	6.4	24.9
1949	19.9	66.9	74.8	5.0	29.7	26.6	7.5	6.7	25.2
1950	21.5	68.2	75.8	5.4	31.6	28.3	8.0	7.2	25.3
1951	23.4	73.0	80.8	6.5	31.9	28.9	8.9	8.0	27.9
1952	24.5	73.8	81.0	7.2	33.1	30.2	9.7	8.8	29.2
1953	26.4	74.4	82.0	7.7	35.3	32.1	10.3	9.4	29.1
1954	26.5	71.6	77.4	7.6	37.0	34.2	10.6	9.8	28.6
1955	29.4	73.8	79.6	8.0	39.8	36.9	10.8	10.1	27.2
1956	32.6	77.9	84.2	9.1	41.8	38.7	11.7	10.8	27.9
1957	33.4	78.4	83.9	9.6	42.5	39.7	12.3	11.5	28.9
1958	33.3	73.9	78.9	9.5	45.0	42.2	12.8	12.0	28.4
1959	35.5	75.3	80.7	10.0	47.0	43.8	13.3	12.4	28.3
1960	36.0	74.3	79.1	10.4	48.5	45.5	14.0	13.1	28.8
1961	37.4	73.1	77.0	10.5	51.1	48.5	14.3	13.6	28.0
1962	40.5	74.9	80.1	11.1	54.0	50.6	14.8	13.9	27.5
1963	42.5	76.6	81.7	11.7	55.5	52.0	15.3	14.4	27.7
1964	46.6	79.9	85.6	12.8	58.4	54.5	16.0	14.9	27.4
1965	50.8	84.6	90.8	14.3	60.1	56.0	16.9	15.8	28.2
1966	53.5	88.3	94.3	16.2	60.6	56.8	18.3	17.1	30.2
1967	55.2	88.0	93.2	17.3	62.8	59.3	19.7	18.6	31.3
1968	58.7	87.2	92.1	18.4	67.3	63.7	21.1	19.9	31.3
1969	61.6	88.5	92.5	20.0	69.6	66.5	22.6	21.6	32.5
1970	60.8	86.5	90.0	21.1	70.2	67.5	24.4	23.4	34.7
1971	63.7	87.6	90.3	23.1	72.7	70.5	26.4	25.6	36.2
1972	68.6	89.7	92.5	25.4	76.5	74.2	28.3	27.5	37.1
1973	75.6	94.4	97.2	29.6	80.1	77.7	31.4	30.5	39.2
1974	77.4	97.3	99.7	35.1	79.6	77.6	36.1	35.2	45.3
1975	73.7	95.4	96.9	39.6	77.3	76.1	41.6	40.9	53.8
1976	79.6	96.8	98.0	45.7	82.3	81.2	47.2	46.6	57.4
1977	82.8	96.5	97.3	50.4	85.8	85.1	52.2	51.8	60.9
1978	84.4	97.8	99.0	54.3	86.3	85.2	55.5	54.8	64.3
1979	87.9	101.9	102.8	60.9	86.3	85.5	59.8	59.3	69.3
1980	86.4	101.8	102.5	67.9	84.8	84.2	66.7	66.3	78.7
1981	89.8	103.0	102.8	78.7	87.2	87.3	76.4	76.6	87.7
1982	82.8	95.4	93.2	78.9	86.8	88.8	82.7	84.7	95.3
1983	86.9	93.3	92.2	81.4	93.1	94.2	87.3	88.3	93.7
1984	93.8	94.8	94.7	87.2	99.0	99.1	91.9	92.0	92.9
1985	99.4	98.3	98.6	94.2	101.1	100.8	95.8	95.5	94.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	104.7	103.2	104.5	109.4	101.4	100.2	106.0	104.7	104.5
1988	110.0	108.7	111.6	122.0	101.2	98.5	112.2	109.3	110.9
1989	111.0	110.9	112.8	131.4	100.1	98.5	118.4	116.5	118.3

[1]Real Gross Domestic Product.

Table 6 - **Indexes of labour productivity and unit labour cost, business sector-goods, excluding agricultural and related services industries and manufacturing industries, 1946-1989, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1946	13.8	54.3	63.5	2.9	25.4	21.8	5.4	4.6	21.1
1947	15.3	61.3	71.7	3.9	25.0	21.4	6.4	5.5	25.6
1948	16.6	62.9	72.7	4.5	26.4	22.9	7.2	6.2	27.1
1949	17.6	64.0	73.5	4.7	27.5	23.9	7.4	6.4	26.8
1950	19.5	66.4	76.4	5.2	29.4	25.5	7.9	6.8	26.7
1951	21.0	72.7	84.9	6.4	28.9	24.7	8.8	7.5	30.4
1952	22.5	71.2	83.9	6.9	31.6	26.8	9.7	8.2	30.7
1953	24.4	68.6	81.0	7.3	35.6	30.1	10.6	8.9	29.6
1954	25.7	66.9	77.2	7.1	38.5	33.4	10.6	9.1	27.4
1955	29.2	70.2	79.5	7.4	41.5	36.6	10.6	9.4	25.5
1956	32.8	76.2	85.5	8.8	43.1	38.4	11.6	10.3	26.8
1957	34.7	77.1	86.0	9.4	45.1	40.4	12.2	10.9	27.0
1958	35.5	71.5	79.3	9.0	49.6	44.7	12.5	11.3	25.2
1959	37.2	74.0	82.1	9.5	50.3	45.3	12.9	11.6	25.5
1960	38.1	72.6	80.1	9.9	52.6	47.6	13.7	12.4	26.0
1961	39.3	70.0	75.8	9.9	56.1	51.8	14.2	13.1	25.2
1962	41.2	71.0	78.3	10.3	58.0	52.6	14.5	13.2	25.0
1963	42.5	72.1	78.7	10.7	58.9	53.9	14.8	13.6	25.2
1964	46.6	75.1	82.2	11.5	62.0	56.7	15.3	14.0	24.7
1965	50.2	80.5	88.6	13.1	62.3	56.6	16.3	14.8	26.2
1966	52.2	83.4	91.8	14.9	62.6	56.9	17.9	16.2	28.5
1967	54.4	81.3	88.2	16.1	67.0	61.7	19.8	18.2	29.5
1968	57.6	80.4	86.1	16.8	71.6	66.8	20.9	19.5	29.2
1969	59.0	80.6	84.6	18.1	73.2	69.7	22.5	21.4	30.7
1970	60.3	79.0	82.8	19.3	76.4	72.8	24.4	23.3	32.0
1971	62.2	82.2	84.9	22.0	75.8	73.3	26.8	25.9	35.4
1972	66.7	83.0	85.8	24.0	80.3	77.7	28.9	28.0	36.0
1973	73.0	88.3	91.9	29.6	82.7	79.5	33.5	32.2	40.5
1974	74.3	92.8	96.3	35.7	80.0	77.1	38.5	37.1	48.1
1975	72.4	91.6	94.4	41.8	79.0	76.7	45.6	44.2	57.7
1976	78.8	94.7	97.1	48.5	83.2	81.2	51.2	49.9	61.5
1977	82.3	97.6	98.2	54.5	84.4	83.8	55.9	55.5	66.2
1978	81.4	95.7	97.1	56.0	85.0	83.8	58.5	57.7	68.8
1979	85.2	100.7	102.6	62.1	84.6	83.0	61.6	60.5	72.9
1980	86.5	101.2	103.1	70.7	85.5	83.9	69.8	68.6	81.7
1981	90.2	104.3	105.9	84.1	86.4	85.1	80.6	79.4	93.2
1982	88.4	97.5	95.1	83.5	90.7	93.0	85.7	87.9	94.5
1983	91.4	95.0	93.5	83.7	96.2	97.7	88.1	89.5	91.6
1984	94.1	94.3	93.9	87.2	99.9	100.2	92.5	92.8	92.6
1985	100.0	99.5	100.3	94.4	100.5	99.7	94.9	94.2	94.4
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.7	103.6	106.3	112.9	102.0	99.5	108.9	106.2	106.8
1988	111.2	110.6	114.9	129.8	100.5	96.7	117.4	113.0	116.8
1989	113.0	115.1	118.5	142.7	98.2	95.3	124.0	120.4	126.3

[1]Real Gross Domestic Product.

Table 7 - Indexes of labour productivity and unit labour cost, agricultural and related services industries, 1946-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity: Real GDP per person	Labour productivity: Real GDP per person-hour	Compen-sation per person	Compen-sation per person-hour	Unit labour cost
1946	54.9	239.4	296.9	11.0	22.9	18.5	4.6	3.7	20.1
1947	51.6	226.6	271.2	15.8	22.8	19.0	7.0	5.8	30.6
1948	53.3	221.2	267.0	14.3	24.1	20.0	6.5	5.4	26.8
1949	50.1	219.4	265.6	13.4	22.9	18.9	6.1	5.1	26.8
1950	54.8	205.5	243.2	17.9	26.7	22.6	8.7	7.4	32.7
1951	62.6	189.6	228.4	20.3	33.0	27.5	10.7	8.9	32.4
1952	76.6	179.9	218.8	19.1	42.6	35.1	10.6	8.7	24.9
1953	70.1	173.2	214.9	17.9	40.4	32.7	10.3	8.3	25.6
1954	53.8	177.2	222.2	17.1	30.4	24.2	9.6	7.7	31.8
1955	66.4	165.4	207.6	18.7	40.2	32.0	11.3	9.0	28.1
1956	70.6	156.7	198.3	19.7	45.0	35.6	12.6	9.9	27.9
1957	59.3	150.2	187.9	20.9	39.5	31.7	13.9	11.1	35.1
1958	65.8	143.8	176.8	20.7	45.8	37.3	14.4	11.7	31.5
1959	63.7	139.7	171.4	19.1	45.6	37.2	13.7	11.2	30.0
1960	66.7	136.3	166.6	20.1	48.9	40.0	14.8	12.1	30.2
1961	57.8	136.1	163.2	20.2	42.5	35.4	14.8	12.4	34.9
1962	71.0	131.9	157.1	19.8	53.9	45.2	15.0	12.6	27.9
1963	79.9	129.4	152.3	20.3	61.8	52.5	15.7	13.4	25.5
1964	73.1	125.5	145.6	20.8	58.2	50.2	16.5	14.3	28.4
1965	76.7	119.0	136.1	20.7	64.5	56.4	17.4	15.2	26.9
1966	86.4	108.6	126.3	21.1	79.6	68.4	19.4	16.7	24.4
1967	70.1	111.6	127.9	22.8	62.8	54.8	20.4	17.8	32.5
1968	75.2	108.9	122.3	23.4	69.0	61.5	21.5	19.1	31.1
1969	80.9	106.8	120.8	24.4	75.7	67.0	22.8	20.2	30.1
1970	71.6	102.5	114.8	23.5	69.8	62.3	22.9	20.5	32.8
1971	84.8	102.6	115.2	24.6	82.7	73.7	24.0	21.4	29.0
1972	72.2	96.5	106.7	25.1	74.8	67.7	26.0	23.5	34.8
1973	79.3	93.8	106.8	32.5	84.6	74.3	34.7	30.5	41.0
1974	69.6	95.0	108.5	35.5	73.3	64.2	37.4	32.7	51.0
1975	81.3	101.3	115.6	40.3	80.3	70.3	39.8	34.9	49.6
1976	88.5	98.8	111.4	42.0	89.5	79.4	42.5	37.7	47.5
1977	87.5	97.7	106.0	46.3	89.5	82.5	47.4	43.7	52.9
1978	83.8	100.0	106.8	53.8	83.8	78.4	53.8	50.4	64.2
1979	77.0	101.8	109.7	57.2	75.6	70.2	56.1	52.1	74.2
1980	81.5	101.2	104.9	60.6	80.6	77.7	59.9	57.8	74.3
1981	88.9	102.3	105.6	75.7	86.9	84.1	74.0	71.7	85.2
1982	94.5	97.7	101.2	80.1	96.7	93.3	82.0	79.2	84.8
1983	91.7	101.7	101.1	82.8	90.2	90.7	81.4	81.9	90.3
1984	88.8	101.5	100.9	88.6	87.4	88.0	87.3	87.8	99.8
1985	85.1	101.4	103.1	98.7	83.9	82.5	97.3	95.7	116.0
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	91.1	98.1	97.9	99.0	92.8	93.0	100.8	101.1	108.7
1988	72.6	95.4	92.8	106.6	76.0	78.2	111.7	114.9	146.9
1989	83.3	92.5	91.0	109.3	90.0	91.5	118.1	120.1	131.1

[1]Real Gross Domestic Product.

Table 8 - Indexes of labour productivity and unit labour cost, manufacturing industries, 1946-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1946	18.2	61.9	69.9	3.3	29.4	26.1	5.3	4.7	18.1
1947	20.0	66.1	73.9	4.3	30.1	27.0	6.5	5.8	21.5
1948	20.8	67.5	75.8	5.0	30.8	27.4	7.3	6.5	23.8
1949	21.4	68.7	75.5	5.2	31.1	28.2	7.6	6.9	24.4
1950	22.8	69.4	75.6	5.6	32.8	30.0	8.1	7.4	24.5
1951	24.8	73.6	79.0	6.6	33.6	31.3	9.0	8.3	26.7
1952	25.7	75.3	79.8	7.3	34.1	32.1	9.7	9.2	28.5
1953	27.5	77.6	82.7	8.0	35.4	33.2	10.2	9.6	29.0
1954	26.9	74.1	77.5	7.9	36.3	34.7	10.6	10.2	29.3
1955	29.5	76.0	79.7	8.4	38.8	36.9	11.0	10.5	28.4
1956	32.3	79.1	83.7	9.2	40.8	38.5	11.7	11.1	28.7
1957	32.2	79.5	83.0	9.8	40.5	38.7	12.3	11.8	30.5
1958	31.6	75.4	78.8	9.8	41.9	40.1	13.0	12.4	31.0
1959	33.9	76.3	80.1	10.3	44.5	42.2	13.5	12.9	30.5
1960	34.5	75.6	78.8	10.7	45.7	43.8	14.1	13.6	31.0
1961	35.9	74.8	77.7	10.8	47.9	46.1	14.4	13.9	30.1
1962	40.0	77.1	81.0	11.6	51.8	49.4	15.1	14.3	29.1
1963	42.6	79.0	83.3	12.4	54.0	51.2	15.7	14.9	29.2
1964	46.9	82.6	87.5	13.6	56.7	53.6	16.5	15.5	29.0
1965	51.6	86.9	92.0	15.1	59.4	56.1	17.4	16.4	29.2
1966	54.9	91.1	95.8	17.0	60.3	57.4	18.6	17.7	30.9
1967	56.2	91.8	96.0	18.1	61.2	58.5	19.7	18.8	32.2
1968	59.9	91.1	95.5	19.4	65.7	62.7	21.2	20.3	32.3
1969	64.1	93.0	97.0	21.2	69.0	66.1	22.8	21.9	33.1
1970	61.4	90.8	94.1	22.2	67.6	65.2	24.5	23.6	36.2
1971	65.3	90.7	93.4	23.8	72.0	69.9	26.2	25.4	36.4
1972	70.6	93.5	96.3	26.3	75.5	73.3	28.2	27.3	37.3
1973	78.2	97.8	100.3	29.7	79.9	77.9	30.4	29.6	38.0
1974	80.5	99.8	101.7	34.6	80.7	79.2	34.7	34.1	43.0
1975	75.1	97.5	98.3	38.3	77.1	76.5	39.3	38.9	50.9
1976	80.6	97.9	98.6	43.9	82.3	81.8	44.8	44.6	54.5
1977	83.6	95.9	96.8	47.7	87.1	86.3	49.8	49.3	57.1
1978	87.4	98.9	100.1	53.2	88.3	87.3	53.7	53.1	60.8
1979	90.6	102.5	102.9	60.2	88.4	88.1	58.7	58.5	66.4
1980	86.6	102.2	102.2	66.2	84.7	84.7	64.8	64.8	76.4
1981	89.8	102.2	101.0	75.3	87.8	88.9	73.7	74.5	83.9
1982	78.2	94.3	92.2	75.9	82.9	84.8	80.6	82.4	97.1
1983	83.2	92.4	91.5	79.9	90.1	91.0	86.6	87.4	96.1
1984	94.0	95.2	95.2	87.2	98.7	98.7	91.6	91.6	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	104.0	103.0	103.5	107.2	101.0	100.5	104.0	103.5	103.0
1988	109.1	107.7	109.8	117.0	101.3	99.4	108.7	106.6	107.3
1989	109.6	108.6	109.5	124.1	100.9	100.1	114.2	113.3	113.2

[1]Real Gross Domestic Product.

Table 9 - Indexes of labour productivity and unit labour cost, construction industries, 1961-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	49.2	70.0	75.4	10.6	70.3	65.3	15.2	14.1	21.6
1962	51.3	70.2	77.6	10.8	73.0	66.1	15.4	13.9	21.1
1963	51.4	71.7	78.9	11.3	71.7	65.2	15.7	14.3	21.9
1964	54.2	75.6	83.7	12.2	71.6	64.7	16.2	14.6	22.6
1965	59.2	83.2	91.9	14.3	71.2	64.5	17.1	15.5	24.1
1966	60.5	86.3	95.4	16.3	70.1	63.4	18.9	17.1	26.9
1967	60.9	83.7	91.3	17.5	72.8	66.7	21.0	19.2	28.8
1968	63.2	83.2	89.6	18.2	75.9	70.5	21.9	20.3	28.8
1969	60.6	83.7	88.6	19.5	72.4	68.4	23.3	22.0	32.1
1970	59.4	80.8	85.1	20.5	73.6	69.8	25.4	24.1	34.5
1971	61.7	83.7	86.9	24.0	73.7	70.9	28.7	27.6	38.9
1972	61.7	85.6	89.2	26.2	72.0	69.2	30.6	29.3	42.4
1973	63.5	91.2	95.4	32.7	69.7	66.6	35.8	34.3	51.4
1974	65.5	96.1	100.6	39.6	68.2	65.1	41.2	39.3	60.4
1975	72.7	94.5	98.3	47.0	76.9	74.0	49.8	47.9	64.7
1976	81.9	99.7	102.6	54.5	82.2	79.8	54.7	53.2	66.6
1977	86.1	101.2	101.5	60.4	85.1	84.8	59.7	59.5	70.2
1978	81.8	98.3	99.8	59.6	83.2	82.0	60.7	59.7	72.9
1979	82.6	103.0	105.2	63.6	80.2	78.6	61.7	60.5	76.9
1980	86.8	101.3	104.1	72.6	85.7	83.4	71.7	69.8	83.7
1981	96.7	104.2	105.8	88.3	92.8	91.4	84.7	83.4	91.3
1982	96.8	96.5	92.9	84.9	100.3	104.2	87.9	91.4	87.7
1983	95.1	93.1	90.9	83.3	102.1	104.6	89.5	91.7	87.6
1984	89.1	91.3	90.6	84.6	97.5	98.3	92.7	93.4	95.0
1985	96.0	98.3	99.2	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	105.9	105.7	109.4	117.4	100.2	96.8	111.1	107.3	110.9
1988	112.6	114.3	119.6	135.2	98.5	94.2	118.2	113.0	120.0
1989	117.5	120.3	125.1	149.8	97.6	93.9	124.5	119.7	127.5

[1]Real Gross Domestic Product.

Table 10 - **Indexes of labour productivity and unit labour cost, transportation and storage industries, 1961-1989, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	34.2	70.3	77.8	10.1	48.7	44.0	14.4	13.0	29.7
1962	34.1	68.9	75.9	10.5	49.6	45.0	15.2	13.8	30.6
1963	37.8	70.5	77.7	11.1	53.6	48.6	15.8	14.3	29.5
1964	41.6	71.0	78.4	12.0	58.6	53.1	16.9	15.3	28.8
1965	44.1	75.1	82.6	13.3	58.7	53.4	17.7	16.1	30.1
1966	47.4	77.2	82.2	14.5	61.5	57.7	18.8	17.6	30.6
1967	48.4	78.9	84.6	15.9	61.4	57.3	20.2	18.8	32.9
1968	50.3	76.9	81.3	17.1	65.4	61.8	22.2	21.0	34.0
1969	54.9	77.8	81.8	18.8	70.6	67.1	24.2	23.0	34.2
1970	59.8	77.3	80.4	19.8	77.3	74.4	25.6	24.6	33.1
1971	62.3	79.5	82.1	21.4	78.4	75.9	26.9	26.0	34.3
1972	66.2	81.2	83.2	24.1	81.5	79.5	29.7	29.0	36.4
1973	70.6	84.0	86.3	27.1	84.1	81.8	32.2	31.4	38.4
1974	73.7	89.1	91.3	32.4	82.8	80.8	36.4	35.5	44.0
1975	72.6	88.1	88.9	37.7	82.4	81.6	42.7	42.4	51.9
1976	72.1	87.3	88.1	42.1	82.6	81.9	48.2	47.8	58.4
1977	75.2	92.7	92.5	47.9	81.2	81.3	51.7	51.8	63.6
1978	79.0	94.6	95.5	53.0	83.6	82.8	56.0	55.5	67.1
1979	88.4	97.5	97.8	59.3	90.6	90.4	60.7	60.6	67.0
1980	85.3	101.9	102.8	66.9	83.7	83.0	65.6	65.0	78.4
1981	84.3	102.5	101.3	75.9	82.3	83.2	74.1	74.9	90.0
1982	79.6	95.8	93.9	80.0	83.1	84.7	83.5	85.1	100.5
1983	85.5	94.3	90.9	81.9	90.7	94.1	86.8	90.1	95.7
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	106.1	102.0	105.4	105.1	104.0	100.7	102.9	99.7	99.0
1988	112.2	101.9	105.7	110.4	110.1	106.1	108.3	104.4	98.4
1989	112.8	106.5	109.8	119.3	105.9	102.7	112.0	108.7	105.8

[1]Real Gross Domestic Product.

Table 11 - Indexes of labour productivity and unit labour cost, communication industries, 1961-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	14.4	51.1	56.4	6.8	28.2	25.6	13.3	12.1	47.3
1962	15.5	53.0	58.2	7.2	29.3	26.7	13.6	12.4	46.3
1963	16.7	55.3	60.7	7.8	30.2	27.5	14.1	12.8	46.7
1964	18.3	58.0	63.9	8.2	31.6	28.7	14.2	12.9	45.0
1965	19.9	57.7	63.3	9.0	34.5	31.4	15.6	14.2	45.3
1966	21.7	63.0	66.7	10.3	34.4	32.5	16.4	15.4	47.5
1967	23.9	64.3	68.7	11.6	37.2	34.8	18.1	17.0	48.7
1968	25.9	62.8	66.1	12.7	41.2	39.1	20.3	19.2	49.2
1969	27.8	66.1	69.3	14.0	42.0	40.1	21.1	20.2	50.3
1970	30.4	67.7	70.3	15.0	44.9	43.2	22.2	21.4	49.5
1971	32.8	71.9	74.0	16.9	45.7	44.4	23.6	22.9	51.6
1972	35.8	74.2	75.6	19.1	48.3	47.3	25.7	25.2	53.3
1973	39.8	79.3	80.9	22.5	50.2	49.2	28.4	27.9	56.6
1974	44.9	85.0	86.6	26.8	52.8	51.8	31.5	30.9	59.7
1975	50.6	85.1	85.2	31.5	59.4	59.4	37.0	36.9	62.2
1976	55.7	91.7	91.7	38.2	60.7	60.7	41.6	41.6	68.6
1977	59.1	94.8	93.8	44.6	62.4	63.0	47.1	47.5	75.4
1978	64.8	93.5	93.9	49.1	69.4	69.0	52.5	52.2	75.7
1979	71.2	95.1	95.0	55.5	74.8	74.9	58.3	58.4	77.9
1980	77.9	97.7	98.2	62.4	79.7	79.4	63.9	63.6	80.1
1981	84.0	100.3	99.3	73.4	83.7	84.6	73.1	73.9	87.3
1982	83.9	102.1	100.1	81.4	82.2	83.9	79.7	81.4	97.0
1983	86.1	101.0	97.7	86.2	85.2	88.1	85.4	88.3	100.2
1984	90.2	101.0	99.8	93.6	89.4	90.5	92.7	93.8	103.7
1985	95.4	101.3	100.6	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	107.6	102.7	102.1	106.0	104.8	105.5	103.2	103.9	98.5
1988	117.3	100.6	100.1	111.3	116.5	117.1	110.6	111.1	94.9
1989	131.3	105.5	104.7	120.6	124.5	125.5	114.3	115.2	91.8

[1]Real Gross Domestic Product.

Table 12 - **Indexes of labour productivity and unit labour cost, wholesale and retail trade industries, 1961-1989, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	32.5	46.6	54.5	8.3	69.7	59.6	17.8	15.2	25.6
1962	34.8	47.5	55.4	8.8	73.2	62.8	18.6	15.9	25.4
1963	36.4	49.1	56.7	9.4	74.1	64.2	19.1	16.6	25.8
1964	39.3	51.1	58.7	10.4	77.0	67.0	20.3	17.7	26.4
1965	42.2	53.5	61.2	11.4	78.9	68.9	21.3	18.6	27.0
1966	45.6	55.9	63.3	12.7	81.7	72.1	22.7	20.1	27.8
1967	47.9	57.0	64.4	13.9	84.0	74.4	24.4	21.6	29.0
1968	49.5	58.3	64.8	14.9	84.9	76.4	25.6	23.0	30.2
1969	52.5	61.4	67.4	17.0	85.4	77.8	27.6	25.2	32.4
1970	54.7	62.7	68.0	18.6	87.3	80.6	29.6	27.4	34.0
1971	57.3	64.2	69.0	20.2	89.3	83.1	31.5	29.3	35.3
1972	61.5	67.6	72.3	22.7	91.1	85.2	33.5	31.4	36.8
1973	65.1	71.4	76.3	25.7	91.2	85.3	36.0	33.6	39.4
1974	67.0	75.5	79.8	30.7	88.8	83.9	40.6	38.4	45.8
1975	69.8	77.8	81.5	36.7	89.8	85.6	47.2	45.0	52.6
1976	74.0	78.7	81.6	41.7	94.0	90.7	53.0	51.1	56.4
1977	73.5	80.2	82.2	45.6	91.6	89.4	56.8	55.5	62.0
1978	74.9	84.1	86.0	48.9	89.1	87.1	58.2	56.9	65.3
1979	77.0	86.7	88.3	55.5	88.8	87.2	64.0	62.9	72.1
1980	78.8	88.5	89.6	62.2	89.0	87.9	70.3	69.4	78.9
1981	81.4	92.9	93.6	70.3	87.5	86.9	75.7	75.1	86.5
1982	76.8	90.0	89.0	74.2	85.3	86.3	82.5	83.4	96.7
1983	82.1	89.1	87.1	77.4	92.1	94.2	86.8	88.8	94.3
1984	87.6	94.1	92.9	85.7	93.1	94.3	91.0	92.2	97.8
1985	95.0	98.1	97.3	93.2	96.9	97.7	95.0	95.8	98.1
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	107.1	102.3	102.1	109.4	104.7	104.9	107.0	107.2	102.2
1988	113.7	106.3	105.9	118.6	107.0	107.4	111.6	112.0	104.4
1989	116.2	107.2	106.2	128.8	108.4	109.5	120.1	121.3	110.8

[1]Real Gross Domestic Product.

Table 13 - Indexes of labour productivity and unit labour cost, community, business and personal services industries, 1961-1989, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	24.5	23.5	29.1	4.4	104.2	84.2	18.7	15.1	18.0
1962	25.8	25.8	31.7	5.0	99.9	81.2	19.3	15.7	19.3
1963	27.3	27.0	32.7	5.4	101.1	83.4	19.9	16.4	19.7
1964	29.2	29.0	34.7	6.0	100.6	84.0	20.7	17.3	20.6
1965	31.8	32.0	37.6	7.1	99.5	84.5	22.1	18.7	22.2
1966	34.6	34.4	39.8	8.2	100.6	87.0	23.9	20.6	23.7
1967	36.4	36.5	41.9	9.6	99.7	86.8	26.3	22.8	26.3
1968	36.1	36.6	41.3	10.0	98.6	87.4	27.3	24.2	27.7
1969	38.5	39.1	43.6	11.2	98.4	88.3	28.7	25.8	29.2
1970	39.2	40.9	44.8	12.6	95.8	87.4	30.7	28.0	32.1
1971	43.9	42.3	46.3	13.9	103.6	94.8	32.9	30.1	31.8
1972	47.4	45.4	49.2	16.0	104.4	96.4	35.2	32.5	33.7
1973	52.7	49.0	53.3	18.6	107.6	98.8	37.9	34.8	35.2
1974	57.2	53.0	57.2	22.5	107.8	100.0	42.5	39.4	39.4
1975	59.9	56.1	60.5	27.1	106.8	99.0	48.4	44.8	45.3
1976	64.6	58.6	62.8	33.0	110.1	102.8	56.2	52.5	51.1
1977	66.3	62.5	65.1	36.5	106.1	101.9	58.4	56.0	55.0
1978	70.9	66.0	69.8	40.9	107.5	101.5	62.0	58.5	57.7
1979	73.6	70.7	73.9	46.3	104.1	99.6	65.5	62.6	62.9
1980	81.0	75.4	78.0	55.3	107.4	103.9	73.3	70.9	68.2
1981	87.6	80.2	82.5	64.2	109.2	106.2	80.0	77.8	73.3
1982	86.3	82.9	83.4	71.2	104.1	103.5	85.9	85.4	82.5
1983	85.1	86.7	86.5	74.7	98.2	98.4	86.1	86.3	87.7
1984	90.1	88.7	88.8	82.0	101.6	101.5	92.5	92.3	91.0
1985	93.6	97.1	97.4	91.5	96.4	96.0	94.2	93.9	97.8
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	105.3	105.2	106.3	112.2	100.1	99.0	106.7	105.5	106.6
1988	111.4	110.4	112.4	128.6	100.9	99.1	116.5	114.4	115.4
1989	117.9	116.0	116.9	143.2	101.6	100.8	123.4	122.5	121.5

[1]Real Gross Domestic Product.

Table 14 - Indexes of labour productivity and unit labour cost, food industries, 1961-1987, (1986 = 100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	53.9	94.0	100.0	13.2	57.3	53.9	14.0	13.2	24.5
1962	58.0	94.1	100.6	13.9	61.7	57.7	14.8	13.8	23.9
1963	58.2	93.8	99.9	14.4	62.1	58.3	15.4	14.4	24.8
1964	62.1	95.7	102.6	15.4	64.8	60.5	16.1	15.0	24.8
1965	66.2	98.1	105.2	16.5	67.5	63.0	16.9	15.7	25.0
1966	66.4	101.0	107.5	18.2	65.8	61.8	18.0	16.9	27.4
1967	71.6	101.3	108.2	19.5	70.7	66.2	19.2	18.0	27.2
1968	73.3	99.9	107.9	20.6	73.4	68.0	20.6	19.1	28.1
1969	73.0	98.7	105.0	22.0	73.9	69.5	22.3	20.9	30.1
1970	72.3	97.8	103.7	23.5	73.9	69.7	24.0	22.6	32.5
1971	78.0	96.1	101.3	24.9	81.1	77.0	25.9	24.6	31.9
1972	79.3	97.6	101.5	27.1	81.2	78.1	27.8	26.7	34.2
1973	83.0	98.4	101.8	29.5	84.3	81.5	30.0	29.0	35.6
1974	82.2	96.9	100.2	33.8	84.8	82.0	34.8	33.7	41.1
1975	76.3	96.6	100.2	39.4	79.0	76.2	40.8	39.4	51.6
1976	84.6	96.4	99.9	44.9	87.8	84.7	46.6	45.0	53.1
1977	89.3	98.0	100.6	49.6	91.2	88.8	50.7	49.3	55.6
1978	90.6	100.1	102.6	54.4	90.5	88.3	54.3	53.0	60.0
1979	93.7	101.1	103.4	60.5	92.7	90.7	59.8	58.5	64.5
1980	91.3	102.4	103.5	67.2	89.1	88.1	65.6	64.9	73.6
1981	92.0	101.1	101.1	75.9	90.9	91.0	75.0	75.1	82.5
1982	91.9	98.2	97.5	80.7	93.6	94.3	82.2	82.8	87.8
1983	90.3	95.9	97.3	84.9	94.2	92.8	88.5	87.3	94.0
1984	94.4	96.0	97.8	88.4	98.3	96.5	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	99.8	101.1	102.2	106.3	98.7	97.7	105.1	104.0	106.5

[1]Real Gross Domestic Product.

Table 15 - Indexes of labour productivity and unit labour cost, beverage industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	55.5	88.4	94.4	11.4	62.8	58.8	12.9	12.1	20.5
1962	58.4	88.2	94.6	11.7	66.2	61.7	13.3	12.4	20.1
1963	64.2	87.8	93.8	12.3	73.2	68.5	14.0	13.1	19.1
1964	66.5	88.8	95.5	13.0	74.9	69.7	14.7	13.6	19.6
1965	71.7	91.0	97.9	14.2	78.8	73.2	15.6	14.5	19.8
1966	83.1	94.6	101.0	16.0	87.9	82.3	16.9	15.8	19.2
1967	88.3	98.0	105.0	17.3	90.1	84.1	17.7	16.5	19.6
1968	84.1	98.5	106.7	18.7	85.3	78.8	19.0	17.5	22.2
1969	93.0	98.5	105.1	20.3	94.4	88.4	20.6	19.3	21.9
1970	98.4	96.1	102.2	21.6	102.4	96.3	22.5	21.2	22.0
1971	106.0	97.4	103.0	23.5	108.8	103.0	24.1	22.8	22.2
1972	109.5	97.1	101.3	25.3	112.8	108.2	26.1	25.0	23.1
1973	119.6	99.1	102.8	28.1	120.7	116.4	28.4	27.4	23.5
1974	121.0	102.7	106.5	33.1	117.9	113.7	32.2	31.0	27.3
1975	116.3	103.0	107.2	38.4	112.9	108.5	37.3	35.9	33.1
1976	112.7	103.3	107.3	44.2	109.1	105.0	42.8	41.2	39.3
1977	118.3	104.4	107.5	48.9	113.3	110.1	46.9	45.5	41.4
1978	115.7	103.2	106.0	52.0	112.2	109.2	50.4	49.1	45.0
1979	118.3	105.0	107.6	58.4	112.7	109.9	55.6	54.2	49.3
1980	114.0	102.0	103.4	64.0	111.7	110.2	62.8	61.9	56.2
1981	113.4	103.1	103.3	72.0	110.0	109.8	69.8	69.7	63.5
1982	103.3	100.6	100.1	78.5	102.7	103.2	78.0	78.4	76.0
1983	99.3	98.7	98.8	84.2	100.6	100.5	85.3	85.2	84.8
1984	103.8	99.9	97.2	89.7	103.9	106.8	89.8	92.3	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	101.0	98.8	100.1	103.9	102.2	100.9	105.1	103.8	102.8

[1]Real Gross Domestic Product.

Table 16 - **Indexes of labour productivity and unit labour cost, tobacco products industries, 1961-1987, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	92.9	147.2	181.1	15.8	63.1	51.3	10.7	8.7	17.0
1962	92.7	159.2	191.5	17.3	58.2	48.4	10.9	9.1	18.7
1963	100.0	157.3	184.6	17.6	63.5	54.2	11.2	9.5	17.6
1964	105.8	155.1	178.8	18.2	68.2	59.2	11.7	10.2	17.2
1965	111.5	146.5	174.7	18.7	76.1	63.8	12.8	10.7	16.8
1966	103.1	145.4	176.1	19.9	70.9	58.6	13.7	11.3	19.3
1967	100.0	150.0	179.8	22.0	66.6	55.6	14.7	12.3	22.1
1968	96.9	144.5	169.0	23.6	67.1	57.4	16.3	13.9	24.3
1969	111.8	142.1	162.4	24.6	78.6	68.8	17.3	15.1	22.0
1970	116.9	141.6	162.9	27.2	82.6	71.8	19.2	16.7	23.3
1971	131.1	137.1	154.5	28.5	95.6	84.8	20.7	18.4	21.7
1972	138.8	135.5	151.3	30.4	102.5	91.7	22.5	20.1	21.9
1973	142.1	133.7	146.7	32.6	106.3	96.9	24.4	22.2	22.9
1974	152.9	136.5	147.6	36.4	112.0	103.6	26.7	24.7	23.8
1975	154.4	138.2	151.0	43.9	111.7	102.2	31.8	29.1	28.5
1976	146.8	129.7	142.1	47.2	113.2	103.3	36.4	33.2	32.1
1977	168.4	127.4	136.0	52.2	132.2	123.9	41.0	38.4	31.0
1978	142.6	124.8	133.7	53.8	114.3	106.7	43.2	40.3	37.8
1979	147.5	123.7	133.0	58.3	119.2	110.9	47.2	43.9	39.6
1980	149.6	120.8	127.2	63.9	123.8	117.6	52.9	50.3	42.7
1981	153.4	124.2	132.5	77.4	123.5	115.7	62.3	58.4	50.4
1982	149.6	123.7	128.7	84.0	121.0	116.2	67.9	65.3	56.1
1983	135.2	115.0	120.1	89.2	117.6	112.5	77.6	74.3	66.0
1984	128.3	109.1	113.5	91.9	117.6	113.0	84.2	81.0	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	105.5	85.1	87.5	95.0	123.9	120.5	111.6	108.5	90.1

[1]Real Gross Domestic Product.

Table 17 - Indexes of labour productivity and unit labour cost, rubber products industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	30.4	66.1	67.9	9.7	46.0	44.8	14.6	14.2	31.7
1962	38.7	67.2	71.1	10.6	57.6	54.5	15.8	14.9	27.4
1963	41.3	72.5	76.1	11.5	57.0	54.2	15.8	15.1	27.8
1964	44.5	76.1	82.0	12.7	58.4	54.2	16.7	15.5	28.7
1965	46.9	80.6	85.2	14.2	58.3	55.1	17.6	16.7	30.3
1966	53.7	86.7	92.4	16.0	61.9	58.1	18.5	17.3	29.8
1967	58.0	88.2	94.6	17.1	65.7	61.3	19.4	18.1	29.5
1968	55.9	82.6	88.3	17.3	67.7	63.3	20.9	19.6	30.9
1969	58.3	84.4	89.6	19.2	69.1	65.1	22.8	21.5	33.0
1970	54.4	80.5	84.5	19.8	67.5	64.3	24.5	23.4	36.3
1971	58.3	80.2	83.5	21.0	72.7	69.8	26.2	25.2	36.0
1972	64.2	87.6	91.1	25.0	73.4	70.6	28.6	27.5	38.9
1973	74.5	97.0	100.0	29.2	76.8	74.5	30.1	29.2	39.2
1974	66.9	95.2	96.1	31.2	70.3	69.6	32.8	32.4	46.6
1975	64.0	96.4	97.0	35.9	66.4	66.0	37.3	37.1	56.2
1976	79.3	100.8	102.1	41.9	78.6	77.6	41.6	41.0	52.8
1977	90.9	101.1	102.0	45.9	89.8	89.1	45.4	45.0	50.5
1978	94.6	102.9	104.0	49.9	92.0	91.0	48.6	48.0	52.8
1979	107.6	105.7	109.6	60.1	101.8	98.2	56.9	54.9	55.9
1980	92.7	102.2	103.1	63.4	90.7	90.0	62.0	61.5	68.3
1981	88.0	103.3	105.1	73.5	85.2	83.7	71.2	70.0	83.6
1982	76.7	97.3	98.5	76.4	78.8	77.9	78.5	77.6	99.6
1983	89.6	97.6	99.2	81.4	91.8	90.3	83.4	82.1	90.9
1984	112.9	99.3	100.5	90.6	113.7	112.3	91.2	90.2	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	104.5	94.1	94.6	97.2	111.1	110.5	103.3	102.8	93.0

[1]Real Gross Domestic Product.

Table 18 - **Indexes of labour productivity and unit labour cost, plastic products industries, 1961-1987, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	7.6	23.9	24.3	3.7	31.7	31.3	15.5	15.3	48.9
1962	9.5	25.5	26.6	4.1	37.2	35.7	16.2	15.6	43.6
1963	11.2	27.7	28.7	4.7	40.3	38.9	16.9	16.3	41.9
1964	14.0	30.8	32.7	5.5	45.4	42.6	17.8	16.7	39.2
1965	15.8	32.9	34.4	6.2	48.0	45.9	18.8	18.0	39.2
1966	18.9	38.1	40.1	7.7	49.6	47.1	20.1	19.1	40.5
1967	20.1	39.8	42.1	8.5	50.5	47.7	21.4	20.2	42.4
1968	28.6	44.4	46.9	10.1	64.4	60.9	22.7	21.5	35.3
1969	32.1	45.5	47.7	11.0	70.6	67.3	24.3	23.2	34.4
1970	32.5	47.4	49.1	12.2	68.6	66.2	25.7	24.8	37.4
1971	36.9	50.4	51.9	13.9	73.3	71.2	27.6	26.9	37.7
1972	46.9	57.5	59.1	17.1	81.4	79.3	29.7	28.9	36.5
1973	54.4	63.9	65.1	20.3	85.1	83.5	31.7	31.2	37.3
1974	52.7	66.7	66.6	24.3	79.0	79.1	36.4	36.5	46.1
1975	47.9	65.5	65.1	26.7	73.1	73.6	40.8	41.0	55.7
1976	53.5	68.7	68.8	32.1	77.9	77.8	46.7	46.6	59.9
1977	56.2	69.6	69.3	35.7	80.7	81.0	51.3	51.5	63.6
1978	63.7	76.1	76.0	42.0	83.7	83.8	55.2	55.2	65.9
1979	73.7	80.0	82.0	48.1	92.1	90.0	60.2	58.7	65.3
1980	73.5	82.4	82.1	54.6	89.2	89.5	66.2	66.5	74.3
1981	75.5	81.6	82.0	61.6	92.5	92.0	75.5	75.1	81.6
1982	68.8	76.4	76.4	62.6	90.1	90.1	82.0	82.0	91.0
1983	78.7	76.3	77.3	67.4	103.1	101.8	88.3	87.2	85.6
1984	90.1	85.4	85.7	77.9	105.5	105.1	91.2	90.9	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	109.8	108.0	108.8	111.9	101.7	100.9	103.7	102.9	102.0

[1]Real Gross Domestic Product.

Table 19 - Indexes of labour productivity and unit labour cost, leather and allied products industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	83.1	153.9	162.7	25.8	54.0	51.1	16.8	15.9	31.0
1962	90.6	155.4	167.0	27.0	58.3	54.2	17.4	16.2	29.8
1963	91.1	154.6	165.4	27.7	58.9	55.1	17.9	16.7	30.3
1964	97.0	154.2	164.5	29.0	62.9	59.0	18.8	17.7	29.9
1965	95.6	154.5	163.1	30.1	61.9	58.6	19.5	18.4	31.5
1966	94.2	154.5	162.4	32.5	61.0	58.0	21.1	20.0	34.5
1967	90.4	147.0	154.2	33.0	61.5	58.6	22.5	21.4	36.5
1968	91.3	145.2	154.9	34.9	62.9	58.9	24.0	22.5	38.2
1969	90.8	142.5	150.2	36.4	63.7	60.4	25.6	24.2	40.1
1970	84.8	129.7	136.5	34.8	65.3	62.1	26.8	25.5	41.0
1971	85.4	127.5	134.7	36.7	67.0	63.4	28.8	27.2	42.9
1972	82.5	124.7	131.8	38.2	66.1	62.6	30.6	29.0	46.3
1973	83.8	124.0	129.2	41.0	67.6	64.8	33.1	31.7	48.9
1974	86.8	121.0	128.2	46.6	71.7	67.7	38.5	36.4	53.7
1975	87.2	121.7	125.2	52.6	71.7	69.7	43.2	42.0	60.3
1976	95.9	120.4	124.9	59.7	79.6	76.8	49.6	47.8	62.3
1977	88.9	107.7	112.0	58.6	82.5	79.3	54.4	52.3	65.9
1978	101.7	110.9	114.5	66.0	91.7	88.8	59.5	57.6	64.9
1979	103.1	115.8	120.4	75.6	89.0	85.6	65.3	62.8	73.4
1980	98.5	113.2	115.9	78.6	87.0	84.9	69.4	67.8	79.8
1981	103.5	117.3	120.1	91.5	88.2	86.2	78.0	76.2	88.4
1982	90.2	101.2	104.6	85.2	89.1	86.2	84.2	81.5	94.5
1983	95.2	101.9	102.5	89.3	93.5	92.9	87.7	87.2	93.8
1984	104.3	104.1	105.6	96.7	100.2	98.8	92.9	91.6	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	93.2	92.9	91.1	96.3	100.3	102.3	103.6	105.6	103.2

[1]Real Gross Domestic Product.

Table 20 - **Indexes of labour productivity and unit labour cost, primary textile and textile products industries, 1961-1987, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	28.3	110.8	118.1	16.2	25.5	24.0	14.6	13.7	57.3
1962	33.9	116.2	123.8	17.7	29.2	27.4	15.2	14.3	52.1
1963	37.8	119.4	129.8	19.0	31.6	29.1	15.9	14.7	50.4
1964	41.1	126.5	138.7	21.2	32.5	29.6	16.8	15.3	51.6
1965	42.2	129.3	140.9	22.9	32.6	29.9	17.7	16.2	54.2
1966	42.1	127.4	137.7	24.5	33.0	30.5	19.2	17.8	58.2
1967	43.6	129.6	139.1	26.3	33.6	31.3	20.3	18.9	60.3
1968	48.4	122.1	130.8	26.5	39.7	37.1	21.7	20.3	54.7
1969	53.9	123.9	132.0	28.7	43.5	40.8	23.2	21.8	53.3
1970	51.3	118.2	124.4	29.3	43.4	41.2	24.8	23.5	57.1
1971	56.6	116.0	121.7	30.9	48.8	46.5	26.6	25.4	54.5
1972	67.0	123.8	129.4	34.9	54.1	51.8	28.2	27.0	52.1
1973	71.4	128.8	133.7	38.7	55.5	53.4	30.1	29.0	54.2
1974	72.1	128.7	132.4	43.9	56.0	54.4	34.1	33.1	60.9
1975	70.8	121.0	123.9	46.3	58.5	57.2	38.2	37.3	65.3
1976	72.0	113.3	115.3	50.4	63.5	62.4	44.5	43.7	70.0
1977	75.8	106.2	107.2	52.6	71.4	70.8	49.5	49.0	69.3
1978	83.4	108.1	109.3	58.3	77.2	76.3	53.9	53.3	69.9
1979	90.6	112.1	113.2	67.0	80.8	80.0	59.8	59.2	74.0
1980	88.1	111.3	111.1	73.5	79.1	79.3	66.0	66.1	83.4
1981	91.8	109.6	110.3	80.9	83.8	83.2	73.8	73.3	88.1
1982	71.2	96.4	97.7	75.7	73.9	72.9	78.5	77.5	106.3
1983	91.6	102.7	103.1	86.8	89.2	88.9	84.5	84.2	94.7
1984	91.1	101.5	101.1	90.3	89.7	90.0	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	103.3	102.6	103.0	108.4	100.7	100.3	105.6	105.2	104.9

[1]Real Gross Domestic Product.

Table 21 - Indexes of labour productivity and unit labour cost, clothing industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	56.6	100.4	102.3	17.0	56.3	55.3	16.9	16.6	30.0
1962	60.3	98.9	103.4	17.6	60.9	58.3	17.8	17.0	29.2
1963	62.8	99.1	104.3	18.4	63.4	60.2	18.6	17.7	29.3
1964	65.1	103.0	108.2	20.0	63.2	60.2	19.4	18.5	30.7
1965	68.1	105.6	110.0	21.6	64.5	61.9	20.4	19.6	31.7
1966	68.9	106.2	109.7	23.1	64.9	62.8	21.7	21.0	33.5
1967	66.7	104.1	108.8	23.8	64.0	61.2	22.9	21.9	35.8
1968	68.4	104.5	109.5	25.6	65.5	62.5	24.5	23.4	37.4
1969	68.7	106.5	111.4	28.0	64.5	61.7	26.3	25.1	40.7
1970	67.3	104.2	109.1	28.8	64.6	61.7	27.6	26.4	42.8
1971	68.3	105.7	108.1	31.3	64.7	63.2	29.6	28.9	45.7
1972	73.0	109.4	111.6	34.7	66.8	65.5	31.7	31.1	47.5
1973	78.3	111.7	112.0	38.1	70.1	69.8	34.1	34.0	48.6
1974	78.9	109.0	109.9	42.9	72.4	71.8	39.4	39.0	54.3
1975	81.8	107.9	109.1	49.4	75.8	74.9	45.7	45.2	60.4
1976	87.2	109.4	110.2	56.7	79.7	79.1	51.9	51.5	65.1
1977	85.7	101.9	102.0	58.4	84.2	84.1	57.3	57.2	68.1
1978	92.9	102.6	102.5	64.1	90.6	90.6	62.5	62.5	68.9
1979	99.7	103.8	103.9	71.7	96.1	96.0	69.1	69.0	71.9
1980	94.1	99.9	98.3	75.7	94.1	95.7	75.8	77.1	80.5
1981	96.9	99.7	96.9	82.2	97.3	100.0	82.5	84.8	84.8
1982	86.1	94.0	89.9	80.3	91.6	95.7	85.5	89.3	93.3
1983	86.2	96.6	95.8	85.3	89.2	89.9	88.3	89.0	99.0
1984	92.8	97.3	97.3	90.1	95.4	95.3	92.6	92.5	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	102.8	98.5	96.8	106.0	104.4	106.2	107.7	109.5	103.1

[1]Real Gross Domestic Product.

Table 22 - **Indexes of labour productivity and unit labour cost, wood industries, 1961-1987, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	33.0	75.9	78.5	9.8	43.4	42.0	12.9	12.5	29.8
1962	37.1	78.4	83.3	10.6	47.4	44.6	13.5	12.7	28.5
1963	41.8	81.1	86.8	11.5	51.5	48.2	14.2	13.3	27.6
1964	44.8	83.3	89.6	12.5	53.8	50.0	14.9	13.9	27.8
1965	46.7	84.9	91.5	13.5	55.0	51.0	15.9	14.8	29.0
1966	47.2	85.2	90.6	14.7	55.4	52.0	17.3	16.3	31.2
1967	48.5	82.6	89.7	15.3	58.7	54.1	18.5	17.0	31.5
1968	52.5	82.5	88.0	16.5	63.7	59.7	20.0	18.8	31.5
1969	53.6	84.4	89.2	18.2	63.5	60.2	21.6	20.4	34.0
1970	53.7	79.8	83.4	18.6	67.3	64.3	23.3	22.2	34.6
1971	55.0	83.6	87.8	21.4	65.8	62.6	25.6	24.4	39.0
1972	55.6	93.5	96.8	25.9	59.5	57.5	27.7	26.8	46.6
1973	61.3	101.5	105.0	31.3	60.3	58.4	30.8	29.8	51.1
1974	63.5	97.2	99.4	35.0	65.3	63.9	36.0	35.3	55.1
1975	56.4	89.3	90.9	36.6	63.2	62.1	41.0	40.3	64.9
1976	68.4	97.6	100.1	46.8	70.1	68.4	47.9	46.7	68.3
1977	75.9	100.0	101.8	54.1	75.9	74.6	54.1	53.1	71.2
1978	76.2	107.3	108.5	62.3	71.0	70.2	58.1	57.4	81.7
1979	76.4	110.2	111.5	70.9	69.4	68.5	64.4	63.6	92.8
1980	81.5	106.0	106.4	75.7	76.8	76.6	71.4	71.1	92.9
1981	78.3	101.7	97.0	79.4	77.0	80.7	78.1	81.9	101.4
1982	63.3	87.8	80.2	72.4	72.1	79.0	82.5	90.3	114.4
1983	78.3	92.0	88.9	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	108.9	109.4	110.0	116.6	99.6	99.0	106.6	106.0	107.0

[1]Real Gross Domestic Product.

Table 23 - Indexes of labour productivity and unit labour cost, furniture and fixture industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	40.5	57.7	61.0	9.6	70.1	66.4	16.7	15.8	23.8
1962	43.6	59.6	63.9	10.4	73.1	68.2	17.4	16.3	23.8
1963	47.9	62.0	66.2	11.2	77.2	72.4	18.0	16.9	23.3
1964	50.8	65.7	70.3	12.4	77.4	72.3	18.8	17.6	24.4
1965	58.6	69.9	74.3	13.7	83.8	78.9	19.7	18.5	23.5
1966	65.4	75.3	80.1	16.0	86.8	81.6	21.3	20.0	24.5
1967	68.0	75.9	79.8	17.0	89.6	85.3	22.3	21.3	24.9
1968	69.6	74.6	78.0	17.8	93.2	89.2	23.8	22.8	25.5
1969	75.8	76.4	79.5	19.6	99.2	95.4	25.6	24.6	25.8
1970	68.1	72.7	75.3	19.7	93.7	90.3	27.1	26.2	29.0
1971	72.3	74.3	77.1	21.3	97.4	93.8	28.7	27.6	29.4
1972	88.2	81.1	84.3	25.2	108.7	104.6	31.0	29.8	28.5
1973	97.3	84.3	87.4	28.3	115.4	111.3	33.6	32.4	29.1
1974	85.2	88.6	92.2	33.8	96.1	92.4	38.2	36.7	39.7
1975	80.6	86.5	89.4	37.1	93.2	90.2	42.9	41.4	46.0
1976	88.2	83.7	87.2	41.7	105.4	101.2	49.8	47.9	47.3
1977	81.9	76.5	79.3	41.6	107.1	103.3	54.4	52.4	50.7
1978	89.7	78.7	81.1	45.8	114.0	110.6	58.2	56.5	51.1
1979	88.5	85.9	89.5	53.0	103.0	98.9	61.7	59.2	59.9
1980	82.3	85.6	87.7	58.4	96.2	93.9	68.2	66.6	70.9
1981	91.7	88.5	90.2	69.8	103.6	101.6	78.8	77.3	76.1
1982	69.9	79.8	80.8	64.9	87.6	86.5	81.4	80.4	92.9
1983	79.0	78.8	77.9	69.4	100.3	101.5	88.2	89.2	87.9
1984	85.0	81.6	81.5	76.0	104.2	104.3	93.1	93.2	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	99.5	110.9	111.4	112.0	89.8	89.3	101.0	100.5	112.5

[1]Real Gross Domestic Product.

Table 24 - Indexes of labour productivity and unit labour cost, paper and allied products industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	62.6	82.0	88.4	11.1	76.4	70.8	13.5	12.5	17.6
1962	63.4	83.8	90.9	11.7	75.7	69.7	13.9	12.8	18.4
1963	65.9	84.6	91.3	12.2	77.8	72.1	14.4	13.3	18.5
1964	72.0	88.4	96.4	13.3	81.4	74.7	15.0	13.8	18.4
1965	74.3	91.5	98.9	14.4	81.1	75.1	15.7	14.5	19.3
1966	79.5	97.2	104.5	16.7	81.8	76.1	17.2	16.0	21.0
1967	77.1	99.3	105.7	18.2	77.6	72.9	18.3	17.2	23.6
1968	80.1	98.7	104.6	19.4	81.1	76.6	19.7	18.6	24.3
1969	87.7	102.0	108.7	21.6	86.0	80.7	21.2	19.8	24.6
1970	86.5	102.1	107.4	22.9	84.6	80.5	22.5	21.4	26.5
1971	85.3	100.3	104.2	24.2	85.0	81.9	24.1	23.2	28.4
1972	92.8	101.1	105.6	26.4	91.7	87.8	26.1	25.0	28.5
1973	100.3	103.1	106.7	28.8	97.2	94.0	27.9	27.0	28.7
1974	108.6	109.9	113.1	35.6	98.8	96.0	32.4	31.5	32.8
1975	77.3	106.5	99.6	36.6	72.5	77.6	34.3	36.7	47.4
1976	95.3	109.1	107.6	45.9	87.4	88.6	42.1	42.7	48.2
1977	94.2	104.0	106.0	49.3	90.6	88.8	47.5	46.5	52.4
1978	104.1	105.5	113.2	54.3	98.7	91.9	51.4	47.9	52.1
1979	102.8	106.9	108.1	59.3	96.2	95.1	55.4	54.8	57.6
1980	100.7	107.8	115.0	66.1	93.4	87.6	61.3	57.4	65.6
1981	96.7	107.6	108.1	75.4	89.9	89.5	70.1	69.8	78.0
1982	82.9	100.5	100.2	78.0	82.5	82.7	77.7	77.9	94.2
1983	92.8	97.6	97.6	82.1	95.0	95.0	84.1	84.1	88.5
1984	96.1	98.9	99.3	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	105.6	102.0	101.7	105.6	103.6	103.9	103.6	103.9	100.0

[1]Real Gross Domestic Product.

Table 25 - Indexes of labour productivity and unit labour cost, printing, publishing and allied industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	44.7	63.2	67.2	10.1	70.7	66.5	15.9	15.0	22.6
1962	46.3	63.1	67.5	10.5	73.4	68.6	16.7	15.6	22.7
1963	47.2	63.7	68.3	11.0	74.1	69.2	17.3	16.1	23.3
1964	47.5	64.1	68.3	11.5	74.1	69.5	17.9	16.8	24.2
1965	49.7	67.1	71.5	12.6	74.0	69.5	18.8	17.7	25.4
1966	52.4	70.0	74.3	14.0	74.9	70.6	20.0	18.9	26.7
1967	53.7	71.4	75.8	14.9	75.3	70.9	20.9	19.7	27.8
1968	54.6	71.7	76.3	16.1	76.2	71.5	22.4	21.1	29.4
1969	55.8	72.3	77.5	17.4	77.2	71.9	24.0	22.4	31.1
1970	54.2	71.6	76.7	18.3	75.6	70.6	25.5	23.8	33.7
1971	54.6	71.9	76.2	19.6	75.9	71.7	27.2	25.7	35.8
1972	58.8	73.3	77.5	21.5	80.2	75.9	29.3	27.7	36.5
1973	65.0	77.4	80.9	24.2	84.0	80.4	31.3	30.0	37.3
1974	65.5	78.4	81.3	27.9	83.5	80.5	35.6	34.3	42.6
1975	66.4	78.7	81.2	31.6	84.3	81.7	40.1	38.9	47.6
1976	72.9	79.3	81.1	35.9	92.0	89.9	45.3	44.2	49.2
1977	76.5	78.1	79.3	38.7	97.9	96.4	49.5	48.7	50.6
1978	82.3	81.7	83.7	43.2	100.7	98.4	52.8	51.6	52.5
1979	84.1	85.4	86.6	48.7	98.4	97.1	57.0	56.2	57.9
1980	88.8	89.3	91.6	56.2	99.4	96.9	62.9	61.4	63.3
1981	91.0	89.7	90.2	64.2	101.3	100.8	71.6	71.2	70.6
1982	83.4	89.4	90.1	69.2	93.2	92.5	77.4	76.8	83.0
1983	86.3	89.3	89.3	75.5	96.6	96.7	84.5	84.6	87.5
1984	93.2	92.1	92.6	82.1	101.2	100.6	89.2	88.7	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	100.2	103.4	103.7	107.3	96.9	96.6	103.8	103.5	107.1

[1]Real Gross Domestic Product.

Table 26 - **Indexes of labour productivity and unit labour cost, primary metal industries, 1961-1987, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	52.2	86.5	92.0	11.4	60.3	56.7	13.2	12.4	21.9
1962	56.6	88.4	94.6	12.0	64.0	59.8	13.6	12.7	21.2
1963	60.1	90.9	97.6	12.9	66.1	61.6	14.1	13.2	21.4
1964	67.4	97.1	104.8	14.2	69.4	64.3	14.7	13.6	21.1
1965	77.2	104.1	112.0	16.0	74.1	68.9	15.4	14.3	20.8
1966	79.4	109.6	116.3	17.9	72.5	68.3	16.3	15.4	22.5
1967	76.7	109.4	115.6	18.9	70.1	66.4	17.3	16.4	24.7
1968	84.6	109.3	114.9	20.2	77.4	73.6	18.5	17.6	23.9
1969	85.9	107.5	112.5	21.2	80.0	76.4	19.7	18.8	24.6
1970	87.3	112.6	117.9	24.1	77.5	74.0	21.4	20.4	27.6
1971	86.5	110.5	114.9	25.6	78.3	75.3	23.1	22.3	29.6
1972	91.4	110.0	115.4	27.8	83.1	79.2	25.3	24.1	30.4
1973	100.3	112.9	118.9	31.0	88.8	84.3	27.4	26.0	30.9
1974	107.6	118.4	124.9	36.9	90.9	86.1	31.1	29.5	34.3
1975	98.0	116.6	118.1	41.4	84.1	83.0	35.5	35.0	42.2
1976	90.2	113.7	115.0	45.4	79.3	78.4	39.9	39.5	50.3
1977	98.9	115.5	117.4	50.5	85.6	84.2	43.7	43.0	51.0
1978	104.1	118.3	120.6	55.9	88.0	86.3	47.3	46.4	53.7
1979	94.8	122.9	126.8	63.7	77.2	74.8	51.8	50.2	67.2
1980	87.3	124.5	128.4	72.2	70.1	67.9	58.0	56.2	82.7
1981	94.5	120.9	122.7	81.2	78.2	77.0	67.2	66.2	85.9
1982	71.0	109.8	110.0	84.1	64.7	64.5	76.6	76.4	118.4
1983	80.1	102.5	102.4	85.0	78.2	78.2	82.9	83.0	106.1
1984	98.0	105.3	109.1	95.6	93.1	89.8	90.8	87.6	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	109.7	100.7	101.0	104.8	109.0	108.7	104.1	103.8	95.5

[1]Real Gross Domestic Product.

Table 27 - Indexes of labour productivity and unit labour cost, fabricated metal products industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	40.4	68.9	70.8	11.7	58.6	57.1	17.0	16.6	29.1
1962	47.2	74.8	77.5	13.1	63.1	60.9	17.5	16.9	27.8
1963	50.8	77.3	81.4	14.1	65.7	62.4	18.2	17.3	27.7
1964	57.9	82.6	87.1	15.6	70.1	66.4	18.9	17.9	27.0
1965	67.2	91.4	96.1	18.0	73.5	69.9	19.7	18.8	26.8
1966	73.2	97.7	102.3	21.0	74.9	71.5	21.5	20.5	28.7
1967	73.6	94.7	99.1	21.4	77.7	74.3	22.6	21.6	29.1
1968	77.4	93.5	98.0	22.6	82.8	79.0	24.2	23.1	29.2
1969	81.0	96.0	100.2	25.1	84.3	80.8	26.2	25.1	31.0
1970	77.7	94.7	98.5	26.5	82.0	78.9	28.0	26.9	34.1
1971	81.1	93.9	97.4	27.9	86.3	83.2	29.7	28.7	34.4
1972	85.1	95.2	98.7	30.4	89.5	86.3	32.0	30.8	35.7
1973	92.5	99.9	102.9	34.5	92.6	89.9	34.6	33.5	37.3
1974	100.4	106.1	107.8	41.7	94.6	93.1	39.3	38.7	41.5
1975	91.4	104.7	106.2	46.7	87.3	86.1	44.6	44.0	51.1
1976	97.6	106.1	107.5	53.1	92.0	90.8	50.0	49.4	54.4
1977	95.9	103.1	104.5	56.4	93.0	91.7	54.7	53.9	58.8
1978	99.0	105.8	108.0	61.9	93.6	91.7	58.5	57.3	62.5
1979	102.3	110.4	110.9	70.4	92.6	92.2	63.8	63.5	68.9
1980	102.4	109.0	109.6	76.7	93.9	93.5	70.3	70.0	74.9
1981	100.6	106.1	106.4	84.3	94.8	94.6	79.4	79.2	83.8
1982	85.5	94.2	93.1	82.2	90.8	91.8	87.2	88.2	96.1
1983	80.7	87.6	86.0	81.2	92.1	93.8	92.7	94.4	100.6
1984	86.9	87.4	86.7	83.9	99.4	100.2	96.0	96.8	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	104.8	106.1	106.5	108.4	98.8	98.4	102.1	101.8	103.4

[1]Real Gross Domestic Product.

Table 28 - Indexes of labour productivity and unit labour cost, machinery industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	35.3	54.2	55.1	8.9	65.1	64.0	16.5	16.2	25.3
1962	40.6	58.6	60.7	10.0	69.3	66.9	17.1	16.5	24.7
1963	45.1	63.4	66.3	11.3	71.1	68.0	17.9	17.1	25.1
1964	54.4	69.7	73.5	13.0	78.1	74.0	18.6	17.6	23.8
1965	62.4	77.4	82.4	15.2	80.6	75.8	19.6	18.4	24.3
1966	68.8	83.1	87.9	17.5	82.7	78.2	21.0	19.9	25.4
1967	69.0	85.7	89.5	18.9	80.5	77.1	22.1	21.1	27.4
1968	66.3	81.2	84.6	19.1	81.7	78.4	23.5	22.6	28.8
1969	73.6	86.7	89.4	22.1	84.9	82.3	25.5	24.7	30.0
1970	68.6	83.0	85.0	22.6	82.7	80.7	27.3	26.6	33.0
1971	71.4	80.5	82.6	23.6	88.8	86.5	29.3	28.6	33.0
1972	77.5	87.2	89.4	27.2	88.9	86.8	31.2	30.4	35.1
1973	85.0	91.8	93.5	30.6	92.6	90.9	33.3	32.7	36.0
1974	96.7	100.9	101.6	38.1	95.8	95.1	37.8	37.5	39.4
1975	96.2	107.7	108.0	45.3	89.4	89.0	42.1	41.9	47.1
1976	97.2	104.0	104.4	49.1	93.4	93.1	47.2	47.0	50.5
1977	99.5	103.5	102.3	53.7	96.2	97.3	51.9	52.5	54.0
1978	105.0	105.7	105.9	59.8	99.3	99.1	56.6	56.5	57.0
1979	120.6	114.7	114.4	71.2	105.1	105.4	62.1	62.2	59.0
1980	122.4	121.4	120.5	83.2	100.8	101.6	68.5	69.0	68.0
1981	118.4	118.7	116.9	93.5	99.7	101.3	78.7	80.0	78.9
1982	88.2	100.4	98.1	86.2	87.9	89.9	85.9	87.9	97.8
1983	78.0	89.1	87.5	78.7	87.6	89.2	88.4	90.0	100.9
1984	94.5	93.1	92.8	86.3	101.5	101.8	92.8	93.0	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	100.1	105.5	106.7	106.7	94.9	93.8	101.2	100.0	106.6

[1]Real Gross Domestic Product.

Table 29 - Indexes of labour productivity and unit labour cost, transportation equipment industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	15.1	46.6	45.2	6.7	32.4	33.4	14.4	14.8	44.4
1962	18.0	49.4	49.4	7.5	36.3	36.4	15.2	15.2	41.8
1963	21.2	52.7	53.4	8.5	40.1	39.6	16.1	15.9	40.2
1964	23.8	58.4	58.4	9.8	40.7	40.6	16.7	16.7	41.1
1965	29.9	64.4	64.9	11.6	46.4	46.0	18.0	17.9	38.8
1966	31.7	70.2	69.8	13.1	45.1	45.4	18.7	18.8	41.4
1967	37.3	72.2	70.1	13.9	51.7	53.3	19.3	19.9	37.3
1968	43.1	72.9	72.5	15.9	59.1	59.4	21.7	21.9	36.8
1969	51.2	77.6	76.6	17.8	66.0	66.9	22.9	23.2	34.7
1970	42.6	72.1	69.7	17.5	59.1	61.1	24.2	25.1	41.0
1971	52.6	74.1	71.9	19.4	71.0	73.2	26.2	27.0	36.9
1972	59.9	78.3	77.4	22.1	76.5	77.5	28.2	28.6	36.9
1973	70.5	86.2	85.2	26.1	81.8	82.8	30.3	30.6	37.0
1974	70.7	85.0	82.6	28.8	83.2	85.7	33.9	34.9	40.8
1975	72.4	79.1	77.1	30.1	91.6	94.0	38.1	39.1	41.6
1976	78.4	82.0	79.0	35.7	95.6	99.1	43.5	45.1	45.5
1977	81.5	83.0	81.5	40.4	98.3	100.0	48.7	49.6	49.5
1978	84.2	88.6	84.8	46.7	95.0	99.3	52.7	55.0	55.4
1979	84.3	93.7	87.6	52.3	90.0	96.3	55.9	59.8	62.1
1980	65.3	87.9	81.6	53.4	74.2	80.0	60.8	65.4	81.8
1981	72.0	87.9	82.3	62.3	81.9	87.5	70.9	75.7	86.5
1982	66.0	80.2	73.9	61.0	82.3	89.3	76.1	82.6	92.5
1983	75.7	80.9	77.2	67.5	93.6	98.0	83.5	87.5	89.2
1984	95.9	91.3	90.0	82.7	105.0	106.6	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	98.9	101.9	103.2	105.7	97.0	95.8	103.8	102.4	107.0

[1]Real Gross Domestic Product.

Table 30 - **Indexes of labour productivity and unit labour cost, electrical and electronic products industries, 1961-1987, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	19.1	72.1	75.9	11.4	26.5	25.1	15.9	15.1	60.0
1962	23.4	77.5	81.6	12.7	30.2	28.7	16.3	15.5	54.1
1963	24.6	81.5	85.7	13.7	30.2	28.8	16.9	16.0	55.8
1964	28.1	84.3	89.5	14.9	33.3	31.4	17.6	16.6	53.0
1965	31.3	90.8	95.8	16.6	34.5	32.7	18.3	17.3	53.0
1966	34.9	99.4	106.1	19.4	35.1	32.9	19.5	18.2	55.4
1967	34.3	104.4	108.7	21.0	32.9	31.6	20.1	19.3	61.2
1968	37.4	102.4	106.1	22.1	36.6	35.3	21.6	20.8	59.1
1969	40.6	105.3	108.9	24.3	38.5	37.3	23.1	22.3	60.0
1970	38.5	101.0	103.8	25.6	38.1	37.1	25.3	24.6	66.4
1971	36.9	98.9	101.0	25.9	37.3	36.6	26.1	25.6	70.0
1972	41.5	98.8	101.3	27.5	42.0	40.9	27.9	27.2	66.4
1973	47.5	104.6	107.5	31.0	45.4	44.2	29.6	28.8	65.2
1974	49.4	109.1	111.5	36.7	45.3	44.3	33.6	32.9	74.3
1975	44.6	102.4	104.1	39.3	43.5	42.8	38.4	37.7	88.1
1976	47.4	99.4	100.2	43.1	47.7	47.3	43.3	43.0	90.8
1977	47.5	90.8	91.3	43.3	52.3	52.0	47.6	47.4	91.1
1978	47.7	92.9	94.1	47.6	51.3	50.6	51.3	50.6	99.9
1979	57.4	98.6	99.3	56.5	58.3	57.9	57.3	56.9	98.4
1980	64.2	101.9	101.9	63.9	63.0	63.0	62.7	62.7	99.6
1981	72.2	107.7	107.6	75.7	67.1	67.1	70.3	70.4	104.8
1982	66.6	99.3	99.0	77.9	67.1	67.3	78.5	78.7	116.9
1983	66.9	94.6	94.8	80.7	70.8	70.6	85.4	85.2	120.6
1984	86.3	100.5	99.6	90.0	85.8	86.6	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	110.2	106.4	107.4	111.2	103.6	102.7	104.5	103.6	100.9

[1]Real Gross Domestic Product.

Table 31 - Indexes of labour productivity and unit labour cost, non-metallic mineral products industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	46.7	81.0	87.2	11.7	57.7	53.6	14.4	13.4	25.0
1962	55.3	85.3	92.5	12.9	64.8	59.8	15.1	13.9	23.3
1963	56.8	86.2	92.6	13.4	65.9	61.3	15.6	14.5	23.6
1964	63.3	90.8	98.9	14.8	69.7	64.0	16.3	15.0	23.4
1965	69.4	95.2	105.0	16.5	72.9	66.1	17.4	15.7	23.8
1966	74.0	98.8	107.0	18.4	74.9	69.1	18.6	17.2	24.8
1967	68.3	96.3	104.0	18.9	70.9	65.7	19.6	18.2	27.7
1968	74.5	97.0	103.9	20.5	76.9	71.7	21.1	19.7	27.4
1969	76.5	97.2	104.3	22.4	78.7	73.3	23.1	21.5	29.3
1970	72.6	94.0	99.0	22.9	77.2	73.3	24.4	23.2	31.6
1971	86.3	97.4	102.7	25.7	88.5	84.0	26.4	25.0	29.8
1972	98.3	101.0	106.1	29.1	97.4	92.7	28.8	27.4	29.6
1973	107.1	106.6	110.8	32.9	100.5	96.7	30.9	29.7	30.7
1974	109.4	110.2	113.5	38.8	99.3	96.4	35.2	34.1	35.4
1975	101.9	107.5	110.7	43.5	94.8	92.1	40.5	39.3	42.7
1976	104.8	106.4	108.4	49.1	98.4	96.6	46.1	45.3	46.8
1977	100.8	102.0	104.0	52.5	98.8	96.9	51.4	50.4	52.1
1978	108.1	104.6	106.4	57.9	103.4	101.6	55.3	54.4	53.5
1979	111.8	106.6	108.0	64.8	104.9	103.5	60.8	60.0	58.0
1980	98.2	105.0	104.0	69.2	93.5	94.4	65.9	66.6	70.5
1981	94.5	104.5	102.9	77.9	90.4	91.8	74.6	75.7	82.5
1982	72.4	90.7	88.2	73.8	79.8	82.1	81.4	83.7	102.0
1983	80.2	88.9	88.0	77.1	90.2	91.2	86.7	87.6	96.1
1984	87.8	91.4	91.1	82.6	96.0	96.3	90.4	90.7	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	109.5	106.2	107.8	109.9	103.1	101.5	103.4	101.9	100.4

[1]Real Gross Domestic Product.

Table 32 - **Indexes of labour productivity and unit labour cost, refined petroleum and coal products industries, 1961-1987, (1986=100).**

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	40.2	88.0	88.7	10.6	45.7	45.4	12.0	11.9	26.3
1962	50.5	87.8	89.3	11.0	57.5	56.5	12.5	12.3	21.8
1963	52.8	84.7	86.7	11.0	62.3	60.9	13.0	12.7	20.8
1964	57.6	84.2	86.4	11.5	68.4	66.6	13.6	13.3	19.9
1965	60.8	78.8	80.2	11.4	77.2	75.8	14.4	14.2	18.7
1966	66.6	81.7	85.6	13.0	81.5	77.8	15.9	15.2	19.5
1967	60.3	100.9	105.6	17.3	59.7	57.1	17.2	16.4	28.8
1968	68.0	98.4	103.3	18.2	69.1	65.8	18.5	17.6	26.8
1969	64.5	101.7	103.2	20.7	63.4	62.5	20.4	20.1	32.1
1970	66.4	102.3	102.8	22.0	65.0	64.6	21.5	21.4	33.2
1971	72.7	101.3	102.5	23.6	71.8	70.9	23.3	23.0	32.5
1972	70.3	99.5	99.7	25.2	70.7	70.5	25.3	25.3	35.8
1973	103.2	104.3	103.1	28.4	98.9	100.1	27.2	27.5	27.5
1974	105.0	115.0	113.2	35.4	91.3	92.8	30.8	31.3	33.7
1975	113.4	113.0	108.4	41.6	100.4	104.7	36.8	38.4	36.7
1976	106.0	112.4	107.0	46.5	94.3	99.1	41.3	43.5	43.9
1977	132.2	119.9	113.7	54.6	110.3	116.3	45.5	48.0	41.3
1978	118.9	137.2	131.1	64.6	86.6	90.6	47.0	49.2	54.3
1979	97.9	126.5	122.2	65.6	77.3	80.1	51.8	53.7	67.0
1980	96.1	131.8	125.9	75.4	72.9	76.3	57.2	59.9	78.5
1981	111.3	153.1	146.9	100.7	72.7	75.8	65.8	68.5	90.5
1982	103.2	146.4	137.5	116.1	70.5	75.0	79.3	84.5	112.6
1983	102.7	125.7	124.4	111.6	81.6	82.5	88.8	89.8	108.8
1984	103.5	114.5	114.0	107.7	90.4	90.8	94.1	94.5	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	108.3	98.4	100.5	105.1	110.1	107.7	106.8	104.5	97.0

[1]Real Gross Domestic Product.

Table 33 - Indexes of labour productivity and unit labour cost, chemical and chemical products industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	28.1	73.1	74.7	10.5	38.5	37.7	14.4	14.1	37.5
1962	30.8	74.2	75.6	11.1	41.5	40.8	15.0	14.7	36.1
1963	33.3	76.1	77.9	11.9	43.8	42.8	15.6	15.3	35.7
1964	37.1	78.2	80.3	12.7	47.5	46.3	16.2	15.8	34.1
1965	40.7	81.3	85.7	13.7	50.0	47.5	16.9	16.0	33.8
1966	44.7	85.1	86.9	15.5	52.5	51.4	18.2	17.8	34.6
1967	45.8	86.7	87.8	16.5	52.8	52.1	19.1	18.8	36.1
1968	48.3	88.7	90.6	18.2	54.5	53.3	20.5	20.1	37.7
1969	52.5	90.5	93.4	20.1	58.0	56.2	22.2	21.5	38.3
1970	51.7	91.4	93.6	21.6	56.6	55.3	23.7	23.1	41.8
1971	54.8	89.9	91.2	22.8	60.9	60.0	25.4	25.0	41.6
1972	56.6	87.0	88.0	23.8	65.1	64.3	27.3	27.0	42.0
1973	64.3	90.2	91.2	26.3	71.3	70.5	29.2	28.9	41.0
1974	65.3	93.1	93.5	30.7	70.1	69.8	33.0	32.9	47.1
1975	58.5	93.6	94.3	34.9	62.5	62.0	37.3	37.0	59.6
1976	64.7	92.8	89.0	38.7	69.7	72.7	41.6	43.5	59.8
1977	70.5	95.3	96.0	44.1	74.0	73.5	46.3	46.0	62.5
1978	78.7	96.7	97.6	48.4	81.3	80.6	50.1	49.6	61.6
1979	84.4	99.9	99.2	54.7	84.4	85.0	54.8	55.2	64.9
1980	79.4	99.5	98.5	61.4	79.8	80.6	61.7	62.4	77.4
1981	85.9	102.6	101.1	72.5	83.8	85.0	70.6	71.7	84.3
1982	76.4	101.3	98.7	78.5	75.4	77.4	77.5	79.5	102.8
1983	89.9	100.1	99.8	82.9	89.8	90.1	82.8	83.0	92.2
1984	98.4	100.2	100.2	89.1	98.2	98.3	88.9	89.0	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	105.5	101.8	101.1	106.6	103.7	104.4	104.8	105.5	101.0

[1]Real Gross Domestic Product.

Table 34 - Indexes of labour productivity and unit labour cost, other manufacturing industries, 1961-1987, (1986=100).

Year	Real GDP[1]	Persons at work	Person-hours	Labour compen-sation	Labour productivity		Compen-sation per person	Compen-sation per person-hour	Unit labour cost
					Real GDP per person	Real GDP per person-hour			
1961	45.2	68.9	72.4	11.5	65.6	62.5	16.7	15.9	25.4
1962	48.5	70.4	75.2	12.2	68.8	64.4	17.3	16.2	25.1
1963	49.0	71.9	76.9	13.1	68.2	63.8	18.2	17.0	26.6
1964	55.1	74.5	80.6	14.2	74.0	68.4	19.1	17.7	25.8
1965	57.3	76.9	82.9	15.4	74.4	69.1	20.0	18.5	26.8
1966	63.6	81.2	87.0	17.2	78.3	73.1	21.2	19.8	27.0
1967	62.8	81.0	86.1	18.2	77.5	73.0	22.5	21.2	29.0
1968	68.8	81.4	85.5	19.5	84.5	80.5	24.0	22.8	28.4
1969	74.9	85.0	89.8	21.9	88.1	83.3	25.7	24.3	29.2
1970	73.9	83.7	88.4	22.9	88.2	83.5	27.3	25.9	31.0
1971	76.0	82.9	87.2	24.4	91.7	87.1	29.5	28.0	32.1
1972	84.6	86.8	90.7	26.6	97.5	93.3	30.7	29.4	31.5
1973	88.7	90.2	93.4	29.3	98.3	94.9	32.5	31.4	33.1
1974	92.5	94.0	97.8	34.5	98.4	94.6	36.7	35.3	37.3
1975	88.3	94.2	97.3	38.2	93.7	90.7	40.6	39.3	43.3
1976	98.7	95.9	97.7	42.9	102.9	101.1	44.8	44.0	43.5
1977	96.2	89.9	91.2	45.3	107.0	105.4	50.4	49.6	47.1
1978	99.3	92.0	93.2	50.3	108.0	106.6	54.6	54.0	50.6
1979	105.1	94.3	95.8	56.8	111.5	109.7	60.3	59.3	54.1
1980	93.0	94.3	95.2	63.6	98.6	97.8	67.4	66.8	68.3
1981	100.9	97.8	98.6	74.8	103.2	102.3	76.6	75.9	74.2
1982	93.9	91.2	90.8	76.1	102.9	103.4	83.4	83.8	81.1
1983	91.0	90.4	91.0	81.6	100.7	100.0	90.3	89.7	89.7
1984	103.7	93.2	94.7	87.5	111.3	109.6	93.9	92.4	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	103.2	99.4	98.0	101.4	103.8	105.3	102.0	103.5	98.3

[1]Real Gross Domestic Product.

APPENDIX 1

About the measures

1 - Labour Productivity

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

Although the partial productivity indexes described above are appropriate for many analytical uses, they do not describe the sources of economic growth. This is the case because measured changes in output per unit of labour input are not necessarily attributable to the contribution of labour alone, but also to the contribution of other productive resources and the effectiveness with which all are combined and organized for production. In other words, changes in technology, capital investment, returns to scale, capacity utilization, work flow, managerial skills and labour management relations each has a bearing on movements in what is termed the "labour productivity" series. In contrast, the *multifactor productivity index* would be quite suitable for analysis concerned with the various sources of economic growth.

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 based on a ratio of output to labour input, and are produced and presented in index number form. The interpretation of real GDP per person at work is straightforward. Real GDP per person-hour, however, may be a more appropriate measure for most applications since it incorporates changes in the average number of hours worked per week, which has a tendency to decline.

2 - Output

The concept of output used in labour productivity measurement is constant price Gross Domestic Product at factor cost by industry (Real Domestic Product by industry). The output measures are calculated with a 1961 price base for the period 1961 to 1971, a 1971 price base for the years 1971 to 1981 and a 1981 price base for the years 1981 to 1986. The price base that applies to subsequent years is 1986. These series were then rescaled to correspond to a 1986 reference year (i.e. 1986 = 100) for convenience, as 1986 is the base year currently in effect. The rates of growth in the original series were protected in the process. A more complete description of the output measures is found in *The Input-Output Structure of the Canadian*

Economy 1961 - 1981 (Catalogue 15-510) and in *The Input-Output Structure of the Canadian Economy in Constant Prices, 1961 - 1981* (Catalogue 15-511).

The productivity measures pertain to business sector industries only[5]. The output of non-business sector industries, because it is not normally marketed, presents some difficulties in measurement. The conventional measure of output for non-business sector industries is labour input or labour input plus depreciation. Such an approach does not yield a meaningful measurement of productivity.

3 - Labour Input

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

Persons at work denote all *paid* and *other-than-paid* persons engaged in the production of output. The 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 time used on vacation, holiday, illness, accident, etc.

4 - Labour Compensation

Labour compensation is a measure of the value of labour services engaged in the production process. It includes all payments in cash or in kind by domestic producers to persons at work as remuneration for work, including wages, salaries and supplementary labour income of paid workers, plus an imputed labour income for self-employed workers. Statistics of labour compensation in this report 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 persons at work for gain.

The value of labour services of self-employed persons is an imputed value. The basis of the imputation is the assumption that the value of labour of an hour of a self-employed person's working time is the same as the value of an hour of an average paid worker in the same industry division. This recognizes that labour services are essentially contracted for on a time basis, and a measure of labour compensation should not reflect returns on investment or to risk taking. An adjustment is made in the case of self-employed persons such as doctors, dentists, lawyers, accountants and engineers. These occupations are largely self-employed, but the average earnings of paid workers in the same industry division underrepresent the earnings of these occupations. In this case direct evidence on average labour income is introduced.

Unpaid family workers, while not directly recompensed for their services, are not a free resource, and their contribution is subsumed 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

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

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.

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 productivity; thus, unit labour cost will increase when average compensation grows more rapidly than productivity.

6 - Absolute Values

All time series in this report are presented in index number form. This form emphasizes relative change as the objective in constructing the productivity and related measures. The indexes are constructed from absolute values of persons at work, person-hours, real gross domestic product and labour compensation, and there is some interest in the absolute values underlying these indexes.

There are some caveats to be observed in the use of absolute values, and these account in part for the choice of an index number presentation. The measurement of employment, output, etc., is subject to some, usually indeterminate, margin of error. While such statistical error will have some effect on measures of relative change, it can be expected that, both for individual sectors and their aggregations, the effect of such error will be more serious when intersectoral comparisons of absolute levels are attempted. It is also worth noting that the relative values of output, because they are adjusted for price change, can change depending on the choice of the base year. Prices do not always change by the same amount, or even necessarily in the same direction, and the choice of a different base year would yield different relative prices for output.

Text table 4 gives the absolute values underlying the indexes for the year 1986. To calculate the absolute values corresponding to the published indexes the following procedure can be followed:

$$\frac{\text{Index}}{100} \times \text{1986 value from Text table 4.}$$

Text table 4 - Absolute values of labour productivity and unit labour cost, 1986

Industry Title	Real gross domestic product	Persons at work	Person-hours	Labour compen-sation
	$'000,000	'000	000,000	$'000,000
Business sector industries	368,535	8,566	15,321	224,272
Business sector - excluding agriculture*	357,478	8,077	14,249	218,767
Business sector - services	206,236	5,257	9,017	125,403
Business sector - goods	162,299	3,309	6,304	98,870
Business sector - goods excluding agriculture*	151,243	2,820	5,232	93,364
Business sector - goods excluding agriculture* and manufacturing industries	64,453	1,016	1,891	36,446
Agriculture*	11,057	489	1,072	5,506
Manufacturing industries	86,789	1,804	3,341	56,919

Industry Title	Real gross domestic product per person	Real gross domestic product per person-hour	Compen-sation per person	Compen-sation per person-hour	Unit labour cost
	$	$	$	$	$
Business sector industries	43,023	24.05	26,182	14.64	0.61
Business sector - excluding agriculture*	44,258	25.09	27,085	15.35	0.61
Business sector - services	39,233	22.87	23,856	13.91	0.61
Business sector - goods	49,044	25.75	29,877	15.68	0.61
Business sector - goods excluding agriculture*	53,624	28.91	33,103	17.85	0.62
Business sector - goods excluding agriculture* and manufacturing industries	63,432	34.08	35,868	19.27	0.57
Agriculture*	22,619	10.31	11,263	5.14	0.50
Manufacturing industries	48,100	25.98	31,545	17.04	0.66

* Agricultural and related services industries

APPENDIX 2

Sources of data

1 - Output

The output data used to calculate the indexes of labour productivity and unit labour cost are the estimates of constant price Gross Domestic Product at factor cost by industry. The following sources are utilized: *Indexes of Real Domestic Product by Industry, 1961 Base*, (61-506), (CANSIM Matrix 389) for the years 1946-1961. For these years, only index values of output are given. For the years 1961 to 1981, *The Input-Output Structure of the Canadian Economy in Constant Prices 1961-1981* (Catalogue 15-511) is used. For the years 1982 to 1987, *The Input-Output Structure of the Canadian Economy in constant prices* (Catalogue 15-202) is used. For the years 1988 and 1989 *Gross Domestic Product by Industry* (Catalogue 15-001) is used.

2 - Labour Input

This report presents two measures of labour input: the annual average number of persons at work and the number of person-hours worked by these persons at work. Employment estimates (for 1988 and 1989 or just 1989 in the case of mining and manufacturing) are produced using the employment growth rates derived from either the *Labour Force Survey* or the *Survey of Employment, Payroll and Hours*, or, a combination of the two independent sources. The data sources relating to final employment estimates are given below.

An explanation of the data sources for the labour input measures for the years 1946 to 1961 can be found in: "Indexes of Output Per Person Employed and Per Man-hour in Canada, Commercial Non-agricultural Industries, 1947-1963" (Catalogue 14-501). The sources of data for the final employment estimates for the years 1961-1987 (1961-1988 in the case of mining and manufacturing) are now presented.

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 workers and unpaid family workers.

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

Logging and forestry industries;
Construction industries;
Transportation and storage industries;
Communication industries;
Other utility industries;
Wholesale and retail trade industries;

Finance, insurance and real estate industries;
Community, business and personal services.

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

The source of the number of paid workers in manufacturing for 1961-1988 is *Manufacturing Industries of Canada: National and Provincial Areas* (Catalogue 31-203). These data are adjusted for improved coverage in the 1970's.

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

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

The primary data source used for the first three groups is the *General Review of the Mineral Industries*, (Catalogue 26-201). The only exception to this is the oil sands industry, which falls into the second major group, crude petroleum and natural gas industries. This industry is not covered in the *General Review of the Mineral Industries*, and therefore the data used for this industry are taken from the *Survey of Employment Payroll and Hours*. The last major group, service industries incidental to mineral extraction, includes three industries according to the 1970 SIC: *Contract Drilling for Petroleum*, *Other Contract Drilling* and *Miscellaneous Services Incidental to Mining*. For the years up to 1976 the number of paid workers in *contract drilling for petroleum* and *other contract drilling* is obtained from *Contract Drilling for Petroleum and Other Contract Drilling* (Catalogue 26-207). Beginning in 1977 the number of paid workers in *other contract drilling* is published in Catalogue 26-201 and the number of paid workers in *contract drilling for petroleum* is estimated from other information pertaining to the industry up to the year 1982. After that, Catalogue 72-002 has been used. The remaining part of the mining, quarrying and oil wells industries is measured using decennial census and the Catalogue 72-002 from 1983-1988.

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

Out of the above list of industries, construction industries need a special mention. In Input-Output concept all construction activity taking place in any sector or industry is rerouted to the construction industries. Thus, the number of paid workers in construction industries, is the sum of the following:

(i) Paid workers in construction industry of business sector;

(ii) Paid workers in own-account construction of business sector;

(iii) Paid workers in construction of government sector;

(iv) Paid workers in own-account construction of government sector;

(v) Paid workers in own-account construction of the personal sector.

Other-than-paid workers. For manufacturing industries the number of other-than-paid workers is derived from the series on working owners and partners in "Manufacturing Industries of Canada: National and Provincial Areas" (Catalogue 31-203). The numbers reported for the 1970's were adjusted to effect consistency with output data. For mining industries the data are interpolated between the decennial censuses of 1961 and 1971. From 1972 onward moving average using *Labour Force Survey* data are used. For all other industries *Labour Force Survey* (Catalogue 71-001) is used.

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

In manufacturing, the basic source is the *Annual Census of Manufactures*, supplemented by other survey results as noted. Distinct calculations are made for production workers and for salaried employees, total person-hours worked being obtained as the sum of the two elements. The adjustments effected to the published levels of persons at work in the 1970's also operate on person-hours worked. For production workers, the number of person-hours worked is obtained from tabulations of returns to the *Annual Census of Manufactures*.

For salaried employees, the methodology for estimating hours worked is slightly different in the early part of the period, up to 1969. The discontinuance of the survey Earnings and Hours of Work in Manufacturing at that time necessitated a different technique in the later period. This survey yielded a value of average hourly earnings applicable to the earnings of salaried employees. With hourly earnings, payroll values are converted into estimated hours paid. The survey *Labour Costs in Canada* covers the manufacturing industry in selected years, and this provides a basis for converting hours *paid* to hours *worked*. For the years after 1969, the occasional surveys of Labour Costs in Canada provide the basis for estimating hours worked by salaried employees. From 1983 onwards the *Annual Census of Manufactures* provides tabulations from which it is possible to estimate average hours worked per week for salaried employees.

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

For recent years, when the *Annual Census of Manufactures* is not yet available, the relative change in average hours worked for the paid workers and working owners and partners in manufacturing is calculated in the same manner as for other industries, as described below.

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

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

3 - Labour Compensation

There are two components to labour compensation: labour income of paid workers and an imputed labour income of self-employed workers. The labour income of paid workers is taken from the following sources: *The Input-Output Structure of the Canadian Economy 1961-1981* (Catalogue 15-510), the same publication for 1982 and following years (Catalogue 15-201) except for the two most recent years where it is taken from the *National Income and Expenditure Accounts* (Catalogue 13-201) (Table 28). Adjustments are made to exclude non-business industries and reroute own-account construction to construction industries.

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 division.

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

An adjustment is made in the case of some professional persons, such as doctors, dentists, lawyers, accountants and engineers. These occupations are largely self-employed, but the average earnings of paid workers in the same industry division underrepresent the earnings of these occupations. In these cases direct evidence on average labour income is introduced.

APPENDIX 3

Aggregation parameters for labour productivity

The statistics in this publication refer to business sector industries, as defined in the Canadian System of National Accounts (SNA). Corresponding statistics for the non-business sector industries are not published due to difficulties in the measurement of output. There is indeed, no clear basis for valuing production given that the goods and services they produce are generally not marketed. As measures of the inputs of labour or labour and capital services are taken as estimates of the output of these industries, their productivity ratios have little meaning.

The most detailed account of the business sector is in terms of individual industries classified as per 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 34 statistical tables on labour productivity appearing in Part 1 of this publication. Tables 1-6 are produced for special aggregates of business sector industries. Tables 7-13 correspond to selected S level business sector industries (except for Table 12 for which two S level industries have been combined). The remaining tables, 14-34, are associated with the M level industries that belong to manufacturing. The industry content for each of the tables in this publication is outlined below.

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

Text table 5 - Concordance between "S" level industry codes, standard industrial classification codes (SIC's) and link codes

S Level Industries

S Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
1	Agricultural & related services ind.	011-017, 021-023	001-021	001-021	1
2	Fishing & trapping industries	031-033	041-047	041-047	2
3	Logging & forestry industries	0411, 0412, 0511	031, 039	031, 039	3
4	Mining, quarrying & oil well industries	0611-0617, 0619, 0621-0625, 0629, 063, 071 081, 082, 091, 092	051-052 057-059, 061, 064, 071-073, 079, 083 087, 096, 098, 099	051-059 061, 063-066, 071, 073, 077, 079, 083 087, 092-099	4-13
5	Manufacturing industries	(See M level below)			14-108
6	Construction industries	401-449	404-421	404-421	109-117
7	Transportation & storage industries	451-459 461, 471 479, 996 9991	501-509 512, 515-517, 519 524, 527	501, 502 504-509 512, 519 515-517 524-527	118-128
8	Communication industries	481-483 4841	543-545 548	543-545 548	129-131
9	Other utilities industries	491, 492 499	572, 574 579	572, 574 579	132-134
10,11	Wholesale and retail trade industries	501-599 601-692	10722,2611 602-629 631-699	1292, 2611 602-629 631-699	135-136
12	Finance, insurance & real estate	701-705 709, 711-729, 731-733, 741-743, 7495 7499, 7511 7512, 7513 759, 761	7011-7016 7019, 703, 705, 707 715, 7211, 7212, 735, 7371-7373	702, 704 7311, 7312 735, 7371-7373	137-141
13	Community, business, personal services	771-777, 779, 851-859, 861 8621, 863 865, 866 8671, 8679 868, 8691-8693, 8699 911-914 921, 922 961-966 969, 971 972, 973, 979, 982 983, 991-995, 9999 4842	801-809 821-827 841-845 849, 851-855, 861-864, 866 867, 869 871, 872 874, 876 877, 879 881-886 891, 8931 894-899	801-809 821,823-827, 851 853-859 861, 862 864, 866 869, 871 872, 874-879, 891 8931, 894-899	142-154

Text table 6 - Concordance between "M" level industry codes, standard industrial classification codes (SIC's) and link codes

M Level Industries - Manufacturing

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

Text table 6 - Concordance between "M" level industry codes, standard industrial classification codes (SIC's) and link codes (concluded)

M Level Industries - Manufacturing

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

Special Aggregations

Industry Title	S code
Business sector industries	1-13
Business sector - goods	1-6, 9
Business sector - services	7-8, 10-13
Business sector - excluding agricultural and related services	2-13
Business sector - goods excluding agricultural and related services	2-6, 9
Business sector - goods excluding agricultural and related services and manufacturing industries	2-4, 6, 9

APPENDIX 4

Quality assurance and rating of the estimates for labour productivity

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

(1) input-output tables, income and expenditure accounts, and the real domestic product accounts of the SNA, and,

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

Quality ratings presented in text tables 7 and 8 are provided only for the latest benchmark year data which is 1987. Data sources are different for past periods than for more recent periods and data for the period following the benchmark year are deemed to be of lesser quality.

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

(i) Real GDP at factor cost;
(ii) Persons at work;
(iii) Person-hours worked;
(iv) Labour compensation;
(v) Real GDP per person at work;
(vi) Real GDP per person-hour;
(vii) 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, 1987* (Catalogue 15-201).

Persons at work. For employment data the rankings have been determined as follows: In general, a rank of 1 has been assigned to the most reliable estimates that are based completely on censuses[6]. A rank of 2 has been assigned to less reliable census data and to establishment-based surveys with minimum 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. However, the quality rating of series taken from sample surveys, like the Labour Force Survey, depends on the size of the sample. Aggregate series may, therefore, have higher ratings than disaggregated series. Likewise, at any level of aggregation, large industries (like manufacturing) may have a better quality rating than small industries.

By this criteria, the employment data from the Census of Manufactures at the S level of aggregation, have the ranking of 1. However, at the M level of the aggregation, it has a ranking of 2.

The employment data for the agriculture industry are taken from Labour Force Survey, which is a household survey. For this industry it is the only source of employment. The quality rating of employment data for agriculture industry is, therefore, 3. For the remaining industries making up 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 SEPH 1983 onwards) or from other surveys. The employment data for the other-than-paid workers is obtained from a household survey. Therefore, for 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 2. However, at the aggregate business sector level, errors are compensating and it is felt that a quality rating of 1 could be attributed to the data.

Person-hours worked. Average hours data from the *Labour Force Survey* are good quality data and where comparisons are possible e.g. in manufacturing, average hours from both sources show very similar year to year changes. As a separate construct, the average hours worked data have a quality rating of 2. Since person-hours worked data are a product of the number of persons at work and the average number of hours worked, the quality rating of person-hours is the lowest of the two ratings. The quality rating of the person-hours worked data both at the S level of aggregation and M level of aggregation in manufacturing industries is, therefore, 2. Aggregate business sector hours are attributed a rating of 1 while agricultural and related services ind. has a rating of 3.

Labour compensation. Labour compensation is the sum of labour income of paid workers and the imputed labour income of self-employed persons. Since the estimates of labour income in the benchmark year come from tax data and have been subjected to various Input-Output adjustments (for example, own-account construction), these are given the rating of 2. In the case of manufacturing industries, the number of self-employed is very small resulting in a quality rating of 1 at the S level.

Labour productivity and *other ratios*. The quality ratings of ratios like real GDP per person at work, real GDP per person-hour and unit labour cost have been set at the rounded average rating of 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.

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

Text table 7 - Quality ratings of labour productivity and related data at aggregation level S and business sector, 1987

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

Text table 8 - Quality ratings of labour productivity and related data for manufacturing industries at aggregation level M, 1987

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

APPENDIX 5

Algebraic Presentation of Indexes

1 - Productivity index

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

$$\textit{Index of productivity} = \frac{\textit{Real GDP Index}}{\textit{Labour Input Index}} \; X \; 100$$

or, in algebraic form:

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

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

2 - Unit labour cost index

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

$$\textit{Unit labour cost index} = \frac{\textit{Labour compensation index}}{\textit{Real GDP Index}} \; X \; 100$$

or, in algebraic form:

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

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

$$U_t = \frac{\textit{Average labour compensation index}}{\textit{Productivity index}} \times 100$$

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

3 - Labour productivity, unit labour cost and average labour compensation

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

$$P = Q/L$$

$$W = C/L$$

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

$$U = W/P$$

The growth in these variables can be presented as

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

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

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

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

$$U_t = W_t / P_t$$

Substituting the preceding three relationships into the above equation yields

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

which simplifies to

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

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

or, solving for u

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

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

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

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

APPENDIX 6

Labour Productivity, unit labour cost and related data in CANSIM

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

PART 2

Multifactor Productivity

Experimental Data

HIGHLIGHTS

Trends and Cycles in Multifactor Productivity in Canada

1 - Macroeconomic Perspective[7]

Productivity has been a major factor responsible for the sustained growth of the Canadian business sector in the past. The annual rate of growth of the sector's real value added[8] was 4.4% from 1961 to 1989. The associated multifactor productivity increased at a 1.1% rate. Approximately one fourth of total growth, therefore, originated from increased efficiency and the rest resulted from the combined growth of capital and labour. The contribution of multifactor productivity to economic growth, however, has fallen substantially after 1973 (see figure 1).

Capital was the major source of economic growth over the last thirty years; it accounted for 39% of total output growth. The capital-labour ratio increased substantially over the period which sustained a strong partial labour productivity growth of 2.0% per annum, as reported in Part 1 of this issue. Indeed, over the period, the capital-labour ratio increased by as much as 82%. The contribution of labour amounted to the 35 remaining percentage points of total output growth.

This overall picture is, however, not very representative of the history of productivity in the intervening years, as successive economic events (oil crisis and business cycles fluctuations) have had considerable impacts along this path. The year 1973 was a significant peak year and the end of a fast rising productivity period (2.2% per annum on average for 1961-1973). It was followed by a difficult economic period of high inflation and low economic growth in which productivity fell by an average of 0.7% a year until 1982 where a trough was reached. As figure 1 indicates, between 1961-73, the contribution of productivity growth to the 97 percentage points increase in output was 36.2 percentage points, much larger than during the 1973-89 period when it contributed 7.7 percentage points only. Therefore, a larger proportion of output growth was accounted for by increases in primary inputs during the latter period. As a result, real incomes have not made much progress over that second period, in contrast with the fast rising real income of the sixties.

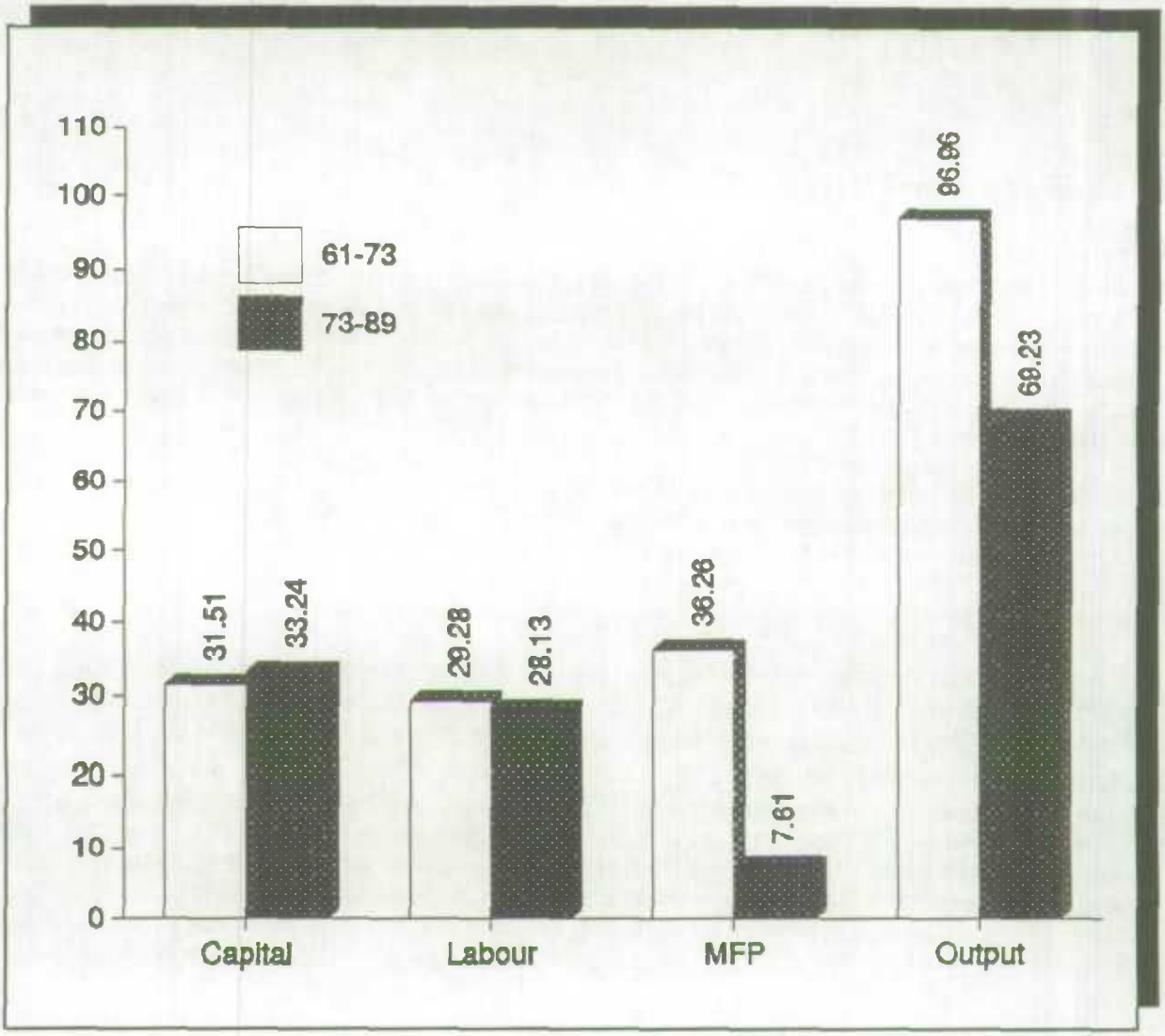
It is only from 1982 to 1989 that steady productivity growth is observed again (at 1.8% increase per year on average). The low contribution of productivity gains over the 1973-1989 period as depicted on figure 1, therefore, is mostly due, in fact, to the productivity decline over the 1973-1982. Nevertheless, the resumption

[7] *Basic concepts used in the highlights are described in Appendix 1 of Part 2. The alternative measures of output used here, that is gross output and net-gross output at the industry level, are further explained in the first accompanying feature article; see below A. Diaz, "Alternative concepts of output and productivity".*

[8] *As the highlights focuses on long term trends, all indices have been based in 1961 when they are equated to 100 while they are based in 1986 in the data tables which follow to be consistent with other parts of the System of National Accounts. Since all estimates are obtained from Tornqvist indices, this does not change their rates of growth which is independent of the choice of the base year. The reader should note that this procedure yields growth rates for outputs which differ from those currently published by Statistics Canada in the National Accounts. For example, the 1961-87 growth rate of business sector real value added, as published, is of 4.5% compared to a 4.4% for the Tornqvist index.*

Figure 1

Contribution of productivity and primary inputs of capital and labour to aggregate business sector's real GDP growth in Canada, 1961-1989



of multifactor productivity growth since 1982 does not yet undoubtedly indicate that the low output growth-high inflation-low productivity growth dilemma is lying definitively behind us. First, average productivity growth is still below the average reached during the first period (1.8% as opposed to 2.2%) and, secondly, productivity declined in 1989 as the recession set in. A further decline, or at most low growth, in multifactor productivity can be expected for 1990. In addition, part of the productivity gains of the recent past can be attributed to a catching up effect. Indeed, the peak level of productivity achieved in 1973 was not reached again until eleven years later, i.e. in 1984. Finally, the Canadian productivity picture in terms of competitiveness with respect to United-States has also become worrisome over the last few years as will be seen below.

2 - *Industrial Perspective*

Figure 2 provides a ranking of estimated multifactor productivity by industry based on the *industry* productivity index using gross output as an activity measure for the 1961-1987 period. Among the presented results, transportation, storage and communication is the industry that shows the highest productivity gains for the period. It is followed by the plastic products industries, the electrical and electronic products industries, wholesale and retail trade and by the textile and textile products and clothing industries. At the other end of the scale, paper and allied products industries and furniture and fixture industries are showing disappointing results. During the high productivity period 1961-1973, the transportation, storage and communication industry and the plastic products industries experienced the highest growth rate of productivity followed by transportation equipment, beverage industries and wholesale and retail trade. During the low productivity period from 1973 to 1982, construction industries and electrical and electronics products industries demonstrated the best productivity increase followed by transportation, storage and communication industries. During the recovery period from 1982 to 1987, non-metallic mineral industries experienced the highest productivity growth followed by chemical and chemical products industries, wood industries, wholesale and retail trade, and transportation, storage and communication industries.

High productivity industries tend to be high growth industries. The five highest ranking industries in terms of output growth are plastic products industries, transportation equipment industries, electrical and electronic products, transportation, storage and communication, and machinery industries. The productivity ranks associated with these are respectively second, seventh, third, first and fifteenth. Indeed, except for the latter, there is some kind of a relationship between output growth and productivity growth.

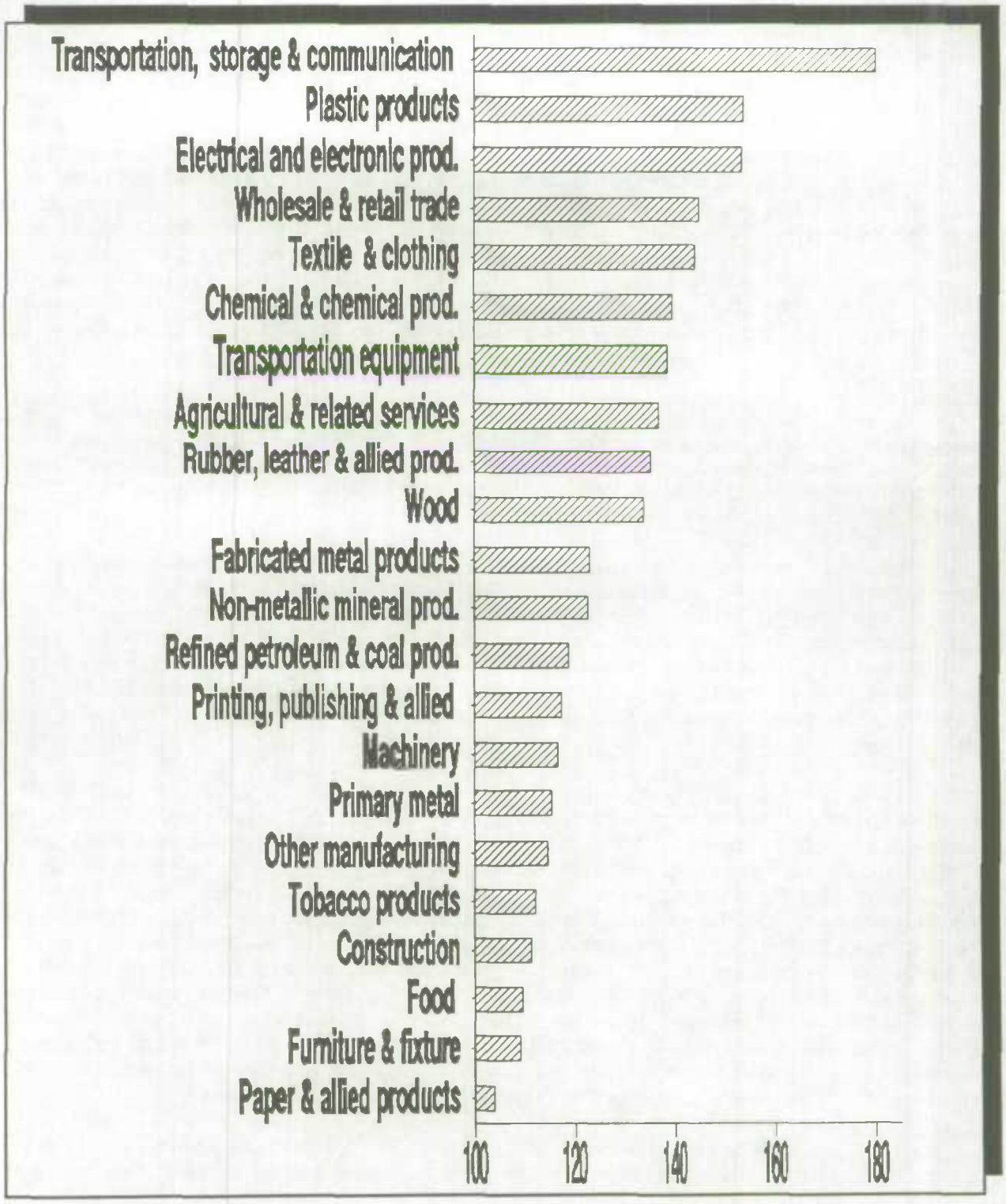
Structural changes in the economy over business cycles have affected some industries more than others as reflected in text table 1. For instance, construction industries productivity had its highest growth during the 1973-82 period while most other industries experienced a productivity deceleration or decrease over this period. Transportation equipment industries, which experienced a strong average 2.5% productivity increase during the period 1961-1973, registered negative productivity growth during the 1973-82 period. Productivity in non-metallic mineral products exhibited the most volatile movement: after an average raise of 1.7% in the first period, it dropped significantly in the second period (-2.2%) and recovered very strongly after 1982 (4.0%).

Comparisons of multifactor productivity indices are made in Figure 3 among large industry groups: agricultural and related services, manufacturing, construction, transportation, storage and communication, and wholesale and retail trade. In addition to basic trend differences as already noted, there is considerable variation in the cyclical behaviour of productivity of the various major industry groups. Of these industrial aggregates, agricultural and related services demonstrates the highest volatility since it depends more on exogenous factors such as the weather. The 1974 recession does not seem to have affected the major industry groups equally; no downward movement is apparent in the productivity of transportation, storage and communication as opposed to other industry groups and manufacturing seems to be lagging the business cycle trough by approximately one year. In 1982, the general recession is not reflected in agricultural and related services and construction and the latter is even unexpectedly moving countercyclically and showing a healthy productivity gain. It is interesting to note that, in fact, construction and manufacturing are behaving countercyclically over the whole historical record as the peak productivity of manufacturing matches almost exactly the troughs of construction and vice versa.

From a summary analysis of turning points, it appears that multifactor productivity tends to move in the same direction as labour productivity in most industries. If this is true also for 1988 and 1989 this would

Figure 2

Indices of gross output multifactor productivity for selected Canadian industries for 1987, index number 1961 = 100



Text table 1 - Multifactor productivity growth (gross output *industry* index) for selected industries and periods

Industry title	1961-87	1961-73	1973-82	1982-87
	Average annual percent change			
Agricultural & related services ind.	1.2	2.0	0.3	1.0
Food industries	0.3	0.6	0.1	0.2
Beverage industries	0.6	2.2	-1.1	-0.3
Tobacco products industries	0.4	1.0	0.4	-0.8
Plastic products industries	1.7	3.0	0.4	0.9
Rubber, leather & allied prod. ind.	1.2	1.2	0.7	2.0
Textile, textile prod. & clothing ind.	1.4	1.5	1.0	2.0
Wood industries	1.1	0.8	0.5	3.0
Furniture & fixture industries	0.3	1.7	-1.4	0.4
Paper & allied products industries	0.1	0.4	-0.9	1.5
Printing, publishing & allied ind.	0.6	0.8	0.7	0.2
Primary metal industries	0.6	0.9	-1.0	2.6
Fabricated metal products industries	0.8	1.7	-0.2	0.6
Machinery industries	0.6	1.5	-0.8	1.0
Transportation equipment industries	1.3	2.5	-0.1	0.9
Electrical & electronics products	1.7	1.7	1.3	2.1
Non-metallic mineral products ind.	0.8	1.7	-2.2	4.0
Refined petroleum & coal products	0.7	1.0	0.4	0.2
Chemical & chemical products ind.	1.3	1.8	-0.4	3.3
Other manufacturing industries	0.5	1.2	0.1	-0.4
Construction industries	0.4	0.2	1.3	-0.6
Transportation, storage & comm. ind.	2.3	3.0	1.1	2.7
Wholesale & retail trade industries	1.4	2.1	-0.2	2.9

Indicate that multifactor productivity would have registered little progress for these two years in most industries. With the 1990 recession, still less favourable results can be expected.

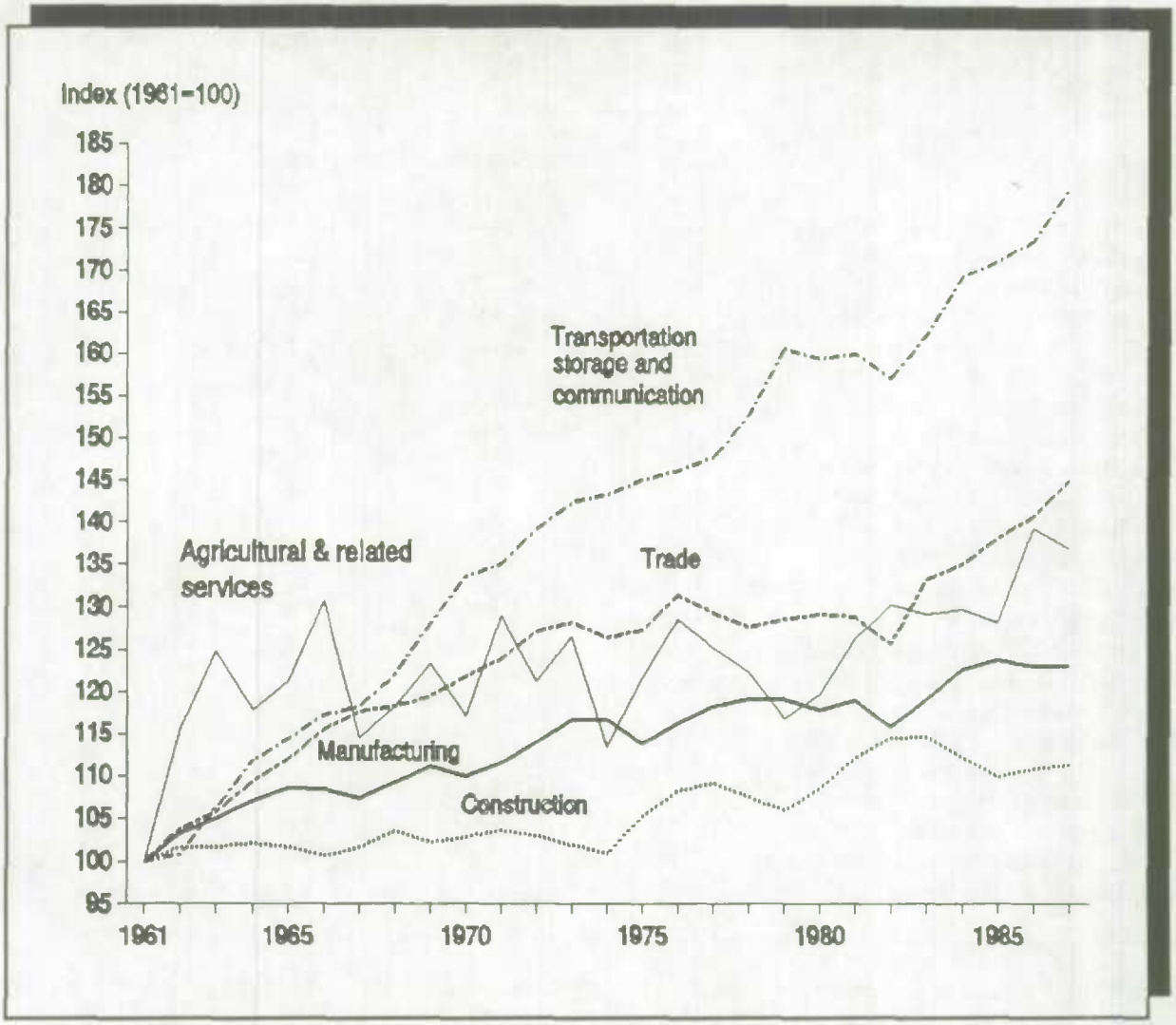
3 - Gauging Canadian Performance in Terms of U.S. Performance

At the total business sector level, multifactor productivity indices for Canada and the United States based on real value added are showing parallel movements, as illustrated in Figure 4. Canadian productivity indicates, a slightly higher overall growth of 1.1% per year versus 1.0% for the United States, for the period 1961 to 1989. This difference may not be statistically significant given differences in sources and methods[9].

[9] *There are differences in the way estimates are being produced by both statistical bureaus. For details, see appendices 2 and 3 of Part 2.*

Figure 3

Comparison of *industry* multifactor productivity indexes (based on gross output) between major industry groupings, 1961-1987, for Canada

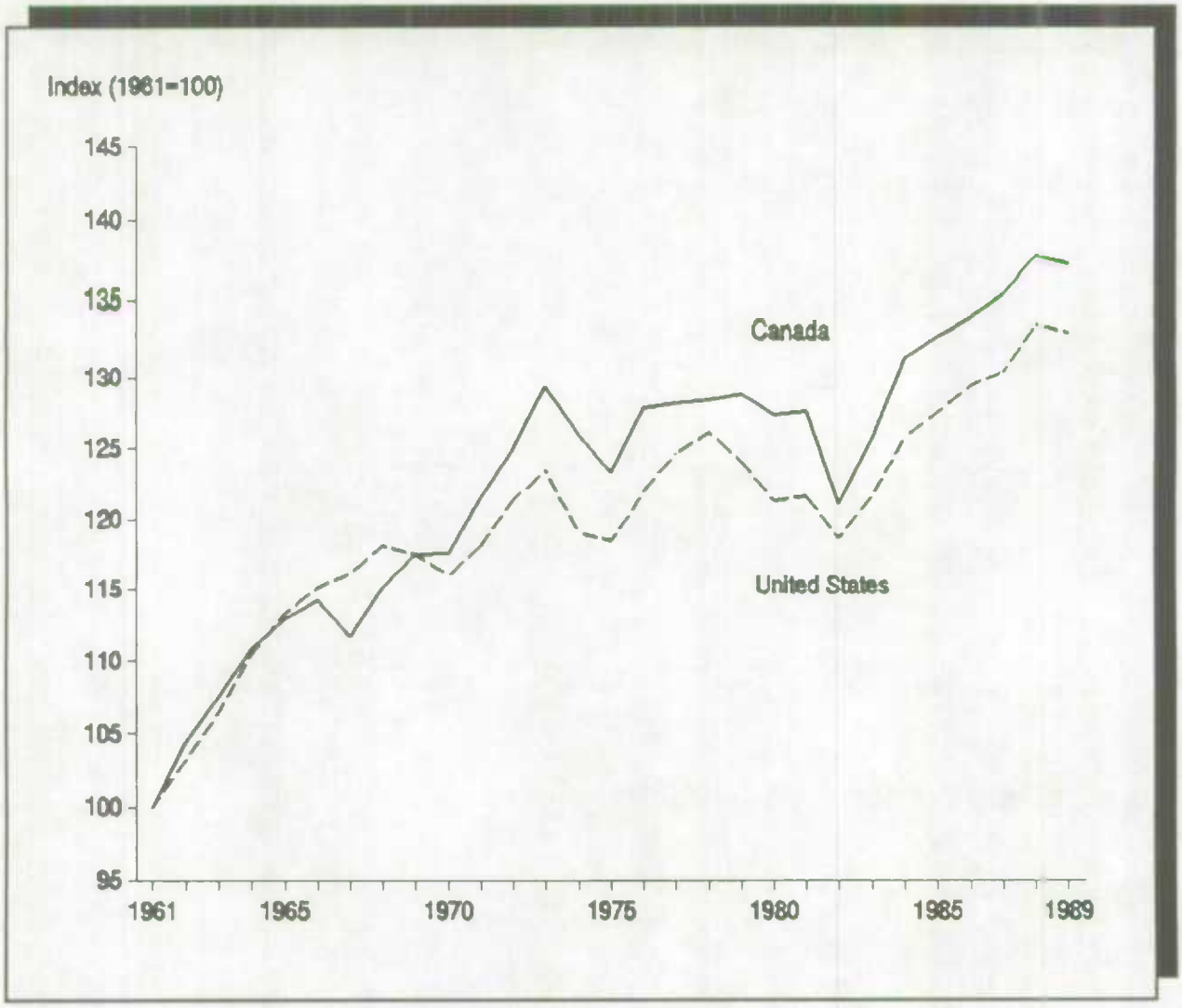


However, the similar productivity fluctuations and overall growth revealed in figure 4 reflect how interrelated these countries are in terms of markets and technology. From 1961 to 1974, productivity in Canada grew by an average of 1.8% per year as compared to 1.3% in United States while during 1974 to 1982 it decreased slightly in Canada and remained practically constant in United States. For the most recent period, 1982-1989, the Canadian productivity increased by 1.6% per year as compared to 1.8% in United States.

For the purpose of analyzing Canada's competitiveness with respect to United-States, manufacturing industries occupy a central place. At the aggregate manufacturing level, the reader may be more familiar with the usual estimates published by the U.S. Bureau of Labor Statistics based on the value added measure

Figure 4

Aggregate multifactor productivity in Canadian and United States business sector



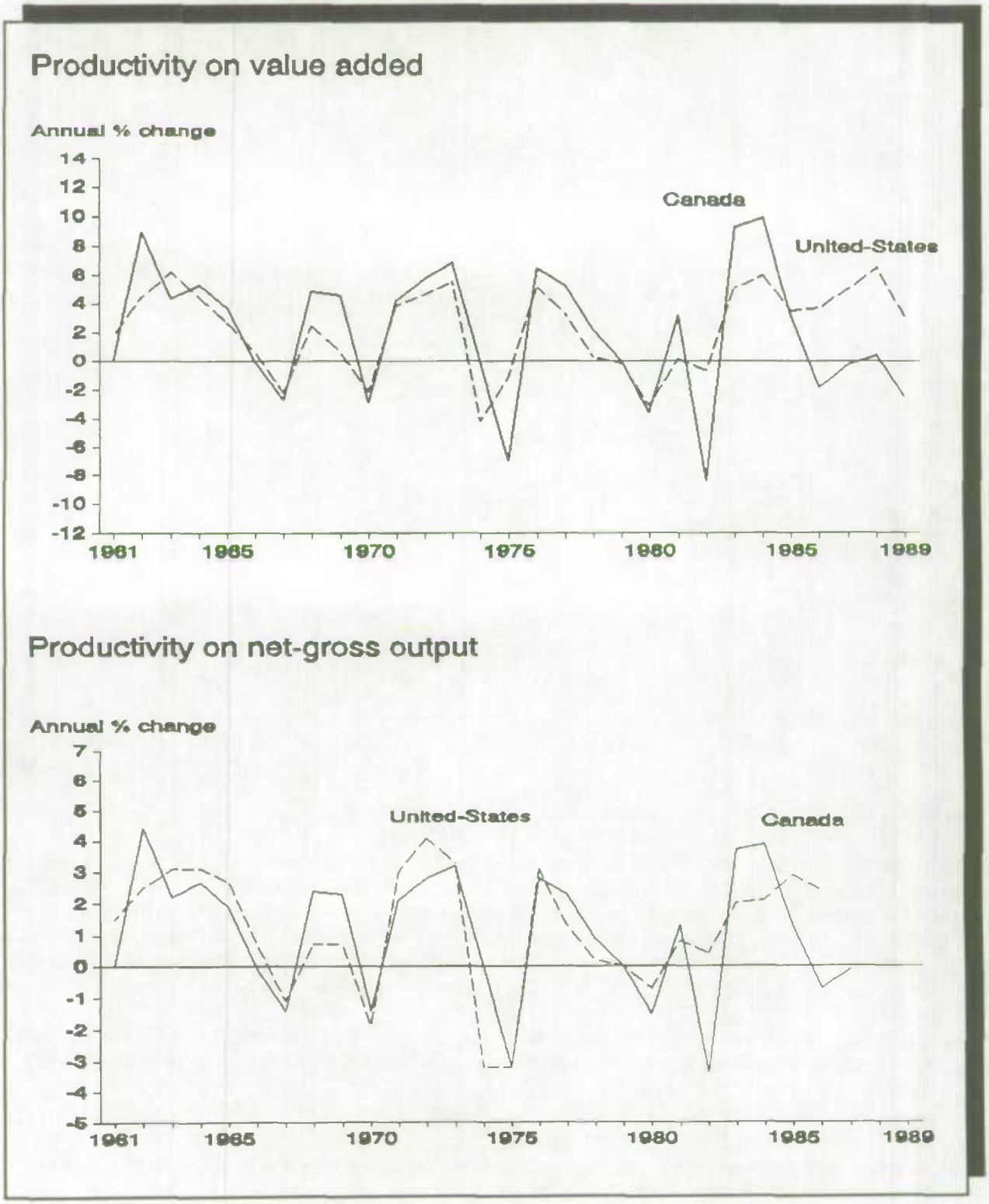
of output rather than the one based on gross or net-gross output as used in Canada although estimates based on a net-gross measure of output are also produced in United-States[10]. We have, therefore, computed estimates for Canada's manufacturing industries on the same value added basis in order to see if the comparative positions of both countries appeared different on the basis of this alternative index. Figure 5 and text table 2 thus compares Canada and U.S. multifactor productivity growth for the manufacturing industries under both the value-added and net-gross output based indices.

There is a strong similarity in the annual productivity movements in both countries on the basis of either productivity indices. In general, Canadian productivity gains exceed slightly U.S. gains for all time periods,

[10] *For United-States, the U.S. Bureau of Labor Statistics has made available estimates of multifactor productivity for major manufacturing industry groups as well as for total manufacturing based on net-gross output.*

Figure 5

Canada United-States comparisons of year to year changes in alternative indexes of multifactor productivity for manufacturing industries



Text table 2 - Canada and United States comparison of year to year changes in alternative indexes of multifactor productivity for manufacturing industries.

	Productivity indices			
	Value added		Net-gross output	
Year	Canada	United States	Canada	United States
1961	..	1.7	..	1.5
1962	9.0	4.5	4.4	2.5
1963	4.4	6.3	2.2	3.1
1964	5.4	4.5	2.7	3.1
1965	3.7	2.7	1.9	2.7
1966	-0.1	0.6	-0.1	0.7
1967	-2.7	-2.2	-1.4	-1.1
1968	4.9	2.5	2.4	0.7
1969	4.6	0.6	2.3	0.7
1970	-2.9	-2.1	-1.4	-1.9
1971	4.3	3.9	2.1	3.0
1972	5.8	4.7	2.8	4.1
1973	6.9	5.6	3.2	3.3
1974	-0.1	-4.2	0.0	-3.2
1975	-7.0	-1.1	-3.2	-3.2
1976	6.5	5.2	2.8	3.1
1977	5.3	3.3	2.3	1.3
1978	2.2	0.3	0.9	0.2
1979	0.0	-0.1	0.0	0.0
1980	-3.6	-3.1	-1.5	-0.7
1981	3.2	0.2	1.3	0.8
1982	-8.4	-0.7	-3.4	0.4
1983	9.3	5.2	3.7	2.0
1984	9.9	6.0	3.9	2.1
1985	3.2	3.5	1.3	2.9
1986	-1.8	3.7	-0.7	2.4
1987	-0.2	5.1	-0.1	..
1988	0.5	6.6	..	..
1989	-2.4	3.0	..	..

with a few exceptions. As well, there is a close agreement in the message conveyed by the two pair of indices. Nevertheless, this may not be entirely indicative of a superior Canadian performance. As noted above, these comparisons have to be examined cautiously as there are differences in sources and methods which may affect the comparability of productivity between the two countries. It must also be noted that U.S. productivity growth has markedly exceeded Canada's productivity growth over the 1986-1990 period. Indeed, judging by the labour productivity estimates reported in part 1 above up to 1989 and the recent though preliminary labour productivity estimates which are not reported here for 1990, the U.S. manufacturing industries may have reinforced substantially their relative strength during the period.

Text table 3 - Multifactor productivity indices for Canada and U.S. manufacturing (net-gross output index), 1986 (1961 = 100)

Canada		United States	
Food industries	111.4	Food and kindred products	116.1
Beverage industries	115.5		
Tobacco products industries	108.1	Tobacco manufacturers	76.0
Plastics products industries	157.2	Rubber & misc. plastics pr.	121.5
Rubber, leather & allied prod. industries	135.4	Leather & leather products	113.2
Textile, textile prod. & clothing industries	160.9	Textile mill products	149.1
		Apparel & other textile	127.5
Wood industries	137.2	Lumber and wood products	158.8
Furniture & fixture industries	114.8	Furniture and fixtures	116.7
Paper & allied products industries	103.0	Paper & allied products	124.7
Printing, publishing & allied ind.	121.4	Printing and publishing	96.0
Primary metal industries	115.4	Primary metal industries	92.2
Fabricated metal products ind.	127.6	Fabricated metal products	110.6
Machinery industries	119.2	Machinery, except electrical	170.6
Transportation equipment ind.	149.3	Motor vehicles\oth. transp. equip.	122.7
Electrical & electronic products	158.4	Electrical and electronic equipment	172.9
Non-Metallic mineral products industries	122.6	Stone, clay and glass products	105.7
Refined petroleum & coal products	117.7	Petroleum refining	108.6
Chemical & chemical products ind.	144.1	Chemicals and allied products	131.0
Other manufacturing industries	114.8	Instruments and related pr.	137.5
		Miscellaneous manufacturing	113.8
Total manufacturing	131.9	Total manufacturing	132.8

At the industry level, the Bureau of Labor Statistics has also developed since 1987[11] an expanded multifactor productivity measure combining capital, labour and intermediate inputs and considering net-gross output as a measure of output. The revised U.S. estimates for the manufacturing industries are included in Text table 3 and compared with the Canadian manufacturing industries for the period 1961 to 1986[12]. Although comparisons between the two countries' manufacturing productivities must be made with care[13], their total growth appear to be very similar for that period. According to these comparative estimates, Canada has improved its productivity much faster than the United States from 1961 to 1986 in the following areas:

a) Tobacco products,
b) Rubber, plastics & leather,
c) Printing & publishing,
d) Primary metal,
e) Fabricated metal products,
f) Transportation equipment,
g) Non-metallic products,
h) Refined petroleum & coal products,
i) Chemical & chemical products.

[11] *W. Gullickson and M.J. Harper, "Multifactor Productivity in U.S. Manufacturing, 1949-83", Monthly Labor Review, October 1987, pp. 18-28.*

[12] *U.S. estimates for 1987 were not available at the moment of preparing this publication.*

[13] *The concordance between the respective classification system differs to some extent.*

On the other hand, U.S. manufacturing has improved its productivity in food & kindred products, machinery (except electrical), electrical & electronic equipment, and in paper & allied products much faster than Canadian manufacturing. Lumber & wood products (U.S. classification) contain what is referred to as logging industries in Canada and cannot therefore be compared directly to the Canadian wood industries. Although textile, textile products & clothing industries and electrical & electronic products are showing among the best rankings in terms of productivity growth in both countries, there is no firm relationship between rankings in Canadian and U.S. manufacturing productivities. For example, transportation equipment industries rank among the best in Canada while they are clearly under the average in the U.S. These industry comparisons contrast sharply from the comparison of aggregate productivity among the two countries. Substantial differences exist between Canadian and U.S. manufacturing productivity growth at the industry level since 1961 even though productivity show similar movements at the aggregate level.

FEATURE ARTICLE 1

Alternative Concepts of Output and Productivity

By Aldo Diaz[14]

1 - Introduction:

As part of the ongoing research activities into productivity measurement and analysis, the feature article of the 1988 issue[15] of this publication introduced three alternative concepts with corresponding estimates of multifactor productivity, namely the *industry*, the *interindustry* and the aggregate *real value added* (business sector) productivity measures. In this feature article we introduce an additional concept of multifactor productivity that complements those previously introduced, and we modify the interindustry measure presented in the previous feature article. The new concept of productivity consists in specifying an alternative measure of industry output. We propose and evaluate productivity on a *net-gross* output basis, a concept of output net of intraindustry transactions. The modification to the interindustry measure consists in treating imports and non-business supplies of materials and service inputs used by the business sector industries as *primary* rather than *intermediate* inputs. In the revised version presented here, the primary inputs are capital, labour and goods and services originating outside the business sector rather than capital and labour inputs as it was the case in the previous version. This modifies the interindustry productivity measure at all levels of aggregation, including the aggregate business sector productivity index.

As explained in detail in Appendix 1, the *industry* index measures the productivity growth originating solely from the industry itself in the production of goods and services while the *interindustry* index includes, in addition, the contribution of the upstream suppliers of the industry to productivity growth. This *joint* productivity refers to the productivity of a group of vertically integrated industries rather than to the productivity of a single industry. An aggregate business sector multifactor productivity index common to both the industry and the interindustry indices was also introduced in the feature article of last year's publication. It was specified on aggregate business sector *real value added* on the output side and on capital and labour on the input side.

In the formulation of industry productivity, the output of an industry is defined as the sum of the gross outputs of its establishments. This method necessarily includes, in the output of the industry, the part of output sold by some establishments of the industry to other establishments of the same industry, that is, industry gross output includes *intraindustry* sales. In this article, we define net-gross output as gross output net of intraindustry sales. To this *net-gross* output concept corresponds intermediate inputs net of intraindustry sales, to maintain the balance between production and inputs used. The present article

[14] *The author wishes to thank René Durand for many valuable comments and Yvon Sabourin and Sean Burrows for producing the estimates.*

[15] *R. Durand, M. Salem and D. Hayes, "A New Look at Productivity of Canadian Industries", Aggregate Productivity Measures, 1988, Catalogue 15-204, June 1990, pp.7-33. Also in the Canadian Economic Observer, Catalogue 11-010, July 1990, pp.4.1-4.17.*

elaborates on the notion of net-gross output and compares it to that of gross output. To each of these concepts is attributed a distinct production model and distinct notion of productivity. The advantages and disadvantages of these models are analyzed and discussed, together with the meaning to be attached to the corresponding productivity measures.

The application of the net-gross output concept to the business sector of the economy results in a measure of output which differs from the original formulation. In the latter, real value added was the specified output and capital and labour were the inputs of the sector. The net-gross output measure of aggregate business sector multifactor productivity recognizes that, in an open economy, the net-gross output of the business sector differs from its aggregate real value added. Business sector's deliveries to final demand includes all final demand consumption except the imports of final goods and services. This output is larger than when final demand is netted of all final and raw commodity imports as in the alternative value added formulation. Correspondingly, on the input side, imported material and service inputs are included as primary inputs in addition to capital and labour. An interesting feature of the new concept is that, at the aggregate business sector level, net-gross output and business sector's deliveries to final demand coincide.

2 - Characterization of Industry Output and Productivity.

The production process carried out by an industry or by an establishment is never complete in the sense of transforming the economy's basic (primary) inputs of capital and labour into final use products. Some inputs come from other industries in the form of partially processed materials or in the form of various services. The output of the industry may contain some commodities which are used as inputs in the same industry or by other industries besides finished products, if any. Complete production processes, therefore, are "distributed" over many industries and, within industries, between establishments. Even at the establishment level, production processes take place at several departments. We could, in principle, measure the outputs and the inputs of each department within an establishment and determine their productivity[16]. We could also define the gross output of the establishment as the sum of the outputs of its several departments in a way analogous to the output of the industry which can be defined as the sum of the output of its establishments. However, the smallest reporting units are the establishments themselves so that the information on the flows of goods and services within the establishments are not recorded in statistics. Only total production and use of establishments are recorded. Intraestablishment flows of goods and services are netted out, that is, the production processes within the establishments are *integrated*[17].

The alternative measure of output described in this article extends this idea of integration from the establishment level to the industry level and to any level of aggregation such as the business sector. It is based on the notion of industry net-gross output as the output that would occur if the activity of all the industry's establishments were merged into a single large establishment[18]. This is one of several characterisations of industry production activity. Others are also possible, giving rise to alternative notions of multifactor productivity.

[16] *Multifactor productivity of a production process is defined as the ratio between an aggregate of output quantities and the corresponding quantity aggregate of all inputs used in the process. Equivalently, productivity growth is the difference between the growth in outputs and the growth in inputs.*

[17] *This idea of integration is developed much further in the immediately following feature article.*

[18] *Domar also used that idea of vertical integration to develop his aggregation rule for industries' productivity to the business sector. See Domar, E.D., "On the Measurement of Technological Change", Economic Journal, 71 (284),december 1961, pp.709-729.*

To take an example, let us assume that the furniture industry has two groups of establishments, one producing finished furniture and the other producing semi-finished furniture. Assume for simplicity that all the semi-finished furniture is sold to the establishments producing finished furniture for further transformation. The furniture industry output can be defined from different perspectives. One is the perspective of the industry as a conglomerate of establishments which views total industry output as the output of the finished as well as the semi-finished furniture, or the output of the two groups of establishments comprising the industry. This is the gross output concept of industry output employed in the multifactor productivity estimates described in the 1988 issue of this publication. Alternatively, one may view the industry from the point of view of furniture buyers for whom what matters is what exits the industry, namely, finished furniture. This is the net-gross output concept presented in this article. It indicates deliveries out of the furniture industry.

The net-gross output of two industries aggregated together is smaller than the sum of their gross outputs as their sales to each other (considered as interindustry sales at the level of each industry) become intraindustry sales which are subtracted from their aggregate output. The wider the industrial group, the larger the amount of intermediate goods which are transferred from the interindustry category to the intraindustry category and consequently subtracted from output. At the aggregate business sector level, all domestically produced intermediate inputs are intraindustry sales and are subtracted from output. Aggregate net-gross output, therefore, ignoring imported inputs and other non-business supplied inputs, is equal to value added. Hence, net-gross output converges gradually from a level close to gross output at a very detailed industrial classification to value added at the business sector level. Considering imports and other non-business supplies of goods and services, net-gross output converges to the business sector's final demand deliveries as discussed further below. Clearly, the largely accepted idea that gross output is a somewhat meaningless concept of output at the aggregate level suggests that productivity growth could alternatively be measured on net-gross output rather than gross output on large sub-aggregates of the business sector.

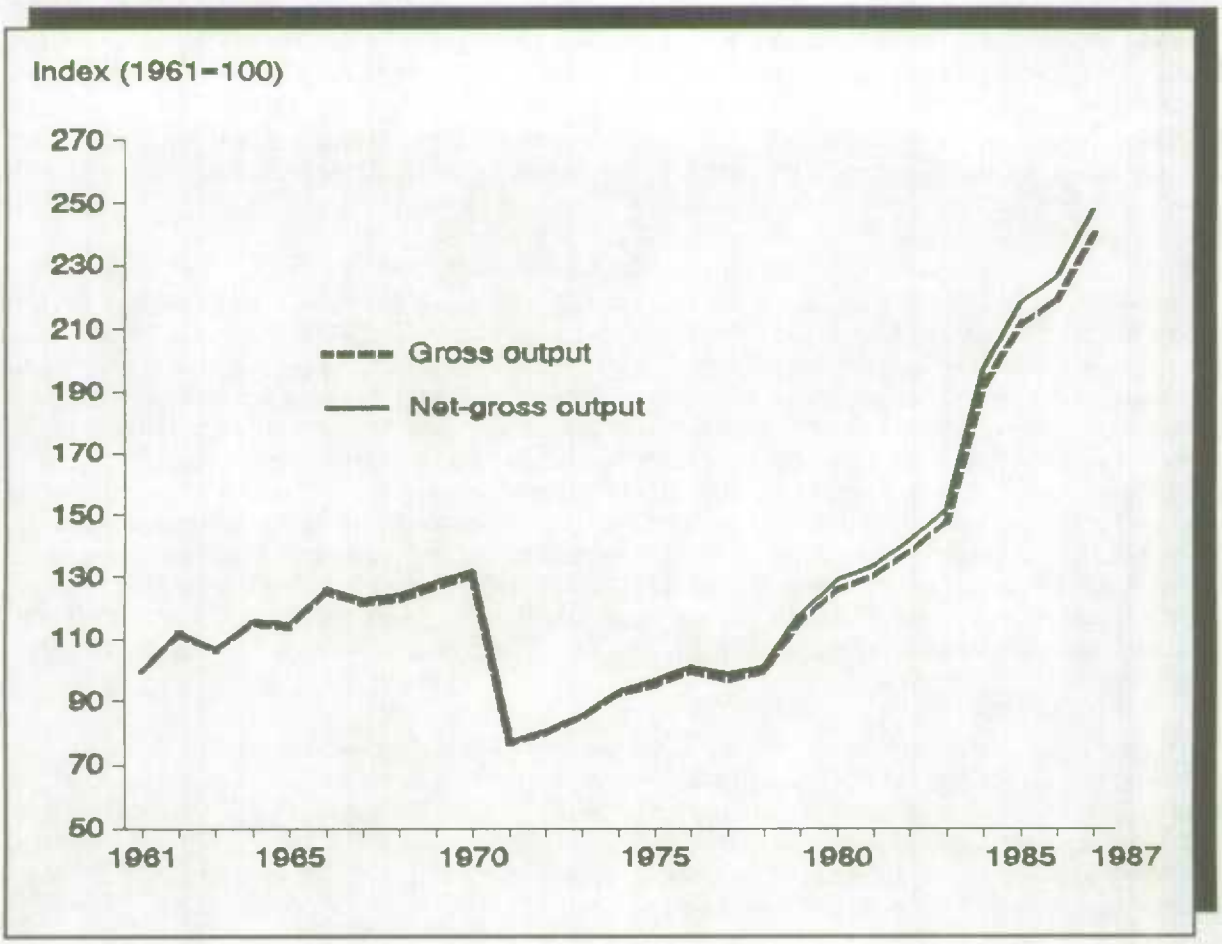
The integrated output measure, or net-gross output, has some interesting features when compared to the traditional gross output measure. One is that it does not require to employ a concept of output at a lower level of aggregation and an alternative concept for larger aggregates. In many productivity studies, gross output is the preferred measure of output at all levels of aggregation except at large aggregation levels such as the business sector where the value added model is specified. With the net-gross output model, a single concept is maintained at all levels of aggregation.

Another property of the net-gross output concept lies in the use of an output measure which is independent of the degree of vertical integration of establishments within their industry, and independent of statistical reporting arrangements and industry consumption of its own output. An advantage of the net-gross output concept may lie in the comparability of productivity. The U.S. Bureau of Labor Statistics makes available measures of productivity based on a concept of industry output similar to the one employed here[19]. This development will facilitate comparability of productivity statistics between the two countries.

[19] *See W. Gullickson and M.J. Harper, "Multifactor Productivity Measurement for Two-Digit Manufacturing Industries", paper presented at the 1986 meeting of the Western Economic Association in San Francisco, July 1-5, 1986. See also Mark, "Problems encountered in measuring single- and multifactor productivity", Monthly Labor Review, Bureau of Labor Statistics, december 1986, pp.3-11.*

Figure 1

Index of gross output and net-gross output multifactor productivity for the office, store and business machine industry



A slight disadvantage of the concept is its greater demand for statistical information which, due to data limitations, needs to be derived by economic modelling[20]. More precisely, this means that imports and other non-business supplies of inputs must be estimated for each industry. Another disadvantage, in some uses, is that the net-gross output measure of productivity growth for an industry tends to be larger than the average productivity growth of its establishments also measured on a net-gross output basis[21]. Establishments' productivity growth cannot be compared directly to the overall industry productivity growth as is the case with the gross output model. Indeed, gross output productivity growth of a group of industries is a weighted average of gross output productivity growth over the same industries. The sum of

[20] *Appendix 2 of Part 2 describes briefly how the estimates are derived. Further technical information is available upon request.*

[21] *It can be shown that the integrated measure of productivity growth is equal to the weighted average productivity growth of establishments multiplied by the ratio of gross to net-gross output. The sum of the weights exceed one. In absolute value, productivity growth associated with net-gross output is, therefore, larger than the one associated with gross output.*

Text Table 1: Gross and net-gross output productivity in selected industries for 1987, index level (1961 = 100)

	Net-gross output	Gross output
Gas distribution systems industry	152.0	152.0
Electric power systems industry	171.0	169.9
Total gas dist. & electric power		
Integrated	170.5	169.5
Average	168.9	169.5

the aggregation weights is equal to one. Thus, it is possible to compare the gross output productivity growth of any component industry with the gross output productivity growth of an aggregated group[22] and with the gross output productivity growth of other aggregated groups or industries. Therefore, when comparability among industries as well as comparability at different aggregation levels is required (or a ranking of industries in term of their productivity is sought), use could be made of the gross output measures. On the other hand, net-gross output productivity of an industrial group is generally higher than the productivity of its individual establishments due to the effect of integration which restricts comparability. To illustrate the differences implied by integration, text table 1 compares the average and integrated productivity measures with reference to the electric power system and the gas distribution system industries. The table shows the integrated and unintegrated productivities of an industry at the same level of aggregation. The integrated net-gross output index is greater than the average (unintegrated) index for the two industries. In the case of the gross output measure, the integrated and average indices coincide. Gross output and net-gross output productivity estimates for several business sector industries at the same aggregate level are presented in data tables 1 and 2 of part 2.

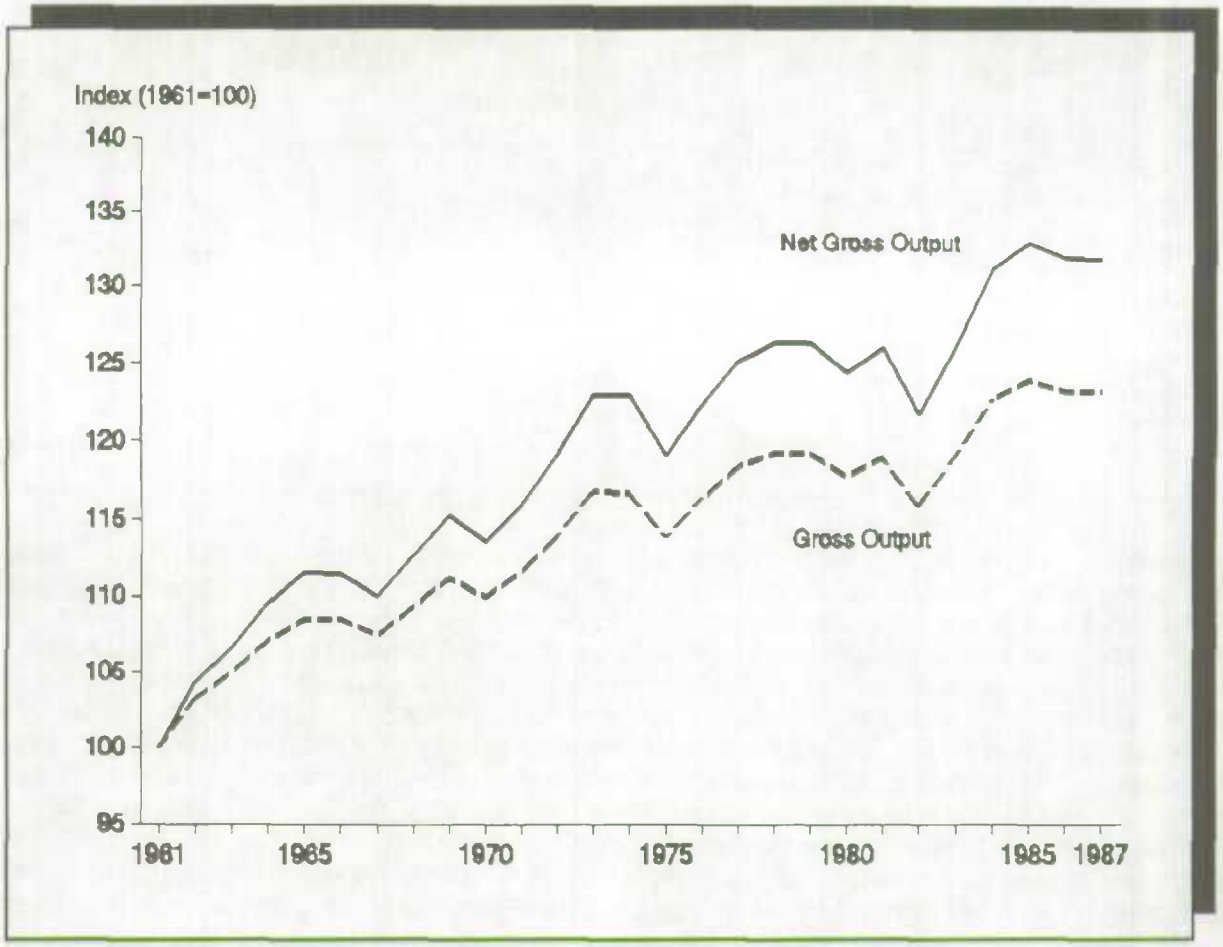
In spite of their conceptual differences, the estimates of productivity from the gross output and net-gross output models tend to be similar at the level of individual industries because, at such a level of aggregation, there are generally few intraindustry transactions. Figure 1 illustrates this by comparing the productivity indexes of the office, store and business machine industry. One may observe that, on an annual basis, net-gross output productivity increases and decreases faster than gross output productivity.

The relative properties of alternative production models and the meaning of productivity to be attached to them becomes more relevant at higher levels of aggregation, such as, for example, the total manufacturing level. The larger the group of industries (the higher the level of aggregation), the more important intraindustry transactions are in total input and the more gross output differs from net-gross output. For large groups of industries, gross output and net-gross output productivity may be substantially different. Still, the difference between gross and net-gross output may be larger for some particular industries within

[22] *Value added productivity also has this property.*

Figure 2

Index of gross output and net-gross output multifactor productivity in Canadian manufacturing industries



the group than for the group as a whole. But the converse will be true in a majority of cases so that, on average, productivity on gross output will generally be smaller than productivity on net-gross output. This is shown on figure 2 which compares the productivity of both models for the Canadian manufacturing industries.

3 - Characterization of Aggregate Output and Productivity

The use of the value added model to study the sources of aggregate economic growth is common practise. E.F. Denison, J.W. Kendrick, D.W. Jorgenson and others have specified the value added model to explain aggregate growth in economic activity in terms of the capital, labour and productivity growth. These studies use value added on the ground that the production objective of society is to satisfy current consumption needs and to accumulate capital to sustain future consumption. In a close economy, value added and final demand deliveries coincide. But in an open economy, final demand deliveries and value added generally differ. If some imports are used as inputs, business sector net-gross output or final demand deliveries

Figure 3

Index of gross output, net-gross output and value added multifactor productivity for the Canadian business sector for the year 1987.

exceeds value added. In addition, on the input side, the aggregate net-gross output model includes all other non-business supply of inputs. Among these, government supply of goods and services and inventory depletion are the major ones[23].

F.M. Gollop argued that final demand deliveries is a better concept of aggregate output in that "only the delivery-to-final-demand model is sensitive to the intertemporal and international variation in imported input requirements"[24]. The argument appears fundamentally to be that the final demand deliveries model measures the productivity of the domestic business sector by taking imported inputs into account on the same principle as the productivity of an industry is measured by taking into account its consumption of

[23] *See Appendix 2 of Part 2 for further detail on non-business supply.*

[24] *Gollop, F.M., "Growth Accounting in an Open Economy" in A. Dogramaci (ed.), Developments in Econometric Analysis of Productivity, Measurement and Modelling Issues, Kluwer Nijhoff pub., Boston, The Hague, London, 1982, pp. 35-62.*

intermediate inputs. Though as convincing as the argument might appear, it may alternatively be argued that, the same way intermediate inputs cancel out when aggregating, imports should also cancel out. If instead of considering the productivity of the domestic economy one were to consider the productivity of the world economy, then clearly, all intercountry transactions in commodity inputs (imports) would become intermediate inputs and, at the aggregate world level, "intraindustry" sales, which would cancel out. World net-gross output coincides with world value added which also coincides with world deliveries to final demand. Productivity growth estimates will be larger that the productivity of the individual countries due to integration caused by international trade in inputs. Thus, the productivity of an individual world economy will be larger for a world-integrated than for the nation-integrated economy.

The world productivity growth is the average productivity growth of the primary inputs of world capital and labour of the component economies in the context of their economic interdependence. Therefore, the value added model would still represents, for a single open economy, a valid alternative to the net-gross output model in the sense that the value-added model includes the productivity effect of world integration.

Figure 3 compares the three productivity indexes based on business sector's gross output, final demand deliveries and value added. The net-gross output productivity growth estimates are less than those based on value added as integration is at a lower level. The gross output and the net-gross output models give a quite different estimate of productivity growth. Usually, the gross output measure of productivity is not presented at this level of aggregation as it is generally considered not to be a relevant concept of output. Instead, value added is the standard concept which is generally used. The gross output measure is presented here to provide an assessment of the numerical importance of integration of all industries together on the estimates of productivity growth.

The gross and the net-gross output measures provide an assessment of the numerical importance of the integration of industries on the productivity growth estimates. Since gross output productivity is a non-integrated measure, the difference between net-gross output and gross output productivity indicates the productivity gains realized as the result of integration taking place within the group of establishments of the business sector. Similarly, the difference between the net-gross output and value added productivity reflects the effect of integration between the domestic business sector and the rest of the world.

4 - Interindustry Productivity in the Open Economy

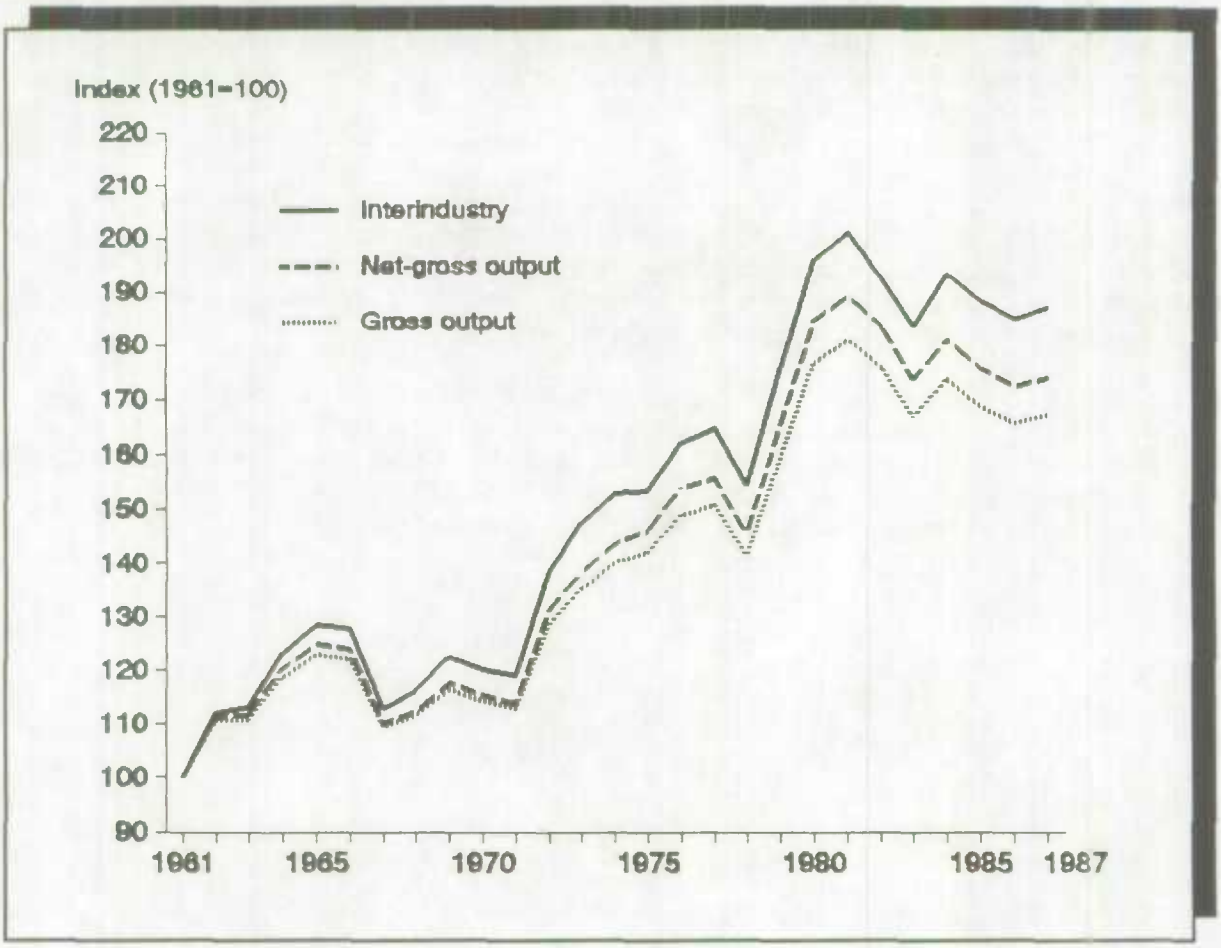
The interindustry measure of productivity introduced with the 1988 issue of this publication[25] corresponds to a vertical integration of establishments' production activities both within and across industries. Vertical integration was extended to include all intermediate inputs originating both within and from other industries whether domestic or foreign. Due to the higher integration, the interindustry productivity index is generally higher than both of the preceding productivity estimates in absolute terms[26]. This is illustrated in figure 4. The new concept of net-gross output introduced in this article does not lead to a modification of the concept of output for the interindustry model as it can be shown that this index remains the same whether output in gross or net of intraindustry sales. On the other hand, the treatment of imports and other non-business supply as primary inputs does change the interindustry estimates as opposed to the estimates

[25] *See Appendix 1 of Part 2 for a full discussion of the interindustry model.*

[26] *Only when the productivity gains of upstream industries would be negative while the industry's productivity gains would be positive would it give a smaller productivity increase than its alternatives.*

Figure 4

Interindustry and industry gross and net-gross output multifactor productivity indices for the Electronic Equipment industries



produced last year. The new estimates of data table 3 and 6 are based upon considering imports and all other non-business supply of commodities used by industries as primary inputs.

Similarly, in the measure of business sector interindustry productivity, output was previously defined as gross output net of intermediate inputs and other non-business supply of inputs which is equivalent to business sector value added. The modified *open economy* model estimates now consider imports and other non-business supply as primary inputs. The aggregate interindustry multifactor productivity index, therefore, is equal to the business sector's final demand deliveries productivity index as shown in table 2.

5 - *Concluding remarks*

This article has dealt with an alternative concept of output for multifactor productivity analysis that applies to all levels of aggregation including the total business sector where it either comes equivalent to value added in a close economy or to Gollop's measure of business sector final demand deliveries in an open economy. This concept of output was also applied to the interindustry multifactor productivity index.

For the industry multifactor productivity index, the new concept has the advantage of maintaining the same measure of output at all aggregation levels contrary to the usual gross output concept which is commonly replaced by value added at the aggregate business sector level. The concept has also some other advantages as discussed above but it is not without its own difficulties, particularly when comparing component production activities to aggregate production activities.

At the aggregate business sector level, the concept corresponds to the usual real value added except when imports and other non-business commodities used as production factors are considered as primary inputs. In such a case, productivity growth estimates tend to be smaller than those based on real value added. The same consequence applies to the interindustry multifactor productivity indices which exhibit lower growth than when these same inputs are treated as other domestic intermediate inputs.

FEATURE ARTICLE 2

Aggregation, Integration and Productivity Analysis: An Overall Framework

By René Durand[27]

1 - Introduction

Vertical integration of production activities within the firm usually refers to its internal allocation of resources. Firms integrate vertically when they produce part of their own commodity inputs instead of buying these on the market. For instance, an automobile firm might buy a steel plant and produce its own steel instead of buying steel from a steel company. The internal allocation of resources of firms through vertical integration can be contrasted to the market allocation of resources between firms through exchange of goods and services. The more productive resources are allocated by the firms themselves through their internal organization, the less firms are interdependent for the purchase of their material and service inputs and the sale of their output. Therefore, vertical integration and market interdependence can be seen as the two opposite sides of the same coin. But clearly, production processes remain interdependent whether they are integrated by the firms or through exchanges of goods and services on the markets. Production processes transform primary inputs of capital and labour into intermediate inputs (raw materials and services) which are, in turn, transformed into other goods and services and so on up to their ultimate use, that is, in the jargon of the national accountants, up to their deliveries to final demand.

However, our perception of the production processes and, in particular, of productivity growth associated with the evolution of these processes through time, is greatly influenced by vertical integration as will be seen below. Vertical integration can be real as defined above or artificially created by transforming the data so as to "statistically" integrate the production process. Real vertical integration within the industry occurs when establishments, which previously exchanged goods and services, merge together. The transactions which were occurring between these establishments disappear from the statistical records as transactions are only reported at the establishment level. Similarly, statistical integration can be performed by not accounting for transactions between establishments as if they were integrated.

Aggregation of production activities refers to the transformation activities of a group of establishments. This group may be the industry at various SIC digit code level or the whole business sector. Aggregation can be performed by adding up, commodity by commodity, the input and output data of establishments. Alternatively, aggregated production data can be computed so as to exclude intraindustry sales, that is the sales of establishments to other establishments of the same industry. Aggregated activities of

[27] *The author wishes to thank Ian Stewart and Terri Markle for their valuable comments on an earlier draft of this paper. The author nevertheless remains solely responsible for errors and omissions.*

establishments may be integrated for analytical purposes by not taking into account the flows of goods and services between them as if these flows were internal to the establishments or equivalently, as if all establishments of the industry were merged into a single large establishment for which we would observe only the flows of inputs coming in and the flows of outputs coming out. In that case, it consists in a partial integration within the industry. Statistical integration may be extended to include interindustry transactions on commodity inputs as well. But, as will be seen below, integration can also be done without aggregation. Therefore, not only does real vertical integration have an impact on the measure of inputs and outputs of production activities but so does the manner in which the statistician or the economist computes inputs and outputs, particularly when aggregating over establishments within in an industry or industries within the economy. It may involve further integration (though not necessarily) of production processes. In changing the measure of inputs and outputs of production processes, integration significantly affects productivity measurement.

That vertical integration and aggregation are two distinct and independent dimensions of productivity analysis is one of the most important notion which is discussed in this article. Productivity can be measured without statistically integrating production activities vertically nor is such integration limited only to cases when aggregation is performed. Aggregation can be performed without integration and vice versa.

Once the above distinctions related to integration and aggregation are recognized, a general analytical framework follows that encompasses most productivity models that appear in the literature. This framework provides a powerful tool to clarify issues and debates about the advantages and weaknesses of alternative productivity models. This will be illustrated by the many examples which will be presented in the article. The framework also lays a better foundation for all of the productivity models presented in this publication as well as other models still in development which are also briefly described in this article.

Rymes[28]'interindustry model is first contrasted with the traditional neoclassical productivity model at the industry level of aggregation. The analytical framework provides support to intuition in understanding the aggregation weights for industries' productivity indices to the aggregate business sector level. In particular, it helps understanding why the aggregation weights of the neoclassical industry productivity indices add to more than one or, what amounts to the same, why aggregate productivity is larger than the average of individual industries' productivity.

The choice of the appropriate gross output measure at the industry level, that is gross output net or not of intraindustry sales, is discussed next. The choice between the value added and the gross output concept is clarified in the following section where the value added model is also compared with the final demand commodity model and the interindustry model. Gollop's[29] (1982) model of an open economy is examined next and compared to the traditional view which measures aggregate productivity on the basis of real value added. It provides the framework to assess the merits of the alternatives of including or not imports into the set of primary inputs for an open economy.

Integration proceeds by linking productive processes across establishments, industries or economies on the basis of their exchange of input commodities. These include all intermediate inputs and, at the international level, imported commodities used as inputs. Imports are often classified as primary commodities in economic analysis. These commodities all share the property of being produced commodities as opposed

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

[29] *Gollop, F.M., "Growth Accounting in an Open Economy" in A. Dogramaci (ed.) Developments in Econometric Analysis of Productivity, Measurement and Modelling Issues, Kluwer Nijhoff Pub., Boston, The Hague, London, 1982.*

to capital and labour. But capital goods, although they are accumulated over many periods, are also produced commodities over which, consequently, it would appear reasonable to integrate production processes. However, such an integration cannot be done within the *static* production framework. Integration over capital goods can only be done through time by extending the analytical framework to cover many periods. This leads us to introduce and discuss a last productivity model with its corresponding dynamic productivity index number formula.

2- The Impact of Integration on Productivity Measurement

In general, vertical integration increases measured productivity growth. As interdependent activities reinforce one another, their joint productivity, when integrated, is higher than the average productivity of the isolated activities. This can be seen as follows. When an establishment uses inputs from other establishments of its industry it is, from the integrated group's perspective, as if it were using indirectly the inputs of its suppliers. It therefore incorporates the productivity gains made on the production of these inputs (now being assumed to be own production) with those made on its own use of these inputs. Integrating the activities of establishments within an industry, that is, taking into account their interdependence, yields a larger estimate of the industry's productivity gain then simply averaging its establishments' productivity gains.

From another perspective, integration can be seen as transforming the inputs of the production process. Intermediate inputs (purchased raw materials and services) of a production process are replaced by the inputs used to produce them. With further integration, the latter inputs may, in turn, be replaced by the inputs of the supplying industries and so on. In the process, *intermediate* inputs, that is *produced* inputs, are replaced by both other intermediate inputs and some *primary*, that is by *non-produced*, inputs. Full integration (both within and across industries) means that all produced inputs are transformed into primary inputs by linking all production processes together and looking only at what goes in and what comes out of the whole set of processes as if all of them were carried out by a single establishment. As primary inputs generally grow at a smaller rate than intermediate inputs because of the productivity gains which are made on the production of the latter, substitution of primary inputs for intermediate inputs lead to higher productivity growth estimates.

In the appraisal of productivity gains, whether and to what degree interdependence should be taken into account must be determined by the purpose of the analysis. Productivity is a relative concept, not an absolute concept, which depends on the perspective of the analyst. The productivity of an industry, for instance, is not a completely defined concept, the reason being that it may be considered from different perspectives, ranging from the perspective of its establishments as components of the industry to the perspective of the industry as an integrated component of the aggregate economy. The appropriate perspective to be taken depends on the degree to which the integration (interdependence) of the productive activities to wider economic activities is deemed analytically important. Some phenomena can only be explained with the proper integration perspective as shown below. The degree of integration is not just a matter of taste.

For example, from an economy wide integration perspective, that is taking into account all interindustry transactions, an industry uses either *directly or indirectly* (through purchases of goods and services from its suppliers) part of the economy's available inputs of capital and labour to produce some bundle of commodities. From that perspective, the industry is viewed as a fully *integrated* component of the set of business industries. This perspective leads to the *interindustry* index of multifactor productivity discussed in Appendix 1, *Basic Concepts and Methods*, of Part 2 of this publication. From a narrower perspective of

a single industry, it uses capital and labour *plus purchased materials and services* to produce some bundle of goods or services which are sold *directly* to other producers or to final demand markets. The industry is viewed as an isolated (non integrated) economic entity, that is without considering its links to other industries. This is the neoclassical *industry* perspective also developed in Appendix 1. This article further develops and extends these ideas.

3 - The Industry versus the Interindustry Model

Rymes has argued that intermediate inputs, because they are produced inputs, should have a different status than primary inputs. The argument is that since these inputs are themselves outputs of the productive system, they incorporate productivity gains of their originating industries. These productivity gains must be incorporated in the assessment of the productivity of any industry. Neoclassical productivity theory fails to take these gains into account and therefore underestimate productivity growth. This would explain why individual industry productivity gains must be "inflated" to obtain aggregate productivity gains[30].

Rymes' arguments for the interindustry model can be cast in terms of integration. The logic is as follows: when an industry is using intermediate inputs, it is, in fact, indirectly using the inputs of the industries producing these intermediate inputs. But these latter industries are indirectly using the inputs of their upstream suppliers. If we consider all industries simultaneously, it amounts to saying that industries are directly and indirectly buying primary inputs from all upstream industries. Their outputs are therefore related to their own primary inputs and those of their upstream suppliers instead of their own primary and intermediate inputs as in the neoclassical model. Industries are all *vertically integrated*. The perspective or integration level clearly covers all intermediate inputs (all interindustry links) so that production is expressed as a function of the primary inputs of the business sector while the focus is some particular bundle of commodities (gross output) produced by a given industry. The level of integration, which can be characterized by the set of interindustry relationships which are taken into account and which, in the present case, covers all industries of the business sector, differs from the level of aggregation which is the industry. In the neoclassical world, integration is fixed at the establishment level at all levels of aggregation, including the industry level on which attention is presently drawned, except for the total business sector. In the latter case, neoclassicals assume full integration. Thus, the productivity estimates for the interindustry and the industry models differ except at the total business sector level. In general, the interindustry productivity estimates tend to be larger than the neoclassical industry productivity estimates as the rate of growth of primary inputs is smaller than the rate of growth of intermediate inputs. Indeed, if productivity is positive, intermediate inputs, which are also outputs of the productive system, must have a larger rate of growth than the primary inputs used in their production. Again, integrated activities generally show larger productivity gains than the average over the productivity gains of the component activities.

Considering these two models in terms of aggregation, however, the neoclassical model changes perspective when aggregating industries' productivity gains to the total business sector level. Aggregation is effectively done *with* integration of industries. Vertical integration in a statistical sense is implicitly performed when industries' productivity gains are aggregated to the total business sector level using recognized procedures such as those suggested by Domar and Hulten[31]. That is, when productivity gains

[30] *Hulten also proposes the same integrated* ***interindustry*** *measure of productivity at the industry level when he distinguishes between productivity changes* ***originating in*** *a sector and the* ***impact*** *of productivity changes* ***on*** *the sector. See Hulten (1978),"Growth Accounting with Intermediate Inputs", Review of Economic Studies, pp.511-518.*

[31] *Hulten Charles R. op. cit..*

of individual industries are aggregated to the total business sector, something more than averaging their productivity gains is actually taking place. The aggregation rule effectively integrates vertically all establishments into a single large establishment whereby inter-establishments transactions cancel out. Intermediate inputs vanish in the process leaving only primary inputs and, as a counterpart, real value added. This integration process affects substantially the resulting measure of aggregate productivity, as shown on figure 3 of the first feature article, and is the single fundamental factor which explains why aggregate productivity growth is not simply a weighted average of industries' productivity growth. This implicit integration explains why aggregation weights sum to more than one. These weights are the gross outputs of industries (non-integrated measure) into the total value added of the economy (integrated measure). In the interindustry model, the integration level is the total business sector level for both the industry and the business sector. This also explains why aggregation weights sum to one. These weights are the final demand delivery shares of industries into total final demand deliveries. Taking into account only final demand deliveries and the associated primary inputs used directly or indirectly corresponds closely to the production function of final demand commodities.

Both productivity models are useful as it is informative to look at industries' productivity from the perspective of both integration levels. Managers from the industry's establishments may be interested to the neoclassical productivity measure to compare their performance with the average performance of the industry uniquely over the transformation process over which they have some control. On the other hand, an economist interested in the comparative advantage of an economy in the production of some goods at the international level might prefer to look at the productivity of the whole set of production activities involved.

4 - The Choice of Gross Output

Productivity growth is simply defined as the rate of growth of output minus the rate of growth of inputs of some economic unit. Though that is a simple statement, a good deal of controversy on applied productivity analysis focuses on the question of how to correctly define outputs and inputs at various levels of aggregation, from the establishment level to the aggregate economy level. In particular, controversy has occurred on the measurement of an industry's output as either its gross output, its gross output net of intraindustry sales, or its real value added. The latter measure of output has been dismissed by many analysts but, as we shall see below, it may be worthwhile reconsidering.

The controversy between gross output and gross output net of intraindustry sales can be understood again as a question of perspective on integration. Gross output net of intraindustry sales corresponds to the idea of what goes in and out of the industry. It consists in a partial vertical integration of establishments over their sales to other establishments of the same industry. In other words, it uses only within industry interdependence links. Domar[32] (1961), in fact, applies (see his rule II) the net gross output concept to the productivity of any "sector" aggregate such as total manufacturing, not only to the productivity of the total business sector aggregate.

The interindustry model just discussed integrates establishments upstream both within and across industries. The level of integration exceeds the level of aggregation. In the gross output net of intraindustry sales model, the level of aggregation and the level of integration coincide. They are both at the industry level.

[32] *Domar himself was aware of the importance of integration in aggregation as he was looking for an aggregation rule which was invariant the actual degree of integration in the real world. He achieved that result by statically integrating fully all industries together.*

In the gross output framework, these levels differ. Integration is at the establishment level while aggregation is at the industry level.

It may be argued that maintaining both integration and aggregation at the same level is preferable as it provides a "smoother" aggregation rule than in the traditional neoclassical model in which industries' output is taken to be the gross output at any level of aggregation except at the total business sector level. Indeed, the higher the level of aggregation, the more important intraindustry sales are in proportion to total intermediate inputs so that net intermediate inputs gradually and smoothly vanish towards zero when going from disaggregated industry levels to the aggregated business sector level. Net-gross output similarly converges gradually toward value added as aggregation goes. This avoids the difficult abrupt switch from a gross output measure at very aggregated levels, such as total goods industries and total services industries, to value added at the business sector level. This switch has always been felt as uneasy in applied productivity analysis.

As a counter argument, one may argue that, as the integration level changes with aggregation, components cannot be compared to their corresponding aggregates. Aggregate manufacturing industries' productivity gains are larger than the weighted average productivity gains of individual manufacturing industries[33]. Similarly, establishments' productivity gains are smaller, on average, than the productivity gains of the integrated establishments or industry. Integration, indeed, implies, for the reason explained in section 2, that aggregation weights sum to more than one. But, it may well be interesting for comparative analysis of establishments' productivity gains to their industry or industries' productivity gains to their industry group, not to integrate when aggregating. Again, it is all a matter of perspective and this perspective must be chosen by considering the context of the particular issue at hand. Clearly, however, it seems that the larger an aggregate is, the less interesting might be its comparison with its fine components so that net gross output would appear to be a more interesting concept than gross output at high aggregation levels. Net gross output based productivity measures also have the advantage of being less sensitive to real intraindustry integration change through time. On the other hand, comparisons of productivity gains across industries might be better based when on a gross output concept as the importance of intraindustry sales vary across industries. Because of that, net-gross output based productivity measures are so not immediately comparable between industries. From what precedes, one may draw the more general conclusion that productivity measures can only be numerically compared when they refer to the same integration level while aggregation does not affect their comparability.

5 - Value Added versus Gross Output

Value added is often rejected as a measure of output for productivity analysis at the industry level on the ground that, unless some strong separability conditions are met[34], the resulting productivity estimates differ from the "correct" productivity estimates based on the gross output model. This idea, of course, rests on the premise that there exists a uniquely correct absolute value of productivity which is independent of the analytical context. But again, it may be shown that this choice too can be understood in terms of perspective on integration and is much more a matter of analytical purpose. If the integration level which is considered is the establishment level, the correct measure of output is the gross output measure.

[33] *It must be noted here that, in the interindustry model, the productivity estimates remain the same when using the net-gross output rather than the gross output.*

[34] *These conditions basically mean that intermediate inputs and primary inputs form two separate groups of inputs such that intermediate inputs can be subtracted from gross output as in the double deflation method.*

Industries are then looked as groups of establishments operating in isolation from one another. However, in the perspective of their full integration to the business sector level, value added may appear as a valid measure of output at the industry level. Real value added must, however, be measured differently from the usual manner based on the double deflation method[35]. Real value added must be computed as the deflated direct and indirect contributions of an industry to final demand commodities. Each nominal contribution of an industry to a final demand commodity delivery is deflated by that commodity price and the deflated commodity contributions of the industry are aggregated on the basis of the Divisia principle[36].

Industries are seen, in such a perspective, as being integrated together, joining their capital and labour resources to produce final demand commodities. It is thereby describing a quite different production process and consequently, the resulting productivity estimates differ from the neoclassical productivity estimates. In that context, separability appears as a false issue. Indeed, the separability question makes sense only if value added and gross output are conceptually contrasted at the same level of integration as is the case when real value added is measured with the double deflation technique. But value added need not (and should not) be considered as an output measure at the industry integration level because its meaning essentially rests on the industries' direct and indirect contribution to final demand deliveries, that is on a full integration perspective. In the non-integrated perspective, real value added simply does not meaningfully exist and cannot be compared to gross output.

The main advantage of the value added based productivity measures would be their insensitiveness to the "thickness"[37] of the industry that is, to the importance of intermediate inputs in total costs. Industries' productivity measure would all be defined at the same (full) level of integration and would be fully comparable both across industries and through time. Value added based productivity measures are easily computed from the neoclassical measures by multiplying the latter by the ratios of gross output to value added. It can be shown that such an integration rule is quite general: Whenever integration proceeds over some intermediate inputs on both sides of the productivity equation, the integrated productivity measure is always equal to the non-integrated productivity measure multiplied by the ratio of the non-integrated output to the integrated output[38].

As the interindustry productivity measure (defined on gross output) is, similarly to the value added productivity measure, an industry aggregation level productivity measure from a full integration level perspective, it is certainly interesting to investigate the differences between these two measures. The interindustry measure corresponds, in fact, to a group of vertically integrated industries rather than to a single industry while the value added measure corresponds to an individual industry component of that group at the same level of integration. One advantage of the value added based productivity measures is that double counting, which appears in the interindustry measure, is suppressed. Indeed, in the interindustry measure, primary inputs are taken into account both as direct primary inputs in their industry and as indirect primary inputs in the downstream industries. As a consequence, the vertically integrated industry groups overlap and primary inputs are counted many times. For instance, the steel product vertically integrated industry group is also, partly, a component of the automobile vertically integrated industry group. The automobile industry group is using the same primary inputs as the steel industry group to the extent that

[35] *This method consists in deflating the industries' outputs and inputs and subtracting the deflated inputs from the deflated outputs.*

[36] *See Durand, R. "An Alternative to Double Deflation for Measuring Real Industry Value Added", Statistics Canada, Input-Output Division, March 1990.*

[37] *On this, see also Domar (1961), p.726.*

[38] *In the interindustry model discussed above, integration was performed only on the input side while maintaining output fixed so that this rule did not apply.*

the automobile industry is using steel. The industries which are located downstream to the steel industries are using all of the steel industry group primary inputs except if some of the steel is delivered to final demand. It follows that, in order to count the contribution of primary inputs only once, only the vertically integrated industries delivering to final demand must be considered when aggregating. This explains, once more, the aggregation rule in the interindustry model: the aggregation weights are the final demand delivery weights of industries. But productivity gains made on final demand deliveries of industries, in the interindustry model, correspond to productivity gains made on the same final demand commodities in the final demand commodity productivity model[39]. Integration is identical in both models and, as a consequence, both models are identical[40]. They provide productivity measures on commodity outputs whether these outputs are gross or net. It follows that the interindustry and the final demand models should not be drastically opposed as it is sometimes done.

The final demand model is just itself a condensed view of a more general framework expressing productivity gains both by commodity and industry and which corresponds to the deflated industries' contributions by final demand commodity referred to above. The final demand commodity model aggregates productivity gains over industries' contributions corresponding to specific commodities while the value added model aggregates these gains over the commodities' contributions of specific industries. In both cases, aggregation proceeds while the integration level remains fixed at the business sector interdependence level. Aggregated results are therefore identical and aggregation weights sum to one in all those cases. It can be shown, indeed, that these aggregation weights are given by the ratios of commodity value shares in total final demand in one case and industries' value added to the business sector value added, in the other case.

6 - The Closed versus the Open Economy Model

Gollop[41] has advocated that the traditional approach to measure productivity at the aggregate business sector level was incorrect in an open economy. Output of the business sector is not the business sector's value added but its deliveries to final demand. This is equal to final demand net of final demand imports. Materials imported as inputs, correspondingly, enter in the input set jointly with capital and labour. As the integration level is lower than when productivity is defined with respect to real value added, productivity growth is also lower in that model.

Again, Gollop's recommendation is to fix both aggregation and integration at the same level. What must be considered is what goes in and out of the business sector. However, doing so, it can be shown that the productivity gains associated with international economic integration are not taken into account. Gollop's model corresponds to the view that, though open, each economy operates in isolation from one another. To see why, let us consider two economies which are trading in raw materials and service inputs. For the sake of simplicity, let us assume also that these two economies are closed to the rest of the world. In Gollop's model, the aggregate productivity of these two economies is measured on the production process which has, on the output side, the deliveries to the final demand and, on the input side, capital, labour and

[39] *The final demand commodity model expresses the productivity gains on each separate final demand commodity as the difference between the rate of growth of that commodity and the rate of growth of the primary inputs used directly and indirectly in its production.*

[40] *Except for the trivial distinction, in a rectangular input-output framework, that the productivity gain associated with a final demand commodity is a weighted average of the productivity gains of the possibly many industries producing that commodity.*

[41] *Gollop, F.M., op. cit.*

imported inputs. In the alternative traditional view, these same economies are seen as being integrated together. From that higher level of integration perspective, imports now appear simply as intermediate inputs. But at the aggregate level, these intermediate inputs become produced inputs which do not enter into the aggregate production function. The latter is specified only on value added on the output side and, on the input side, on capital and labour. The productivity gains of the integrated economy are therefore generally larger than the weighted average of the productivity gains of the component economies. The aggregation weights, once more, add up to more than one.

From the higher integration perspective, the productivity gains are higher because the benefits from economic integration resulting from trade are taken into account. Those benefits are excluded from Gollop's measure. As, over the long run, real income accruing to primary inputs depends essentially on productivity growth from an integrated perspective, Gollop's model, consequently, could not explain the growth in the real price of capital and labour services[42].

To conclude, once more, both models have their merits. They ask and answer different questions. Their value does not rest on one being better than another but on how well they answer to the question which is at stake and on how relevant that question is.

7 - Integration through Time: A Dynamic Perspective

Capital goods are produced commodities over which industries can be linked. However, industries, in any time period, are not directly providing capital services to one another. Capital services can rather be seen as being provided by asset holders. The latter buy their capital goods (through, say, financial markets) which they accumulate and lend to the firms against a rental income. At the time capital goods are purchased, they are part of capital goods industries' deliveries to final demand. Productivity gains are realised on the production of these capital goods in each period so that their production requires less and less primary inputs as time goes. This simply means that households holding the assets now have to sacrifice less consumption goods (that is to save less) than in the past to obtain the same capital goods. The capital stock, therefore, grows through time both because of savings and because of technical progress in the capital goods producing industries and their upstream suppliers.

It may be argued, from an economic standpoint, that the sacrifice done by households through their savings, and for which they are paid for, is the postponement of their consumption. Households basically supply labour (sacrifice leisure) and postpone their consumption (wait). Technical progress is a free gift of nature and cannot be considered as a production factor. It follows that only that part of the capital stock originating from savings should be considered as an input. The growth of the capital stock resulting from technical progress should be accounted for in the productivity residual.

The amount of consumption forgone per unit of capital is decreasing through time as just mentioned so that the real cumulated value of the waiting sacrifice is growing less rapidly than the cumulated capital stock. In other words, for the same waiting sacrifice, the growth in the capital stock is larger when capital goods

[42] *There is an additional issue in the present case, which is to determine how productivity gains should be shared between the two economies. Business sector final demand deliveries can be distributed on the basis of domestic and foreign factor income. Growth in the production originating from imported inputs uses, measured on the basis of these shares, should exceed, if productivity gains are positive, the growth in the real value of the imported inputs. This difference could be interpreted as being the net gain received by the domestic factors resulting from international trade. Thus, the real gross domestic product would still be the most adequate measure of domestic factor income as in a closed economy.*

producing industries register productivity gains than otherwise. Taking waiting as *the primary input* in place of the capital stock, or integrating over capital goods through time, therefore, leads to larger productivity gains estimates than when using the traditional measure of the capital stock.

The latter, in a time perspective, appears as an intermediate input in that it is the transformation of waiting inputs into capital goods which are themselves totally re-used by industries as inputs to produce consumption goods. Indeed, the capital stock is never consumed and capital goods are not part of final output when considering an infinite time horizon. It may be argued that, over a limited horizon, the capital stock can be looked at as a pure stock of wealth in that it only represents future consumption. It may also be argued along the same lines that, in such a perspective, the capital stock should be deflated by a consumption price index[43]. To complete the picture, waiting services inputs should be measured as the number of some base year units of consumption foregone consumed in the production process, that is as a kind of depreciation of the accumulated stock of waiting[44].

8 - Concluding Remarks

As illustrated by a few examples which, to the exclusion of the dynamic indices, are reproduced on figure 1, the application of the analytical framework into which aggregation and integration are seen as two independent dimensions of productivity analysis, one determining the object of analysis and the other the perspective, can be a powerful tool. But integration is not just a matter of perspective; it is also a matter of fact. Industries are integrated (that is interdependent) components of the business sector of any economy as well as the latter is an integrated component of productive economies at the international level. Some facts can only be explained by models into which integration as a perspective correspond to integration in the real world. We have raised such a point with respect to the analysis of the prices of capital and labour services when discussing the merits of Gollop's open economy versus the "closed" economy model.

Rymes had raised a similar issue with respect to the prices of intermediate inputs. How can it be, he was arguing, that intermediate input prices do not grow faster than output prices as a result of productivity gains? According to the neoclassical view, indeed, input prices must grow faster than output prices if productivity is growing. This is, in fact, simply the dual expression for productivity growth measurement. But this is paradoxical as intermediate inputs are also outputs of the same productive system and must have the same prices as outputs. Rymes concludes from that paradox that the neoclassical productivity model must have something wrong. Of course, this is just a matter of perspective again. But clearly, only the perspective of full integration is capable of explaining the paradox. That is, prices can be explained only into a general equilibrium framework into which interdependence are taken into account, not into the partial equilibrium isolated industry model.

[43] *For a more detailed discussion, see Durand R., "Growth accounting and the quality adjustment of the capital stock", Statistics Canada, Input-Output Division, February 1990.*

[44] *Capital services are usually assumed to be proportional to the stock of capital which is equivalent to assume that they are equivalent to depreciation only when the latter is a fixed proportion of the existing net stock. This happens only when depreciation is geometric.*

Figure 1

Classification of alternative productivity models into the integration-aggregation framework.

Integration \ Aggregation	Establishment	Industry	Group of industries	Business sector
Establishment	Neoclassical industry gross output	Neoclassical Industry gross output	Neoclassical Industry gross output	Not used
Industry	Not used	Neoclassical net-gross output	Not used	Not used
Group of industries	Not used	Not used	Neoclassical net-gross output	Not used
Business sector	Not used	Interindustry gross output Industry value added	Interindustry gross output Industry value added	All Models Including final demand

Similarly, if balanced growth in the original Solow[45] model was compatible only with Harrod neutral technical progress, it was because productive processes were not integrated through time over capital goods. This fixed the relative price of capital goods with respect to consumption equal to one, leaving no room for technical progress to increase the real price of that input. But the price of waiting can increase similarly to the price of labour through time under the action of technical progress as more capital or consumption units per unit of waiting can be obtained. Only this larger integration perspective can be used to relax the unduly restrictive assumption made by Solow on technical progress.

Finally, it seems that there would be some advantages of using full integration productivity measures at both the Industry and aggregate level as Integrated measures are free from the changing degree of real integration of establishments through time and as they ease cross-industry comparisons. This would leave

[45] *Solow. R.M., "A Contribution to the Theory of Economic Growth", Quarterly Journal of Economics, LXX, 1 (February,1956), pp. 65-94.*

the interindustry/final demand model and the industry value added model as the preferred choices both cast in terms of the dynamic framework into which integration proceeds over capital goods through time.

Table 1 - Indexes of *industry gross output* multifactor productivity for selected industries, (1986=100), aggregation level PS*

Year	Business sector	Agricultural & related services industries	Manufacturing industries	Construction industries	Transportation, storage & comm. industries	Wholesale & retail trade industries
1961	74.6	71.8	81.2	90.2	57.5	71.1
1962	77.9	83.0	83.8	91.7	58.0	73.8
1963	80.3	89.6	85.2	91.7	61.1	75.1
1964	82.7	84.6	86.9	92.1	64.3	77.7
1965	84.2	87.1	88.1	91.7	65.8	79.6
1966	85.2	93.9	88.0	90.8	67.5	82.1
1967	83.3	82.2	87.1	91.7	68.1	83.6
1968	85.9	84.9	88.7	93.4	70.3	84.1
1969	87.7	88.6	90.2	92.2	73.8	85.0
1970	87.7	84.1	89.2	92.7	76.9	86.6
1971	90.7	92.7	90.6	93.5	77.7	88.1
1972	93.3	87.1	92.5	92.8	80.0	90.4
1973	96.5	90.9	94.7	92.0	81.9	91.1
1974	94.0	81.5	94.7	91.0	82.4	89.9
1975	92.0	87.4	92.4	94.9	83.4	90.5
1976	95.4	92.3	94.4	97.6	84.1	93.4
1977	95.6	90.0	96.0	98.4	84.9	91.9
1978	95.8	87.9	96.7	97.0	87.9	90.8
1979	96.1	83.9	96.7	95.6	92.4	91.4
1980	95.0	86.0	95.6	97.9	91.7	91.8
1981	95.2	90.7	96.5	101.1	92.1	91.6
1982	90.4	93.5	94.0	103.4	90.4	89.4
1983	93.8	92.7	96.6	103.4	93.4	94.8
1984	98.0	93.2	99.6	101.2	97.5	95.9
1985	99.1	92.2	100.6	99.2	98.5	98.3
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	101.0	98.3	99.9	100.4	103.5	103.0
1988	102.7	..	..	..	..	..
1989	102.4	..	..	..	..	..

* Appendix 3 concords with other aggregation levels

Table 2 - Indexes of *industry net-gross output* multifactor productivity for selected industries, (1986=100), aggregation level PS*

Year	Business sector	Agricultural & related services industries	Manufacturing industries	Construction industries	Transportation, storage & comm. industries	Wholesale & retail trade industries
1961	78.0	69.6	75.8	90.2	54.4	70.6
1962	80.9	80.8	79.1	91.7	54.8	73.4
1963	83.1	87.4	80.9	91.6	58.1	74.7
1964	85.2	82.4	83.0	92.1	61.4	77.3
1965	86.5	84.9	84.6	91.7	62.9	79.2
1966	87.4	91.7	84.5	90.8	64.7	81.8
1967	85.7	79.9	83.4	91.7	65.3	83.4
1968	88.0	82.6	85.4	93.3	67.6	83.8
1969	89.5	86.4	87.3	92.2	71.3	84.7
1970	89.6	81.8	86.1	92.7	74.6	86.3
1971	92.1	90.6	87.8	93.5	75.4	87.9
1972	94.3	84.9	90.3	92.8	78.0	90.2
1973	97.1	88.8	93.2	92.0	80.0	91.0
1974	94.9	79.2	93.2	91.0	80.6	89.7
1975	93.3	85.2	90.2	94.9	81.6	90.3
1976	96.1	90.2	92.8	97.6	82.4	93.3
1977	96.3	87.8	94.9	98.4	83.3	91.8
1978	96.5	85.7	95.8	97.0	86.5	90.6
1979	96.7	81.6	95.8	95.6	91.5	91.3
1980	95.8	83.7	94.3	97.9	90.7	91.7
1981	95.9	88.6	95.5	101.1	91.2	91.4
1982	92.0	92.0	92.2	103.4	89.3	89.2
1983	94.9	91.1	95.7	103.4	92.7	94.7
1984	98.4	91.6	99.4	101.2	97.1	95.9
1985	99.2	90.3	100.7	99.2	98.4	98.2
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.9	97.9	99.9	100.4	104.0	103.1
1988	102.3	..	..	..	..	..
1989	102.0	..	..	..	..	..

* Appendix 3 concords with other aggregation levels

Table 3 - Indexes of *interindustry* multifactor productivity for selected industries, (1986=100), aggregation level PS*

Year	Business sector	Agricultural & related services industries	Manufacturing industries	Construction industries	Transportation, storage & comm. industries	Wholesale & retail trade industries
1961	78.0	62.1	70.7	77.3	55.4	67.6
1962	80.9	72.8	74.9	80.9	56.3	70.8
1963	83.1	79.5	77.6	82.1	59.6	72.5
1964	85.2	75.9	79.8	84.8	63.4	75.5
1965	86.5	78.7	81.7	85.6	65.1	77.6
1966	87.4	85.7	82.3	85.2	66.9	80.5
1967	85.7	74.2	80.5	84.6	67.1	81.2
1968	88.0	77.7	83.0	87.8	69.8	82.2
1969	89.5	81.6	85.8	87.5	73.6	83.5
1970	89.6	77.2	84.5	87.9	76.9	85.2
1971	92.1	86.3	87.2	89.9	78.1	87.3
1972	94.3	81.6	90.1	90.9	81.3	90.1
1973	97.1	85.4	94.5	91.4	84.0	91.4
1974	94.9	76.8	92.9	89.5	84.1	89.7
1975	93.3	82.5	89.4	91.4	84.3	89.8
1976	96.1	87.8	92.9	95.1	85.3	93.1
1977	96.3	85.4	94.6	96.0	86.2	91.6
1978	96.5	83.0	95.3	95.2	89.1	90.6
1979	96.7	79.1	95.5	94.3	94.1	91.4
1980	95.8	80.9	93.2	96.0	92.8	91.6
1981	95.9	85.5	93.6	98.8	92.8	91.1
1982	92.0	87.5	89.5	97.6	89.9	87.6
1983	94.9	88.6	93.5	99.9	93.7	93.5
1984	98.4	90.5	98.6	100.4	97.7	95.5
1985	99.2	89.9	100.2	99.5	98.8	98.0
1986	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.9	98.5	100.4	101.1	104.1	103.2
1988	102.3	..	..	..	..	..
1989	102.0	..	..	..	..	..

* Appendix 3 concords with other aggregation levels

Table 4 - Indexes of *industry gross output* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Food industries	Beverage industries	Tobacco products industries	Plastic products industries	Rubber, leather & allied prod. ind.
1961	91.1	87.0	94.2	64.6	75.6
1962	92.4	88.4	92.9	65.4	80.9
1963	92.3	92.0	95.5	68.2	81.5
1964	93.2	92.9	97.2	71.6	83.3
1965	94.1	95.4	99.4	72.7	83.2
1966	93.5	101.3	96.3	74.1	84.5
1967	94.4	102.6	94.3	73.3	84.0
1968	94.7	99.1	93.3	83.4	84.6
1969	94.5	102.9	96.8	86.8	85.3
1970	94.7	105.4	98.5	84.1	84.2
1971	96.7	107.3	102.5	85.8	85.3
1972	96.8	108.1	104.9	89.5	85.1
1973	97.7	112.5	106.2	91.8	87.4
1974	97.6	110.6	109.1	87.8	85.1
1975	96.1	107.5	107.7	84.4	83.0
1976	98.9	106.6	106.7	85.4	89.0
1977	99.9	109.0	114.3	87.4	93.9
1978	99.8	108.2	109.0	91.2	96.8
1979	99.9	108.2	110.0	95.4	98.7
1980	98.8	106.9	110.7	93.6	95.6
1981	98.5	105.6	110.2	97.2	95.0
1982	98.9	102.2	109.8	94.9	92.8
1983	98.7	101.0	106.8	98.3	96.7
1984	99.5	102.0	105.4	101.5	103.7
1985	100.5	101.8	100.6	102.6	104.3
1986	100.0	100.0	100.0	100.0	100.0
1987	99.8	100.9	105.6	99.2	102.3

* Appendix 3 concords with other aggregation levels

Table 4 - Indexes of *industry gross output* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Textile, textile prod. & clothing industries	Wood industries	Furniture & fixture industries	Paper and allied products ind.	Printing, publishing and allied ind.
1961	69.7	75.1	87.4	97.3	83.4
1962	72.9	77.8	89.7	97.6	85.0
1963	74.9	80.7	92.0	98.6	85.3
1964	75.4	81.9	91.8	100.9	84.7
1965	74.9	82.4	94.5	99.4	84.3
1966	74.6	82.3	95.7	98.6	84.9
1967	74.2	83.7	95.2	94.7	85.1
1968	76.9	86.2	96.3	95.2	85.8
1969	78.2	86.2	98.6	97.9	86.6
1970	77.7	86.2	95.9	97.4	85.5
1971	79.8	85.1	97.2	96.8	85.9
1972	82.5	82.3	103.5	99.5	88.4
1973	83.6	82.8	106.7	102.0	91.3
1974	83.6	82.8	97.7	103.9	90.8
1975	84.5	81.2	96.1	90.9	91.7
1976	86.5	84.4	101.3	98.1	96.3
1977	88.7	87.0	102.2	98.8	99.4
1978	92.2	85.8	106.2	102.1	101.7
1979	94.4	85.8	104.1	101.4	100.9
1980	94.0	88.6	102.2	101.4	101.3
1981	95.3	88.7	103.3	99.7	101.4
1982	91.3	86.7	93.6	93.9	96.8
1983	95.0	91.8	98.5	98.2	98.8
1984	96.6	96.3	100.9	99.4	101.6
1985	97.6	99.8	101.8	99.6	101.1
1986	100.0	100.0	100.0	100.0	100.0
1987	100.8	100.7	95.4	100.9	98.0

* Appendix 3 concords with other aggregation levels

Table 4 - Indexes of *industry gross output* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Primary metal industries	Fabricated metal products ind.	Machinery industries	Transportation equipment ind.	Electrical & electronic products ind.
1961	88.5	80.0	84.5	70.2	65.8
1962	90.6	84.0	88.6	73.5	70.7
1963	91.5	85.8	91.0	76.4	71.4
1964	93.3	89.0	95.0	77.1	74.2
1965	95.1	91.6	95.6	80.0	75.8
1966	94.6	91.8	97.0	78.5	76.6
1967	92.2	90.7	95.5	81.0	72.9
1968	95.1	92.6	94.5	83.3	75.2
1969	95.7	93.0	97.1	87.1	77.3
1970	95.1	91.4	96.2	83.6	76.6
1971	94.6	93.5	98.1	87.7	73.3
1972	96.3	95.2	99.0	90.7	77.0
1973	98.3	97.7	100.9	94.3	80.7
1974	99.2	98.7	102.1	94.8	80.5
1975	96.1	95.1	98.5	96.8	78.9
1976	93.6	96.9	99.0	97.8	81.9
1977	96.7	97.5	100.6	98.9	84.5
1978	98.2	98.1	102.8	98.5	83.9
1979	94.7	95.1	106.2	98.1	89.8
1980	92.7	96.2	104.5	92.6	93.2
1981	95.3	98.0	101.7	94.5	94.3
1982	89.9	95.6	93.5	93.1	90.9
1983	94.7	96.8	91.9	96.2	91.2
1984	98.8	100.4	98.8	100.2	97.2
1985	100.9	102.1	99.5	101.3	99.2
1986	100.0	100.0	100.0	100.0	100.0
1987	102.1	98.5	98.5	97.3	101.0

* Appendix 3 concords with other aggregation levels

Table 4 - Indexes of *industry gross output* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Non-metallic mineral products industries	Refined petroleum and coal products	Chemical & chemical products ind.	Other manufacturing industries
1961	83.2	85.2	73.1	87.5
1962	88.8	89.7	75.2	89.5
1963	89.9	90.6	77.3	88.4
1964	93.1	92.6	80.1	91.8
1965	94.7	94.4	81.9	91.6
1966	94.6	96.1	81.7	93.4
1967	89.0	92.2	80.1	91.0
1968	92.1	94.1	80.6	93.9
1969	93.7	92.4	81.8	95.7
1970	92.1	92.7	81.4	93.9
1971	98.0	93.1	84.1	95.5
1972	104.9	92.9	86.3	99.3
1973	102.2	96.4	90.3	101.1
1974	97.7	95.9	90.4	100.8
1975	94.7	96.4	85.3	99.1
1976	95.3	95.8	87.1	104.1
1977	94.2	98.8	86.9	104.9
1978	95.5	96.6	88.9	105.7
1979	96.0	95.3	90.6	104.4
1980	90.2	95.7	88.4	101.9
1981	89.6	97.8	91.4	103.2
1982	83.9	100.0	86.7	102.4
1983	89.4	101.7	94.2	101.9
1984	94.1	102.3	97.3	105.7
1985	98.2	101.2	98.8	106.3
1986	100.0	100.0	100.0	100.0
1987	102.1	101.2	102.0	100.4

* Appendix 3 concords with other aggregation levels

Table 5 - Indexes of *industry net-gross output* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Food industries	Beverage industries	Tobacco products industries	Plastic products industries	Rubber, leather & allied prod. ind.
1961	89.8	86.6	92.5	63.6	73.8
1962	91.2	88.0	90.9	64.5	79.6
1963	91.1	91.8	94.1	67.3	80.3
1964	92.1	92.7	96.1	70.8	82.3
1965	93.1	95.3	98.7	71.9	82.2
1966	92.4	101.5	95.0	73.4	83.5
1967	93.5	102.9	92.5	72.5	83.1
1968	93.8	99.2	91.3	82.9	83.7
1969	93.6	103.2	95.6	86.4	84.4
1970	93.8	105.7	97.6	83.7	83.2
1971	96.1	107.8	102.5	85.4	84.4
1972	96.3	108.6	105.4	89.1	84.2
1973	97.4	113.2	107.1	91.6	86.6
1974	97.1	111.2	110.6	87.4	84.2
1975	95.4	108.0	108.9	83.9	81.9
1976	98.7	107.0	107.7	84.9	88.3
1977	99.8	109.5	117.0	86.9	93.5
1978	99.8	108.7	110.6	90.9	96.6
1979	99.9	108.7	111.7	95.3	98.6
1980	98.6	107.3	112.6	93.4	95.3
1981	98.2	105.9	112.0	97.1	94.7
1982	98.7	102.3	111.5	94.7	92.3
1983	98.4	101.1	107.9	98.3	96.5
1984	99.4	102.2	106.3	101.6	103.9
1985	100.6	101.9	100.7	102.7	104.6
1986	100.0	100.0	100.0	100.0	100.0
1987	99.7	101.0	106.5	99.2	102.4

* Appendix 3 concords with other aggregation levels

Table 5 - Indexes of *industry net-gross output* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Textile, textile prod. & clothing industries	Wood industries	Furniture & fixture industries	Paper and allied products ind.	Printing, publishing and allied ind.
1961	62.1	72.9	87.1	97.1	82.4
1962	66.0	75.8	89.5	97.3	84.1
1963	68.5	79.0	91.8	98.5	84.4
1964	69.0	80.3	91.6	101.1	83.7
1965	68.5	80.8	94.4	99.4	83.3
1966	68.1	80.7	95.6	98.5	83.9
1967	67.6	82.3	95.1	94.1	84.1
1968	71.0	85.0	96.2	94.6	84.9
1969	72.6	85.1	98.6	97.7	85.7
1970	71.9	85.0	95.8	97.1	84.6
1971	74.6	83.8	97.1	96.4	85.0
1972	78.0	80.8	103.7	99.5	87.7
1973	79.3	81.3	106.9	102.4	90.8
1974	79.4	81.3	97.6	104.6	90.2
1975	80.5	79.5	96.0	89.8	91.2
1976	83.0	83.0	101.4	97.9	96.1
1977	85.7	85.9	102.3	98.6	99.4
1978	90.1	84.6	106.4	102.3	101.9
1979	92.9	84.5	104.2	101.5	101.0
1980	92.4	87.6	102.3	101.6	101.4
1981	94.1	87.7	103.4	99.6	101.5
1982	89.0	85.6	93.4	93.1	96.5
1983	93.7	91.1	98.5	97.9	98.7
1984	95.7	95.9	101.0	99.3	101.7
1985	96.9	99.8	101.9	99.5	101.2
1986	100.0	100.0	100.0	100.0	100.0
1987	101.1	100.7	95.2	101.0	97.8

* Appendix 3 concords with other aggregation levels

Table 5 - Indexes of *industry net-gross output* multifactor productivity for manufacturing industries, (1986=100) aggregation level PM*

Year	Primary metal industries	Fabricated metal products ind.	Machinery industries	Transportation equipment ind.	Electrical & electronic products ind.
1961	86.6	78.3	83.9	67.0	63.2
1962	89.0	82.6	88.2	70.7	68.3
1963	90.0	84.6	90.6	74.1	69.1
1964	92.1	88.2	94.7	74.8	72.2
1965	94.2	90.9	95.4	78.2	73.9
1966	93.6	91.2	96.9	76.5	74.8
1967	90.9	90.0	95.4	79.3	70.8
1968	94.2	92.0	94.3	81.8	73.3
1969	94.9	92.5	97.0	86.1	75.6
1970	94.2	90.7	96.0	82.2	74.8
1971	93.6	93.0	98.0	86.7	71.2
1972	95.6	94.9	99.0	89.9	75.2
1973	97.8	97.6	100.9	93.8	79.2
1974	98.8	98.7	102.2	94.3	79.0
1975	95.3	94.8	98.4	96.4	77.2
1976	92.5	96.8	99.0	97.5	80.4
1977	96.1	97.4	100.6	98.7	83.3
1978	97.7	98.0	103.0	98.3	82.6
1979	93.7	94.8	106.6	97.9	89.0
1980	91.5	96.0	104.7	92.0	92.7
1981	94.5	97.9	101.8	94.0	93.8
1982	88.2	95.3	93.1	92.5	90.2
1983	93.7	96.6	91.5	95.9	90.5
1984	98.5	100.4	98.7	100.2	97.0
1985	101.0	102.3	99.5	101.4	99.2
1986	100.0	100.0	100.0	100.0	100.0
1987	102.4	98.4	98.4	97.2	101.1

* Appendix 3 concords with other aggregation levels

Table 5 - Indexes of *industry net-gross output* multifactor productivity for manufacturing industries, (1986=100) aggregation level PM*

Year	Non-metallic mineral products industries	Refined petroleum and coal products	Chemical & chemical products ind.	Other manufacturing industries
1961	81.6	85.0	69.4	87.1
1962	87.7	89.5	71.7	89.1
1963	88.9	90.4	74.0	88.0
1964	92.4	92.4	77.1	91.5
1965	94.2	94.3	79.1	91.3
1966	94.1	96.0	78.9	93.2
1967	87.8	92.1	77.1	90.7
1968	91.3	94.0	77.7	93.7
1969	93.1	92.3	79.0	95.6
1970	91.3	92.5	78.5	93.7
1971	98.0	93.0	81.5	95.3
1972	105.8	92.8	83.9	99.2
1973	102.7	96.3	88.3	101.1
1974	97.7	95.8	88.4	100.8
1975	94.2	96.3	82.6	99.0
1976	95.0	95.7	84.7	104.3
1977	93.7	98.7	84.5	105.1
1978	95.2	96.5	86.7	106.0
1979	95.7	95.2	88.7	104.6
1980	89.2	95.6	86.1	102.0
1981	88.5	97.7	89.8	103.4
1982	82.2	100.0	84.1	102.5
1983	88.3	101.8	93.0	101.9
1984	93.5	102.4	96.7	106.0
1985	98.0	101.2	98.5	106.6
1986	100.0	100.0	100.0	100.0
1987	102.4	101.2	102.5	100.4

* Appendix 3 concords with other aggregation levels

Table 6 - Indexes of *interindustry* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Food industries	Beverage industries	Tobacco products industries	Plastic products industries	Rubber, leather & allied prod. ind.
1961	71.8	77.5	76.0	55.4	65.4
1962	78.0	79.9	79.4	57.7	71.8
1963	80.8	84.1	84.9	61.0	73.3
1964	80.8	85.8	86.4	66.0	76.3
1965	83.2	88.7	89.9	67.2	76.6
1966	85.2	95.0	89.1	68.7	78.0
1967	81.3	95.3	82.0	67.3	77.2
1968	83.4	92.9	82.8	77.7	78.7
1969	85.1	97.5	88.9	81.9	80.1
1970	84.1	100.0	89.4	79.2	79.0
1971	90.0	103.0	97.4	81.8	81.0
1972	89.1	105.3	99.6	86.9	82.0
1973	93.0	111.6	103.3	91.4	85.4
1974	87.6	108.3	103.2	86.7	82.6
1975	87.1	103.6	102.6	80.6	79.1
1976	93.3	104.9	104.1	82.6	86.1
1977	93.9	107.4	112.7	84.1	91.2
1978	93.2	107.4	106.4	88.7	94.8
1979	91.4	107.3	106.5	95.1	98.0
1980	90.1	105.1	107.6	91.3	93.4
1981	91.8	104.2	108.5	95.4	93.3
1982	92.1	98.6	106.6	89.5	88.6
1983	93.2	99.0	104.8	95.7	94.2
1984	95.7	102.1	104.8	101.3	103.1
1985	97.1	102.2	99.3	102.2	104.2
1986	100.0	100.0	100.0	100.0	100.0
1987	99.6	101.3	106.5	100.8	102.9

* Appendix 3 concords with other aggregation levels

Table 6 - Indexes of *interindustry* multifactor productivity for manufacturing industries, (1986 = 100), aggregation level PM*

Year	Textile, textile prod. & clothing industries	Wood industries	Furniture & fixture industries	Paper and allied products ind.	Printing, publishing and allied ind.
1961	60.1	54.8	73.7	82.8	75.7
1962	64.1	58.1	77.3	83.2	77.4
1963	66.7	61.9	80.6	85.5	78.2
1964	67.7	64.2	82.1	89.2	78.6
1965	67.4	64.4	84.9	87.6	78.2
1966	67.5	64.5	86.2	87.4	79.0
1967	66.6	65.0	85.3	82.2	78.2
1968	70.1	69.2	87.9	84.3	79.6
1969	71.5	70.6	91.1	88.3	81.2
1970	71.3	71.5	88.6	88.1	80.3
1971	74.2	70.8	90.6	88.0	81.0
1972	77.5	70.0	97.9	92.7	84.8
1973	79.3	70.8	102.3	96.6	88.7
1974	79.1	70.7	93.1	98.0	88.1
1975	80.0	66.9	89.4	80.9	86.0
1976	82.9	71.9	95.9	90.5	92.6
1977	85.5	74.5	97.4	91.6	96.0
1978	90.1	74.0	102.1	95.7	99.4
1979	93.0	74.2	100.6	95.4	98.8
1980	92.3	77.8	98.3	95.1	99.1
1981	93.5	77.7	99.6	92.9	98.7
1982	87.6	75.2	87.2	84.9	91.9
1983	92.2	84.1	95.0	92.5	96.3
1984	95.5	93.1	99.7	97.1	100.9
1985	96.8	97.9	101.6	98.6	100.9
1986	100.0	100.0	100.0	100.0	100.0
1987	101.5	101.6	95.8	102.5	98.5

* Appendix 3 concords with other aggregation levels

Table 6 - Indexes of *interindustry* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Primary metal industries	Fabricated metal products ind.	Machinery industries	Transportation equipment ind.	Electrical & electronic products ind.
1961	85.8	71.6	75.6	60.7	53.3
1962	86.3	77.3	80.7	65.2	59.0
1963	87.1	80.1	84.8	68.9	59.9
1964	92.1	84.8	90.3	70.5	63.1
1965	93.9	88.3	91.7	74.3	65.2
1966	91.3	88.6	93.2	72.9	66.4
1967	90.1	86.7	90.7	75.4	62.4
1968	92.5	89.7	90.9	78.5	64.9
1969	93.2	91.1	93.9	83.2	67.5
1970	91.8	89.6	93.2	79.4	66.5
1971	88.3	91.4	95.4	84.0	64.2
1972	91.6	93.8	97.6	88.0	69.6
1973	99.4	98.6	101.3	93.0	74.4
1974	94.3	99.1	102.5	93.3	74.6
1975	88.9	92.7	96.8	94.2	72.1
1976	87.8	94.8	98.1	95.8	75.8
1977	90.4	95.8	99.9	97.0	78.5
1978	93.8	96.8	102.3	96.9	77.9
1979	88.6	93.7	106.1	96.7	85.3
1980	86.6	93.2	103.3	90.5	89.7
1981	86.1	94.9	100.7	92.5	90.9
1982	81.6	89.1	89.8	89.5	86.9
1983	87.5	93.4	89.6	94.2	88.2
1984	97.0	100.6	98.3	99.9	96.7
1985	101.0	103.1	99.6	101.4	99.0
1986	100.0	100.0	100.0	100.0	100.0
1987	106.8	99.0	98.9	97.5	101.5

* Appendix 3 concords with other aggregation levels

Table 6 - Indexes of *interindustry* multifactor productivity for manufacturing industries, (1986=100), aggregation level PM*

Year	Non-metallic mineral products industries	Refined petroleum and coal products	Chemical & chemical products ind.	Other manufacturing industries
1961	62.0	97.4	62.8	77.8
1962	67.3	104.0	65.5	80.2
1963	68.7	106.5	68.7	80.2
1964	73.4	111.1	72.1	84.6
1965	76.0	114.1	74.8	84.7
1966	75.4	118.1	75.6	86.6
1967	73.3	113.7	73.4	83.4
1968	76.9	118.2	75.1	87.3
1969	79.7	117.2	77.4	90.0
1970	77.9	120.6	78.2	88.3
1971	83.1	122.1	82.4	90.7
1972	90.5	126.7	85.3	96.1
1973	93.8	135.4	90.7	99.6
1974	92.0	131.8	90.8	98.3
1975	89.1	125.7	84.7	95.0
1976	91.7	121.1	86.9	101.4
1977	90.4	122.8	87.8	101.8
1978	93.7	114.6	89.5	103.1
1979	95.3	115.9	91.7	102.1
1980	87.6	108.1	88.1	99.7
1981	85.6	104.2	91.7	101.0
1982	77.9	102.7	84.6	98.2
1983	86.4	104.8	91.7	99.4
1984	93.8	106.0	96.3	105.5
1985	97.6	105.0	98.9	106.2
1986	100.0	100.0	100.0	100.0
1987	104.2	105.4	103.0	101.0

* Appendix 3 concords with other aggregation levels

APPENDIX 1

Basic concepts and methods

1 - Multifactor productivity in a nutshell

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

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

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

At the industry level, two alternative but complementary indices of multifactor productivity are proposed. One 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.

The first index, based on the most usual concept of multifactor productivity, measures the productivity gains taking place within a business 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 ones called primary, which are the labour and capital inputs, and the intermediates, which are the material and service inputs purchased from other industries. This index does not take account of the

productivity gains which take place in the industries which produce these intermediate inputs[46]. We will refer to this index as the *industry* index.

The alternative productivity index presented here does. It is based on the *interindustry* concept[47] of multifactor productivity which is relatively new. This index takes into account the productivity gains realized within an industry as well as within all industries directly or indirectly supplying that industry. 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 sense, the interindustry productivity index takes into account all the primary inputs which have been used in *the business sector of the economy 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 production sector of the economy rather than as an isolated entity.

At the aggregate business sector level, i.e., when considering the productivity of all business sector industries combined, both indices refer to the same outputs and inputs. They consequently give the same results for the total business sector gross domestic product.

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

2 - The concept and measurement of productivity

The *level* of productivity is a ratio between the level of production of some economic units and the quantity of inputs they use. Although there may be alternative ways to compute the productivity ratio, all of these consist in combining all the goods and services produced into a single *aggregate output index* and, likewise, all of the production factors used into a single *aggregate input index*. The aggregation of the goods and services produced or used in the production process requires that these goods and services be measured in some common units. These units in economics, similarly to the weight and size units of physics, are naturally taken to be the relative values of the goods and services on the market at some specific point(s) in time. Each quantity of a commodity is therefore attributed a weight according to its contribution to the value of the aggregate of which it is a part of. Thus, the larger the quantity produced (used) of a commodity and/or the higher its price relatively to other commodities, the larger will be its importance in the value of all goods and services produced (used) and the larger will be

[46] *Except possibly for intermediate inputs originating from the industry itself as will be explained below.*

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

its importance in the aggregate output (input) index[48]. The multifactor productivity index *level* is computed as the ratio of the aggregate output index level to the aggregate input index level. Productivity *growth* is positive if the aggregate output index grows faster than the aggregate input index. Productivity decreases in the opposite case.

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

Correspondingly, on the input side, the measure of the index had to be inclusive of all purchased (and measurable) inputs which can basically be classified into two broad categories: (1) *intermediate* inputs which are comprised of the many goods (raw materials) and services purchased by the industries, and (2) *primary* inputs including labour inputs, capital inputs and natural resources. More formally, we consider as intermediate inputs those inputs which are produced and are consumed during the same period (usually a year) by the business sector of the economy. The primary inputs[49] are supplied from other sectors of the economy such as the household sector. As discussed further below, in an open economy context, imports and a few other variables can as well be included in the set of primary inputs.

In the actual implementation 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 some other investigators.

The multifactor productivity indices have an important advantage over the partial labour productivity indices. This advantage stems from the inclusiveness of all the major factors contributing to the growth of output in the economy. Output growth is accounted for by increases in productive capacity, the use of increased amount of various services and goods purchased by industries (including energy) and by labour. Output growth which is not accounted for by the growth of inputs is what we call productivity. Therefore, the more detailed and inclusive[50] is the list of production factors entering into the estimates, the more growth in output can be "explained".

[48] *This can be established more formally as the Divisia aggregation formula for a twice differentiable linearly homogeneous production function under competitive market conditions and profit maximisation.*

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

[50] *All input costs are taken into account but the quantities of these inputs are not broken down into perfectly homogenous categories through time. Some inputs are simply omitted and their costs reported under the capital costs which are computed residually. Externalities are also neglected.*

The explanation is cast, it is true, only in descriptive terms in that it shows the apportionment of output growth between the major contributing factors. But it may be pursued much further. One may attempt, for instance, to relate the increasing efficiency of labour to various factors such as basic education, on the job training, improvements in working conditions, changes in managerial style, etc. Such an attempt has not been undertaken here as our main purpose is to focus on the development of the database and on measurement issues, in order to provide to the user community the basic elements necessary to carry the analysis further.

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 attempt 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 all 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 the labour productivity, in that it precisely allows the decomposition of increased labour productivity between the portion which comes from the contribution of the other production factors, and the portion which comes from other factors explaining the increased efficiency of labour such as education. The labour productivity indices regularly published in this publication do not allow such a decomposition.

3 - Which production activities?

In the application of the concept of productivity, inputs and outputs must be clearly identified. They may refer to the entire Canadian economy and/or to various components of the economy. These components, in the 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 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..."[51]. An industry is defined, in the System of 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"[52]. Industries include both business and non business establishments but can be sectored to include only business establishments. The productivity indices presented in this publication refer only, either explicitly or implicitly, to business establishments.

The productivity of the government sector is not covered as it cannot be computed at the present time within the framework of the System of National Accounts. The latter adopts indeed as a convention (for lack of a better alternative) to measure the output of the government sector as being equal to its primary input use. As a consequence, the growth in outputs cannot diverge from the growth in inputs as required for a meaningful productivity measure.

[51] *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).*

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

The productivity indices, therefore, provide an accounting record of the effectiveness with which business establishments make use of the economy's resources through time. To make the interpretation of these indices more precise, we still need to clarify further how they are actually derived. Basically, we need to define more precisely the sets of inputs and outputs used in their compilation both conceptually[53] and empirically (see Appendix 2).

4 - Which resources and how they are measured

Unemployed resources are excluded from the computation of productivity. Thus, for example, the labour input is measured by employment (and will eventually be measured by hours worked) rather than by 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 waste 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.

Secondly, employed resources may not be fully utilized as is often the case in the downturn phase of the business cycle. Labour hoarding is a classical example. The productivity indices presented here do not correct for the short run under-utilization of employed resources and, consequently, do not track perfectly the evolution of the technological possibilities (potential efficiency). Over the short run, the indices will reveal, in addition to improvement in technical possibilities, a loss of efficiency, if any, related to the under-utilization of the employed resources. This sensitivity of the productivity indices to business cycle fluctuations is not without its own advantages. Many would argue that what counts is the measure of the *actual* efficiency with which business firms use production factors at a given time rather than the *potential* (maximum) efficiency of the production factors, were they fully utilized. Only over the long run, that is from peak to peak use of employed resources, will the indices reveal the increased productivity associated with the existing technological possibilities in either the form of change in that technology (technical progress) or a better use of all of the available technologies (scale economies).

5 - Alternative measures of multifactor productivity

5.1 Two concepts of industry. Basically, two distinct notions of an industry are considered which include different groups of production activities. The first notion corresponds to the traditional view and is based on the definition of an industry as the set of establishments producing similar goods and services. Such an industry transforms purchased goods and services (intermediate inputs) by using its own capital and labour services (primary inputs).

Starting with the industry, as traditionally defined, the latter rarely carries all of the transformations from basic minerals 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

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

production of automobiles but it is not part of the transformation processes of the automobile industry itself. If one is interested in the productivity of all the production processes involved in the production of the output of the automobile industry, one would *integrate* the productivities of activities of all industries having participated in such production. This would embrace the industry directly involved in the manufacture of automobiles (the automobile industry) as well as those industries indirectly involved in supplying the automobile industry with all the necessary parts, materials and services (all the "upstream" industries, such as the steel industry). The *interindustry* productivity estimates presented here are based on this notion of industries and, therefore, refer to the productivity of groups of industries linked to each other by the flow of intermediate goods and services.

The *vertically* integrated industry produces the same output bundle as the traditional industry (say automobiles) but, as it comprises an enlarged group of activities, it uses a different set of inputs. Its inputs also comprise own capital and purchased labour services. However, it looks behind the purchase of goods and services from other industries at the inputs used by these upstream industries to produce the goods and services purchased.

In the example of the automobile industry, the inputs are the capital and labour inputs of this industry and the intermediate inputs it purchases, say steel. The inputs of the steel industry are its own capital and labour inputs and the intermediate inputs it purchases, say steel ingots. In turn, the steel ingot industry has as inputs its own capital and labour and iron ore from a mine it owns. In 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, it takes the capital and labour of the automobile industry 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 sense, the interindustry concept integrates the contribution of upstream industries to the production of its output bundle.

As just mentioned, if one adopts the restricted point of view of an industry's participants, the sources of the industry's inputs, whether intermediate or primary, do not matter. From that point of view, 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 concerns lie 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 an open economy context, primary inputs can as well include imports and non-business supplies. Intermediate inputs, at the industry level as well as at the aggregate business sector level, do not count in the appraisal of productivity gains. Intermediate inputs are only important in that they provide a bridge-measure of the indirect usage of primary inputs by industries. The usage of the latter can only be computed from the intermediate input usage through the interindustry links. The interindustry productivity indices thus refer to a group of industries which are *computationally* vertically integrated.

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 integrate more or less vertically but also migrate from one industry to another as their output mix changes through time. By artificially fully integrating all industries vertically, the interindustry productivity indices become insensitive to such "statistical" influences. Indeed, they measure the productivity of the same production processes.

From the point of view of the economist 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, including up to 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 handicapped on the international automobile market because of the relative inefficiency of the industries which "feed" its motor vehicle industry.

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

5.2 Two concepts of gross output. As mentioned above, in addition to the standard gross output measure derived from the input-output tables, one may adopt another production concept for the purpose of estimating multifactor productivity: the gross output net of all intraindustry flows. According to Gullickson and Harper[54], "...removing intraindustry transactions assures that vertical integration or disintegration through time in the Census data do not bias the estimates." This advantage refers only to intraindustry integration while the interindustry measure introduced above possesses the same advantage over both intra- and interindustry sales.

The concept of net gross output has the further advantage of smoothing the aggregation process. With the traditional view, the concept of gross output is maintained at all levels of aggregation except at the total business sector level. This means that productivity of broad aggregates such as goods industries and services industries are defined on gross output while productivity of the business sector is defined on value added. Therefore, a switch is made abruptly from gross output on broad aggregates to value added at the business sector level. With the alternative measure of net gross output, the output measure converges gradually toward value added as, when moving to broader aggregates, intermediate inputs are progressively reclassified from interindustry sales to intraindustry sales and subtracted from gross output.

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

If the economic structure were simple, one industry producing one good or service, it would be easy to remove intraindustry transactions from inputs and outputs; however, in rectangular input-output tables, industries are producing many commodities and each commodity may be produced by many industries. In addition, imports and other non-business sources of supply must first be removed from commodity uses. For a given industry, it is therefore not trivial to identify the amount of an intermediate input being produced by that same industry. The only way to derive net gross output is to bring in an assumption about who produces the inputs of a given industry net of imports and other leakages. For this, we assume that the commodities used in an industry originate from all producing industries according to their production shares[55].

As an example, let's assume that the fabricated metal products industry makes 80% of total fabricated structural metal products and that 20% of it is being produced by the primary metal industries. Therefore, only 80% of the former industry's input, net of leakages, in fabricated metal products will be subtracted from inputs and total output in order to balance the input-output productivity database according to this concept of net gross output.

There is still an advantage in deriving productivity growth estimates based on gross output instead of net gross output. By doing so, it is possible to compare individual industries' productivity growth to the productivity growth of some aggregate they are part of since the latter is a weighted average of the former with weights summing to one. This is, however, not possible when using the net gross output concept since the productivity gain of the aggregate is a weighted average of the individual industries' productivity gains with weights summing to more than one.

6 - Aggregate business productivity

When considering the business sector as a whole, only primary inputs are given, as mentioned above. Intermediate inputs must be produced and, consequently, can be looked at equally as outputs of the production process. From that point of view, what counts is the amount of primary resources used by the business sector and, as a counterpart, the amount of goods and services delivered by the business sector for final consumption. Therefore, at the aggregate business sector level, output must be netted out of intermediate goods and services used as inputs. This also corresponds and is equal to the gross output net of intraindustry sales. But aggregate output may also be defined as gross output minus intermediate and primary *commodity* inputs, that is as real value added.

Correspondingly, on the input side, only primary inputs must be taken into account. These include principally capital, labour, natural resources and, in an open economy, imported inputs. To that list, all other inputs not produced by the domestic business sector may be added, that is government supply of goods and services, inventory depletion and other leakages, including the commodities produced by industries which have been reclassified as non business for the purpose of productivity analysis (see Appendix 3 of Part 2). The universe over which productivity indices are computed is then the *entire business sector*. From that point of view, *intermediate inputs* are just *intermediate outputs*, that is, an intermediate step in the production process rather than a final end as it was the case from the point of view of the isolated industry.

[55] *For technical details, see René Durand,"Productivity Analysis and the Measurement of Gross Output Net of Intraindustry Sales", Statistics Canada, Input-Output Division, January 1991.*

It is easy to see, from what precedes, that *net final demand* for commodities is equivalent to business value added, that is, to the value of total business output (gross output) minus the consumption of all commodity inputs. Similarly, final demand net of imports of final goods and other final uses of non-business supplies is equivalent to final demand deliveries of the business sector to which correspond all business primary inputs, including imports of raw materials. Hence, the alternative aggregate productivity indices can be seen as the index of productivity on net final demand[56] or the index of productivity on final demand originating from the business sector.

Relating the disaggregated productivity indices to their common aggregate counterpart for the whole business sector leads to the establishment of aggregation weights. The aggregation weights for the industry and the interindustry indices differ. Given that the interindustry indices integrate the productivity of all the industries associated directly and indirectly with the production of final demand deliveries, it follows that the aggregation weights are simply equal to the ratios of industries' final demand sales to the total business sector's final demand sales. These weights sum to one.

Similarly, for the industry productivity indices, both the productivity gains of the industries selling directly and those of the upstream industries selling indirectly to final demand have to be considered and weighted. But the productivity gains of the industries associated with final demand deliveries correspond, in this case to the productivity gains associated with the gross deliveries of all industries. It follows that the aggregation weights are given by the ratios of the value of industries' gross outputs (gross output net of intraindustry sales) to the business sector's value added (value of final demand deliveries). These weights sum to more than one.

To conclude, the productivity indices refer to a gross output (or net gross output) measure at the industry level and to value added (final demand deliveries) at the aggregate business sector level. Value added here is the sum of value added at factor cost (as defined in the System of National Accounts) and *Other Indirect Taxes*. The latter, which include mostly property taxes, are considered as part of gross capital income. Taxes paid on other primary inputs are also included such as import duties on imported imports. This is the case for both the traditional (isolated) industry and the alternative interindustry measures. Productivity in the government sector is not covered as it cannot presently be meaningfully computed.

7 - Usefulness of productivity indices in economic analysis

As indicated earlier, a principal role of 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 permits a more complete accounting of the sources of economic growth than the existing partial measures within the framework of the 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, multifactor productivity assessments help analysts and policy makers address such issues as domestic industrial policy and international industrial strategy. Similarly, businesses and

[56] *Final demand productivity indices by commodity could be computed but they are not presented here.*

other private organizations observe productivity movements to evaluate the long-term viability of various industries and formulate 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 scale economies 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 scale economies. 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

Multifactor productivity database description

1 - Introduction

The multifactor productivity database complements the industry and commodity database of the System of National Accounts by incorporating employment and capital stock data to fit the purpose of production analysis.

In order to derive multifactor productivity indices, prices and volumes of outputs and inputs are estimated from various sources. For outputs and intermediate inputs by industry, the data are obtained from the current and constant prices Canadian input-output tables[57]. Some transformations of these data are required to obtain better conceptual measures for the purpose of estimating multifactor productivity. They are summarized in this appendix. Some of these transformations were suggested by Rymes and Cas in an earlier study[58]. Primary input costs are also taken from input-output tables while their volumes are estimated from other sources. Labour input data are taken from the labour productivity program and their sources are described in Appendix 1 of Part 1 of this publication. Capital input data are described in a technical note which is summarized below[59]. The industry coverage of the "business sector" used for multifactor productivity estimates differs slightly from the usual definition of the national accounts in both Canada and United-States as explained in further detail in Appendix 3.

2 - Input-output commodity data

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

[57] *For informations on data sources and concepts, refer to* ***The Input-Output Structures of the Canadian Economy, 1961-1981 (Revised Data)****, Statistics Canada, Catalogue 15-510, Input-Output Division, 1987, pp. 1-127.*

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

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

As the proposed productivity measures are derived under the assumption of competitive market behaviour, it can be argued that outputs of industries should be valued at producers' prices while their inputs should be valued at purchasers' prices. The *Divisia* index of productivity growth, which is used here, rests, on the assumption of profit maximization behaviour of firms in competitive markets. This implies that the marginal product of each input be equated to its real price defined as the purchasing cost of the input including all margins divided by the net selling price of the output, excluding all margins. But as real margins represent real inputs which can be substituted for other inputs over the long run, they were considered as distinct inputs rather than included in the physical volumes of the other inputs. Tax margins were excluded from the input set. All commodity input and output volumes were therefore taken from the producers' prices input-output tables. In current prices, commodity taxes paid were added to the value of commodities purchased.

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

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

Since government goods and services cannot be substituted by other business industry supplies, they are added to primary inputs. As well, unallocated imports and exports of commodities are considered as part of the primary inputs. In general, all commodities which are not produced by the business sector as defined for productivity analysis (see section 5 below) are considered as primary commodities. This is the case, for instance, of postal services. For neoclassical productivity estimates, this classification of inputs is immaterial. It does have an incidence, however, on the interindustry estimates.

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

3 - Labour Input at Current and Constant Prices

The measure of labour input volumes includes employment of paid employees and employment of other-than-paid employees (self-employed and unpaid family workers). These series have the same sources as the ones used for the labour productivity measure described in this publication. Although hours-worked by type of employment would constitute a better conceptual measure of labour input, they are not currently available for all industries[60]. In order to allow for comparison of productivity estimates between industries, we are thus confined to use employment count as labour input volume estimates. Labour costs are the current dollar values of wages and salaries, supplementary labour income and labour income of the self-employed.

[60] *In United-States, person-hours are used.*

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

4 - Capital Input at Current and Constant Prices

The input of capital services for a given year is assumed to be proportional to net capital stock in constant prices at the end of the previous year. The choices of a net rather than a gross capital stock measure or of a convex rather than a concave depreciation curve are still open issues which will require further research[61]. The capital stock excludes investment done during the current year as the latter are not yet, in general, productive.

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 business and non business establishments, not only for the business industries like in the case of input-output tables. Capital assets for industry segments have been estimated, removed from some industry groups and reclassified to others so as to maximize the number of concordant industry classes. Non-business industry capital stocks were estimated and removed from the industries where significant sectoring differences were known to exist: namely, non-metal mines, chemical and chemical products industries, miscellaneous manufacturing industries, railway transport and related service industries, and other utility industries.

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

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

APPENDIX 3

Aggregation parameters for multifactor productivity measures

For the purpose of deriving multifactor productivity growth rates, the inputs in goods and services were taken from the input-output tables in their most disaggregated level[62] (about 600 commodities). However, it was not possible to use the industries' outputs or inputs 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 109 business sector industries (including Postal Services for which no capital data are yet available). For analytical purposes, two other aggregation levels were built: 29 industries (level PM) and 11 industries (level PS). These levels were determined to be as close as possible to the M and S levels of industry classification of input-output tables. It is hoped that further developments of the capital database will eventually allow a full reconciliation of the PM and PS aggregation levels with the corresponding M and S levels and that these developments will extend the PL level closer to the L level.

The industrial coverage of the business sector in both Canada and United-States departs slightly from the current definition of the System of National Accounts as some components were excluded. In Canada, these are Owner Occupied Dwellings (industry L 141), Postal Service (industry number L 131), Other Utility Industries nec (L 134) and Government Royalties on Natural Resources (industry number L 140). Owner Occupied Dwellings and Government Royalties on Natural Resources were considered as improperly defined industries for productivity analysis while capital stock data were not available for the Postal Service Industry and Other Utility Industries. In United States, capital stock data are also responsible for the exclusion of all government enterprises as well as owners occupied dwellings from the aggregate measure of multifactor productivity. The business sector excluding these components is called the *private business sector* in the U.S. accounts.

Tables 4 through 6 establish the concordance between the input-output L level and the multifactor productivity database PL, PM and PS levels of aggregation. In a few cases, and again because of capital stock data limitations, multifactor productivity estimates refer to a somewhat different group of industries from those regularly published in the labour productivity section: as showed in Table 5, at the PS level, Communication Industries were grouped with Transportation & Storage Industries, Wholesale and Retail Trade Industries were also grouped together; as shown in Table 6, at the PM level for Manufacturing Industries, Leather & Allied Products Industries were grouped with Rubber Products Industries, Clothing Industries were grouped with Primary Textile & Textile Products Industries.

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

Text table 4 - Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries

PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
1	Agricultural & related services ind.	011-017 021-023	001-021	001-021	1
2	Fishing and 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	0617,0621 0622-0625 0629,063	071-073 0791-0799 061	061,071 073,077 079	7-10
6	Crude petroleum & natural gas	071	064	064	11
7	Quarrying, sand pits & mining serv.	081,082	083,084 091,092 099	083,087 096,098	12-13 092-099
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 product industries	106,109 1051-1052 1081-1083	105 1081-1083 1089	124,125 131,133 135,139	20,23,24
14	Biscuit, bread & other bakery prod.	1071-1072	1071,10721	128,1291	21,22
15	Beverage industries	111-114	1091-1094	141,143 145,147	25-28
16	Tobacco products industries	121,122	151,153	151,153	29
17	Rubber & footwear products ind.	151-159 1712	1623,1624 1629,174	161,163 169,174	30,33
18	Plastic products industries	161-169	1651,27332	27332,3851	31
19	Leather tanneries	1711	172	172	32
20	Misc. leather & allied prod. ind.	1713,1719	179	179	34

Text table 4 - Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries

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

Text table 4 - Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries

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

Text table 4 - Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries

PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
65	Misc. transportation equipment ind.	328,329	328,329	328,329	81
66	Small electrical appliance industry	331	331	331	82
67	Major appliances (elec & non-elec.)	332	332	332	83
68	Record players, radio & tv receiver	334	334	334	84
69	Electronic equipment industries	335	335	335	85
70	Office, store & business machines	336	318	318	86
71	Communications, energy wire & cable	338	338	338	87
72	Other elect. & electronic products	333,337 3391-3399	268,333 336,3391 3399	268,336-337,339	88-89
73	Clay products industry	351	351	351	90
74	Cement industry	352	352	341	91
75	Concrete products industry	354	354	347	92
76	Ready-mix concrete industry	355	355	348	93
77	Glass & glass products industries	356	356	356	94
78	Non-metallic mineral products nec	357-359	353,357-359	343,345 352-355 357,359	95
79	Refined petroleum & coal products	361,369	365,369	365,369	96
80	Industrial chemicals industries nec	371	371	378	97
81	Plastic & synthetic resin industry	373	373	373	98
82	Pharmaceutical & medicine industry	374	374	374	99
83	Paint & varnish industry	375	375	375	100
84	Soap & cleaning compounds industry	376	376	376	101
85	Toilet preparations industry	377	377	377	102
86	Chemical & Chemical Products nec	372,379	372,379	371-372 379	103

Text table 4 - Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries

PL Codes	Industry Title	1980 SIC	1970 SIC	1960 SIC	Link Code
87	Jewellery & precious metal ind.	392	392	382	104
88	Sporting goods & toy industries	393	393	393	105
89	Sign and display industry	397	397	397	106
90	Other manufacturing industries nec	391,3991-3994,3999	391,3991-3994,3999	381,383 384,395 398,399	107-108
91	Construction industry	401-449	404-421	404-421	109-117
92	Air transport & services incidental	451,452	501-502	501-502	118
93	Railway transport & telecommun.	453,482,483	503,544,545	506,544 545	119,130
94	Water transport & rel. Services	454,455	504,505	504,505	120
95	Truck and other transport ind.	456,4572-4575,4589 4592,4599 996,9991	506-508 517,519	507-508 517,519	121,123 125
96	Urban transit system industry	4571	509	509	122
97	Highway & bridge maintenance ind.	4591	516	516	126
98	Pipeline transport industries	461	515	515	127
99	Storage and warehousing industries	471,479	524,527	524-527	128
100	Telecomm. broadcasting ind.	481	543	543	129
101	Postal services (not used)	4841	548	548	131
102	Electric power systems industry	491	572	572	132
103	Gas distribution systems industry	492	574	574	133
104	Wholesale & retail trade ind.	501-599	602-629	602-629	135,136
105	Finance, insurance & real est. ind.	701-705 709,711-729,731-733,741-743,7499 7511,7512 759,761	7011-7016 7019,7211, 7212,703-715,735 7371	702,704 7312,735 7371	137-139

Text table 4 - Concordance between the PL aggregation level and the link level of aggregation of industries of input-output tables

PL Level Industries

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

Text table 5 - Concordance between the PS aggregation level and the input-output link aggregation level.

PS Level Industries

PS Codes	Industry Title	Link Code	PL Code
1	Agricultural & related services ind.	1	1
2	Fishing & trapping industries	2	2
3	Logging & forestry industries	3	3
4	Mining, quarrying & oil well industries	4-13	4-7
5	Manufacturing industries	14-108	8-90
6	Construction industries	109-117	91
7	Transportation, storage & communication industries	118-123* 125-130	92-100*
8	Other utilities industries	132,133**	102,103**
9	Wholesale and retail trade industries	135,136	104
10	Finance, insurance & real est. ind.	137-139	105
11	Community, business, person. serv. ind.	124,142-154***	106-109***

* Postal service and taxicab excluded.
** Other utilities n.e.c. excluded.
*** Taxicab included

Text table 6 - Concordance between the PM aggregation level and the input-output link aggregation level.

PM Level Industries
Manufacturing

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

APPENDIX 4

Quality ratings of multifactor productivity and related data.

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

The productivity quality assessment of multifactor productivity estimates is based on a two-tier quality rating system. Ratings are first assigned to the data sources and, second, ratings are given to the composites obtained from the data. At the level of individual data sources, a quality rank of 1 is given to the most reliable census data, a rank of 2 is given to census data of a lower quality and to survey data providing reliable information, while a 3 rating is used to identify acceptable data from other sources. Data not meeting acceptable standards are ranked 4 and are not used in the productivity estimates. The same ordering is used to quantify the quality of the composites.

The quality ratings of the productivity data sources coincides with the data quality ratings of the source. Thus, inputs and outputs in current and constant prices from the Input-Output tables carries the quality ratings of the tables as described in Appendix A of *The Input-Output Structure of the Canadian Economy*, Catalogue 15-201. The quality ratings of employment and labour compensation are discussed in the Labour Productivity part of this publication. Capital stock data quality is based on the ratings of business investment as given by the Input-Output tables. Because the return to capital services in current prices is calculated residually as the difference between production value and non-capital input cost, its quality rating depends on the qualities of current and constant price revenues and non-capital inputs.

Quality assessment cannot be made without considering changes in census, survey and estimation techniques over time and across industries. Nor can it be made without due regard to changes in the relative importance of the components. In addition, quality depends on whether the estimates are preliminary and subject to revision as opposed to more reliable benchmark estimates which are revised less often and to a minor degree. This suggests that it is preferable to publish annually only the quality ratings for the most recent benchmark years. Text tables 7 and 8 give the ratings for aggregate multifactor productivity corresponding to the 1987 benchmark year.

Text table 7 - Quality ratings of the components of multifactor productivity estimates by industry at aggregation level PS and for the business sector industries, 1987.

Industry Title	Gross output		Labour inputs		Capital inputs		Interme-diate inputs		GDP		Value added MFP	Gross Output MFP	Net Gross Output MFP
	C$	K$	C$	pers.*	C$	K$	C$	K$	C$	K$			
Agricultural & related serv. ind.	2	2	2	3	2	2	2	2	...	...	...	2	2
Manufacturing industries	1	1	1	1	2	2	2	2	...	...	...	1	1
Construction industries	1	2	2	2	3	3	3	3	...	...	...	3	3
Transportation, storage and communication	1	2	2	2	2	3	2	2	...	...	...	2	2
Wholesale and retail trade	1	2	2	2	2	3	3	3	...	...	...	2	2
Business sector	...	...	1	1	1	2	...	...	1	1	1	...	1

* Persons at work

Text table 8 - Quality ratings of the components of multifactor productivity estimates by manufacturing industry at aggregation Level PM, 1987.

Industry Title	Gross Output		Labour Inputs		Capital Inputs		Interme-diate Inputs		Gross Output MFP	Net Gross Output MFP
	C$	K$	C$	pers.*	C$	K$	C$	K$		
Food	2	2	2	2	2	3	2	2	2	2
Beverage	1	2	2	2	2	3	2	2	2	2
Tobacco	2	2	2	2	2	3	2	2	2	2
Plastic	2	2	2	2	2	3	2	2	2	2
Rubber & leather	2	2	2	2	2	3	2	2	2	2
Textile, textile prod. & clothing	1	1	2	2	2	3	2	2	2	2
Wood	2	2	2	2	2	3	2	2	2	2
Furniture & fixture	1	1	2	2	2	3	2	2	2	2
Paper & allied	1	1	2	2	2	3	2	2	2	2
Printing, publishing & allied	2	2	2	2	2	3	2	2	2	2
Primary metal	2	2	2	2	2	3	2	2	2	2
Fabricated metal	2	2	2	2	2	3	2	2	2	2
Machinery	2	2	2	2	2	3	2	2	2	2
Transp. equip.	1	1	2	2	2	3	2	2	2	2
Electrical & electronic	1	2	2	2	2	3	2	2	2	2
Non-metallic mineral	2	2	2	2	2	3	2	2	2	2
Refined petroleum & coal	2	2	2	2	2	3	2	2	2	2
Chemical & chemical prod.	2	2	2	2	2	3	2	2	2	2
Other manufacturing	2	2	2	2	2	3	2	2	2	2

* Persons at work

APPENDIX 5

Multifactor productivity and related data in CANSIM

	CANSIM Matrices
Index since 1961	
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Net-gross output productivity	7901
Interindustry productivity	7903

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