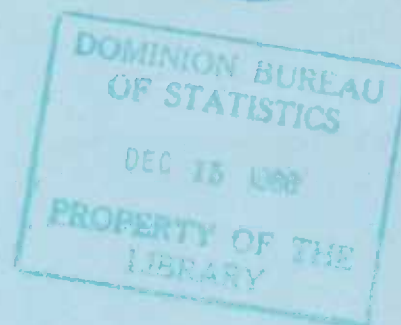


CATALOGUE No.

14-502 C-3

OCCASIONAL



PRODUCTIVITY TRENDS IN INDUSTRY

REPORT No. 1

SYNTHETIC TEXTILE MILLS

BREWERIES

PULP AND PAPER MILLS

1947-61

DOMINION BUREAU OF STATISTICS

1966

DOMINION BUREAU OF STATISTICS

Industry Division

Productivity Research and Analysis Section

BDLY 5270727 C.3.

PRODUCTIVITY TRENDS IN INDUSTRY 1947-61

REPORT No. 1

INDEXES OF OUTPUT PER PERSON EMPLOYED
AND PER MAN-HOUR, 1947-61:

SYNTHETIC TEXTILE MILLS
BREWERIES
PULP AND PAPER MILLS

Published by Authority of
The Minister of Trade and Commerce

December 1966
6505-502

Price: \$1.50

FOREWORD

This report initiates a new series of productivity studies in individual industries undertaken by the Dominion Bureau of Statistics in response to demands from a wide variety of sources. Industry, labour and government, as well as private researchers and international organizations, have for a long time recognized that productivity measures, expressed as ratios between output and one or more of the inputs used in its production, could provide useful yardsticks of change in the overall effectiveness of the productive process, whether for the individual plant or industry, or for the economy as a whole. As early as 1949, an interdepartmental committee on productivity analysis began to review the conceptual and measurement problems involved and the available data sources in Canada. The interest in questions of economic growth which began to develop in the mid-fifties gave further emphasis to the need for an official programme of productivity research and analysis, but it was not until fairly recently, however, that resources became available with which to pursue the original initiative.

First priority was given to the development of overall productivity measures, and in 1965 the Dominion Bureau of Statistics released a set of annual indexes of real output per unit of labour input for the commercial nonagricultural economy and its manufacturing and nonmanufacturing components. In the same year, data for agriculture were also included, thus extending the coverage of the series to the commercial economy as a whole. The measures are being kept up-to-date, and it is planned to provide progressively more analytical detail, so as to isolate some of the broader influences contributing to overall productivity change.

The need for productivity measures relating to individual industries is, however, hardly less compelling, particularly in view of current emphasis on the development of secondary industry. Productivity changes for broad aggregates such as Manufacturing undoubtedly conceal marked differences of performance among component industries, and it is the objective of this series of studies to make explicit some of these divergences. It is hoped that individual industry measures of productivity will provide standards of reference by which the performance of component establishments can be evaluated. Also, to the extent that international comparisons between similar industries can be made, they should shed light on the structural characteristics of Canadian industry and its international competitiveness. Again, industry productivity measures make possible more detailed forecasting of such related variables as output, employment, prices and wage rates.

The early publications in this series must be considered as pilot studies, which can be improved with experience and the further development of basic statistical data. In this connection, comments from users will be particularly welcome. The initial selection of industries for productivity measurement

was made from Manufacturing with the following criteria in mind: that the industries chosen be relatively important to the economy as a whole, that they represent a cross section of import-competing, export and domestic industries, and that there exist comparable measures for one or more major foreign countries. In addition to the three industries presented in this report, work is now in progress on the Iron and Steel Mills, Agricultural Implement, Sugar Refineries, and Hosiery Mills industries. In the future, it is planned to extend these studies to cover major group aggregates such as Food and Beverage, Tobacco Products, Paper and Allied Industries, and eventually to individual nonmanufacturing industries.

The measures presented in this report relate output to a single input only, labour time. This is partly for reasons of the relative ease of measurement and availability of labour data as compared with those of capital inputs and because labour cost is a major component of value added in production. Nevertheless, labour productivity indexes, as they are sometimes called, have a more fundamental justification because of man's dual role as producer and consumer. Better utilization of the most basic productive resource, which these indexes seek to measure, is the only way by which our standard of living can be improved. It must be emphasized, however, that changes in output per unit of labour input cannot be attributed directly and solely to labour. These measures reflect not only changes in the skills and effort of the labour force, but also the contribution of other productive resources with which it works, as well as the effectiveness with which all are combined and organized for production.

On the output side, both gross and net measures of real output have been developed which, in conjunction with the alternative concepts of labour input used, make possible a choice of productivity measures for other uses. The time period covered does not, in this first instance, extend beyond 1961, but it is hoped that the studies can be updated fairly soon and kept as current as the availability of basic data permits.

The industry studies programme was developed by D. A. Worton, Chief of the Productivity Research and Analysis Section of the Industry Division, under the general direction of V. R. Berlinguette, Director, who participated in the work of the interdepartmental committee previously referred to. This report was prepared by the staff of the Industry Productivity Measures Unit under the supervision of M. Lafontaine. The interest and co-operation of other officials of the Bureau is also acknowledged, particularly that of G. J. Garston, Chief of the Industrial Output Section, National Accounts and Balance of Payments Division. Mention must also be made of the contribution of various representatives of the three industries concerned, whose advice was extremely valuable in the preparation of the report.

WALTER E. DUFFETT,
Dominion Statistician.

NOTE

The term "persons employed", when used in this report, covers paid workers plus working owners and partners engaged in the production of output. This is in contrast to the definition used in the Bureau's aggregate productivity reference paper (Indexes of Output per Person Employed and per Man-hour in Canada, Commercial Nonagricultural Industries, 1947-63, DBS Catalogue No. 14-501), where unpaid family workers are also included. In addition, the aggregate productivity measures relate output to total employment only, whereas in this report a distinction is made between production and related workers and administrative and office employees.

The measures of output and input presented in this report are variously referred to as being on

"old basis" or "new basis" (see Part IV, General Technical Notes, page 115). The former measures use the 1948 Standard Industrial Classification and the activity concept, while the latter reflect the full impact of the 1960 Standard Industrial Classification and the new reporting procedures introduced in 1961. The important difference between the two sets of data for the industries under study is that the "old basis" measures of real output are calculated with 1949 unit value weights, while those on the new basis use 1961 unit values. Data on both bases are shown in the tables of Section B for the Synthetic Textile Mills, Breweries, and Pulp and Paper Mills industries respectively. However, for analytical purposes, and for all charts, data assembled on the old basis only are used.

SYMBOLS

The interpretation of the symbols used in the tables throughout this publication is as follows:

- .. figures not available.
- ... figures not appropriate or not applicable.
- nil or zero.

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PART I
SYNTHETIC TEXTILE MILLS

SECTION A

**TRENDS AND FLUCTUATIONS IN OUTPUT
PER UNIT OF LABOUR INPUT**

SECTION A

TRENDS AND FLUCTUATIONS IN OUTPUT PER UNIT OF LABOUR INPUT

Introduction

The predominant impression conveyed by the results presented below for all establishments in the Synthetic Textile Mills industry is one of continuous and rapid growth in the volume of output during the greater part of the period 1947-61, accompanied by a fairly stable or even declining volume of labour input, so that the various measures of output per unit of labour input show an even more impressive record of growth. The overall increase in the latter was considerably greater than was achieved in Manufacturing as a whole.¹

At the same time, the measures relating to Synthetic Textile Mills in total conceal quite different patterns of growth in output per unit of labour input and its components for those establishments engaged in fibre production and fibre processing respectively.² In the former case, the growth of output was greater overall and less variable from year to year, but achieved with a generally increasing volume of labour input. On the other hand, growth in the volume of output of the fibre processing establishments was both smaller and more variable than for the industry as a whole, but accompanied by a decline in the volume of labour input. Although these differences with regard to labour input in the two branches of the industry partially offset the differences on the output side, the growth of output per unit of labour input of the fibre producers was considerably greater than that of the fibre processors.

In the area of international comparisons, the overall increase in output per unit of labour input for the Canadian fibre producers industry during the period 1957-61 was greater than that for the comparable industrial grouping in the United States, although part of the dissimilarity may be due to conceptual and statistical differences.³

Overall Changes in Output per Unit of Labour Input, 1947-61

Charts B3 and B4, which show real net output per production and related worker and per person employed respectively for the Synthetic Textile Mills industry, its component branches, and Manufacturing for the period 1947 to 1961, bring to the fore the most significant differences in productivity

change between the various levels of aggregation. Generally speaking, differences between net and gross measures of output and between measures of employment and man-hours are not large, and the generalizations made here on the basis of the particular series depicted in Charts B3 and B4 are much the same as those which would have emerged from series based on alternative combinations of output and input data.

Overall increases in real net output per production worker between 1947 and 1961, shown in Chart B3, were 220.4%, 287.6%, 132.3% and 71.4% for all establishments, fibre producers, fibre processors and Manufacturing respectively. The corresponding growth rates, calculated by the least squares of logarithm method, were 8.7%, 8.7%, 6.0% and 4.0% per annum. While the linear trend appears in varying degrees to be a good fit to the data for all establishments, fibre processors, and Manufacturing, such is not the case for the data of the fibre producers, largely as a result of occurrences between 1952 and 1956. A similar pattern is reflected in the figures of real net output per person employed shown in Chart B4 where the overall increases for the fifteen-year period were 175.9%, 227.8%, 101.9%, 55.5%, again for all establishments, fibre producers, fibre processors and Manufacturing respectively, with corresponding growth rates of 7.3%, 7.4%, 4.8% and 3.3%. Again, the qualification with respect to fibre producers appears to be necessary.

Year-to-year Changes in Output per Unit of Labour Input

Charts B5 to B12 permit the analysis of year-to-year changes in a number of alternative measures of real output per unit of labour input for the Synthetic Textile Mills industry and its two main branches based on the available measures of labour input. In general, as may be seen from Chart B2, year-to-year changes in persons employed and production and related workers are not significantly different in any of the three groupings under discussion. Again, for the industry as a whole, the movements of the two man-hour based indexes are very similar to those of the corresponding employment based indexes, as may be seen from a comparison of Charts B11 and B12 with B5 and B8. Consequently, the main points of this section can be established from an examination of three charts only, B8, B9 and B10.

Chart B8, which shows real net output per person employed and its components for the Synthetic Textile Mills industry, brings out very clearly the relatively constant nature of year-to-year changes in the productivity measure at this level and the resultant good fit of the trend line. Between

¹ Dominion Bureau of Statistics, *Daily Bulletin*, June 7, 1966, Ottawa, Queen's Printer (DBS Catalogue No. 11-001).

² See Section C, page 39, for a detailed definition of the two components.

³ No figures corresponding to those presented here for fibre processors are available for the United States. Real gross output was calculated using 1949 unit value weights for Canada and 1958 unit man-hour weights for the United States. See page 18.

1951 and 1954, decreases in the output measure were accompanied by relatively larger decreases in employment so that real net output per person employed still continued to increase.

Quite a different picture emerges from Chart B9, which demonstrates the value of separate data for the fibre producing establishments. With the single exception of 1953-54, year-to-year changes in the real net output of the latter were positive. However, the growth of output per person employed was interrupted during the years 1952 to 1956. Examination of the employment series seems to suggest two distinct phases of relatively stable employment with a sharp increase taking place in the latter part of the 1952-56 period. Since it was in these years that several important establishments entered the industry, it may not be inappropriate to regard the middle nineteen-fifties as a transitional period during which the present structure of the fibre producing branch of the industry, importantly influenced by the true synthetics, began to emerge.

As shown in Chart B10, the fibre processing branch of the industry also experienced a period, from 1951 to 1954, during which the growth of real net output per person employed was interrupted.

However, the period does not appear to have the same significance as that just discussed in Chart B9. It is not only shorter, but also by no means unique, output per person employed also having either decreased, or failed noticeably to increase, in 1947-48, 1949-50 and 1956-57. The general impression of year-to-year changes during the entire period from 1947 to 1961 remains one of reasonably close correspondence to the straight line logarithmic trend. Furthermore, the movements of output per person employed between 1951 and 1954 in the fibre processing branch of the industry also differ from those between 1952 and 1956 in the fibre producing branch as far as the movements of their underlying components are concerned. In the former case, the period of unchanged productivity coincides with the sharp and roughly matching decreases in output and input, while in the latter case output and input were generally increasing.

A direct comparison of the year-to-year changes in real net output per person employed in the industry and its two component branches, shown in Chart B4 and expressed in Table A1 below in percentage terms, brings to light certain apparent inconsistencies between the three sets of data.

TABLE A1. Percentage Year-to-year Changes in Real Net Output per Person Employed, Synthetic Textile Mills, Canada, 1948 - 61

Year	Percentage change from preceding year		
	All establishments	Fibre producers	Fibre processors
	per cent		
1948	+ 2.2	+ 19.6	- 4.7
1949	+ 11.0	+ 1.8	+ 15.6
1950	+ 8.3	+ 20.3	+ 0.2
1951	+ 15.8	+ 11.5	+ 17.7
1952	+ 8.5	+ 23.4	- 1.7
1953	+ 4.1	+ 2.7	+ 1.6
1954	+ 1.3	- 1.5	- 4.2
1955	+ 11.2	- 0.8	+ 18.0
1956	+ 0.3	- 6.8	+ 4.1
1957	+ 5.1	+ 10.8	- 5.5
1958	+ 8.0	+ 10.3	+ 8.6
1959	+ 15.5	+ 13.1	+ 9.0
1960	+ 9.0	+ 15.9	+ 3.4
1961	+ 6.4	+ 8.6	+ 14.4

Source: See Section B, Tables B1, B5 and B6, pages 20 and 22.

It might at first sight be thought that any change in real net output per person employed from one year to the next for the industry as a whole should in some way fall between the changes originating

in the component branches of the industry, i.e., if both the latter were positive, then the former would also be positive with a numerical value between those of the latter, and so on. This would imply,

however, that the index of real net output per person employed for the industry as a whole is an average of the component indexes. Actually, the formula used to measure output per person employed at the industry level is a simple ratio of aggregates,

$$\frac{\sum q_i}{\sum q_o} \div \frac{\sum l_i}{\sum l_o} = \frac{\sum q_i \sum l_o}{\sum q_o \sum l_i}$$

where q and l are volume measures of output and input respectively at the component branch level, and the subscripts o and i indicate the base-year and given-year value of the terms. Alternatively, and perhaps more appropriately, it could be said that the component measures are derived from a disaggregation of $\frac{q_i}{q_o} \frac{l_o}{l_i}$, with the terms defined at the industry level.

Such being the case, the apparent inconsistencies of Table A1 can be accounted for in terms of the absolute levels of the output and input components of the three productivity measures. A numerical illustration, using the actual data for the change between 1953 and 1954 already referred to, will make this clearer.

Between 1953 and 1954, real net output decreased by a greater percentage than did employment in both the fibre producing and the fibre processing branches of the industry, thus resulting in a decrease of real net output per person employed in both cases. The sum of the two output figures, however, decreased by less than did the sum of the two employment figures so that, in consequence, real net output per person employed for the industry as a whole increased.

TABLE A2. Real Net Output per Person Employed and Components, Synthetic Textile Mills, 1953 and 1954

Item	1953	1954	Percentage change
	thousands of dollars		%
Real net output:			
Fibre producers	49,106	47,560	- 3.1
Fibre processors	51,761	41,305	- 20.2
Totals	100,867	88,865	- 11.9
Employment:	number		
Fibre producers	3,743	3,679	- 1.7
Fibre processors	11,980	9,983	- 16.7
Totals	15,723	13,662	- 13.1
Real net output per person employed:	dollars		
Fibre producers	13,119	12,927	- 1.5
Fibre processors	4,321	4,138	- 4.2
Totals	6,415	6,505	+ 1.4

Growth of Real Output, 1947-61

As may be seen from Chart B1, the growth patterns of real output in the Synthetic Textile Mills industry and its component branches during the period 1947-61 were markedly different. For the industry as a whole, gross and net measures increased by 217.7% and 199.4% over the entire period, the average rates of growth being 7.1% and 6.6% per annum respectively. For the fibre producing establishments, the increases of the two measures were again very similar but, at 388.7% and 395.2%, substantially greater than for the industry as a whole, the annual growth rates being 11.4% for the gross and 11.2% for the net measure. In the case of the fibre processing establishments, however, the increases in gross and net output were not only much lower but, at 131.2% and 94.7% or, in terms of their average annual rates, 3.7% and 2.5% respectively, also exhibited a marked disparity.

For the industry as a whole, year-to-year changes in both net and gross output were positive from 1947 to 1951 and from 1954 on. With the minor exception of the net measure between 1953 and 1954,

changes in both the net and gross output of the fibre producing establishments were positive in all years. Thus the period of irregular change in the output of the industry as a whole between 1951 and 1954 derives mostly from the successive decreases in the output of fibre processing establishments. On the other hand, the decreases of output in the latter branch of the industry between 1956 and 1957 were apparently more than offset in the total industry measures by the better performance of the fibre producers.

It may be noted that real domestic product in Manufacturing also declined between 1953 and 1954, and between 1956 and 1958.⁴ It is therefore evident that the growth of real output in the fibre producing establishments was virtually immune to the factors at work in the wider context.

⁴ Dominion Bureau of Statistics, *Annual Supplement to the Monthly Index of Industrial Production*, May 1966, Ottawa, Queen's Printer, page 9 (DEB Catalogue No. 61-005).

As already noted, the differences between the gross and net measures of real output are not of major significance for the Synthetic Textile Mills industry as a whole, nor for the fibre producing establishments. The faster growth of net output in the latter between 1950 and 1952 can probably be identified with the changeover which took place at this time from imported to domestically produced nylon intermediaries. Again, the occasions such as 1953-54 and 1955-56, when the growth of net output lagged behind that of gross output, can at least partially be identified with the opening of new establishments when the ratio of materials used to production would be temporarily higher than normal. Since the fibre processing establishments comprise a larger and more heterogeneous group than the fibre producing establishments and since the methods used in splitting the output data for the industry as a whole derive the fibre processing measures as residuals,⁵ it is difficult to account unambiguously for the divergence between the growth rates of the gross and net output of fibre processors which took place between 1955 and 1960. It is possible, however, that this may be accounted for by a shift in the composition of output towards products requiring relatively less processing.

Changes in Labour Input, 1947-61

Chart B2 shows that the trends of employment for the industry as a whole again reflect two widely differing patterns of change in its component branches.⁶ In the fibre producing establishments, the employment of production and related workers and of all persons employed increased between 1947 and 1961 at average annual rates of 2.3% and 3.5% respectively. In the fibre processing establishments, on the other hand, the trend of employment was downwards, with the production and related workers series decreasing at the rate of 3.4% per annum and that of all persons employed at 2.2% per annum.

The most noteworthy of the year-to-year changes shown on Chart B2 appears to be the sharp reduction in the employment of production and related workers in fibre processing establishments which was sustained from 1951 through 1954 and which coincided with the decrease in output noted on Chart B1.

New Capital and Repair Expenditures, 1947-61

The contribution of capital inputs to productivity change is an extremely important one, although there is very little theoretical agreement as to how it can be quantified. A basic requirement for even the most rudimentary statistical analysis is a set of real capital stock and flow estimates which, for the purposes of this report, would have to be available by three-digit industry within Manufacturing.

⁵ See Part V, Industry Technical Notes, page 123.

⁶ For this purpose, attention is concentrated solely on changes in the number of persons employed, since no separate man-hours data have been compiled for the fibre producing and fibre processing establishments.

Such data are not at present available,⁷ but it seems worthwhile to investigate whether some of the insights which they might have revealed can be found in data relating to new capital and repair expenditures.⁸

For this particular purpose, Chart A1 which compares indexes of new capital and repair expenditures with real net output per person employed between 1947 and 1961, suffers from the fact that the former are expressed in current dollars and are therefore not strictly consistent with the latter series. There are at the present time no published deflators by means of which these expenditures could be expressed in real terms, but this deficiency is not crucial, since it is probably sufficient to determine the direction rather than the precise magnitude of year-to-year changes.

There appears from the data of Chart A1 to be no obvious relationship, either current or lagged, between the movements of the two series. As may be seen more clearly from Chart B8, the trend underlying the increases of real net output per person employed is one of more or less steady growth, whereas the movements of the capital and repair expenditures series are generally irregular, although the level of the series between 1951 and 1957 was higher than in the initial and later years.

It is probably over-optimistic to expect any direct statistical evidence of the influence of new capital and repair expenditures on productivity in the Synthetic Textile Mills or any other industry. In the first place, the magnitude of such an influence during any particular period will depend on the size of new capital and repair expenditures relative to the pre-existing capital stock, and this may be small by comparison with other factors currently at work, such as the level of capacity utilization, for example. This latter point is probably quite important for the Synthetic Textile Mills industry. Reference has already been made to the large additions to productive capacity during the early and mid-nineteen fifties, particularly in the fibre producing branch of the industry. If this additional productive capacity had been fully put to use as it became available, some immediate and noticeable effect on productivity might have resulted. In fact, it appears that it was brought into use only gradually, since important increases in output were achieved between 1957 and 1961 with no major additions to productive capacity.⁹ Under the circumstances, the effects on productivity are bound to be so gradual and delayed as to elude any easy statistical identification.

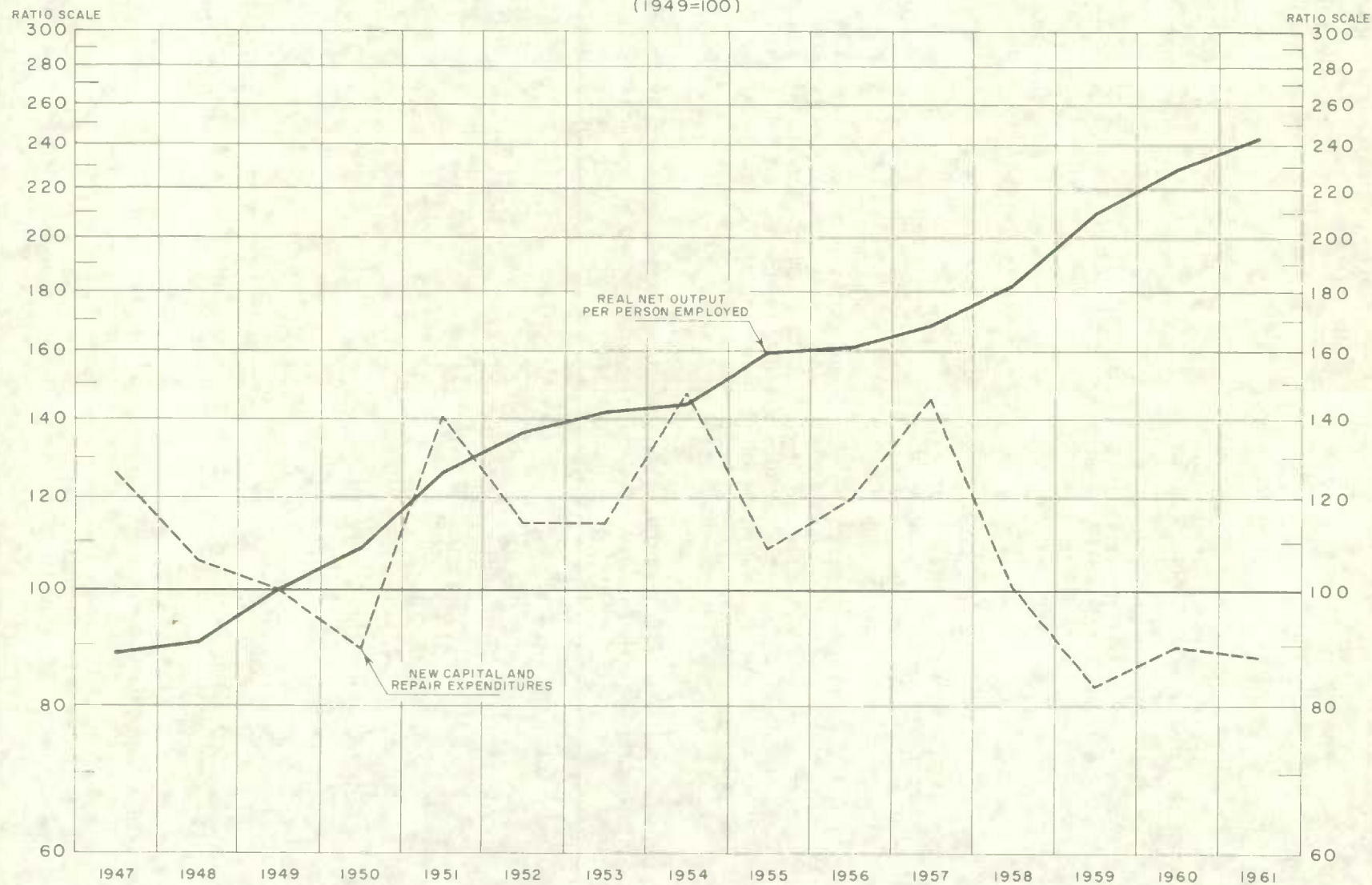
⁷ A programme of data development in this area at the Dominion Bureau of Statistics is well advanced, and a reference paper presenting estimates for the manufacturing industries (2-digit, or major group level) was recently released. See: Dominion Bureau of Statistics, *Fixed Capital Flows and Stocks, Manufacturing, Canada, 1926-1960*, Ottawa, Queen's Printer, Occasional (DBS Catalogue No. 13-523)—*Statistical Supplement to DBS Report, Methodology* (DBS Catalogue No. 13-522).

⁸ See Section C, page 48.

⁹ Tariff Board, *Silk and Man-made Fibres, and Products*, Reference No. 125. Ottawa, Queen's Printer, 1959, page 91.

INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED AND NEW CAPITAL AND REPAIR EXPENDITURES,
SYNTHETIC TEXTILE MILLS, CANADA, 1947-61

(1949=100)



Comparisons with United States Data

As previously noted, the official U.S. productivity measures for Synthetic Fibers have approximately the same industrial coverage as those for the fibre producing branch of the Synthetic Textile Mills industry in Canada. However, there are differences in concept and compilation between the two sets of measures which, while not invalidating the comparison, should certainly be kept in mind when interpreting the results described below. The Canadian index of real gross output is derived by weighting the whole range of Census output with 1949 unit values, whereas the U.S. output index is constructed by applying 1958 unit man-hour weights to a more limited range of representative products. On the labour input side, no difficulties arise with respect to the comparability of Canadian and U.S. data on production workers which are derived in both cases from establishment surveys similar in scope and coverage. Because of the more comprehensive definition of administrative and office employees in the United States,¹⁰ comparisons are restricted to ratios of real gross output per production and related worker and their components.

The period of comparison is a limited one, 1957 to 1961. United States data are available for earlier years and could in fact be considered conceptually and statistically closer to the Canadian data, since they are also based on unit value output weights of a roughly comparable time period.

However, in view of the fact that they are regarded by the BLS as officially superseded by the more recently developed measures, it seems preferable to make the comparison in terms of the latter and for the shorter time period which these data made necessary.

Chart B13 shows that increases in the overall growth of real gross output per production and related worker for fibre producers in Canada and in the United States amounted to 50.4% and 15.9% respectively. The corresponding average rates of growth, again calculated by the least squares of logarithm method, were 11.2% and 3.5%. As the foregoing comments imply, the major part of the difference in these growth rates is due to the faster increase in Canadian output and to differences in the weighting of real gross output. In fact, the results in Table B1 suggest that the Canadian index would not have increased as fast if 1961 unit value weights had been used.

A more detailed analysis of the relative movements of the productivity indexes must be based on those of the underlying components. Indexes of real gross output per production and related worker, real gross output, and production and related workers in the fibre producing branch of the Synthetic Textile Mills industry are presented together with the corresponding data for the U.S. Man-made Fibers industry in Table A3 and Chart B14.

TABLE A3. Indexes of Real Gross Output per Production and Related Worker, Real Gross Output, and Production and Related Workers, Fibre Producers, Canada and United States, 1957-61
(1959 = 100)

Year	Canada			United States		
	Real gross output per production and related worker	Real gross output	Production and related workers	Real gross output per production and related worker	Real gross output	Production and related workers
1957	81.1	80.1	98.8	90.0	91.7	102.0
1958	91.0	80.7	88.7	90.8	83.7	92.2
1959	100.0	100.0	100.0	100.0	100.0	100.0
1960	116.0	113.1	97.4	95.5	94.1	98.5
1961	122.0	116.5	95.4	104.3	99.0	94.9
1961 as % of 1957	150.4	145.4	96.6	115.9	108.0	93.0
Annual trend rate of change (%)	+ 11.2	+ 11.5	+ 0.2	+ 3.5	+ 2.7	- 0.8

Source: For Canadian data, see Table B5, page 22. For United States data, see: United States Department of Labor, Bureau of Labor Statistics, *Indexes of Output per Man-hour, Man-made Fibers Industry, 1957-63*, October 1965, page 11.

By contrast with the Canadian index of real gross output which increased consistently and steadily between 1957 and 1961, the corresponding U.S. index moved somewhat irregularly. For the period 1957-61, overall increases were 45.4% and

8.0% for Canada and the United States respectively, representing annual rates of growth of 11.5% and 2.7%. On the employment side, the two indexes followed similar patterns with overall decreases of 3.4% for Canada and 7.0% for the U.S. Although the average annual rate of change for the Canadian index was positive at +0.2%, this is really little different from the U.S. rate of -0.8% in view of the degrees of fluctuation over such a short period and the method of calculation used.

¹⁰ See: *Data for Measurement of Industrial Productivity in the United States* by Leon Greenberg, U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C., March 1964.

SECTION B
STATISTICAL TABLES AND CHARTS

TABLE B 1. Indexes of Real Output per Unit of Labour Input, Synthetic Textile Mills, Canada, 1947-61
(1949 = 100)

Item and year	Real gross output per					Real net output per				
	Person employed	Production worker	Man-hour paid of persons employed	Man-hour paid of production workers	Man-hour worked of production workers	Person employed	Production worker	Man-hour paid of persons employed	Man-hour paid of production workers	Man-hour worked of production workers
Old basis:										
1947	88.2	83.5	85.9	81.3	..	88.2	83.5	85.9	81.3	..
1948	92.7	89.0	91.7	87.3	..	90.1	86.5	89.1	84.8	..
1949	100.0	100.0	100.0	100.0	..	100.0	100.0	100.0	100.0	..
1950	109.1	112.9	111.2	113.7	..	108.3	112.1	110.4	112.9	..
1951	120.8	124.4	124.6	126.7	..	125.4	129.2	129.4	131.6	..
1952	128.8	138.3	133.8	141.4	..	136.0	146.0	141.3	149.2	..
1953	135.3	144.1	139.7	146.3	..	141.6	150.9	146.2	153.1	..
1954	142.0	160.6	146.9	161.9	..	143.5	162.3	148.4	163.6	..
1955	160.4	180.2	166.2	182.7	..	159.6	179.4	165.4	181.8	..
1956	162.3	183.3	172.8	190.4	190.4	160.1	180.9	170.5	187.9	187.9
1957	173.4	198.4	183.1	201.9	202.7	168.3	192.6	177.7	196.0	196.8
1958	188.9	214.7	204.9	229.3	230.6	181.7	206.5	197.1	220.5	221.8
1959	218.8	250.9	229.9	257.9	258.9	209.8	240.5	220.4	247.2	248.1
1960	239.4	267.3	253.3	279.9	281.4	228.7	255.4	242.0	267.5	268.9
1961	258.2	283.9	269.9	293.8	298.1	243.3	267.5	254.2	276.8	280.8
1961 as % of 1947	292.7	340.0	314.2	361.4	...	275.9	320.4	295.9	340.5	...
Annual trend rate of change (%)	+ 7.8	+ 9.2	+ 8.4	+ 9.6	...	+ 7.3	+ 8.7	+ 7.9	+ 9.1	...
New basis:										
1959	218.8	250.9	229.9	257.9	258.9	209.8	240.5	220.4	247.2	248.1
1960	232.0	261.4	246.4	273.7	275.1	220.1	248.0	233.8	259.6	261.0
1961	247.7	274.6	261.3	286.2	290.0	224.7	249.1	237.0	259.6	263.0

TABLE B 2. Indexes of Real Output and Labour Input, Synthetic Textile Mills, Canada, 1947-61
(1949 = 100)

Item and year	Real output		Persons employed		Production workers		
	Gross	Net	Number	Man-hours paid	Number	Man-hours paid	Man-hours worked
Old basis:							
1947	77.2	77.2	87.5	89.9	92.4	94.9	..
1948	88.7	86.2	95.7	96.7	99.7	101.6	..
1949	100.0	100.0	100.0	100.0	100.0	100.0	..
1950	116.4	115.6	106.7	104.7	103.1	102.4	..
1951	129.1	134.1	106.9	103.6	103.8	101.9	..
1952	120.3	127.0	93.4	89.9	87.0	85.1	..
1953	126.4	132.3	93.4	90.5	87.7	86.4	..
1954	115.3	116.5	81.2	78.5	71.8	71.2	..
1955	146.9	146.2	91.6	88.4	81.5	80.4	..
1956	151.4	149.4	93.3	87.6	82.6	79.5	79.5
1957	157.1	152.5	90.6	85.8	79.2	77.8	77.5
1958	162.1	155.9	85.8	79.1	75.5	70.7	70.3
1959	195.2	187.1	89.2	84.9	77.8	75.7	75.4
1960	213.3	203.8	89.1	84.2	79.8	76.2	75.8
1961	245.3	231.1	95.0	90.9	86.4	83.5	82.3
1961 as % of 1947	317.7	299.4	108.8	101.1	93.5	88.0	...
Annual trend rate of change (%)	+ 7.1	+ 6.6	- 0.6	- 1.2	- 1.9	- 2.3	...
New basis:							
1959	195.2	187.1	89.2	84.9	77.8	75.7	75.4
1960	210.2	199.4	90.6	85.3	80.4	76.8	76.4
1961	237.8	215.7	98.0	91.0	86.6	83.1	82.0

TABLE B 3. Selected Statistics of Manufacturing Activities, Synthetic Textile Mills, Canada, 1947-61

Item and year	Estab- lishments	Value of shipments ¹	Cost at factory of materials used	Cost at factory of fuel and electricity used	Value added	Value added per person employed	Salaries and wages, persons employed, as per cent of value added	Book value of inventories, year end
	No.					\$	%	\$'000
Old basis:								
1947	40	84,870	32,660	2,401	49,809	3,382	48.8	..
1948	45	107,142	41,178	3,013	62,951	3,911	48.8	..
1949	48	124,125	45,218	3,329	75,578	4,491	47.8	..
1950	47	147,048	55,519	3,766	87,763	4,888	45.7	..
1951	46	166,550	66,041	4,032	96,477	5,361	46.3	..
1952	48	157,629	63,780	3,844	90,005	5,724	47.5	..
1953	47	146,418	63,938	3,895	78,585 ²	4,998	55.9	..
1954	46	132,403	57,081	3,538	69,985	5,123	58.1	33,845
1955	48	159,234	69,896	4,428	86,031	5,584	54.5	35,847
1956	47	161,161	76,493	4,875	79,629	5,074	61.7	38,293
1957	44	163,810	79,136	5,081	85,274	5,591	59.8	44,033
1958	48	177,214	81,967	4,912	87,012	6,027	56.7	39,873
1959	48	207,061	96,429	5,108	107,446	7,161	49.9	42,869
New basis: ³								
1959	47	205,452	98,327	5,056	104,877	7,111	50.1	42,986 ⁴
1960	51	218,429	101,624	4,881	113,483	7,575	48.6	46,291 ⁴
1961	57	251,360	121,993	5,056	122,496	7,710	48.6	46,527

¹ Figures up to and including 1952 represent gross value of products.

² Because of insufficient inventory data in 1953, this figure has been calculated from value of factory shipments and therefore only approximates the true "value added".

³ Some of the figures in this table have been adjusted to conform to the 1962 revision of 1961 data on manufacturing activities. They may, therefore, differ slightly from the corresponding figures in Section C which are consistent with those of the "General Review of the Manufacturing Industries of Canada, 1961", Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201). Such differences do not invalidate the inter-industry comparisons made in Section C.

⁴ Figures do not completely reflect changes due to the 1960 Standard Industrial Classification and the New Establishment Concept.

TABLE B 4. Selected Labour Statistics of Manufacturing Activities, Synthetic Textile Mills, Canada, 1947-61

Item and year	Persons employed				Production and related workers							Administrative and office employees			
	Number	Per estab- lishment	Earn- ings	Man- hours paid	Number	As per cent of persons em- ployed	Earn- ings	Man-hours ¹			Average hourly earn- ings ²	Average of man- hours paid per week ²	Number	Average hourly earn- ings ³	Average of man- hours paid per week ³
								Paid	Worked	Not worked but paid as per cent of man- hours paid					
		No.	\$'000	'000		%	\$'000	'000		%	\$	No.		\$	No.
Old basis:															
1947	14,728	368	24,284	35,385	13,101	89.0	19,565	31,056	..	..	0.63	44.5	1,627	1.12	41.2
1948	16,097	358	30,739	38,081	14,134	87.8	24,931	33,241	..	..	0.75	44.5	1,963	1.23	41.3
1949	16,828	351	36,122	39,369	14,178	84.3	27,818	32,727	..	..	0.85	44.0	2,650	1.25	41.2
1950	17,955	382	40,112	41,208	14,622	81.4	29,488	33,510	..	..	0.88	45.2	3,333	1.43	40.6
1951	17,997	391	44,694	40,782	14,719	81.8	33,001	33,334	..	..	0.99	43.9	3,278	1.62	39.9
1952	15,723	328	42,709	35,403	12,335	78.5	29,809	27,859	..	..	1.07	44.2	3,388	1.74	39.9
1953	15,723	335	43,939	35,615	12,437	79.1	31,116	28,288	..	..	1.10	44.2	3,286	1.75	40.3
1954	13,662	297	40,628	30,899	10,184	74.5	26,791	23,296	..	..	1.15	43.9	3,478	1.85	39.8
1955	15,408	321	46,927	34,800	11,562	75.0	31,037	26,302	..	..	1.18	44.5	3,846	1.90	39.9
1956	15,694	334	49,116	34,491	11,718	74.7	32,005	26,020	24,849	4.5	1.23	42.7	3,976	2.06	39.6
1957	15,251	347	51,034	33,793	11,225	73.6	33,292	25,463	24,235	4.8	1.31	43.6	4,026	2.15	39.4
1958	14,436	301	49,357	31,129	10,710	74.2	31,195	23,128	21,986	4.9	1.35	41.5	3,726	2.32	38.9
1959	15,004	313	53,642	33,442	11,037	73.6	33,843	24,758	23,569	4.8	1.37	43.1	3,967	2.28	39.1
New basis: ⁴															
1959	14,748	314	52,520	32,982	10,984	74.5	33,473	24,628	23,439	4.8	1.36	43.1	3,764	2.28	39.1
1960	14,981	294	55,099	33,108	11,348	75.7	35,975	25,004	23,748	5.0	1.44	42.4	3,633	2.36	38.6
1961	15,887	279	59,572	35,315	12,214	76.9	39,957	27,059	25,476	5.9	1.48	42.6	3,673 ⁵	2.39	38.5

¹ The series were constructed using man-hours estimated by payroll deflation for the period 1947-55 and reported man-hours from 1956 on.

² From 1947 to 1955 inclusive the figures originate from the publication *Review of Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-202); from 1956 on they are calculated from reported data in the Census of Manufactures.

³ Data on the old basis were obtained from the publication *Earnings and Hours of Work in Manufacturing*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-204); and were estimated on the new basis by adjustment of old basis data.

⁴ See Table B 3, footnote 3, above.

⁵ In 1961, the reported figures of administrative and office employees have been assigned in total to manufacturing activities although, in accordance with the New Establishment Concept, they are actually applicable to total activities. In this particular industry, however, nonmanufacturing activities are relatively unimportant and the comparability of 1961 data with those of previous years is therefore not significantly affected.

Note: The terms "production and related worker" and "administrative and office employee" as defined in the Census of Manufactures can be considered roughly synonymous with "wage-earner" and "salaried employee" respectively as used in the Employment Surveys. (See Part IV, General Technical Notes, page 112).

**TABLE B5. Indexes of Real Output per Unit of Labour Input, Real Output, and Labour Input,
Fibre Producers - Synthetic Textile Mills, Canada, Old Basis, 1947-61**
(1949 = 100)

Year	Real gross output per		Real net output per		Real output		Employment	
	Person employed	Production worker	Person employed	Production worker	Gross	Net	Persons employed	Production workers
1947	81.9	77.3	82.1	77.5	74.3	74.5	90.7	96.1
1948	95.1	94.0	98.2	97.0	87.9	90.7	92.4	93.5
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	120.7	127.3	120.3	127.0	133.2	132.8	110.4	104.6
1951	131.4	140.1	134.1	142.9	148.8	151.8	113.2	106.2
1952	153.5	170.3	165.5	183.6	150.9	162.7	98.3	88.6
1953	158.3	175.0	170.0	188.0	165.7	178.0	104.7	94.7
1954	164.8	185.6	167.5	188.6	169.6	172.4	102.9	91.4
1955	162.1	184.0	166.1	188.5	207.2	212.3	127.8	112.6
1956	160.1	183.2	154.8	177.1	223.3	215.9	139.5	121.9
1957	175.4	196.4	171.5	192.1	249.6	244.1	142.3	127.1
1958	193.4	220.5	189.1	215.6	251.6	246.0	130.1	114.1
1959	210.0	242.3	213.9	246.9	311.8	317.7	148.5	128.7
1960	248.1	281.1	247.9	280.9	352.5	352.2	142.1	125.4
1961	264.8	295.7	269.1	300.4	363.1	368.9	137.1	122.8
1961 as % of 1947	323.3	382.5	327.8	387.6	488.7	495.2	151.2	127.8
Annual trend rate of change (%)	+ 7.6	+ 8.9	+ 7.4	+ 8.7	+11.4	+11.2	+ 3.5	+ 2.3

**TABLE B6. Indexes of Real Output per Unit of Labour Input, Real Output, and Labour Input,
Fibre Processors - Synthetic Textile Mills, Canada, Old Basis, 1947-61**
(1949 = 100)

Year	Real gross output per		Real net output per		Real output		Employment	
	Person employed	Production worker	Person employed	Production worker	Gross	Net	Persons employed	Production workers
1947	87.5	83.0	90.8	86.1	75.9	78.7	86.7	91.4
1948	91.1	86.7	86.5	82.3	87.9	83.5	96.5	101.4
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	103.7	106.7	100.2	103.1	109.6	105.9	105.7	102.7
1951	114.5	116.9	117.9	120.3	120.6	124.2	105.3	103.2
1952	114.8	122.1	115.9	123.2	105.7	106.7	92.1	86.6
1953	117.5	123.6	117.7	123.9	106.2	106.4	90.4	85.9
1954	115.8	130.9	112.7	127.5	87.2	84.9	75.3	66.6
1955	136.4	152.5	133.0	148.6	111.6	108.8	81.8	73.2
1956	136.5	155.2	138.5	155.2	111.9	111.9	80.8	72.1
1957	142.0	164.3	130.9	151.4	108.9	100.4	76.7	66.3
1958	153.4	173.6	142.1	160.9	113.2	104.9	73.8	65.2
1959	181.8	207.3	154.9	176.6	133.1	113.4	73.2	64.2
1960	186.8	206.7	160.2	177.2	139.7	119.8	74.8	67.6
1961	209.9	229.1	183.3	200.0	175.5	153.2	83.6	76.6
1961 as % of 1947	239.9	276.0	201.9	232.3	231.2	194.7	96.4	83.4
Annual trend rate of change (%)	+ 5.9	+ 7.3	+ 4.8	+ 6.0	+ 3.7	+ 2.5	- 2.2	- 3.4

CHART B1

INDEXES OF REAL GROSS AND NET OUTPUT, SYNTHETIC TEXTILE MILLS: ALL ESTABLISHMENTS, FIBRE PRODUCERS AND FIBRE PROCESSORS, CANADA, 1947-61 (1949=100)

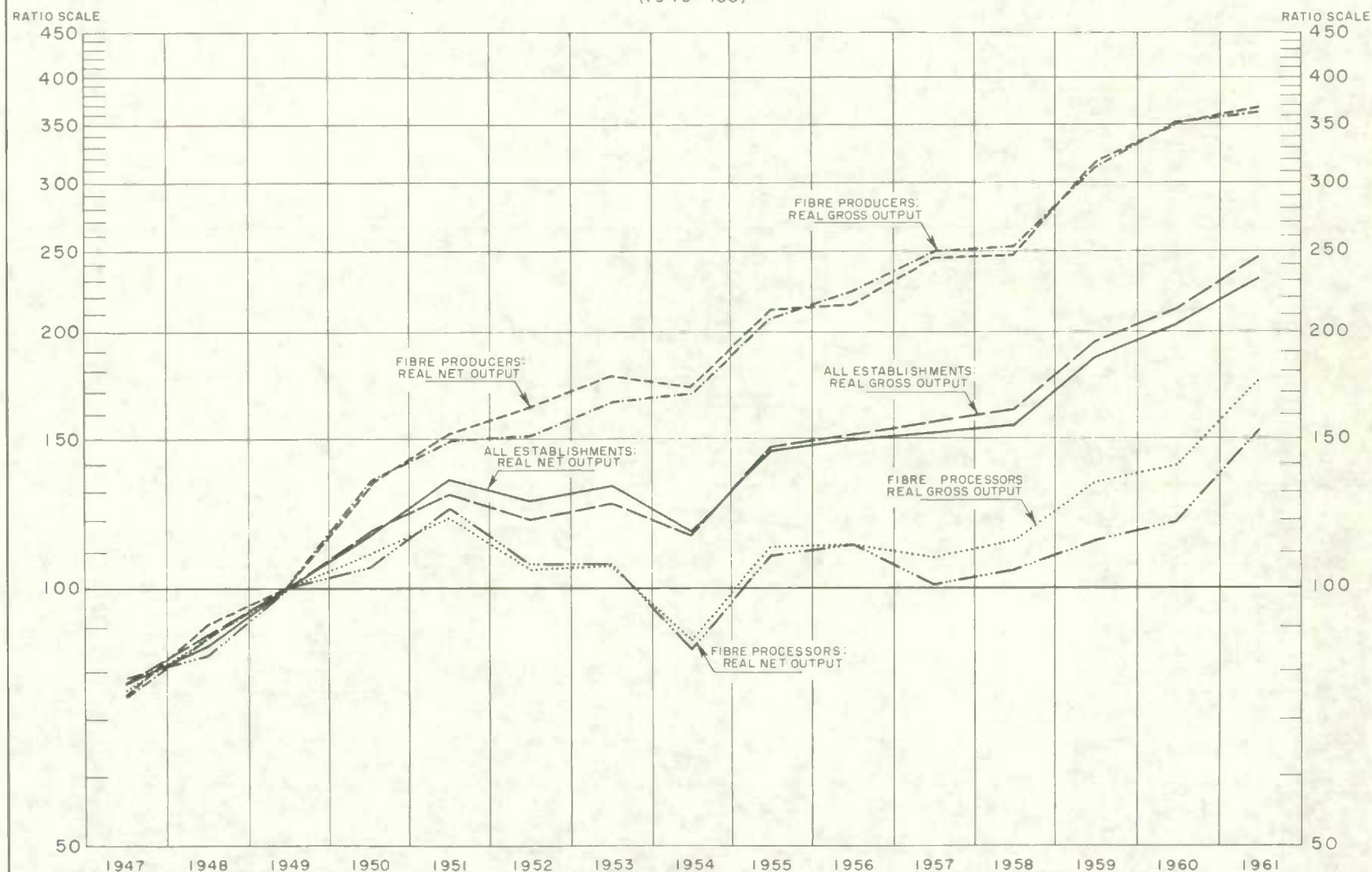


CHART B2.

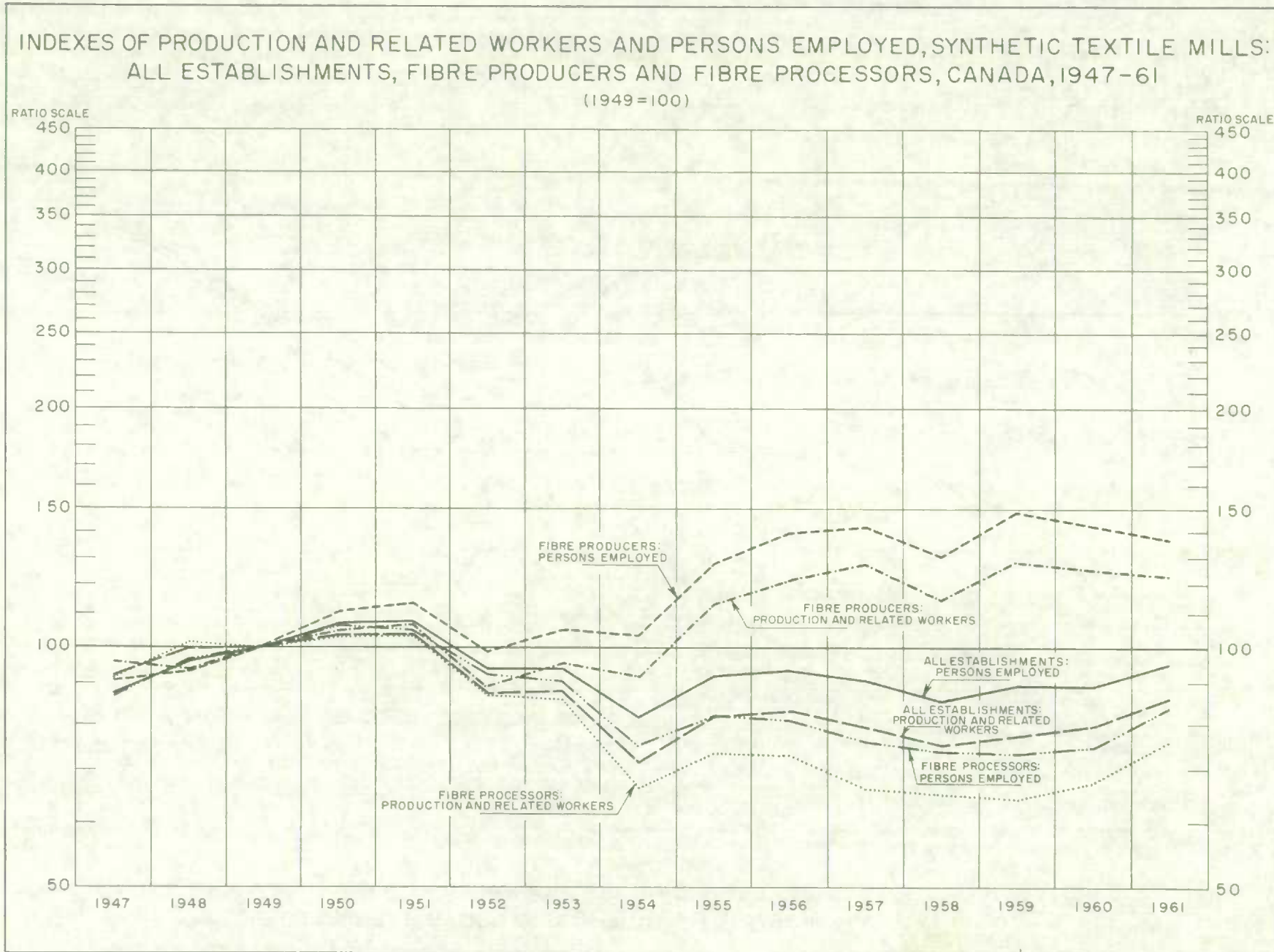


CHART 83

INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER, SYNTHETIC TEXTILE MILLS:
ALL ESTABLISHMENTS, FIBRE PRODUCERS, FIBRE PROCESSORS, AND MANUFACTURING, CANADA, 1947-61
(1949=100)

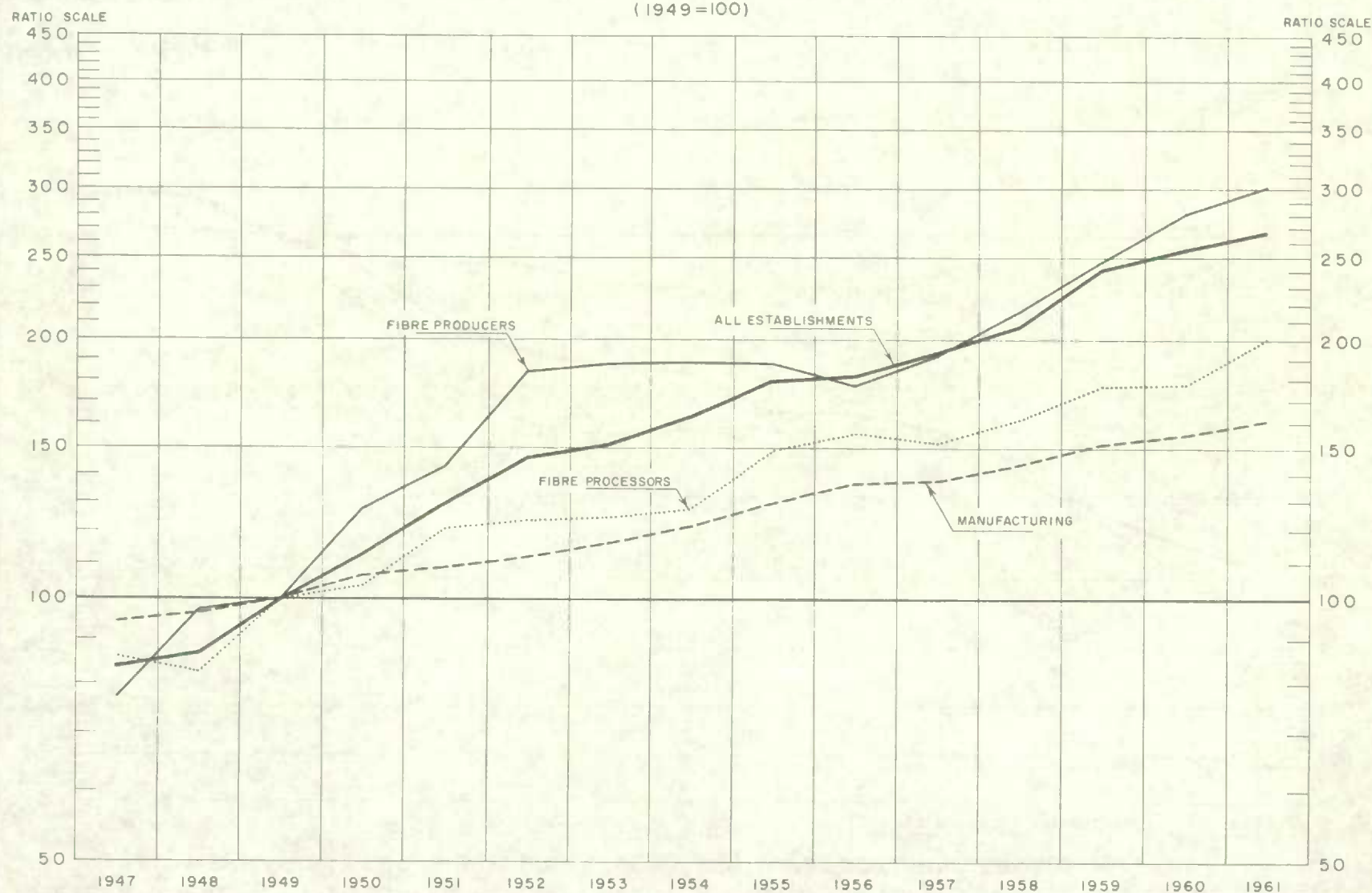
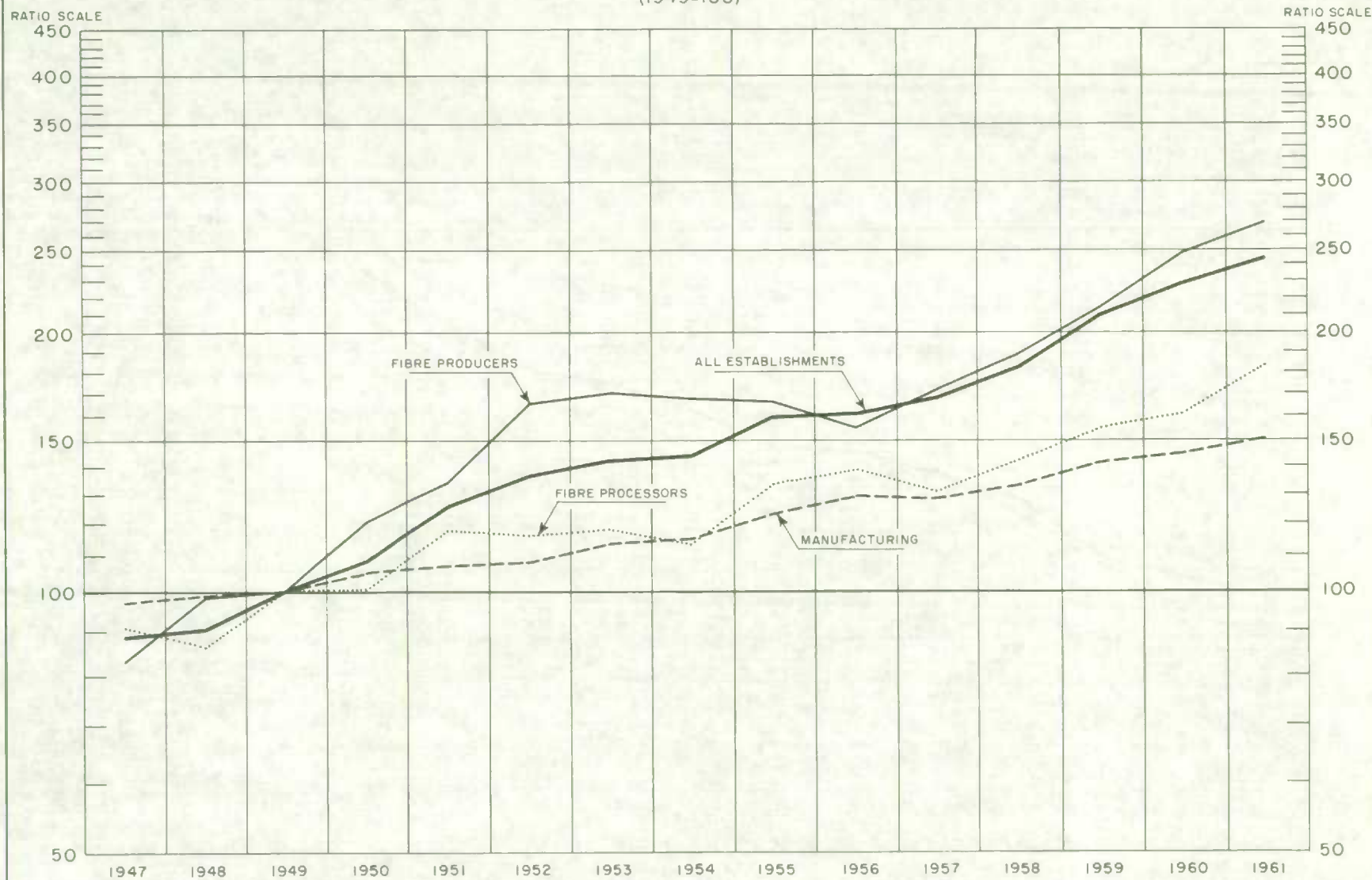


CHART B4

INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED, SYNTHETIC TEXTILE MILLS: ALL ESTABLISHMENTS,
FIBRE PRODUCERS, FIBRE PROCESSORS, AND MANUFACTURING, CANADA, 1947-61
(1949=100)



INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER AND COMPONENTS,
SYNTHETIC TEXTILE MILLS, CANADA, 1947-61

(1949=100)

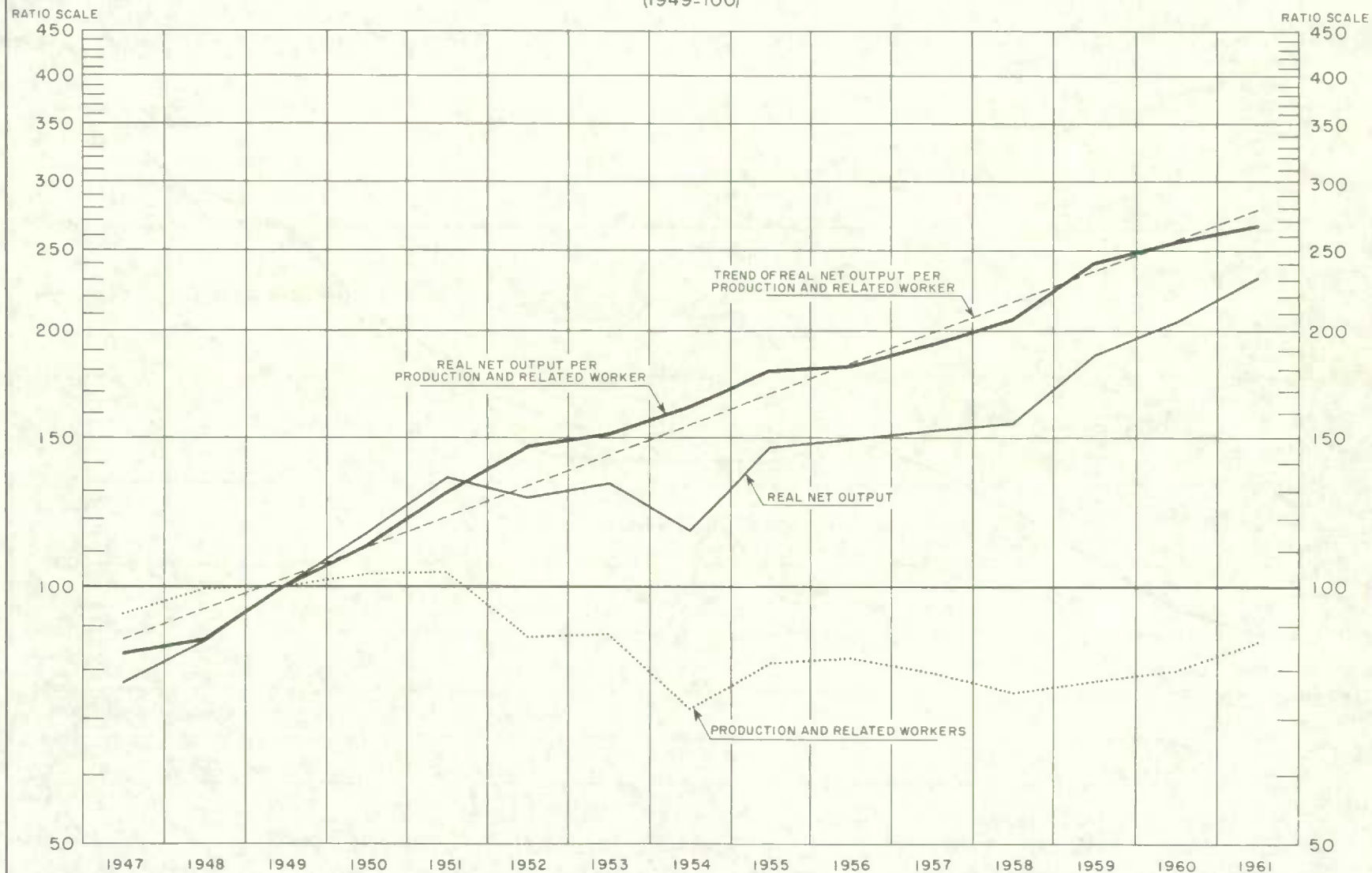


CHART B6.

INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER AND COMPONENTS,
FIBRE PRODUCERS-SYNTHETIC TEXTILE MILLS, CANADA, 1947-61
(1949=100)

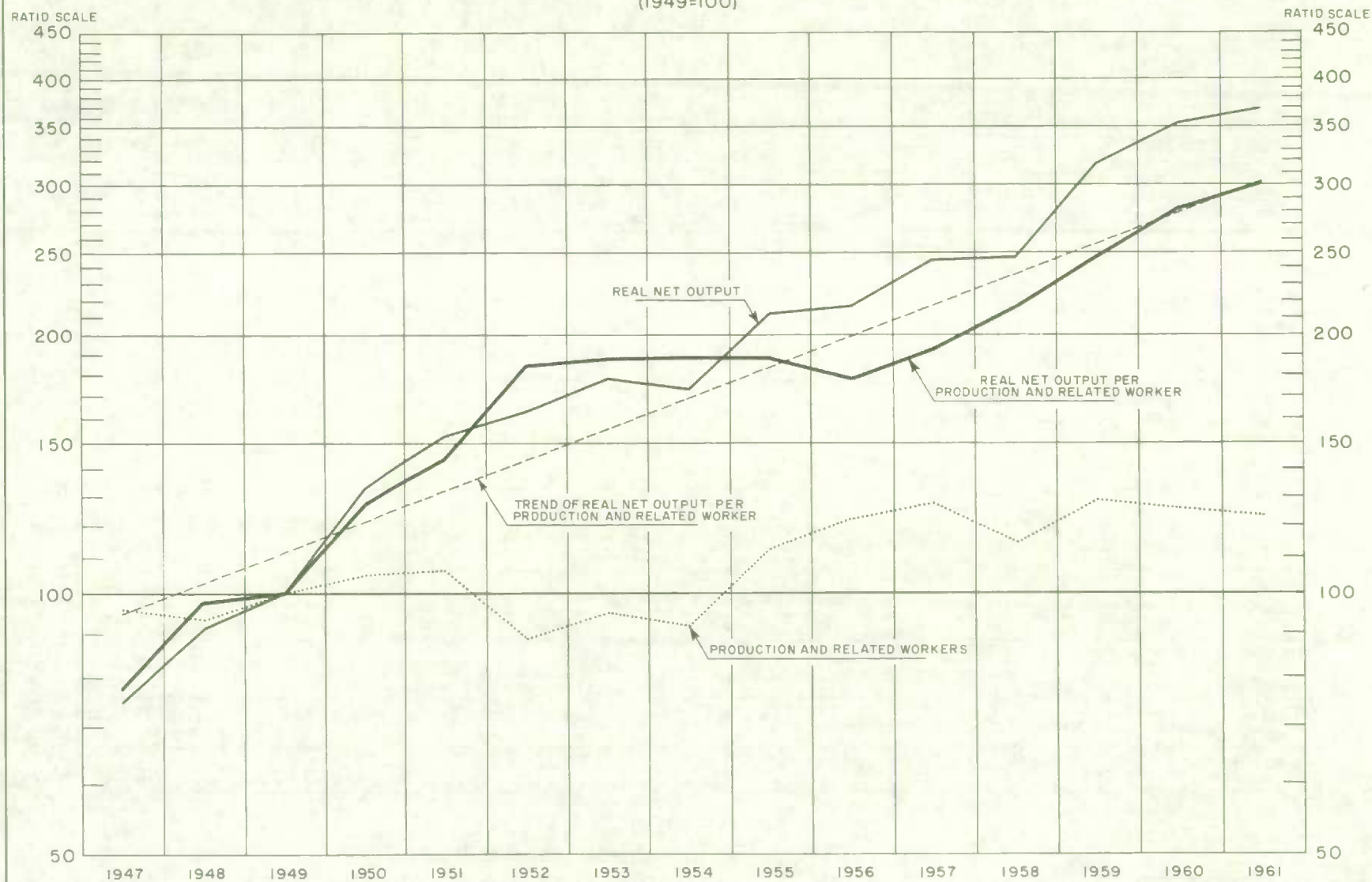


CHART B7.

INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER AND COMPONENTS, FIBRE PROCESSORS—SYNTHETIC TEXTILE MILLS, CANADA, 1947-61

(1949=100)

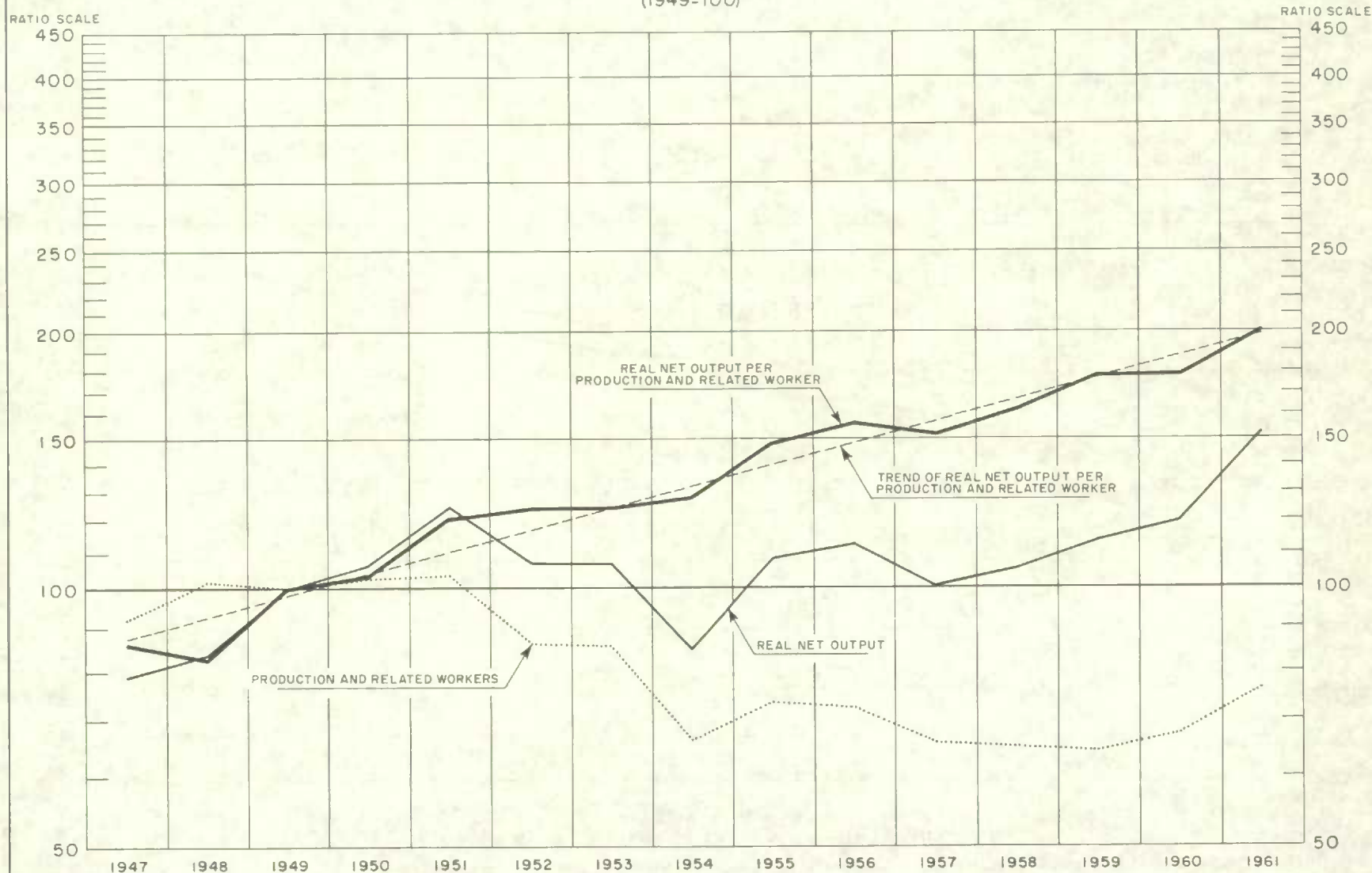


CHART B8

INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED AND COMPONENTS, SYNTHETIC TEXTILE MILLS, CANADA, 1947-61 (1949=100)

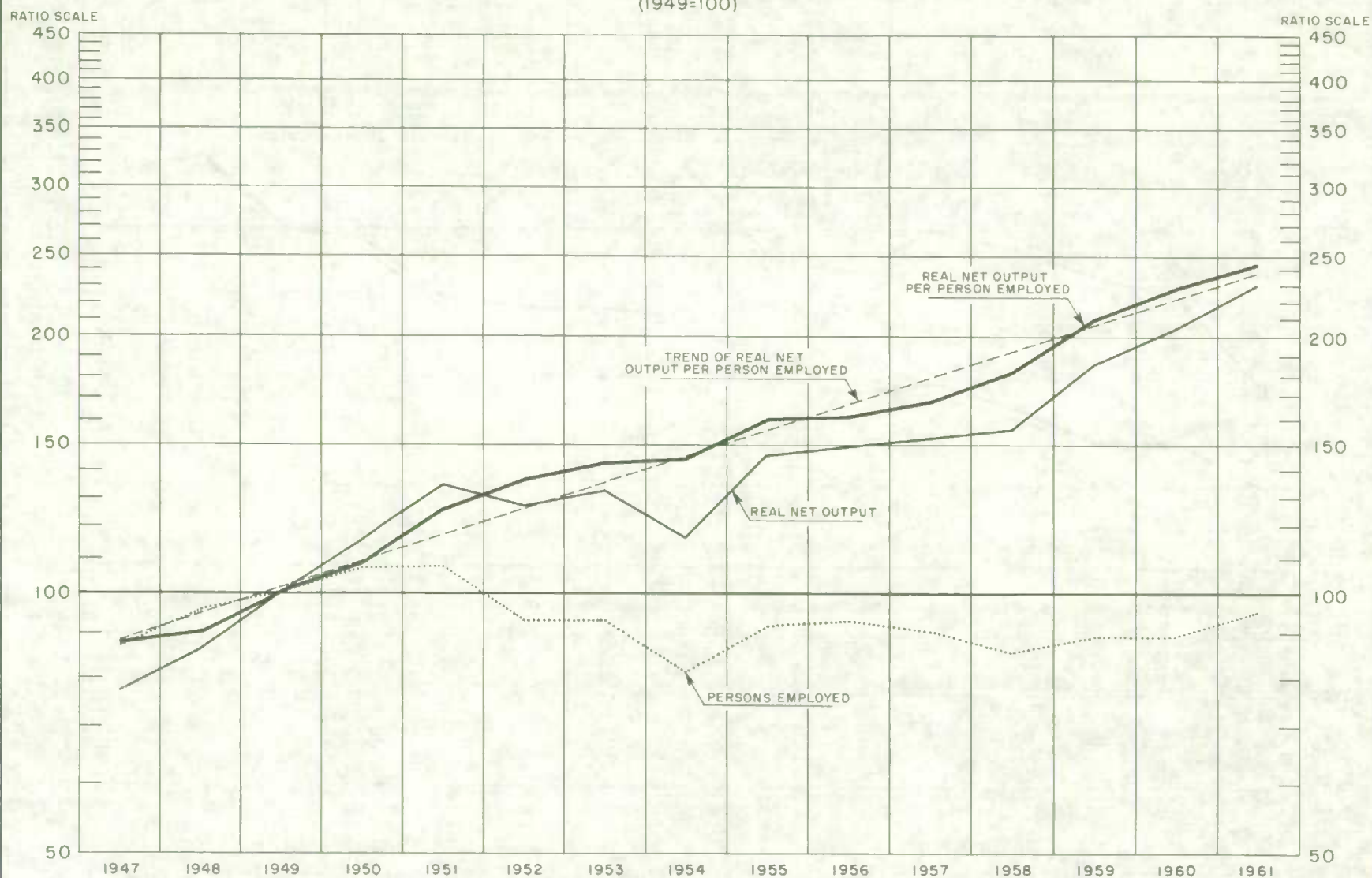
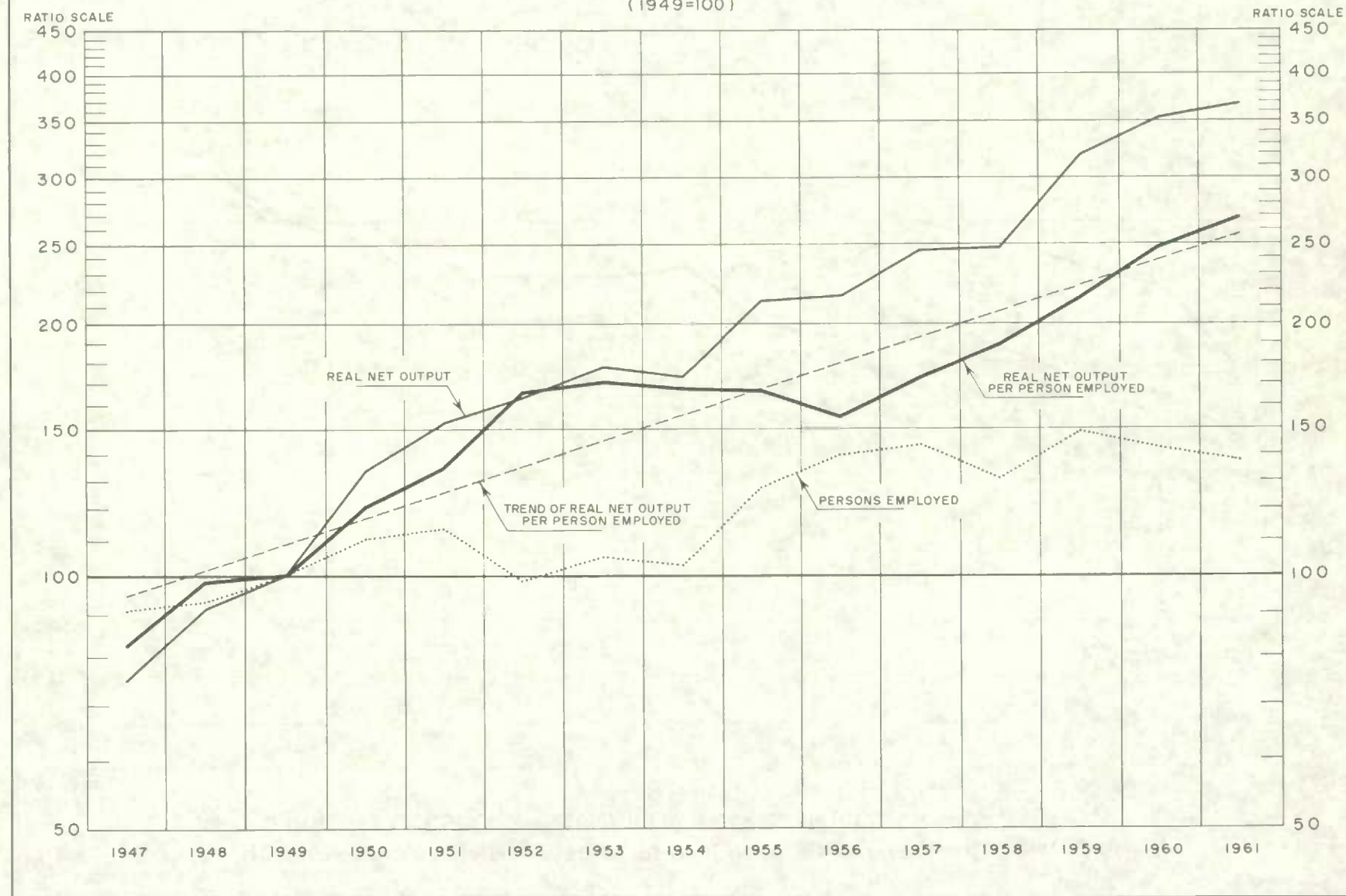


CHART B9.

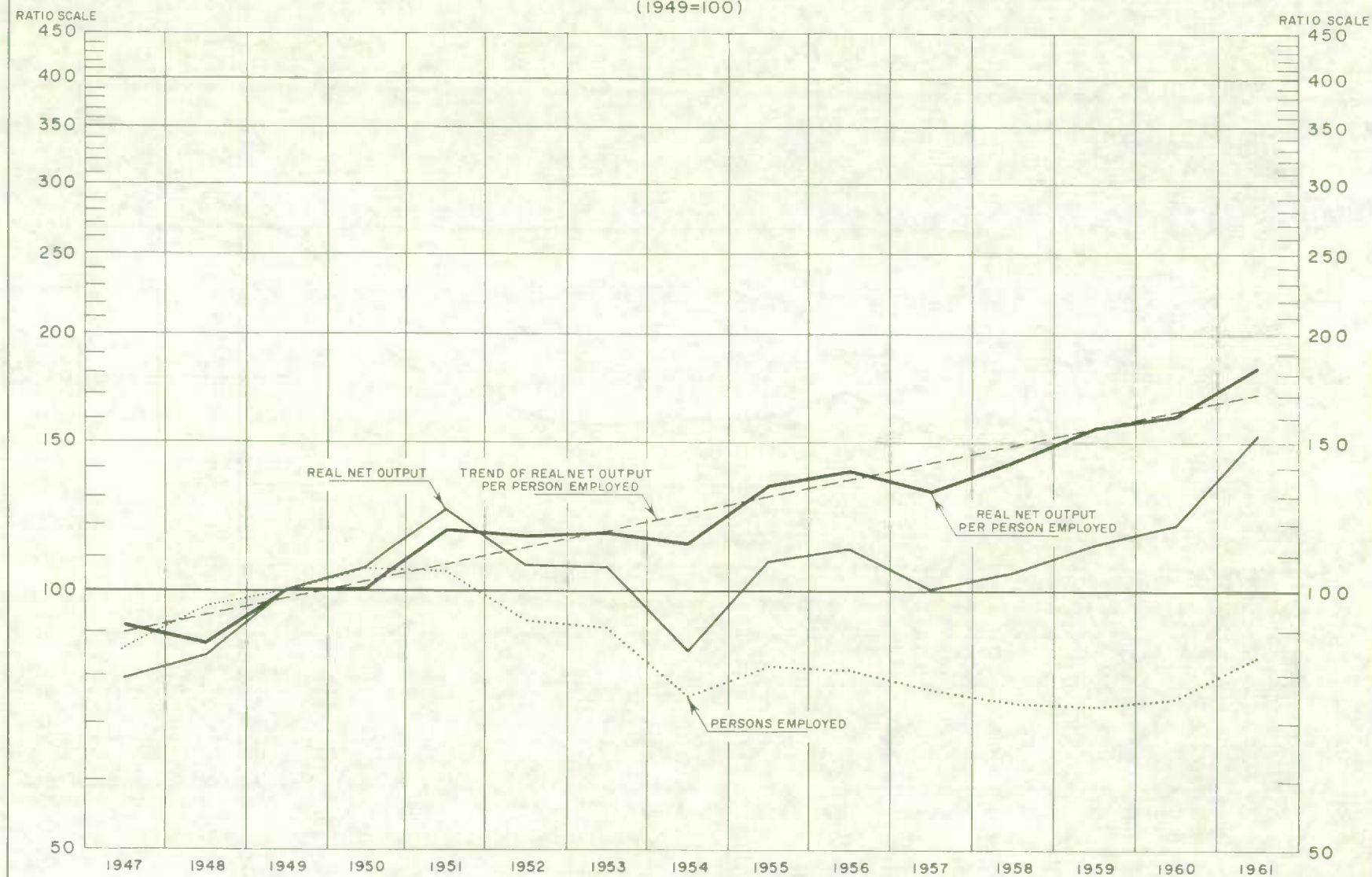
INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED AND COMPONENTS, FIBRE PRODUCERS—SYNTHETIC TEXTILE MILLS, CANADA, 1947- 61

(1949=100)



INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED AND COMPONENTS,
FIBRE PROCESSORS-SYNTHETIC TEXTILE MILLS,CANADA,1947- 61

(1949=100)



INDEXES OF REAL NET OUTPUT PER MAN-HOUR PAID OF PRODUCTION AND RELATED WORKERS AND COMPONENTS,
SYNTHETIC TEXTILE MILLS, CANADA, 1947-61
(1949=100)

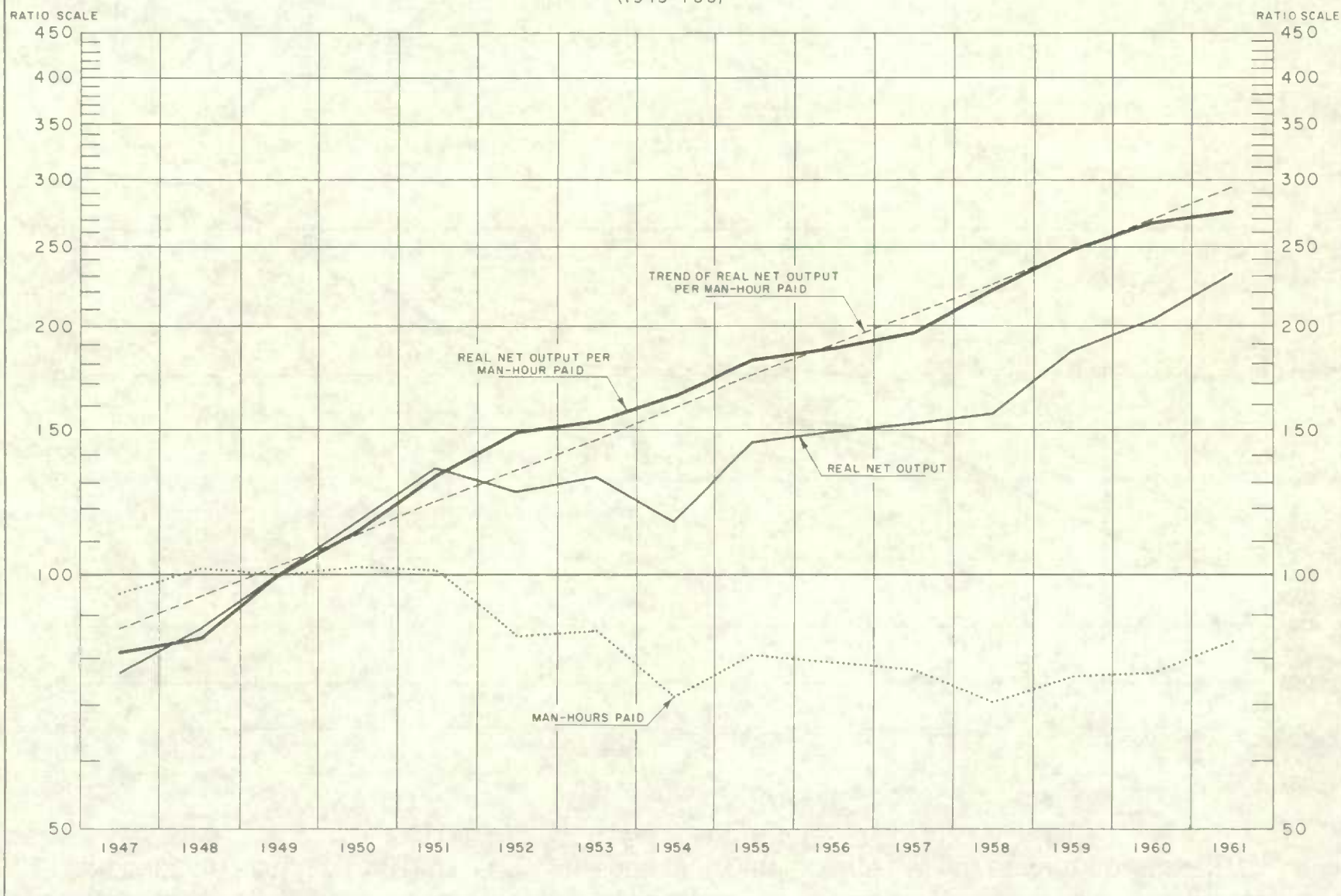


CHART B12.

INDEXES OF REAL NET OUTPUT PER MAN-HOUR PAID OF PERSONS EMPLOYED AND COMPONENTS,
SYNTHETIC TEXTILE MILLS, CANADA, 1947-61
(1949=100)

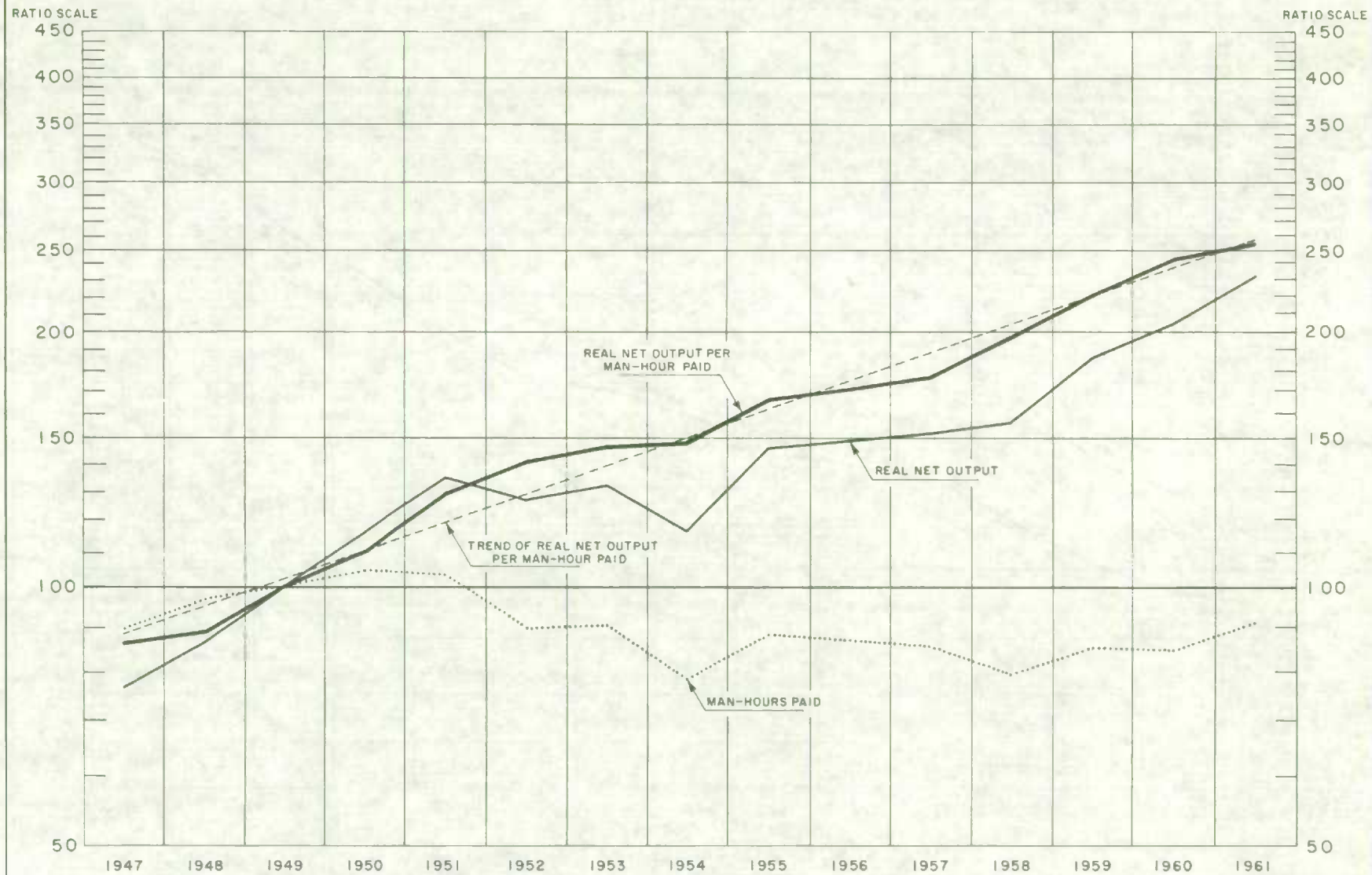


CHART B 13.

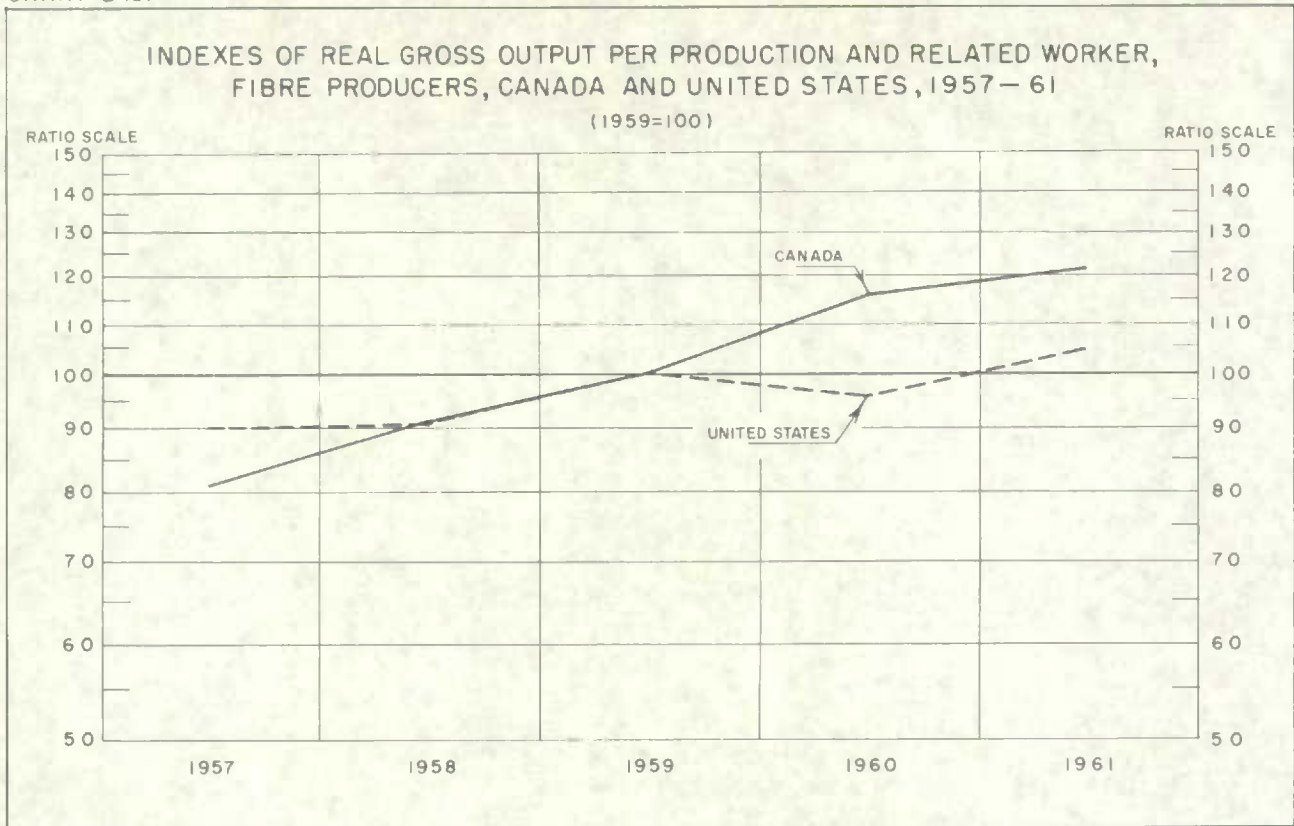
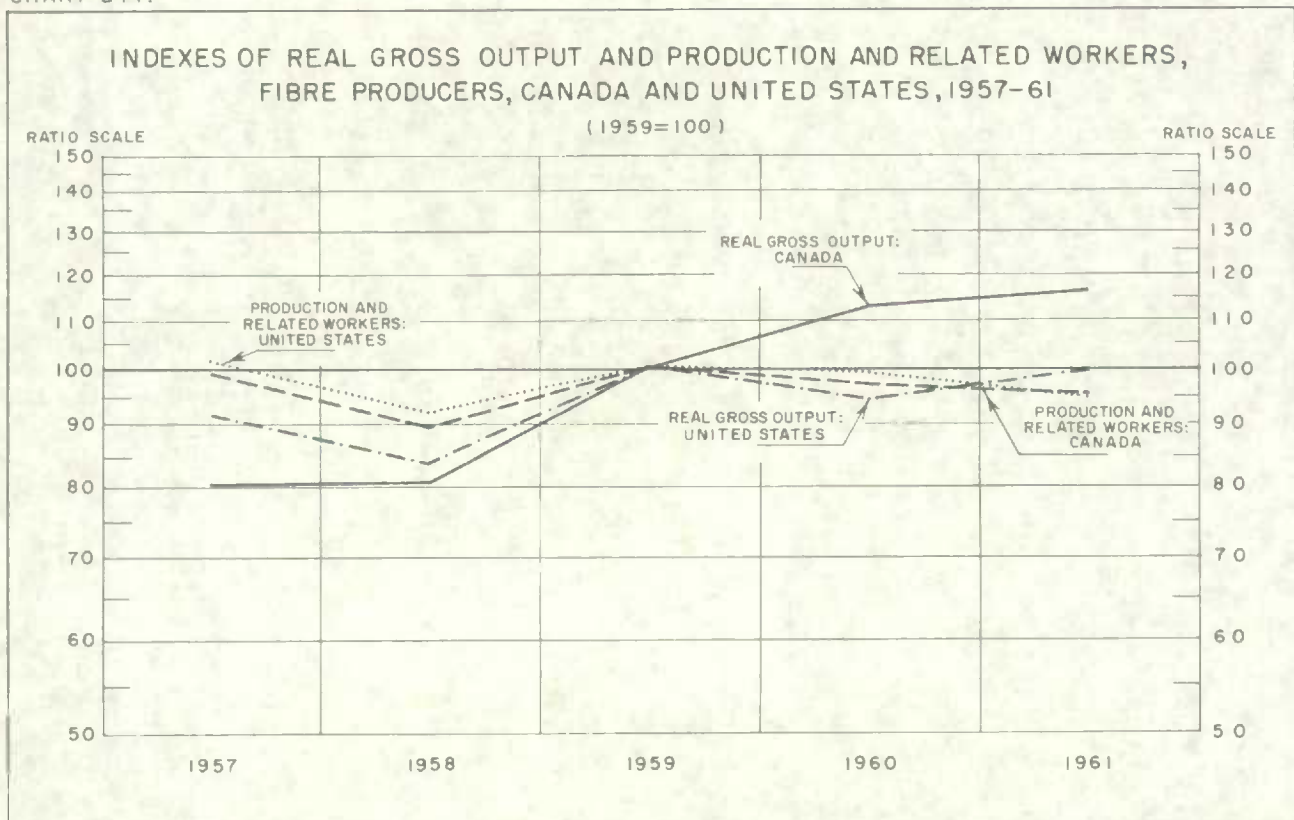


CHART B 14.



SECTION C
GENERAL DESCRIPTION AND CHARACTERISTICS
OF THE INDUSTRY

SECTION C

GENERAL DESCRIPTION AND CHARACTERISTICS OF THE INDUSTRY

Definition and Structure

The Synthetic Textile Mills industry, No. 201 in the (new) 1960 Standard Industrial Classification, is defined as follows:

"Establishments primarily engaged in manufacturing yarns and broad woven goods of synthetic textile fibres,¹¹ including glass fibres. This industry includes establishments primarily engaged in manufacturing yarns and broad woven goods of natural silk. It also includes establishments engaged in extrusion of synthetic textile filaments. Establishments primarily engaged in producing the basic synthetic material in such forms as liquids, chips, powders and flakes are classified in Industry No. 373—Manufacturers of Plastics and Synthetic Resins."¹²

This definition does not differ essentially from that which prevailed while the 1948 Standard Industrial Classification was in force, when the industry was known as Synthetic Textiles and Silk. When the revised classification was implemented in 1960 in the Census of Manufactures, the manufacturers of synthetic thread were transferred to the newly established Thread Mills industry (new S.I.C. No. 212) and two establishments, one formerly classified in the Dyeing and Finishing of Textiles (old S.I.C. No. 261) and the other in Wool Yarn (old S.I.C. No. 257), were brought in. In addition, as a result of the implementation of a new definition of reporting units (establishments)¹³ in the Census of Manufactures of 1961, the manufacturing activities of a major fibre and chemicals producer with an integrated plant at a single location, which had previously formed the basis for two reports to the Census, one classified to Synthetic Textile Mills and the other to the Manufacturers of Industrial Chemicals industry (new S.I.C. No. 378), were combined in a single report classified to the latter. The net effect of these changes on the principal statistics of the industry was quite small. For instance, the value of shipments declined by less than 2%.¹⁴

As the definition indicates, the Synthetic Textile Mills industry embraces three main kinds of manufacturing activity. The first of these, the production of synthetic filament yarns and staple fibre, is essentially chemical in nature while the other two, which consist of the spinning and processing of yarn and the weaving and finishing of fabrics, resemble the conventional textile processes based

on natural fibres. With one major exception, these three activities are carried on in separate establishments.¹⁵ In this report, the establishments engaged in the first kind of activity are referred to as "fibre producers", while the others are grouped together as "fibre processors". On the new basis of classification, there were, in 1961, fifty-six establishments in the industry and, of these, six establishments were primarily fibre producers and the remainder primarily fibre processors.

Because of the interest which undoubtedly attaches to these distinct branches of the industry, it has seemed desirable to calculate separate output, input and productivity measures for fibre producers and fibre processors, in addition to those for the industry as a whole. The detailed procedures involved in these additional calculations are described later in this report.¹⁶

Changes in the relative importance of the two branches of the industry are illustrated in Table C 1 below which shows the percentage share of each in real net output¹⁷ and total employment from 1947 to 1961.

Apart from the analytical advantages to be derived from a split of the Canadian data, international comparisons are also facilitated, since the Standard Industrial Classifications of other leading producers of synthetic textiles such as the United States, the United Kingdom, Japan and Italy, usually classify the activities embraced by the Canadian definition in more detail.

Growth and Characteristics

As Table C 2 shows, the value in current dollars of factory shipments in the Synthetic Textile Mills industry increased by almost 200% between 1947 and 1961 while, for Manufacturing as a whole, the corresponding increase was about 140%. The share of the Synthetic Textile Mills industry in the Manufacturing total increased by about 25%. On the other hand, the major group of Textile Industries, of which Synthetic Textile Mills forms a part, increased the value of its shipments by barely 70% between 1947 and 1961. Consequently, the major group's share of Manufacturing declined. It is thus evident, as the year by year percentages indicate, that the shipments of the Synthetic Textile Mills industry have become a progressively more important part of the overall Textile Industries' aggregate.

¹¹ The term "fibres" as used in this report refers to continuous filament yarns and various forms of staple fibre.

¹² Dominion Bureau of Statistics, *Standard Industrial Classification Manual*, Ottawa, Queen's Printer, December 1960, Occasional (DBS Catalogue No. 12-501).

¹³ See Part IV, General Technical Notes, page 115.

¹⁴ See Table 1, Dominion Bureau of Statistics, *Synthetic Textile Mills, 1961*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 34-208).

¹⁵ For a more detailed discussion of this point and other descriptive aspects of the industry, see Tariff Board, *op. cit.*, page 75.

¹⁶ See Part V, Industry Technical Notes, page 123.

¹⁷ Roughly, the sum of current year quantities of products valued at 1949 average unit values minus the sum of current year quantities of materials, etc. used at 1949 average unit values. See Part IV, General Technical Notes, pages 107 and 108 for a more complete explanation.

**TABLE C 1. Percentage Distribution of Real Net Output and Total Employment,
Synthetic Textile Mills: Fibre Producers and Fibre Processors,
Canada, Old Basis, 1947-61**

Year	Real net output		Total employment	
	Fibre producers	Fibre processors	Fibre producers	Fibre processors
	per cent			
1947	34.9	65.1	22.0	78.0
1948	38.1	61.9	20.5	79.5
1949	36.2	63.8	21.3	78.7
1950	41.6	58.4	22.0	78.0
1951	40.9	59.1	22.5	77.5
1952	46.4	53.6	22.4	77.6
1953	48.7	51.3	23.8	76.2
1954	53.5	46.5	26.9	73.1
1955	52.5	47.5	29.7	70.3
1956	52.2	47.8	31.8	68.2
1957	58.0	42.0	33.4	66.6
1958	57.1	42.9	32.2	67.8
1959	61.4	38.6	35.4	64.6
1960	62.5	37.5	33.9	66.1
1961	56.8	43.2	30.7	69.3

**TABLE C 2. Value of Factory Shipments,¹ Synthetic Textile Mills, Textile Industries
and Manufacturing, Canada, 1947-61**

Year	Synthetic textile mills	Textile industries	Manufacturing	Synthetic textile mills as per cent of textile industries	Synthetic textile mills as per cent of manufacturing
	millions of dollars			per cent	
1947	85	515	10,081	16.5	0.8
1948	107	605	11,875	17.7	0.9
1949	124	637	12,480	19.5	1.0
1950	147	741	13,818	19.8	1.1
1951	167	846	16,392	19.7	1.0
1952	158	744	16,983	21.2	0.9
1953	146	701	17,785	20.8	0.8
1954	132	641	17,555	20.6	0.8
1955	159	735	19,514	21.6	0.8
1956	161	767	21,637	21.0	0.7
1957 ²	168	736	21,452	22.8	0.8
1958	176	725	21,435	24.3	0.8
1959	203	786	22,831	25.8	0.9
1960	217	796	23,280	27.3	0.9
1961	249	875	24,243	28.5	1.0
1961 as % of 1947	292.9	169.9	240.5	...	...

¹ Up to 1952, gross value of products, except Synthetic Textile Mills which started reporting shipments in 1953.

² From 1957 on, data are based on the new S.I.C. and the New Establishment Concept. There would have been no significant differences in the results if data on the "old basis" had been used.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

A qualification must, however, be made which bears importantly on the validity of the above comparison between the factory shipments of the Synthetic Textile Mills industry and those of its major group, Textile Industries. Given the definition of the industry, its shipments reflect elements particular to this industry, in that the former is engaged

to a significant extent in the actual production of its own fibres. Thus, the comparisons of value added between Synthetic Textile Mills and the Textile Industries major group for the period 1947-61, shown in Table C3 below, probably provide a more realistic indication of the relative importance of the industry.

TABLE C3. Value Added in Manufacturing Operations, Synthetic Textile Mills and Textile Industries, Canada, 1947-61

Year	Synthetic textile mills	Textile industries	Synthetic textile mills as per cent of textile industries
	millions of dollars		per cent
1947	50	215	23.3
1948	63	262	24.0
1949	76	286	26.6
1950	88	316	27.8
1951	96	338	28.4
1952	90	313	28.8
1953	79	299	26.4
1954	70	275	25.5
1955	86	315	27.3
1956	80	324	24.7
1957	85	331	25.7
1958 ¹	86	317	27.1
1959	104	353	29.5
1960	113	362	31.2
1961	123	393	31.3
1961 as % of 1947	246.0	182.8	...

¹ From 1958 on, data are based on the new S.I.C. and the New Establishment Concept. There would have been no significant differences in the results if data on the "old basis" had been used.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

This comparison shows that while the relative importance of Synthetic Textile Mills within the Textile Industries major group was consistently higher than when figured on the factory shipments basis, the overall increase in relative importance between 1947 and 1961 was not nearly so great. Furthermore, while the year-to-year changes in the percentage relationship between the Synthetic Textile figures and those of the major group were generally in the same direction on both bases of comparison, the magnitude of the decreases from 1952-53, 1953-54 and 1955-56 were greater in the case of value added. In effect, the relative importance of Synthetic Textile Mills remained static between 1952 and 1956 on the basis of factory shipments, whereas it decreased appreciably on the basis of value added.

Using the number of persons employed as a criterion of the relative growth of the Synthetic Textile Mills industry, the previous picture is modified somewhat. In the first place, overall changes between 1947 and 1961, as shown in Table C4 below, were

quite small. The number of persons employed in manufacturing operations in Synthetic Textile Mills and in Manufacturing as a whole increased by about 8% and 12% respectively, so that the share of the former in the Manufacturing total decreased very slightly, although this does not show in the calculated percentages due to rounding. In the Textile Industries major group, the number of persons employed actually decreased by about 16%, with the result that the relative share of Synthetic Textile Mills within this aggregate increased from 19.9% to 25.3%, i.e. by roughly 27%.

Thus, by any token, the post-war growth of the Synthetic Textile Mills industry has been more pronounced than that of the Textile Industries major group, and there can be little doubt that this is the result of certain advantages which are unique to it. In all textile operations the characteristics of the end product, such as resistance to wear, shrinkage, pilling or creasing, the type of finish, weight in relation to bulk, etc., are ultimately dependent on the mechanical properties of the basic fibres in-

TABLE C 4. Persons Employed in Manufacturing Operations, Synthetic Textile Mills, Textile Industries and Manufacturing, Canada, 1947-61

Year	Synthetic textile mills	Textile industries	Manufacturing	Synthetic textile mills as per cent of textile industries	Synthetic textile mills as per cent of manufacturing
	number			per cent	
1947	14,728	73,979	1,131,750	19.9	1.3
1948	16,097	75,816	1,155,721	21.2	1.4
1949	16,828	77,773	1,171,207	21.6	1.4
1950	17,955	80,328	1,183,297	22.4	1.5
1951	17,997	81,710	1,258,375	22.0	1.4
1952	15,723	72,739	1,288,382	21.6	1.2
1953	15,723	73,190	1,327,451	21.5	1.2
1954	13,662	64,581	1,267,966	21.2	1.1
1955	15,408	69,144	1,298,461	22.3	1.2
1956	15,694	70,873	1,353,020	22.1	1.2
1957 ¹	15,109	67,046	1,340,948	22.5	1.1
1958	14,120	62,005	1,272,686	22.8	1.1
1959	14,693	62,304	1,287,809	23.6	1.1
1960	14,930	60,726	1,275,476	24.6	1.2
1961	15,849	62,544	1,264,946	25.3	1.3
1961 as % of 1947	107.6	84.5	111.8	...	...

¹ See Table C 2, footnote 2, page 40.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

volved. Since synthetic fibres can literally be made to order from basic molecular building blocks these mechanical characteristics can be varied almost at will, and this gives them a versatility which is limited only by the ability to translate into commercially feasible processes the possibilities which are continuously being opened up by the research chemist. Ironically, the fibre which laid the basis for the development of the Synthetic Textile Mills industry, viz. rayon, is not a genuine synthetic. Vegetable fibres such as cotton, linen and jute are composed essentially of cellulose fibres and the development of "artificial silk", as rayon often used to be called,¹⁸ followed the development of methods by which this basic substance could be cheaply produced from woodpulp.

The true synthetics¹⁹ resulted from the discovery that fibre-producing substances other than cellulose could be synthesized from intermediate chemicals, mostly by the process of polymerization, i.e. the building of molecular chains. Most of the intermediates, e.g., those used for nylon, terylene and

orlon, are hydrocarbons, a family of petroleum derivatives. The development of this group of synthetics probably derived its first impetus from military demands during World War II, but civilian demands quickly made themselves felt after the end of hostilities and, since then, their importance, relative to the various rayon products, has steadily increased. However, the absolute importance of rayon products continues to grow.

As a result of these developments, it is extremely difficult to summarize statistically the changes which took place in the composition of the output of the Synthetic Textile Mills industry during the period in question. In Table C 5 below, which shows the distribution of shipments in 1947 and 1961 between the various kinds of product, more detailed comparisons are not possible, because frequent changes in reporting requirements, which were designed to show the current pattern as clearly as possible, have affected the continuity of product detail, particularly in the area of woven fabrics. Furthermore, much of the continuous detail which is available cannot be disclosed because of its confidential nature. Nevertheless, with the aid of some supplementary comments, the table conveys a clear impression of the changes in the composition of output between 1947 and 1961.

¹⁸ Before 1947, the name of the industry was "Artificial and Real Silk Goods".

¹⁹ As an all-embracing description of both cellulosic and synthetic fibres, the term "man-made fibres" seems to be gaining some acceptance.

The broad impression of a relative shift from woven fabrics to yarns and staple fibres, which these figures convey, is similar to that of the real net output data of Table C 1 which illustrates the growth in relative importance of the fibre producing branch of the industry. In 1947, only three establishments were engaged in the production of synthetic fibres. One of these was integrated, so that part of its fibre

output does not appear directly in the following table. It has been estimated elsewhere²⁰ that in 1947 these producers accounted for some 60% by weight of the synthetic fibres used in Canada. As existing establishments increased their capacity and output and new ones came into the market, this percentage was progressively increased and a small percentage of total production began to be exported.

TABLE C 5. Distribution of Factory Shipments¹ by Principal Products, Synthetic Textile Mills, Old Basis, Canada, 1947 and 1961

Products	1947		1961	
	\$'000	%	\$'000	%
Woven fabrics	52,100	61.4	81,185	32.1
Knitted fabrics	—	—	3,950	1.6
Totals	52,100	61.4	85,135	33.7
Yarn and fibre:				
Synthetic singles (including tire yarn)	16,452	19.4	73,284	29.0
Thrown yarn	6,594	7.8	11,079	4.4
Spun rayon yarn (including mixtures)	2,722	3.2	4,895	1.9
All other yarns and thread ²	1,661	2.0	17,321	6.9
Staple fibre and tow	—	—	22,327	8.8
Totals	27,429	32.3	128,906	51.0
All other products	2,989	3.5	37,111	14.7
Custom and commission work	2,352	2.8	1,377	0.5
Total shipments	84,870	100.0	252,529	100.0

¹ In 1947, gross value of products.

² Thread, 1947 only. In 1947, total also includes knitted fabrics and staple fibre and tow, data for which are confidential.

By 1961, not only had the volume of production of man-made fibres increased substantially but also the variety, with glass, polyvinylidene chloride, polyester and acrylic fibres all being well established supplements and competitors of nylon and the cellulose. As well as meeting a greater portion of the requirements of the domestic textile industry, significant quantities of output were also flowing into other industrial uses such as tire manufacture and the production of cigarette filters.

Although "all other products" is a residual category, and no value figures can be shown in detail, mention may be made of certain commodities which were not shipped at all in 1947 but which had grown substantially in importance by 1961. These include consumer products such as carpets and blankets, various kinds of building material, and

intermediate chemicals for the manufacture of nylon and polyester fibres for which there exists an export demand.

In terms of fabric construction, rayon still remained the most important basic fibre in 1961, but its importance relative to that of nylon, polyester and the acrylic fibres had declined substantially since 1948.

In contrast to the situation in fibres, the available data²¹ seem to indicate that exports of fabricated products comprised a much smaller proportion of total shipments during the period in question and that the percentage of the domestic market served by imports tended to increase.

²⁰ Tariff Board, op. cit., pages 49-61.

²¹ Ibid, pages 49-61.

TABLE C6. Percentage Distribution of Selected Statistics, Classified by Number of Persons Employed in Manufacturing Operations,¹ Synthetic Textile Mills, Canada, 1947, 1956 and 1961²

Item and year	Persons employed			
	Total	1-99	100-499	500 and over
Per cent				
Establishments 1947	100.0	35.1	46.0	18.9
..... 1956	100.0	48.9	37.8	13.3
..... 1961	100.0	48.1	36.5	15.4
Persons employed ³ 1947	100.0	4.6	25.5	69.9
..... 1956	100.0	7.4	27.3	65.3
..... 1961	100.0	8.3	29.2	62.5
Salaries and wages ³ 1947	100.0	4.5	22.7	72.8
..... 1956	100.0	6.7	24.8	68.5
..... 1961	100.0	7.3	26.3	66.4
Gross value of production 1947	100.0	4.1	25.1	70.8
..... 1956	100.0	8.1	23.8	68.1
..... 1961	100.0	8.9	30.5	60.6
Cost of materials used 1947	100.0	4.3	36.9	58.8
..... 1956	100.0	9.6	29.9	60.5
..... 1961	100.0	11.0	38.8	50.2
Value added 1947	100.0	4.0	17.9	78.1
..... 1956	100.0	6.8	18.3	74.9
..... 1961	100.0	6.9	23.1	70.0
Dollars				
Value added per person employed 1947	3,471	3,007	2,434	3,879
..... 1956	5,458	5,001	3,661	6,260
..... 1961	8,307	6,978	6,568	9,294

¹ Sometimes the data for two separate establishments are combined in a single report for Census purposes. Such combinations are treated as single establishments in this table.

² 1961 data are based on new S.I.C. and New Establishment Concept.

³ Excludes persons employed in separate head offices.

Size and Location of Establishments

For the purpose of commenting on changes in the size structure of the Synthetic Textile Mills industry between 1947 and 1961, percentage distributions of certain principal statistics for the years 1947, 1956 and 1961 by establishment size group (based on the number of persons employed) are shown in Table C6.²² Attention is also drawn to Tables B3 and B4 in which a broader selection of summary statistics for the entire period from 1947 to 1961 is presented.

²² Since 1961 the processing of Census of Manufactures principal statistics has been on a computer basis. A number of analytical ratios, also classified by establishment size group on the basis of persons employed, have been made available as a by-product of the computer runs. The availability of these data in future reports is expected to enhance considerably their description and analytical usefulness.

In broad outline, the size structure of the industry underwent no drastic change between 1947 and 1961. The increase in the reported number of establishments from 40 to 56, was mostly concentrated in the 1-99 size group, thereby increasing the relative importance of the latter group in terms of number of establishments. However, in all three years, the relatively small number of establishments which employed 500 persons or more consistently accounted for major portions of the gross value of production and value added of the industry.

Another important point which emerges from Table C6 is that there was apparently, for the industry as a whole, no simple relationship between the size of establishment and the level of value added per person employed. For instance, in each of the three years, value added per person employed is lower in the 100-499 size group than in the 1-99 size group, but higher in the 500 and over size group than in either of the other two.

A more revealing comparison could have been made by breaking down the establishments within each size group into the three categories of fibre producers, spinners and throwsters, and weavers and finishers, since not only does the level of value added vary considerably between categories and between size groups within categories, but also, the distribution of the three types of establishment varies between size groups. For instance, the level of value added per person employed in fibre produc-

ing establishments in 1961 tended to increase as the size of establishment increased and was, on the average, about twice as high as in the other two categories. On the other hand, the level of value added per person employed in spinning and throwing and in weaving and finishing establishments tended to decrease as the size of establishment increased. However, a detailed discussion of these points would have involved the disclosure of confidential information.

TABLE C 7. Number of Establishments, Persons Employed and Value of Shipments by Province, Synthetic Textile Mills, Canada, as Originally Reported, 1947 and 1961

Province	Establishments		Persons employed in manufacturing operations		Value of shipments ¹	
	No.	%	No.	%	\$'000,000	%
1947						
Canada.....	40	100.0	14,728	100.0	85	100.0
Quebec.....	30	75.0	10,388	70.5	57	67.1
Ontario and New Brunswick	10	25.0	4,340	29.5	28	32.9
1961						
Canada.....	56	100.0	15,849	100.0	249	100.0
Quebec.....	38	67.9	10,526	66.4	133	53.4
Ontario and Alberta	18	32.1	5,323	33.6	116	46.6

¹ In 1947, gross value of products.

Source: Dominion Bureau of Statistics, *Synthetic Textile Mills*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 34-208).

As Table C 7 indicates, the majority of the establishments in the Synthetic Textile Mills industry in both 1947 and 1961 were located in Quebec. The remainder, with one exception in each year, being located in Ontario. Between 1947 and 1961, however, there was a relative shift from Quebec to Ontario and the other provinces in the number of establishments, employment and value of shipments. The shift in the value of shipments was particularly pronounced and was undoubtedly the result of the relatively faster growth of the fibre producing establishments, all but one of which are located outside Quebec.

Employment, Hours of Work and Remuneration of Labour

For the comparisons that follow, the relevant data are mostly drawn from the *Review of Man-hours and Hourly Earnings*²³ and *Earnings and Hours of Work in Manufacturing*²⁴ which provide a common source of labour statistics over the period under review for the Synthetic Textile Mills (Synthetic Textiles and Silk) industry, Textile Industries (Textile Products) and Manufacturing. In Table B 4, a broader selection of labour statistics is presented for the Synthetic Textile Mills industry alone.

Employment and Hours of Work.—Overall changes in employment in the Synthetic Textile Mills industry during the period under review have already been noted in the course of describing its growth relative to that of the Textiles major group and Manufacturing as a whole. The changes which occurred in the composition of this employment, as between production and related workers and administrative and office employees, are now summarized for the three levels of aggregation under discussion.²⁵ In all three cases, the ratio of administrative and office employees to persons employed increased between 1947 and 1961. However, the increase from 11.0% to 23.1% in the ratio for the Synthetic Textile Mills industry was larger than that for Textile Industries (11.7% to 19.3%) and that for Manufacturing (16.9% to 23.4%). The increases took place mostly before 1954 and the ratios have been generally stable since that time.

During the period 1947 to 1961, there was a widespread tendency for the length of the working week of production and related workers (wage-earners)

²³ DBS Catalogue No. 72-202.

²⁴ DBS Catalogue No. 72-204.

²⁵ In this connection, the terms "wage-earner" and "salaried employee" as used in the Employment Surveys can be considered roughly synonymous with "production and related worker" and "administrative and office employee" respectively as defined in the Census of Manufactures.

in the Manufacturing industries to decline, to which Synthetic Textile Mills was no exception. Average hours paid per week in the latter declined from 44.5 to 43.3, i.e., by about 2.7% while the corresponding decrease in the Textile Industries major group was from 43.2 hours to 42.0 hours (2.8%) and in total Manufacturing from 42.5 hours to 40.6 hours (4.5%).

The differences between the absolute levels of the data are noteworthy, average hours paid of wage-earners in the Synthetic Textile Mills industry being invariably higher than those in Textile Industries, which in turn were generally higher than those in Manufacturing. The limited data for the component branches of Synthetic Textile Mills, however, seem to indicate that the averages for all establishments concealed two quite different levels of hours worked,

wage-earners in fibre processing (Spun Yarn and Fabrics) working longer hours than those in fibre producing (Yarn and Staple Fibres) where the averages were much closer to those of Textile Industries.

Since 1956, the Census of Manufactures has collected the man-hours worked, man-hours not worked but paid, and total man-hours paid of production and related workers. Thus, although the period of availability is a relatively short one, these data do permit a tentative appraisal of the relative rates of growth of man-hours worked and man-hours paid of production and related workers at the three levels of aggregation under study. Perhaps the most suitable way in which the contrast can be drawn is by a comparison of the percentages of man-hours not worked but paid to total man-hours paid, shown in Table C 8 below.

**TABLE C 8. Man-hours not Worked but Paid of Production and Related Workers
as Per cent of Total Man-hours Paid, Synthetic Textile Mills,
Textile Industries and Manufacturing, Canada, 1956-61**

Year	Synthetic textile mills	Textile industries	Manufacturing
	per cent		
1956	4.5	5.1	4.9
1957	4.8	5.4	5.1
1958	4.9	5.4 ¹	5.2 ¹
1959	4.8	5.4 ¹	5.2 ¹
1960 ²	5.1	5.4	5.3
1961 ³	5.9	5.5	5.6

¹ Interpolated data.

² New S.I.C.

³ New S.I.C. and New Establishment Concept.

There is no great disparity in the absolute levels of the percentages shown here. For instance, on the assumption of 260 possible working days in a year (disregarding their length), the biggest difference between any two percentages in the same year, 0.6%, represents about 1½ working days. Because of the partial use of interpolated data, no useful interpretation of the year-to-year changes can be made. It seems, however, that the man-hours not worked but paid in the Synthetic Textile Mills industry have increased at a somewhat faster rate than those in Textile Industries, the initial disparity having been more than made good by 1961. Scrutiny of individual Census returns suggests that most of the impetus for this relatively faster rate of growth came from the fibre producing establishments.

The tendency already noted for the length of the working week of wage-earners to decline over the period from 1947 to 1961 was even more pro-

nounced in the case of salaried employees. By contrast with the situation for wage-earners, however, the levels of the data for Synthetic Textile Mills, Textile Industries, and Manufacturing were relatively close. In the first two cases, average hours paid per week decreased from exactly the same level and by exactly the same amount between 1947 and 1960²⁶, i.e., from 41.2 to 38.6, or by 6.3%, while in Manufacturing, there was a decrease from 40.4 to 38.5 hours, or by 4.7%.

For the longest period over which comparisons between the two classes of persons employed in Synthetic Textile Mills are possible, namely 1947 to 1960, average hours paid per week of wage-earners decreased by 3.2% as against 6.3% for salaried employees.

²⁶ The annual survey of *Earnings and Hours of Work in Manufacturing*, on which these data are based, was not carried out in 1961.

Remuneration of Labour.—The remuneration of labour in the Synthetic Textile Mills industry may be considered from at least two points of view, as a cost to the industry and in terms of the earnings of its employees. As regards the former, the points of interest are the relative importance of labour costs in the industry, the extent to which these may have varied over the period in question and how they compare with those of other industries and industry groups. To the extent that salaries and wages paid can be taken as an approximation of total labour costs and value added in manufacturing as an approximation of total factor income inclusive of capital consumption allowances, the ratio of these magnitudes is a useful indication of the importance of labour costs within total factor income. By implication such ratios are, of course, also highly suggestive of the capital intensity of the industries concerned. The values of such ratios for 1961, together with their component data, are shown in Table C9 for Synthetic Textile Mills,

Textile Industries and Manufacturing, as well as for a number of other industries and industrial groups chosen to illustrate the wide limits within which the ratio appears to fluctuate.

The ratio for the Synthetic Textile Mills industry is very close to that for Manufacturing and a little lower than that for the Textile Industries major group. Some indication of the annual fluctuations of the ratio of salaries and wages paid to value added in manufacturing operations in the industry between 1947 and 1961 may be derived from Table B3, Part I. In fact, the ratio seems to have fluctuated within a very narrow range of its 1961 value except between 1953 and 1958 when it was appreciably higher. The explanation for this increase may be partially bound up in the decreased profitability of the industry during this period, which has been commented on in the study referred to earlier.²⁷

TABLE C9. Salaries and Wages Paid as Per cent of Value Added by Selected Manufacturing Industries, Industrial Groups and Manufacturing, as Originally Reported, Canada, 1961

Industry and industrial group	Salaries and wages paid	Value added by manufacture	Salaries and wages paid as per cent of value added by manufacture
	thousands of dollars		per cent
Textile industries	212, 558	392, 689	54.1
Synthetic textile mills	59, 393	123, 478	48.1
Food and beverage industries	687, 996	1, 704, 715	40.4
Breweries	40, 882	197, 399	20.7
Petroleum and coal products industries	85, 340	290, 699	29.4
Transportation equipment industries	522, 470	828, 670	63.0
Aircraft and parts manufacturers	141, 930	192, 085	73.9
Manufacturing	5, 231, 447	10, 682, 138	49.0

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada, 1961*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

The average hourly earnings of wage-earners in the Synthetic Textile Mills industry rose from 63¢ in 1947 to \$1.45 in 1961, or by 130.2%. The increase is partly the result of a shift in the sex composition of production workers. Females in 1947 represented 35.5% of total production and related workers whereas, by 1961, the ratio had declined to 21.9%. For the Textile Industries major group, where there was an increase from 62¢ to \$1.38 or 122.6%, the ratio of females decreased from 40.5% in 1947 to 34.4%. In Manufacturing, the overall increase was 125.9%, but from a somewhat higher initial level with average hourly earnings in 1947 being 81¢ and \$1.83 in 1961. However, in this instance, the ratio of females diminished only slightly from 23.3% in 1947 to 21.8%. In the case

of establishments producing filament yarns and staple fibre only, where separate data were available after 1957, the level of earnings in 1961 was, at \$1.80, quite close to the Manufacturing average, with that for fibre processing being correspondingly lower than the average for the industry as a whole at \$1.18.

Average hourly earnings of salaried employees in Synthetic Textile Mills in 1947 were, at \$1.12, about 8% below those in Textile Industries (\$1.22) and in Manufacturing (\$1.23). By 1960, however, they had increased by 113.4% to \$2.39, which more than matched the increase of 112.2% in Manufactur-

²⁷ Tariff Board, op. cit., pages 75-81.

ing to \$2.61. In Textile Industries, the overall increase to \$2.31 was proportionately smaller (89.3%), so that Synthetic Textile Mills improved its relative standing within the major group. A comparison of the increases between 1947 and 1960 in the average hourly earnings of wage-earners and salaried employees in Synthetic Textile Mills indicates that the former increased by 127.0% as compared with 113.4% for the latter.

New Capital and Repair Expenditures²⁸

Within the Synthetic Textile Mills industry, expenditures on construction comprised the more variable portion of the total new capital and repair expenditures, the data for 1947 and 1958 representing the extreme values of the series in both absolute and percentage terms. Such expenditures tend, of course, to be more usually associated with the

addition of new capacity rather than with the replacement of old, and the sharp decrease in their level which took place after 1957 coincides with the completion at about that time of the sustained period of major expansion of productive facilities which was described earlier.

Total new capital and repair expenditures in the Synthetic Textile Mills industry constituted, on the average, about 38% of the Textile Industries total between 1947 and 1961. As may be seen from Table C 10 the year-to-year variations in this percentage were somewhat erratic, but the highest values were registered between 1951 and 1958, which reflects the generally high levels of the absolute data for Synthetic Textile Mills during those years and the greater stability of the Textile Industries total over the whole period. On the other hand, capital and repair expenditures in the Synthetic Textile Mills industry between 1947 and 1961 constituted a gradually diminishing share of the Manufacturing total.

TABLE C 10. New Capital and Repair Expenditures in Synthetic Textile Mills, Textile Industries, and Manufacturing, Canada, 1947 - 61

Year	Synthetic textile mills			Textile industries (except clothing)	Manufacturing	Synthetic textile mills construction as per cent of synthetic textile mills total	Synthetic textile mills total as per cent of textile industries total	Synthetic textile mills total as per cent of manufacturing total
	Construction	Machinery and equipment	Total					
	millions of dollars					per cent		
1947	6.1	15.5	21.6	51.6	801.2	28.2	41.9	2.7
1948	2.8	15.4	18.2	53.7	901.8	15.4	33.9	2.0
1949	2.2	14.9	17.1	50.6	874.6	12.9	33.8	2.0
1950	2.6	12.6	15.2	46.8	849.1	17.1	32.5	1.8
1951	5.0	19.0	24.0	59.8	1,215.1	20.8	40.1	2.0
1952	3.3	16.2	19.5	50.9	1,431.3	16.9	38.3	1.4
1953	5.2	14.3	19.5	47.3	1,448.9	26.7	41.2	1.3
1954	5.7	19.4	25.1	45.5	1,310.6	22.7	55.2	1.9
1955	3.5	15.0	18.5	47.5	1,459.7	18.9	38.9	1.3
1956	3.2	17.2	20.4	58.8	1,971.6	15.7	34.7	1.0
1957	3.3	21.5	24.8	60.5	2,092.8	13.3	41.0	1.2
1958	1.2	16.0	17.2	42.1	1,666.9	7.0	40.9	1.0
1959	1.5	12.7	14.2	42.7	1,806.3	9.9	33.3	0.8
1960 ¹	1.6	13.7	15.3	48.1	1,849.0	10.5	31.8	0.8
1961	1.7	13.2	14.9	51.6	1,766.7	11.4	28.9	0.8
Totals	48.9	236.6	285.5	757.5	21,445.6	17.1	37.7	1.3

¹ From 1960 on, new S.I.C.

Source: For the Textile Industries and Manufacturing, see: *Private and Public Investment in Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-504) - *Private and Public Investment in Canada Outlook*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-205). For the Synthetic Textile Mills industry 1947-59, see: *Synthetic Textile Mills, 1960*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 34-208). For 1960 and 1961, the figures were obtained from the supplement to *Private and Public Investment in Canada Outlook, 1963*, Business Finance Division, Dominion Bureau of Statistics.

PART II

BREWERIES

SECTION A

TRENDS AND FLUCTUATIONS IN OUTPUT
PER UNIT OF LABOUR INPUT

SECTION A

TRENDS AND FLUCTUATIONS IN OUTPUT PER UNIT OF LABOUR INPUT

Introduction

During the period 1947-61, the Breweries industry was characterized by a more or less steady growth in the volume of output, accompanied by a declining volume of labour input. As a result, the measures of output per unit of labour input showed an even more impressive record of growth. The overall increases in the latter were greater than those achieved in Manufacturing as a whole.

For more detailed analysis, the post-war growth of the Breweries industry can actually be considered in three stages. Between 1948 and 1951, both the volume of output and labour input showed little change as reflected in Chart B1.¹ From 1951 to 1956, output underwent a general upward movement whereas labour input remained more or less constant. Finally, the general upward trend in output persisted from 1956 to 1961, but was accompanied during this phase by a steady decline in labour input. As a result of these different movements, output per unit of labour input increased slightly during the first sub-period, substantially more during the second, and to an even greater extent in the third.

The Canadian series of real gross output per production worker for Breweries also grew substantially faster than its counterpart in the United States during the period 1949-61. The relationship between real net output per person employed and new capital and repair expenditures in the Breweries industry is not discussed in this report because, as in the case of the Synthetic Textile Mills industry,² it was not found possible to identify statistically the influence of new capital and repair expenditures on productivity.

Overall Changes in Output per Unit of Labour Input, 1947-61

Charts B2 and B3, which show real net output per production and related worker and per person employed for the Breweries industry and Manufacturing for the period 1947 to 1961, bring to light the most significant differences in productivity change between the two levels of aggregation. Differences between net and gross measures of output are not large, and the comments made here on the basis of the particular series depicted in Charts B2 to B7 are much the same as those which would have emerged from series based on gross output data.

¹ 1947 is excluded because the change in output between 1947 and 1948 is inconsistent with the later movements between 1948 and 1951.

² See Part I, Synthetic Textile Mills, page 10.

Overall increases in real net output per production and related worker between 1947 and 1961, shown in Chart B2, were 123.6% and 71.4% for the Breweries industry and Manufacturing respectively. The corresponding growth rates, calculated by the least squares of logarithm method, were 5.6% and 4.0% per annum. Similar orders of magnitude are reflected in the figures of real net output per person employed, shown in Chart B3, where the overall increases during the period 1947-61 were 97.9% for Breweries and 55.5% for Manufacturing, the corresponding growth rates being 4.8% and 3.3%. The strong similarity between Charts B2 and B3 suggests that the influence of administrative and office employees was roughly of the same relative importance at both levels of aggregation.

During the first of the three sub-periods identified above, real net output per production and related worker and per person employed in the Breweries industry increased at average rates of 2.6% and 0.9% per annum respectively. The corresponding growth rates were 4.9% and 4.4% in the second sub-period and 6.9% and 5.9% in the third, indicating a general acceleration in the rate of productivity change.

Table B1 shows that, between 1947 and 1961, the increases in the two measures of output per unit of man-hour paid, 155.0% and 123.9%, were higher than those for the parallel series of output per production and related worker and per person employed. In terms of annual growth rates, these represented increases of 6.7% and 5.8% respectively.

Year-to-year Changes in Output per Unit of Labour Input

From Charts B2 and B3, it appears that year-to-year changes in output per unit of labour input were more irregular for Breweries than for Manufacturing. Nevertheless, year-to-year changes in output per production and related worker and per person employed were not significantly different within each universe. Again, in the Breweries industry, the movements of output per man-hour in Charts B6 and B7 were very similar to those of output per man in Charts B4 and B5, except that the year-to-year changes of the former were smaller, which accounts for the closer correspondence to the straight line logarithmic trend.

Year-to-year changes in output per production and related worker and per person employed, as shown in Charts B4 and B5, were roughly of the same magnitude, with the largest increase taking

place between 1951 and 1952 as a result of an important increase in output and a small decrease in labour input. From Charts B6 and B7, it is evident that this was also the case in the output per man-hour paid series.

Growth of Real Output, 1947-61

Real gross output and real net output increased by 65.5% and 75.7% respectively over the whole period, at average rates of growth of 3.7% and 4.2% per annum. The difference between these growth rates is the result of increased efficiency on the part of productive factors in the transformation of materials into finished goods.

In terms of the sub-periods previously mentioned, gross and net output remained relatively stable from 1948 to 1951 (annual average rates of growth being 0.8% and 0.6%), increased by 4.2% and 5.1% per annum respectively between 1951-56, and finally showed increases of 3.1% and 3.3% per annum from 1956 to 1961.

The year-to-year movements of gross and net output were virtually identical over the whole period, with individual changes fluctuating between an increase of 15.9% in 1951-52 and a decrease of 2.6% in 1957-58. With the exceptions of 1949-50, 1953-54, and 1957-58, the changes were positive for all years.

Changes in Labour Input, 1947-61

The number of persons employed and the number of production and related workers in the Breweries industry followed similar downward trends during the period 1947-61, decreasing at average annual rates of 0.6% and 1.4% respectively. The corresponding man-hour series decreased somewhat faster, at the rate of 1.5% and 2.4% per annum.

Chart B1 shows that both employment series remained generally stable until 1957 and then decreased steadily. The most noteworthy of the year-to-year changes appears to be the sharp reduction in the employment of production and related workers and persons employed from 1949 to 1950.

During the sub-periods mentioned earlier, the number of production and related workers changed at average annual rates of -1.9%, +0.2% and -3.4%

respectively. In addition, the number of persons employed followed a similar pattern of change (-0.2%, +0.7%, -2.5%), although the general downward movement was not as pronounced.

Comparisons with United States Data

The official U.S. productivity series for the Malt Liquors industry have more or less the same industrial coverage as those for Breweries in Canada, and can also be regarded as reasonably consistent with the latter from a conceptual standpoint since, for the period 1949 to 1958, their output component is derived by combining physical volumes of product with 1947 unit value weights. After 1958, 1958 unit values were used but these probably did not change in relative importance to any great extent. The same qualifications that were made in respect of the comparability of labour inputs for the Man-made Fibers industry³ also apply here. The period of comparison is 1949-61 since U.S. data for 1948 are not available.

Chart B8 shows that the differences in overall growth of real gross output per production and related worker in the two countries were fairly substantial. In fact, total increases between 1949 and 1961 were 88.4% and 36.7% for Canada and U.S. respectively. In terms of average rates of growth, they amounted to 5.2% and 2.7% per annum. The general movements of the two series suggest a steadily widening gap.

The following analysis of the components is based on data from Table B1 for Canada and Table A1 below for the United States. From Chart B9 it is evident that in real gross output the Canadian industry sustained a higher rate of growth than its American counterpart. In fact, the index of real gross output for the Canadian Breweries industry increased by 50.9% between 1949-61 while the corresponding series for the U.S. registered a gain of only 17.5%. In both cases, the index of production and related workers decreased—slightly more for the Canadian than for the U.S. industry.

Thus, the general movements of the components suggest that the faster rate of productivity growth in the Canadian industry was due mainly to the more rapid growth of its output during the period 1949-61.

³ See Part I, Synthetic Textile Mills, page 18.

TABLE A 1. Indexes of Real Gross Output per Production and Related Worker, Real Gross Output, and Production and Related Workers, Malt Liquors, United States, 1947-61
(1949 = 100)

Year	Real gross output per production and related worker	Real gross output	Production and related workers
1947	91.8	101.0	110.0
1948 .....	..	98.2	..
1949	100.0	100.0	100.0
1950	100.6	100.9	100.3
1951	101.3	104.0	102.7
1952	103.5	106.0	102.5
1953	103.1	109.5	106.3
1954	106.4	106.5	100.2
1955	108.9	109.1	100.2
1956	111.9	109.9	98.3
1957	114.8	109.6	95.5
1958	124.0	110.8	89.4
1959	128.6	114.9	89.3
1960	130.1	115.4	88.8
1961	136.7	117.5	86.0
1961 as % of 1949	136.7	117.5	86.0
Annual trend rate of change (%)	+ 2.7	+ 1.2	- 1.5

Source: United States Department of Labor, Bureau of Labor Statistics, *Indexes of Output per Man-hour, Selected Industries, 1939 and 1947-63*, December 1965, page 54.

SECTION B
STATISTICAL TABLES AND CHARTS

TABLE B 1. Indexes of Real Output per Unit of Labour Input, Breweries, Canada, 1947-61
(1949 = 100)

Item and year	Real gross output per					Real net output per				
	Person employed	Production worker	Man-hour paid of persons employed	Man-hour paid of production workers	Man-hour worked of production workers	Person employed	Production worker	Man-hour paid of persons employed	Man-hour paid of production workers	Man-hour worked of production workers
Old basis:										
1947	91.9	89.5	90.5	87.7	..	90.9	88.5	89.5	86.7	..
1948	101.5	99.4	101.0	99.2	..	101.3	99.2	100.8	99.0	..
1949	100.0	100.0	100.0	100.0	..	100.0	100.0	100.0	100.0	..
1950	103.5	103.8	106.9	107.2	..	103.5	103.8	106.9	107.2	..
1951	104.0	107.7	102.2	104.1	..	103.0	106.7	101.2	103.1	..
1952	122.3	124.2	119.7	120.2	..	123.6	125.6	121.1	121.6	..
1953	125.2	128.2	124.9	126.6	..	127.6	130.7	127.3	129.0	..
1954	121.3	123.8	129.3	132.6	..	123.9	126.5	132.1	135.4	..
1955	129.5	134.6	137.1	142.6	..	134.0	139.4	141.9	147.6	..
1956	128.1	135.5	139.7	148.4	148.4	133.3	141.0	145.5	154.5	154.5
1957	141.5	149.0	156.1	165.7	166.1	147.4	155.3	162.7	172.7	173.1
1958	142.1	150.4	157.5	168.0	170.4	148.3	157.0	164.4	175.3	177.7
1959	155.3	166.6	169.7	182.6	186.2	161.6	173.4	176.7	190.1	193.8
1960	162.8	178.3	177.2	193.5	201.1	170.2	186.4	185.3	202.2	210.2
1961	171.3	188.4	190.8	210.5	218.7	179.9	197.9	200.4	221.1	229.7
1961 as % of 1947	186.4	210.5	210.8	240.0	...	197.9	223.6	223.9	255.0	...
Annual trend rate of change (%)	+ 4.3	+ 5.1	+ 5.3	+ 6.2	...	+ 4.8	+ 5.6	+ 5.8	+ 6.7	...
New basis:										
1959	155.3	166.6	169.7	182.6	186.2	161.6	173.4	176.7	190.1	193.8
1960	162.2	177.6	176.5	192.7	200.3	169.0	185.1	184.0	200.8	208.7
1961	171.4	188.5	190.9	210.6	218.8	178.9	196.8	199.2	219.8	228.4

TABLE B 2. Indexes of Real Output and Labour Input, Breweries, Canada, 1947-61
(1949 = 100)

Item and year	Real output		Persons employed		Production and related workers		
	Gross	Net	Number	Man-hours paid	Number	Man-hours paid	Man-hours worked
Old basis:							
1947	91.2	90.2	99.2	100.8	101.9	104.0	..
1948	98.7	98.5	97.2	97.7	99.3	99.5	..
1949	100.0	100.0	100.0	100.0	100.0	100.0	..
1950	99.5	99.5	96.1	93.1	95.9	92.8	..
1951	101.6	100.6	97.7	99.4	94.3	97.6	..
1952	115.3	116.6	94.3	96.3	92.8	95.9	..
1953	121.3	123.6	96.9	97.1	94.6	95.8	..
1954	119.7	122.3	98.7	92.6	96.7	90.3	..
1955	125.2	129.6	96.7	91.3	93.0	87.8	..
1956	129.1	134.4	100.8	92.4	95.3	87.0	87.0
1957	137.5	143.3	97.2	88.1	92.3	63.0	82.8
1958	133.9	139.7	94.2	85.0	89.0	79.7	78.6
1959	144.1	150.0	92.8	84.9	86.5	78.9	77.4
1960	148.0	154.7	90.9	83.5	83.0	76.5	73.6
1961	150.9	158.5	88.1	79.1	80.1	71.7	69.0
1961 as % of 1947	165.5	175.7	88.8	78.5	78.6	68.9	...
Annual trend rate of change (%)	+ 3.7	+ 4.2	- 0.6	- 1.5	- 1.4	- 2.4	...
New basis:							
1959	144.1	150.0	92.8	64.9	86.5	78.9	77.4
1960	147.4	153.6	90.9	83.5	83.0	76.5	73.6
1961	151.0	157.6	88.1	79.1	80.1	71.7	69.0

TABLE B 3. Selected Statistics of Manufacturing Activities, Breweries, Canada, 1947-61

Item and year	Estab- lishments	Value of shipments ¹	Cost at factory of materials used	Cost at factory of fuel and electricity used	Value added	Value added per person employed	Salaries and wages, persons employed, as per cent of value added	Book value of inventories, year end
	No.	\$'000				\$	%	\$'000
Old basis:								
1947	61	114,547	25,871	1,875	86,801	10,112	22.4	..
1948	61	126,939	34,995	2,161	89,783	10,680	23.7	..
1949	64	142,400	37,940	2,334	102,126	11,804	23.0	..
1950	63	149,409	42,018	2,318	105,073	12,643	22.7	..
1951	63	161,159	45,906	2,512	112,741	13,344	24.4	..
1952	61	178,769	49,713	2,590	126,465	15,492	23.8	..
1953	61	200,886	51,482	2,598	146,806	17,512	21.6	..
1954	62	198,390	47,590	2,651	147,836	17,309	22.6	26,064
1955	58	210,572	48,678	2,730	158,371	18,926	21.7	26,268
1956	59	215,897	53,047	3,049	161,031	18,458	22.8	30,510
1957	57	231,116	59,230	3,252	169,991	20,206	21.8	30,187
1958	55	232,353	55,656	3,182	172,383	21,156	21.9	29,099
1959	56	244,766	57,936	3,225	183,535	22,853	22.0	29,005
New basis:								
1959	56	243,357	57,936	3,225	182,465	22,720	22.1	29,005
1960	54	250,023	58,050	3,289	188,855	24,015	22.3	29,575
1961	54	259,438	59,062	3,300	197,399	25,895	20.7	31,708

¹ Excludes federal and provincial taxes, duties, brewers' license fees and permits, and outward transportation costs. Figures up to and including 1953 represent gross value of products.

TABLE B 4. Selected Labour Statistics¹ of Manufacturing Activities, Breweries, Canada, 1947-61

Item and year	Persons employed				Production and related workers								Administrative and office employees		
	Number	Per estab- lishment	Earn- ings	Man- hours paid	Number	As per cent of persons em- ployed	Earn- ings	Man-hours ²			Average hourly earn- ings ³	Average of man- hours paid per week ³	Number	Average hourly earn- ings ⁴	Average of man- hours paid per week ⁴
								Paid	Worked	Not worked but paid as per cent of man- hours paid					
No.	\$'000	'000	%	\$'000	'000	'000	%	\$	No.	\$	No.				
Old basis:															
1947	8,584	141	19,427	19,621	7,143	83.2	14,477	16,834	..	..	0.86	45.3	1,441	1.71	37.2
1948	8,407	138	21,253	19,015	6,961	82.8	15,952	16,113	..	..	0.99	43.8	1,446	1.84	38.6
1949	8,652	135	23,461	19,461	7,010	81.0	17,324	16,191	..	..	1.07	43.0	1,642	1.85	38.3
1950	8,311	132	23,889	18,121	6,725	80.9	16,822	15,020	..	..	1.12	43.1	1,586	1.91	37.6
1951	8,449	134	27,489	19,351	6,608	78.2	19,433	15,799	..	..	1.23	43.6	1,841	2.10	37.1
1952	8,163	134	30,144	18,745	6,507	79.7	22,044	15,524	..	..	1.42	43.1	1,656	2.22	37.4
1953	8,383	137	31,738	18,906	6,629	79.1	23,269	15,513	..	..	1.50	42.6	1,754	2.35	37.2
1954	8,541	138	33,423	18,018	6,779	79.4	23,975	14,619	..	..	1.64	40.6	1,762	2.44	37.1
1955	8,368	144	34,388	17,766	6,522	77.9	24,163	14,214	..	..	1.70	40.6	1,846	2.53	37.0
1956	8,724	148	36,770	17,982	6,678	76.5	25,372	14,088	13,089	7.1	1.80	40.6	2,046	2.77	36.6
1957	8,413	148	37,003	17,139	6,467	76.9	26,042	13,445	12,455	7.4	1.94	40.0	1,946	2.86	36.5
1958	8,148	148	37,709	16,541	6,236	76.5	26,275	12,902	11,828	8.3	2.04	39.8	1,912	3.00	36.6
1959	8,031	143	40,348	16,520	6,067	75.5	28,005	12,782	11,645	8.9	2.19	40.5	1,964	3.18	36.6
New basis:															
1959	8,031	143	40,348	16,520	6,067	75.5	28,005	12,782	11,645	8.9	2.19	40.5	1,964	3.18	36.6
1960	7,864	146	42,105	16,250	5,816	74.0	28,416	12,384	11,065	10.7	2.29	40.9	2,048	3.29	36.3
1961	7,623	141	40,882	15,390	5,615	73.7	27,560	11,610	10,373	10.7	2.37	39.8	2,008 ⁵	3.48	36.2

¹ For 1959, 1960 and 1961, labour data of manufacturing activities are identical under the old and new basis.

² The series were constructed using man-hours estimated by payroll deflation for the period 1947-55 and reported man-hours from 1956 on.

³ From 1947 to 1955 inclusive the figures originate from the publication *Review of Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-202); from 1956 on, they are calculated from reported data in the Census of Manufactures.

⁴ From 1947 to 1957 and for 1961, the figures were estimated (See Part V, Industry Technical Notes, page 128); from 1958 to 1960, they were obtained from the ledgers of the Employment Section, Labour Division, DBS.

⁵ In 1961, the reported figures of administrative and office employees have been assigned in total to manufacturing activities, although, according to the New Establishment Concept, they are actually applicable to total activities. This was done despite the fact that nonmanufacturing activities in this industry are of some importance.

Note: The terms "production and related worker" and "administrative and office employee" as defined in the Census of Manufactures can be considered roughly synonymous with "wage-earner" and "salaried employee" respectively as used in the Employment Surveys. (See Part IV, General Technical Notes, page 112).

CHART B1.

INDEXES OF REAL OUTPUT AND LABOUR INPUT, BREWERIES, CANADA, 1947-61 (1949=100)

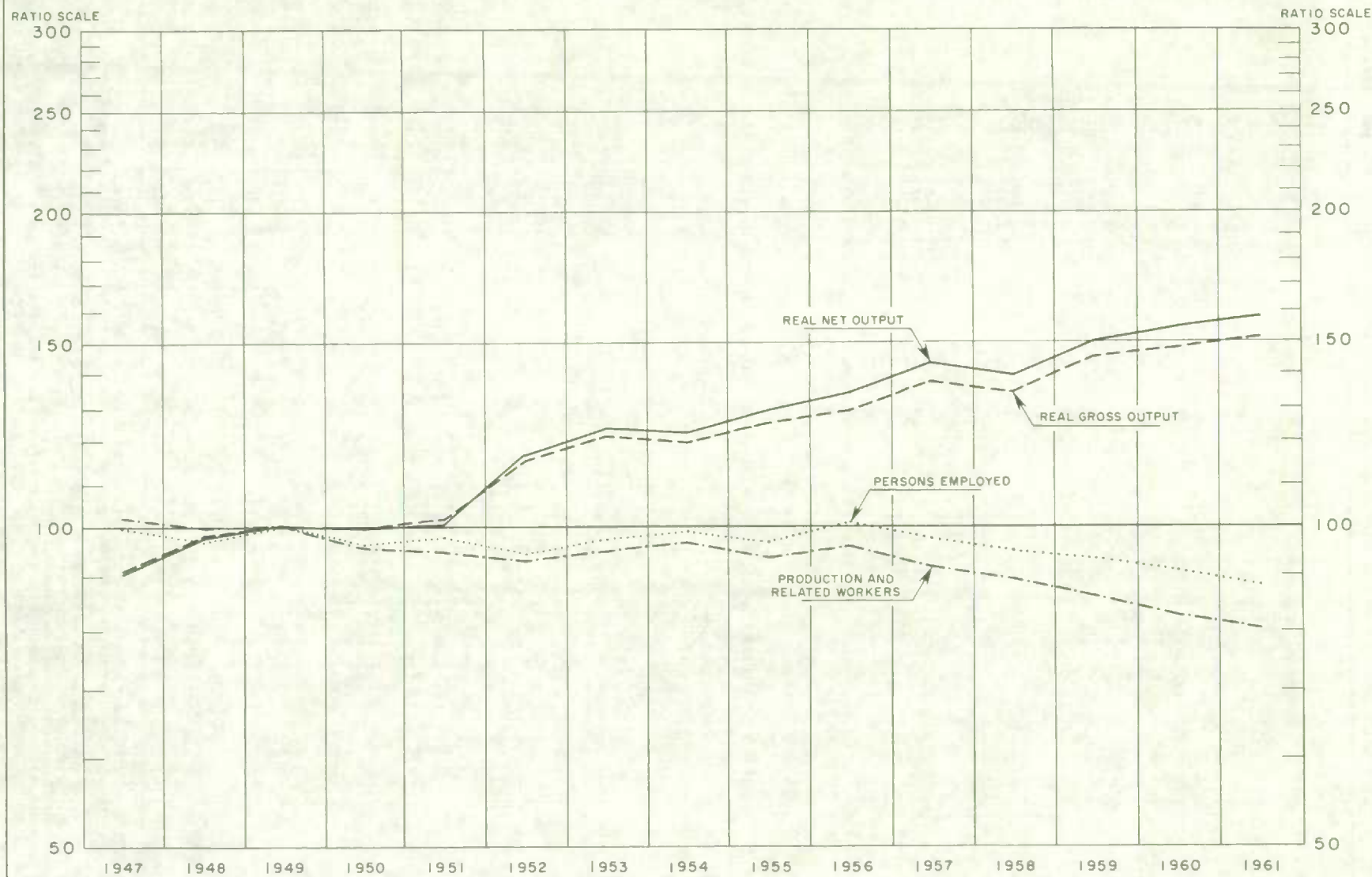


CHART B2.

INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER, BREWERIES AND MANUFACTURING, CANADA, 1947-61

(1949=100)

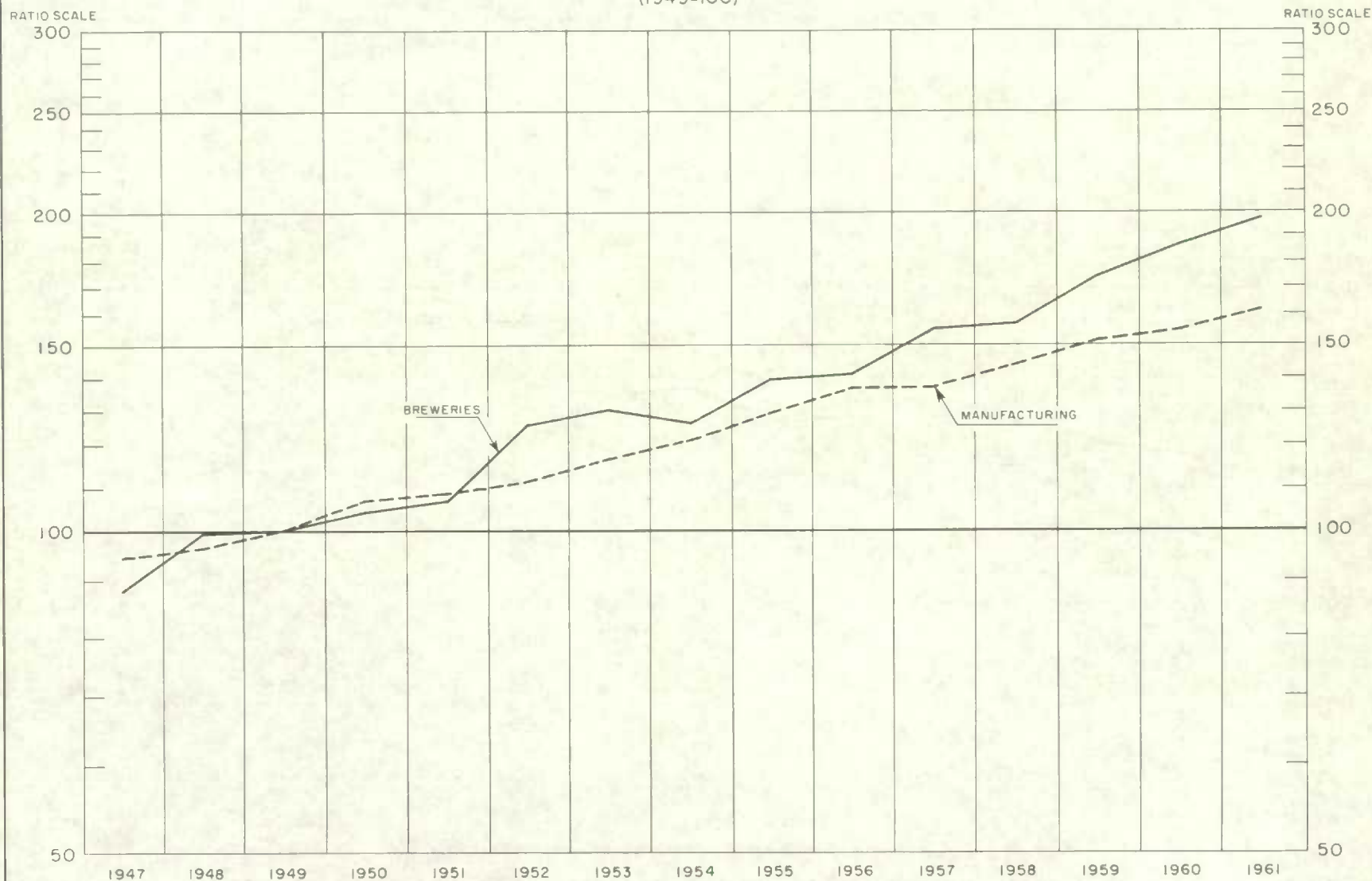
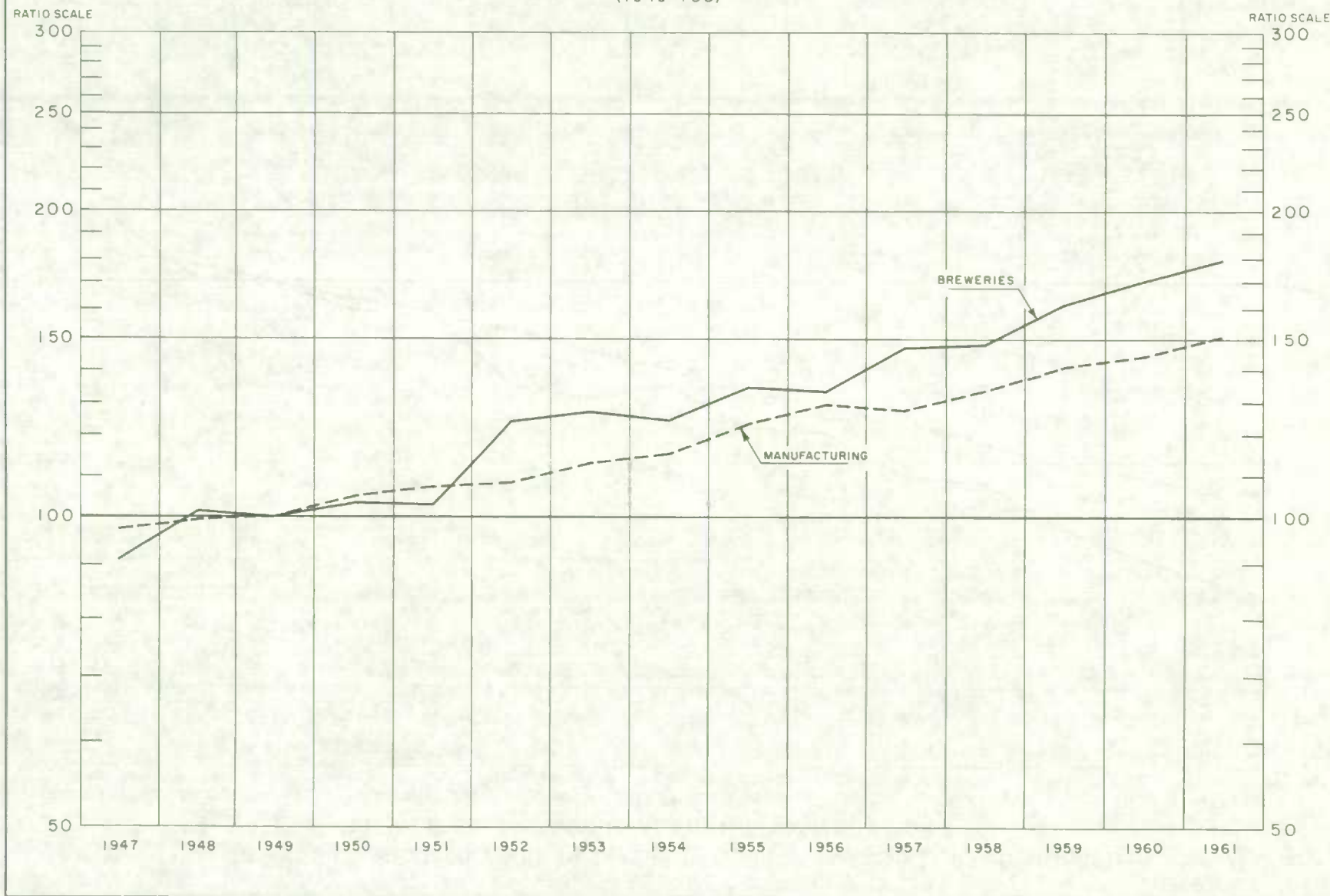


CHART B3.

INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED,
 BREWERIES AND MANUFACTURING, CANADA, 1947-61
 (1949=100)



INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER AND COMPONENTS,
BREWERIES, CANADA, 1947-61

(1949=100)

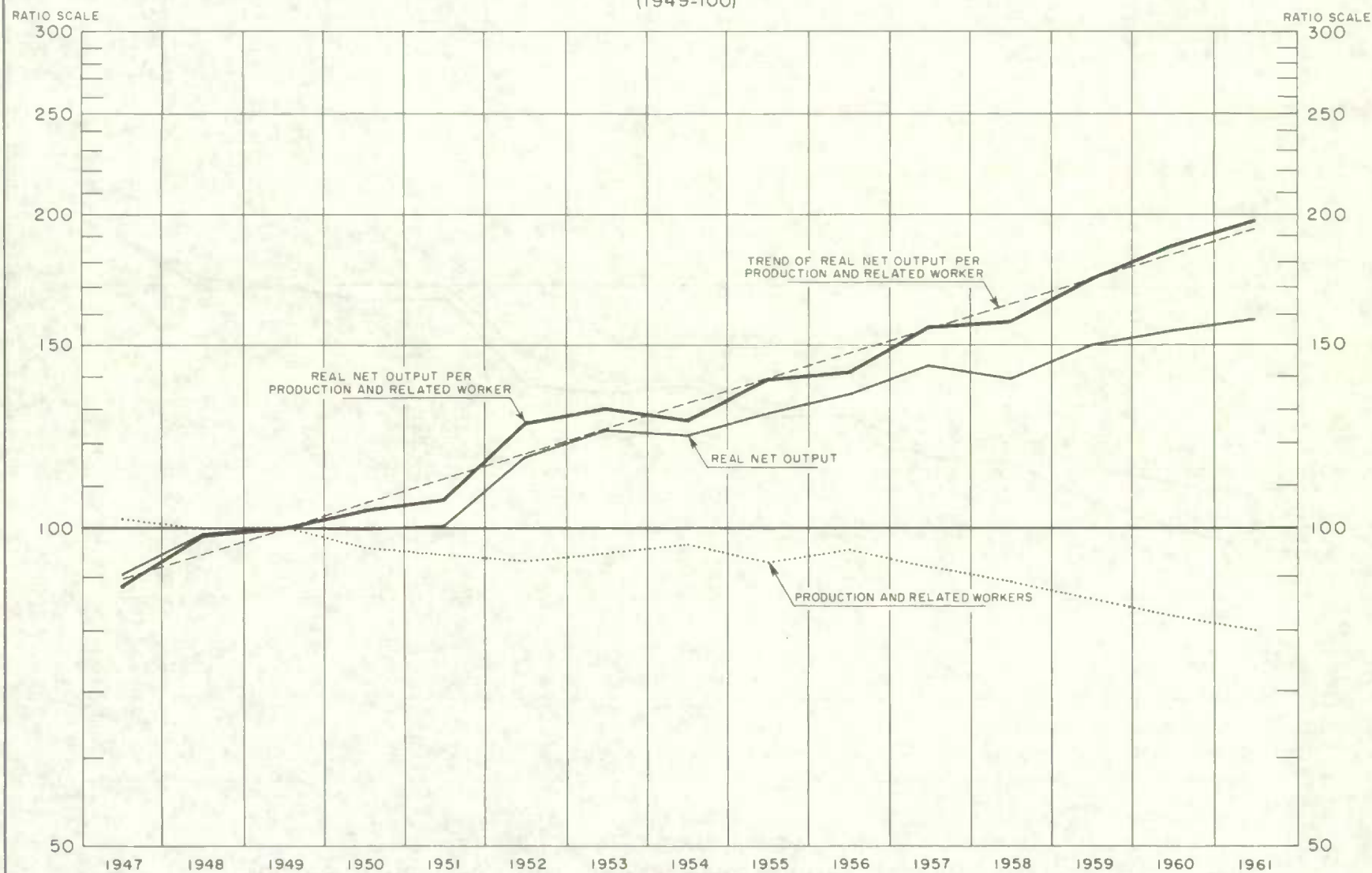
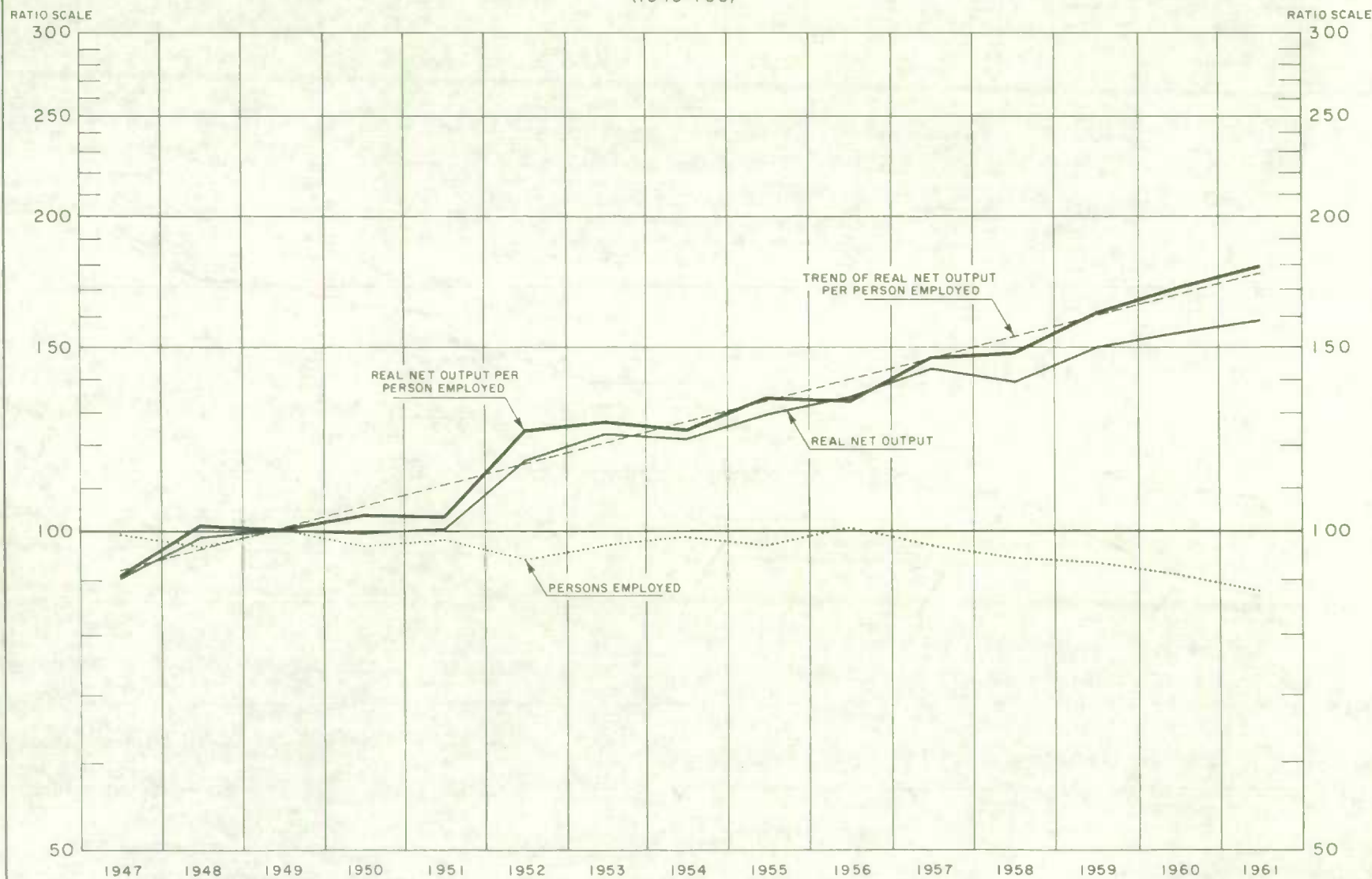


CHART B5.

INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED AND COMPONENTS, BREWERIES, CANADA, 1947-61 (1949=100)



INDEXES OF REAL NET OUTPUT PER MAN-HOUR PAID OF PRODUCTION AND RELATED WORKERS AND COMPONENTS,
BREWERIES, CANADA, 1947-61

(1949=100)

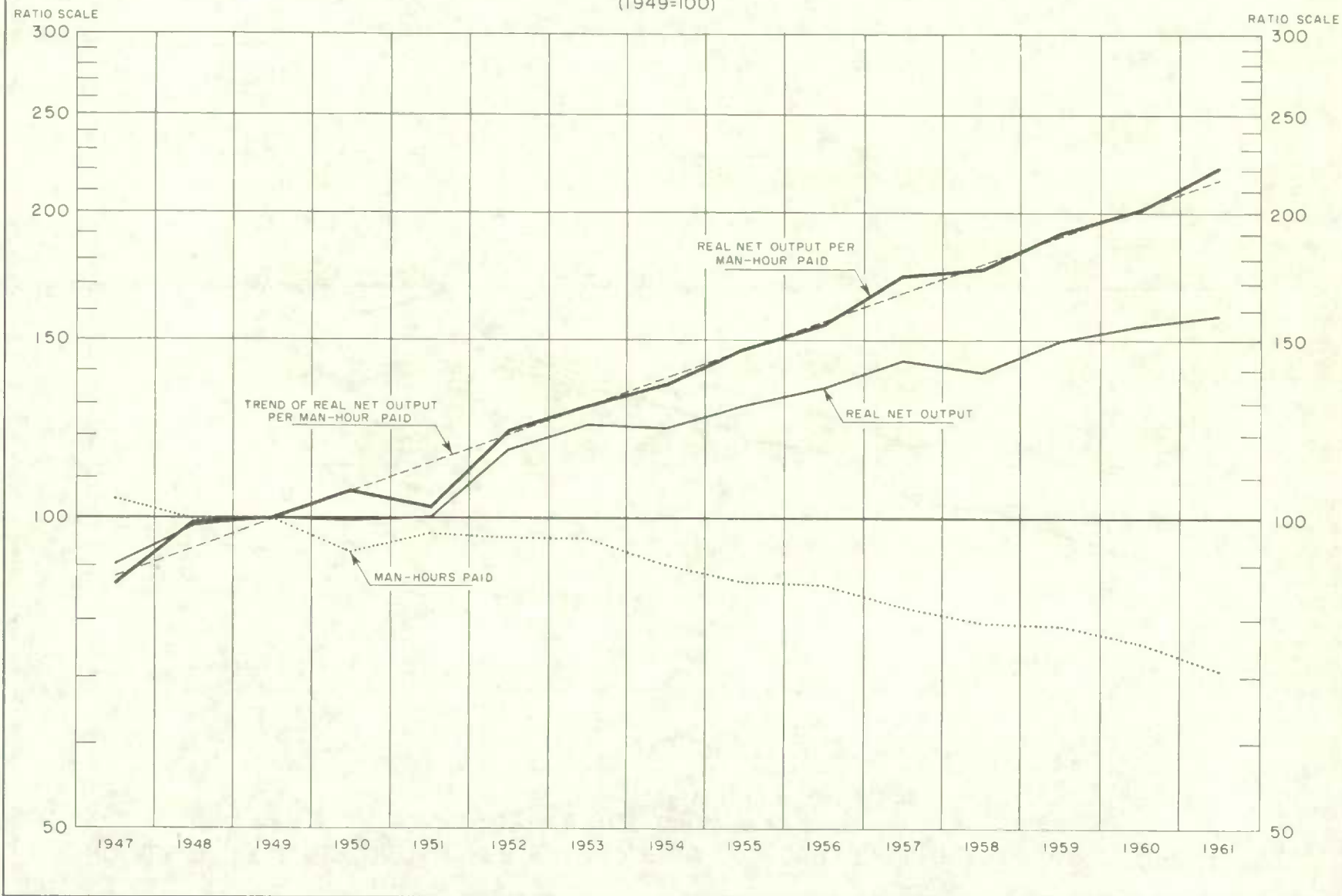
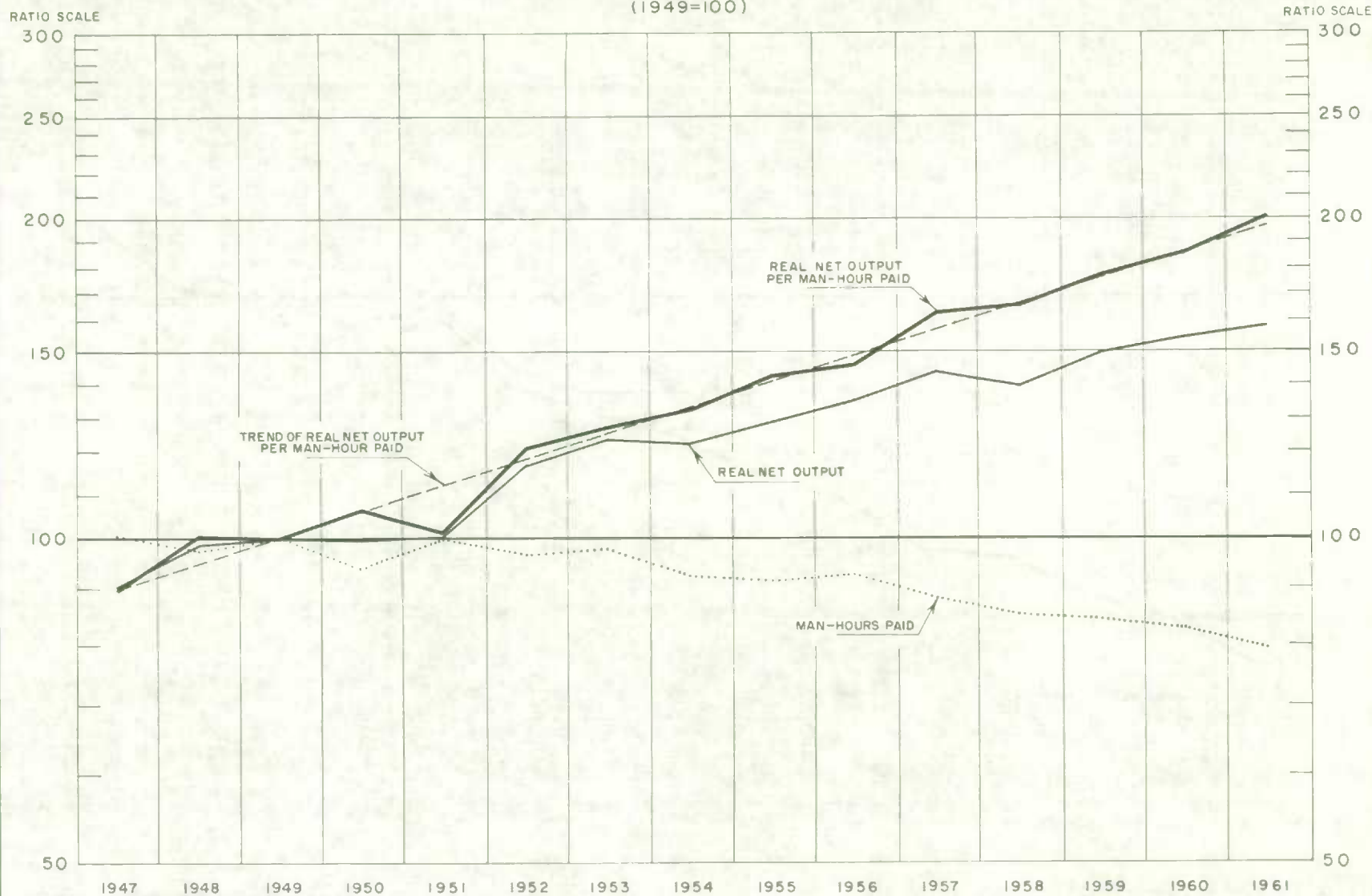


CHART B7.

INDEXES OF REAL NET OUTPUT PER MAN-HOUR PAID OF PERSONS EMPLOYED AND COMPONENTS, BREWERIES, CANADA, 1947-61 (1949=100)



INDEXES OF REAL GROSS OUTPUT PER PRODUCTION AND RELATED WORKER, BREWERIES,
CANADA AND UNITED STATES, 1947-61

(1949=100)

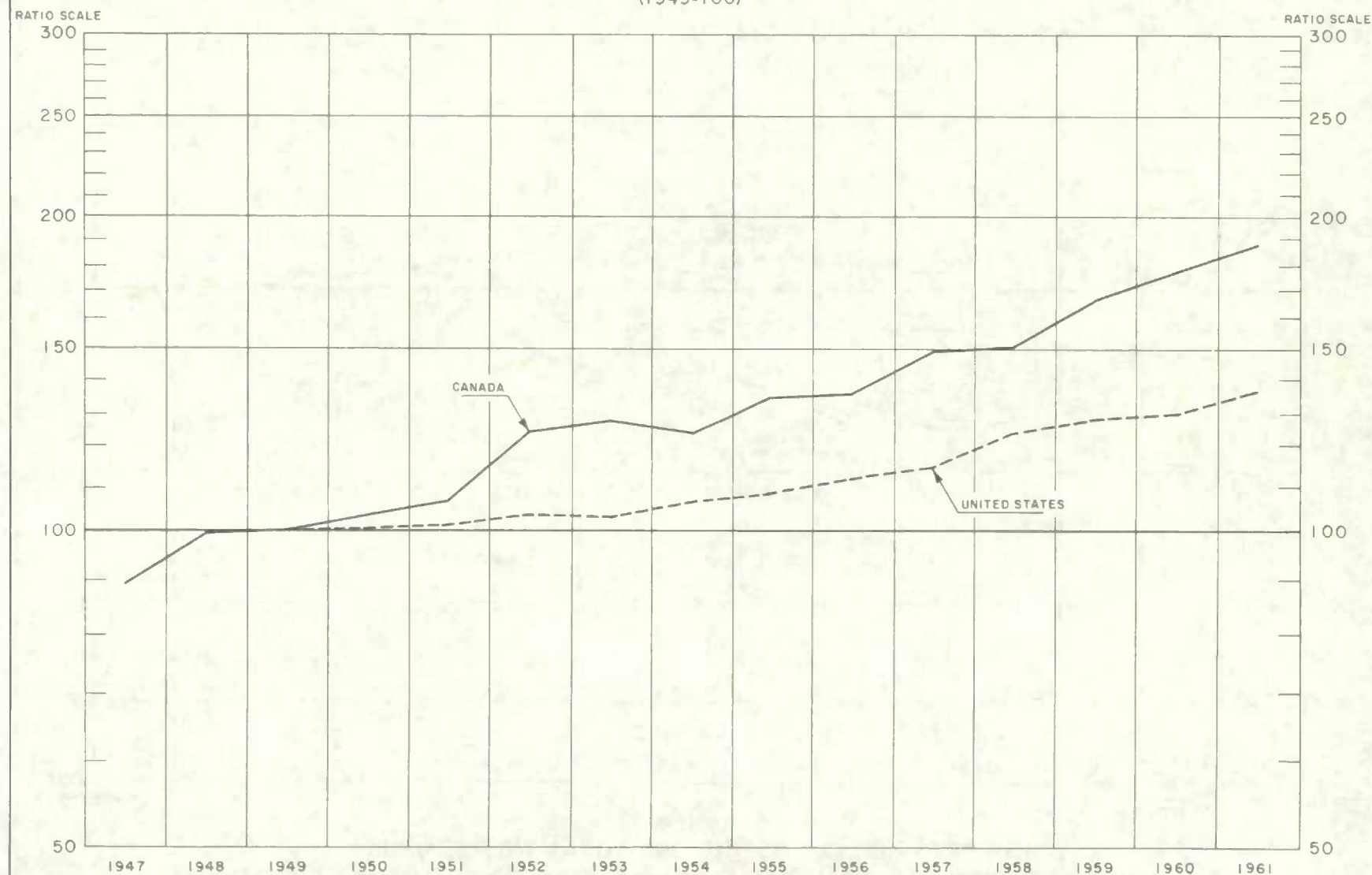
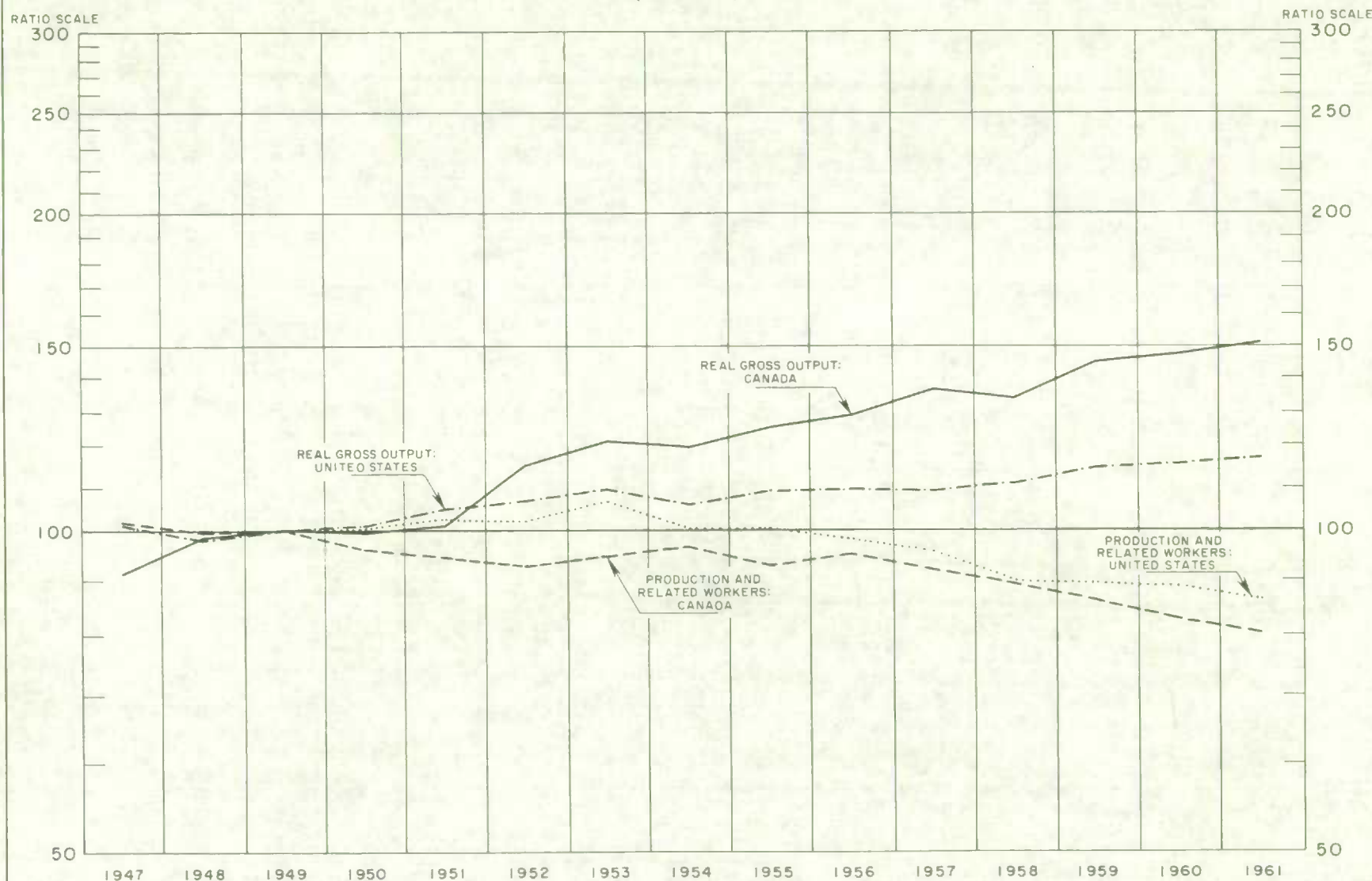


CHART B9.

INDEXES OF REAL GROSS OUTPUT AND PRODUCTION AND RELATED WORKERS, BREWERIES, CANADA AND UNITED STATES, 1947-61 (1949=100)



SECTION C

GENERAL DESCRIPTION AND CHARACTERISTICS OF THE INDUSTRY

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GENERAL DESCRIPTION AND CHARACTERISTICS OF THE INDUSTRY

Definition and Structure

The Breweries industry, No. 145 in the (new) 1960 Standard Industrial Classification, is part of the major group, Food and Beverage Industries, and is defined as follows:

"Establishments primarily engaged in manufacturing ale, beer, porter, stout and other malt liquors."⁴

This definition does not differ from the one which prevailed while the 1948 Standard Industrial Classification was in force, when the industry was known as Malt Liquors. Moreover, the introduction of a new definition of reporting units (establishments)⁵ in the 1961 Census of Manufactures has not affected the principal statistics of manufacturing operations except for minor valuation adjustments.⁶

Growth and Characteristics

The current value of factory shipments in the Breweries industry excluding indirect taxes and fees, as shown in the following Table C 1, increased

⁴ Dominion Bureau of Statistics, *Standard Industrial Classification Manual*, Ottawa, Queen's Printer, December 1960, Occasional (DBS Catalogue No. 12-501).

⁵ See Part IV, General Technical Notes, pages 115-116.

⁶ Ibid, page 115.

by 125.2% between 1947 and 1961, while for Manufacturing as a whole the corresponding increase was 140.5%. The share of Breweries in the Manufacturing total was very small and remained virtually unchanged at 1.1% from 1947 to 1961. During the same period, the value of factory shipments of the major group, Food and Beverage Industries, and of the Beverage Manufacturers sub-group⁷ increased by 105.7% and 147.0% respectively. Thus, the value of shipments of Breweries became a slightly more important part of the Food and Beverage Industries total, increasing from 4.8% in 1947 to 5.3% in 1961, while its share in the shipments of the Beverage Manufacturers declined from 45.8% to 41.8%.

On the employment side, the patterns of growth between 1947 and 1961 were somewhat different. As shown in Table C 2 the number of persons employed decreased by 11.2% in the Breweries industry and increased by 11.8% in Manufacturing, 12.5% in the major group Food and Beverage Industries, and 1.5% in the Beverage Manufacturers sub-group.

⁷ The Beverage Manufacturers sub-group includes the Soft Drink Manufacturers, Distilleries, Breweries and Wineries industries.

TABLE C 1. Value of Factory Shipments,¹ Breweries, Beverage Manufacturers, Food and Beverage Industries, and Manufacturing, Canada, 1947-61

Year	Breweries (excluding indirect taxes and fees)	Beverage manufac- turers	Food and beverage industries	Manufac- turing	Breweries as per cent of beverage manufac- turers	Breweries as per cent of food and beverage industries	Breweries as per cent of manufac- turing
	millions of dollars				per cent		
1947	115	251	2,384	10,081	45.8	4.8	1.1
1948	127	286	2,840	11,875	44.4	4.5	1.1
1949	142	314	2,883	12,480	45.2	4.9	1.1
1950	149	335	3,030	13,818	44.5	4.9	1.1
1951	161	375	3,450	16,392	42.9	4.7	1.0
1952	179	410	3,473	16,983	43.7	5.2	1.1
1953	201	442	3,492	17,785	45.5	5.8	1.1
1954	198	445	3,563	17,555	44.5	5.6	1.1
1955	211	469	3,614	19,514	45.0	5.8	1.1
1956	216	495	3,827	21,637	43.6	5.6	1.0
1957 ²	230	531	4,135	21,452	43.3	5.6	1.1
1958	231	555	4,486	21,435	41.6	5.1	1.1
1959	243	589	4,623	22,831	41.3	5.3	1.1
1960	250	602	4,668	23,280	41.5	5.4	1.1
1961	259	620	4,905	24,243	41.8	5.3	1.1
1961 as % of 1947	225.2	247.0	205.7	240.5	...	...	...

¹ In 1952, the general basis of collection was changed from "gross value of products" to "selling value of factory shipments".

² From 1957 on, data are based on the new S.I.C. and the New Establishment Concept. There would have been no significant differences in the results if data on the "old basis" had been used.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

TABLE C 2. Persons Employed in Manufacturing Operations, Breweries, Beverage Manufacturers, Food and Beverage Industries, and Manufacturing, Canada, 1947-61

Year	Breweries	Beverage manufacturers	Food and beverage industries	Manufacturing	Breweries as per cent of beverage manufacturers	Breweries as per cent of food and beverage industries	Breweries as per cent of manufacturing
	number				per cent		
1947	8,584 ¹	20,015	167,856	1,131,750	42.9	5.1	0.8
1948	8,407	19,967	168,893	1,155,721	42.1	5.0	0.7
1949	8,652	21,069	170,024	1,171,207	41.1	5.1	0.7
1950	8,311	20,693	167,664	1,183,297	40.2	5.0	0.7
1951	8,449	21,037	172,493	1,258,375	40.2	4.9	0.7
1952	8,163	21,105	175,552	1,288,382	38.7	4.6	0.6
1953	8,383	21,855	176,649	1,327,451	38.4	4.7	0.6
1954	8,541	21,847	177,883	1,267,966	39.1	4.8	0.7
1955	8,368	21,690	180,085	1,298,461	38.6	4.6	0.6
1956	8,724	22,452	183,008	1,353,020	38.9	4.8	0.6
1957 ²	8,413	21,912	189,104	1,340,948	38.4	4.4	0.6
1958	8,148	21,180	187,720	1,272,686	38.5	4.3	0.6
1959	8,031	21,030	189,180	1,287,809	38.2	4.2	0.6
1960	7,864	20,766	190,946	1,275,476	37.9	4.1	0.6
1961	7,623	20,313	188,855	1,264,946	37.5	4.0	0.6
1961 as % of 1947	88.8	101.5	112.5	111.8	...	...	...

¹ Revised.

² See Table C 1, footnote 2, page 71.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

In summary then, the Breweries industry was characterized by a substantial increase in the value of shipments accompanied by a moderate reduction in the number of persons employed. Manufacturing, on the other hand, experienced greater growth in shipments and a slight increase in employment.

During the post-war period, the composition of output in the Breweries industry showed a substantial change, reflecting changing consumer tastes

and habits. Table C 3 presents the distribution of shipments in 1950 and 1961 among the various products. A further distribution by varieties of beer (lager, bock, ale, porter, and stout) could not be made because of the restricted amount of product detail in the Census of Manufactures questionnaire. The group "all other products" comprises shipments of grain dried for sale, grain sold wet, fresh and dried yeast, carbonated beverages, distilled water, etc., produced by brewing establishments.

TABLE C 3. Distribution of Factory Shipments¹ by Principal Products, Breweries, Canada, 1950 and 1961

Products	1950 ²		1961	
	\$'000	%	\$'000	%
Beer in small bottles	135,538	56.2	306,213	73.3
Beer in large bottles	58,760	24.3	41,062	9.9
Canned beer	719	0.3	4,310	1.0
Draught and bulk beer	43,686	18.1	61,388	14.7
All other products	2,639	1.1	4,544	1.1
Total shipments	241,343	100.0	417,517	100.0

¹ Value of shipments includes indirect taxes and fees.

² Prior to 1950, no product detail was requested in the Census of Manufactures for beer in small bottles, beer in large bottles and canned beer.

It is clear that there was a definite shift from draught and bulk beer, and beer in large bottles, to beer in small bottles. As a percentage of total shipments, the latter increased from 56.2% in 1950 to

73.3% in 1961, while shipments of beer in large bottles were reduced from 24.3% to 9.9%. Shipments of draught and bulk beer represented 18.1% of total shipments in 1950, but had fallen to 14.7% by 1961.

Size and Location of Establishments¹

Generally, as shown in Table C 4 the size structure of the Breweries industry underwent no important change between 1947 and 1961. The decrease in the number of establishments, from 61 to 54, occurred largely in the latter part of the period and was concentrated in the 1-99 employment size group. During this period, the number of gallons brewed per establishment increased from 2.8 to 4.8

millions respectively. Although the proportion of establishments in the group of 500 and over comprised less than 6% of the total number of establishments in 1961, its share of total employment was 31.2%, of salaries and wages 35.1%, of value of production 27.6%, and of value added 27.3%. However, the largest concentration of employment was in the 100-499 size group which, except for 1956, contributed over 50% of the gross value of production and value added of the Breweries industry.

TABLE C 4. Percentage Distribution of Selected Statistics, Classified by Number of Persons Employed in Manufacturing Operations,¹ Breweries, Canada, 1947, 1956 and 1961²

Item and year	Persons employed			
	Total	1-99	100-499	500 and over
Per cent				
Establishments 1947	100.0	54.1	41.0	4.9
..... 1956	100.0	64.4	30.5	5.1
..... 1961	100.0	59.3	35.2	5.5
Persons employed ³ 1947	100.0	20.3	54.7	25.0
..... 1956	100.0	24.3	43.5	32.2
..... 1961	100.0	19.5	49.3	31.2
Salaries and wages ³ 1947	100.0	18.8	53.9	27.3
..... 1956	100.0	23.1	42.0	34.9
..... 1961	100.0	18.0	46.9	35.1
Gross value of production 1947	100.0	17.5	57.7	24.8
..... 1956	100.0	21.7	44.0	34.3
..... 1961	100.0	15.8	56.6	27.6
Cost of materials used 1947	100.0	16.5	58.0	25.5
..... 1956	100.0	20.2	46.3	33.5
..... 1961	100.0	16.7	54.5	28.8
Value added 1947	100.0	17.7	57.7	24.6
..... 1956	100.0	22.1	43.3	34.6
..... 1961	100.0	15.4	57.3	27.3
Dollars				
Value added per person employed 1947	10,112	8,786	10,671	9,966
..... 1956	18,703	17,015	18,607	20,106
..... 1961	26,032	20,500	30,277	22,786

¹ Sometimes the data for two separate establishments are combined in a single report for Census purposes. Such combinations are treated as single establishments in this table.

² 1961 data are based on new S.I.C. and New Establishment Concept.

³ Excludes persons employed in separate head offices.

Another major impression which emerges from Table C 4 is that there was, for the industry as a whole, no simple relationship between the size of establishment and the level of value added per person employed. In the Breweries industry, value added per person employed is more likely to be a function of productive capacity, as measured by the size and number of brewing kettles in the establish-

ments concerned, rather than by the number of employees. The necessary information with which to pursue this question was not available.

Table C 5 below shows that the largest concentration of establishments in the Breweries industry remained in Ontario even though their number decreased from 22 in 1947 to 17 in 1961. The most impressive relative gains were achieved by the Atlantic provinces which virtually doubled their percentage share of the number of establishments and value of shipments.

⁴ See Part I, Synthetic Textile Mills, footnote 22 page 44.

Employment, Hours of Work and Remuneration of Labour

Employment and Hours of Work.—Overall changes in employment in the Breweries industry (Malt Liquors) during the period 1947-61 have already been discussed in the context of the industry's growth relative to that of Manufacturing, Food and Beverage Industries (Food and Beverages), and Beverage Manufacturers as illustrated in Table C 2.⁹ The changes which occurred in the composition of employment, i.e., between production and related

workers and administrative and office employees, may now be summarized.¹⁰ In all three cases, the ratio of administrative and office employees to total employment increased between 1947 and 1961. However, the increase from 16.8% to 26.3% in the ratio for the Breweries industry was larger than that for the Food and Beverage Industries (19.0% to 20.4%) and for Manufacturing (16.9% to 23.4%). The increases for the latter groups took place mostly before 1954 whereas, for the Breweries industry, the important changes occurred after 1954.

TABLE C 5. Number of Establishments, Persons Employed and Value of Shipments by Province, Breweries, Canada, 1947 and 1961

Province	Establishments		Persons employed in manufacturing operations		Value of shipments ¹ (excluding indirect taxes and fees)	
	No.	%	No.	%	\$'000,000	%
1947						
Canada	61	100.0	8,584	100.0	115	100.0
Atlantic Provinces	4	6.6	437	5.1	4	3.5
Quebec	8	13.1	2,857 ²	33.3	32	27.8
Ontario	22	36.1	2,935 ¹	34.2	43	37.4
Manitoba	6	9.8	630	7.3	7	6.1
Saskatchewan	5	8.2	392	4.6	7	6.1
Alberta	5	8.2	565	6.6	10	8.7
British Columbia	11	18.0	768	8.9	12	10.4
1961						
Canada	54	100.0	7,623	100.0	259	100.0
Atlantic Provinces	7	12.9	597	7.8	17	6.6
Quebec	5	9.3	2,329	30.6	62	23.9
Ontario	17	31.5	2,637	34.6	114	44.0
Manitoba	6	11.1	623	8.2	15	5.8
Saskatchewan	5	9.3	362	4.7	11	4.2
Alberta	6	11.1	516	6.8	17	6.6
British Columbia	8	14.8	559	7.3	23	8.9

¹ In 1947, gross value of products.

² Revised.

Source: Dominion Bureau of Statistics, *Breweries*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 32-205).

During the period 1947-61, there was a widespread tendency, to which the Breweries industry was no exception, for the length of the working week of production and related workers (wage-earners) in the Manufacturing industries to decline. Average hours paid per week in Breweries declined from 45.3 hours to 39.7, i.e., by 12.4%, while the corresponding decrease in the Food and Beverage Industries major group was from 42.0 hours to 40.4 (3.8%) and in Manufacturing from 42.5 hours to 40.6 (4.5%). In absolute terms, average weekly man-hours

paid in the Breweries industry were, until 1954, greater than those for the other two aggregates. Subsequently, man-hours in the former declined substantially to a level lower than that prevailing in both the Food and Beverage Industries and Manufacturing.

⁹ Because labour data are not as readily available for the Beverage Manufacturers sub-group as for the Food and Beverage Industries and Manufacturing, the following comparisons are restricted to Breweries and the latter industrial groups.

¹⁰ For this comparison and those which follow, the relevant labour data for the Breweries industry are drawn from Table B 4, or as for Manufacturing and for the Food and Beverage Industries from the basic sources referred to in the footnotes of Table B 4. In this connection, the terms "wage-earner" and "salaried employee" as used in the Employment Surveys can be considered as roughly synonymous with "production and related worker" and "administrative and office employee" respectively as defined in the Census of Manufactures. Delivery workers in the Employment Survey are classified as wage-earners.

As may be seen from Table C6, there are wide differences between the three aggregates in the ratios of man-hours not worked but paid to total man-hours paid. Because of the partial use of interpolated data, no useful interpretation of the year-

to-year changes can be made. Nevertheless, there can be no doubt that the man-hours not worked but paid in the Breweries industry have increased at a significantly faster rate than those in the Food and Beverage Industries and in Manufacturing.

TABLE C 6. Man-hours not Worked but Paid of Production and Related Workers as Per cent of Total Man-hours Paid, Breweries, Food and Beverage Industries and Manufacturing, Canada, 1956-61

Year	Breweries	Food and beverage industries	Manufacturing
	per cent		
1956	7.1	4.2	4.9
1957	7.4	4.0	5.1
1958	8.3	4.3 ¹	5.2 ¹
1959	8.9	4.5 ¹	5.2 ¹
1960 ²	10.7	4.7	5.3
1961 ³	10.7	4.9	5.6

¹ Interpolated data.

² New S.I.C.

³ New S.I.C. and New Establishment Concept.

The downward trend in the average weekly hours paid of wage-earners in the Breweries industry was also evident for salaried employees,¹¹ but to a lesser extent. In the Food and Beverage Industries and Manufacturing, average weekly man-hours paid decreased in the period 1947-60 from 41.2 hours to 38.8 (5.8%) and from 40.4 hours to 38.5 (4.7%) respectively, while for the Breweries industry, the corresponding decrease was smaller at 2.4% (from 37.2 hours to 36.3). The difference in the absolute levels of the data is noteworthy, average hours paid of salaried employees in the Breweries industry

being invariably lower than those in Manufacturing, which in turn were always lower than those in Food and Beverage Industries.

Remuneration of Labour.—It is evident from Table C7 that the ratio of payroll to value added¹² for the Breweries industry is very low in comparison with that for Manufacturing, Food and Beverage Industries, and for all other selected industries, except Distilleries. The annual fluctuations of the ratio in the Breweries industry are shown in Table B3 in Part II. The figures indicate that labour's share in value added has remained reasonably stable over the period under study.

¹² See Part I, Synthetic Textile Mills, page 47.

TABLE C 7. Salaries and Wages Paid as Per cent of Value Added by Selected Manufacturing Industries, Industrial Groups and Manufacturing, Canada, 1961

Industry and industrial group	Salaries and wages paid	Value added by manufacture	Salaries and wages paid as per cent of value added by manufacture
	thousands of dollars		per cent
Food and beverage industries	687,996	1,704,715	40.4
Breweries	40,882	197,399	20.7
Distilleries	21,001	113,895	18.4
Wineries	2,529	9,953	25.4
Soft drink manufacturers	29,766	116,068	25.6
Tobacco products industries	39,154	128,640	30.4
Machinery industries (except electrical machinery)	195,606	329,764	59.3
Electrical products industries	353,568	617,534	57.3
Chemical and chemical products industries	254,004	760,928	33.4
Paper and allied industries	471,137	1,071,316	44.0
Manufacturing	5,231,447	10,682,138	49.0

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada, 1961*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

Average hourly earnings of production and related workers (wage-earners) in the Breweries industry were consistently higher during the period 1947-61 than those prevailing in Food and Beverage Industries and in Manufacturing, and increased substantially more. In fact, average hourly earnings of wage-earners in the Breweries industry rose from 86¢ in 1947 to \$2.34 in 1961, or by 172.1%. In the Food and Beverage Industries, the overall increase was 126.8%, from 71¢ in 1947 to \$1.61 in 1961. These figures compare closely with those of Manufacturing where there was an increase of 125.9% but from a slightly higher level, i.e., from 81¢ to \$1.83.

Average hourly earnings of salaried employees in Breweries¹³ in 1947, at \$1.71 were 48.7% higher than in Food and Beverage Industries (\$1.15) and 39.0% higher than in Manufacturing (\$1.23). By 1960, however, the gap between Breweries and the other two aggregates had diminished to 41.2% and 26.1% respectively. In the Breweries industry, the overall increase during the period 1947-60 was proportionately lower (92.4%) than those of Food

and Beverage Industries at 102.6% and Manufacturing at 112.2%. Average hourly earnings of wage-earners increased by 161.6% between 1947-60, and for salaried employees, the increase was 92.4%.

New Capital and Repair Expenditures¹⁴

During the period 1947-61, construction expenditures in the Breweries industry represented a substantial part of total capital and repair expenditures, even though their relative importance declined somewhat.

Total capital and repair expenditures in the Breweries industry constituted, on the average, 11.8% of those in the Food and Beverage Industries between 1948 and 1961. As may be seen from Table C8 the year-to-year variations in this percentage were somewhat erratic, the highest values being registered before 1956. Until 1956, when the trend was more or less reversed, capital and repair expenditures in the Breweries industry constituted a diminishing share of the Manufacturing total.

¹⁴ See Part I, Synthetic Textile Mills, footnote 7, page 16.

¹³ See footnote 10, page 74.

TABLE C 8. New Capital and Repair Expenditures in Breweries, Food and Beverage Industries, and Manufacturing, Canada, 1948-61

Year	Breweries			Food and beverage industries	Manufac- turing	Breweries construction as per cent of breweries total	Breweries total as per cent of food and beverage total	Breweries total as per cent of manu- facturing total
	Con- struc- tion	Machinery and equipment	Total					
	millions of dollars					per cent		
1948	8.3	11.9	20.2	130.2	901.8	41.1	15.5	2.2
1949	7.5	8.8	16.2	119.8	874.6	46.3	13.5	1.9
1950	6.4	8.9	15.3	116.8	849.1	41.8	13.1	1.8
1951	6.2	8.3	14.5	125.2	1,215.1	42.8	11.6	1.2
1952	6.8	8.1	14.9	125.8	1,431.3	45.6	11.8	1.0
1953	5.8	11.4	17.2	137.9	1,448.9	33.7	12.5	1.2
1954	12.3	12.1	24.4	158.7	1,310.6	50.4	15.4	1.9
1955	10.6	11.8	22.4	160.0	1,459.7	47.3	14.0	1.5
1956	5.9	10.2	16.1	166.3	1,971.6	36.6	9.7	0.8
1957	5.4	13.4	18.8	181.1	2,092.8	28.7	10.4	0.9
1958	4.8	10.0	14.8	191.5	1,666.9	32.4	7.7	0.9
1959	7.0	14.6	21.6	202.3	1,806.3	32.4	10.7	1.2
1960 ¹	9.6	16.0	25.5	221.8	1,849.0	37.6	11.5	1.4
1961	9.5	16.4	25.9	240.8	1,766.7	36.7	10.8	1.5
Totals	106.1	161.9	267.8	2,278.2	20,644.4	39.6	11.8	1.3

¹ From 1960 on, new S.I.C.

Source: For the Food and Beverage Industries and Manufacturing, see: *Private and Public Investment in Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-504) - *Private and Public Investment in Canada Outlook*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-205). For the Breweries industry 1948-59, see: *The Brewing Industry, 1959 and 1960*, Ottawa, Queen's Printer (DBS Catalogue No. 32-205). For 1960 and 1961, the figures were obtained from the supplement to *Private and Public Investment in Canada Outlook*, 1963, Business Finance Division, Dominion Bureau of Statistics.

PART III
PULP AND PAPER MILLS

SECTION A

**TRENDS AND FLUCTUATIONS IN OUTPUT
PER UNIT OF LABOUR INPUT**

SECTION A

TRENDS AND FLUCTUATIONS IN OUTPUT PER UNIT OF LABOUR INPUT

Introduction

During the period 1947-61, the increases in output per unit of labour input in the Pulp and Paper Mills industry were approximately half of those of the Manufacturing industries as a whole. For the years 1947 to 1952 and 1958 to 1961 the productivity of the Pulp and Paper Mills industry and that of the Manufacturing industries increased at approximately the same rate, so that the gap between the two sets of measures is the result of a period of very slow growth in productivity experienced by the Pulp and Paper Mills industry during the years 1952 to 1958.

The growth of productivity in Pulp and Paper Mills was achieved through moderate increases in the volume of output accompanied by even smaller increases in labour input. A closer examination of the productivity series suggests that the industry passed through three successive stages. Between 1947 and 1952, output per unit of labour input increased by more than the average for the period as a whole; this was achieved with substantial increases in both output and input. Between 1952 and 1958, the productivity components increased at approximately the same rate and, as a result, the growth in output per unit of labour input was negligible. From 1958 on, productivity increased markedly due to substantial increases in output achieved by more or less constant labour inputs.

It is evident when real gross output per production and related worker in the Canadian industry is compared with that of the United States that productivity in the latter increased more noticeably.

As in the case of the Breweries industry, no comparison between real net output per person employed and new capital and repair expenditures is presented for the Pulp and Paper Mills industry because it was not found possible to identify statistically the influence of new capital and repair expenditures on productivity.¹

Overall Changes in Output per Unit of Labour Input, 1947-61

In Charts B2 and B3 the movements of real net output per production and related worker and per person employed for the Pulp and Paper Mills industry are compared to those for Manufacturing. Because differences between net and gross measures are insignificant, as in the case of the Breweries industry,² the conclusions from a study of Charts B2 to B7 are much the same as those which would have emerged from series based on real gross output data.

For the period 1947-61, as shown in Chart B2, overall increases in real net output per production and related worker were 37.8% and 71.4% for

Pulp and Paper Mills and Manufacturing, the respective annual growth rates being 1.7% and 4.0%. Very much the same degree of increase is evident in the figures of real net output per person employed. Chart B3 shows that real net output per person employed increased by 32.5% and 55.5% between 1947 and 1961 for Pulp and Paper Mills and Manufacturing, with corresponding annual growth rates of 1.4% and 3.3%. A comparison of Charts B2 and B3 shows that the influence of administrative and office employees was of roughly the same relative importance at both levels of aggregation.

The real net output per man-hour paid series in the Pulp and Paper Mills industry increased substantially more than the corresponding real net output per man series. During the period 1947-61, real net output per man-hour paid of production and related workers increased in overall terms by 63.0% or 3.2% per annum and real net output per man-hour paid of persons employed by 55.5% or 2.9% per annum. These increases in real net output per man-hour paid were more evenly spread over the period under consideration than those of real net output per man.

Year-to-year Changes in Output per Unit of Labour Input

From Charts B2 and B3, it is evident that year-to-year changes in output per unit of labour input were more irregular for Pulp and Paper Mills than for Manufacturing as a whole. However, year-to-year changes in output per production and related worker and per person employed were not significantly different within each universe. In the Pulp and Paper Mills industry, the year-to-year movements of output per man in Charts B4 and B5 were similar to those of output per man-hour in Charts B6 and B7; however, the latter were less pronounced which accounts for the closer correspondence to the straight line logarithmic trend.

Year-to-year changes in real net output per production and related worker and per person employed were positive for all years except for 1950-52, 1953-54 and 1956-57. In both man-hours paid measures, negative year-to-year changes were fewer in number and smaller in size.

Growth of Real Output, 1947-61

The overall increases in real gross output and real net output, as shown in Chart B1, amounted to 68.9% and 74.5% respectively for the period 1947-61. In terms of their annual growth rates both increased by 3.6% per annum.

Year-to-year changes in gross and net output were approximately of the same magnitude and were generally positive except for the years 1951-52 and 1956-58. Although some of the turning points in output coincide roughly with those of the Canadian

¹ See Part I, Synthetic Textile Mills, page 16.

² See Part II, Breweries, page 53.

business cycle³ it should be remembered that demand for the products of the Pulp and Paper Mills industry depends to a large extent on the conditions of foreign markets.

Changes in Labour Input, 1947-61

From Chart B1, it is evident that the production and related workers and persons employed series showed similar patterns of growth. In terms of overall change, the production and related workers series increased by 26.7%, corresponding to an average annual rate of growth of 1.9% while the persons employed series rose by 31.8% or 2.2% per annum. The slightly higher rate of growth of persons employed reflects the increasing importance of administrative and office employees relative to production and related workers.

Year-to-year fluctuations were generally in the same direction for production and related workers and persons employed. Although year-to-year changes were not as pronounced in employment as in output, their magnitudes were larger than for the corresponding man-hour series.

³ Cyclical downturns for the Canadian economy are identified as running from 4th quarter 1948 to 3rd quarter 1949, 2nd quarter 1953 to 2nd quarter 1954, 2nd quarter 1957 to 2nd quarter 1958 and 1st quarter 1960 to 1st quarter 1961. See: *Report of the Royal Commission on Banking and Finance*, Ottawa, Queen's Printer, 1964, page 402.

Comparisons with United States Data

Comparisons between Canada and the United States are possible because the U.S. official series have approximately the same industrial coverage as those for Canada. The same qualifications concerning the conceptual and statistical basis of the component output and input measures hold as in the case of the Breweries industry.⁴

For the period 1949-61, the index of real gross output per production and related worker for the U.S. grew substantially more than the Canadian index. However, it may be noted that the indexes for the two countries increased at approximately the same rate between 1958 and 1961. In overall terms, as shown in Chart B8, real gross output per production and related worker increased by 27.5% and 68.5% in Canada and the United States respectively with corresponding growth rates of 1.5% and 3.6% per annum.

Chart B9 compares the output and input components of the productivity series for Canada and the United States. The data for the United States are shown in Table A1 below. The increases in real gross output for the period 1949-61 amounted to 55.7% or 3.3% per annum and 85.1% or 4.5% per annum for Canada and the United States respectively. The Canadian employment series increased 22.1% or 1.7% per annum and that for the U.S. by 9.9% or 0.9% per annum.

⁴ See Part II, Breweries, page 54.

TABLE A1. Indexes of Real Gross Output per Production and Related Worker, Real Gross Output, and Production and Related Workers, Paper, Paperboard and Pulp Mills, United States, 1947-61
(1949 = 100)

Year	Real gross output per production and related worker	Real gross output	Production and related workers
1947	98.3	103.2	105.1
1948 .....	..	107.5	..
1949	100.0	100.0	100.0
1950	116.0	119.5	103.1
1951	121.6	130.2	107.2
1952	118.0	123.9	105.0
1953	118.6	132.1	111.5
1954	121.9	134.6	110.4
1955	133.0	151.0	113.5
1956	139.5	160.2	114.9
1957	136.9	156.0	114.0
1958	139.8	156.7	112.1
1959	152.4	174.4	114.4
1960	156.5	178.2	114.0
1961	168.5	185.1	109.9
1961 as % of 1949	168.5	185.1	109.9
Annual trend rate of change (%)	3.6	4.5	0.9

Source: United States Department of Labor, Bureau of Labor Statistics, *Indexes of Output per Man-hour for Selected Industries, 1939 and 1947-63*, Annual Industry Series, Washington, D.C., U.S. Government Printing Office, December 1965, page 60.

SECTION B
STATISTICAL TABLES AND CHARTS

TABLE B 1. Indexes of Real Output per Unit of Labour Input, Pulp and Paper Mills, Canada, 1947-61
(1949 = 100)

Item and year	Real gross output per					Real net output per				
	Person employed	Production worker	Man-hour paid of persons employed	Man-hour paid of production workers	Man-hour worked of production workers	Person employed	Production worker	Man-hour paid of persons employed	Man-hour paid of production workers	Man-hour worked of production workers
Old basis:										
1947	96.0	95.6	93.7	93.0	..	92.4	92.0	90.1	89.5	..
1948	98.0	97.7	95.9	95.5	..	94.5	94.2	92.5	92.1	..
1949	100.0	100.0	100.0	100.0	..	100.0	100.0	100.0	100.0	..
1950	107.5	108.2	105.7	105.6	..	107.5	108.2	105.7	105.6	..
1951	108.2	109.0	107.2	107.3	..	107.2	108.0	106.2	106.3	..
1952	102.3	103.1	105.7	106.2	..	101.7	102.4	105.0	105.5	..
1953	104.9	105.3	112.1	112.8	..	105.1	105.5	112.3	113.0	..
1954	106.3	106.4	116.8	117.6	..	104.4	104.5	114.8	115.5	..
1955	109.6	109.8	121.7	122.8	..	105.7	105.9	117.4	118.4	..
1956	110.0	110.9	122.8	124.3	124.3	107.3	108.2	119.8	121.3	121.3
1957	106.8	108.8	121.9	125.3	125.9	104.0	106.0	118.7	122.0	122.6
1958	107.5	110.4	124.6	129.3	130.3	105.0	107.8	121.7	126.3	127.3
1959	114.4	117.4	132.6	137.4	139.0	112.2	115.1	130.0	134.7	136.3
1960	119.7	124.4	136.7	142.5	144.5	118.6	123.1	135.3	141.0	143.1
1961	123.1	127.5	140.9	146.7	150.0	122.4	126.8	140.1	145.9	149.1
1961 as % of 1947	128.2	133.4	150.4	157.7	...	132.5	137.8	155.5	163.0	...
Annual trend rate of change (%)	+ 1.4	+ 1.6	+ 2.8	+ 3.2	...	+ 1.4	+ 1.7	+ 2.9	+ 3.2	...
New basis:										
1959	114.4	117.4	132.6	137.4	139.0	112.2	115.1	130.0	134.7	136.3
1960	119.4	124.1	136.2	142.1	144.0	117.8	122.3	134.3	140.1	142.0
1961	121.8	126.3	139.2	145.4	148.6	117.7	122.1	135.0	140.6	143.7

TABLE B 2. Indexes of Real Output and Labour Input, Pulp and Paper Mills, Canada, 1947-61
(1949 = 100)

Item and year	Real output		Persons employed		Production workers		
	Gross	Net	Number	Man-hours paid	Number	Man-hours paid	Man-hours worked
Old basis:							
1947	92.2	88.7	96.0	98.4	96.4	99.1	..
1948	97.8	94.3	99.8	102.0	100.1	102.4	..
1949	100.0	100.0	100.0	100.0	100.0	100.0	..
1950	108.1	108.1	100.6	102.3	99.9	102.4	..
1951	119.1	118.0	110.1	111.1	109.3	111.0	..
1952	113.7	113.0	111.1	107.6	110.3	107.1	..
1953	117.3	117.5	111.8	104.6	111.4	104.0	..
1954	124.3	122.1	116.9	106.4	116.8	105.7	..
1955	131.0	126.3	119.5	107.6	119.3	106.7	..
1956	139.5	136.1	126.8	113.6	125.8	112.2	112.2
1957	135.3	131.8	126.7	111.0	124.3	108.0	107.5
1958	132.3	129.2	123.1	106.2	119.8	102.3	101.5
1959	142.9	140.1	124.9	107.8	121.7	104.0	102.8
1960	151.0	149.5	126.1	110.5	121.4	106.0	104.5
1961	155.7	154.8	126.5	110.5	122.1	106.1	103.8
1961 as % of 1947	168.9	174.5	131.8	112.3	126.7	107.1	...
Annual trend rate of change (%)	+ 3.6	+ 3.6	+ 2.2	+ 0.7	+ 1.9	+ 0.3	...
New basis:							
1959	142.9	140.1	124.9	107.8	121.7	104.0	103.8
1960	150.6	148.5	126.1	110.6	121.4	106.0	104.6
1961	153.7	148.6	126.2	110.1	121.7	105.7	103.4

TABLE B 3. Selected Statistics of Manufacturing Activities, Pulp and Paper Mills, Canada, 1947-61

Item and year	Estab- lishments	Value of shipments ¹	Cost at factory of materials used	Cost at factory of fuel and electricity used	Value added	Value added per person employed	Salaries and wages, persons employed, as per cent of value added	Book value of inventories, year end
	No.	\$'000				\$	%	\$'000
Old basis:								
1947.....	115	706,972	295,444	55,442	356,085	7,129	36.4	..
1948.....	117	825,858	349,244	63,843	412,770	7,950	36.7	..
1949.....	123	836,148	348,663	64,110	423,376	8,134	37.2	..
1950.....	123	954,138	373,883	69,112	511,143	9,765	33.1	..
1951.....	126	1,237,897	483,014	75,626	679,258	11,856	31.4	..
1952.....	128	1,157,888	497,047	76,740	584,101	10,105	38.6	..
1953.....	127	1,179,665	499,351	80,380	599,935	10,309	39.3	..
1954.....	125	1,241,665	515,258	84,891	641,517	10,545	39.4	..
1955.....	125	1,326,938	546,079	91,041	689,818	11,089	38.5	..
1956.....	126	1,453,442	625,205	103,506	736,346	11,159	40.4	245,226
1957.....	128	1,411,934	617,176	108,637	693,476	10,517	44.4	281,035
1958.....	128	1,394,679	597,805	105,797	702,951	10,969	43.7	279,838
1959.....	127	1,498,042	628,269	108,859	759,492	11,679	42.4	258,857
New basis:								
1959.....	126	1,562,312	630,203	109,002	763,184	11,712	42.3	258,722
1960.....	126	1,583,107	657,865	111,259	814,798	12,388	42.4	278,982
1961.....	125	1,632,834 ²	680,168	117,084	840,647 ²	12,776	42.2	285,856

¹ Figures up to and including 1955 represent gross value of products.

² Revised.

TABLE B 4. Selected Labour Statistics of Manufacturing Activities, Pulp and Paper Mills, Canada, 1947-61

Item and year	Persons employed				Production and related workers								Administrative and office employees		
	Number	Per estab- lishment	Earn- ings	Man- hours paid	Number	As per cent of persons em- ployed	Earn- ings	Man-hours ¹			Average hourly earn- ings ²	Average of man- hours paid per week ²	Number	Average hourly earn- ings ³	Average of man- hours paid per week ³
								Paid	Worked	Not worked but paid as per cent of man- hours paid					
		No.	\$'000	'000		%	\$'000	'000		%	\$	No.		\$	No.
Old basis:															
1947	49,946	434	129,478	124,851	42,240	84.6	103,191	108,623	..	..	0.95	49.6	7,706	1.60	40.5
1948	51,924	444	151,663	129,380	43,858	84.5	121,203	112,225	..	..	1.08	49.0	8,066	1.69	40.9
1949	52,050	423	157,704	126,895	43,807	84.2	124,920	109,579	..	..	1.14	47.8	8,243	1.80	40.4
1950	52,343	426	169,247	129,819	43,765	83.6	133,517	112,199	..	..	1.19	48.7	8,578	1.88	39.5
1951	57,291	455	213,170	140,948	47,878	83.6	169,043	121,614	..	..	1.39	48.1	9,413	2.19	39.5
1952	57,803	452	225,353	136,576	48,310	83.6	177,234	117,373	..	..	1.51	45.8	9,493	2.33	38.9
1953	58,194	458	235,742	132,703	48,800	83.9	185,810	113,994	..	..	1.63	43.9	9,394	2.52	38.3
1954	60,837	487	252,598	135,014	51,148	84.1	199,294	115,868	..	..	1.72	42.9	9,689	2.70	38.0
1955	62,205	498	265,298	136,565	52,272	84.0	209,317	116,937	..	..	1.79	42.6	9,933	2.77	38.0
1956	65,985	524	297,572	144,197	55,118	83.5	233,496	122,893	115,643	5.9	1.90	42.9	10,897	2.96	37.7
1957	65,940	515	307,628	140,872	54,445	82.6	237,267	118,337	110,783	6.4	2.01	41.8	11,495	3.13	37.7
1958	64,084	501	307,416	134,741	52,490	81.9	233,162	112,132	104,611	6.7	2.08	41.1	11,594	3.20	37.5
1959	65,028	512	322,311	136,811	53,326	82.0	244,801	113,931	105,941	7.0	2.15	41.1	11,702	3.28	37.6
New basis:															
1959	65,162	517	322,936	137,112	53,451	82.0	245,376	114,215	106,207	7.0	2.15	41.1	11,711	3.28	37.6
1960	65,772	522	345,093	140,593	53,313	81.1	260,199	116,492	108,017	7.3	2.23	42.0	12,459	3.47	37.2
1961	65,799	526	355,170	140,071	53,428	81.2	271,234	116,141	106,917	7.9	2.34	41.8	12,371 ⁴	3.51	37.2

¹ The series were constructed using man-hours estimated by payroll deflation for the period 1947-55, and reported man-hours from 1956 on.

² From 1947 to 1955, the figures originate from the publication *Review of Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-202); from 1956 on, they are calculated from reported data in the Census of Manufactures.

³ From 1947 to 1960, the figures originate from the publication *Earnings and Hours of Work in Manufacturing*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-204); the figures for 1961 were estimated.

⁴ In 1961 the reported figures of administrative and office employees have been assigned in total to manufacturing activities, although, according to the New Establishment Concept, they are actually applicable to total activities.

Note: The terms "production and related worker" and "administrative and office employee" as defined in the Census of Manufactures can be considered roughly synonymous with "wage-earner" and "salaried employee" respectively as used in the Employment Surveys. (See Part IV, General Technical Notes, page 112).

CHART 81.

INDEXES OF REAL OUTPUT AND LABOUR INPUT, PULP AND PAPER MILLS, CANADA, 1947-61 (1949=100)

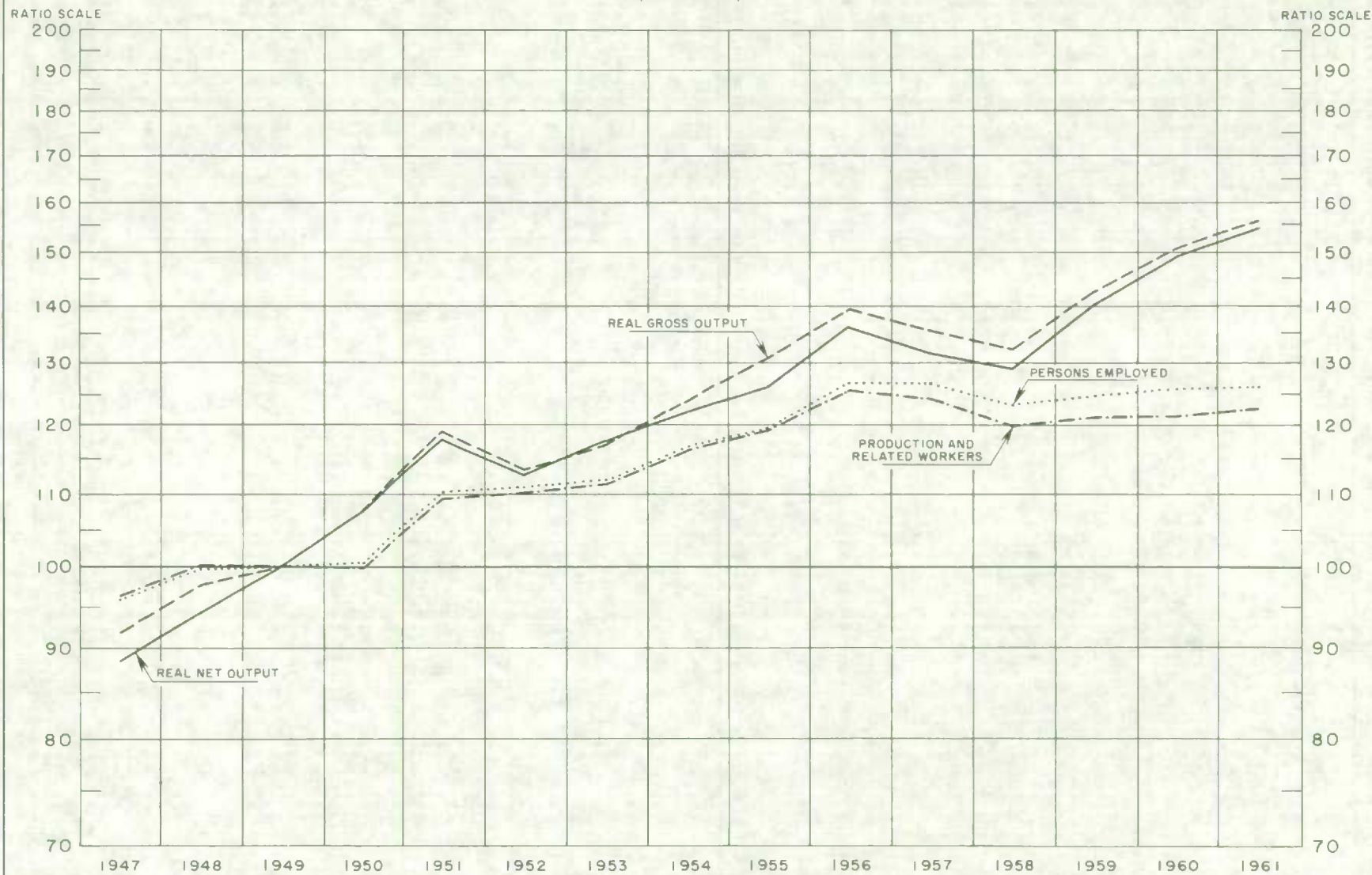


CHART B 2.

INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER, PULP AND PAPER MILLS AND MANUFACTURING, CANADA, 1947-61

(1949=100)

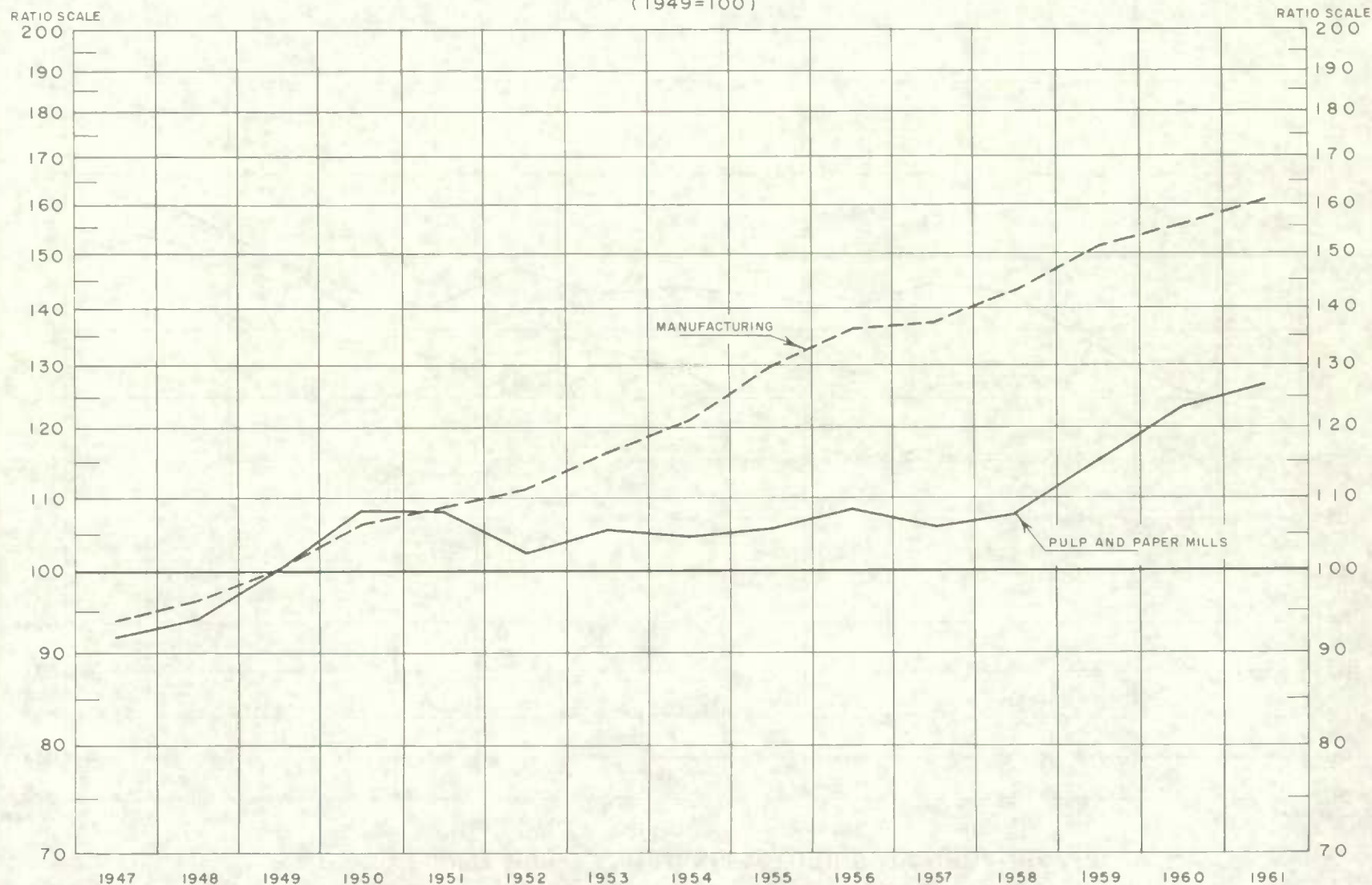
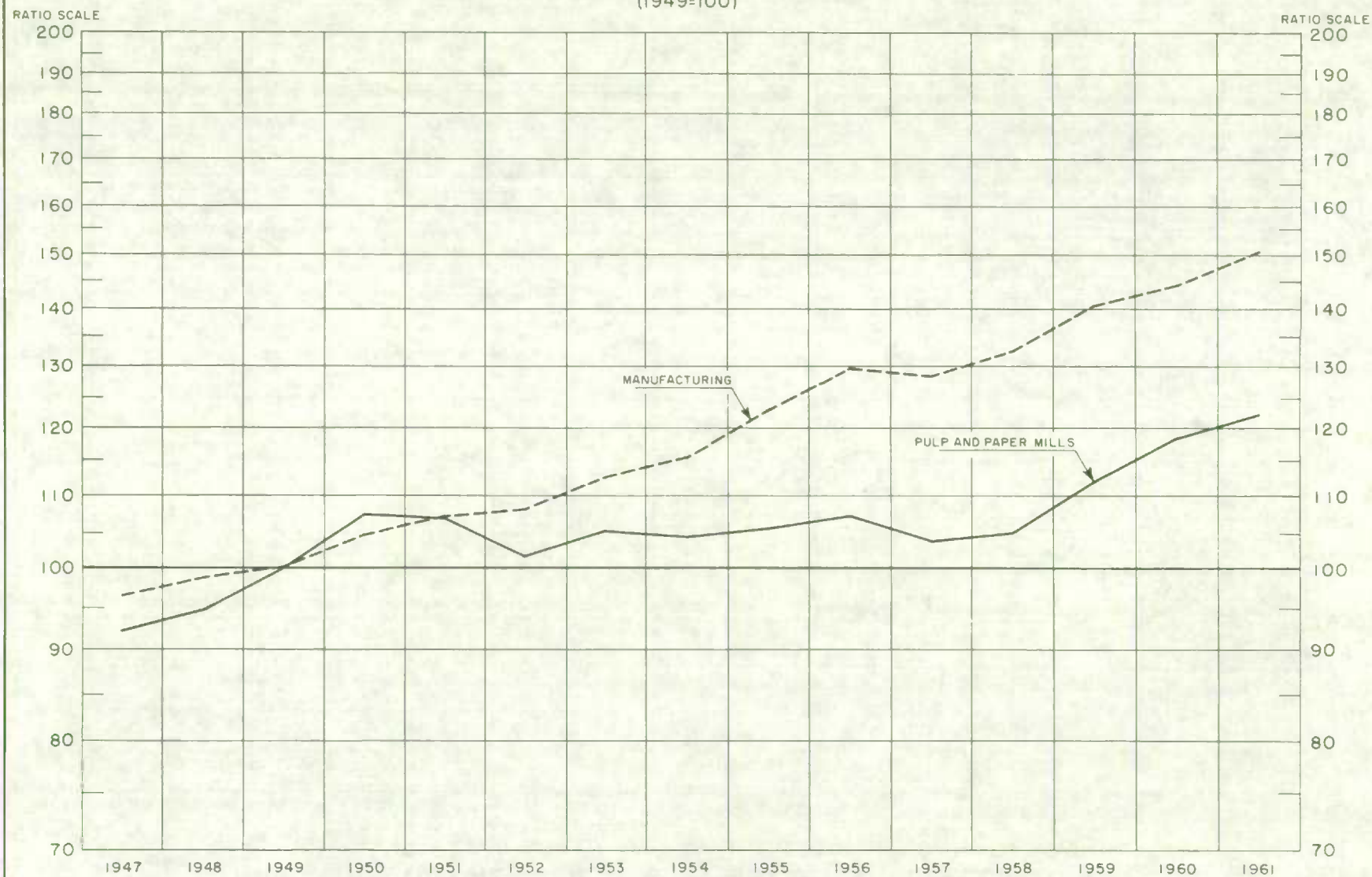


CHART B3.

INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED, PULP AND PAPER MILLS AND MANUFACTURING, CANADA, 1947-61 (1949=100)



INDEXES OF REAL NET OUTPUT PER PRODUCTION AND RELATED WORKER AND COMPONENTS, PULP AND PAPER MILLS, CANADA, 1947-61

(1949=100)

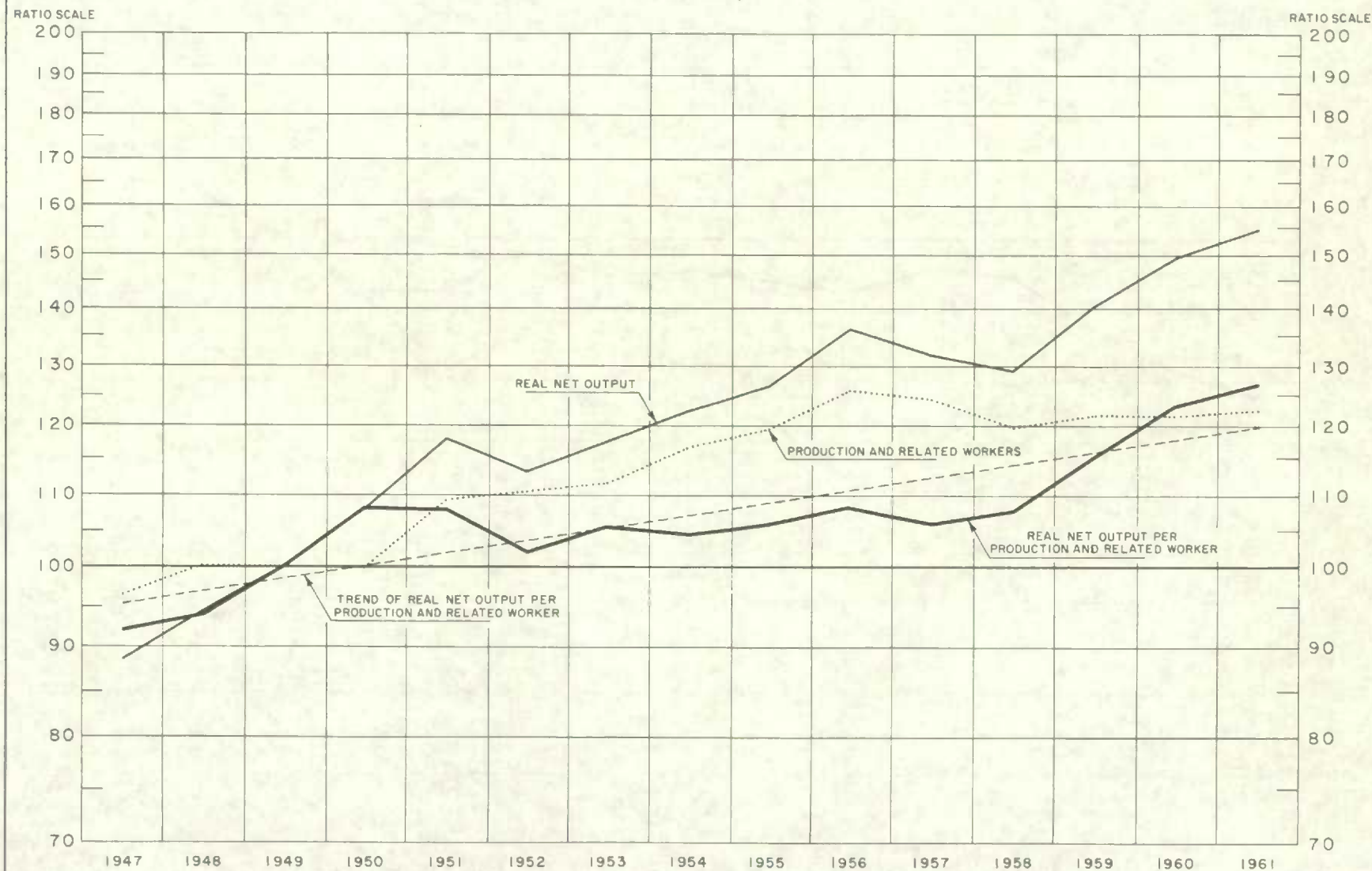
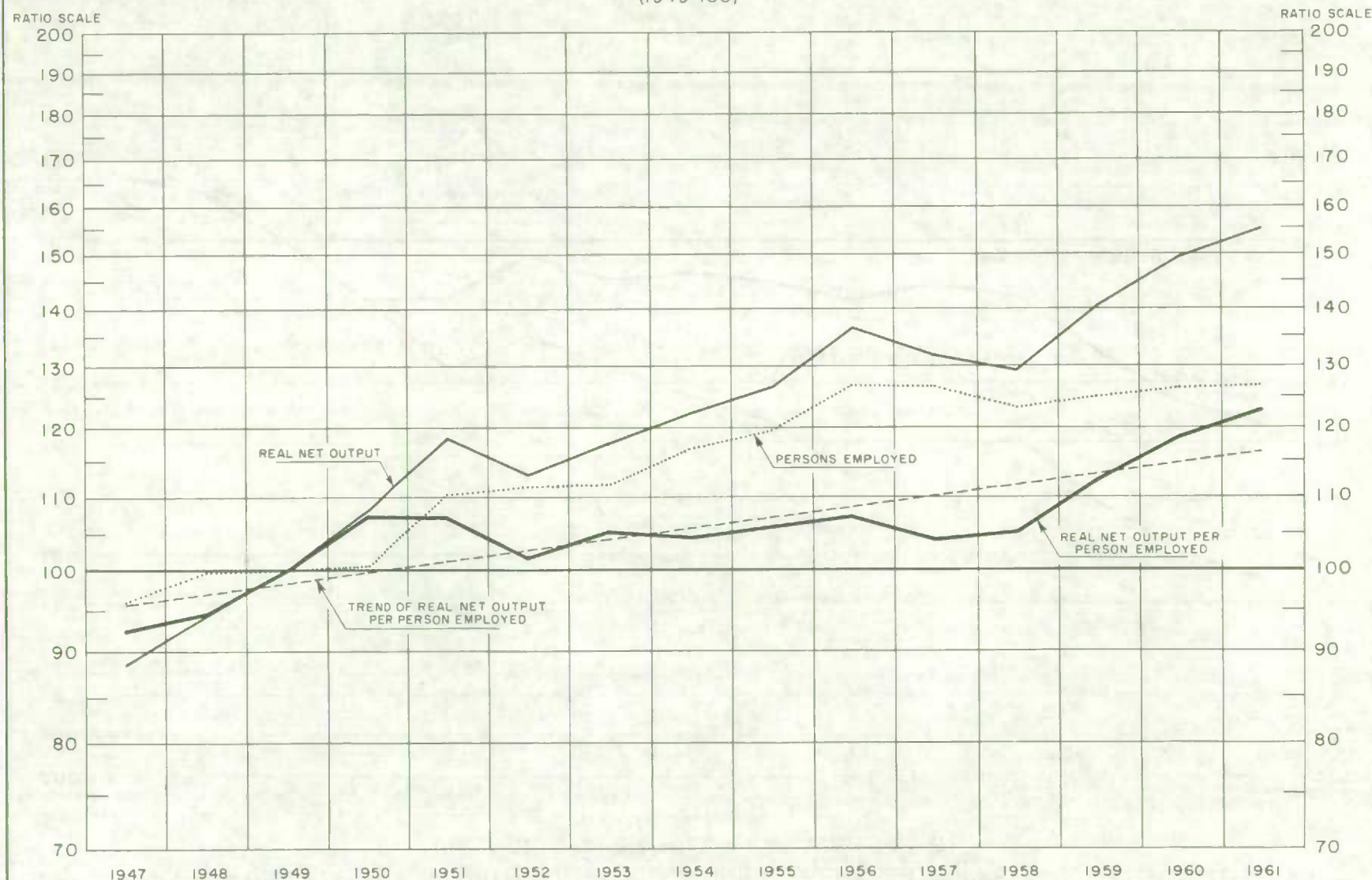


CHART B5.

INDEXES OF REAL NET OUTPUT PER PERSON EMPLOYED AND COMPONENTS, PULP AND PAPER MILLS, CANADA, 1947-61 (1949=100)



INDEXES OF REAL NET OUTPUT PER MAN-HOUR PAID OF PRODUCTION AND RELATED WORKERS AND COMPONENTS,
PULP AND PAPER MILLS, CANADA, 1947-61
(1949=100)

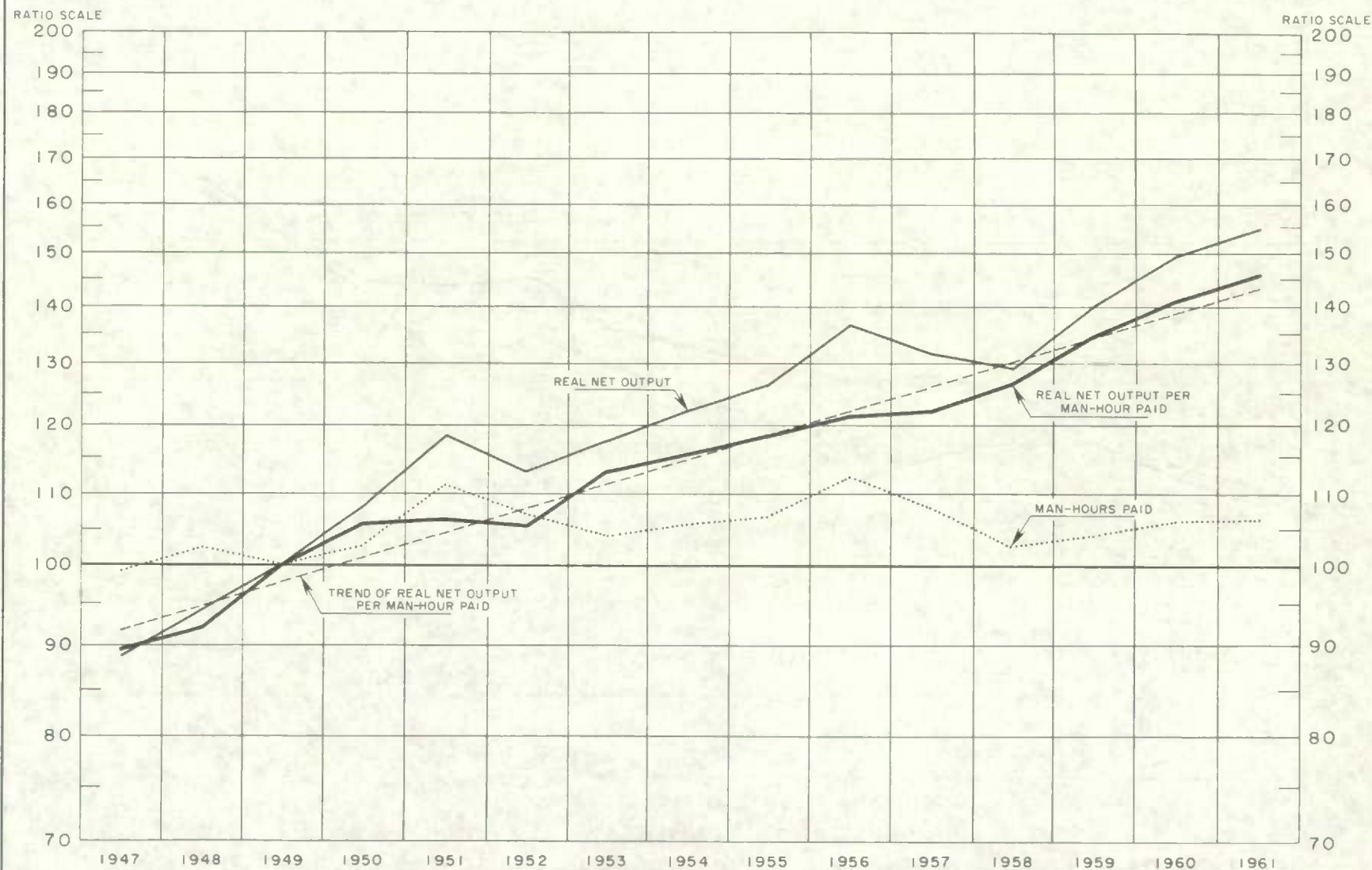


CHART B7.

INDEXES OF REAL NET OUTPUT PER MAN-HOUR PAID OF PERSONS EMPLOYED AND COMPONENTS, PULP AND PAPER MILLS, CANADA, 1947-61

(1949=100)

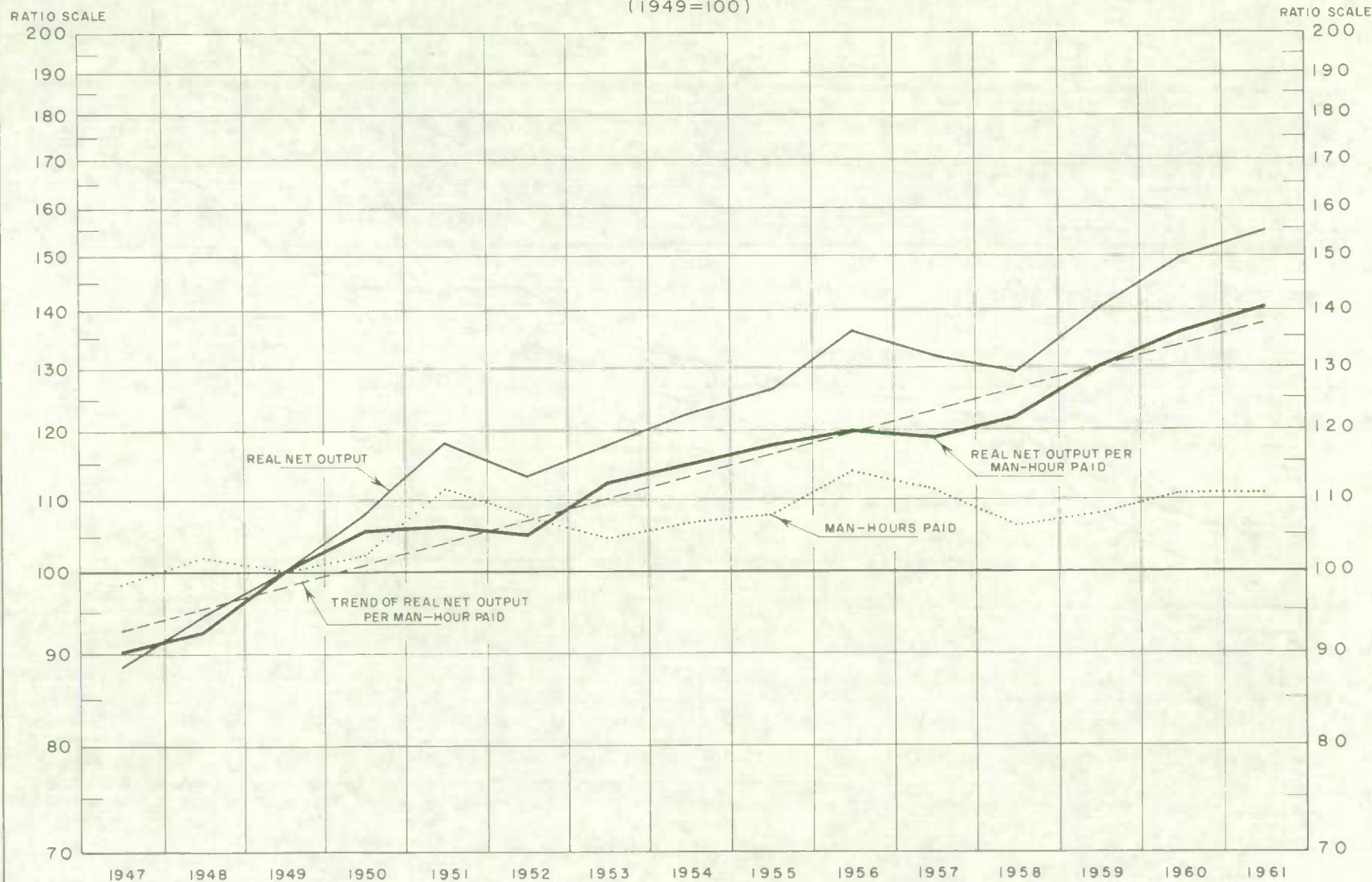


CHART BB.

INDEXES OF REAL GROSS OUTPUT PER PRODUCTION AND RELATED WORKER, PULP AND PAPER MILLS, CANADA AND UNITED STATES, 1947-61

(1949=100)

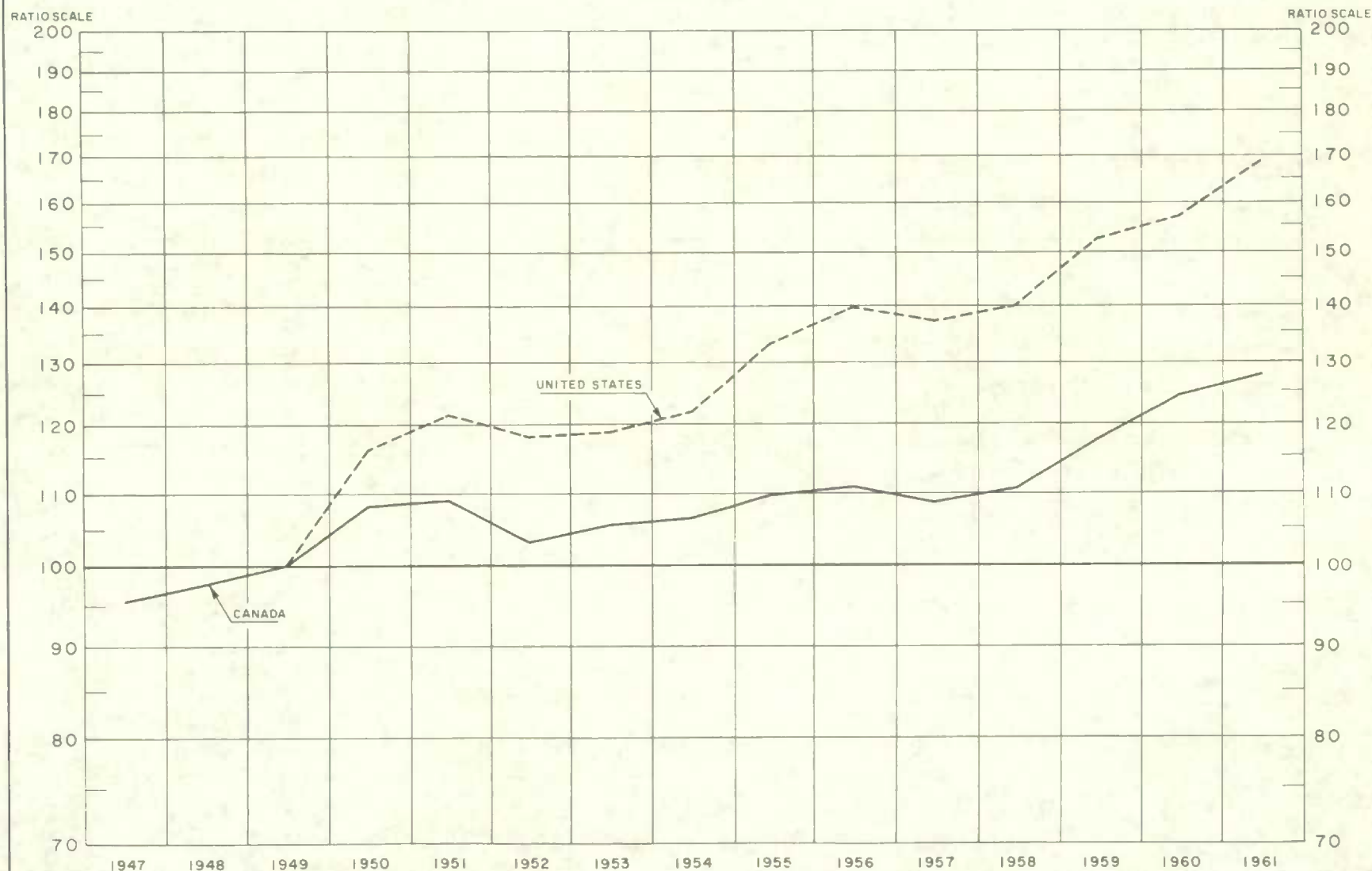
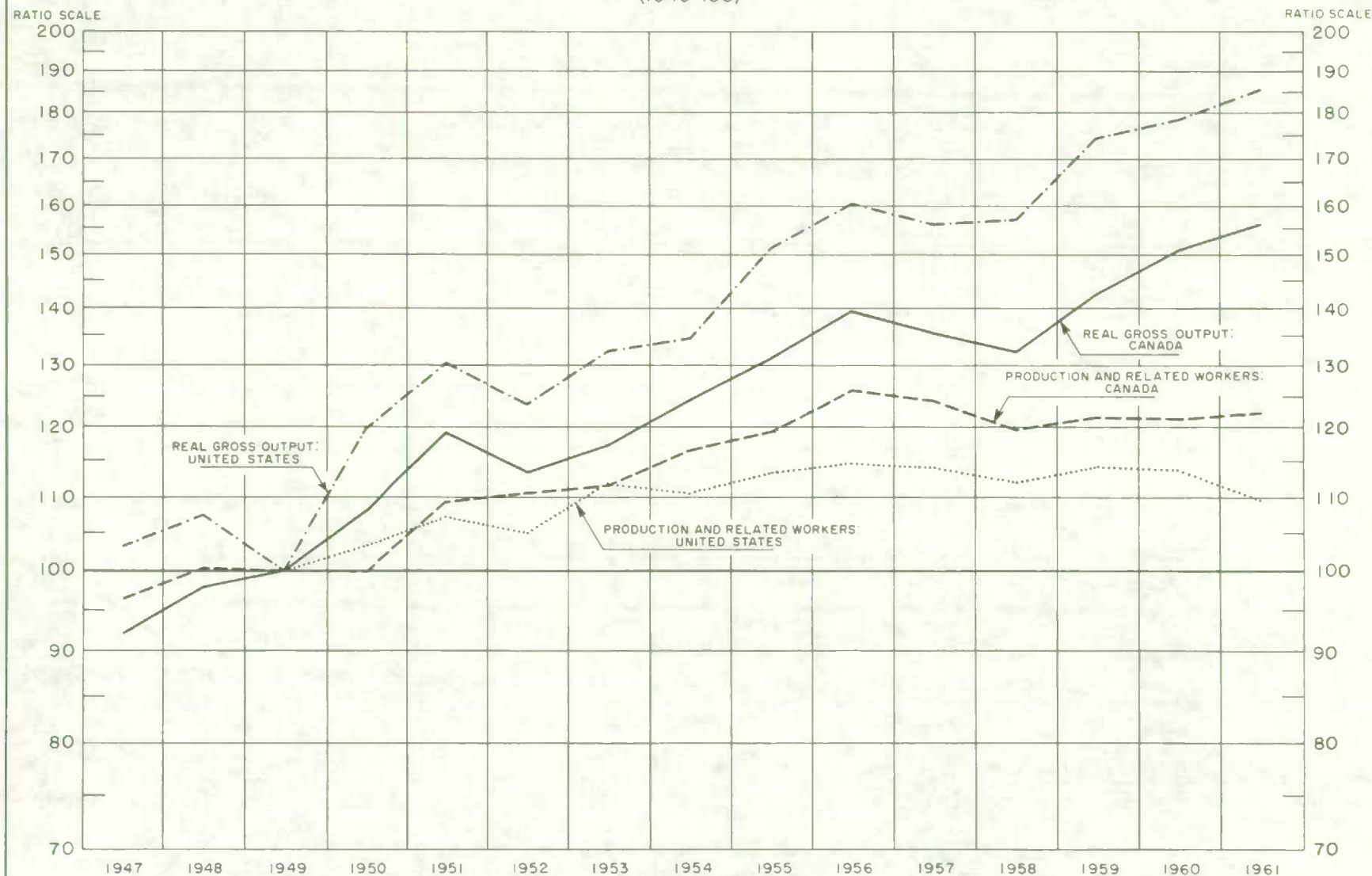


CHART B9.

INDEXES OF REAL GROSS OUTPUT AND PRODUCTION AND RELATED WORKERS, PULP AND PAPER MILLS, CANADA AND UNITED STATES, 1947-61 (1949=100)



SECTION C
GENERAL DESCRIPTION AND CHARACTERISTICS
OF THE INDUSTRY

SECTION C

GENERAL DESCRIPTION AND CHARACTERISTICS OF THE INDUSTRY

Definition and Structure

The Pulp and Paper Mills industry, No. 271 in the (new) 1960 Standard Industrial Classification, is part of the major group, Paper and Allied Industries, and is defined as follows:

"This industry includes pulp mills producing chemical or mechanical woodpulp; and combined pulp and paper mills and paper mills manufacturing newsprint, book and writing papers, kraft paper, paperboard or building and insulation board. Barking mills engaged in producing barked or rossed pulpwood are included in this industry. Establishments primarily engaged in manufacturing converted paper and paperboard products are classified in Industry No. 273—Paper Box and Bag Manufacturers, or Industry No. 274—Other Paper Converters."

This definition differs from the one which prevailed while the 1948 Standard Industrial Classification was in force, when the industry was called Pulp and Paper, in that it includes barking and rossing mills which were previously classified in the Sawmills industry. Notwithstanding the implementation of the 1960 Standard Industrial Classification and the introduction in 1961 of a new

definition of reporting units (establishments), the comparability between the principal statistics compiled on the old basis and those collected on the new basis was not seriously affected. An important part of the difference is attributable to the transfer of one large establishment from the Pulp and Paper Mills industry to the Veneer and Plywood Mills industry (new S.I.C. No. 252). There were also minor valuation adjustments⁶ which, however, did not seriously affect the principal statistics relating to manufacturing activities.

Growth and Characteristics

As shown in Table C1, the current value of factory shipments in the Pulp and Paper Mills industry increased by 131.0% between 1947 and 1961, while for Manufacturing as a whole the corresponding increase was 140.5%. The share of the Pulp and Paper Mills industry in the Manufacturing total decreased slightly from 7.0% in 1947 to 6.7% in 1961. The value of shipments of the major group of Paper and Allied Industries, of which the industry under study forms a part, increased by 142.2%, so that the relative importance of the Pulp and Paper Mills industry within the major group of Paper and Allied Industries decreased only slightly, from 77.6% in 1947 to 74.0% in 1961.

⁵ Dominion Bureau of Statistics, *Standard Industrial Classification Manual*, Ottawa, Queen's Printer, December 1960, Occasional (DBS Catalogue No. 12-501).

⁶ See Part IV, General Technical Notes, pages 115-116.

TABLE C 1. Value of Factory Shipments,¹ Pulp and Paper Mills, Paper and Allied Industries, and Manufacturing, Canada, 1947-61

Year	Pulp and paper mills	Paper and allied industries	Manufacturing	Pulp and paper mills as per cent of paper and allied industries	Pulp and paper mills as per cent of manufacturing
	millions of dollars			per cent	
1947	707	911	10,081	77.6	7.0
1948	826	1,061	11,875	77.9	7.0
1949	836	1,093	12,480	76.5	6.7
1950	954	1,251	13,818	76.3	6.9
1951	1,238	1,590	16,392	77.9	7.6
1952	1,158	1,510	16,983	76.7	6.8
1953	1,180	1,568	17,785	75.3	6.6
1954	1,242	1,630	17,555	76.2	7.1
1955	1,327	1,754	19,514	75.7	6.8
1956	1,453	1,888	21,637	77.0	6.7
1957 ²	1,416	1,878	21,452	75.4	6.6
1958	1,398	1,895	21,435	73.8	6.5
1959	1,502	2,030	22,831	74.0	6.6
1960	1,583	2,126	23,280	74.5	6.8
1961	1,633 ³	2,206	24,243	74.0	6.7
1961 as % of 1947	231.0	242.2	240.5	...	...

¹ In 1956, the general basis of collection was changed from "gross value of products" to "selling value of factory shipments".

² From 1957 on, data are based on the new S.I.C. and the New Establishment Concept. There would have been no significant differences in the results if data on the "old basis" had been used.

³ Revised.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

Using employment as an indicator of growth, the patterns are somewhat different. Table C2 indicates that, between 1947 and 1961, the number of persons employed increased slightly more in the Pulp and Paper Mills industry than in the major group (31.7% versus 29.2%). This compares with an increase in employment for Manufacturing of 11.8% over the period in question.

In summary, the 1947-61 period in the Pulp and Paper Mills industry was characterized by a substantial growth in the value of shipments ac-

companied by a notable increase in the number of persons employed. While the increase in employment in the major group of Paper and Allied Industries compared fairly closely with that of the industry under study, the rise in the value of shipments in the former was more important. Again, at the aggregate level, the value of shipments in Manufacturing and in the Paper and Allied Industries grew by a similar percentage, but employment in the latter increased substantially more than in the former.

TABLE C 2. Persons Employed in Manufacturing Operations, Pulp and Paper Mills, Paper and Allied Industries, and Manufacturing, Canada, 1947-61

Year	Pulp and paper mills	Paper and allied industries	Manufacturing	Pulp and paper mills as per cent of paper and allied industries	Pulp and paper mills as per cent of manufacturing
	number			per cent	
1947	49,946	73,445	1,131,750	68.0	4.4
1948	51,924	75,980	1,155,721	68.3	4.5
1949	52,050	76,471	1,171,207	68.1	4.4
1950	52,343	77,519	1,183,297	67.5	4.4
1951	57,291	82,889	1,258,375	69.1	4.6
1952	57,803	82,965	1,288,382	69.7	4.5
1953	58,194	84,436	1,327,451	68.9	4.4
1954	60,837	87,370	1,267,966	69.6	4.8
1955	62,205	89,750	1,298,461	69.3	4.8
1956	65,985	93,705	1,353,020	70.4	4.9
1957 ¹	66,067	95,067	1,340,948	69.5	4.9
1958	64,199	93,227	1,272,686	68.9	5.0
1959	65,162	94,435	1,287,809	69.0	5.1
1960	65,772	95,281	1,275,476	69.0	5.2
1961	65,799	94,862	1,264,946	69.4	5.2
1961 as % of 1947	131.7	129.2	111.8	...	...

¹ See Table C 1, footnote 2, page 97.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

Basically, there are two methods used in the production of woodpulp, i.e., mechanical and chemical. As Table C3 indicates, the proportion of total woodpulp which was mechanically produced decreased from 36.5% in 1947 to 29.9% in 1961. There was also a significant shift within the chemically produced woodpulp where production based on the sulphite process declined from 46.6% in 1947 to 27.4% in 1961, while that from the sulphate process increased from 14.7% to 32.7%. The percentage share of production of the group "all other woodpulp products" increased from 2.2% in 1947 to 10.0% in 1961. In 1961, 75% of the production in this group consisted of the product "Dissolving and Special Alpha (Sulphite and Sulphate)". It is evident from Table C3 that during the period 1947-61, the value of exports of woodpulp products and newsprint paper as a percentage of their respective value of production did not change significantly.

Table C4 shows that the products of the Pulp and Paper Mills industry form a very important part of Canada's total exports. In fact, exports of woodpulp and newsprint accounted for approximately one-fifth of Canada's total exports of domestically produced goods. The United States and the United Kingdom were the main markets for these products. In the case of woodpulp, the American market accounted for a diminishing percentage share of exports, i.e., from 87.8% in 1947 to 77.6% in 1961, while the proportion of exports to the United Kingdom remained fairly constant (8.3% in 1947 and 8.9% in 1961). On the other hand, Canadian exports of newsprint paper to the United Kingdom rose significantly from 1.4% in 1947 to 7.8% by 1961, while exports of this product to the United States decreased slightly from 85.3% in 1947 to 82.7% in 1961.

**TABLE C 3. Value of Production and Exports, by Principal Products,
Pulp and Paper Mills, Canada, 1947 and 1961**

Products	1947		1961 ¹	
	\$'000	%	\$'000	%
Woodpulp	403,853	100.0	769,291	100.0
Sulphite, paper grades	188,154	46.6	218,431	27.4
Sulphate, paper grades	59,304	14.7	260,555	32.7
Groundwood pulp, bleached and unbleached	147,424	36.5	237,598	29.9
All other woodpulp products	8,971	2.2	79,707	10.0
Basic paper and paperboard	507,101	100.0	1,183,080	100.0
Newsprint paper	355,541	70.1	809,602	68.4
Wrapping papers	26,010	5.1	71,427	6.0
Paperboards	66,126	13.1	147,375	12.5
All other paper and paperboard products	59,424	11.7	154,676	13.1
Exports: ²				
Woodpulp	177,803	44.0	346,662	43.5
Newsprint paper	342,293	96.3	761,313	94.0

¹ 1961 data are based on new S.I.C. and New Establishment Concept.

² Value of exports as per cent of their respective total value of production.

Source: Dominion Bureau of Statistics, *Pulp and Paper Mills*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 36-204).

**TABLE C 4. Distribution of Exports by Principal Products and Countries of Destination,
Pulp and Paper Mills, Canada, 1947, 1951, 1957 and 1961**

Exports	1947	1951	1957	1961
	thousands of dollars			
Canada total ¹	2,774,902	3,914,460	4,839,094	5,754,986
Woodpulp:				
All countries	177,803	365,133	292,406	346,661
United Kingdom	14,741	37,771	28,662	31,023
United States	156,122	276,761	235,258	268,949
Newsprint paper:				
All countries	342,293	536,372	715,490	761,313
United Kingdom	4,623	7,488	44,009	59,294
United States	291,893	496,852	610,290	629,792
	per cent			
Woodpulp:				
All countries as per cent of Canada total	6.4	9.3	6.0	6.0
U.K. as per cent of woodpulp to all countries	8.3	10.3	9.8	8.9
U.S. as per cent of woodpulp to all countries	87.8	75.8	80.5	77.6
Newsprint paper:				
All countries as per cent of Canada total	12.3	13.7	14.8	13.2
U.K. as per cent of newsprint paper to all countries	1.4	1.4	6.2	7.8
U.S. as per cent of newsprint paper to all countries	85.3	92.6	85.3	82.7

¹ Total exports exclude exports of foreign produce.

Source: Dominion Bureau of Statistics, *Trade of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue Nos. 65-201 and 65-202).

Size and Location of Establishments⁷

Overall, the size structure of the Pulp and Paper Mills industry remained relatively stable between 1947 and 1961. The increase in the number of establishments, from 115 to 125⁸ occurred mainly in the early fifties. In addition, there was a shift in the size structure of the industry towards the 200-499 group which became particularly noticeable in the 1957 to 1961 period. Table C5 also indicates that the 1,000 and over size group which included 12.8% (9.5% in 1947) of the number of total establishments in 1961, accounted for more than 27% in 1947 and between 32% and 41% in the latter part of the period, of employment, payroll, gross value of production, cost of materials used and value added.

Of all the size groups in the Pulp and Paper Mills industry, those with 200 to 499, 500 to 999, and 1,000 and over employees showed the greatest

value added per person employed for each of the three years under consideration, with only small differences between these three groups.

As Table C6 indicates, the majority of establishments in the Pulp and Paper Mills industry continued to be located in Quebec, even though its share of the total number of establishments decreased slightly from 43.5% in 1947 to 41.6% in 1961. However, from the point-of-view of employment and value of shipments its relative position declined more significantly, i.e., from 47.4% to 40.2% and from 48.9% to 37.9% respectively, between 1947 and 1961. The most important gains were registered by British Columbia, where there has been a marked increase in the percentage share of total establishments, employment, and value of shipments. Due to the limitations imposed by the Statistics Act, it is not possible to provide data by province for the aggregate of "other provinces". However, it may be noted that increases in the number of establishments are due to the opening of new plants in the Prairie provinces.

TABLE C 5. Percentage Distribution of Selected Statistics, Classified by Number of Persons Employed in Manufacturing Operations,¹ Pulp and Paper Mills, Canada, 1947, 1957 and 1961²

Item and year	Persons employed					
	Total	1-99	100-199	200-499	500-999	1,000 and over
	Per cent					
Establishments 1947	100.0	28.7	14.8	20.9	26.1	9.5
..... 1957	100.0	21.9	15.6	22.6	26.6	13.3
..... 1961	100.0	18.4	14.4	28.8	25.6	12.8
Persons employed ³ 1947	100.0	3.6	5.1	17.3	46.4	27.6
..... 1957	100.0	2.0	4.6	16.2	38.5	38.7
..... 1961	100.0	2.0	4.1	21.2	36.6	36.1
Salaries and wages ³ 1947	100.0	3.0	4.3	16.4	47.0	29.3
..... 1957	100.0	1.6	3.8	15.2	39.1	40.3
..... 1961	100.0	1.6	3.4	20.4	37.4	37.2
Gross value of production 1947	100.0	2.9	4.3	16.5	47.7	28.6
..... 1957	100.0	1.8	3.4	16.9	40.3	37.6
..... 1961	100.0	1.7	3.2	22.2	38.9	34.0
Cost of materials used 1947	100.0	3.5	5.0	16.2	46.8	28.5
..... 1957	100.0	1.8	3.6	17.6	41.0	36.0
..... 1961	100.0	1.9	3.6	23.6	38.5	32.4
Value added by manufacture 1947	100.0	2.5	3.8	16.6	48.7	28.4
..... 1957	100.0	2.0	3.2	16.1	39.7	39.0
..... 1961	100.0	1.5	2.9	21.0	39.4	35.2
	Dollars					
Value added per person employed 1947	7,411	5,071	5,499	7,145	7,781	7,616
..... 1957	10,969	10,515	7,681	10,890	11,319	11,069
..... 1961	13,378	10,049	9,368	13,273	14,396	13,043

¹ Sometimes the data for two separate establishments are combined in a single report for Census purposes. Such combinations are treated as single establishments in this table.

² 1961 data are based on new S.I.C. and New Establishment Concept.

³ Exclude persons employed in separate head offices.

TABLE C 6. Number of Establishments, Persons Employed and Value of Shipments by Province, Pulp and Paper Mills, Canada, 1947 and 1961

Province	Establishments		Persons employed in manufacturing operations		Value of shipments ¹	
	No.	%	No.	%	\$'000,000	%
1947						
Canada	115	100.0	49,946	100.0	707	100.0
New Brunswick	5	4.3	3,493	7.0	52	7.4
Quebec	50	43.5	23,675	47.4	346	48.9
Ontario	45	39.1	16,927	33.9	228	32.3
British Columbia	8	7.0	4,426	8.9	61	8.6
Other provinces ²	7	6.1	1,425	2.8	20	2.8
1961						
Canada	125	100.0	65,799	100.0	1,633³	100.0
New Brunswick	8	6.4	4,258	6.5	109	6.7
Quebec	52	41.6	26,455	40.2	619	37.9
Ontario	39	31.2	19,985	30.4	482	29.5
British Columbia	14	11.2	9,496	14.4	284	17.4
Other provinces ⁴	12	9.6	5,605	8.5	139	8.5

¹ In 1947, gross value of products.

² Nova Scotia and Manitoba.

³ Revised.

⁴ Newfoundland, Nova Scotia, Manitoba, Saskatchewan and Alberta.

Source: Dominion Bureau of Statistics, *Pulp and Paper Mills*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 36-204).

Employment, Hours of Work and Remuneration of Labour

Employment and Hours of Work.—Changes in employment in the Pulp and Paper Mills industry have already been discussed in general terms in the analysis of Table C2, in the context of the industry's growth relative to that of Paper and Allied Industries and Manufacturing. The changes which occurred in the composition of employment, i.e., between production and related workers and administrative and office employees, may now be summarized for the various levels of aggregation.⁹ The ratio of administrative and office employees to total employment increased between 1947 and 1961 in all three cases. The percentage increase from 15.4% to 18.8% in the Pulp and Paper Mills industry was slightly smaller than that in Paper and Allied Industries from 15.8% to 19.7%, and in Manufacturing from 16.9% to 23.4%.

During the period 1947-61, the general reduction in the length of the working week of wage-earners in the Pulp and Paper Mills industry was

also evident in the Manufacturing industries as a whole. Average hours paid per week for wage-earners in the Pulp and Paper Mills industry declined from 49.6 hours to 41.3, i.e., by 16.7%, while the decrease in the major group Paper and Allied Industries¹⁰ was from 47.6 hours to 41.2 (13.4%) and in Manufacturing from 42.5 hours to 40.6 (4.5%). In absolute terms, the level of average weekly man-hours paid for wage-earners in the Pulp and Paper Mills industry never fell below those of the other two aggregates.

It is evident from Table C7 that man-hours not worked but paid of production and related workers as per cent of total man-hours paid in the Pulp and Paper Mills industry correspond very closely to those of the Paper and Allied Industries, but the ratios in both cases were higher for all years than in Manufacturing. Because of the partial use of interpolated data, no useful interpretation of the year-to-year changes can be made.

¹⁰ The industry composition of Paper Products as used in the Employment Surveys conforms to that of Paper and Allied Industries as designated in the Census of Manufactures nomenclature.

⁹ See Part I, Synthetic Textile Mills, footnote 25, page 45.

TABLE C 7. Man-hours not Worked but Paid of Production and Related Workers as Per cent of Total Man-hours Paid, Pulp and Paper Mills, Paper and Allied Industries, and Manufacturing, Canada, 1956 - 61

Year	Pulp and paper mills	Paper and allied industries	Manufacturing
	per cent		
1956	5.9	5.7	4.9
1957	6.4	6.1	5.1
1958	6.7	6.3 ¹	5.2 ¹
1959	7.0	6.6 ¹	5.2 ¹
1960 ²	7.3	6.8	5.3
1961 ³	7.9	7.3	5.6

¹ Interpolated data.

² New S.I.C.

³ New S.I.C. and New Establishment Concept.

The previously noted decline in the average weekly hours paid of wage-earners in the Pulp and Paper Mills industry also held true for salaried employees, but to a lesser extent. In fact, average weekly hours paid for the latter group fell between 1947 and 1960 from 40.5 hours to 37.2 (8.1%), while in Paper and Allied Industries and Manufacturing reductions from 39.9 hours to 37.2 (6.8%) and from 40.4 hours to 38.5 respectively (4.7%) took place. The absolute levels of weekly hours paid for salaried employees in the Pulp and Paper Mills industry were invariably higher than in Paper and Allied Industries and, from 1950 on lower than in Manufacturing.

Remuneration of Labour.¹¹ - As shown in Table C 8, the ratio of payroll to value added for the Pulp and Paper Mills industry is lower than that of Manufacturing, Paper and Allied Industries, and of all the other selected industries, except Food and Beverage Industries. The annual movements of the ratio in the Pulp and Paper Mills industry are shown in Table B3 of Part III of this report. The figures indicate that labour's share in value added has slowly increased over the 1947-61 period.

¹¹ See Part I, Synthetic Textile Mills, page 47.

TABLE C 8. Salaries and Wages Paid as Per cent of Value Added by Selected Manufacturing Industries, Industrial Groups and Manufacturing, Canada, 1961

Industry and industrial group	Salaries and wages paid	Value added by manufacture	Salaries and wages paid as per cent of value added by manufacture
	thousands of dollars		per cent
Paper and allied industries	471, 137	1, 071, 316	44.0
Pulp and paper mills	355, 171	840, 647 ¹	42.2
Folding box and set-up box manufacturers	28, 360	48, 358	58.6
Other paper converters	39, 497	82, 272	48.0
Furniture and fixtures industries	112, 446	185, 103	60.7
Wood industries	280, 331	431, 373	65.0
Printing, publishing and allied industries	327, 901	591, 099	55.5
Food and beverage industries	687, 996	1, 704, 715	40.4
Iron and steel mills	193, 112	411, 494	46.9
Motor vehicle manufacturers	120, 939	277, 151	43.6
Manufacturing	5, 231, 447	10, 682, 138	49.0

¹ Revised.

Source: Dominion Bureau of Statistics, *General Review of the Manufacturing Industries of Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201).

Average hourly earnings of production and related workers (wage-earners) in the Pulp and Paper Mills industry rose from 95¢ in 1947 to \$2.34 in 1961, or by 146.3%. This was virtually the same as in Paper and Allied Industries, where the corresponding increase was 146.6%, from 88¢ in 1947 to \$2.17 in 1961. The gain in hourly earnings, both in absolute and relative terms, is considerably greater in the Pulp and Paper Mills industry than in Manufacturing, where the percentage increase was 125.9%, from 81¢ in 1947 to \$1.83 in 1961.

During the period 1947-60, average hourly earnings of salaried employees increased by 116.9% in the Pulp and Paper Mills industry, 112.8% in the major group of Paper and Allied Industries, and 112.2% in Manufacturing. Although the 1947 average hourly earnings of \$1.60 in the industry under study were 7.4% higher than those prevailing in Paper and Allied Industries (\$1.49) and 30.1% higher than in Manufacturing (\$1.23), by 1960 average hourly earnings in the Pulp and Paper Mills industry were 9.5% higher than in the former group (\$3.47 as against \$3.17) and 33.0% higher than in the latter (\$3.47 as compared to \$2.61). Average hourly earn-

ings of wage-earners in the Pulp and Paper Mills industry increased by 134.7% between 1947 and 1960, and for salaried employees the corresponding increase was 116.9%.

New Capital and Repair Expenditures¹²

During the period 1948-61, construction expenditures in the Pulp and Paper Mills industry represented a somewhat variable portion of total expenditures, the highest percentages being recorded prior to 1952 and in 1956.

Total new capital and repair expenditures in the Pulp and Paper Mills industry constituted, on the average, 88.6% of those in the Paper and Allied Industries between 1948 and 1961. Table C9 also indicates that the year-to-year percentages of total investment expenditures in the Pulp and Paper Mills industry relative to those of the Paper and Allied Industries and Manufacturing varied very little.

¹² See Part I, Synthetic Textile Mills, page 16.

TABLE C9. New Capital and Repair Expenditures in Pulp and Paper Mills, Paper and Allied Industries, and Manufacturing, Canada, 1948-61

Year	Pulp and paper mills			Paper and allied industries	Manufacturing	Pulp and paper mills construction as per cent of pulp and paper mills total	Pulp and paper mills total as per cent of paper and allied industries total	Pulp and paper mills total as per cent of manufacturing total
	Construction	Machinery and equipment	Total					
	millions of dollars					per cent		
1948	31.9	97.2	129.1	143.8	901.8	24.7	89.8	14.3
1949	31.4	93.4	124.8	141.3	874.6	25.2	88.3	14.3
1950	24.9	97.2	122.1	138.2	849.1	20.4	88.4	14.4
1951	43.6	136.5	180.1	204.1	1,215.1	24.2	88.2	14.8
1952	36.3	153.2	189.5	210.7	1,431.3	19.2	89.9	13.2
1953	24.7	136.9	161.6	180.8	1,448.9	15.3	89.4	11.2
1954	21.1	123.6	144.7	170.6	1,310.6	14.6	84.8	11.0
1955	34.8	159.5	194.3	222.9	1,459.7	17.9	87.2	13.3
1956	88.8	239.3	328.1	353.3	1,971.6	27.1	92.9	16.6
1957	59.2	265.1	324.3	364.5	2,092.8	18.3	89.0	15.5
1958	24.3	167.4	191.7	220.1	1,666.9	12.7	87.1	11.5
1959	30.4	174.1	204.5	230.3	1,806.3	14.9	88.8	11.3
1960 ¹	35.6	198.3	233.9	269.4	1,849.0	15.2	86.8	12.7
1961	40.9	197.8	238.7	272.0	1,766.7	17.1	87.8	13.5
Totals	527.9	2,239.5	2,767.4	3,122.0	20,644.4	19.1	88.6	13.4

¹ From 1960 on, new S.I.C.

Source: For the Paper and Allied Industries and Manufacturing, see: *Private and Public Investment in Canada*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-504) - *Private and Public Investment in Canada Outlook*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-205). For the Pulp and Paper Mills industry 1948-56, see: *General Review of the Manufacturing Industries of Canada, 1956*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 31-201). For the years 1956 to 1959 inclusive, figures were obtained from the ledgers of the Business Finance Division, DBS, while for 1960 and 1961, see the supplement to *Private and Public Investment in Canada Outlook, 1963*, Business Finance Division, Dominion Bureau of Statistics.

PART IV
GENERAL TECHNICAL NOTES

PART IV

GENERAL TECHNICAL NOTES

Basic Concepts and Methods

Introduction

The various indexes of output per unit of labour input presented in this report seek to measure the changing relationship between the volume of output in the industry each year and the labour time which is expended in its production. Each index is derived as the quotient of a base-weighted (Laspeyres) index of real output and an unweighted index of labour time and thus reflects the joint effect of all contributing factors, of which the skill and effort of the labour force itself is only one.

Attempts to take into account the influence of inputs other than labour time may take the form of their actual measurement and embodiment into further partial or "total factor" productivity ratios. Alternatively—and this is the approach adopted in this report—the appraisal may be qualitative in character, making use of data such as those relating to new capital and repair expenditures for descriptive purposes.

Output

The basic concept of output used in this report is that of Gross Domestic Product at factor cost by industry of origin. Prior to 1961, in the case of industries covered by the Annual Census of Manufactures, this embraced manufacturing activities only. Beginning in that year, the concept was widened to include all revenue-producing activities of which, however, nonmanufacturing activities normally comprise only a relatively small part. This report deals only with manufacturing activities.

Gross Domestic Product by industry of origin, or net output as it may conveniently be called, is, in the manufacturing industries, essentially a measure of the contribution of the factors of production which are utilized in the transformation of raw materials into finished output. In practice, this concept has to be approximated by "census value added" which tends to overstate net output to the extent that it fails to exclude certain purchased services. Net output (census value added) cannot be expressed in real terms directly but only by the "double deflation" technique in which aggregate measures of gross output and intermediate inputs (materials, fuel, etc.) are separately calculated in real or constant dollar terms and the latter subtracted from the former.¹ For this purpose, quantities of the various products and intermediate inputs of each year are weighted by the average unit values

prevailing in the base year.² The algebraic formulation of the "double deflation" index of real net output by what may be called the commodity approach (commodity net output) is as follows:

$$I_{CNO} = \frac{\sum Q_i P_o - \sum q_i p_o}{\sum Q_o P_o - \sum q_o p_o}$$

where P and Q are the average unit values and quantities of products, p and q are the average unit values and quantities of intermediate inputs, and the subscripts o and i indicate the base-year and given-year values respectively.

As a supplement to the index of real net output and in some cases as a substitute for it, the index of real gross output by the commodity approach (commodity gross output) is also presented in this report.

$$I_{CGO} = \frac{\sum Q_i P_o}{\sum Q_o P_o}$$

In its substitute capacity, the gross output concept can be used in productivity calculations when the value data on intermediate inputs cannot be separated into unit value and quantity components in sufficient detail and when it seems unlikely that an

² The details of the actual procedure—*Revised Index of Industrial Production, 1935-57*, Queen's Printer, Ottawa, page 26 (DBS Catalogue No. 61-502) have been summarized as follows:

"The first step was the tabulation, for each year of the period covered, of the quantities and values of (available) products, materials, fuel and electricity, (and) the opening and closing inventories of finished goods and goods in process....the tabulated material was given a preliminary examination in order to discard any obviously defective data or items which lacked continuity or had been affected by changes in classification.....The total value for each item in the base period was (then) divided by the total corresponding quantity, giving a fixed unit value for the item. The quantity in each year of the period covered by the index was multiplied by this fixed unit value. After each item in the industry had been treated in this way, a sum was taken, for each year, of the values at constant prices. At the same time, the values at current prices of the same items were also summed. The division of the latter figure by the total current value of the industry in each year gave the percentage of coverage. The sum of the values at constant prices of the covered items was then divided by this coverage ratio.....The resulting "blown up" aggregate in each year was then divided by the aggregate in the base year to derive the physical volume index. This procedure was applied to the products, materials and fuel and electricity of the industries for which these data were available."

See also Appendix C for a simplified example of the worksheet procedure.

¹ The terms "gross" and "net" have a different meaning in the National Accounts, where they denote the inclusion or exclusion of capital consumption allowances.

index of real net output, if available, would have given significantly different results. However, where it is known that there are discrepancies arising from such causes as changes in the amount of interplant transfers or processing, special efforts are made, where possible, to apply compensating adjustments to the gross series.

When used in conjunction with the index of real net output, the gross index has extremely useful analytical properties, permitting, for instance, the quantification of trends towards increasing vertical integration which could otherwise be appraised only qualitatively. The effects of more efficient utilization of materials and the changes in the relative importance of different products, which would probably be extremely difficult to verify in any other way from the available data, may also be assessed.

It will be readily apparent that the two indexes just described can also be derived by deflating current dollar values of output and intermediate input with currently-weighted price indexes and, provided the price and quantity components of the basic data are identical in concept and coverage with those of the commodity approach, the formulae below for I_{DNO} (deflation net output) and I_{DGO} (deflation gross output) should yield results identical with those previously outlined.

$$I_{DNO} = \frac{\frac{\sum P_i Q_i}{\sum P_o Q_i} - \frac{\sum P_i q_i}{\sum P_o q_i}}{\frac{\sum P_i Q_i}{\sum P_o Q_i} - \frac{\sum P_i q_i}{\sum P_o q_i}} = I_{CNO}$$

$$\text{and } I_{DGO} = \frac{\frac{\sum P_i Q_i}{\sum P_o Q_i}}{\frac{\sum P_i Q_i}{\sum P_o Q_i}} = I_{CGO}$$

In practice, of course, such an identity of results can rarely be achieved due to such factors as the use of base-weighted price indexes, varying levels of commodity detail in price and production statistics, differences between average unit values and price quotations for comparable commodities and so on.

Input

The basic concept of labour input utilized in this report, i.e., labour time, may be measured either by the man-years or man-hours expended within the industry concerned. The latter may be expressed either by measures of man-hours worked or man-hours paid. Indexes of labour input based on these several alternatives will vary on account of changes in hours worked per week and in the length of paid vacations, sick leave, etc. Before

the Second World War, the difference between hours worked and hours paid was of little significance, but the distinction has more recently become an important one. From the standpoint of defining a purely quantitative relationship between output and labour time, hours worked may be the more appropriate concept, whereas hours paid emphasize the economic aspect of the relationship. In this report, both are shown to the extent that adequate measures are available.

Since even small errors in the component parts of the productivity ratios can result in significant distortion of the changes which the ratios ought to indicate, it is desirable that the measures of labour time should match the output to which they are related as closely as possible. In some cases, output is reported for a different time period than input. However, this problem varies in importance from industry to industry and, as will be apparent from the description of sources below, can be minimized in practice.

Until comparatively recently, it seemed that the average annual employment and man-hours of production workers only could be taken as representative of the trend over a period of years in the labour input of most industries, since office staff and other non-production workers' were comparatively few in number and their relative importance changed only slightly. More recently, however, the proportion of non-production workers in the labour force has increased quite markedly. This has generally been associated with the quickening pace of technological change and the growing importance of the marketing function. This raises the question of whether the traditional distinction between production and non-production workers still continues to be valid in the light of the fundamentally different industrial structure which seems to be emerging. From this point of view, then, it is desirable to have available more widely defined measures of input and output embracing "total activities".

The preceding discussion on output recognized the need for a weighting system that would appropriately combine a set of heterogeneous outputs into a single measure. The labour inputs associated with those outputs may be equally heterogeneous and for certain purposes it may be desirable to weight them also. The point is frequently made in connection with the construction of aggregate productivity measures when the labour inputs of a number of industries are to be combined, but it may be just as valid for intra-industry differences in labour inputs at the individual industry level.

³ The term "non-production worker" does not, of course, mean that the employees referred to are literally not productive, but, rather, that they are engaged only indirectly in the production process. It generally covers professional, technical, clerical, administrative and supervisory employees, and working owners and partners.

There are, however, a number of conceptual and data difficulties which make the weighting of labour inputs extremely difficult in practice. For instance, the rate of compensation, including fringe benefits, might appear to be useful for this purpose, but information on the latter is extremely scarce. Again, geographical differentials in compensation for the same job are quite commonplace.

Sources and Measures

Census of Manufactures

The primary source for the measures of output and intermediate input of the industries dealt with in this report is the Annual Census of Manufactures, the results of which are available for the whole of the period covered in a form more or less suitable for productivity measurement purposes.

Real Gross Output.—For the measurement of real gross output as previously defined, the Census compilations provide specific product detail in quantity and value terms by industry which is usually extensive enough to permit the calculation of a reliable aggregate according to the methods and subject to the precautions which have been described elsewhere.⁴ Until about 1952, this detail was requested in terms of actual production of the commodities concerned. Since that date, in recognition of the fact that respondents can usually supply data on values of shipments more readily than on values of production, the product detail has been on a shipments basis. This has necessitated adjustments for changes in the inventories of finished goods and goods in process at the aggregate level without, however, any significant loss of accuracy of the output measures. Until 1961, the main emphasis in the Census of Manufactures was on manufacturing activities and the measures of real gross output have been calculated accordingly. Since 1961, respondents to the Census have been asked to report on the total operations carried on within their accounting boundaries, with manufacturing activities reported separately, and the measurement of real gross output will therefore eventually be extended to include such other revenue-producing activities as the shipment of goods not of own manufacture, the production of fixed assets for own use, the sale of electricity, etc. These broader measures will be reported side by side with the measures of manufacturing only, each being related to the appropriate measures of labour input.

Real Net Output.—As already mentioned, the concept of Gross Domestic Product by industry of origin must be approximated by "census value

Finally, the compensation of labour is not necessarily proportionate to the effectiveness and quality of the work performed. In view of the above considerations, only unweighted measures of labour input have been used in this report. In fact, for some practical uses such as the forecasting of employment, these unweighted measures may even be preferable.

added", and the calculation of real net output indexes therefore necessitates the assembly of base-weighted volume measures of intermediate inputs. As in the case of products, the Census compilations also generally provide commodity detail by quantity and cost for the materials and supplies used in manufacturing operations. These data have always been requested on a "used" basis so that the question of adjustment for inventories should not arise in this case. The percentage of coverage which it is possible to achieve in the process of developing a volume index of materials and supplies other than containers is frequently not as high as that which can be obtained from products. In the case of assembly-type industries, for instance, the value of many purchased components cannot be related to any meaningful measure of quantity. Often the limitation lies in the make-up of the Census schedule itself which was not primarily designed for this type of analysis. In future revisions of the schedules, consideration will be given to the requirements of productivity measurement, and some improvements have in fact already been effected.

Census information on containers and packaging materials is available in value terms only and, in the absence of suitable price indexes for deflating the reported costs, it has been found necessary to project the base-year figures according to the movements of the real gross output index. This is an unsatisfactory procedure which can only be justified when the proportion of containers and packaging materials to total materials and supplies is small enough for the resultant aberrations from a true volume measure to have an insignificant effect on the index of real net output. The only immediate prospect of any improvement in this area of measurement lies in a detailed survey of expenditures on containers and packaging materials which was recently undertaken in connection with the 1961 input-output table, and which may afford a basis for the construction of fixed-weight price indexes for the deflation of industry current values.

For the period covered, information on the purchase of electricity is available from the Census in both quantity and value terms so that an accurate volume measure can be constructed by multiplying current quantities with base-year unit values. The Census schedule currently provides for the detailed reporting of various types of fuel used in terms of both quantity and value but unfortunately the information is not available for certain back years,

⁴ Dominion Bureau of Statistics, *Revised Index of Industrial Production, 1935-57*, Ottawa, Queen's Printer, 1959 (DBS Catalogue No. 61-502). Measures of output in this report are based on detailed scrutiny of the bench-mark indexes first published in 61-502 and more recently updated and revised in 61-005. See: *Annual Supplement to the Monthly Index of Industrial Production*, Ottawa, Queen's Printer, May 1966 (DBS Catalogue No. 61-005).

so that it has been necessary to construct the volume measures by deflating reported current values with specially constructed price indexes. These will be described in the Industry Technical Notes.

Finally, it may be noted that the broadening in scope of the Census of Manufactures since 1961 makes it necessary henceforth to take into account the materials and supplies corresponding to the additional nonmanufacturing activities previously discussed in order to construct measures of real net output consistent with the total activity concept of "census value added".

Employment.—The preceding discussion under "Basic Concepts and Methods" referred to the need for measures of labour input in terms of both production and non-production workers. The classification of persons engaged in manufacturing operations used by the Census of Manufactures until 1961 distinguished between "working owners and partners", "administrative and office employees", and "production and related workers". The first category related to unincorporated companies only and therefore varied in importance according to how prevalent this form of organization happened to be in a particular industry. "Administrative and office employees" was defined as including "all executive and supervisory officials, such as presidents, vice-presidents, secretaries, treasurers, etc., together with managers, professional employees, superintendents and factory supervisors above the working foreman level and their clerical staffs". "Production and related workers" was essentially a residual category, covering all factory workers in manufacturing operations not otherwise reported, whether paid on a monthly, weekly, hourly, or piece-work basis. Specific classes of workers defined as falling into this category were "working foremen doing similar work to that of employees they supervise; also maintenance, warehousing and delivery staffs, etc."

It seems reasonable to identify the second and third of these categories, i.e., "administrative and office employees" and "production and related workers" with the concepts of non-production and production workers in manufacturing operations respectively, in spite of the fact that some of the labour time of administrative employees would actually be expended outside the area of manufacturing operations. The first category, "working owners and partners", is difficult from the point of view of classification, since by definition they are almost certain to be engaged in both production and non-production activities. Their status can best be resolved in practice by including them in measures of total employment in manufacturing operations, although they too may be partly engaged in nonmanufacturing operations. Before 1961, outside piece-workers were also reported to the Census of Manufactures but were classified separately from the total of manufacturing employment. The importance of such employment is very slight

in the majority of manufacturing industries but, to the extent that their output and the intermediate inputs used by them are included in the numerator of productivity ratios, proper matching requires that the corresponding labour time be included in the denominator also.

There exists yet a further category of employed persons who may contribute to manufacturing output, namely, unpaid family workers. Unfortunately, neither the Census of Manufactures nor any other establishment survey conducted by the Bureau collects data on this category of employment. Unpublished data from Labour Force Survey sources, however, suggest that unpaid family workers are relatively unimportant in manufacturing. On the basis of data for selected survey weeks in 1959, they comprised less than a quarter of one per cent of persons employed in manufacturing.

Since 1961, as a consequence of the change in emphasis in the Census of Manufactures from activity to establishment statistics, manufacturing operations are no longer identified as a separate area of total employment since administrative and office employees cannot be properly allocated. The schedule still continues to distinguish production and related workers engaged in manufacturing operations, which can, of course, be matched against the corresponding output. The only other significant employment grouping has to be an all-embracing measure which also includes working owners and partners, administrative and office employees, sales and distribution workers, employees in new construction, outside piece-workers and other production and related workers. Such a measure can only be related to total output, net or gross, as previously discussed. Thus, all future compilations will be in terms of output per production and related worker in "manufacturing activities" and output per person employed in "total activities".

It should be pointed out that, with the exception of production and related workers in manufacturing operations, all the measures of employment so far referred to are based on averages reported for a complete year. The figures for production and related workers, on the other hand, are averages of the numbers of employees reported as receiving pay during the last pay period of each month. This raises certain questions as to the relative reliability of the two kinds of measures which are discussed further below.

Man-hours.—Man-hours of production and related workers in manufacturing have been collected in the Census of Manufactures since 1956, the annual totals being the sum of four separate quarterly estimates. Respondents are required to indicate for each period the total man-hours at work, the total man-hours not worked but nevertheless paid, and the grand total of all man-hours paid.

Summary.—The various combinations of output and input which can be derived directly from the Census of Manufactures for productivity measurement at the 3-digit industry level are summarized

in Table 1. Not all of them are necessarily logical or useful. For instance, it would be difficult to interpret the ratio of real gross or net output (total activities) to the man-hours of production and related workers only.

Secondary Sources

Price Indexes. — As was previously noted, measures of real output, both net and gross, can be derived either by the commodity approach or by the deflation of current dollar values of output and intermediate input with appropriate price indexes. However, just as the Census of Manufactures data were not primarily collected for the purpose of real output measurement, neither are available price indexes primarily constructed for the express purpose of deflation. Thus, both approaches usually fall short of the requirements for complete parallelism of results. Until quite recently, for instance, wholesale price indexes in Canada were classified by commodity and, apart from questions of conceptual consistency, their coverage was usually too restricted to permit the construction of indexes for deflation purposes at the industry level where a considerable degree of heterogeneity in the commodity detail usually exists.

However, the publication of a set of wholesale price indexes for manufacturing industries, compiled and presented at the 3-digit level of the Standard Industrial Classification, affords a much more realistic basis for such procedures. This system of

industrial price indexes⁵ does not as yet cover all manufacturing industries and is limited to products shipped, so that its usefulness is so far confined to the construction of indexes of real gross output. Also, the historical range of most of the indexes goes back no further than the year 1956, which is rather too brief a time span for the purpose of this report. Another deficiency of the indexes, from the standpoint of their use in the deflation of the current value of output, is that they are base-weighted, whereas the requirements of this procedure call for a currently-weighted price index if deflation at the aggregate level is to result in a measure of real output which is strictly comparable from year to year. The desired effect could be substantially achieved if it were possible to deflate output at the individual commodity level. However, the possibilities of such an approach are restricted in practice because of the limited commodity price quotations within particular industries. Nevertheless, limited experience so far has shown that, in those industries where the amount of Census detail is not extensive enough to permit complete confidence in the results of the commodity approach, the calculation of an alternative index by the price deflation approach may be instrumental in identifying areas of difficulty and in providing a starting point for their clarification. Some of the specific problems involved in the use of these indexes will be discussed in Part V of this report, "Industry Technical Notes".

⁵ Dominion Bureau of Statistics, *Industry Selling Price Indexes, 1956-59*, Ottawa, Queen's Printer, Occasional, 1961 (DBS Catalogue No. 62-515).

TABLE 1. Availability of Material for Industry Measures of Output per Unit of Labour Input, Census of Manufactures

Input Output	Employment				Man-hours	
	Production and related workers (manufacturing activities)	Administrative and office employees (manufacturing activities)	Total (manufacturing activities)	Total (total activities)	Man-hours worked, production and related workers (manufacturing activities)	Man-hours paid, production and related workers (manufacturing activities)
Real gross output (manufacturing activities).....	1947 to date	1947-61	1947-61	1961 to date	1956 to date	1956 to date
Real net output (manufacturing activities)	"	"	"	"	"	"
Real gross output (total activities)	1961 to date	..	..	"	1961 to date	1961 to date
Real net output (total activities) .....	"	..	..	"	"	"

Work presently under way and directed towards the improvement and extension of the Industry Selling Price Indexes will undoubtedly extend their usefulness in the area of real output measurement. For instance, the published indexes are presently being re-based to a 1961 weight base and a programme of assembling material input price indexes has been under way for some time. The period prior to 1956 still remains a problem, although in some cases it is possible to construct substitute indexes, for the deflation of gross output at least, from other sources of price data. For such indexes to be considered acceptable, it is a minimum requirement that their movements roughly match those of the Industry Selling Price Indexes during the period of overlap.

The calculation of volume measures of fuel used involves the deflation of currently-reported values by means of specially constructed price indexes, the component elements of which, such as natural gas, fuel oil, bituminous coal, etc., are drawn from the general wholesale price indexes⁶ and currently weighted according to their relative value as reported to the Census.

Monthly Employment Survey.—Another major source within the Bureau has been drawn on for the purpose of further developing the labour input data of the Census of Manufactures. The Employment Section of the Labour Division conducts a monthly survey in which the establishments employing 15 persons and over across a broad industrial composite which includes Manufacturing are asked to report separately the numbers of "wage-earners" and "salaried employees" drawing pay in the last pay period of each month together with the corresponding total of wages and salaries and, in respect of those wage-earners for whom they keep records of hours paid, separate figures of man-hours and wages.

The results of the Employment Survey are published monthly by industry⁸ and include annual averages of average weekly hours and average hourly earnings of wage-earners for whom hours are recorded.⁹ This permits two alternative means of estimating the man-hours paid of production and related workers in manufacturing operations for the years prior to 1956 when the man-hour questions were first included on the Census of Manufactures

schedule. The first of these is the "pay deflation" method, i.e., the division of Census wages of production and related workers by the average hourly earnings of Employment Survey wage-earners, while the second or "employment inflation" method consists of the multiplication of the average number of Census production and related workers by measures of Employment Survey total per capita hours per annum. In connection with these procedures, historical data from Census and Employment Survey sources are not strictly comparable for the following reasons: (a) differences in industrial classification,¹⁰ (b) differences in establishments covered,¹¹ (c) the definition of wage-earners in the Employment Survey is restricted to those for whom records of man-hours are kept, and (d) differences in activity coverage, i.e., the definition of production and related workers in the Census is narrower than that of wage-earners in the Employment Survey in that the latter covers total activities rather than just manufacturing activities. At the level of total manufacturing the wage-earners for whom records of hours are kept comprised, in 1957, some 83% of the annual number of production and related workers reported to the Census of Manufactures so that, in those industries where establishments employing less than 15 persons do not form a significant proportion of the total, there is sufficient common coverage to ensure that the average weekly hours and average hourly earnings of the Employment Survey are reasonably representative.

Secondly, it should be noted that the "average weekly hours" of the Employment Survey are actually "hours paid" since they are defined to include any hours credited to wage-earners absent on leave with pay in the reported pay periods. Thus, when the "employment inflation" procedure is carried out for a particular industry, an estimate of the total hours paid is derived. Similarly, the gross wages reported to the Employment Survey for the full-time and part-time wage-earners whose hours are reported also include those amounts credited to wage-earners on leave with pay, so that when the resultant annual averages of hourly earnings are divided into Census payroll of production and related workers, which is also defined to include payment for hours not worked, an estimate of total hours paid again results. The "pay deflation" method is generally considered to be more satisfactory than the "employment inflation" method because the payroll figures of the Census

⁶ Published up to 1952 in: *Prices and Price Indexes, 1949-52*, Ottawa, Queen's Printer, 1954 (DBS Catalogue No. 62-501), since which time the detail has been made available from unpublished sources.

⁷ These two categories correspond roughly to the "administrative and office employees" and the "production and related workers" of the Census of Manufactures.

⁸ Dominion Bureau of Statistics, *Employment and Payrolls*, Ottawa, Queen's Printer, Monthly (DBS Catalogue No. 72-002) — *Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Monthly (DBS Catalogue No. 72-003).

⁹ Dominion Bureau of Statistics, *Review of Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-202).

¹⁰ The Employment Survey classifications have recently been revised in conformity with the 1960 S.I.C. and the historical data for a number of years prior to 1961 will be made available in the near future. See: Dominion Bureau of Statistics, *Employment Indexes, Average Weekly Wages and Salaries, Average Weekly Hours and Average Hourly Earnings, Monthly and Annual Statistics, January 1961-May 1965*, Ottawa, Queen's Printer (DBS Catalogue No. 72-504).

¹¹ Since 1961 a monthly sample survey of employment in smaller establishments has been conducted as a supplement to the long-standing survey of larger establishments. See: Dominion Bureau of Statistics, *Estimates of Employees by Province and Industry, 1961-64*, Ottawa, Queen's Printer, Occasional (DBS Catalogue No. 72-503).

of Manufactures cover the entire year whereas the employment data, being based on the average of monthly sample periods, are subject to possible imperfections. However, the above qualifications do not always hold and, in some cases, the "employment inflation" method is found to be more acceptable. These considerations have been confirmed by actual comparison of reported man-hours and those estimated by the two alternative methods in a number of cases at the individual industry level.

Since the man-hours paid of production and related workers before 1956 can be satisfactorily estimated, it might seem desirable to extend the process still further and estimate also the man-hours not worked but paid in each year so as to derive, by subtraction, the man-hours worked. Unfortunately, there are no quantitative data in Canada on which such an estimate can be based. As is shown later in these notes,¹² the Department of Labour has published information on the provisions for paid holidays and vacations with pay in Canadian industry, but not in a form suitable for estimation of man-hours worked. It may be mentioned that this limitation also applies to the estimation of the man-hours paid of administrative and office employees for all years.¹³

The availability of employment data from the Monthly Employment Survey, simultaneously with those of the Census of Manufactures, permits a check on the accuracy of both. When, at the individual industry level, the published Employment Survey annual average of wage-earners for whom records of hours are kept is subtracted from the annual average of total wage-earners and salaried employees,¹⁴ a figure is derived which represents the sum of salaried employees and those wage-earners for whom hours are not kept. The two components may be compared with the numbers of production and related workers and administrative employees reported to the Census. Significant differences in year-to-year changes between corresponding components can then be further investigated by comparison of source data at the establishment level, and resulting differences in establishment and activity coverage, etc., can be made explicit and allowed for. Detailed reconciliation studies of this kind are time-consuming but result in considerable improvement in the quality of the data when ambiguities in the data of both sources can be identified and clarified with respondents.

Annual Survey of Employment.—The Monthly Survey of Employment, Payrolls and Man-hours is supplemented by an Annual Survey¹⁵ conducted in

¹² See Department of Labour Publications, this page.

¹³ See Annual Survey of Employment, this page.

¹⁴ Dominion Bureau of Statistics, *Review of Employment and Payrolls*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-201).

¹⁵ Dominion Bureau of Statistics, *Earnings and Hours of Work in Manufacturing*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-204). 1961 and 1962 were not surveyed.

October of each year, which is the only source of data on the average hours and average hourly earnings of salaried employees in manufacturing. This makes it possible to estimate, at the individual industry level, man-hours paid of salaried employees by the methods previously described. Such estimates differ from those which are derived for production and related workers in that the inflators and deflators are based on the data of a single sample week in October of each year. The existence of any seasonal pattern in the average hours paid and average hourly earnings of salaried employees, such as may characteristically occur for wage-earners in certain manufacturing industries, cannot be confirmed or denied statistically but seems less likely in practice. Furthermore, although there is a long-run tendency towards a shorter work week, it is not sufficiently pronounced to cause any significant differences between the figures reported for the survey week and the corresponding annual averages that would result from the availability of monthly data. Average hourly earnings, however, have tended to increase over most of the period in question, with year-to-year changes big enough to invalidate the use of October figures as representative of annual averages. Wherever it seemed warranted, adjustments have been made to the published figures of average hourly earnings to correct for this suspected upward bias.

In the case of administrative and office employees, as with production and related workers, there is a presumption in favour of "payroll deflation". However, the results of the two methods are compared before a final choice is made. It should be noted that the man-hour estimates for administrative and office employees cannot be compared with any reported man-hours.

Department of Labour Publications.—Two publications of the Economics and Research Branch of the Department of Labour may also be mentioned. "Wage Rates, Salaries, and Hours of Labour" contains tabulations by selected 3-digit manufacturing industry of representative occupational wage rates and standard hours per week on the basis of a survey conducted in the last pay period prior to October 1 each year covering all establishments with 15 or more employees.

"Working Conditions in Canadian Industry" has at various times published information by 3-digit manufacturing industry for both plant and office employees on such points as: the standard work week, overtime provisions, paid statutory or public holidays, vacations with pay, pension plans, group life insurance plans, industrial medical services, health benefit plans, etc.

While these sources were not in fact drawn upon in the preparation of this report, they provide a potentially useful supplement to the labour input data of the various Bureau surveys, and "Working Conditions in Canadian Industry" is particularly

interesting in that its findings could provide a starting point for the estimation of indexes of unit labour cost at the individual industry level.

Summary of Available Measures of Output per Unit of Labour Input

By means of the secondary sources just discussed, it becomes possible to extend considerably Table 1, which indicated the various measures of output per unit of labour input derivable directly from the Census of Manufactures data. Because of the desirability of classifying the measures of output and input by method of calculation, the two cannot be directly related in the same table and are therefore enumerated separately in Tables 2 and 3. As before, meaningful ratios cannot necessarily be derived for every combination of outputs and inputs. The ratios which have been chosen as of particular analytical significance are discussed in Section A of Parts I, II, and III respectively of this report and their values, together with those of their components, are presented in Section B of each Part.

Sources of Background and Interpretative Material

In the textual portions of Parts I to III of this report, frequent use is made of supplementary information for the purpose of describing the characteristics of the industry in question and of relating it to the 2-digit industry of which it forms a part, as well as to manufacturing as a whole. The main sources of this information are as follows:

Census of Manufactures.—The Census of Manufactures provides a certain amount of detail which is already embodied in the indexes of real net output per unit of labour input, but which is also useful in any calculation of related measures such as real gross output per unit of fuel and electricity or material consumed. Information as to the composition of the industry by size and geographic location, and such factors as trends in value added per person employed is also drawn from Census sources.

Capital Expenditures Survey.—Another important source of background material is the Annual

Capital Expenditures Survey of the Bureau.¹⁶ This survey collects details of new investment on durable physical assets for construction and machinery and equipment, as well as repair expenditures necessary to maintain the stock of durable assets. The concept of investment used is defined in gross terms and embraces durable physical assets, i.e., those which continue to be used in their original form for more than one year, the usual accounting period. The data are published primarily at the 2-digit level of industrial classification and higher, but figures of investment for the post-war years have been made available at the 3-digit level for the purpose of industry division publications.¹⁷

Aggregate Productivity Measures.—The interpretation of changes over time in ratios of output per unit of labour input at the individual industry level is undoubtedly facilitated by the availability of similar ratios at higher levels of aggregation. In this connection, the Bureau now publishes indexes of output per person employed and per man-hour worked in the commercial economy, with separate detail for agriculture, manufacturing and the commercial nonagricultural nonmanufacturing residual.¹⁸ As previously mentioned in the "foreword", it is planned to extend the productivity studies to cover major group aggregates. The manufacturing series provides a particularly useful frame of reference for the individual industry measures presented in this report.

¹⁶ Dominion Bureau of Statistics, *Private and Public Investment in Canada, 1946-57*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-504). *Private and Public Investment in Canada, Outlook*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 61-205), jointly prepared by the Dominion Bureau of Statistics and the Economics Branch of the Department of Trade and Commerce.

¹⁷ See, for instance: *Synthetic Textile Mills*, Ottawa, Queen's Printer, Annual, 1960 (DBS Catalogue No. 34-208), and *General Review of the Manufacturing Industries*, Ottawa, Queen's Printer, Annual, 1961 (DBS Catalogue No. 31-201).

¹⁸ Dominion Bureau of Statistics, *Indexes of Output per Person Employed and per Man-hour in Canada, Commercial Nonagricultural Industries, 1947-63*, Ottawa, Queen's Printer, 1965 (DBS Catalogue No. 14-501), as updated and extended by the DBS Daily Bulletins of October 12, 1965 and June 7, 1966.

TABLE 2. Availability of Material for Industry Measures of Output, Primary and Secondary Sources

Calculated by \ Output measure	Real gross output (manufacturing activities)	Real net output (manufacturing activities)	Real gross output ¹ (total activities)	Real net output ¹ (total activities)
Commodity approach	1947 to date	1947 to date	1961 to date	1961 to date
Deflation approach	1956 to date	..	1961 to date	..

¹ Or combinations of both approaches.

**TABLE 3. Availability of Material for Industry Measures of Labour Input,
Primary and Secondary Sources**

Input measure Derived from	Employment				Man-hours				
	Produc- tion and related workers (manufac- turing activi- ties)	Adminis- trative and office employees (manufac- turing activi- ties)	Persons employed (manufac- turing activi- ties)	Persons employed (total activi- ties)	Man-hours worked, produc- tion and related workers (manufac- turing activi- ties)	Man-hours paid, produc- tion and related workers (manufac- turing activi- ties)	Man-hours paid, adminis- trative and office employees (manufac- turing activi- ties)	Total man- hours paid (manufac- turing activi- ties)	Total man- hours paid (total activi- ties)
Reported data.....	1947 to date	1947-61	1947-61	1961 to date	1956 to date	1956 to date	..	..	..
Estimated data....	..	..	..	..	..	1947 to date	1947-61	1947-61 ¹	1961 ¹ to date

¹ Combinations of estimated and reported data.

Special Problems

Changes in the Census of Manufactures¹⁹

The data compiled on the old basis are fully consistent with the 1948 Standard Industrial Classification and the manufacturing activity concept while those on the new basis reflect the 1960 Standard Industrial Classification and the New Establishment Concept.

New Standard Industrial Classification.—In 1960, as the first stage in a major revision of the Census of Manufactures, reporting establishments which had up to that time been coded according to the 1948 Standard Industrial Classification were regrouped in conformity with the 1960 Standard Industrial Classification. At the individual industry level, this implies the possibility of discontinuity in the indexes of output per unit of labour input. The manufacturing industries most affected by the change are in the group generally known as "durable goods" industries. In most of the industry productivity studies scheduled for early publication the problem is either non-existent or of minor importance.

Revisions in Concept.—The second major problem for the construction of productivity indexes which is implicit in the revision of the Census of Manufactures arises out of the shift in

emphasis from the purely manufacturing activities of reporting establishments to a wider concept of all non-financial activities of establishments engaged primarily in manufacturing. This change, from the "activity" to the "establishment" concept, became effective in 1961.

As far as manufacturing activities are concerned, it was formerly required that manufacturing shipments be reported at an "f.o.b. plant" level of valuation so as to be consistent with related operational statistics such as employment, payrolls, materials and supplies, etc. In many cases, however, respondents' accounting records were not organized on an activity basis and firms operating sales branches and marketing divisions, for instance, where significant valuations emerged only at the point of sale, were not always able to report at the proper level of valuation. Reporting requirements for the Census of Manufactures have, with some exceptions, been accommodated to these realities and the valuation of shipments is now requested "f.o.b. establishment", i.e., at whatever level the accounting records of the respondents fix the boundary of the establishment.

When the commodity approach to the measurement of manufacturing output in real terms is used, the average unit values used as weights for particular commodities reflect the base-year marketing practices of the various establishments producing them, and subsequent organizational changes among the establishments, which show up in the current value of their output, would have no effect on the

¹⁹ For a wider discussion of these changes and their implications, see the article: *Forthcoming Changes in the Census of Industry*, *Canadian Statistical Review*, July, 1961, and the introductory notes of any 1962 Census of Manufactures publication.

real measures during the currency of a particular weighting pattern. However, drastic shifts in the contribution to the industry's total output of particular commodities by establishments reporting at different levels of valuation could have effects similar to those which result when, under a uniform concept of valuation, major changes take place in the composition of output and in the corresponding unit values. In both cases, the relative importance of commodities implied in the base-year weighting pattern may no longer be adequate for real output measurement purposes.

When, on the other hand, the price deflation approach to the measurement of real manufacturing output is being used, an organizational change such as the entry into the field of distribution by manufacturers, resulting in an increase in the current value of the output of the producing establishment, would also be reflected in a corresponding increase in the real measure. The problem of maintaining a real measure of purely manufacturing activities thus becomes a problem of adjusting the price index to conformity with the new "marketing mix" of the establishments in the industry. This would, of course, be very difficult to achieve in practice.

Care must also be taken that the differential effects of organizational changes on the labour side do not result in artificial increases or decreases of the productivity ratios because of a mismatching of components. In the example just referred to, there would be an increase in the number of sales and distribution workers which, in the case of a commodity-derived volume measure, would not be accompanied by a corresponding increase on the output side. Under such circumstances, it would be preferable to restrict the denominator of the productivity measure to the employment or man-hours of production and related workers only. In the future, this will be the logical measure. On the other hand, when the real output measure has been calculated by price deflation, it will, to the extent that the price index has not been correspondingly adjusted, reflect the increase in activity and is thus only suitable for use in measures which compare total output with total employment or man-hours since these also reflect the changes in marketing organization. Individual industries will be carefully scrutinized for changes of this kind and adjustments for continuity made where possible.

The extension of the Census of Manufactures to activities other than manufacturing has already been described earlier in these notes and its implications for the measurement and matching of real output and inputs briefly discussed. It may be pointed out that the problem of compiling statistics on an activity basis which was exemplified by the difficulty of allocating administrative and office employees is no less evident on the output side. Some respondents cannot distinguish in their records between materials, shipments and inventories relating to own manufacturing operations and those relating to their other activities. For these reasons,

from 1961 on, complete consistency is more likely to be achieved at the "total activities" level although, even here, certain organizational changes of the kind just noted can make comparisons between the "manufacturing" and "total activities" measures invalid unless proper adjustments are made.

Output per person employed based on "total activities" data will be linked in 1961 to the corresponding series relating solely to manufacturing activities. Consequently, from 1961 on, the output per person employed series will be restricted to "total activities" while productivity in manufacturing activities will still be measured in terms of output per production and related worker.

Change of Weight Base

As already mentioned, the weight base used in this report for the construction of real output measures by the commodity approach is 1949. Thus, the latter are consistent with the published measures of real domestic product by industry of origin, and the desirability of a change of weight base in the industry productivity measurement programme must, in practice, be considered in this wider context. There is considerable evidence at the individual industry level to show that the use of such a remote base has caused varying amounts of distortion in the real output indexes and that an updating is urgently required. The accelerating pace of technological change during the post-war period has resulted in a proliferation of new products and major shifts in the relative importance of old products in the output of many industries. The methodology of the commodity approach allows for the effects of the former by calculating artificial weight bases but the more fundamental solution for both problems is a frequent change of weight base.²⁰

International authorities have recommended that the weight base of index numbers of industrial production be reviewed at five-year intervals.²¹ It has, however, been for practical rather than a neglect of theoretical considerations that rebasing of the Canadian series was deferred until 1961. Limitations on resources made it impossible to rebase the industry of origin indexes to 1957 together with the Gross National Expenditure series. The year 1961 then seemed appropriate for a number of reasons including the fact that the 1961 input-output table would be available to provide the inter-industry weighting system. The choice of 1961 was also consistent with plans for the rebasing of important related series in the area of labour and prices. Again, it seemed desirable to wait until the revised Standard Industrial Classification was put into effect.

²⁰ For a more detailed discussion of the impact of these problems on the Synthetic Textile Mills industry and the steps taken to deal with them, see Part V, Industry Technical Notes, pages 122-123.

²¹ Statistical Office of the United Nations, *Index Numbers of Industrial Production, Studies in Methods*, No. 1, New York, UN, September 15, 1950.

The indexes of real manufacturing output per unit of labour input presented in this report attempt, where possible, to go as far as 1961 on the basis of 1949 weights, the 1948 Standard Industrial Classification, and the manufacturing activity concept in order to provide the maximum amount of continuity of comparable data. As previously noted²² this may not always be possible because of classification difficulties as well as changes in reporting practices arising out of the implementation of the New Establishment Concept.

Quality Problem

The effects of quality change on volume and price measures of industrial groupings of commodities constitute an extremely difficult conceptual and practical problem which can only be dealt with in an arbitrary manner and to a partial extent, with a warning as to the limited nature of the solution, if any. It is not the intention here to attempt a comprehensive discussion of this complex topic but simply to bring to the fore one or two aspects of the problem which have an immediate bearing on the two general approaches to volume measurement which have been discussed in these notes and to comment briefly on the manner in which they are or might be dealt with.

Product Mix.—The term "quality change", when used in its broadest sense, actually embraces a number of logically separate phenomena, some of which are more amenable to treatment than others. For instance, changes over time in "product mix" can be described as group or structural quality change. Product mix may be defined as the proportional composition of the set of distinguishable product "varieties" contained in a prescribed total or aggregate. The problem caused by changing product mix occurs for instance when a broadly defined product category in the Census of Manufactures schedule for a particular industry, such as "tractors", conceals a gradual shift from large to small units. In such a case, a volume index based on the total number of tractors weighted by the base-year average unit value would have a progressive upward bias.

This kind of quality change is not difficult to deal with in principle by either of the two measurement techniques. If data for each variety of tractor within the aggregate are available, then the commodity approach will yield a more accurate indicator of volume change than could be derived by working at the aggregate level. Again, the price deflation approach, to the extent that it can be based on similar commodity detail, will in turn reflect the changing composition of the aggregate.

New Varieties.—The preceding illustration assumed that the product mix change referred to was a shift in the relative importance of varieties, all of which were represented in the aggregate over the entire period in question. The introduction of

new varieties into the aggregate is a closely related problem, the treatment of which is similar to that for new products. Under the commodity approach, an artificial base-year unit value for the variety should ideally be calculated so that it can be explicitly recognized in the volume measure without undue delay. From the standpoint of price deflation, the solution is parallel in nature, namely, to introduce into the index a price quotation for the new variety. For instance, in a currently-weighted price index, an artificial price for the base year would have to be estimated.

Changes in Components.—A further kind of quality change which cannot be handled nearly as well occurs when, for example, what is basically the same model of tractor is improved over the years in some of its minor specifications by means of changes in certain component parts. From the standpoint of the commodity approach, it would be formally correct to regard each change as a new variety. This could conceivably result in considerable discontinuity at the individual commodity level and an extensive reliance on artificial weights, the total effect of which might be somewhat less satisfactory than if no adjustment had been attempted at all.

When such a situation results in an increase in the price quotation for a particular product, conventional methodology in the construction of price indexes permits either of two extreme positions or some intermediate compromise. At one extreme, price quotations of the consecutive varieties may be regarded as directly comparable so that the difference between the two is embodied into the index as pure price increase. Alternatively, the contiguous price quotations may be treated as directly proportional to the qualities of the varieties concerned so that the price index registers no increase on this account at the time of introduction. When the current value of output in the later period is deflated by a price index determined according to the second of these alternatives, the resultant volume measure is higher than that which would be derived from the use of a price index based on the first assumption.

The Industry Selling Price Indexes previously referred to take an intermediate position between these two extremes with regard to the treatment of quality change. The convention most extensively used relies on the quantity of direct labour and materials embodied in each of the two material varieties to be compared as indicators of their relative quality, the precise measure of which is determined by cost comparisons of common and non-common components.²³

For any given industry, it will usually be the case that the appropriate Industry Selling Price Index reflects to a greater or lesser extent an adjustment for this kind of quality change, whereas the available data from the Census of Manufactures

²² See page 115, new Standard Industrial Classification.

²³ Dominion Bureau of Statistics, *Industry Selling Price Indexes, 1956-59*, Ottawa, Queen's Printer, Occasional, page 86 (DBS Catalogue No. 62-515).

will not permit the kind of adjustment previously suggested for the commodity approach. Thus, when a gross output index derived by price deflation is growing faster than the corresponding commodity-based index, it may be the case that the latter understates the importance of an improvement in quality. From the standpoint of real product by industry of origin, however, the impact of quality change must be assessed in terms of the net index. If, for instance, the increase in quality was known to have originated in a purchased component, it would be clear that the index of real gross output derived by deflation would overstate the volume increase, thus, in effect, quantifying the quality change in the wrong industry or duplicating it. Correct allocation would require the use of a corresponding set of quality adjusted purchase price indexes, for the purpose of deflating materials and constructing a net index, as a result of which the impact of the quality change would be largely netted out of the purchasing industry's output.

Most discussion of quality change in a context such as the present one is restricted to changes over time in externally measurable physical characteristics which differentiate classes or varieties of related products and which thus can be related to changes in the quantity of primary inputs involved. It thus rules out from consideration the type of quality changes which are rooted in the consumers' subjective attitudes to the products in question and which are therefore thought to be essentially nonquantifiable. An example of such a change would be the case where a product such as a television set was altered in appearance only in order to appeal to consumers. The television might incorporate a number of styling changes such as

alterations to the shape and colour of the cabinet which bear no relation to the intrinsic usefulness of the television and which do not change production costs.

Reporting Period

Mention has already been made of the importance of properly matched components in indexes of output per unit of labour input. The availability of a common source for the basic data utilized in this report undoubtedly minimizes this problem, but there remains one aspect of it which may call for adjustment, depending on its severity in particular cases. Respondents in the Census of Manufactures are asked to report their labour input data on a calendar-year basis (fiscal year in the 1966 Census), but are permitted to report their shipments, purchases and inventory data on a financial-year basis if their accounting period does not coincide with the calendar year and the task of converting to the latter basis is too difficult.

Strictly speaking, the requirements of productivity measurement call for an adjustment of one set of data to the other in all cases where such mismatching has occurred. Practical considerations apart, it would be a matter of indifference which way the adjustment was made, but since the Census employment figures (production and related workers) are reported monthly and the other data are only available in annual totals, the adjustment can be most easily made to the labour input data. In practice, however, no adjustment was made in this report since the problem appeared to be of minor significance in all three industries concerned.

PART V

INDUSTRY TECHNICAL NOTES

PART V

INDUSTRY TECHNICAL NOTES

Introduction

In this part of the report, some salient characteristics of the various measures of output and input underlying the productivity indexes for the Synthetic Textile Mills, Breweries, and Pulp and Paper Mills industries are described, as well as the difficulties, both conceptual and statistical, encountered in their preparation and the steps taken to deal with them.

It is anticipated that these comments will be of value to users in enabling them to appraise the suitability of the measures for particular purposes. In spite of a common origin in sources such as the Census of Manufactures and the Employment Surveys, it should not be assumed that the measures for different industries are always of comparable and unvarying quality. The nature of the industry may be such that it is difficult to construct a volume measure of output in accordance with the concepts described in Part IV,¹ for instance, when custom-made products with a long period of production are involved. Even in the more normal case, such factors as the introduction of new varieties or completely new products and changes in the relative importance of existing varieties and products pose serious conceptual problems which may be further aggravated by reporting and editing difficulties.

Output

As may be seen from the analytical tables, it was possible to calculate both gross and net measures of real output for each of the three industries under consideration for the period 1947-61.

Coverage.—Since these measures were for the most part calculated by the commodity approach, an important dimension of their reliability lies in the magnitude of the "coverage ratios" underlying the indexes of gross output and materials exclusive of containers.² The efficacy of the coverage adjustment technique depends on the extent to which the price movements of represented products can be assumed to approximate those of excluded products, thus there can be no absolute criteria for acceptable levels of coverage, although it has been suggested that, on account of the greater diversity in the nature and origin of unrepresented materials, a much higher level of coverage is required in the measurement of the volume of materials used than would be necessary in the case of gross output where the minimum standard

has been set at 50%.³ From this point of view, the data relating to the Synthetic Textile Mills industry as a whole in Table 1, seem acceptable.

In an industry such as Synthetic Textile Mills, characterized by a continual tendency towards the displacement of old products by new, increasing remoteness from the weight base normally leads to a progressive reduction of the coverage ratio unless such new products can be brought into the coverage by means of artificial weights. This was done quite extensively with the result that coverage was well maintained throughout the entire period. The relatively low coverage ratio for both the materials and products indexes in 1961 and for the materials index in 1947 was caused by the use of Census schedules in which the commodity detail was classified somewhat differently than during the remainder of the period. On the new basis of compilation, of course, the 1961 indexes will have an extremely high level of coverage, while those for 1959 and 1960 will be somewhat less broadly based as a result of the break in continuity.

No comparable coverage ratios are presented here for the fibre producing and fibre processing components of the industry. However, scrutiny of the individual worksheets indicates that, for both gross output and materials, overall coverage was certainly higher in the fibre producing than in the fibre processing branch.

In the Breweries industry, the complete coverage for gross output for every year of the 1947-61 period was due to the relatively limited and unvarying range of products shipped by the industry which permitted the reporting of all required details. Different varieties of beer were introduced and there were shifts from draught beer and beer in large bottles to beer in small bottles, but these changes had no impact on the coverage. Table 1 below shows that the coverage ratio of materials used in this industry was also consistently high, although it diminished slightly in the latter part of the period. This was largely due to an increase in the value of the residual category in the Census schedule, "all other materials (malt beverages)", for which no commodity detail was reported.

For the Pulp and Paper Mills industry, the coverage ratios for gross output and materials used, as shown in Table 1, were extremely high over the whole period with the exception of the 1961 ratio for materials used. This lower ratio for 1961 arises because certain types of materials were not reported in such a detailed form on the Census of Manufactures schedule as they were in previous years.

¹ See Part IV, General Technical Notes, pages 107-108.

² Ibid, footnote 2, page 107 and Appendix C.

³ *Revised Index of Industrial Production*, op. cit., page 20.

TABLE 1. Coverage Ratios for Indexes of Real Gross Output and Materials Used (excluding Containers). Synthetic Textile Mills, Breweries and Pulp and Paper Mills, Old Basis, Canada, 1947-61

Year	Coverage ratios					
	Gross output			Materials used		
	Synthetic textile mills	Breweries	Pulp and paper mills	Synthetic textile mills	Breweries	Pulp and paper mills
	per cent					
1947	84.11	100.00	99.95	68.49	98.54	99.16
1948	87.47	100.00	99.95	80.10	99.18	99.19
1949	86.47	100.00	99.99	78.71	98.43	99.23
1950	89.98	100.00	99.99	79.77	97.45	99.17
1951	87.96	100.00	99.99	81.08	96.86	98.63
1952	92.63	100.00	99.99	83.05	99.05	98.68
1953	84.13	100.00	99.98	81.08	98.98	98.88
1954	86.61	100.00	99.99	77.63	97.97	98.71
1955	83.49	100.00	99.98	78.90	97.36	98.66
1956	82.55	100.00	99.07	77.44	97.48	97.71
1957	82.00	100.00	98.84	79.09	96.89	97.78
1958	86.71	100.00	98.96	74.81	96.37	97.49
1959	85.92	100.00	99.17	78.85	96.04	97.29
1960	86.11	100.00	99.23	73.95	95.99	97.22
1961	75.28	100.00	98.81	69.64	95.47	93.07

New Products.—Normally, when new products or materials appear in the commodity detail of the Census of Manufactures subsequent to the year of the weight base, an attempt is made to include them in the covered portion of the real output calculations by assigning to them an artificial weight which may be estimated in one of a number of ways. For instance, there may exist suitable price data by means of which the average unit value of the newly reported product can be adjusted to an approximation of its assumed base-year value, or the adjustment may be made indirectly on the basis of changes in the average unit value between the base year and the given year of some closely related product. Newly introduced products were of no particular consequence and did not require special attention in the case of the Breweries and Pulp and Paper Mills industries. However, the problem was more serious for the Synthetic Textile Mills industry, and in a number of important cases base-year weights had to be computed.

On the product side, such estimates were made in the case of terylene singles yarn, woven terylene fabrics, nylon tire yarn, orlon yarn, various nylon intermediaries and carpets of synthetic fibre. None of these was produced in 1949, but all became progressively more important over the period in question, to the point where their exclusion from the coverage would have seriously impaired the value of the gross output index. The adjustments effected on the materials side were no less important. Artificial weights were calculated for adipic acid and hexamethylene diamide, the basic chemicals involved in the production of nylon, dimethylterephthalate and ethylene glycol which are used in terylene, and acrylonitrile which is the basis of

orlon, as well as cellulose acetate flakes, terylene singles yarn, and continuous filament fibre-glass yarn.

There is, however, a more fundamental problem arising out of the growth during the period in question in the relative importance of the true synthetics. This problem is quite independent of whether they were produced in 1949 or not, and may be summarized as follows.

When a completely new synthetic fibre is developed, it typically goes through a sequence from low output and high unit value to progressively higher output and decreasing unit value. The high initial unit value can be partially explained by such factors as high overhead due to under-utilization of capacity and the fast write-off of research expenditures, and partially in terms of market considerations. Eventually, the time comes when both the output and unit value series begin to level off, their subsequent movements being determined in a more normal fashion.

The relevance of this point to the construction of gross output and materials used indexes in real terms is that, if in the year chosen as the weight base, the unit value, actual or estimated, of any commodity represents an early stage of the growth sequence, its abnormally high level will build into the index concerned a potential upward bias, the actual extent of which then depends on the rate of increase of the quantities concerned in subsequent years. The avoidance of such bias thus depends on the development of a weighting pattern based on a relatively uniform degree of maturity among all products, both old and new. For the

calculation of real output measures on the new 1961 weight base, the problem virtually solves itself. Since, by this time, most of the new products and materials under discussion had either reached or were on the threshold of the mature phase of their development.

In the case of the measures calculated on the old basis, however, which are the ones analysed in this report, adjustments were made which, while preserving the general character of the 1949 weighting pattern, were sufficient to eradicate most of the bias that would have resulted from an uncritical acceptance of 1949 unit values, whether actual or as conventionally estimated. Between 1949 and 1960, for instance, the average unit value of nylon singles yarn decreased substantially while shipments were continually increasing at a rapid rate. During the same period, the unweighted average of the three published U.S. wholesale price relatives for nylon yarn⁴ decreased by 18.7%. It was assumed that the development of nylon in the U.S. had,

⁴ United States Department of Labor, Bureau of Labor Statistics, *Wholesale Prices and Price Indexes*, Washington, D.C., U.S. Government Printing Office, Annual.

in the sense previously discussed, reached the stage of maturity by 1949, and the decrease of 18.7% in its average price was accepted as a fair measure of the long-term influences at work. This price movement was used to estimate a 1949 average unit value of the Canadian product at a level which substantially discounted the factors associated purely with the growth process. By way of corroboration, it may be pointed out that the change over the same period in the average unit value in Canada of continuous filament viscose yarn, a well established fibre, was almost identical.

The total effect of all such adjustments is shown in Table 2 which compares, over the period 1949 to 1959, indexes of real gross output for the Synthetic Textile Mills industry based on adjusted and unadjusted 1949 unit values.

It will be noted that the levels of the two indexes were reasonably close in the early years but began to diverge after 1954 as the impact of the new products was increasingly felt. However, it should be remembered that even the adjusted 1949 weighting pattern does not fully reflect the conditions that developed after 1954.

TABLE 2. Indexes of Real Gross Output Using Adjusted and Unadjusted 1949 Unit Value Weights, Synthetic Textile Mills, Canada, Old Basis, 1949-59
(1949 = 100)

Year	Index of real gross output	
	Adjusted 1949 unit values as weights	Unadjusted 1949 unit values as weights
1949.....	100.0	100.0
1950.....	116.4	119.3
1951.....	129.1	131.1
1952.....	120.3	124.4
1953.....	126.4	132.0
1954.....	115.3	119.2
1955.....	146.9	155.4
1956.....	151.4	163.2
1957.....	157.1	173.2
1958.....	162.1	183.5
1959.....	195.2	226.2

Output in the Component Branches of the Synthetic Textile Mills Industry.—The procedures involved in the calculation of real gross and net output indexes for the fibre producing and fibre processing branches of the Synthetic Textile Mills industry were as follows.

The availability of individual establishment schedules and the reporting requirements of the Census of Manufactures made it possible to divide the industry into three separate groups of establishments—the fibre producers, the fibre processors

and the integrated establishments that produce and further process the basic yarns and fibres.

To arrive at real gross and net output for the fibre producing establishments, constant dollar totals of gross and net output by establishment were assembled according to the procedure illustrated in Appendix C. In the case of the two integrated establishments, output and intermediate inputs were split between fibre producing and fibre processing activities respectively in the following manner.

On the output side, the Census of Manufactures requests the total yarn and fibre production, whether for own use or for sale. This was attributed in each case as output to the fibre producing branch of the industry after first being assigned a constant dollar value by means of the industry average unit values in 1949 of the shipped portion of such products. The output attributable to the fibre processing branch of the industry, based on the further processing of the basic yarns and fibres produced for own use and purchased from others, was reported in full in the Census schedules and valued in constant dollars in the conventional manner.

The constant dollar value of gross output for the fibre producing branch was thus assembled as the sum of the values for the specialized establishments (those that produce only fibres) and those of the fibre producing activities identified within the integrated establishments. In the case of the fibre processing branch of the industry, the constant dollar value of gross output was arrived at by subtracting from the total for the industry as a whole, the constant dollar output of the fibre producing establishments (excluding integrated establishments), the constant dollar output (before the split) of the integrated establishments and then adding back the constant dollar value of the separately calculated fibre processing activities of the latter. This method reflects the true growth of the gross output for each branch of the industry. However, as a result of the inclusion of the fibres produced for their own use by the integrated establishments, the sum of the separate constant dollar gross outputs of the component branches is larger than the constant dollar gross output of the industry as a whole.

For the calculation of net indexes in constant dollar terms, it was necessary to split between the two branches the reported material usage of the integrated establishments as well as the containers, fuel and electricity. In the case of materials, it was usually possible to identify them as directly applicable to one or the other branches and the other items were prorated on the basis of the relative magnitude of constant dollar gross output. The fibres produced for their own use by the integrated establishments, previously shown as output of the fibre producing branch, were treated as materials used by the fibre processing branch, thus eliminating the duplication previously referred to. In calculating the separate aggregates of constant dollar net output, it was therefore possible to simplify the procedure described for gross output by simply deducting from the industry total the aggregate for fibre producers only.

Indirect Taxes and Fees, Breweries Industry. —

The value of factory shipments by commodity as reported for the Breweries industry in the Annual Census of Manufactures includes a significant amount of indirect taxes and fees paid to the federal and provincial governments. The removal of such taxes from the reported value of factory shipments adjusts the latter to the correct level of valuation for real output measurement (GDP at

factor cost) so that when intermediate, or material, inputs are subtracted, an approximation of the cost of primary inputs (factor costs plus capital consumption allowances) remains.⁵ Failure to make such an adjustment would invalidate the conceptual basis of the output measures and lead to distorted results in any case, but matters would be complicated even further if changes in the tax structure were to take place.

Because the method used in estimating real gross output is based on summation of the constant dollar values of individual products,⁶ it was necessary to make a detailed distribution of total taxes and fees between the various products of the Breweries industry in the base year, 1949. As a first step, the percentage distribution of the quantities of various beer products shipped in 1949 was calculated. Total gallonage taxes and excise duties paid were then distributed on the basis of these percentages, and the prorated amounts deducted from the value of shipments of each product.

The remaining taxes, licence fees and permits, were allocated among the various beer products on the basis of a percentage distribution of the value of shipments excluding gallonage taxes and excise duties. Finally, to derive a set of base-year unit values which were net of taxes, the values of shipments of individual products, adjusted as above, were divided by the corresponding quantities shipped.

Quality. — The quality of the products originating in the industries under review is generally thought to have improved, although available data for the measurement of real output do not permit the quantification of such improvement.

In the case of the Synthetic Textile Mills industry, developments in resistance in the end product to wear, shrinkage, pilling and creasing were important quality changes which are not taken into account in the output data.

An important quality improvement in the Breweries industry was the development of a filtering process which eliminates the need of pasteurization, thereby extending considerably the keeping quality of beer. Another was the change in bottling technique which permits a reduction in the volume of air in the bottle and thus a longer shelf-life for bottled beer. Because bottles and containers are an important part of the products of the Breweries industry, improvements such as more compact bottle shapes and containers which are easier to open and handle must have also contributed to this process of quality improvement.

The products of the Pulp and Paper Mills industry were also subject to quality improvements in the post-war period. The development of more refined chemical and mechanical processes contributed to the increase in the strength of paper relative

⁵ See Part IV, General Technical Notes, page 107.

⁶ Ibid, page 107.

to its thickness. In addition, advanced bleaching methods led to the production of paper of a purer white colour.

Containers.—For the Breweries industry, non-returnable containers and other packaging materials and supplies represented approximately 30% of the cost of total materials and supplies (including containers and excluding fuel and electricity) in 1947 and over 40% in 1961. As indicated in Part IV of this report, Census information on containers and packaging materials is available in value terms only and, in the absence of suitable price indexes for deflating the reported values, it has been found necessary to project the base-year figures according to the movements of the real gross output index.

Because the proportion of containers and packaging materials to total materials and supplies used is relatively large in the Breweries industry, some bias in the measurement of material inputs must therefore be conceded. However, the impact on the indexes of real net output presented in this report was not very serious because of the low ratio of materials used to value of production.

Containers did not represent a significant part of total materials used in either the Synthetic Textile Mills or the Pulp and Paper Mills industries. In both cases, deflation was carried out by methods similar to those described above for the Breweries industry.

Fuel Costs.—The fuel composite, as reported in the Census of Manufactures schedules, generally comprises coal, petroleum, wood, and gas products. The coal products group is made up of bituminous, sub-bituminous, lignite, and anthracite coal, and also coke. Petroleum products include fuel oil and gasoline, while the gas aggregate represents the total of manufactured and natural gas.

For the years 1949 to 1952 inclusive and 1954-55, there was, in the Census of Manufactures reporting requirements, no provision for a distribution of expenditures by major categories, only total fuel cost being asked for. For this reason, the current value of fuel expenditures in each year was deflated by means of a price index rather than by the "commodity approach".⁷

However, a ready-made price index for the fuel aggregate was not available. Thus, for each industry a composite index was constructed from the General Wholesale Price Indexes for coal, petroleum products and natural gas, weighted by each year's distribution of expenditures on the three categories of fuel products. For those years when the breakdown was not available, the weights were interpolated. Current weights were used because, for the three industries under consideration, there was a significant change over time in the pattern of fuel consumption from coal to oil and more recently to gas.

Input

Employment.—The indexes of employment of production and related workers and persons employed in the Synthetic Textile Mills, Breweries, and Pulp and Paper Mills industries from 1947 to 1961, originate in the Census of Manufactures and ought thus to be fully consistent with the output data from the same source, except to the extent that the latter may sometimes be reported for periods other than the calendar year.⁸ Adjustments can be made for this particular inconsistency, but were not necessary for any of the industries in question. While Census employment data must be regarded as preferable to those from other sources, some assessment of their intrinsic limitations seemed desirable. For instance, the reporting procedures which underlie the Census employment data⁹ give rise to the possibility that the latter are not as reliable as the output or payroll data which are based on detailed accounting records. Accordingly, an independent verification of the Census employment data by means of the corresponding data from the Monthly Employment Survey was attempted. Comparisons were restricted to those years which exclude differences in employment resulting from the implementation of the new Standard Industrial Classification and the New Establishment Concept in the Census of Manufactures.

From Table 3, it is immediately apparent that for the Synthetic Textile Mills industry the alternative estimates for production and related workers are much closer than those for administrative and office employees. In their published form, however, the data from Census and Employment Survey sources are not strictly comparable for a number of reasons.¹⁰

After a detailed reconciliation at the establishment level involving adjustments for each of the differences noted in Part IV, a comparison was made of the employment estimates from the two sources for the period 1956 to 1959. As a result of these refinements, in the case of production and related workers, the Employment Survey to Census ratios improved from 94.7% to 99.3% for 1956 and from 94.7% to 95.3% for 1959. Those for administrative and office employees increased from 80.7% to 89.9% for 1956, and from 86.5% to 95.8% for 1959.

Because the number of salaried employees for Breweries in the Employment Survey was available only as part of a composite of Distilled and Malt Liquors prior to 1958, it was necessary to combine the figures of Distilleries and Breweries from Census sources. However, since the combined industry data are heavily dominated by Breweries, close correspondence between the employment series from the two sources can be accepted as confirmation of the adequacy of the Census employment series for the Breweries industry.

⁷ See Part IV, General Technical Notes, page 107.

⁸ Ibid, page 118.

⁹ Ibid, page 110.

¹⁰ Ibid, page 112.

TABLE 3. Comparison of Published Figures of Employment, Census of Manufactures and Employment Survey, Synthetic Textile Mills, Canada, 1947-59

Year	Average number of administrative and office employees, C. of M.	Monthly average of salaried employees, E.S. (1)	Employment survey as per cent of census of manufactures	Average number of production workers, C. of M.	Monthly average of wage-earners, E.S.	Employment survey as per cent of census of manufactures
	No.	No.	%	No.	No.	%
1947	1,627	1,713	105.3	13,101	13,046	99.6
1948	1,963	1,715	87.4	14,134	14,417	102.2
1949	2,650	2,199	83.0	14,178	14,497	102.2
1950	3,333	2,861	85.8	14,622	14,149	96.8
1951	3,278	3,445	105.1	14,719	14,349	97.5
1952	3,388	3,490	103.0	12,335	11,813	95.8
1953	3,286	3,117	94.9	12,437	12,238	98.4
1954	3,478	3,396	97.6	10,184	10,342	101.6
1955	3,846	3,400	88.4	11,562	11,126	96.2
1956	3,976	3,208	80.7	11,718	11,102	94.7
1957	4,026	3,068	76.2	11,225	11,198	99.8
1958	3,726	3,321	89.1	10,710	10,024	93.6
1959	3,967	3,432	86.5	11,037	10,453	94.7

¹ More strictly: Total employees minus wage-earners for whom records of hours are kept.

Source: Dominion Bureau of Statistics, *Review of Employment and Payrolls*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-201); *Review of Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-202); *Synthetic Textiles*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 34-208).

TABLE 4. Comparison of Published Figures of Employment, Census of Manufactures and Employment Survey, Breweries and Distilleries, Canada, 1947-59

Year	Average number of administrative and office employees, C. of M.	Monthly average of salaried employees, E.S. (1)	Employment survey as per cent of census of manufactures	Average number of production workers, C. of M.	Monthly average of wage-earners, E.S.	Employment survey as per cent of census of manufactures
	No.	No.	%	No.	No.	%
1947	2,359	3,254	137.9	10,313	10,530	102.1
1948	2,434	3,616	148.6	10,186	10,455	102.6
1949	2,582	3,895	150.9	10,103	10,153	100.5
1950	2,517	4,036	160.3	9,915	9,939	100.2
1951	2,831	3,983	140.7	10,261	10,152	98.9
1952	2,659	3,937	148.1	10,288	10,281	99.9
1953	2,772	4,118	148.6	10,721	10,711	99.9
1954	2,816	4,243	150.7	10,774	10,789	100.1
1955	2,894	4,266	147.4	10,653	10,701	100.5
1956	3,088	4,287	138.8	11,072	11,166	100.8
1957	3,029	4,344	143.4	10,634	10,809	101.6
1958	3,017	4,602	152.5	10,167	10,403	102.3
1959	3,127	4,527	144.8	9,786	10,380	106.1

¹ More strictly: Total employees minus wage-earners for whom records of hours are kept.

Source: Dominion Bureau of Statistics, *Review of Employment and Payrolls*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-201); *Review of Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-202); *Breweries*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 32-205).

Table 4 shows that the alternative estimates are quite close in the case of production and related workers but significantly different for administrative and office employees.

Because of the disparity in the latter case, a detailed reconciliation of the two data sources at the establishment level for Breweries only seemed desirable, and this necessarily extended to both classes of employees. Due to the scarcity of resources, the reconciliation was limited to the period 1958-61. In summary, the Employment Survey to Census ratios for both production and related workers and administrative and office employees improved in all four years.

On the basis of these tests, then, the Census employment estimates for the Synthetic Textile Mills and the Breweries industries appear to be substantially corroborated by the Employment Survey data for the limited period in question when the necessary conceptual and statistical adjustments to the latter were made.

In the case of the Pulp and Paper Mills industry, the strong correspondence between data from the two sources, as shown in Table 5, made unnecessary any reconciliation at the individual establishment level. The marked differences in the alternative estimates of the number of administrative and office employees in 1951 and 1952 resulted from certain irregularities in the data reported in the Employment Survey.

Man-hours.—The indexes of man-hours paid of production and related workers in the three industries under review from 1956 to 1961 were derived directly from data reported to the Census of Manufactures. Since the latter source also provides annual earnings and employment data for the same employees the reported man-hours may be conveniently verified at the establishment level through a number of editing checks.

The choice of the man-hour series to serve as a denominator for the productivity ratio from 1947 to 1956 is based on the relative movements of the two estimated series (pay deflation and employment inflation) over the whole period supported by their respective degree of comparability with the reported series from 1956 on.

For the Synthetic Textile Mills, Breweries, and Pulp and Paper Mills industries, the man-hours paid of production and related workers estimated by the two alternative methods did not differ significantly. In fact, they never diverged by more than 2.5% in any direction for Synthetic Textile Mills, 6.4% for Breweries, and 2.3% for the Pulp and Paper Mills industry. However, the "pay deflation" estimates for all three industries were closer to the reported series between 1956 and 1961 and therefore the "pay deflation" method seemed preferable as the basis for estimating man-hours between 1947 and 1956.

TABLE 5. Comparison of Published Figures of Employment, Census of Manufactures and Employment Survey, Pulp and Paper Mills, Canada, 1947-60

Year	Average number of administrative and office employees, C. of M.	Monthly average of salaried employees, E.S. ¹	Employment survey as per cent of census of manufactures	Average number of production workers, C. of M.	Monthly average of wage-earners, E.S.	Employment survey as per cent of census of manufactures
	No.	No.	%	No.	No.	%
1947	7,706	6,802	88.3	42,240	42,311	100.2
1948	8,066	7,042	87.3	43,858	43,603	99.4
1949	8,243	7,368	89.4	43,807	41,622	95.0
1950	8,578	7,294	85.0	43,765	41,781	95.5
1951	9,413	5,036	53.5	47,878	48,890	102.1
1952	9,493	5,125	54.0	48,310	49,400	102.3
1953	9,394	8,060	85.8	48,800	49,431	101.3
1954	9,689	9,870	101.9	51,148	51,775	101.2
1955	9,933	10,552	106.2	52,272	52,931	101.3
1956	10,867	11,007	101.3	55,118	55,108	100.0
1957	11,495	11,657	101.4	54,445	53,421	98.1
1958	11,594	11,208	96.7	52,490	51,774	98.6
1959	11,702	11,978	102.4	53,326	53,269	99.9
1960	12,452	12,304	98.8	53,190	53,581	100.7

¹ More strictly: Total employees minus wage-earners for whom records of hours are kept.

Source: Dominion Bureau of Statistics, *Review of Employment and Payrolls*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-201); *Review of Man-hours and Hourly Earnings*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-202); *Pulp and Paper Mills*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 36-204).

In the case of administrative and office employees, man-hours paid were estimated over the entire period from 1947 to 1961 and both methods were again used. However, for the Synthetic Textile Mills industry, the results proved to be not nearly so close as in the case of production and related workers, the employment inflation estimates being invariably lower than those derived by pay deflation, particularly in the earlier part of the period. Actually, the employment inflation to pay deflation ratios for man-hours paid were 80.5% and 88.4% in 1947 and 1961 respectively. Man-hour estimates derived by the "pay deflation" method were used as the official man-hour series for administrative and office employees. For the Breweries industry, an unbroken series of data exists in the Census of Manufactures relating to employment and payroll of administrative and office employees. On the other hand, representative figures of weekly hours paid and hourly earnings for salaried employees were available for the years 1947 to 1957 only for the composite of "Distilled and Malt Liquors".¹¹ From 1958 on, separate data for the "Malt Liquors" industry are available from unpublished material. It was therefore possible to develop man-hour series for the 1947-57 period by the two methods of estimation on the basis of the known relationship from 1958 to 1960 between the data of "Malt Liquors" and "Distilled and Malt Liquors".

¹¹ Dominion Bureau of Statistics, *Earnings and Hours of Work in Manufacturing*, Ottawa, Queen's Printer, Annual (DBS Catalogue No. 72-204).

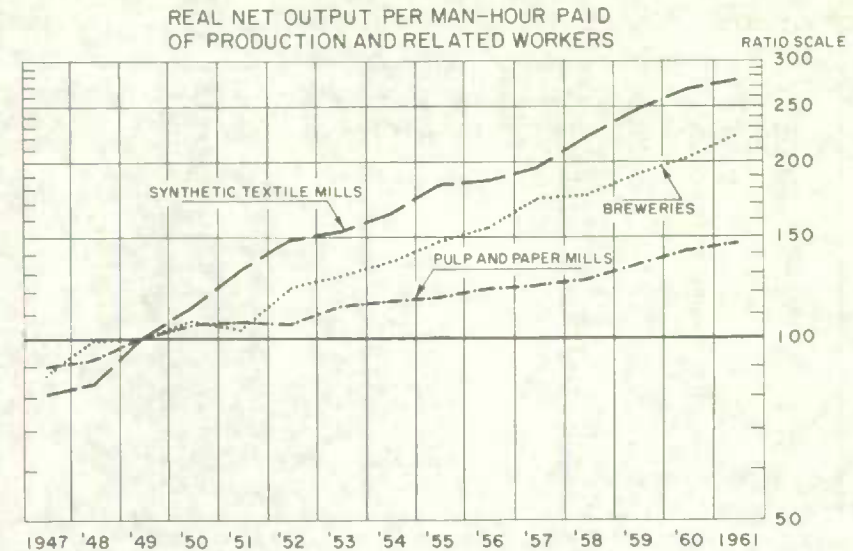
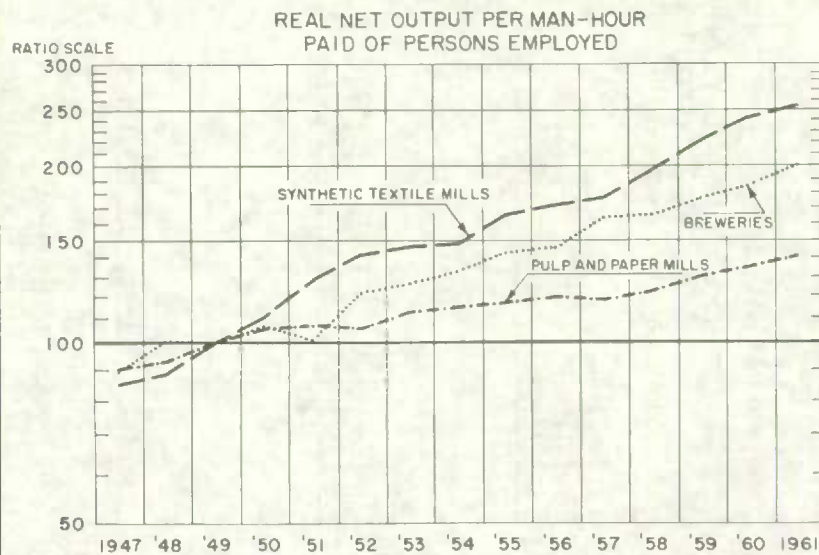
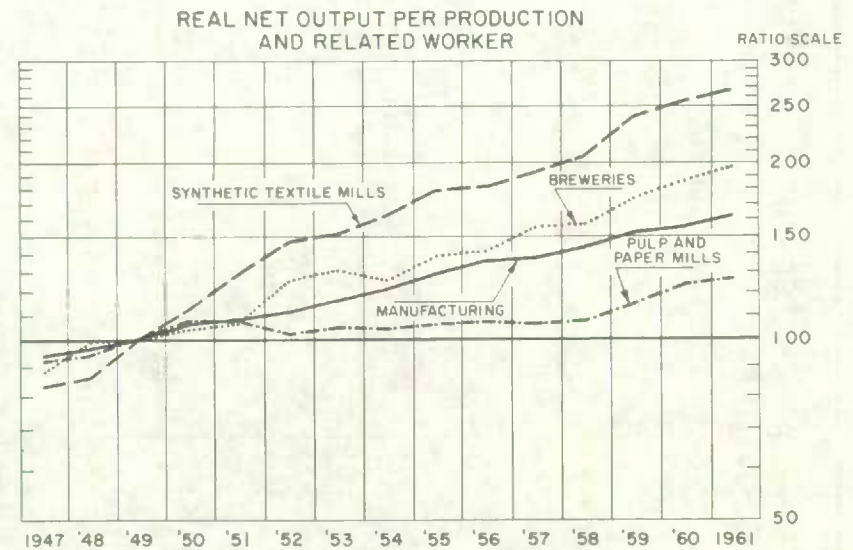
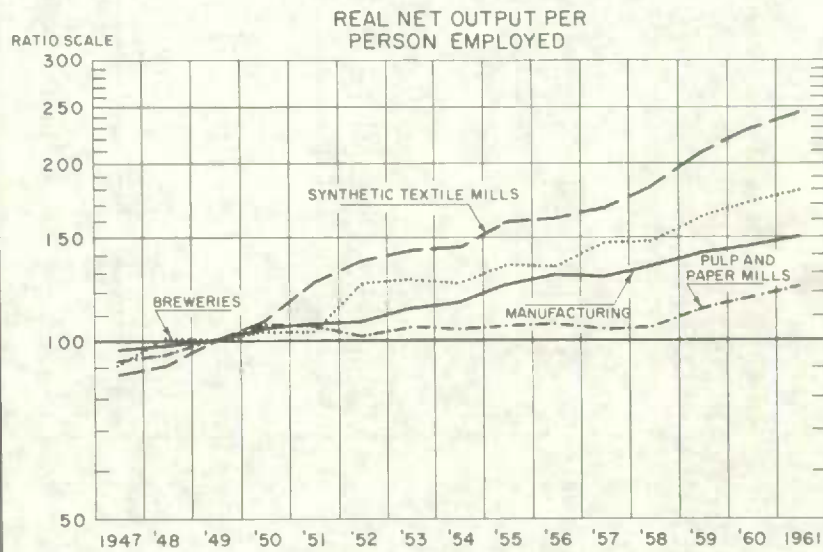
The employment inflation estimates for the Breweries industry were generally lower than those derived by pay deflation, the employment inflation-pay deflation ratios for man-hours paid being 96.3% and 94.5% in 1947 and 1961 respectively. Their year-to-year movements followed a similar pattern except in 1950 when they moved in opposite directions. As the result of a close scrutiny of individual establishment reports and the general movements of output, it seemed preferable to use the "employment inflation" man-hour estimates.

The estimation of man-hours paid for administrative and office employees in the Pulp and Paper Mills industry did not present any special problem. Year-to-year movements in the man-hour series estimated by the two methods previously mentioned were similar for all years except 1953. In addition, the employment inflation-pay deflation ratios were quite high at 98.8% in 1947 and roughly 100% in 1961, although in the early fifties they varied between 92% and 95%. An analysis of the results proved the "employment inflation" estimates to be preferable to the "pay deflation" estimates.

It may be noted that when the data for administrative and office employees are combined with those of production and related workers, the relative importance of these two categories is such that the disparity in the former has a much smaller impact at the total level.

APPENDICES

INDEXES OF REAL NET OUTPUT PER UNIT OF LABOUR INPUT, SELECTED MANUFACTURING INDUSTRIES, CANADA, 1947-61 (1949=100)



APPENDIX B

PERCENTAGE YEAR-TO-YEAR CHANGES IN REAL NET OUTPUT PER



PERCENTAGE YEAR-TO-YEAR CHANGES IN REAL NET OUTPUT PER MAN-HOUR PAID OF



APPENDIX C
Sample Worksheet Procedure for Indexes of Real Net Output
Synthetic Textile Mills

		1949	1949 unit value (2-1) = P_0^1	1950	1951
Part A (Gross output index):					
1. Q_i - Reported production of woven fabrics, continuous filament rayon	'000 yd.	72,369		74,706	71,491
2. $P_i Q_i$ - Reported current value	\$'000	50,277	0.69473	49,674	47,832
3. $P_0 Q_i$ - 1949 unit value x reported quantity	"	50,277		51,900	49,667
1. Q_i - Reported production of woven fabrics, all spun rayon	'000 yd.	17,406		20,993	19,544
2. $P_i Q_i$ - Reported current value	\$'000	12,719	0.73073	17,882	16,382
3. $P_0 Q_i$ - 1949 unit value x reported quantity	"	12,719		15,340	14,281
1. } 2. } Other specified products ² 3. }					
(a) $\sum P_i Q_i$ (specified products) (\sum line 2) ²	\$'000	107,325		132,736	149,036
(b) $\sum P_i Q_i$ (census value of all products)	"	124,125		147,515	169,444
(c) Coverage ratio $100 [(a) \div (b)]$	%	86.47		89.98	87.96
(d) $\sum P_0 Q_i$ (specified products) (\sum line 3) ²	\$'000	107,319		129,938	140,987
(e) $\sum P_0 Q_i$ (all products) $100 [(d) \div (c)]$	"	124,111		144,408	160,285
(f) Index: 1949 = 100, $100 [(e) \div \sum P_0 Q_0]$	%	100.0		116.4	129.1
Part B (Materials index exclusive of containers):					
1. q_i - Reported use of acetate rayon yam, singles	'000 lb.	5,639		5,527	5,884
2. $p_i q_i$ - Reported current value	\$'000	5,517	0.97836	5,231	5,898
3. $p_0 q_i$ - 1949 unit value x reported quantity	"	5,517		5,407	5,757
1. q_i - Reported use of rayon staple fibre	'000 lb.	8,960		12,940	14,424
2. $p_i q_i$ - Reported current value	\$'000	3,230	0.36049	4,758	6,165
3. $p_0 q_i$ - 1949 unit value x reported quantity	"	3,230		4,665	5,200
1. } 2. } Other specified products ² 3. }					
(a) $\sum p_i q_i$ (specified materials) (\sum line 2) ²	\$'000	35,046		43,441	52,547
(b) $\sum p_i q_i$ (census value of all materials excluding containers)	"	44,523		54,460	64,811
(c) Coverage ratio $100 [(a) \div (b)]$	%	78.71		79.77	81.08
(d) $\sum p_0 q_i$ (specified materials) (\sum line 3) ²	\$'000	34,508		41,198	43,170
(e) $\sum p_0 q_i$ (all materials) $100 [(d) \div (c)]$	"	43,842		51,646	53,244
(f) Index: 1949 = 100, $100 [(e) \div \sum p_0 q_0]$	%	100.0		117.8	121.4
Part C (Containers):					
1949 value of containers projected on real gross output index	\$'000	694		808	896
Part D (Electricity purchased):					
1. q_i - Reported quantity purchased	'000 kwh.	179,056		213,757	201,304
2. $p_i q_i$ - Reported value of purchased electricity	\$'000	1,161	0.06484	1,254	1,299
3. $p_0 q_i$ - 1949 unit value x reported quantity	"	1,161		1,386	1,305
Part E (Purchased fuel used):					
(a) $p_i q_i$ - Reported total census value	\$'000	2,168		2,512	2,733
(b) Currently-weighted price index (special computation)	%	100.0		104.6	106.4
(c) $p_0 q_i$ - $100 [(a) \div (b)]$	\$'000	2,168		2,402	2,569
Part F (Net output index):					
(i) $\sum P_0 Q_i$ Products [(e) of Part A]	\$'000	124,111		144,408	160,285
(ii) $\sum p_0 q_i$ Materials [(e) of Part B]	"	43,842		51,646	53,244
(iii) $p_0 q_i$ Containers (Part C)	"	694		808	896
(iv) $p_0 q_i$ Electricity [(3) of Part D]	"	1,161		1,386	1,305
(v) $p_0 q_i$ Fuel [(c) of Part E]	"	2,168		2,402	2,569
(vi) Net output in 1949 dollars, (i) - [(ii) + (iii) + (iv) + (v)]	"	76,246		88,166	102,271
(vii) Net output index: 1949 = 100	%	100.0		115.6	134.1

¹ In some instances, the base-year unit values used for the calculation of constant dollar values may differ from the 1949 value of $P_i Q_i \div Q_i$. The extent to which this has occurred is reflected in the differences between (a) and (d), and (b) and (c) of Parts A and B above.

² Includes all those other reported products (or materials) for which both quantity and value were sufficiently consistent to be usable.

APPENDIX D

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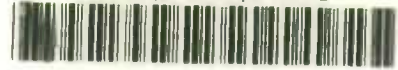
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