STAFF STUDY No. 23

Canadian Income Levels and Growth:

An International Perspective

by

Dorothy Walters

prepared for the

Economic Council of Canada

CANADIAN INCOME LEVELS AND GROWTH:

AN INTERNATIONAL PERSPECTIVE

by

Dorothy Walters

Staff Study No. 23

Economic Council of Canada

1968

Appendix by E. C. West

Real Output Comparison,
Canada and the United States,
1966 and Selected Years Back to 1950

This is one of several studies prepared as background for the Fifth Annual Review of the Economic Council of Canada. Although these studies are published under the auspices of the Council, the views expressed are those of the authors themselves. A list of other Council publications appears at the end of this study.

Available by mail from the Queen's Printer, Ottawa,
and at the following Canadian Government bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
Æterna-Vie Building, 1182 St. Catherine St. West

OTTAWA
Daly Building, Corner Mackenzie and Rideau

TORONTO
221 Yonge Street

WINNIPEG
Mall Center Bldg., 499 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price $2.25 Catalogue No. EC22-1/23

Price subject to change without notice

ROGER DUHAMEL, F.R.S.C.
Queen's Printer and Controller of Stationery
Ottawa, Canada
1968

PREFACE

The conception and methodology of this Study are not original. They derive from the work of Dr. E. F. Denison -- the 1962 Sources of Economic Growth in the United States, and his recent study Why Growth Rates Differ in which he was assisted by Jean-Pierre Poullier. This analysis for Canada parallels the Denison-Poullier study and sets out the Canadian results in the context of Denison's estimates for the United States and eight Western European countries. The author of this Study is greatly indebted to Dr. Denison and Mr. Poullier for their advice and assistance.

The analysis for Canada, which was undertaken as part of the Economic Council of Canada's concern with problems of growth and productivity, was initiated by Dr. D. Daly and owes much to his support and enthusiasm. Mr. Craig West put together the material on final expenditure prices in Canada and the United States and contributed the Appendix on that subject. Dr. Denison and Professor Harvey Lithwick read the first draft of the Study and made many valuable suggestions for its improvement. A number of other persons also made helpful comments. The author wishes particularly to acknowledge the generous co-operation and counsel of colleagues at the Dominion Bureau of Statistics. She would like to thank Council staff -- those in the Library who were so helpful in gathering the source material, those who worked with patience and good humour through the long resolution of the estimates, and those who prepared the Study for publication.

In spite of encouragement, assistance and advice, the author is entirely responsible for errors and inadequacies of the measures and the analysis.

Dorothy Walters

ABBREVIATED TABLE OF CONTENTS

TABLE OF CONTENTS

CONTENTS OF

NOTES, SOURCES AND METHODS

CHAPTER I

INTRODUCTION AND SUMMARY

INTRODUCTION

It has recently been suggested that "growthmania" has been the economic psychosis of the post-war years. 1/ This may well be true, but it is not surprising.

The prolonged period of stagnation in the 1930's cast a long shadow. Even before the war had ended, world leaders met to strike for the future a different balance between domestic and international policy. Governments were, from that time, committed to economic policies that established growth, full employment, and a rising standard of living as prime national goals. The depression made clear that it was necessary; the war, that it was possible.

History does not tell us what would have happened if the portents of economic collapse in the immediate post-war years had come true, or if the United States had withdrawn its financial and industrial strength, leaving Europe to effect its own recovery. Neither occurred, and Europe, as well as North America, set about reconstruction and growth. By and large they were successful. In most of the Western countries economic growth is now assumed to be a fact of life -- so much so that a large part of the current discussion is shifting to emphasize the content and shape of growth rather than its origin, its distribution rather than its level. 2/

In the third world of Asia, Africa and Latin America, the war had also served as a stimulant to rising expectations and a sense of personal and national identity. Over the past 15 years the colonial empires dissolved into a multitude of independent states. Leaders of these new nations know that they stand or fall on their ability to meet the economic and social aspirations of their people. Population pressures, archaic institutions and resource scarcity exacerbate the riddle of economic growth. In spite of a growing awareness of the human and economic rationale for helping the developing nations meet their challenge, the resources allocated by the industrial and affluent countries have been woefully inadequate. Growth in the developing countries remains a problem of wide and deep international concern.

And so the world is riddled with "growthmania" and it is difficult to see how it could be otherwise. In spite of this emphasis, surprisingly little is known about the forces that underlie the growth process. Although many excellent contributions have been made in this field of economics, the mechanics of medium- and long-term growth are not well understood. We do not yet have "the combination", or indeed know if there is one. We are, in fact, still trying to learn the

---

1/ E. J. Mishan, The Costs of Economic Growth, London, Staples Press, 1967.

2/ An elegant academic statement of this recent emphasis is John Kenneth Galbraith's The Affluent Society, Boston, Houghton Mifflin Co., 1958. Less coherent but more impassioned statements have recently been heard from university students all over the Western world, particularly in France and Germany where post-war growth has been exceptionally fast.

"how" and the "why" of post-war economic growth in the expectation that answers to some of these questions will provide guidelines to future growth.

During the 1950's, most European countries enjoyed a rate of growth that was higher and more sustained than in Canada or the United States. It was, however, late in the decade before major concerns arose in Canada and the United States about the performance of their economies. As both moved sharply away from the potential level of output, the wider problem of slow growth came into focus. North America began to look with interest and some envy eastward across the Atlantic and westward to Japan. What was the magic formula behind the dynamic growth performance in other countries?1/

Among the speculations about the dynamics of growth, emphasis has been given to many diverse factors. Some of the stimulus was attributed to an enormous backlog of demand-oriented growth in the war-torn economies of Europe and Japan. The European Common Market and Free Trade Area were said to have provided scope for a rising level of exports, increased scale and specialization in industry, a nicer co-ordination of domestic policies, a freer and more stable environment for investment planning, and, in general, a more efficient allocation of resources. The role of governments in economic planning was also put forward as a factor contributing to the better economic performance of most West European countries. Whatever the source, growth was, by and large, higher and more sustained in Europe.

The complexity of domestic and international economic relationships in the modern industrial state suggests that many factors are involved interdependently. An approach that attempts to isolate a single or dominant source of growth may be unrealistic and, for policy purposes, even dangerous. In fact there has been a growing interest in an integrated approach to growth analysis. The variety and complexity of models used to describe the economic system and the process of growth are impressive,2/ but there are still too many unanswered questions and too many slow-growth economies to assume that we are yet on the rim of discovery.

A pioneering study by Dr. Edward F. Denison in 1962 on the sources of economic growth in the United States developed one such approach to isolating and measuring the factors that contribute to medium- and long-term growth.3/ This work aroused considerable interest, discussion and controversy and was followed by other studies using the Denison approach.4/ A more recent study by Denison,

---

1/ Professor Kazushi Ohkawa of the Institute of Economic Research, Japan, is currently engaged in a study of the source of historical and post-war growth in Japan. This analysis will add an interesting dimension to international growth comparisons.

2/ Unfortunately the level of model sophistication is, for empirical research, often limited by the capacity of the available statistical base.

3/ Edward F. Denison, The Sources of Economic Growth and the Alternatives Before Us, New York, Committee for Economic Development (Supplementary Paper No. 13), 1962.

4/ A study of the Canadian economic growth has been made by Professor N. H. Lithwick, Economic Growth in Canada: A Quantitative Analysis (Canadian Studies in Economics, No. 19), Toronto, University of Toronto Press, 1967. This study compares the sources of historical growth in Canada and the United States with special emphasis on the effect of changes in their industrial structures.

assisted by Jean-Pierre Poullier, Why Growth Rates Differ,[1] used a similar framework to analyze the growth performance of the United States and eight European countries between 1950 and 1962, and to compare the levels of real output in the same countries for the year 1960.

This Staff Study of growth in, and the level of, output in Canada was undertaken to put the Canadian scene into the international context provided by Denison's nine-country comparison. The framework of analysis and the methodology of Why Growth Rates Differ were followed so that the cross-sectional comparisons between Canada and the other nine countries would not be complicated by different assumptions and methods. The sources of growth of net national income in Canada between 1950 and 1962, and the 1960 level of real national income per person employed in Canada, are contrasted, using the Denison-Poullier study, with the experience of the United States, the seven countries in Northwest Europe, and selected individual countries.

This approach does not imply that the Canadian experience was, or should have been, similar to that elsewhere. The Study was, however, made in the belief that the wider focus provided by additional observations lends an extra dimension to the growth process. The differences are likely to be as important and revealing as the similarities.

In addition to providing a comparative growth context, international productivity comparisons have a crucial relevance to competitiveness and international trade. Canada is seeking to broaden and deepen its industrial base, partly through increased participation in trade. As technology becomes more sophisticated and widespread, world markets become more competitive, and productivity performance more crucial. While other factors bear on the ability to compete in international markets, countries that succeed in generating a high rate of productivity growth have a large advantage, and the less successful a large handicap. This Study compares both the level and the growth of productivity in Canada with that in the United States and a number of industrial countries in Europe.

The Ten Countries

Casual observation attests to some distinctive differences in physical characteristics and social and economic institutions between Canada and the United States, but the contrasts are substantially wider between North America and most European countries. From this diversity one would expect differences in economic performance. The eight European countries included in the Denison-Poullier study cover the range of Europe's variety from Scandinavia (Norway) to the Mediterranean (Italy). The miscellaneous measures shown in Table 1 illustrate this variety, and provide a perspective for the contrasts and comparisons in the rest of the Study.

---

[1] Edward F. Denison, assisted by Jean-Pierre Poullier, Why Growth Rates Differ: Postwar Experience in Nine Western Countries, Washington, The Brookings Institution, 1967. References to Denison in subsequent footnotes and Table source notes pertain to this study; references to other Denison publications including The Sources of Economic Growth... are specified.

Table 1

MEASURES OF SIZE, INCOME AND TRADE, CIRCA 1960

	Land Area Relative (U.S. = 100)	Population 1961 (Millions)	Population Density per Square Kilometre 1961	1960 Relative Net National Income[1] (U.S. = 100) Total	Per Person Employed	Foreign Trade as a Percentage of GNP[2] (1957-59 average)
Canada	106.5	18	2	7	82	37
United States	100.0	181	20	100	100	9
Northwest Europe[3]	15.8	183	123	70	59	n.a.
Belgium	.3	9	301	3	61	63
Denmark	.5	5	107	2	58	67
France	5.9	46	83	17	59	27
Germany	2.7	55	217	22	59	36
Netherlands	.4	12	346	4	65	95
Norway	3.5	4	11	1	59	86
United Kingdom	2.6	53	217	21	59	42
Italy	3.2	50	164	12	40	28

(1) In U.S. prices.

(2) The sum of imports and exports of goods and services, excluding investment income as a share of Gross National Product (GNP) at market prices in current dollars.

(3) Northwest Europe includes the seven European countries indented under the heading, and excludes Italy.

Source: Tables 10 and 83; United Nations, Demographic Yearbook, New York, 1962; Denison, Tables 2-4 and 17-2, pp. 22 and 231.

Canada has the largest land area, but about one-tenth the population of the United States or of Northwest Europe. The United States and Northwest Europe have almost identical populations, but the United States has a land area six times larger. Only Norway is as sparsely populated as Canada and the United States. These physical measures of "largeness" and "smallness" do not seem to relate in a direct way to the measures of income and commerce. The role of international trade varied from the lowest level of participation by the United States, through Canada which was about half way up the scale, to the Netherlands with the highest ratio of trade to output.

Total real income of the Northwest European countries was 10 times the Canadian level, and about 70 per cent of the U. S. level in 1960. Output in Canada was about 7 per cent of the level of output in the United States or about the same level as in Belgium and the Netherlands combined. Measures of output per person employed (or per capita) take on a different look. Canadian output per person employed in 1960 was over 80 per cent of the U. S. level; Northwest Europe was 60 per cent (with little variation among countries) and Italy about 40 per cent. [1/]

Table 1 also reinforces the fact that the estimates for Northwest Europe are a composite of individual data for seven very different countries. In some measures there is a strong central tendency, and the Northwest European mean or average is generally representative, as, for example, in output per person employed in 1960. On the other hand, the range in some of the measures is so wide that the seven-country average conceals more than it discloses.

SUMMARY

This section briefly summarizes the results of the statistical analysis and provides a perspective for the detailed Chapters which follow. The detail is developed in subsequent Chapters and drawn together in summary Chapters XV and XVI. The Study falls into two distinct but related parts. One part is concerned to identify the factors contributing to the growth in output in total and per person employed from 1950 to 1962. The second part compares the level of real output per person employed in 1960.

Sources of Growth

Table 2 summarizes the factors underlying Canadian growth during the period from 1950 to 1962, [2/] and compares the Canadian performance with that in the United States, Northwest Europe and the United Kingdom. The contributions to growth arose from two sources -- an increase in factor inputs, and an increase in output per unit of input (i. e. factor productivity). A central point of the analysis is that a large part of the growth in total output in Canada reflected the growth in inputs. In fact the share of growth associated with increased factor inputs of labour and capital was the largest of any of the 10 countries. Conversely the share of growth associated with increases in factor productivity was smaller in Canada than in any of the other countries. Inputs of labour and capital each provided just under 1 1/2 percentage points of the 3. 8 per cent increase in growth of total output in Canada during this period. Capital was the stronger element in the earlier years,

---

[1/] The comparison of the level of real income per person employed in 1960 was developed to complement the growth analysis. The rationale for income differences between the United States and the eight European countries is covered in Denison and Poullier, Why Growth Rates Differ. A similar comparison for Canada and the United States is made in this Study.

[2/] Since a large part of the reconstruction and recovery in Europe had been effected by 1955, the Denison study subdivided the 1950-62 period into subperiods, 1950-55 and 1955-62. The estimates for Canada include data for the subperiods which are set out in Chapter XVI. The subperiod analysis should, however, be interpreted with particular attention to the statistical reservations noted in Chapters XIV and XVI.

a not surprising development in view of the investment boom of the early and mid-1950's. Later in the decade, as the rate of investment fell off and the rate of growth in the labour force and employment accelerated, labour became the dominant factor. A major purpose of the first half of this Study is to describe the effect of various quantitative and qualitative elements of these primary factor inputs, such as the increase in the level of formal education and in capital facilities.

Table 2

CONTRIBUTION OF FACTOR INPUTS AND FACTOR PRODUCTIVITY

TO GROWTH OF NET NATIONAL INCOME, 1950-62

(Contribution to growth rates in percentage points)

	Canada	United States	Northwest Europe	United Kingdom
Net national income	3.8	3.3	4.8	2.3
Factor inputs	2.7	2.0	1.7	1.1
Labour	1.4	1.1	0.8	0.6
Capital and land	1.3	0.8	0.9	0.5
Output per unit of input	1.1	1.4	3.1	1.2
Productivity elements, specified	0.6	0.6	1.8	0.4
Residual sources of growth(1)	0.5	0.8	1.3	0.8

(1) Includes advances in knowledge. See footnote 1, p. 152.

Note: Detail may not add due to rounding.

Source: Canada -- Table 100.
United States and Europe -- Denison, Tables 21-1, 21-3 and 21-17, pp. 298, 300 and 314.

The relatively small increase in output per unit of input occurred in spite of a large shift of resources out of agriculture and out of other self-employed occupations, such as retail trade, into higher-income alternatives. The large crop production towards the end of the period also contributed to income growth. On the other hand, the slack in the Canadian economy in the late 1950's and early 1960's was associated with a lower level of output per unit of input. After allowing for the effect of a number of specific factors on output per unit of input, a net unspecified component of growth is left -- the residual sources of growth. Over the 12-year period from 1950 to 1962, the factors that could be identified accounted for about half of the productivity growth in Canada. No fully articulated or satisfactory explanation of these residual sources of growth can be provided, but the discussion in Chapter XV suggests some of the possible causes.

The increase in output per person employed in Canada was also small when compared to the experience of Northwest Europe. As Table 3 suggests, factor input per worker, taking account of hours worked, education and the age-sex distribution of the labour force, contributed under one percentage point to growth of output per worker in Canada, the United States, and Northwest Europe. There were, however, significant differences in the role of individual factors: for example, a larger contribution from capital in Canada and a larger contribution from education

in the United States. By and large the major source of difference in output per worker among the various countries was in the efficiency of resource use. The residual sources of growth that could not be identified were sufficiently large in all countries to suggest that there is still a substantial gap in our understanding of the forces underlying productivity growth, and in our ability to quantify them.

Table 3

CONTRIBUTION OF FACTOR INPUTS AND FACTOR PRODUCTIVITY TO GROWTH OF NET NATIONAL INCOME PER PERSON EMPLOYED, 1950-62

(Contribution to growth rates in percentage points)

	Canada	United States	Northwest Europe	United Kingdom
Net national income	1.8	2.2	3.8	1.6
Factor inputs	.7	.8	.7	.5
Labour	- .1	.2	.1	.1
Hours worked	- .2	- .2	- .1	- .2
Age-sex contribution	- .1	- .1	—	—
Education	.2	.5	.2	.3
Capital and land	.8	.6	.6	.4
Housing	.2	.2	—	—
Non-residential structures and equipment	.5	.3	.5	.4
Other	—	.1	.1	—
Output per unit of input	1.1	1.4	3.1	1.2

Note: Detail may not add due to rounding.

Source: Canada -- Table 102.
United States and Europe -- Denison, Tables 21-1, 21-3 and 21-17, pp. 298, 300 and 314.

In the analysis of productivity as a factor in growth, one relationship seems to stand out: a high rate of growth of output has frequently been associated with a substantial increase in productivity or output per unit of input. Table 4 compares the importance of productivity in absolute and percentage terms for high- and low-growth countries. While the majority of countries are in a middle band of performance in both growth and productivity, countries such as Germany, Italy and France, with annual rates of growth from 5 to 7 per cent, had productivity increases that contributed 60 to 75 per cent of total growth. At the other extreme, the United Kingdom, Belgium, the United States and Canada had relatively low growth and a poor productivity performance.

Table 4

RATES OF GROWTH OF INCOME AND OUTPUT PER UNIT OF INPUT, 1950-62

	Net National Income	Output per Unit of Input	Share of Growth Arising from Increased Output per Unit of Input
	(Annual average rates)		(Per cent)
Germany	7.3	4.5	62
Italy	6.0	4.3	72
France	4.9	3.7	75
CANADA	3.8	1.1	28
United States	3.3	1.4	41
Belgium	3.2	2.0	63
United Kingdom	2.3	1.2	52

Note: These data relate to estimates unadjusted for differences in agricultural output, the level of demand, and statistical adjustments. The use of "adjusted" growth and productivity data would give similar results. (See measurements in Chapter XIV and growth summary tables in Chapter XV.)

Source: Canada -- Table 100.
United States and Europe -- Denison, selected Tables 21-1 to 21-19, pp. 298-316.

Half of this Study is related to comparing the Canadian growth performance with that in the United States and Europe, and to specifying, in as much detail as possible, the factors that contributed to growth of output in Canada.

Income Levels, 1960

The comparison of real output per person employed in Canada and the United States was set within the same framework, and complements the growth analysis. A number of studies indicate that the rate of increase in gross output per person employed has for the past 35 years been about the same in Canada and the United States. This suggests that the gap in real income per person employed of about 20 per cent has been a persistent feature of Canadian-U. S. economic growth. The second half of this Study relates to a more detailed statement of the factors that contributed to the difference in the level of real labour productivity in Canada compared to the United States in 1960.

Net national income per person employed in Canada was 18 per cent below the U. S. level in 1960. The Denison comparisons indicated that the Netherlands had the next highest income level, and a gap of 35 per cent with the United States. Real income per person employed was 59 per cent of the U. S. level in Germany, Norway and the United Kingdom, and the gap was, therefore, 41 per cent. Italy had the lowest level of income per person employed -- only 40 per cent of the level in the United States. The relative levels of income per person employed and a summary of the source of the differences are given for Canada, Northwest Europe and the United Kingdom in Table 5.

Table 5

CONTRIBUTION OF FACTOR INPUTS AND FACTOR PRODUCTIVITY TO DIFFERENCES FROM THE UNITED STATES IN REAL NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

(Percentage of U.S. net national income in U.S. prices per person employed)

	Canada	Northwest Europe	United Kingdom
Net national income per person employed	81.7	59.0	59.0
Difference from the United States	18.3	41.0	41.0
Due to:			
Factor input per person employed	0.7	11.3	11.0
Labour	--	1.1	0.6
Capital and land	0.7	10.2	10.4
Output per unit of input	17.6	29.7	30.0
Productivity elements, specified	7.5	6.0	0.7
Residual productivity	10.1	23.7	29.3

Note: Detail may not add due to rounding.

Source: Canada -- Table 105.
Europe -- Denison, Table 21-28, p. 332.

The comparison of the level of output per person employed in Canada and the United States in 1960 indicated that factor inputs per worker did not account for any significant amount of the lower level of labour productivity in Canada. The adverse effect on output in Canada of a lower level of education per worker was largely offset by the higher proportion of male and of full-time workers. A higher level of capital inputs in Canada, such as business construction and housing, accounted for only a relatively small part -- less than one percentage point of the income difference with the United States.

Almost all of the gap in output per worker was attributed to a significantly lower level of productivity or output per unit of input in Canada. About 40 per cent of the factor productivity difference was accounted for by specified or quantitatively identified elements, such as a larger allocation of resources to agriculture, and differences in the level of demand in 1960. More than half of the total gap in income per worker was not attributed to a specific cause. The final Chapter of this Study indicates some of the factors that may have contributed.

Outline

Following this introductory Chapter are 13 subject-matter and two summary Chapters. Because there is a close statistical and analytical relationship between the growth and level comparisons, each subject-matter Chapter deals with both. Chapter II is a statement of the phenomenon to be studied, that is, the growth experience of the countries between 1950 and 1962, and the levels of real income in 1960. Chapter III describes the general framework of the Study and develops the input weighting system of factor shares. Employment, hours of work, and the age-sex and education characteristics of the labour force are presented in Chapters IV,

V, and VI and summarized in Chapter VII. The contributions of capital investment in equipment and structures, housing, inventories, land and foreign assets, are described in Chapters VIII and IX. Factor input contributions are brought together and summarized in Chapter X.

The elements of growth or income differences that are not accounted for by inputs of labour, capital and land are attributed to output per unit of input and subjected to further specification. Chapters XI to XIV discuss the productivity implications of resource allocation, economies of scale, and cyclical variations in demand and weather. Chapters XV and XVI draw together and summarize the input and productivity components of the growth and level comparisons. A set of Notes relating to the subject-matter Chapters is appended. The Notes contain descriptive material on sources and methods as well as some supplementary analysis.

This Study is primarily concerned with setting out Canada-U. S. comparisons of the growth and level of income. Denison's estimates for Northwest Europe and selected individual countries are used to provide the international perspective. In a majority of cases the tables in this Study include data for the United Kingdom; this country was selected because of the general interest in its post-war economic performance. Norway was also included to highlight some similarities with Canada. There is no systematic or detailed discussion of the European figures in this Study. Interested readers will find the statistical comparisons and a comprehensive analysis of the U. S. and European material in the Denison and Poullier volume.

It was stated earlier that the primary objective of attempting to understand the mechanics of past growth is to help evaluate the priorities and potentials for future growth. Both in the early study Sources of Economic Growth and in Why Growth Rates Differ, Denison discussed the implications of his analysis for future growth in the United States. 1/ More recently he used his analysis as a basis for evaluating U. K. economic growth. 2/ It is appropriate that this Study should provide a similar perspective for Canada. A section on the prospects for future growth has been included in Chapter XV.

This extension of the analysis may also be used in a more formal way to develop projections of potential output from the supply side. In the Fourth Annual Review 3/ some preliminary results from this Study were used to estimate potential output in the Canadian economy to 1975.

The Denison and Poullier study Why Growth Rates Differ, which compared the growth and levels of real output, and the factors that contributed to differences, was a pioneering contribution to empirical analysis. It identified and compared the large and pervasive sources of growth and productivity differences in the United States and eight European countries. The purpose of this Study was to place the performance of the Canadian economy within this broad international framework. Macro-economic and international comparisons do not, by and large, generate detailed or specific policy directives. They may, however, provide a perspective for focusing resources and attention on areas that are of crucial importance in the

1/ See also Edward F. Denison, "The Lagging U. S. Growth Rate", American Economic Review (A. E. R.), Vol. LII, No. 2, May 1962.

2/ Edward F. Denison, "Economic Growth" in Britain's Economic Prospects, Richard Caves and Associates, Washington, The Brookings Institution, 1968.

3/ See Economic Council of Canada, Fourth Annual Review, Ottawa, Queen's Printer, 1967, Chapter 4.

dynamics of growth and productivity. In many cases the international comparisons provide a benchmark against which national economic performance can be assessed, and potentials for change evaluated.

This approach to analysis has a particular relevance to Canada as we attempt to isolate and explain the factors contributing to the productivity gap between Canada and the United States. The analysis of growth and income levels in Canada provides a framework for asking questions about Canadian economic performance, for evaluating the importance of the various elements and, in some cases, for suggesting answers. The threads of the analysis provide guidelines to further research and to policy formulation in areas such as formal, technical and management education, tariffs, and resource shifts -- agricultural, regional and industrial.

CHAPTER II

GROWTH RATES AND LEVELS OF REAL INCOME

NET NATIONAL INCOME AS A MEASURE OF OUTPUT

The measure of output used in this Study is net national income at factor cost. In Chapter 2 of Why Growth Rates Differ, Denison discussed the rationale for assuming that national economic policies should be directed towards growth of output of final goods and services for domestic consumption using this measure as the point of departure. [1] The pros and cons, and strengths and limitations, of using net output as opposed to gross, national income as opposed to domestic, and factor cost valuation as opposed to market price, have been discussed at considerable length in the literature. [2] No attempt is made in this Study to engage in further discussion on these points. There is a large measure of agreement that:

> Although the gross national product is the most widely used of product totals it should be approached with great circumspection. First, it has the defect of gross concepts, that it embodies under the form of depreciation a number of products which should be classed as running expenses. [3]

and

> ... it is useful to have a product concept which excludes indirect taxes because these in no way represent a service to the production into whose cost they enter. Equally it is useful to have an income concept which includes direct taxes because the inclusive concept reflects the actual costs of different factors of production. [4]

This Study is designed to provide, for Canada, estimates parallel to those made by Denison for the United States and Europe; it therefore follows a similar set of measures and methods. The relevance of particular measures is discussed briefly in the text or in the Notes to this Chapter.

Problems in Intertemporal Growth Comparisons

Conceptual and measurement difficulties are a plague to meaningful international comparisons. Fortunately the Canadian and U. S. national accounts have followed similar lines of development and no serious problems of comparability

---

[1] See Denison, pp. 14 et seq.

[2] A valuable collection of different points of view on the meaning and relevance of these (and other) variations in national accounts measurement is contained in a National Bureau of Economic Research (NBER) publication, A Critique of the United States Income and Product Accounts, Studies in Income and Wealth, Vol. 22, Princeton University Press, 1958.

[3] Richard and Giovanna Stone, National Income and Expenditure, London, Bowes & Bowes, 1961, p. 19.

[4] Ibid., p. 21.

exist.[1] Estimates for other countries, however, have varying degrees of incomparability. The Organization for Economic Co-operation and Development (OECD) publishes a set of national accounts for member countries which have been adjusted to a more or less standard framework.[2] These accounts provided the basis for Denison's international comparisons and for the Canadian estimates used in this Study. To obtain a more realistic measure of real net output, Denison revalued the depreciation estimates to a replacement cost basis. A similar adjustment has been made to the Canadian income data; the details of this adjustment are set out in the Notes to this Chapter.

A time series of net national income at factor cost is not readily available in constant prices or in volume terms for Canada. The estimates for the United States and Europe (after adjustment for depreciation at replacement cost) were deflated by Denison using the GNP implicit price deflators and, in so far as possible, factor cost weights. The Canadian estimates of net national income in constant prices for 1950 to 1962 were obtained by deducting from constant price GNP at market prices (OECD definitions) an allowance for indirect taxes and subsidies at base-year rates, and replacement-cost depreciation in constant prices (see Notes to this Chapter).

Problems of relating and measuring quality changes, incorporating new products, etc., continue to bedevil the deflation process. A detailed comparison of deflation techniques and an assessment of their quantitative effect on the output volume series is not within the compass of this Study. Denison made certain minor adjustments[3] for inconsistencies in deflation for Belgium and France. For Canada and the United States it was assumed that deflation techniques are sufficiently similar to cause no significant distortion.[4]

It should also be noted that in the growth comparison an allowance was made for changes in output per unit of input that arose from differences in the short-cycle level of output or pressure of demand, and from the variable effects of weather on farm output.[5] In a sense these calculations standardize the international comparisons for statistical and cyclical differences.

---

[1] The Dominion Bureau of Statistics (DBS) and the U. S. Office of Business Economics (OBE) might demur at such a sweeping statement but their concern with the fine points of estimation makes them overly modest.

[2] OECD, National Accounts Statistics, Paris, various issues.

[3] Denison, p. 27.

[4] See, however, the statistical adjustment to the Canadian data included in contributions to growth in output per unit of input arising from the difference in the growth of real Gross Domestic Product (GDP) and deflated Gross National Expenditure (GNE), Chapter XIV.

[5] The estimates of these factors are discussed in Chapter XIV; see also Denison, Chapter Nineteen.

GROWTH IN REAL NATIONAL INCOME

Estimates of output and output per unit of input, "adjusted" to exclude these special factors, are given in the summary tables. Table 6 sets out the growth rates of national income for each country for the period 1950 to 1962 and for two sub-periods.[1] These are the growth rates used throughout this Study. The rates of growth for the more widely known measure of GNP at market prices are also given in this Table for comparison. The differences in the growth rates of the two output series, which range between one-tenth and three-tenths of one percentage point of the annual rates,[2] do not alter, in a material way, the relative growth performance of the countries.

Table 6

GROWTH OF REAL NET NATIONAL INCOME AND GROSS NATIONAL PRODUCT

(Annual average rates)

	Net National Income at Factor Cost			Ranking by Growth of Net National Income	GNP at Market Prices
	1950-62	1950-55	1955-62	1950-62	1950-62
Canada	3.8	4.2	3.6	5	4.1
United States	3.3	4.2	2.7	9	3.4
Northwest Europe	4.8	5.7	4.1	--	--
Belgium	3.2	3.3	3.2	8	3.4(1)
Denmark	3.5	1.6	4.9	6	3.7
France	4.9	4.8	5.0	3	4.7
Germany	7.3	9.9	5.4	1	7.1
Netherlands	4.7	6.0	3.8	4	4.6
Norway	3.5	3.7	3.3	7	3.8
United Kingdom	2.3	2.3	2.3	10	2.6
Italy	6.0	6.3	5.7	2	6.1(1)

(1) 1953-62.

Source: Net national income in the United States and Europe from Denison, Table 2-1, p. 17; in Canada see text and Notes to Chapter. GNP rates for all countries estimated from OECD, National Accounts Statistics, op. cit., various issues, and United Nations, Yearbook of National Accounts Statistics, New York, various issues.

Annual growth rates of net national income for the period 1950 to 1962 ranged between a low of 2.3 per cent in the United Kingdom and 7.3 per cent in Germany. Among the 10 countries, Canada ranked fifth or sixth in growth over most of the period, but the Canadian rate was one full percentage point less than

[1] The estimates of net national income in this Study are based on OECD definitions and include depreciation at replacement cost.

[2] It is of interest that in seven out of the ten countries GNP growth rates are larger than net national income rates. This reflects in large part the increasing importance of depreciation in real output. It also reinforces the preference expressed earlier for using net output to assess real growth.

the rate for Northwest Europe. Norway, the United States, Belgium and the United Kingdom consistently trailed the growth pace-setters throughout the period. Italy was one of the top 10, ranking second in the 1950-62 period and topping the growth list in 1955-62. These rates of growth, for the earlier period in particular, convey a strong impression that the process of reconstruction on the Continent provided the basis for some of the exceptional growth in countries such as Germany, Italy, and the Netherlands.

A high rate of growth of total output creates an environment in which productivity gains and economies of scale are more readily achieved. It does not, however, ensure a satisfactory performance in productivity (output per person employed) or welfare (output per capita). Table 7, which gives rates of growth of national income per person employed and per capita, tells a rather different story -- particularly for Canada.

Table 7

GROWTH OF REAL NET NATIONAL INCOME PER PERSON EMPLOYED AND PER CAPITA

(Annual average rates)

	Ranking by Growth in Net National Income per Person Employed	Net National Income per Person Employed			Net National Income Per Capita		
	1950-62	1950-62	1950-55	1955-62	1950-62	1950-55	1955-62
Canada	9	1.8	2.4	1.4	1.2	1.4	1.1
United States	8	2.1	2.7	1.7	1.6	2.5	1.0
Northwest Europe	--	3.8	4.5	3.3	3.9	5.0	3.1
Belgium	6	2.6	2.6	2.7	2.6	2.7	2.6
Denmark	7	2.6	1.1	3.6	2.8	0.8	4.2
France	3	4.8	4.7	4.9	3.9	4.0	3.8
Germany	2	5.2	7.1	3.8	6.1	8.9	4.1
Netherlands	4	3.6	4.9	2.8	3.4	4.7	2.5
Norway	5	3.3	3.5	3.1	2.5	2.7	2.4
United Kingdom	10	1.6	1.4	1.8	1.8	2.1	1.7
Italy	1	5.4	5.3	5.4	5.3	5.7	5.1

Source: Canada -- based on Table 6.
United States and Europe -- Denison, Table 2-2, p. 18.

The rate of growth of real income per person employed between 1950 and 1962 was lower in Canada than in any other country except the United Kingdom. If one extends the terminal year to 1964 to take in more of the Canadian recovery after 1960, the annual rate would increase from 1.8 to 2.0 per cent, but even in this longer period the growth of income per person employed in Canada was low. The relatively poor growth performance in Canada as one moves from total growth (Table 6) to growth per person employed (Table 7) reflects the very large growth in employment in Canada compared with the United States and Europe. As Table 8

indicates, Canada and Germany had employment increases of over 25 per cent in the 12-year period. In Norway and France the growth in employment was negligible.

Table 8 also suggests wide differences in population growth. In all of the 10 countries except Germany the growth in population was comparable to or exceeded the growth in employment. 1/ As a result most of the countries had a lower rate of growth of output per capita than per person employed. In Canada, the increase in population was 35 per cent, and the rate of growth of income per capita was the lowest of the 10 countries. The U. S. population increased by 23 per cent, and the growth of income per capita was the second lowest of the 10. In Germany, the growth in employment was so much larger than the growth in population that income per capita increased significantly faster than income per person employed. 2/

Table 8

EMPLOYMENT AND POPULATION, 1950-62

	Growth 1950 to 1962		Ratio of Employment to Population	
	Population	Employment	1950	1962
	(Percentage change over 12 years)		(Per cent)	
Canada	35	26	37	34
United States	23	15	41	38
Northwest Europe	11	12	44	44
Belgium	7	7	39	39
Denmark	9	12	46	48
France	12	1	46	42
Germany	14	27	43	47
Netherlands	17	13	37	36
Norway	12	2	45	41
United Kingdom	6	8	46	47
Italy	7	7	40	40

Source: OECD, Manpower Statistics, 1950-62, and 1954-64, and Labour Force Statistics, 1956-66, Paris, 1963, 1965 and 1968 respectively, and Denison, Table 5-3, p. 52.

The demographic relationships are relevant to interpreting differences in output growth in total, per person employed and per capita, but they do not provide an explanation of growth itself. One purpose of this Study was to see if an analysis of the sources of growth in Canada, in the context of the experience of other countries, would throw any light on the reasons for the relatively low rate of growth in total output or in output per person employed in Canada; the per capita analysis is given here for comparative purposes but is not pursued further.

1/ The effects of the age structure of the population and the female participation rate on this relationship are brought out in Chapter V.

2/ The impact of migratory workers in Germany affects this particular comparison. See employment and population data in Tables 8 and 18.

COMPARISONS OF REAL OUTPUT LEVELS

The crucial element in making an international comparison of output levels is a common denominator to convert national outputs, which are expressed in a variety of currencies, to a standard value unit. Exchange rates are frequently used but they are not appropriate for this purpose.[1] The research that provided a philosophical and methodological basis for comparing national output in "real" terms was carried out by Milton Gilbert and Irving Kravis, et al., at the Organization for European Economic Co-operation (OEEC) during the 1950's.[2] Except for a study by Paige and Bombach,[3] surprisingly little has been done in this area since then, although there seems to have been some renewed interest in the past few years.[4]

Using as much detail on price and quantity of individual items as could be collected for each country, Gilbert and Kravis compared real output in the United States and Europe by expressing European output in U. S. dollars, and conversely U. S. output in the currency of each European country. In the two OEEC studies comparisons were made of real output for the United States and selected European countries in 1950 and 1955. On the basis of somewhat less detailed methods, Denison updated the 1950 comparison to 1955, 1960 and 1962 for the United States and the eight European countries. It was in fact the availability of the Gilbert "real" output comparisons that largely determined the countries included by Denison in Why Growth Rates Differ.

For Canada no such mine of existing research and analysis was available. However, an excellent starting point was provided by a recent study by DBS of consumer prices in Canada and the United States.[5] E. C. West of the Economic Council's staff added additional data on other final expenditure prices in the two countries and estimated Canada-U. S. GNE price relatives with both Canadian and U. S. quantity weights, and conversely Canada-U. S. GNE volumes using both Canadian and U. S. market price weights. The calculations, with output and prices at market, were based on 1965 data and extrapolated to 1950 for the benchmark years of this Study. The 1960 cross-section volume comparison of net national income was, however, at factor cost. Detail on the relative incidence and type of indirect taxes in 1960 was used to estimate factor cost price relatives for output in both Canadian and U. S. volume weights. West's Appendix[6] to this Study

---

1/ In discussing spatial comparisons, Professor and Mrs. Stone commented that "The conclusion is that exchange rates, though temptingly simple, are a most unreliable guide...." Stone and Stone, op. cit., p. 91.

2/ See Milton Gilbert and Irving B. Kravis, An International Comparison of National Products and the Purchasing Power of Currencies, Paris, OEEC, 1954, and Milton Gilbert and Associates, Comparative National Products and Price Levels, Paris, OEEC, 1958.

3/ Deborah Paige and Gottfried Bombach, A Comparison of National Output and Productivity of the United Kingdom and the United States, Paris, OEEC, 1959.

4/ A short list of studies on this subject is given in the Notes to this Chapter.

5/ Herbert Segal and Frances Pratt, Comparative Urban Consumer Price Levels in the United States and Canada, Ottawa, DBS, Prices Division, September 1967, mimeo.

6/ E. C. West, "Real Output Comparison, Canada and the United States, 1966 and Selected Years Back to 1950", attached as a technical Appendix.

describes in more detail the price and volume estimates. It should be noted in this connection that the aggregate estimates appear to be reasonable orders of magnitude, but it would be unwise to attribute too much credence to individual expenditure components. Using these price relatives, estimates of real net national income per person employed in Canada were set in the context of the Denison relatives for the United States and Europe in 1960.

One of the most interesting and baffling aspects of real international output comparisons is related to the choice of alternative price weights, and the difference in the results obtained. For example, Canadian output valued in Canadian prices may be compared with U. S. output valued in Canadian prices, or the output of both countries may be expressed in U. S. prices. A significant result of the Gilbert studies[1/] was the very large difference in the output relationships using U. S. and European price weights. Table 9 illustrates this point and includes, as a matter of interest, a calculation of output relatives based not on relative real prices but on 1950 exchange rates. Gilbert discussed in some detail the forces which tend to produce a wide divergence in output relatives based on different price weights. The Notes to this Chapter set out a simple illustration of the relationships and the methodology; the interested reader should also refer to the OEEC studies. In general the relatives in Table 9 suggest that both the price and output structures are very different in the European countries compared with the United States. This point has particular relevance to the Canadian-U. S. comparisons, which do not appear to have the same characteristic.

Table 9

INTERNATIONAL COMPARISON OF GROSS NATIONAL PRODUCT PER CAPITA, 1950

(Relatives, U.S. = 100)

	U.S. Prices	National Prices	Exchange Rates
United States	100	100	100
United Kingdom	62	48	37
Denmark	61	48	37
Norway	59	44	34
Belgium	57	48	43
France	53	39	35
Netherlands	52	37	27
Germany	44	30	26
Italy	30	18	16

Source: Based on Gilbert and Associates, op. cit., Tables 2 and 4, pp. 23 and 28.

1/ Gilbert and Kravis, and Gilbert and Associates, op. cit.

INTERNATIONAL COMPARISONS OF REAL INCOME LEVELS, 1960

In Table 10, net national income in Canada, Northwest Europe, Norway and the United Kingdom is compared with income in the United States in 1960. The comparison is made for total income, income per capita, per person in the labour force and per person employed.

The Canada-U. S. estimates were made on the basis of both U. S. and Canadian (national) price weights; the European-U. S. comparisons were made in U. S. prices and in the individual prices of each country. Total Canadian output in 1960 was 7 per cent of output in the United States. Norwegian output was only 1 per cent of the U. S. output. The total output of the seven countries of Northwest Europe was 70 per cent of the U. S. level in U. S. prices, and 55 per cent in national prices.

National income per person employed was 18 per cent lower in Canada than in the United States. The Canadian level was about half way between the level for Northwest Europe and the United States when expressed in U. S. prices. Most of the Northwest European countries, and the area as a whole, were 40 per cent below the United States in output per person employed in U. S. prices, and almost 55 per cent below in national prices. It is a major focus of this Study to assess the factors contributing to the significantly lower level of productivity in Canada compared with the United States.

Table 10

INTERNATIONAL COMPARISON OF REAL NET NATIONAL INCOME, 1960

(Relatives, U.S. = 100)

	Based on U.S. Price Weights				Based on National Price Weights[1]			
	Total	Per Capita	Per Person in the Labour Force	Per Person Employed	Total	Per Capita	Per Person in the Labour Force	Per Person Employed
Canada	7.2	73	80	82	7.0	70	78	79
United States	100.0	100	100	100	100.0	100	100	100
Northwest Europe	70.1	69	62	59	54.6	54	48	46
Norway	1.3	64	62	59	1.0	48	47	45
United Kingdom	21.0	72	61	59	16.5	57	48	46

(1) National weights are used for each country and for the United States to estimate individual-country/U.S. relatives; the relatives are therefore only meaningful for comparisons of the United States and each individual country.

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Table 2-4, p. 22.

As noted in Table 8 the share of population in employment in Canada was lower than in the United States. In terms of real income per capita, the shortfall in Canada compared with the United States was even larger -- 27 per cent.[1] On the other hand, for most of the European countries the share of the population in employment was higher than in the United States, and the relative of real output (output in one country as a proportion of output in the United States) per capita for these countries was larger than per person employed.

The data in Table 10 indicate a peculiar feature of the Canadian estimates -- the similarity of the Canada-U. S. output relatives in U. S. and in national (i. e. Canadian) prices. This result stands in sharp contrast to the European-U. S. output relatives (both total and per capita) which differ on average by 15 percentage points or 30 per cent when expressed in U. S. or national price weights.[2] Each volume comparison, in U. S. or national prices, has its shortcomings for comparative purposes. Differences in output patterns and price relationships in the United States and in each of the other countries make either U. S. or national price weights somewhat inappropriate for both countries. As a result, the use of national (European) price weights understates European relative to U. S. output, and U. S. price weights overstate European output. For some purposes, Gilbert used a geometric mean to average the results obtained by the two methods of weighting, but there is no uniquely correct answer.

The similarity of the Canada-U. S. output relatives in alternative price weights implies a close correspondence in the composition of output and relative prices in the two countries. With a level of real output per person employed in Canada some 20 per cent lower than in the United States, this result is somewhat surprising. It would, however, require much more detailed information than is presently available on output and relative prices of individual goods and services to confirm or deny the implications of the Canada-U. S. output comparison in each country's relative prices.[3]

1/ A comparison of output based on an adult equivalent population increased the 1960 Canada-U. S. per capita relative from 73 to 74 and decreased the Northwest Europe-U. S. relative from 69 to 66. For the details of this calculation see the Notes to this Chapter.

2/ Care should be taken in interpreting the relatives in national prices. The comparison in U. S. prices has a common set of price weights. Comparisons in national prices were binary comparisons for the United States and each of the other countries, expressed in the (national) price weights of that country, so that there is no common valuation base.

3/ This point is picked up again in Chapter XII which compares real consumption per capita on a similar basis. The price relatives from the survey of consumer prices in Canada and the United States, undertaken by DBS (Segal and Pratt, op. cit.), are qualitatively superior to price detail for the other components of final expenditure. It seems appropriate therefore to focus major attention on the consumption relatives expressed in different price weights rather than on the less firm and less detailed price data for other components of final expenditure. Since consumption is a significant part of total output, its importance justifies special emphasis.

The cross-section comparisons of real output were combined with the volume time series to compare the shifts over time in real output per person employed between the United States and each country in U. S. prices. In Table 11 below, the GNP relatives are compared, and the Canadian series is updated. All the European countries except the United Kingdom substantially improved their position relative to the United States. Canada has not. This reflects the fact that output per person employed has not risen nearly as rapidly in Canada as in Europe, and that from 1950 to 1964 the Canadian rate has been slightly lower than the U. S. rate. At this rate of change it would not be many years before the level of output per worker in a number of European countries had reached the level in Canada. Evidence suggests that, by 1965, gross output per capita in Germany, Denmark, Norway and the United Kingdom was approaching the Canadian level.1/

Table 11

INTERNATIONAL COMPARISON OF REAL GROSS NATIONAL PRODUCT(1)

PER PERSON EMPLOYED

(Relatives, U.S. = 100)

	1950	1955	1960	1964	1966(2)
Canada	86	85	85	84	82
United States	100	100	100	100	100
Northwest Europe	51	52	57	59	
Norway	55	56	61	65	
United Kingdom	56	54	56	56	

(1) At factor cost in 1955 U.S. price weights.

(2) The estimates for 1966 are approximations based on the relative growth in real GNP in market prices, as given by the official national accounts estimates.

Source: Canada and United States -- these figures were derived explicitly by West in the time series comparison of output in Canada and the United States in U.S. price weights (see Appendix).
United States and Europe 1950 to 1964 -- Denison, Table 2-5, p. 23.

1/ Angus Maddison has put together a number of international cross-sectional estimates to compare real output levels over a wider range of countries, including Japan and the U. S. S. R. The comparison of recent levels was set in an historical context extending back to 1870. See Maddison, "Comparative Productivity Levels in the Developed Countries", Banca Nazionale del Lavoro Quarterly Review, No. 83, December 1967, particularly Table X.

It would appear that the 1965 estimate of gross output per capita in Canada was slightly understated and in Germany overstated.

The relatives of gross output for Canada and Norway compared with the United States are slightly larger than those for net income (compare Table 10 and the 1960 estimates in Table 11). This reflects the importance of depreciation in these two countries. In the other European countries, and for Northwest Europe as a whole, depreciation per person employed, valued in U. S. prices, was equal to or lower than in the United States.

CHAPTER III

FRAMEWORK AND FACTOR SHARES

FRAMEWORK AND METHOD

Sources of Growth

Tables 2 and 3 in Chapter I provide a capsule summary of Denison's analysis of the sources of growth in the United States, Northwest Europe and the United Kingdom and the results of the present Study for Canada. They also illustrate the framework of the methodology described below.

The Study identifies changes in the quantity, and in important elements of quality, of primary factor inputs, and determines the contribution of these inputs to growth of national income. The difference between the total growth performance and that accounted for by the measured factor inputs is attributed to changes in output per unit of input.[1/] The growth of total factor productivity is, in turn, ascribed to a number of particular sources that could be identified and quantified, leaving an unidentified component representing the residual sources of growth.[2/]

The growth of factor inputs was estimated separately for labour, business enterprise fixed capital and inventories, land, housing, and income on foreign investments. The labour input measure was further specified to take account of the contribution to increased output per worker of hours of work, education and the age-sex distribution of the labour force.

To estimate the contribution of changes in the various factor inputs to growth requires a measure of the relative importance of each factor in the growth process, or a set of weights. Since the relationship of changes in factor inputs and

---

1/ D. W. Jorgenson and Z. Griliches in "The Explanation of Productivity Change", The Review of Economic Studies, July 1967, put forward "the hypothesis that if real product and real factor input are accurately accounted for, the observed rate of growth of total factor productivity is negligible". This article points up a number of limitations in the statistical base of estimates of output and factor inputs, in the method relating one to the other, and in the conceptual difficulties associated with capital input measures of the embodiment type. On the other hand, there is a substantial amount of empirical evidence that suggests that such factors as scale, resource allocation, and the combination and organization of labour and capital contribute to changes in output per unit of input. It is not clear how these factors would be taken into account in the Jorgensen-Griliches framework.

2/ This Study departs in one important respect from Denison's framework in that he included among the identifiable sources of growth an estimate of the contribution of advances in knowledge; this Study used the "residual sources" of growth which include the effect of "advances in knowledge" and lags in the application of these advances. See footnote 1, p. 152.

output is related to the comparative static formulation of the conventional Cobb-Douglas production function, the contribution of changes in factor inputs to output is derived as the sum of changes in each input weighted by the share of that input in total output or by its marginal productivity. The use of a weighting system based on factor shares -- the share of net national income accruing to labour, land and capital -- may be illustrated by a somewhat oversimplified example. The growth of employment in Canada in the period 1950-55 was 1.7 per cent per annum (see Table 20), and the share of labour in total national income was 72.5 per cent (see Table 12). The measured contribution of employment to the growth of net national income would be 72.5 per cent of 1.7, or 1.3 per cent per annum (Table 100). 1/

To provide for shifts in the relative importance of factors over time, factor shares were calculated annually and averaged for the periods 1950-54, 1955-59 and 1960-62. The average weights were applied to input growth for the period 1950-55, 1955-60 and 1960-62. Growth contributions in the three subperiods were combined on the basis of 5:5:2.

Growth that was not accounted for by increases in factor inputs was attributed to increased output per unit of input. The method of estimating some of the factors that contributed to changes in output per unit of input was too varied to be generalized; the measurements and assumptions are described in Chapters XI to XIV. The residual, which remained after taking account of a number of factors contributing to higher levels of factor productivity, reflected a variety of unmeasured or unmeasurable elements contributing to productivity changes. Some of these factors would enhance, and others reduce, over-all productivity performance. The residual sources of growth also include errors or omissions in measuring output, factor inputs and productivity.

Income Levels, 1960

The international comparison of factors contributing to differences in net national income per person employed was based on a framework similar to that used in the growth analysis. Total net national income per person employed for each country in 1960, in U.S. prices, was compared with U.S. net income per worker. The real income relative or index (i.e. national income per person employed in Canada as a percentage of that in the United States) gives the income gap to be explained by the cross-section analysis.

Primary factor input levels per person employed, including labour input quality, were estimated for each country and compared with those in the United States. The percentage difference in level for each factor was weighted with U.S. factor share weights. 2/ For example, given the Canada-U.S. relative for education was 93.4 (Table 37) and the relevant U.S. factor share weight was 80 (Table 14), the contribution of education as reflected in the quality of the labour force to the

1/ This example is an approximation only. It does not include the adjustment for certain output data limitations discussed in Chapter X. In addition, the contribution of income from housing and of income from foreign investment to growth was measured directly, as they are explicit components of net national income. See Chapter IX.

2/ Average weights for the period 1960 to 1962 were used instead of 1960 because the weight for 1960 alone would reflect the substantial degree of underutilization of the U.S. economy in that year.

Canada-U. S. income difference of 18 percentage points would be .80 times 6.6 or five percentage points. 1/ This formulation of the factor input to output relationship is also an elaboration of the basic production function statement.

That part of the total income gap that was not accounted for by factor inputs was attributed to higher levels of output per unit of input. The various methods used to identify some of the factors responsible for productivity differences are discussed in Chapters XI to XIV. The factors contributing to the gap were adjusted to exclude the effect of interaction among themselves by the use of "pseudo" growth rates (see Chapter X).

The residual that remains after deducting the identifiable productivity elements reflects items that have not been specified, as well as errors and omissions. As in the growth analysis, this residual must be assumed to be made up of factors that contribute in varying amounts, both positively and negatively, to the real income difference; i. e. it is a net residual.

FACTOR SHARE WEIGHTS

This formulation of the input "model" carries with it a number of assumptions which, on the basis of existing evidence, are not met in the real world -- an economy in equilibrium, constant returns to scale, and factor returns equal to the marginal value product.

The appropriateness of factor share weights for growth models and of the marginal productivity theory which provides the rationale for their use has been a controversial subject among model-builders and analysts. It is possible to argue that this weighting system is appropriate, and conversely that it is inappropriate, but it does not seem possible to prove that the calculations based on its acceptance are reasonable or unreasonable. This controversy is not new, and the issues cannot be resolved in this Study. 2/

It is, however, not necessary to accept the existence of perfect competition or the detailed relevance of marginal-productivity theory to make use of factor share weights as a useful operational tool of investigation. Having used this assumption to assess the contribution of factor inputs to output, Denison proceeded, in the analysis of factor productivity, to take account of the effect of departures from a competitive economy, from equilibrium, from constant returns to scale, etc.

It is not intended to give the impression, through lack of comment in this Study, that the assumptions and methods do not raise interesting and sometimes important questions. To many of the questions, we do not as yet have answers --

---

1/ The example is only approximate; it does not take account of the refinements described in Chapter X. It should be noted that when the volume or quality of a factor input in a particular country was higher than in the United States, the contribution to the difference in income level was measured the same way, but it was negative. Other things being equal, the larger factor density would have raised the level of income per person employed, relative to that in the United States, and contributed negatively to the income gap.

2/ The reviews and comments on Denison's U. S. growth study illustrate the controversy. See, especially, Moses Abramovitz, "Economic Growth in the United States, A Review Article", A. E. R., September 1962; and OECD, The Residual Factor and Economic Growth, Paris, 1964.

let alone answers firmly based on empirical evidence. The controversy will have made a significant contribution if it leads to more research and improved methodology. Estimates based on this framework of analysis are put forward in the belief that they are pertinent and revealing.

Factor Shares in Canada, 1950-62

The distribution of net national income among the factors of production posed no special conceptual difficulties.[1] The measurement problems are discussed in the Notes to this Chapter. Annual factor shares were estimated and averaged for the periods 1950 to 1954, 1955 to 1959 and 1960 to 1962. The period averages were used as weights in combining the growth contributions of individual factor inputs for the three subperiods; the growth estimates for the subperiods were combined into the longer time-span with weights of 5:5:2. Table 12 below sets out the average factor shares in Canada.

Table 12

DISTRIBUTION OF NET NATIONAL INCOME, CANADA

(Average of annual shares)

	1950-62	1950-54	1955-59	1960-62
Net national income	100.0	100.0	100.0	100.0
Labour income	75.3	72.5	76.3	78.1
Income from housing	3.9	3.0	4.2	4.8
Income on foreign investments	- 1.8	- 1.8	- 1.8	- 2.0
Other property income	22.7	26.3	21.3	19.1
Non-residential land	3.7	4.7	3.3	2.9
Non-residential structures and equipment	14.3	15.6	13.8	12.8
Inventories	4.7	6.0	4.2	3.4

Note: Figures may not add due to rounding.

Source: See text and Notes to Chapter.

As the Notes to this Chapter suggest, the allocation of income among factors is based on a number of difficult assumptions, but the broad pattern in Table 12 is likely to represent reasonable orders of magnitude. Over the 12-year period, an increased share of factor income has accrued to labour. To some extent, however, the higher labour shares in the late 1950's and early 1960's reflect the degree of slack in the economy at that time. The share of output in housing has risen significantly, in fact far more in percentage terms than the labour share. The return to fixed investment, inventories, and land, declined. But to some extent this, too, reflects the low level of investment and underutilization in the Canadian economy around 1960.

[1] Admittedly the problem of dividing unincorporated business and farm income into the labour and capital shares involves very difficult conceptual and measurement problems. Fortunately the quantitative significance of these shares is much less than the intellectual difficulties. The assumptions are detailed in the Notes.

International Differences in Factor Shares

The predominant feature of Table 13, which compares factor shares in a number of countries, is the similarity of the shares. Because of the difficulties in assessing a labour contribution of proprietors and unpaid family workers, small differences in the total labour share should not be overemphasized. In general, labour input in Northwest Europe was estimated to account for some 76 per cent of net national income with extreme positions among the nine countries in the Denison analysis of 72 and 79 per cent. 1/ Except in Canada and Norway, changes over time in the labour share were not large; the increase in labour's share of some eight percentage points in Norway and six in Canada from the 1950-54 period to the 1960-62 period is not likely to be attributable entirely to statistical aberrations. 2/ The labour share in both countries was noticeably below the average share in Northwest Europe at the beginning of the period and rose to exceed the average share in 1960-62.

Table 13

DISTRIBUTION OF NET NATIONAL INCOME, 1950-62

(Average of annual shares)

	Canada	United States	Northwest Europe	Norway	United Kingdom
Net national income	100.0	100.0	100.0	100.0	100.0
Labour income	75.3	78.6	75.8	74.1	77.8
Income from housing	3.9	3.5	1.7	1.0	2.2
Income on foreign investments	- 1.8	0.6	0.6	- 0.8	1.8
Other property income	22.7	17.3	21.9	25.7	18.2
Non-residential land	3.7	2.9	3.9	4.6	2.9
Non-residential structures and equipment	14.3	11.2	14.0	16.4	11.9
Inventories	4.7	3.2	4.0	4.7	3.4

Source: Canada -- DBS, National Accounts, Income and Expenditure (13-201), Ottawa, Queen's Printer, various issues.
United States and Europe -- Denison, Table 4-1, p. 38.

1/ Small differences in the labour share, and conversely in the total share of the various capital inputs, would not affect, in a material way, the contribution to growth based on them. For example, the difference between a labour share of 72 or 77 on a growth rate of employment of 2 per cent per annum would amount to the difference between 1.4 and 1.5 per cent in labour's contribution to growth.

2/ These calculations do not provide a basis for furthering the discussion about long-run stability of labour's share in total output. In the process of making the imputation for the value of "unpaid" labour input, it became apparent that the assumptions and methods could be critical in obtaining shifts or stability in the shares, particularly for periods in which the number and share of farmers, unincorporated proprietors and family workers in employment were rapidly changing (Tables 77 and 79).

There were small but interesting differences between countries in the shares of national income accruing to capital and land. Income from housing was twice as important in North America as in Northwest Europe. The low rate of return on housing investment in Europe arose in part from rent controls; the use of various forms of housing subsidies may have had the effect of understating the measured rate of return on housing investment.

Since the growth analysis is related to national, not domestic, income, the factor share calculations must take account of that part of domestic output that is paid to non-residents as a return on investment. Of the 10 countries, only Canada and Norway have a continuing inflow of capital and an outflow of investment income. Apart from one or two exceptional circumstances, national income in the other countries -- net capital exporters in receipt of investment income -- was larger than domestic income. 1/

The greatest difference in factor shares among the countries under study was in the returns to fixed enterprise investment in structures and equipment. Countries like Canada and Norway, traditionally defined as capital-intensive, had substantially higher shares going to this factor than most other countries. It is, however, important to note that the calculations are not sufficiently precise to support the conclusion that the Canadian share, shown as 14.3 in Table 13, was in fact larger than the Northwest European share of 14.0. It should also be noted that the revaluation of depreciation from a capital consumption allowance basis to replacement cost, by reducing profits and unincorporated income, lowered the net return to business fixed capital.

Land and inventories make up the balance of capital inputs. The difference in their shares was of the order of one percentage point. In Canada, the return to inventories was particularly high, as it was in Norway. Both inventories and land pose particular valuation problems which are inherent in the national accounts data.

Total property income, excluding housing, represented 23 per cent of net income in Canada over the period 1950 to 1962. The shares for other countries ranged from a low of 17 per cent in the United States to a high of 26 per cent in Norway. The return on all capital accounted for some 25 per cent of net national income in Canada. It should be noted that these shares were estimated net of depreciation. On a gross basis, all of depreciation would be attributable to capital. The relative labour-capital share shifts from a ratio of 3 to 1 when based on a net return to 2 to 1 using gross shares. 2/

1/ National income, as presently measured in most countries, does not include retained earnings or (withholding) taxes in the measure of income remitted to non-residents and vice versa. The Notes to Chapter IX include an estimate of the effect on national income, and income on foreign investment, of using total earnings on foreign investment.

2/ As noted earlier, factor shares as weights for the growth contribution of inputs are one of two elements determining the relative importance of various inputs to growth. Given this method and the net shares, equivalent increases in labour and capital inputs produce three times more growth in the case of labour than of capital. Alternatively, the elasticity of output with respect to labour was three times larger than to capital.

U. S. Factor Shares for Level Comparison, 1960

The comparison of the level of real net national income per person employed in 1960 was based on U. S. price weights and U. S. factor shares for the period 1960-62. Table 14 below sets out the factor share distribution.

Table 14

DISTRIBUTION OF NET NATIONAL INCOME, UNITED STATES, 1960-62

(Average of annual shares)

	Per Cent
Net national income	100.0
Labour income	79.9
Income from housing	4.2
Income on foreign investments	.7
Other property income	15.2
Non-residential land	2.5
Non-residential structures and equipment	10.2
Inventories	2.5

Source: Denison, Table 4-1, p. 38.

CHAPTER IV

EMPLOYMENT AND MAN-HOURS

This and the following three Chapters are concerned with an assessment of the growth in, and relative level of, the labour input. The quantity of input takes account of employment and hours worked. In addition, there is an evaluation of the effect of some labour attributes that affect the input quality. These include the age, sex, and educational characteristics of the labour force and the effect of the length of the work week on productivity.

POPULATION AND LABOUR FORCE

The relationship between population, labour force and employment[1/] was mentioned in Chapter II in connection with the comparison of income per capita and income per person employed. Income is generated by the employed population, but it must provide a livelihood for the whole population. The proportion of the population in Canada that was in the labour force or in employment in 1960 was the smallest, only 34 per cent, of any of the countries under study (Table 15). As a result, the gap between income per worker and income per capita in this country was especially wide (Table 10).

Table 15

POPULATION, LABOUR FORCE AND EMPLOYMENT, 1960

	Population (000)	Labour Force (000)	Employment[(1)] (000)	Labour Force as Percentage of Population		Employment[(1)] as Percentage of Population	Female Labour Force as Percentage of Female Population Age 15-64
				Total	Age 15-64		
Canada	17,870	6,530	6,084	37	62	34	32
United States	180,684	73,126	69,195	41	68	38	43
Northwest Europe	182,462	82,769	81,696	45	70	45	47
Norway	3,585	1,493	1,476	42	66	41	39
United Kingdom	52,539	25,026	24,700	48	73	47	48

(1) Including military.

Source: Canada — OECD, Manpower Statistics, 1954-64, op. cit., Tables I and II, pp. 26-27.
United States and Europe — Denison, Table 5-2, p. 51.

1/ For a discussion of the structure of the Canadian population and labour force, see Wolfgang M. Illing, with technical contributions by Yoshiko Kasahara, Frank T. Denton and M. V. George, Population, Family, Household and Labour Force Growth to 1980, Staff Study No. 19, prepared for the Economic Council of Canada, Ottawa, Queen's Printer, 1967.

The labour force is largely drawn from an adult "source" population, from age 15 to 64[1/]. The size of the source population depends on the age structure of the population. As the population ages or grows younger with time, or with fluctuations in the birth (and death) rates and migration, the size of the source population changes. Table 16 shows, for example, changes in the relative importance of the source population in total population over time in four countries.

Table 16

DISTRIBUTION OF THE POPULATION BY AGE GROUPS, 1950 AND 1962

(Percentage of total population)

	1950			1962		
	Under Age 15	Age 15 to 64	Age 65 and Over	Under Age 15	Age 15 to 64	Age 65 and Over
Canada	30	63	8	34	58	8
United States	27	65	8	31	60	9
Norway	24	66	10	25	63	11
United Kingdom	22	67	11	23	65	12

Note: Percentages may not add due to rounding.

Source: OECD, Manpower Statistics, op. cit.

The "participation rate" measures the share of the available male and female source population actually in the labour force. Participation rates are subject to wide variations among countries, particularly for females (Table 15). Shifts in the age distribution and changes in the participation rates for each sex are considered in more detail in the next Chapter.

Over the post-war years, a large part of the increase in the source population and labour force in several countries has been the result of a substantial inflow of people from other countries[2/]. The contribution of immigration to growth of the labour force and to output varies with such factors as the age, sex, marital status, education and experience of the migrants. A detailed analysis of the role of migration in the Canadian labour force is beyond the scope of this Study. Tables 17 and 18 suggest, however, its quantitative effect. Not since the first decade of this century has net immigration played so important a role in population growth in Canada.

1/ The source population is defined to cover approximately those ages from which the labour force is largely drawn. The source population in the United States has, from January 1967, been raised from 14 to 16 years of age and over. In Canada the labour force is measured from 14 years of age and over. Some 45 per cent of the population age 65 and over is currently in the Canadian labour force. The use in Table 15 of a source population that terminates at age 64 follows, as a matter of convenience, the OECD definition of population of working age from 15 to 64 years.

2/ For a discussion of the impact of immigration and emigration on economic growth in Canada, see Thomas A. Wilson and N. Harvey Lithwick, "The Sources of Economic Growth", Studies of the Royal Commission on Taxation, No. 24, Ottawa, Queen's Printer, 1968, Chapters III and IV.

In spite of approximately half a million emigrants[1] between 1951 and 1961, net immigration represented 25 per cent of population growth.

Table 17

MIGRATION AND POPULATION GROWTH, CANADA, 1901 TO 1961

	Population Change	Net Immigration	
		Total	Percentage of Population Change
	(000)	(000)	
1901-11	1,836	716	39
1911-21	1,581	231	15
1921-31	1,589	229	14
1931-41	1,130	- 92	- 8
1941-51	2,141	162	8
1951-61	4,229	1,081	26

Source: Adapted from Wilkinson, ibid.

Table 18 compares the role of net migration in population and labour force growth for a number of countries. During the 12-year period 1950 to 1962, both the United States and Germany acquired about three and a half million net immigrants. Net immigration to Canada exceeded one million. A number of West European countries experienced a net exodus. Italy lost a million and a half people. Net immigration as a proportion of population growth during this period ranged from about 11 per cent in the United States, and 23 per cent in Canada, to 48 per cent in Germany. If, as a rough guide, one assumes that half of the migrant population joined the labour force,[2] net immigration contributed about 20 per cent of the labour force growth in the United States, and over 35 per cent in Canada.

1/ See Bruce W. Wilkinson, Studies in the Economics of Education, Occasional Paper No. 4 of the Economics and Research Branch, Department of Labour, Ottawa, Queen's Printer, 1966, Table 2, p. 53.

2/ Data support this inference. Gross immigration into Canada between 1946 and 1961 was 1.5 million persons. In 1961, the labour force contained over 800,000 persons (53 per cent of 1.5 million) who had immigrated between 1946 and 1961. DBS, 1961 Census of Canada, Population, Vol. I -- Part 3, Bulletin 1.3-11 (92-562), Ottawa, Queen's Printer, 1964, Table 125, p. 125-2, and DBS, 1961 Census of Canada, Labour Force, Vol. III -- Part I, Bulletin 3.1-15 (94-515), Ottawa, Queen's Printer, 1964. See also Wolfgang M. Illing, op. cit., Table 4-E, p. 84, which indicates that some 50 per cent of the labour force increase between 1950 and 1960 came from net immigration.

Table 18

MIGRATION AS A FACTOR IN POPULATION AND LABOUR FORCE GROWTH, 1950-62

	Population Growth (000)	Labour Force Growth (000)	Net Migration Total (000)	Net Migration As a Share of Population Growth (Per cent)	Net Migration As a Share of Labour Force Growth (Per cent)
Countries of:					
Net immigration					
Canada	4,858	1,525	1,127	23	74
United States	34,385	9,800	3,772	11	38
Belgium	581	130	90	15	69
Germany	6,892	3,929	3,300	48	84
United Kingdom	2,842	1,983	110	4	6
Net emigration					
Denmark	382	189	- 48		
Netherlands	1,692	458	- 145		
Norway	374	37	- 16		
Italy	3,380	383	-1,714		

Note: The estimates of net migration pose large statistical problems and should be treated as approximations only. The figures for Germany include the Saar throughout, but exclude West Berlin before 1960. Estimates for France have not been included. The Manpower Statistics on net migration 1950 to 1962 in France suggested some two million immigrants (a large number of whom came from Algeria), but the increase in the labour force over the period was only 200,000. This result suggests the need for a more detailed reconciliation of the underlying data.

Source: OECD, Manpower Statistics, op. cit., and Labour Force Statistics, 1956-66, op. cit.; and Denison, Tables 5-1A and 5-1D, pp. 46 and 49.

EMPLOYMENT

Employment is the basic element in estimating the contribution of labour input to output. The changing structure of Canadian employment is compared with that of the United States, Northwest Europe and the United Kingdom in Table 19[1/].

1/ The percentage distribution of the labour force that corresponds to the absolutes in Table 19 is given in Table N-8.

Table 19

LABOUR FORCE COMPONENTS, 1950 AND 1962

	Canada		United States		Northwest Europe		United Kingdom	
	1950	1962	1950	1962	1950	1962	1950	1962
	(Thousands)		(Millions)		(Millions)		(Millions)	
Labour force	5,215	6,741	64.7	74.7	75.6	84.0	23.6	25.6
Male	4,100	4,942	46.1	50.2	50.8	55.6	16.1	16.9
Female	1,114	1,800	18.7	24.5	24.8	28.4	7.5	8.6
Unemployment	186	390	3.4	4.0	2.5	1.0	0.3	0.4
Employment	5,028	6,351	61.4	70.7	73.1	83.0	23.3	25.1
Armed Forces	52	126	1.7	2.8	1.4	2.0	0.7	0.4
Civilian employment	4,976	6,225	59.7	67.8	71.7	81.1	22.6	24.7
Male	3,891	4,488	42.2	44.9	47.6	52.9	15.2	16.2
Female	1,085	1,737	17.6	23.0	24.1	28.1	7.4	8.5

Source: Canada -- DBS, The Labour Force, (71-001), Ottawa, Queen's Printer, Supplement to the March 1965 Report; and, for military employment, Bank of Canada, Statistical Summary Supplement, 1963, p. 131. United States and Europe -- Denison, Tables 5-1A and 5-1D, pp. 46 and 49.

Labour force and employment growth has been a unique and outstanding feature of recent economic developments in Canada. Table 20 compares employment growth rates and the contribution made by this increase to the growth of net national income. The contributions of employment to growth in each period reflect the growth of employment weighted by the factor share of labour (Table 12). Since the rate of growth of employment in Canada (and Germany) was substantially larger than in other countries, the contribution of employment to the growth in national income was also larger. The contributions of employment to output growth among the 10 countries ranged from a low of 0.1 in France and Norway, to 1.5 per cent in Germany and Canada.

Table 20

GROWTH OF EMPLOYMENT AND THE CONTRIBUTION TO INCOME GROWTH

	Employment Growth			Contribution of Employment Growth to Growth Rate of Net National Income(1)		
	1950-62	1950-55	1955-62	1950-62	1950-55	1955-62
	(Annual average rate)			(In percentage points)		
Canada	2.0	1.7	2.1	1.5	1.3	1.6
United States	1.1	1.5	0.9	0.9	1.1	0.7
Northwest Europe	0.9	1.2	0.7	0.7	0.9	0.6
Norway	0.2	0.2	0.2	0.1	0.1	0.1
United Kingdom	0.7	0.9	0.5	0.5	0.7	0.4

(1) Does not take account of minor refinements discussed in Chapter X.

Source: Canada -- see text.
United States and Europe -- Denison, Table 5-3, p. 52.

MAN-HOURS

Level in 1960

The objective of this section is to develop for 1960 the number and "quality" of hours worked per person employed. The estimation of the role of man-hours in accounting for differences in the level of output was affected to a significant degree by the lack of comprehensive data on hours worked that corresponded to the labour force employment data.[1/] The hours estimates for Canada are discussed in the Notes to this Chapter.

For the economy as a whole in 1960, hours worked per week in Canada were somewhat longer than in the United States. Many of the apparent differences in the aggregated data reflect, however, the relative importance of paid workers vs. proprietors, full- vs. part-time employment, or male vs. female workers. The average European worked a substantially longer week than his opposite number in Canada or the United States.

1/ Data on employment and man-hours for the commercial sector and several subsectors of the Canadian economy are available in the DBS publication, Aggregate Productivity Trends, 1946-66 (14-201), Ottawa, Queen's Printer, 1967. The employment and hours components derived for these productivity estimates are especially refined to represent actual annual labour inputs that correspond to the sector output data.

Table 21

AVERAGE WEEKLY HOURS OF CIVILIANS AT WORK

ABOUT OCTOBER,(1) 1960

(Relatives, U.S. = 100)

	Canada	United States	Northwest Europe	United Kingdom
Nonagricultural paid workers				
Full-time -- total	98.9	100.0	106.6	106.2
Male	98.0	100.0	107.2	109.2
Female	100.2	100.0	105.5	99.8
All civilian employment				
Full-time and part-time -- total	104.6	100.0	112.3	108.7
Male	103.2	100.0	111.4	109.8
Female	104.2	100.0	115.2	106.6

(1) The effect of weather on the survey week is discussed in the Notes.

Source: Canada -- The comparison of hours worked in Canada and the United States in 1960 was based on data from DBS (see Notes).
United States and Europe -- Denison, Table 6-2, p. 56.

If the hours worked by male, full-time, paid, nonagricultural workers shown in Table 21 represent reasonable orders of magnitude, Canadians in this group worked 2 per cent or an hour less per week than their U. S. counterparts in 1960.[1/] Nonfarm full-time workers in Italy, France and the Netherlands worked more hours per week -- some 10 per cent more than in Canada. In all the Northwest European countries, the hours spent in nonfarm employment were significantly more than in Canada and about 6 1/2 per cent longer than in the United States.

The average number of hours per week for all employees was almost two hours more in Canada than in the United States. This reflects relatively fewer part-time workers in Canada as well as substantially longer hours for farm workers.[2/]

1/ The hours comparison reflects the effect of cyclical fluctuation of hours in response to changing levels of demand. In 1960, the level of underutilization as indicated by the unemployment rate was significantly higher in Canada than in the United States, i. e. 7. 0 compared with 5. 6 per cent. The impact of differences in the level of demand on output per unit of input is taken into account in Chapter XIV.

2/ The hours data raise a number of interesting and disturbing questions. For example, the hours recorded for Canadian farm workers were exceeded only in the Netherlands. The hours for farm women in Canada were the lowest of all the countries; male farm hours were equivalent to the European average and more than in the United States. Total farm hours were just slightly under the male average because of the few women employed on farms. These data suggest the possibility of differences among countries in the reporting of farm hours.

Hours worked in a particular survey week do not provide an indication of the number of hours worked per year until account has been taken of any special characteristics of the survey week and of the people who are employed but not at work because of vacations, statutory holidays, illness, strikes, etc. Various data relating to the adjustments used to derive the annual estimates are referred to in the Notes to this Chapter. It was concluded on the basis of the available evidence that the relationship of hours in the survey week to annual hours was similar in Canada and the United States. The annual hours relatives for Canada and the United States in Table 23 are therefore identical to those in Table 22. In most of Northwest Europe, workers were away from work more each year than in the United States; as a result the relatives of annual hours were lower than those for the survey week.

Productivity and Hours: Quality of an Hour's Work

There is a strong presumption that, within limits, efficiency and productivity per hour rise as weekly hours are reduced.[1/] The extent to which the decline in hours worked is accompanied by an increase in hourly output is referred to subsequently as the productivity offset. In the United States in 1960 the level of hours worked by full-time nonfarm wage and salary workers was assumed by Denison to be consistent with a 30 per cent productivity offset; that is to say, a 1 per cent decline in annual hours would reduce output by only 7/10 of a per cent. The productivity offset in Canada in 1960 was assumed to be only marginally under 30 per cent.[2/]

Special assumptions were made for three remaining groups of employees -- part-time workers, the self-employed and the military. Differences in the number of hours worked per week by part-time workers were assumed to have no measurable effect on output per hour, and the annual labour input was measured by total annual hours. For proprietors, including farmers and other full-time but unpaid workers, annual output was assumed to be independent of annual hours and input was related to employment. Since military hours were assumed to be identical in all countries, no quality adjustment was required.

The average number of hours per year per worker, adjusted to take account of the effect of the number of hours on output per hour and per year, are shown in Table 22. Annual hours worked by nonfarm, full-time, paid employees were marginally fewer and the quality of an hour's work per man was higher in Canada than in the United States.[3/] As a result, the quality of a full year's work by this group

1/ See Denison, p. 59 et seq., for a discussion of the effect of the length of hours on the quality of an hour's work and for related literature and studies. Irving F. Leveson, "Reductions in Hours of Work as a Source of Productivity Growth", Journal of Political Economy, (J. P. E.), Vol. 75, No. 2, April 1967, discussed the assumptions made by Denison in his earlier study of U. S. Sources of Economic Growth, and the 1947 study by the U.S. Bureau of Labor Statistics (BLS). The second Denison study, Why Growth Rates Differ, which had not been published at the time the Leveson article appeared, used a more restricted application of the productivity offset.

2/ Hours for full-time male nonfarm workers in Canada in 1960 were 2 per cent lower than in the United States. It has been assumed, however, that some part of this difference reflects cyclical factors that do not necessarily imply a smaller productivity offset in Canada than in the United States.

3/ This calculation is compatible with the required methodology, but the quality of the data inputs suggests caution in drawing conclusions from small differences between hours in Canada and the United States.

of employees was not quite 1 per cent below the level in the United States. Average annual hours worked by civilian and all employees were about 4 1/2 per cent more than in the United States, and the quality of a year's work (taking account of the productivity offset for full-time, paid, nonfarm workers) was about 4 1/2 per cent above the level in the United States. As indicated in Tables 21 and 22, weekly and annual hours worked in Northwest Europe were more than 10 per cent greater than in the United States, but output per worker per hour was about 2 per cent lower. As a result the quality of output per man-year was 8 per cent above the U. S. level.

Table 22

ANNUAL HOURS WORKED AND THE QUALITY OF LABOUR INPUT

PER PERSON EMPLOYED, 1960

(Relatives, U.S. = 100)

	Canada	Northwest Europe	Norway	United Kingdom
Annual hours worked				
Nonagricultural paid full-time workers	98.9	105.6	101.4	106.5
Civilian employment	104.6	110.8	107.8	109.0
Total employment	104.3	110.4	107.5	108.7
Quality of an hour's work				
Nonagricultural paid full-time workers	100.4	97.8	99.7	97.2
Civilian employment	100.3	97.7	99.5	97.8
Total employment	100.3	97.8	99.6	98.0
Quality of a year's work				
Nonagricultural paid full-time workers	99.3	103.3	100.9	103.6(1)
Civilian employment	104.9	108.2	107.3	106.6
Total employment	104.5	108.0	107.0	106.5

(1) This figure is a correction by Denison to the 104.1 given in Why Growth Rates Differ.

Source: Canada — Table 21, text and Notes.
United States and Europe — Denison, Table 6-4, p. 63.

Changes in Hours Worked

Average weekly hours of work have, by and large, been declining everywhere. In general the decline is smaller in countries that have achieved a relatively low level of hours per week than in those countries with longer hours and more scope for reductions. The decline in average hours reflects both the trend to a shorter work week and an increase in the importance of part-time workers, particularly women. Comparable data have not, as yet, been fully developed for Canada, but the evidence suggests that the pattern in Canada has been similar to that in the United States (see Notes for a discussion of the time series estimates for Canada).

Table 23

INDEXES OF AVERAGE ANNUAL HOURS WORKED

BY NONAGRICULTURAL WAGE AND SALARY EMPLOYEES

(1950 = 100)

		1950	1955	1960	1962
Canada	Males	100.0	96.2	94.2	94.0
	Females	100.0	97.3	92.8	91.1
United States	Males	100.0	100.0	98.5	98.7
	Females	100.0	96.8	94.2	92.7
France	All workers	100.0	100.9	99.5	99.2
United Kingdom	Females	100.0	99.5	96.0	92.5

Source: Canada -- see footnote to Table 21 and Notes.
United States and United Kingdom -- Denison, Table 6-5, p. 64.

Table 24 sets out indexes of annual hours, the increased quality of an hour's work which reflects the productivity offset, and the quality of a year's work, for nonfarm paid workers.[1/] The annual quality index for total employment takes into account a zero productivity offset for hours worked by the military, by agricultural workers and by other unpaid workers.

1/ Changes in the annual average of monthly data on hours worked per week are used to represent changes in annual hours worked. The estimates of labour input for the commercial sector of the economy available in Aggregate Productivity Trends, op. cit., take account in a comprehensive way of changes over time in full- and part-time employment, hours worked, holidays and other time away from work.

Table 24

INDEXES OF ANNUAL HOURS, OUTPUT PER HOUR, AND PER YEAR, PER PERSON EMPLOYED, CANADA AND UNITED STATES

(1950 = 100)

	Canada				United States			
	1950	1955	1960	1962	1950	1955	1960	1962
Nonagricultural paid workers								
Annual hours	100	96.4	93.6	92.9	100	98.7	96.3	96.0
Quality of an hour	100	101.8	102.8	102.9	100	100.2	100.2	100.2
Quality of a year	100	98.1	96.2	95.6	100	98.9	96.5	96.2
All employment								
Quality of a year	100	98.5	97.1	96.6	100	99.1	97.2	97.0

Source: Canada -- see footnote to Table 21 and Notes.
United States -- Denison, Table 6-6, p. 66.

The decline in average hours worked in Canada reduced the total labour input per person employed by 0.3 per cent per year. This reduction reflected a 7 per cent decline in hours worked[1/] and a 3 per cent increase in the quality of an hour worked by nonfarm wage and salary workers. In the United States, on the other hand, the hours of paid workers declined less and, because of the increase in part-time employment, the productivity offset was marginal. As a result, the decline in the average quality of a year's work due to changes in hours was almost identical in the United States and Canada. The European countries, like Canada, experienced a larger drop in average annual hours worked and a substantially larger productivity offset. The decline in annual quality due to changes in hours was also 3 per cent in Northwest Europe.

1/ Aggregate Productivity Trends, op. cit., indicates that in the commercial non-agricultural sector in Canada, hours per person employed declined almost 7 per cent from 1950 to 1962.

CHAPTER V

AGE AND SEX COMPOSITION OF EMPLOYMENT

There are wide international differences in the age and sex composition of the population and the labour force. As Table 25 indicates, employment in Canada was made up of a small proportion of females and conversely a high proportion of males compared with the United States or with Europe. The male participation rate in Canada was comparable to that in the United States and in many European countries (see Table 27). The rates of male participation were particularly high in the United Kingdom and Germany.

Males age 20 to 64 dominate the labour force. The importance of this group varied from a low share of 53 per cent in Denmark and Germany to 64 and 65 per cent in Canada and the Netherlands. But these share differences also reflected the importance of the "marginal" groups -- females, young adults and the elderly. Variations in the distribution of employment by age and sex arise from factors other than the age distribution of the population, such as the school-leaving age for young people, the female participation rate, 1/ and the adequacy of pension and other retirement benefits for older people.

Table 25

EMPLOYMENT BY SEX, AGE AND MILITARY STATUS, 1960

(Percentage shares)

	Total Employment	Civilians						Military
		Males			Females			
		Under 20	20-64	65 & Over	Under 20	20-64	65 & Over	
Canada	100	4.9	63.9	3.0	4.0	21.6	0.6	2.0
United States	100	4.2	56.9	3.2	3.0	27.8	1.3	3.6
Northwest Europe	100	5.4	55.6	2.5	5.1	27.8	1.2	2.4
Netherlands	100	6.2	65.0	2.6	6.5	16.0	0.5	3.1
Norway	100	4.5	58.8	4.3	5.0	22.8	1.5	3.0
United Kingdom	100	5.3	56.6	2.6	5.3	27.2	0.9	2.1

Source: Canada -- DBS, The Labour Force, op. cit.; and Bank of Canada, Statistical Summary Supplement, op. cit.
United States and Europe -- Denison, Table 7-1, p. 71.

It is assumed that, other things being equal, labour quality is proportional to earnings. As a result, the wide difference in male-female earnings gives particular importance to the quality-deteriorating effects of a high or rising female

1/ Changes in the female participation rate accounted for three-quarters of the increase in the number of women in the labour force between 1951 and 1961; one-quarter reflected demographic and interaction effects. See John D. Allingham, The Demographic Background to Change in the Number and Composition of Female Wage-Earners in Canada, 1951 to 1961, DBS, Special Labour Force Studies, Series B, No. 1 (71-511), Ottawa, Queen's Printer, 1967, Table VIII, p. 16.

participation rate. In 1960, 26 per cent of employment in Canada was female -- the smallest share of all the countries under study except the Netherlands (Table 25). In Germany, 37 per cent of workers were female, 11 percentage points more than in Canada. A low level of female participation, however, has larger scope for increase. In the period 1950 to 1962, the Canadian female participation rate rose from 26 to 34 per cent, the U. S. rate from 38 to 44 per cent, and the U. K. rate from 43 to 49 per cent (Table 26).

Table 26

MALE AND FEMALE LABOUR FORCE PARTICIPATION RATES(1)

(Per cent)

	Male	Female				
	1962	1950	1955	1960	1962	1964
Canada	90.3	26.2	27.3	32.0	33.5	35.2
United States(2)	91.5	37.6	40.4	43.2	43.5	44.4
France	91.0	n.a.	47.8	47.0	44.7	42.8
Germany	94.9	n.a.	n.a.	49.1(3)	49.4	49.1
Netherlands	92.1	n.a.	n.a.	n.a.	27.1	27.4
Norway	92.2	n.a.	39.8	38.8	39.2	39.3
United Kingdom	98.2	42.9(4)	46.3	48.0	49.0	49.6

(1) Number in the labour force as a percentage of population of that sex, age 15 to 64.

(2) 1950 and 1955 exclude Alaska and Hawaii.

(3) Excludes West Berlin.

(4) Excludes women on release leave from the services who have not yet taken up employment.

Source: OECD, Manpower Statistics, op. cit., various issues.

Many countries, faced with a small increase in the male labour force, actively seek to lure women, particularly married women,[1/] out of their homes and into shops and offices. There is little evidence that Canada has gone as far in this direction as, for example, some of the Scandinavian countries. In this country, the continued growth in the importance of the service industries and in part-time employment will reinforce the growing importance of women in the labour force.[2/]

1/ The changing pattern of female employment includes a marked increase in the importance of married women. In the United States in 1947, some 41 per cent of working women were married; by 1967, 57 per cent were married. See Vera C. Perrella, "Women and the Labor Force", Monthly Labor Review, BLS, Washington, U. S. Government Printing Office (GPO), Vol. 91, No. 2, February 1968, p. 1.

2/ For a discussion of the role of women in the Canadian labour force, see also John D. Allingham, Women Who Work: Part I, The Relative Importance of Age, Education and Marital Status for Participation in the Labour Force, DBS, Special Labour Force Studies, No. 5 (71-509), Ottawa, Queen's Printer, 1967.

Participation of the elderly in the labour force reflects many factors -- tradition and custom, government and industrial pension policies, economic circumstances, levels of education, health, etc. In labour-deficient countries there is, of course, a special incentive to try to retain workers past a "normal" retirement age, and some countries have policies directed to this end. High levels of income from employment, pensions and social security encourage early retirement. The individual decision to retire takes account of physical and mental well-being, as well as employment opportunities and income or wealth.

In Canada and the United States, the share of people age 65 and over in the labour force declined significantly between 1950 and 1962. In Canada the share fell from 22 per cent in 1951 to 17 per cent in 1961; the U. S. share was higher to start with -- 25 per cent in 1950 -- and declined to 19 per cent in 1960. In the United Kingdom the participation rate for over-65's was well below that in Canada or the United States; it was 16 per cent in 1951 and had declined by three percentage points in 1961.[1/] It is interesting, but beyond the scope of this paper, to assess the effect of the welfare state, the level and distribution of income, health, and education on the role of the elderly in the economically active population.

As Table 25 suggests, only 2 to 6 per cent of total employment in 1960 was drawn from the 65-and-over age group. In Norway the share was almost 6 per cent; in Belgium it was 2. 3 per cent. The relative importance of older workers in employment reflects the scarcity of workers, the importance of self-employment, including unpaid family workers in farm and nonfarm employment, as well as the age distribution of the population.

1/

Economically Active Labour Force Participation Rates

(Per cent)

	Under 20 Years		65 Years and Over	
	1951	1961	1951	1961
Canada	48	38	22	17
United States(1)	36	36	25	19
United Kingdom	81	74	16	13

(1) 1950 and 1960.

These estimates were compiled from a variety of sources: OECD, Manpower Statistics, op. cit.; International Labour Office (ILO), Year Book of Labour Statistics, Geneva; DBS, The Labour Force, Special Tables, unpublished; U. S. Department of Commerce, Statistical Abstract of the United States, Washington, GPO; and Central Statistical Office, Annual Abstract of Statistics, London, Her Majesty's Stationery Office (HMSO).

Table 27

CHANGES IN THE DISTRIBUTION OF EMPLOYMENT BY AGE AND SEX

(Percentage shares)

	Canada		United States		United Kingdom	
	1950	1960	1950	1960	1952	1962
Males						
Under 20	6.5	4.9	4.5	4.2	4.6	6.1
20-64	66.9	63.9	60.4	56.9	56.7	55.0
65 and over	4.0	3.0	3.8	3.2	2.4	2.0
Females						
Under 20	3.9	4.0	2.9	3.0	5.6	5.9
20-64	17.2	21.6	24.9	27.8	26.9	28.3
65 and over	0.4	0.6	0.9	1.3	0.5	0.8
Subtotal	99.0	98.0	97.3	96.4	96.8	98.1
Military	1.0	2.0	2.7	3.6	3.2	1.9
Total employment	100.0	100.0	100.0	100.0	100.0	100.0

Source: Canada -- see Notes.
United States -- Manpower Report of the President, March 1965, Washington, GPO.
United Kingdom -- Central Statistical Office, Annual Abstract of Statistics, 1962 and 1966, op. cit.
United States and United Kingdom -- military data from OECD, Manpower Statistics, 1950-62, op. cit.

The share of employment consisting of young people varied from 7 per cent in the United States in 1960 to almost 14 per cent in Italy. It was over 10 per cent in the countries of Northwest Europe. In Canada, 10 per cent of all employees were under 20 years of age in 1950, and about 9 per cent in 1960. As footnote 1, page 47, indicated, the participation rate for young people was almost twice as high in the United Kingdom as in Canada or the United States. These differences in participation largely reflected differences in school enrolments. By 1961 the youth participation rates in Canada and the United States were roughly similar.

It would be unreasonable to expect the share of young people in the labour force to increase significantly as long as a high priority is given to raising the average number of years of education and to increasing the number of workers with high levels of full-time technical and professional education. As noted above, the age distribution of the population is a major factor determining the relative contributions of various age groups to the labour force,[1/] but the continuing rise in the

1/ For a discussion of nonparticipation of adult males, see Susan S. Holland, "Adult Men Not in the Labor Force", Monthly Labor Review, op. cit., Vol. 90, No. 3, March 1967, p. 5.

school retention rate has tended, and will continue, to reduce the importance of young people in the labour force. 1/

HOURS WORKED BY AGE AND SEX

In the absence of Canadian data on average hours worked by different age groups, the U. S. pattern was used. The level of hours for each sex was adjusted to that appropriate for Canada and consistent with the estimates used in the previous Chapter. 2/ The 1960 distribution of man-hours was based on the age-sex distribution of the labour force and of average hours (Table 28). Shorter hours for women and young people reduce the importance of these groups in labour input relative to males age 20 to 64. The female input weight dropped from 26. 2 per cent based on the number of workers to 23. 1 per cent based on hours.

Table 28

DISTRIBUTION OF MAN-HOURS BY AGE AND SEX, 1960

(Percentage shares)

	Total Man-Hour Inputs	Civilians						Military
		Males			Females			
		Under 20	20-64	65 & Over	Under 20	20-64	65 & Over	
Canada	100	3.3	69.0	2.6	2.7	19.9	0.5	2.1
United States	100	2.9	62.5	2.8	1.9	24.9	1.0	4.0
Northwest Europe	100	4.8	60.4	2.1	4.0	25.3	1.0	2.4
United Kingdom	100	4.9	62.3	2.5	4.0	23.5	0.7	2.1

Source: Canada -- see text.
United States and Europe -- Denison, Table 7-2, p. 72.

EARNINGS BY AGE AND SEX

The cross-section comparison for 1960 of the quality of the labour input, with respect to the age and sex distribution, used U. S. average hourly earnings as weights for each age and sex group. These are given in Table 29 below.

1/ The recent increase in the lower age limit used to measure the labour force and employment in the United States -- from 14 to 16 years -- reflects the declining importance of the younger age groups in the economically active population. See BLS, Employment and Earnings and Monthly Report on the Labor Force, Washington, GPO, Vol. 13, No. 8, February 1967.

2/ Tables 25 and 27 provide the distribution of employment by age and sex. The distribution of hours by age group for each sex was derived from Denison, Table E-1, p. 371; average hours for Canadian males and females were separately distributed at levels consistent with those used in Chapter IV (Table 21).

After looking at the available earnings data for other countries, 1/ Denison decided to use the 1960 U. S. earnings relatives for the time series as well as for the 1960 cross-section comparison. Census data on annual earnings of Canadian workers employed for a full year were broadly similar to those in the United States, and the age-sex adjustment would not have been very different if it were based on Canadian weights. 2/ To maintain comparability with the Denison estimates, U. S. earnings data were also used for Canada.

Table 29

U.S. EARNINGS RELATIVES BY AGE AND SEX, 1960

(Males, age 20-64 = 100)

	Average Hourly Earnings by Age		
	Under 20	20-64	65 & Over
Civilians			
Males	31	100	82
Females	40	59	47

Source: Denison, Table 7-3, p. 72.

LABOUR QUALITY AND EMPLOYMENT BY AGE AND SEX

The distribution of man-hours by age and sex, weighted with U. S. earnings, gave the cross-section and time series estimates of the effect of age and sex on the quality of output per man-hour shown in Table 30.

1/ Hourly earnings in the United Kingdom indicated relatives not very different from those in the United States. These relatives are based on data in Britain: An Official Handbook, 1961 Edition, prepared by the Central Office of Information, London, HMSO, 1961, p. 463.

Hourly Earnings Relatives	
Men, 21 and over	100
Youths and boys, under 21	47
Women, 18 and over, full-time	60
Girls, under 18	38

2/ Census data on average wages and salaries of (full-time) wage-earners in Canada suggest relatives by age and sex for the year ending May 31, 1961 of

	Male	Female
Under age 20	47	41
Age 20-64	100	61

Based on earnings data for employees in the current labour force who reported usually working 35 hours a week or more, from J. R. Podoluk, Earnings and Education (91-510), DBS, Ottawa, Queen's Printer, 1965, Table 4, weighted by the number of full-time and part-time workers from the 1961 Census of Canada, Vol. III (Part 3), Earnings of Wage-Earners by Marital Status and Sex, Bulletin 3. 3-4 (94-536), Ottawa, Queen's Printer, 1964, Table 15.

Table 30

RELATIVES FOR 1960, AND INDEXES OF THE QUALITY OF A MAN-HOUR'S WORK AS AFFECTED BY AGE AND SEX, 1950-62[1]

	1960 Relatives U.S. = 100	Quality Index, 1950 = 100			
		1950	1955	1960	1962
Canada	102.6	100	99.9	98.7	98.3
United States	100.0	100	99.1	98.4	98.2
Northwest Europe	97.5	100	99.7	100.1	100.5
United Kingdom	98.6	100	99.5	99.6	99.3

(1) U.S. earnings weights are used for all countries.

Source: Canada -- see text.
United States and Europe -- Denison, Tables 7-5 and 7-7, pp. 75 and 77.

From 1950 to 1955 the Canadian age-sex quality index did not change appreciably, but the index for the United States and the European countries declined. This is a reflection of the very small increase in the female participation rate in Canada during that period. In the next five years and to 1962, however, the Canadian female participation rate rose rapidly -- much faster than in the United States. As a result the Canadian quality index declined. Over the 12-year period as a whole, the largest increase in the labour input quality index was 2 per cent in France and Italy, and the largest decline was just under 2 per cent in Canada and the United States.

The Canada-U. S. relative for 1960 of 102. 6 largely reflects the opposite side of the coin -- the low female participation rate in Canada. Of all the countries in Denison's study, only the Netherlands, which had an even smaller female participation rate than Canada, had an age-sex quality adjustment which was higher than that of the United States.

In both Canada and the United States, the share of young people in the labour force was small compared with Europe. This reflects higher school retention rates in North America, particularly in the United States. The pattern of participation of workers age 65 and over was more varied in its effect on labour quality. Early retirement may reflect affluence or forced idleness for the unemployable. On the other hand, skilled professional workers tend to stay on past a traditional retirement age. The participation of these junior and senior citizens affected the average "quality" of labour input. The major impact, however, arose from the relative importance of adult males and females in the labour force.

CHAPTER VI

EDUCATION

The role of education in economic growth has been the subject of much attention over the past decade,[1] but data in many areas are still incomplete. Two studies provided the backdrop and a statistical base for the estimates of the contribution of education to growth and income levels in Canada that are presented in this Chapter.[2][3]

The estimates of the contribution of education to the level and growth of output in Canada follow the Denison assumptions and methods.[4] The results differ somewhat from those in the Bertram study which measured the stock of education in the Canadian male labour force age 25 to 64. Women and young men under 25 are important elements in labour force changes over time, and their role differs markedly among countries. For this Study, therefore, it was necessary to assess the educational content of the total labour force.

EDUCATION COMPOSITION OF THE LABOUR FORCE

Table 31 illustrates the striking international differences in the distribution of the male labour force by level of education.[5] The most striking feature in this comparison is the difference in the concentration of higher levels of education in the labour force. In the United States in 1957 almost 20 per cent of the male labour force had some university or higher education; in Canada in 1961 the share was under 10 per cent. In 1951 only about 4 to 5 per cent of the male labour force in the United Kingdom had more than a secondary level of education. By 1961, using a more restricted classification in the Census for England and Wales,[6] the proportion with higher education may have been between 6 and 7 per cent, but was still

---

[1] It is beyond the scope of this paper to outline the literature relating to human capital and education. A bibliography and an interesting summary of the field are given in Wilkinson, Studies in the Economics of Education, op. cit. Wilkinson also discusses the education and productivity assumptions and estimates used by Denison in his earlier study Sources of Economic Growth, op. cit. These have been substantially altered in Why Growth Rates Differ, op. cit.

[2] Podoluk, op. cit.

[3] Gordon W. Bertram, The Contribution of Education to Economic Growth, Staff Study No. 12, prepared for the Economic Council of Canada, Ottawa, Queen's Printer, 1966.

[4] Denison, Chapter Eight.

[5] Data are for different years and therefore are not strictly comparable. Since the distribution of the labour force by level of education does not change rapidly, broad inferences from the data may be warranted. The comparison is drawn for the male labour force because comparable data for the total labour force are not available. The inference of significant differences in the education distribution would be appropriate for the total as well as for the male labour force.

[6] Estimate based on General Register Office, England and Wales, Census 1961, Education Tables, London, HMSO (70-898), 1966.

well below the level in Canada and a long way below the level in the United States. These large international differences in the amount of skilled or highly educated manpower reflect, to some extent, differences in the economic and social background of the countries. To the extent that the application of new technology requires education, economic growth and productivity are jeopardized by a shortage of skilled manpower at every level.

Table 31

DISTRIBUTION OF THE MALE LABOUR FORCE BY YEARS OF EDUCATION

(Percentage shares)

Number of Years of Education	Canada 1961	United States 1957	France 1954	United Kingdom 1951	Italy 1961
0-4	7.5	7.1	2.7	0.4	39.8
5-6	20.8	6.3	19.2	0.8	38.0
7		5.8	21.1	4.0	4.2
8	17.6	17.2	27.8	27.2	8.1
9	11.1	6.3	4.6	45.1	0.7
10	12.0	7.3	4.1	8.4	0.7
11	6.6	6.0	6.5	7.3	0.6
12	14.9(1)	26.2	5.4	2.5	1.8
13-15	3.9(1)	8.3	5.4	2.2	3.0
16+	5.6	9.5	3.2	2.1	3.1
	100.0	100.0	100.0	100.0	100.0

(1) The shares for 12 and 13-15 years of education in Canada reflect the fact that in some provinces senior matriculation requires five (not four) years of high school; on this basis the 13-15-year group would include some high school students, as well as those with some university education. The high school component of 13 years (over six percentage points) has been moved back into the 12-year group so that 13-15 more closely approximates post-secondary or university education.

Source: Canada -- Bertram, op. cit., Table A-15, p. 90 and Table 11, p. 21; the Canadian figures are for males age 25-64. See also footnote (1). United States and Europe -- Denison, Table 8-1, p. 80; the U.S. figures include civilian males 18 years and over.

Using the labour force distribution by level of education, mean years of education per person in the labour force may be estimated in total or by sex. Table 32 sets out some of the estimates which have been made of the average number of years of education embodied in the labour force.[1/] This comparison suggests that the average level of labour force education in Canada is more than one full year below the U. S. level, but above the level in a number of European countries. Estimates of the median level of education indicate a similar disadvantage in Canada compared with the United States.[2/]

1/ It is possible to use mean years of education as the basis for estimating labour-input quality relatives. A calculation, based on mean years, values each year of education equally. This seems a doubtful presumption. Denison discusses the possibility of incorporating various adjustments into the "years" calculation. Since the method is not in fact used, it is not pursued here. See Denison, p. 104.

2/ The median level of schooling of the male labour force age 25 to 64 in Canada was 9.4 in 1961; for the U. S. male population age 25 and over, the median was 10.3 years in 1960 and 11.1 years in 1962. Bertram, op. cit., Table 4, p. 13.

Table 32

MEAN YEARS OF EDUCATION OF THE LABOUR FORCE

(In years)

	Bertram[1] 1961 Males	OECD[2] 1961 Labour Force	Denison[3] 1962 Males
Canada	9.15	9.43	n.a.
United States		10.54	10.68
France		8.38	8.65
Netherlands		7.60	9.11
Norway		8.69	8.40
United Kingdom		9.02	9.71

(1) Mean years for males age 25 to 64 from Bertram, op. cit., Table 5, p. 14.

(2) Colin Leicester, "Manpower Link Between Economic Growth and Education", unpublished paper prepared for OECD, 1966, Table 3.

(3) See Denison, Table 8-12, p. 107, unadjusted for absenteeism and extension of the school year.

CHANGES IN THE STOCK OF EDUCATION

Changes in the labour force and its education content arise in three major ways: first, through immigration; second, as young people with more and more education leave school to seek employment; and third, as increasingly large numbers of women, especially married women, join or rejoin the labour force. Withdrawals from the labour force arise largely from retirement of older, and on average less well-educated, members of the labour force. The following section discusses the impact of immigration, and of participation of women, the elderly and the young, on the stock of education in the Canadian labour force.

The importance of immigration in Canadian labour force growth was discussed in Chapter IV. The gain to the economy of this immigrant influx was not only in numbers, but in their contribution to a more highly educated labour force. While the median level of education of the post-war immigrant and native Canadian-born worker was almost identical, a larger proportion of both the male and female immigrant workers had a university degree or high school education (Table 33). The gap between Canada and the United States with respect to the higher levels of education would have been larger without these more highly qualified immigrants.

Not only did the immigrant population bring to Canada a higher level of education, but labour force participation rates of the migrant population were higher at every level of education (Table 34). Immigrant females in particular had participation rates well above those for Canadian-born women. These special characteristics of the immigrant population reflect in part different economic circumstances and a lower average age compared with native-born persons.

Table 33

DISTRIBUTION OF EDUCATIONAL ATTAINMENT

OF NATIVE-BORN AND POST-WAR IMMIGRANT LABOUR FORCE,

14 YEARS OF AGE AND OVER, CANADA, FEBRUARY 1965

	Labour Force					
	Native-Born			Post-War Immigrant		
	Male	Female	Total	Male	Female	Total
	(Per cent)					
Completed elementary school or less	42.7	25.9	37.9	41.9	36.1	40.2
Some high school	33.7	36.8	34.6	24.0	25.1	24.3
Completed high school or attended university	18.3	32.8	22.4	25.2	33.3	27.6
University degree	5.3	4.5	5.1	8.9	5.5	7.9
	100.0	100.0	100.0	100.0	100.0	100.0
	(In years)					
Median years completed	9.2	10.5	9.6	9.5	10.2	9.7

Source: Frank J. Whittingham, Educational Attainment of the Canadian Population and Labour Force: 1960-1965, DBS, Special Labour Force Studies, No. 1 (71-505), Ottawa, Queen's Printer, 1966, Table 11, p. 15.

Table 34

LABOUR FORCE PARTICIPATION RATES OF NATIVE-BORN AND POST-WAR IMMIGRANTS,

25 YEARS OF AGE AND OVER, BY SEX AND LEVEL OF EDUCATION,

CANADA, FEBRUARY 1965

(Per cent)

	Native-Born		Post-War Immigrant	
	Male	Female	Male	Female
Completed elementary school or less	75	18	95	31
Some high school	92	30	98	39
Completed high school	91	36	97	41
Some university	89	41	92	45
University degree	94	50	96	60

Source: Ibid., Table 13, p. 17.

The discussion of the distribution of the labour force by level of education and the estimates of median levels of education were based largely on data relating to the educational achievements of the male labour force because more complete data were not available. This does not affect, in a significant way, the analysis or conclusions about education, but it may be of interest to note that, by and large, the female population and labour force are better educated than the male. The distribution of the population and labour force by broad levels of education is shown in Table 35.

Table 35

DISTRIBUTION OF POPULATION AND LABOUR FORCE, 14 YEARS OF AGE AND OVER, BY LEVEL OF EDUCATION, CANADA, FEBRUARY 1965

(Percentage shares)

	Population			Labour Force		
	Male	Female	Total	Male	Female	Total
Less than a complete high school education	77.6	74.9	76.2	75.1	62.5	71.4
Completed high school or attended university	17.7	22.6	20.2	19.2	32.9	23.2
University degree	4.7	2.5	3.6	5.7	4.6	5.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Ibid., Table 4, p. 10.

The proportion of women in the population and in the labour force with a university degree was smaller than the proportion of men. However, a much larger share of the female population and labour force had secondary education compared with males. In the United States, the margin between levels of male and female education exists but has narrowed. The median number of school years completed by the 1960 female population 25 years of age and over, in the United States, was 10.7 years; the median was 10.3 years for males. Some 43 per cent of the female population in 1960 had at least four years' high school or more, while 40 per cent of U. S. males had reached that level.[1/]

In periods of rapid labour force growth when the increment of young workers is large, the impact of recent education patterns on the education stock of the labour force is substantial. The effect of young well-educated recruits into the labour force is reinforced by the retirement of the elderly. The median years of education by age group are shown in Table 36. For both males and females, the education of those entering the labour force was two to three years longer than the education of those going into retirement.[2/]

1/ John K. Folger and Charles B. Nam, Education of the American Population, a 1960 Census Monograph, U. S. Department of Commerce, Washington, GPO, 1967, Table V-5, p. 143.

2/ In the U. S. population in 1960 the difference in median years of schooling between the 65-and-over age group and the 25-to-34 was almost four years. Ibid., Table V-3, p. 136.

Table 36

MEDIAN YEARS OF EDUCATION COMPLETED

FOR COHORTS OF THE NATIVE-BORN POPULATION BY SEX, CANADA, 1965

Age in 1965	Male Population	Female Population
65 years and over	7.7	8.0
55-64 years	8.0	8.2
45-54 years	8.4	9.1
35-44 years	9.2	9.5
25-34 years	9.6	10.1
20-24 years	10.5	10.8

Source: Whittingham, op. cit., Table 3, p. 9.

By and large, however, the quantity of education embodied in the labour force as a whole reflects the levels and standards of education back to the turn of the century. Significant improvement in productivity through increases in the average level of formal education of the labour force is not effected in the short run. The education policy of today will be reflected in the productivity performance of the future.

The earlier discussion of the age and sex attributes of the labour force took account of changes in the contribution of young people and women, and attempted to quantify their effect on the average level of productivity of the labour force. This Chapter is concerned to measure the formal education content of the labour force and to assess its contribution to growth and income levels. The changes in education content of the labour force are, however, indirectly related to the age and sex characteristics and sometimes in an ambivalent way. Young people in the labour force reflect an age (experience) liability on the one hand, but an education advantage on the other. Older workers have, on average, lower earnings, reflecting both an age disability and lower levels of education. The contribution of higher levels of skill and know-how gained through experience is not covered by the measures used in this Study.[1/]

THE EFFECT OF EDUCATION ON LABOUR QUALITY

The marginal productivity assumption used in this Study implies that average earnings are proportional to the average value of the marginal product. Thus the estimate of labour quality due to education was based on earnings at different levels of educational achievement. The most controversial aspect of the quality adjustment for education arises from this assumption relating differences in education to differences in earnings. How much of the measured differences in earnings should be attributed directly to education? Denison suggested that some

1/ Some assessment of the contribution of experience is included in Chapter VII, but the estimates are not used in the analysis.

60 per cent of the earnings differential for each level of education (relative to a base of eight years of education) arose from differences in education.[1/]

The calculation of education-related quality was standardized, in an approximate way, for age and sex differences by averaging relative earnings by level of education over several age groups for males and females separately. The Population Census provided data on male and female labour force by level of education in 1961. The comparable distributions in the benchmark years were approximated, using age-cohort techniques.[2/] The male and female distributions by level of education were separately weighted with the earnings relatives. The education earnings data and distributions are discussed in the Notes to this Chapter.

It is possible on the basis of the earnings data and the labour force distributions to estimate the change in the educational quality of the labour force based on the number of years of education. In the following section, the education measure is further refined to take account of changes in the number of days of schooling. A summary estimate based on years and the more restrictive data provided by the 1951 and 1961 Censuses is, however, given in Table N-12 in the Notes. This calculation indicates one interesting aspect which is not apparent in the more aggregative tables. The change in the average quality of the labour force based on years of education rose faster for males than for females. This is not surprising since a large part of the increase in the female labour force came, not from young girls with a higher-than-average level of education, but from married women returning to the labour force or joining it for the first time in "middle age".

Days of Schooling

So far the discussion of education quality has assumed that the value of a given number of years of education has been similar for the last 50 years and that it was identical in the countries under study. Considering the estimates based on years of education, Denison noted:

> These calculations, however, would imply that a person who had attended school for any given number of years around the year 1900, and was still working in 1950, had an education equivalent to that of a person who attended school for the same number of years in the 1920's or 1950's. Taking the United States as a whole this assumption is not tenable, and an adjustment is required to allow for the fact that the amount of education represented by a year has increased over time.[3/]

The length of the school year and school attendance have changed significantly over the years during which the two or three generations in the present labour force were being educated. An adjustment was made to the "years"

1/ The other 40 per cent takes account of differences in earnings that are correlated with education but do not arise from it; these differences reflect factors such as social and economic status, and inherited or acquired characteristics such as drive, ambition, etc. For a discussion of this point, see Denison, pp. 83-84.

2/ The 1961 Census of Canada asked for the highest grade of schooling attended; 1951 Census asked for number of years of schooling. The 1960 Census in the United States asked for the highest grade completed.

3/ Denison, p. 88.

calculation to reflect this aspect of the quality of education.[1/] The number of days of schooling received by each pupil[2/] rose as the school year lengthened, and became more uniform among the provinces and between urban and rural areas. In addition, and particularly in the rural schools, there was a significant increase in attendance ratios. Average school attendance in Canada in 1910 was only 65 per cent of total enrolment compared with over 90 per cent in 1960 (Table N-11). The adjustment for days was combined with the effect of years of education into a composite estimate of labour quality as related to education. The Notes to this Chapter provide more detail.

Table 37 indicates that the quality effect of the formal education content of the labour force in Canada was well below that of the United States in 1960. It was close to the average European level, but below several European countries such as the United Kingdom, the Netherlands and Norway.

Table 37

EDUCATION QUALITY: RELATIVES FOR 1960 AND INDEXES, 1950-62

	1960 Quality Relative (U.S. = 100)	Quality Index (1950 = 100)			
		1950	1955	1960	1962
Canada	93.4	100.0	102.0	103.8	104.3
United States	100.0	100.0	103.3	107.4	109.0
Northwest Europe	92.7	100.0	101.8	103.6	104.5
Norway	94.3	100.0	102.1	104.2	105.1
United Kingdom	93.9	100.0	102.1	104.4	105.5

Source: Canada -- see text.
United States and Europe -- Denison, Tables 8-6 and 8-7, pp. 89 and 91.

The lower education quality relative reflects in part a smaller proportion of the Canadian labour force with 12 or more years of education. In 1959, just over 45 per cent, and three years later over half, of the U. S. male labour force was at or above this level.[3/] Canada had only 25 per cent with this level of education in 1961 (see Table 31). The Canadian labour force had a decided education advantage in having relatively more young people with a higher level of education than the average for the labour force as a whole, and similarly in having fewer elderly members. On balance, however, the lower average and median level of

1/ The assumptions of the effect of a longer school year and higher rates of attendance used by Denison in Why Growth Rates Differ were substantially modified from those used in The Sources of Economic Growth in the United States, op. cit. The increase in the education quality index for the civilian labour force from 1950 to 1960 was 7. 6 per cent in the recent study compared with 10. 3 per cent in the earlier (see Denison, Appendix F, p. 383).

2/ The adjustment for quality relating to days of schooling per year is not made for persons with more than high school education. At the university level, the relationship between the quality of education, length of term and attendance is tenuous to say the least. This assumption also implies that people of the same level of university education attended school regularly and on a full-time basis in 1900 and 1960.

3/ Denison, Table F-9, p. 381.

education of the labour force in Canada in 1960 resulted in an average education quality about 6 1/2 per cent lower than in the United States.

The increase in the average quality of the labour force that arose from changes in the stock of education embodied in it was significantly smaller in Canada (4 per cent) than in the United States (9 per cent) and in certain of the European countries such as Belgium and Italy.[1] As the study by Professor Bertram dramatically illustrated, the rate of increase in the educational attainments has for many decades been lower in Canada than in the United States:

> This appears to reflect, in particular, the widening of the gap at the secondary and university level. In relation to the United States, Canada began to lose ground in its efforts to prepare high school students in the inter-war years, and university students in both the inter-war and the post-war years.[2]

Table 38

MEDIAN YEARS OF SCHOOLING, MALES, CANADA AND UNITED STATES

	Median Years of Schooling				
	Canada	United States		Canada	United States
	(In years)		(Percentage change per decade)		
1910	7.4	7.4			
1920	7.8	7.7	1910-20	5.4	3.6
1930	8.0	8.0	1920-30	3.7	4.3
1940	8.4	8.6	1930-40	4.9	6.7
1950	8.7	9.0	1940-50	3.7	5.3
1960	9.4	10.3	1950-60	7.2	14.4

Note: Canadian labour force age 25-64; U.S. population 25 years and over. Canadian data for Census years by decades 1911 to 1961; United States 1910 to 1960.

Source: Bertram, op. cit., Table A-7, p. 82.

By and large, Canada did not send as many of its young people to school or keep them in school as long as the United States. In 1951-52, secondary school enrolment as a percentage of the population age 14 to 17 was 46 per cent in Canada compared with 78 per cent in the United States.[3] In spite of the number of well-educated immigrants, the educational quality of the labour force did not increase as rapidly in Canada as in the United States over the last decade. A number of factors have contributed to this result. Since the average entrant to the labour force in the mid-1950's would likely have started school about the end of the war,

---

1/ It is possible that the use of only two categories of primary education in the estimate for Canada understated somewhat the rate of growth of education quality.

2/ Bertram, op. cit., p. 61.

3/ Wolfgang M. Illing and Zoltan E. Zsigmond, Enrolment in Schools and Universities 1951-52 to 1975-76, Staff Study No. 20, Economic Council of Canada, Ottawa, Queen's Printer, 1967, Table 3-2, p. 28.

the lack of a significant upgrading of the educational quality of the labour force relates to education policy and practices at, and since, that time. In addition, a second large source of labour force growth during this period was the increase in the female participation rate. It has been noted earlier that these were, in large part, matrons who were older and less well-educated than more recent school-leavers. A final factor, which affected unfavourably the increase in labour force education quality over the period, related to current education practices. Between 1951 and 1961, the share of young people (under age 20) who were economically active in Canada declined sharply as more of them stayed in school. In the United States, the participation remained relatively unchanged. As a result of the increase in the school retention rate in Canada the upgrading of the education content of the labour force through new entries was diminished.[1/]

This pool of more highly educated young people will eventually find its way into the labour force and make, at that time, its contribution to raising the education quality level of the labour force. Thus, current levels of education and longer years of schooling will be reflected in the quality of the labour force in future years. As the enrolment ratios in Table 39 suggest, there are wide differences in school attendance in different countries.[2/] Enrolment ratios at the secondary and vocational school level are somewhat, but not markedly, lower in Northwest Europe and Canada compared with the United States. On the other hand, the share of young people age 20-24 receiving higher education was about four times larger in the United States than in Canada.

Nonformal Education

The estimates of the quality effect of the stock of education on labour input were limited to the formal and full-time aspects of education. For the most part, adult education, including night school, vocational and commercial in-service training, and industrial apprenticeship training and retraining, were not taken into account.[3/] The incorporation of the effect of these additional forms of education for the 1950's would pose almost insuperable measurement problems even for Canada and the United States.

1/ Between 1951-52 and 1960-61 the ratio of secondary school enrolment to population age 14-17 increased from 46 to 66 per cent, and full-time university enrolment to population age 18-24, from 4.2 to 6.7 per cent. Illing and Zsigmond, op. cit., Tables 3-2 and 4-7, pp. 28 and 51.

2/ Comparisons of this type pose difficult measurement problems, and the numbers should be interpreted as broadly suggestive.

3/ For a discussion of the areas of education not covered, see Denison, pp. 96-98 and 401-403.

Table 39

LEVEL OF SCHOOL ENROLMENT, CIRCA 1959[1]

	Primary[2]	Secondary[3]	Vocational[4]	Higher[5]
Canada	884	608	86	73
United States	856	(775)		299
Belgium	696	406	532	71
Denmark	666	426	375	42
France	762	548	200	76
Germany	699	276	478	52
Netherlands	638	474	317	50
Norway	774	347	199	41
United Kingdom	640	(1,023)		39
Italy	565	220	246	39

(1) United States and Netherlands, 1960; Italy, 1958.

(2) Primary school enrolment per 1,000 population age 5-14 years.

(3) Secondary school enrolment per 1,000 population age 15-19 years.

(4) Vocational school enrolment per 1,000 population age 15-19 years.

(5) Higher school enrolment per 1,000 population age 20-24 years.

Source: W. Galenson and G. Pyatt, The Quality of Labour and Economic Development in Certain Countries, Geneva, ILO, 1964.

Differences in educational institutions and practices among countries are even wider in these "peripheral" areas of education than in the formal sphere. Some of the differences affect the definition of formal education as well as its measurement. A study of vocational training by the OECD indicated that this type of training is part of the school system in some countries and part of industry in others.

> Vocational education systems . . . differ widely in pattern in the light of the circumstances in which they have developed. Some of these circumstances are economic. It has already been shown how rationalisation of work during the first industrial revolution might explain the almost complete absence in the United States of any specific vocational education as a preparation for active life. By the same token one might emphasize the fact that vocational education given at school is better suited to small countries such as Belgium, the Netherlands and Sweden, where industry, however technically developed, cannot be highly diversified; and that on the contrary in-firm training is better suited to the needs of larger countries such as Germany or the United Kingdom where production is much more diversified.[1/]

This point suggests the possibility that the level of education as it relates to productivity may be somewhat understated in the comparison of Europe with the United States. Part-time and in-industry training seem to have been an important

[1/] Roger Grégoire, Vocational Education, Paris, OECD, 1967, p. 33.

part of workers' education in a number of European countries. In the mid-1950's, in Germany and the United Kingdom, some 50 per cent of the 15-19 age group was enrolled in part-time technical education. In Denmark the ratio was about 30 per cent.[1/] While there are differences in the extent of vocational and technical training in Canada and the United States, it appears unlikely that the effect of this omission on the Canada-U. S. education comparison is large. The lack of emphasis on these forms of education has, however, important implications for Canada. The stock of education in the labour force cannot be upgraded significantly and quickly to meet the technological changes and requirements of the 1970's without a deliberate and dramatic use of adult training and retraining programs.

In terms of education, it would appear that Canada suffers by comparison with either the United States or Europe. The share of the labour force with some post-secondary education is only half as large in Canada as in the United States. Mean years of education were lower in Canada than in the United States and in most Northwest European countries. In addition, the role of technical and other nonformal education for both children and adults has received substantially less emphasis and resources in Canada.

1/ J. Frederic Dewhurst, John O. Coppock, P. Lamartine Yates and Associates, Europe's Needs and Resources -- Trends and Prospects in Eighteen Countries, Toronto, Macmillan, 1961, p. 324.

CHAPTER VII

LABOUR INPUT SUMMARY

Measures of the quantity and quality of the labour input, developed in the previous three Chapters, are drawn together and summarized in this Chapter.

GROWTH OF LABOUR INPUT

Changes in the quantity and quality of the labour input covered in earlier Chapters related to employment, hours, age, sex, and education. Indexes showing the growth of these components and their aggregates[1/] from 1950 to 1962 are set out in Table 40. An international comparison of growth in the input elements is shown in Table 41.

Table 40

CHANGES IN LABOUR INPUTS, CANADA

(Index, 1950 = 100)

	1950	1955	1960	1962
Employment	100.0	109.0	121.0	126.3
Hours worked	100.0	98.5	97.1	96.6
Age-sex composition	100.0	99.9	98.7	98.3
Education	100.0	102.0	103.8	104.3
Total labour input	100.0	109.3	120.4	125.3
Total per person employed	100.0	100.2	99.4	99.1

Source: Tables 20, 24, 30 and 37.

From 1950 to 1962, Canada had the largest growth in total labour input of all the countries covered. Only Germany came close to having so large a total increase; Italy and the United States ranked next to Germany. At the other extreme, the increase in labour input in Norway was less than 3 per cent over the 12-year period.

1/ The indexes of the total labour input were obtained by multiplying the indexes (based on 1960 = 100) of the individual input components (Denison, p. 115).

Table 41

INTERNATIONAL COMPARISON OF CHANGES IN LABOUR INPUTS, 1950-62

(Percentage change over 12 years)

	Employment	Hours Worked	Age-Sex Composition	Education	Total Labour Input	Labour Input per Person Employed
Canada	26.3	-3.4	-1.7	4.3	25.3	- .9
United States	14.6	-3.0	-1.8	9.0	18.9	3.8
Northwest Europe	11.6	-3.0	.5	4.5	14.0	1.9
Norway	2.1	-3.0	-1.3	5.1	2.7	.6
United Kingdom	8.1	-2.7	- .7	5.5	10.0	1.8

Source: Canada -- Table 40.
United States and Europe -- Denison, Tables 5-3, 6-6, 7-7, 8-6 and 9-3, pp. 52, 66, 77, 89 and 115, respectively.

The growth in employment was the dominant element of the change in labour input. The sharpest contrast was between Canada, with an increase of 26 per cent, and France and Norway with a growth in employment over the 12 years of only 1.3 and 2.1 per cent.

Changes in the factors that affect the quality of the labour input were smaller and less extreme. In most countries hours worked were declining. The drop in average hours worked was larger in Canada but, by and large, the differences in the indexes were not large. The effect of shifts in the age-sex content of the labour force was negative for the countries shown in Table 41 and for Denmark. An increase in the participation of women and young men was the major contributing factor in these countries. In the other European countries, the shift in the age structure of the labour force was large enough to offset the effects of rising female participation rates. All countries experienced an upgrading of the quality of the labour force from education. The United States and Belgium had the largest increase -- 7.6 per cent. Germany experienced the smallest increase -- only 2 per cent. 1/ In Canada, the increase was roughly comparable to that for Northwest Europe as a whole, but less than half that in the United States.

Labour input per person employed reflects the combined effect of hours, age, sex and education on a man-year of employment. A majority of countries showed some growth in labour input per worker but in Canada, Denmark and Germany the indexes declined. These three countries had the smallest gain in the quality of labour input from education.

1/ It has been suggested earlier that the different institutional structure of trade and apprenticeship training may account for part of the wide disparity in these measures of European growth rates.

LEVELS OF LABOUR INPUT, 1960

The components of the cross-section comparison of labour inputs in 1960 are drawn together in Table 42. The size of total labour input is dominated by the level of employment in each country.[1/] Total employment in Canada was less than 9 per cent of that in the United States; in Northwest Europe as a whole employment was almost 20 per cent larger than in the United States.

Table 42

LABOUR INPUT RELATIVES, 1960

(U.S. = 100)

	Canada	United States	Northwest Europe	Norway	United Kingdom
Total labour input	8.8	100.0	115.3	2.1	35.2
Employment	8.8	100.0	118.1	2.1	35.7
Hours worked	104.5	100.0	108.0	107.0	106.5
Age-sex composition	102.6	100.0	97.5	99.7	98.6
Education	93.4	100.0	92.7	94.3	93.9
Labour input per person employed	100.0	100.0	97.7	100.6	98.6

Source: Canada -- Tables 15, 22, 30 and 37.
United States and Europe -- Denison, Table 5-2 (Index of employment data), Tables 6-4, 7-5, 8-7 and 9-2, pp. 51, 63, 75, 91 and 115, respectively.

The relatives of labour input per person employed, which reflect the combined effects of hours, age, sex and education, are those used in the comparison of levels of net national income per person employed in 1960. The labour quality input per person employed was largest in the Netherlands, i.e. 10 per cent above the U.S. level; in Italy it was the lowest, i.e. 11 per cent below the United States. Labour input per person employed in Canada was identical to that in the United States. A longer work week and a lower female participation rate are reflected in higher quality relatives for Canada, but a lower level of education -- fewer years of schooling and a smaller share of highly educated workers compared with the United States -- offsets the relative advantage.

Volume and Quality of Labour Inputs

The labour input measures have been rearranged in Table 43 to show volume as measured by man-hours, and quality as reflected by the age, sex and education

[1/] Differences in unemployment rates are reflected in this comparison; the relative size of the labour force would be broadly similar. In Chapter XIV an allowance is made for differences in the effect of the level of demand on output per unit of input.

characteristics of the labour force and by the productivity offset.[1] Since all nine countries worked more hours than the United States, the volume relatives based on man-hours were larger than those for employment. Conversely the quality indexes, which cover the effects of education, age-sex distribution of the labour force, and the hours-productivity offset, were less favourable on the basis of man-hours than on the basis of employment. Labour input quality per man-hour in Canada was some 4 per cent below the United States but, as a result of the even longer work week in Europe, the deterioration for these countries was even larger.

Table 43

LABOUR INPUTS, VOLUME AND QUALITY, 1960

(Relatives, U.S. = 100)

	Volume of Labour Input		Quality of Labour Input	
	Employment	Man-Hours	Per Person Employed	Per Man-Hour
Canada	9	9	100	96
United States	100	100	100	100
Northwest Europe	118	130	98	89
Belgium	5	6	98	89
Denmark	3	3	94	89
France	28	31	98	88
Germany	38	42	95	85
Netherlands	6	7	110	94
Norway	2	2	101	94
United Kingdom	36	39	99	91
Italy	29	32	89	81

Source: Columns 1 and 3, see source of Table 42; Column 2 is Column 1 x annual hours relatives for total employment (Table 19); Column 4 is Column 3 ÷ annual hours relatives. Data for Europe from Denison, Tables 6-4 and 9-2, pp. 63 and 115.

ADDITIONAL QUALITY FACTORS, INCLUDING EXPERIENCE

The estimates of labour input, including factors affecting the quality of labour inputs, do not purport to cover the whole range of elements that affect changes over time, or international differences in output per person. Denison devoted a large part of Chapter Nine of Why Growth Rates Differ to a discussion of some other factors, particularly experience, effort and health. Only one of these is considered in this Study -- experience.

Experience as a factor contributing to the quality of labour was evaluated by Denison, but he did not include an allowance for it in the labour quality adjustments.[2] The measure in Chapter V of the effect of age on labour quality isolated

[1] The "hours" measure in the Denison analysis included both a volume and a quality element and the data were not broken down into man-hours and quality. The combination of the employment and hours indexes in Table 43 provides a rough estimate of labour volume expressed in man-hours, and labour quality per man-hour.

[2] Denison, pp. 109-111.

the under-20 and over-64 age groups. The years between ages 20 and 64 reflect, at least for males, the accumulation of some 45 years of experience. The age distribution of the labour force within this range differed markedly among countries.

Table 44

DISTRIBUTION OF THE LABOUR FORCE BY AGE, 20-64 YEARS,

CANADA AND UNITED STATES, 1960

(Percentage shares)

Age Group	Canada		United States	
	Male	Female	Male	Female
20-24	12	21	11	13
25-34	28	25	25	21
35-44	26	25	27	27
45-54	21	20	22	25
55-64	13	10	15	15
	100	100	100	100

Note: Figures may not add due to rounding.
The 1961 Census of Canada, Labour Force, Vol. III, Bulletin 3.1-2 (94-502), indicated a very similar distribution for Canada.

Source: Canada -- DBS, The Labour Force, Special Tables, op. cit.
United States -- U.S. Department of Commerce, Bureau of the Census, United States Census of Population: 1960, United States Summary, Detailed Characteristics, Final Report PC(1) - 1D, Washington, GPO, 1963, Table 196, p. 1-501.

As Table 44 suggests, the age distribution of the male labour force in Canada and the United States in 1960 was roughly similar. The female labour force in Canada had a higher proportion of 20-to-24-year-olds -- a reflection in part of the smaller number of Canadian women receiving higher education. On the other hand, Canada had fewer men and women in the 55-to-64 age group than the United States.

Table 45

QUALITY RELATIVES FOR EXPERIENCE,[1] 1960

(U.S. = 100)

Canada	98.1
United States	100.0
Norway	100.5
United Kingdom	100.8

(1) Labour force, males and females 20-64.

Source: Canada -- see text.
United States and Europe -- Denison, Table 9-1, p. 111.

The quality relatives in Table 45 were estimated, using U. S. male earnings weights[1/] and the distribution of the labour force by age groups from 20 to 64. A post-war baby boom and immigration of unprecedented size gave rise to a very young labour force in Canada. France, Germany and the Netherlands also had a relatively young labour force; in the United Kingdom and Italy the average age was somewhat older. If the experience factor, as measured in Table 45, were taken into the Canada-U. S. comparison of 1960 income levels, it would account for about one to two percentage points of the 18 percentage point gap in income per person employed. It is worth noting, however, that experience is largely a function of time; 20 years from now the Canadian labour force should have a much larger content of experience within the 20-to-64 age group.

1/ Denison, p. 110:

Age (in years)	Average income as a percentage of income of males aged 45 to 54 years
20-24	47
25-29	64
30-34	79
35-44	86
45-54	100
55-64	93

See Denison, for the assumption about female earnings.

CHAPTER VIII

INVESTMENT AND FIXED ENTERPRISE CAPITAL INPUTS

INVESTMENT, OUTPUT AND GROWTH

If one were to detail the literature that has suggested that investment is a major element in economic growth, the list would be a long one. This point of view is widely held and would indeed be difficult to refute. Table 46 compares the average share of gross investment in GNP in Canada, the United States, Norway and the United Kingdom, over the period 1950 to 1962. The share of its gross output invested by Norway was larger than that of any other country covered in this Study. The United Kingdom invested the smallest share.

Table 46

GROSS INVESTMENT AS A SHARE OF GROSS NATIONAL PRODUCT(1)

BY TYPE OF INVESTMENT, 1950-62

(Per cent)

	Canada	United States(2)	Norway	United Kingdom
Total national gross investment	21.9	18.4	28.4	16.1
Non-residential fixed	18.4	12.1	24.1	11.7
Structures	10.3	6.0	9.0	4.1
Equipment	8.1	6.1	15.1	7.6
Residential construction	4.6	5.2	4.8	3.0
Inventories	1.5	1.1	1.1	1.0
Net foreign lending	- 2.6	.0	- 1.6	0.5

(1) Average of percentages for individual years, in current market prices.

(2) Excludes federal government expenditures on equipment.

Note: Denison discussed some of the limitations of the investment data in Chapter Ten. It should be noted that a comparison of investment statistics in the United Kingdom and Norway suggested that U.K. investment was understated by some 11 per cent in 1958. The share of investment in GNP in the United Kingdom would increase by about two percentage points, using these adjusted data. See Geoffrey Dean, "Fixed Investment in Britain and Norway, An Experimental International Comparison", Journal of the Royal Statistical Society (J.R.S.S.), Series A (General), Volume 127, Part 1, 1964, especially p. 101.

Source: Canada -- DBS, National Accounts (13-201), op. cit., Table 2.
United States and Europe -- Denison, Table 10-1, p. 118.

Table 47 contrasts the growth performance of the 10 countries, ranked according to the relative shares of total domestic investment in GNP, with data on fixed and private investment.[1/] These data suggest some of the inconsistencies that arise in a simple comparison of investment and growth. The three countries that experienced the highest rate of growth between 1950 and 1962 -- Germany, Italy and France -- were in the middle range in terms of investment as a share of GNP. Norway and Denmark had similar rates of growth but very different allocations of output to investment. Canada invested the second largest share of output, but did not enjoy an equally or equivalently good growth performance.

Table 47

GROSS INVESTMENT SHARES

AND THE REAL GROWTH OF GROSS NATIONAL PRODUCT,(1) 1950-62

	Share of Domestic Investment in GNP				
	Total Domestic Fixed(2) and Inventories	Total Domestic Fixed(2)	Business Domestic Fixed(2)	General Government Investment as a Share of Total Domestic Fixed Investment	Rate of Growth of Real GNP
	(Per cent)				(Annual average)
Norway	30	29	26	11	3.8
CANADA	25	23	20	15	4.1
Netherlands	25	22	19	17	4.6
Germany	24	22	19(3)	11(3)	7.1
Italy	21	20	18	14	6.1(4)
France	20	18	16	12	4.7
Belgium	19	18	16(5)	10(5)	3.4(4)
Denmark	19	18	16	11	3.7
United States	18	17	15	14	3.4
United Kingdom(6)	16	15	13	9	2.6

(1) At market prices.

(2) Fixed investment includes housing, non-residential structures and machinery and equipment.

(3) 1950, 1953-62.

(4) 1953-62.

(5) 1955-62.

(6) See Note to Table 46.

Source: Tables 6 and 46; Denison, Table 10-1, p. 118; and U.N., National Accounts, op. cit.

The ranking of domestic investment as shares of output was very similar for the three series -- total fixed and inventory investment, total fixed investment, and business[2/] fixed investment. By and large, government investment represented

1/ These ratios do not take account of differences in the price level of total output and of capital goods, or among the various investment components.

2/ Public and private investment less investment by general government; this measure is similar to the enterprise measure used in connection with the capital stock estimates.

2 to 3 per cent of total output. These small shares disguise some significant differences in the relative importance of general government investment among the countries. In the Netherlands and Canada, the shares of government in total fixed investment were 17 and 15 per cent, while in Belgium and the United Kingdom the shares were only 10 and 9 per cent respectively. The importance of government investment reflects, among other things, a widening of the social capital infrastructure in response to high rates of population growth in Canada, the United States and the Netherlands, as well as capital deepening in most countries. There did not, however, appear to be any close correspondence between relative growth performance and levels of government investment.

In Chapter Ten of Why Growth Rates Differ, Denison discussed the relationship of investment and output and "What Investment Ratios Do Not Mean". He suggested that the main line of cause and effect led from high rates of growth to high levels of investment. In addition,

> Although there is also some reason to expect a correlation to emerge with causation running from investment ratios to growth rates, this expectation is tenuous.[1/]

This conclusion has been reinforced in an article by T. P. Hill,[2/] and summed up in the comment by Johnson and Chiu, "... a high rate of investment may be a necessary, but by no means sufficient, condition for growth."[3/]

This Chapter and the following one are concerned with the effect of investment on changes in the stock of assets. Five components of capital inputs are covered -- enterprise structures and equipment, housing, land, inventories, and foreign investments. The contribution of each capital input to growth was estimated, in most cases, on the basis of changes in the stock of capital. Differences in the level of the various capital input components were related to the international differences in the level of output per person employed in 1960.

CAPITAL STOCK OF ENTERPRISES

Growth theory and empirical research have traditionally placed a heavy emphasis on the role of fixed capital investment. Much of the comparative analysis of post-war growth in Europe has focused on the high ratios of fixed investment in GNP. As Table 47 suggests, this relationship has, at best, been indirect. Production function models, on the other hand, tend to combine the labour input with various measures of capital input or capital services. The analysis of the contribution of capital to growth and to levels of income in this Study used the stock of machinery and structures of business enterprises as the measure of capital input.

1/ Denison, p. 121.

2/ T. P. Hill, "Growth and Investment According to International Comparisons", The Economic Journal (E. J.), June 1964.

3/ Dudley W. Johnson and John S. Chiu, "Growth and Investment According to International Comparisons: A Comment", E. J., September 1965, p. 629.

Enterprise investment or enterprise capital are defined to include business and government enterprise[1] investment in fixed non-residential structures and equipment on a domestic basis.[2] The investment of general government,[3] expenditure on consumer durables, and, in so far as possible, investment of non-commercial institutions are excluded.[4] This definition of the enterprise sector corresponds approximately to that underlying the category of non-residential business capital formation as used in the national accounts of Canada.

The conventional measure of capital stock is usually based on the perpetual inventory method[5] of cumulating annual investment data; this is the method used, for example, in Canada, the United States and the United Kingdom. There are, however, two basic difficulties inherent in the use of the measure of capital input. One is statistical and the other, more or less conceptual. The capital stock series based on annual increments of real investment takes account of the "economic or measured quality change".[6] The price indexes used in deflation, particularly of

---

1/ Utilities such as power and transportation are found largely in the private sector in some countries and in the public sector in others. In view of the importance of utilities and the amount of investment in this type of infrastructure, it seemed preferable to have utilities in the estimates of capital stock, particularly in the level comparison. Government enterprise capital was not included in Denison's growth series for the United States; it was included in the Canadian growth series. For the "direct" comparison of enterprise stocks in Canada and the United States in 1960, an estimate of government enterprise stocks in the United States was added to the private stock data.

2/ Structures include non-residential building and engineering structures; equipment includes producers' durables and machinery and transportation equipment. The terms "enterprise capital" and "enterprise investment" exclude investments in dwellings, inventories, and land. These capital inputs are discussed in the following Chapter.

3/ Government enterprise capital, e. g. in utilities, is included with private capital (see footnote 1). Estimates of output do not, by and large, contain any significant (or realistic) estimate of the return on general government capital. This does not mean that general government infrastructure does not make a contribution to productivity (Denison, pp. 135-136). A large part of the contribution of government investment in education capital is taken into account in the labour force "quality" adjustment for education. The effect of other government capital, e. g. roads, is not taken into account. Further research is needed to clarify the rates of return on various types of government investment, particularly in regional analysis.

4/ Government participation in education and hospital care varies from country to country, and the size of the private institutional versus the public institutional sector reflects this aspect of the social organization. It seemed reasonable either to include or to exclude all institutions in the comparison of enterprise capital stocks, particularly for the comparison of level. Both public and private institutional capital were excluded from the growth estimates for Canada. Private institutional capital was implicitly included in Denison's growth estimates for the United States, but it is not clear whether it was in the data for Europe. The 1960 cross-section comparison of U. S. and Canadian capital stock was based on estimates adjusted to exclude all institutions. See also Denison, pp. 135-136.

5/ For a description of the perpetual inventory method of estimating capital stock, see DBS, "The Measurement of the Stock of Fixed Capital by Industry in Canada: A Progress Report", Canadian Statistical Review, July 1964.

6/ Denison, p. 134.

construction, have tended somewhat to understate the growth in investment; as a result both the growth and level of the capital stock may be understated. This point is discussed further in the Notes to this Chapter.

The second point concerns the use of the capital stock as a measure of the services of capital. A discussion of this point would feather out into a whole range of problems including embodied and disembodied technological change, the vintage effect, capacity, depreciation and so forth. It would require a long digression from the main focus of this Study even to survey the literature.[1/] The issues are important, but they are not resolved in this Study. Changes in the capital stock are assumed to approximate changes in capital services.[2/]

Capital and Income Growth

The contribution of enterprise fixed capital to income growth in Canada and in the United States was based on estimates of the capital stock.[3/] The most comprehensive study of the stock of capital in Canada was made by Professor T. K. Rymes when he was with the Dominion Bureau of Statistics.[4/] These data formed the basis of the estimates of capital input used in this Study. The Notes to this Chapter describe the method used to update the estimates to 1962, and to adjust them to a basis broadly comparable to the U. S. data.

1/ Readers interested in this point are referred to the following articles from which the body of relevant literature may be traced: Joan Robinson, "Solow on the Rate of Return", E. J., Vol. LXXIV, No. 29, June 1964; R. M. Solow, Capital Theory and the Rate of Return, Amsterdam, North Holland Publishing Company, 1963; R. M. Solow, "Technical Progress, Capital Formation and Economic Growth", A. E. R., Proceedings, May 1962.

2/ Any understatement of the contribution of capital as a factor input will be reflected in the residual sources of growth or of factor productivity. This includes technological advances associated with, but not reflected in, the capital stock.

3/ Since gross stock data were not available for European countries, Denison's estimates for these countries were based on available estimates of net stock.

4/ See DBS, "Preliminary Estimates of Fixed Capital Flows and Stocks, Canada, 1946-1960", Daily Bulletin Supplement -2, Tuesday, December 22, 1964; and DBS, Fixed Capital Flows and Stocks, Manufacturing, Canada, 1926-1960, Methodology (13-522) and Statistical Supplement (13-523), Ottawa, Queen's Printer, 1967 and 1966 respectively. Preliminary estimates of capital stock in selected nonmanufacturing industries to 1959 were provided for use in this Study by the Business Finance Section of DBS. The stock estimates have recently been updated and the sector coverage widened. A publication is in process.

Table 48

GROSS AND NET CAPITAL STOCK OF ENTERPRISES, 1950-62

		Annual Average Growth Rate 1950-62	Index 1950 = 100			
			1950	1955	1960	1962
		(Per cent)				
Canada	Gross	5.1	100	132	170	182
	Net	6.2	100	140	192	206
United States	Gross	3.7	100	123	149	155
	Net	3.8	100	125	147	156
Northwest Europe	Gross	4.0	100	119	146	161
	Net	5.1	100	123	161	181
Germany	Gross	5.5	100	124	168	190
	Net	6.9	100	133	192	222
Norway	Gross	4.2	100	125	153	165
	Net	5.1	100	131	167	181
United Kingdom	Gross	3.0	100	115	132	143
	Net	4.2	100	118	148	163

Source: Canada -- estimates based on DBS official data (see Notes).
United States and Europe -- Denison, Tables 12-1 and 12-2, pp. 136-137.
See Notes for comparison with official OBE estimates.

Table 48 sets out the growth of enterprise (business) fixed assets, both gross and net of depreciation, from 1950 to 1962. Germany had the highest rate of growth of gross stock -- 5.5 per cent per annum between 1950 and 1962; this is not surprising considering the war damage that remained in the early 1950's. Canada, with a rate of 5.1 per cent per annum, had the next highest rate; Belgium and the United Kingdom had the lowest rates of capital accumulation.

The rates of growth of the net and gross stock were similar in both the United States and Belgium, but the net rate was much higher than the gross in Canada and most of the European countries. When new investment is growing rapidly, the net stock of capital tends to rise faster than gross stock. A comparison of the share of non-residential fixed investment in GNP over the period from 1950 to 1962 is shown in Table 46. The differences between the growth of net and gross stock were, by and large, confirmed by the recent investment shares. Both Canada and Germany had high investment ratios and much larger growth rates in the net stock of capital. The United States, on the other hand, had a low investment share and almost no difference in the gross and net rate. Data for the United Kingdom indicated, however, a low ratio of investment to output and a larger growth in net stock than in gross. This may, in part, reflect the measurement problem suggested in connection with Table 46, or an especially low level of discards.

Comparable data showing the accumulation of capital per person employed gave quite a different impression (Table 49). In terms of relative growth performance, Canada dropped from a rank of second, based on total accumulation, to fifth, based on accumulation per person employed. The relative position of Germany also declined -- from first to third, and Norway and Denmark rose to top the list. The United Kingdom still ranks last, with the lowest rate of growth of gross enterprise stock, in total and per worker. While total capital was growing very rapidly in Canada over this period, the increase in capital per worker was no larger than in Northwest Europe.

Table 49

GROWTH OF GROSS CAPITAL STOCK OF ENTERPRISES

PER PERSON EMPLOYED

(Annual average rate)

	1950-62	1950-55	1955-62
Canada	3.1	3.9	2.5
United States	2.5	2.6	2.5
Northwest Europe	3.1	2.3	3.6
Germany	3.4	1.7	4.6
Norway	4.1	4.3	3.9
United Kingdom	2.3	1.8	2.7

Source: Canada -- see Notes.
United States and Europe -- Denison, Table 12-3, p. 139.

There were wide variations in the rate at which capital per person was growing during the subperiods. In Norway and Denmark the rates of growth from 1950 to 1955 were over 4 per cent a year, while in the United Kingdom and Germany they were under 2 per cent. After 1955, the differences were not so extreme. The rate of accumulation accelerated to 4.6 per cent a year in Germany. In Canada, the United States, Belgium and the United Kingdom, the rate of growth of gross capital was around 2.5 per cent per year. The improved performance in Northwest Europe as a whole, from 1955 to 1962, was dominated by the extraordinarily strong performance in all of the countries except Belgium and the United Kingdom. The investment boom in Canada during the early part of the decade and the subsequent downturn in the level of output and investment were reflected in substantially different growth rates in the two subperiods.

The contribution of capital to income growth was estimated using an average of the increase in gross and in net enterprise capital stock,[1/] weighted by the share of fixed enterprise capital in net national income. The contribution of capital to growth was largest in Germany, Canada and Norway. Belgium, the United Kingdom and the United States derived the least impetus to growth from increased capital inputs.

1/ Empirical research does not provide a firm basis for choosing the growth in the gross or the net stock as a measure of the increase in capital services. There is, however, some evidence to suggest that within the limitations of the conventional measure of capital input, a "real" capital stock series would be closer to the gross than the net. Estimates based on gross and on net (Denison, Table 12-4, p. 140) indicate that the difference in the contribution of fixed enterprise capital to output growth, using the two series, was not large -- in many cases less than 1/10 of 1 per cent per annum.

Table 50

CONTRIBUTION OF ENTERPRISE CAPITAL

TO GROWTH RATES OF NET NATIONAL INCOME

(Percentage points)

	1950-62	1950-55	1955-62
Canada	.81	.99	.70
United States	.43	.53	.35
Northwest Europe	.64	.55	.69
Germany	1.00	.83	1.13
Norway	.78	.92	.68
United Kingdom	.43	.38	.46

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Table 12-4, p. 140.

The smallness of this measured contribution of enterprise capital to growth is likely to startle many readers. It seems to go against traditional wisdom, experience and logic. It is a feature of the method of analysis, however, that factor inputs, including fixed business capital, carry an importance that is proportional to their share in net national income. For fixed capital, this share was only about 14 per cent in Canada and 11 to 16 per cent in the United States and Europe (Table 13). On this basis, business capital can make a large contribution to growth only in extreme circumstances.

The Age of Capital and Growth

The capacity of capital to contribute to output tends to change over the years as its efficiency is increased. Thus new capital equipment may be more efficient than old. Capital input models that attempt to take account of the contribution of advances in knowledge to creating new and more productive capital are frequently called embodiment or vintage models. As Denison suggested in Why Growth Rates Differ, the important consideration is not so much the classification of this contribution to growth either as a characteristic of the capital input or as a contribution of advances in knowledge; the important consideration is the size of the "gain or loss". He concluded that "... differences in the level of gross investment, and resulting differences in average age, will not have nearly so large an effect on the average quality of the capital stock as embodiment models suppose.". 1/

Each year's new investment is put in place beside an existing stock of capital. Since the existing stock of equipment may be from 1 to 15 years old, each new annual increment is not large relative to the stock base. Even if the advance of knowledge for the economy as a whole were relatively even over time, its effect on improving the efficiency of particular assets would tend to be lumpy. Important improvements in individual assets do not occur, by and large, as small annual upgradings, but as less frequent and large technological breakthroughs. New investments arising out of technical obsolescence of existing equipment will include the effect of capital improvements. Not all capital investment, however, reflects obsolescence; a large part reflects the more regular and systematic process of discard and replacement. It is unlikely, therefore, that annual changes in the "quality"

1/ Denison, pp. 145-146.

of capital are proportional to changes in age. Indeed it is quite possible that the higher the rate of investment, the larger the component representing pure replacement, and the smaller the share of obsolescence based on advances in knowledge. Exceptions may occur when the length of life of capital is, for some reason, extended, when the age distribution is widely spread, or when the tendency to equivalence in rates of return is inhibited by lack of competitiveness. If investment is not taking place, recent and higher levels of technology are not incorporated. For example, real and intellectual resources directed to wartime military production may not only inhibit actual investment but more importantly divert the application of knowledge to technological improvement away from nonstrategic industries. At the end of such a period, an injection of new capital carries with it a backlog of quality improvement: if market forces operate successfully to allocate resources, the improvements will be incorporated into high-return peacetime opportunities.

In post-war Europe and North America such a backlog existed. Denison cites the "... backlog of high yielding investment opportunities deriving from improvement in capital goods."[1/] in the post-war period, particularly in the United States. During this period, productivity improvement reflected not only high levels of investment and a falling age of capital stock, but a catch-up in the adaptation of knowledge to capital (and to other aspects of production such as logistics, etc.).[2/]

A comparison of the average age of capital is somewhat hazardous. Estimates of age based on capital stocks reflect to a large degree the length-of-life assumptions; if the life assumptions are not realistic, the age differences will be similarly fictional. The assumption of a constant life in the stock and age calculations is clearly not supportable by empirical evidence, and further complicates the interpretation of age estimates.

Table 51

AVERAGE AGE OF GROSS CAPITAL STOCK OF ENTERPRISES, CANADA AND UNITED STATES

(In years)

	1950		1960		Change in Age	
	United States	Canada	United States	Canada	United States	Canada
Equipment	6.9	6.6	7.2	7.1	+0.3	+0.5
Structures and equipment	15.4	16.1	13.8	12.7	-1.6	-3.4

Source: Based on calculations using the perpetual inventory method of cumulating deflated investment (1958 dollars), and 1950 weights.

1/ Denison, p. 146.

2/ This process may also operate to some extent during the short cycle of economic activity. It is not unreasonable to assume that periods of slack investment discourage the maximum application of technology to upgrading capital. Gains in labour productivity in the early stages of the upswing would be reinforced by a technological backlog which would be incorporated as investment expenditures recover. The technological gap would not be large except in periods of prolonged recession. Investment expenditures on equipment in Canada turned down in 1958 and did not recover the 1957 volume until 1964. This long a period of slack may well have resulted in a technological backlog.

Table 51 indicates that the age of equipment in Canada and the United States was broadly similar, but that there may have been a small increase in age over the decade 1950 to 1960.[1/] The extent of the decline in the age of all non-residential enterprise capital -- structures and equipment -- suggests that the average age of structures must have fallen even more than equipment. This is not surprising in the light of heavy utility and resource investments in Canada in the early and mid-1950's. It is not likely, however, that declines of this order of magnitude in the age of structures had a direct impact on productivity.[2/] This point is reinforced by the sectoral pattern of changes in the age of capital. The detail of the age calculation underlying the estimates in Table 51 indicated that the capital stock in agriculture and manufacturing in 1960 was older than in 1950 in the United States and in Canada.[3/] Thus the major declines in age seem to have taken place in construction, and in the nonfarm, nonmanufacturing sector of the economy. However, it was suggested earlier that the assumption of a constant service life in the stock estimates may have introduced some bias to the calculations of average lives. Unless the weighting pattern can be held constant for each type of asset with a different service life, the average age calculation is not particularly meaningful.

1/ Estimates of average age of the U. S. gross capital stock have been made by OBE, Survey of Current Business (S.C.B.), December 1967, Washington, GPO, Tables 1, 2 and 3, and by Denison, Table 12-5, p. 147.

Average Age of Gross Capital Stock in the United States

(In years)

	Denison		OBE	
	1950	1961	1950	1960
Equipment	n. a.	n. a.	6. 4	6. 9
Structures	n. a.	n. a.	19. 4	15. 3
Equipment and structures	15. 6	13. 6	13. 9	11. 3

The Denison estimates are Bulletin F service lives in 1954 prices and current weights. The OBE estimates are based on Bulletin F, less 15 per cent service lives, the Winfrey distribution of discards, "constant cost 1" deflators, and 1958 prices. Because the age estimates are in current weights they reflect changes in the mix of investment over time, as well as differences in the life and discard assumptions.

2/ The relative contribution of equipment and structures is discussed later in this Chapter.

3/ The OBE estimates of age (consistent with those set out above) indicate that the average age for gross equipment stocks for the manufacturing industry, and of agricultural equipment (excluding tractors), and tractors, increased from 6. 1 to 7. 2 and 6. 3 to 8. 2 and 6. 1 to 6. 5 years respectively between 1950 and 1960. These increases in age are larger than those for all enterprise equipment, and suggest that there was a drop in the average age of equipment in the nonfarm, nonmanufacturing industries.

Germany, Norway and Denmark experienced a large depletion of their fixed capital during the war. The growth in the capital stock in these countries from 1950 to 1955 suggests that reconstruction may still have been taking place in the early 1950's. Using data on the age of the capital stocks,[1/] Denison attempted to quantify the effects that this may have had on growth in these countries.

The rate of growth of gross and net capital stock in Canada between 1950 and 1955 was higher than in any of the other nine countries, but the evidence based on age does not suggest that there was any substantial upgrading in the quality of capital, particularly of equipment, in this country. The special circumstances during the war in which large amounts of industrial capital were destroyed does not apply to Canada or the United States. In fact it is more than likely that Canadian industry made considerable technological gains during and immediately after the war as a result of its unique position. In these circumstances, a special estimate of capital improvement or vintage effect did not appear to be warranted for Canada.

INTERNATIONAL COMPARISONS OF REAL INVESTMENT PER PERSON EMPLOYED

The role of capital in growth is frequently assessed using comparisons of the level of investment per person, or the share of investment in output. Wide differences in the price of investment goods and other goods and services within and between countries may seriously distort such comparisons. The ratios in Table 52 below have been adjusted for the international differences in price levels of investment goods.

Table 52

NON-RESIDENTIAL FIXED INVESTMENT PER CIVILIAN EMPLOYED

IN 1950 AND 1962

(Relatives, U.S. = 100)

	1950		1962	
	U.S. Price Weights	National Price Weights	U.S. Price Weights	National Price Weights
Canada	108	105	114	107
United States	100	100	100	100
Northwest Europe	35	—	56	--
United Kingdom	31	28	41	38

Note: Defence investment is excluded. Estimates in National price weights use Canadian price weights for the Canadian-U.S. relative, and United Kingdom weights for the U.K.-U.S. relative.

Source: Canada -- based on the estimates by West of price relatives for investment goods in Canada and the United States. See the Appendix. United States and Europe -- Denison, Table 12-7, p. 160.

1/ The contribution to growth from the reduction in the average age of capital over the period 1950 to 1955 was estimated as 0.1 per cent per annum for Denmark, Germany and Norway. In addition, a special estimate (0.6 per cent per annum) of the contribution of changes in capital investment to balancing the structure of the stock, was included for Germany for the period 1950 to 1955. See Denison, pp. 148-151 and Table 12-6.

As Tables 46 and 47 indicate, Canada had on average a high ratio of enterprise investment to GNP from 1950 to 1962. The level of real investment per worker provides another perspective on relative performance (Table 52). In 1950 investment per person employed in Canada was 5 to 8 per cent above the level in the United States and more than three times the level in Northwest Europe. By 1962, investment in capital per worker in Canada was even larger compared with the United States.[1] The increase in European investment had narrowed the margin between investment per worker in Europe and North America.

This comparison of the volume of investment in 1950 and in 1962 shows a lower level of real investment per person employed in Canada in national (Canadian) prices than in U. S. prices. The difference reflects the price and the composition of investment in the two countries. With wage levels in Canada substantially lower than in the United States, the cost of construction was relatively lower here. On the other hand, higher prices for many types of equipment in Canada, a large part of which is imported, offset some of the construction advantage, so that, over all, the Canadian price level for investment goods was just under the U. S. level until 1962.[2][3] Nevertheless a larger part of Canadian investment in this period was construction. Since construction was relatively more expensive in the United States, Canadian investment was larger when expressed in U. S. prices than in Canadian.[4]

FIXED ENTERPRISE CAPITAL AND INCOME LEVELS, 1960

The 1960 cross-section comparison of capital inputs among the European countries and with the United States could not be based on the existing and limited capital stock data. In the absence of adequate statistics, Denison used cumulative investments as a proxy for stocks.

For the comparison of relative capital density in Canada and the United States, the available data indicated the possibility of using both the Denison investment cumulation method and a "direct" comparison of capital stock levels in the two countries. Both calculations were in fact made. The direct calculation, which compared stock levels, was used as the basis for assessing the contribution of fixed capital to income differences. It is described below and in the Notes. The results of the cumulative method are shown but are not described in detail.[5]

1/ A relatively low level of investment in the United States in 1962 reflected the degree of underutilization which had persisted from 1960.

2/ The investment price relatives in Canada and the United States are not as firmly based on empirical investigation as one would wish. However, the conclusion that non-residential investment per worker was higher in Canada than in the United States is likely to be valid, in spite of a margin of error in the real deflators (see Appendix Table).

3/ The high proportion of industrial equipment imported from the United States, and the devaluation of the Canadian dollar, contributed to a rise in the price of investment goods in Canada relative to the United States after 1962.

4/ For a discussion of international price comparisons, readers are referred to the OEEC studies mentioned in Chapter II (footnote 2, page 18) and the Appendix by West. The Notes to Chapter II set out a simple example of the price and volume relationships in this type of calculation.

5/ For a description of the cumulation method, see Denison, pp. 165-173.

Capital per Worker by Sector

The main problem in comparing the level of capital stocks in the United States and Canada related to selecting among the various estimates the comparable or appropriate assumptions concerning asset lives, write-off methods and discard patterns. The existing capital stock data for Canada provide a limited number of alternatives for manufacturing, but the number of permutations and combinations available for the United States is large indeed.[1/] Given wide differences in types of asset, service-lives and prices, the validity of the results of a comparison of stock levels is in part a function of the amount of available detail. The lack of homogeneity among the categories and characteristics of capital inputs suggested the need to use the available industry detail.[2/]

The U. S. capital stock estimates were available for farm, manufacturing and other enterprise sectors; similar detail was available for Canada. For each industry group, equipment and structures were compared separately, using additional detail for vehicles and other equipment, and engineering and buildings. An interesting by-product of this comparison for the enterprise sector was a set of relatives for structures and equipment by industry (Table 53). The comparison used U. S. asset prices to value Canadian stocks so that the effect of differences in price levels in the two countries was excluded.

Table 53

CANADA-U.S. CAPITAL STOCK IN U.S. PRICES

PER PERSON EMPLOYED IN THE ENTERPRISE SECTORS,(1) 1960

(Relatives, U.S. = 100)

	Equipment	Structures	Total Fixed Capital
Agriculture	103	156	122
Manufacturing	103	149	123
Other enterprise	63	112	94
All enterprises	79	120	102

(1) Relatives of the average of gross and net stocks valued in U.S. prices. Enterprise stocks exclude housing, inventories and land, and general government and institutional fixed capital.

Source: See text and Notes for a description of capital stocks and employment by industry.

1/ The discussion of Canadian and U. S. capital stock data is contained in the Notes to this Chapter.

2/ The evidence suggests that some part of the higher capital-output ratio in Canada compared with the United States related to differences in the industrial structure in the two countries. See Derek A. White, Business Investment to 1970, Staff Study No. 5, Economic Council of Canada, Ottawa, Queen's Printer, 1964, p. 34. This comparison weighted the Canadian net capital-output ratios in 19 industry categories with Canadian and U. S. output weights. The results indicated that over 10 per cent of the higher capital-output ratio in Canada (approximately 15 per cent for construction and 5 per cent for equipment) was due to differences in the structure (by value) of output in the two countries. The U. S. weighting in U. S. dollars included the effect of differences in the real (volume) distribution and in relative prices of output in the two countries. Output price data in the two countries are not available to separate these two effects.

For each of the three industry groups, Canada had a substantially larger amount of investment in structures, that is, construction per person employed, than the United States.[1/] It is likely that climate and geography were important factors accounting for the higher level of construction capital in Canada. The comparison of the volume of construction in the two countries took account of differences in the quality of buildings. Throughout a large part of the United States the climate permits a very different standard and method of construction. Less rigorous climatic conditions permit less expensive foundations, insulation, heating and plumbing equipment, etc. These differences were reflected in the higher average volume and quality of construction in Canada.

There has been a considerable amount of emphasis on the importance of investment as a share of GNP in Canada in the post-war years. However, even in the 1930's and 1940's, a large share of GNP was devoted to investment in structures in Canada. Over the 20-year period from 1930 to 1950 Canada invested over 6 3/4 per cent of GNP in engineering and building construction; the comparable ratio for the United States was just over 5 per cent.[2/]

In contrast to the comparison of construction per worker, in both agriculture and manufacturing, workers had approximately the same amount of equipment to work with in the United States and Canada. The proposition that a lack of capital per worker in manufacturing has been a significant factor in lower productivity performance in Canada does not receive much support from this comparison.[3/] Other factors must be at work, but, for the most part, these remain to be identified.[4/] Equipment per worker in the "other enterprise" sector in Canada was only two-thirds of the U. S. level. The large difference in machinery and equipment per worker in "other enterprise" industries suggests that this may be an element in the lower level of productivity in Canada vis-à-vis the United States.

1/ It should be noted that for agriculture and manufacturing the differences were so large that this conclusion would hold even if Canadian construction prices were substantially higher than estimated for purposes of this Study. A large part of other enterprise, i. e. nonagricultural, nonmanufacturing structures, was engineering construction. Price comparisons for such a heterogeneous group of assets are hazardous. If the Canadian price has been understated by overemphasizing the lower wage rates in Canada, or if productivity in this type of construction is much lower in Canada, engineering stocks will be overstated.

2/ These ratios were based on investment and GNP in each country's national currency; if they were adjusted to reflect real prices of construction goods and GNP, the Canadian ratio would rise still further, relative to the United States.

3/ See N. H. Lithwick, Prices, Productivity and Canada's Competitive Position, The Canadian Trade Committee, The Private Planning Association of Canada, Montreal, 1967. The Lithwick study (p. 10) indicated a level of net capital per worker some 29 per cent higher in Canadian manufacturing. This is very close to the net figure implicit in the 23 per cent (average gross and net) used in this Study. The more important element in relationship of capital to productivity is the relative level of equipment stocks, in which the Canadian advantage is negligible.

4/ For a discussion of some of the factors contributing to the lower level of Canadian productivity, see D. J. Daly, B. A. Keys and E. J. Spence, Scale and Specialization in Canadian Manufacturing, Staff Study No. 21, Economic Council of Canada, Ottawa, Queen's Printer, 1968, and Ronald J. Wonnacott and Paul Wonnacott, Free Trade Between the United States and Canada, The Potential Economic Effects, Harvard Economic Studies, Volume CXXIX, Cambridge, Harvard University Press, 1967.

The gap in equipment per worker, as measured in this Study, was so wide that no reasonable alternative method of estimation or set of assumptions would eliminate it. These data suggest that this area is worth further exploration in the search for factors that contribute to lower levels of productivity in Canada.[1/]

Estimates of the contribution of fixed enterprise capital to differences in output per worker in Canada and the United States are set out in Table 54. The Canada-U. S. relationship was based on the direct comparison of the level of capital stocks; and the U. S.-European, on a cumulation of investments since the war. In each case, the contribution of capital to growth was measured by averaging the effects of gross and net capital stocks.[2/]

Table 54

COMPARISON OF LEVELS AND CONTRIBUTION OF ENTERPRISE STOCK

TO DIFFERENCES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

	Relative Level of Enterprise Capital Stock (U.S. = 100)				Contribution to the Gap in Net National Income per Person Employed with the United States(1)		
	Total		Per Person Employed				
	Gross	Net	Gross	Net	Gross	Net	Average
					(In percentage points)		
Canada	8.9	10.0	101	113	-0.1	-1.3	-0.7
United States	100.0	100.0	100	100	--	--	--
Northwest Europe	50.2	55.7	42	47	5.9	5.4	5.6
Germany	13.8	16.9	36	45	6.5	5.6	6.1
Norway	1.7	1.8	80	86	2.1	1.4	1.7
United Kingdom	13.5	14.7	38	41	6.3	6.0	6.2

(1) Before adjustment for interaction (Chapter X).

Note: The broken line indicates a degree of incomparability. The Canada-U.S. comparison was based on stock levels; and the European-U.S., on investment cumulations.

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Table 12-14, p. 172.

On the basis of the estimates of enterprise stock levels in Canada and the United States developed for this Study, Canada had, in 1960, slightly more capital per worker than the United States.[3/] Fixed capital, therefore, did not account for any of the shortfall in income per worker in Canada. On the contrary, its contribution was, if anything, a negative one; other things being equal, the capital input would have resulted in a higher level of income per worker in Canada.

1/ The official U. S. stock data are not broken down into industry detail. The overall capital disparity suggests the need for further investigation on an industry-by-industry basis.

2/ The contribution of enterprise capital to growth was also based on the average of the growth performance of net and gross stock series. (See footnote 1, page 77.)

3/ The comparison of capital per worker in Table 53 was based on employment in the enterprise sector. Table 54 and the estimate of contribution of capital to differences in levels of output per person employed were based on total employment including military.

None of the European countries approached the level of fixed capital per worker that obtained in Canada or in the United States. Norway came closest in 1960 with some 86 per cent of the U. S. volume of real net capital per worker. Denison noted that about 20 per cent of Norwegian enterprise capital was in shipping but that it was associated with only 5 per cent of Norwegian civilian employment.[1] Apart from this concentration, however, Norway would still remain the most capital-intensive of the European countries covered by this analysis.[2]

At the other extreme, Italy had the smallest amount of fixed capital per worker, so that over seven percentage points of the income gap between Italy and the United States was attributed to a deficiency in real capital. Except for Canada and Norway, a lower level of enterprise capital per worker was responsible to a significant degree[3] for the lower level of income per person employed in every country compared with the United States.

1/ Denison, p. 170, footnote 102.

2/ Similarities in climate, population density, resources, and foreign capital suggest the possibility of parallel explanations for the high levels of capital per worker in Canada and Norway.

3/ The return to fixed enterprise capital as a share of U. S. national income in 1960-62 was 10 per cent (Table 14). With a weight of this size, only large differences in capital per worker could make a significant contribution to the income gap. The assumptions of the marginal-productivity/factor-share type of analysis are such that capital could not, by definition, play the dominant role that has frequently been attributed to it.

CHAPTER IX

OTHER CAPITAL INPUTS AND LAND

INVENTORIES

Inventory holdings represent a significant allocation of real resources to production. A large part of inventory theory and empirical analysis has emphasized the role of cyclical fluctuations in inventories; this Study is concerned, however, with the longer-term investment implications of the level of total investment in inventories and changes in the level over time.

The growth in the volume of enterprise[1/] inventories from 1950 to 1964 for a number of countries is compared in Table 55. Because of the cyclical pattern of inventory behaviour, and the degree of slack in 1960 and 1962 in the Canadian and U. S. economies, 1964 represents a more "normal" level of activity. Farm inventories are an important part of inventory accumulation and liquidation in Canada. However, the change in level of farm inventories and grain in commercial channels from 1950 to 1964 was similar to that of nonfarm business inventories and therefore did not alter the longer-run growth rate of total enterprise inventories.

Table 55

GROWTH IN THE VOLUME OF ENTERPRISE INVENTORIES

(Index 1950 = 100)

	1950	1955	1960	1962	1964
Canada[(1)]	100	129	150	156	168
United States	100	121	136	143	154
Northwest Europe	100	122	153	160	180
Norway	100	121	128	138	141
United Kingdom	100	108	126	135	141

(1) The level of enterprise inventories in Canada was established for year-end 1960 using unpublished data made available by the National Accounts Division of DBS, and data on the quantities and prices of farm inventories of grain and livestock. Changes in the volume of inventories were used to project the 1960 figure to 1949 and 1964. The annual estimates were obtained as the average of the year-end figures.

Source: United States and Europe -- Denison, Table 13-1, p. 176.

1/ The inventory statistics for Canada include farm (grain and livestock) and nonfarm business stocks and grain in commercial channels. The term "enterprise" is used to describe the sector, not the unit of collection (see definition of enterprise sector in the Notes to Chapter VIII.

Inventory accumulation from 1950 to 1964 was much larger in several of the European countries than in Canada or the United States. Germany, the Netherlands and France show index levels of 240, 201 and 194 respectively; the smallest accumulation, to 125 in 1964, was in Belgium. The average inventory growth rates from 1950 to 1962 were 3.0 per cent per annum for the United States, 3.8 for Canada, 4.5 for Northwest Europe and 2.6 for the United Kingdom. Although fluctuations in inventory holdings arising from short-cycle variations in demand contributed to some part of this difference in growth rates, the largest part of the difference was assumed to arise from the relationship of changes in inventories and output in the various countries.

Income Growth

The contribution of inventory accumulation to growth was calculated using the annual growth rate of inventories weighted by their share in national income (Table 12). The estimates are shown below.

Table 56

CONTRIBUTION OF ENTERPRISE INVENTORIES

TO GROWTH RATES OF NET NATIONAL INCOME

(Percentage points)

	1950-62	1950-55	1955-62
Canada	.18	.31	.11
United States	.10	.15	.07
Northwest Europe	.18	.16	.19
Germany	.33	.35	.32
Norway	.13	.20	.09
United Kingdom	.09	.06	.10

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Table 13-3, p. 177.

Income Levels, 1960

There are difficult measurement problems in estimating total inventories and these affect the 1960 cross-section or level comparison more than the time series comparison. The estimates suggest that Canada had a slightly larger inventory holding per person employed in 1960 than the United States. 1/ On this basis,

1/ Professor T. M. Brown estimated inventory holdings excluding government at June 30, 1960 at $12.9 billion; see Canadian Economic Growth, Royal Commission on Health Services, Ottawa, Queen's Printer, 1965, Table B-1, p. 198. This estimate was about 4 per cent larger than the estimate in Canadian dollars used in Table 57 as a basis for the Canada-U.S. relative.

inventories did not account for any of the Canada-U. S. income gap; indeed income per person employed in Canada would have been larger than in the United States if inventories were the only factor considered.

All of the European countries had a lower stock of inventories than the United States in 1960. The level in Northwest Europe was two-thirds, but in the Netherlands it was 93 and in Italy 46 per cent, of the U. S. level.

Table 57

COMPARISON OF LEVEL AND CONTRIBUTION OF ENTERPRISE INVENTORIES

TO DIFFERENCES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

	Relative Inventories in U.S. 1955 Prices		Contribution to the Gap in Net National Income per Person Employed with the United States[2]
	Total	Per Person Employed	
	(U.S. = 100)		(In percentage points)
Canada[1]	9.5	108	-.2
United States	100.0	100	--
Northwest Europe	78.4	66	.8
Norway	1.6	77	.6
United Kingdom	24.6	69	.8

(1) The estimate of Canadian inventories in 1960 was converted to 1955 Canadian prices and then to 1955 U.S. prices, using a Canada-U.S. price relative for inventory holdings. The contribution to the gap in income per person employed was measured by weighting the Canada-U.S. relative of inventories per person employed in U.S. prices by the U.S. share of inventories in national income (Table 14).

(2) Before adjustment for interaction; see Chapter X.

Source: United States and Europe -- Denison, Table 13-4, p. 177.
The level of inventories in the United States appears in Denison, Appendix K, p. 428.

INCOME FROM HOUSING

In the post-war years about one-fifth to one-quarter of fixed capital investment in Canada went into housing. The growth in population and labour force has resulted in high rates of family formation and a need for rising levels of expenditure on housing. In addition, the level of internal migration and the pace of urbanization in Canada have aggravated the demand for housing. 1/

Table 58 sets out the number of dwelling units built, and relative levels of housing investment, per person employed from 1950 to 1962. These comparisons do not take explicit account of differences in the importance of single and multiple

1/ For more detail on family formation and housing in Canada, see Wolfgang M. Illing, Housing Demand to 1970, Staff Study No. 4, Economic Council of Canada, Ottawa, Queen's Printer, 1964; also discussion in Chapters 2, 5 and 7 of the Economic Council of Canada's Fourth Annual Review, op. cit.

dwelling units, or the shift to apartment living during the period, although some of the difference between the number of units built and expenditure on housing reflects the mix in types of dwelling units.

Table 58

RESIDENTIAL CONSTRUCTION PER PERSON EMPLOYED,(1) FROM 1950 TO 1962

	Relative Cumulative Expenditure on Residential Construction(2) per Person Employed (U.S. = 100)	Dwellings(3) Built per Person Employed (No.)
Canada	85	.23
United States	100	.28
Northwest Europe	64	.19
Norway	89	.25
United Kingdom	53	.15

(1) 1962 employment.

(2) Canada -- based on housing in DBS, Private and Public Investment in Canada, 1946-57 (61-504) and succeeding annuals (61-205), Ottawa, Queen's Printer, revalued to U.S. 1950 residential construction prices.
United States and Europe -- Denison, Table 11-2, p. 127.

(3) Canada -- based on dwelling completions from Central Mortgage and Housing Corporation, Canadian Housing Statistics, Ottawa, 1967.
United States and Europe -- Denison, loc. cit.

The United States, Germany, Norway and Canada topped the list in terms of house-building per person employed. The United States built half again as many dwellings as Northwest Europe as a whole, and twice as many as the countries at the bottom of the ranking, such as France, Denmark, the United Kingdom and Italy. These figures are particularly startling in the light of the wide destruction of housing in Europe during the war.

The increases in expenditure on rent (in constant prices), shown in Table 59, follow a similar pattern.[1/] The largest increases in rents occurred in Germany, Canada and the United States. These figures give some indication of the growth in the housing stock and confirm the general investment picture in Table 58. The smaller increases in rent in some of the European countries reflect, to some extent,

1/ For the most part, national accounts statistics include an imputation for rent on owner-occupied dwellings, but differences among countries in the method of estimation may affect this comparison.

the use of rent controls and subsidies on the capital cost and rents of new houses.[1/] The United Kingdom, for example, had one of the smallest increases in rents, but almost 60 per cent of all houses built in 1957 in the United Kingdom were publicly financed and for rent. In part, the growth in expenditure on rent parallels and reflects the growth in total consumption. Only in Canada and the United States did expenditure on rent increase substantially more than total personal expenditure.

1/ The quotations and table below suggest the extent of government assistance in new house-building in Europe.

> ... during the period 1955-1957 more than half the residential construction was achieved with some form of financial aid. More than half the aided dwellings were built for rental.... [Dewhurst, et al., op. cit., p. 233.]

> For dwellings built for rental the financial aid consists partly of loans at especially low interest rates for longer amortization periods than the open market would accept, and partly of annual rent subsidies paid by government to the owner of the building, to local authorities (United Kingdom) or to nonprofit housing associations. [Dewhurst, et al., op. cit., p. 232.]

Extent of Public Financial Aid to Housing,

Selected Countries, 1957

	Dwellings Receiving Aid as Per Cent of All New Dwellings Completed			Dwellings Completed by Public Bodies as Per Cent of Total
	Total	Owner Occupied[a]	Rented	
Netherlands	95	25	70	27
France	91	56	35	39
Denmark	85	31[b]	60[b]	8
Norway	66	62[c]	13[c]	4
United Kingdom	58	--	58	58
Belgium	53	40	14	n. a.
Germany	52	32[e]	63[e]	3
Italy	21	50[d]	50[d]	19

[a] Owner-occupied dwellings here include cooperatively owned dwellings in apartment houses.

[b] Urban areas only.

[c] 1956.

[d] Per cent of all new aided dwellings rather than all new dwellings.

[e] Includes those aided with tax concessions.

Source: Dewhurst, et al., op. cit., Tables 7-10 and 7-14, pp. 231 and 237.

Table 59

INCREASE IN HOUSE RENTS AND PERSONAL EXPENDITURE, 1950 TO 1962

(1962 as percentage of 1950, in constant prices)

	Gross Rent(1)	Private Consumption Expenditure(2)
Canada	196	165
United States	182	146
Belgium	115	n.a.
Denmark	150	147
France	158	176
Germany	227	250
Netherlands	144	158
Norway	143	147
United Kingdom	123	132
Italy	138	n.a.

(1) Canada — based on national accounts data for personal expenditure on shelter less the category "other" shelter; see DBS, National Accounts, op. cit., 1926-56 and 1965, Table 47, deflated by the implicit price index for shelter.
United States and Europe -- Denison, p. 126.

(2) Based on U.N., National Accounts, 1964, op. cit.

Income Growth

The share of net national income that derived from housing services was measured by net rents plus interest on mortgages for dwellings. 1/ It was not feasible to separate the income on residential land from that on dwellings. Farm dwellings were included with housing and not with farm capital.

Since the net income arising from housing services is an explicit component of net national income, the estimate of the contribution of housing to income growth was made directly. For example, from 1950 to 1962 the increase in volume (deflated value) of housing services was some 8 per cent of the increase in real net national income, and the rate of growth of net national income over the period was 3.8 per cent per annum (Table 6). The contribution of housing to the growth of national income was estimated to be 8 per cent of 3.8 or 0.30 per cent. This method and the detail for the subperiods were used to derive the growth contribution of housing in total and per person employed (Table 60).

1/ Denison used the OECD National Accounts, op. cit., estimate of the income accruing from ownership of dwellings. The figures for Canada given in these accounts are not appropriate for use here as they are gross of depreciation and do not include mortgage interest. The housing estimates are currently in process of revision. Preliminary data as a basis for the estimates in this Study were provided by DBS, National Accounts Section.

Table 60

CONTRIBUTION OF HOUSING TO GROWTH RATES OF NET NATIONAL INCOME

(Percentage points)

	Total Net National Income			Net National Income per Person Employed		
	1950-62	1950-55	1955-62	1950-62	1950-55	1955-62
Canada	.30	.40	.24	.23	.35	.15
United States	.25	.26	.25	.21	.22	.21
Northwest Europe	.07	.05	.08	.04	.04	.05
Norway	.04	.05	.04	.04	.05	.04
United Kingdom	.04	.02	.06	.02	.00	.04

Source: Canada -- see text.
United States and Europe -- Denison, Table 11-1, p. 124.

Housing as a factor in growth was much more important in the United States and Canada than in Europe. Over the period as a whole, the contribution of dwellings in Europe was less than a quarter of that in Canada. Only Denmark and Germany approached even half the Canadian level. The small contribution in most European countries contrasts with the real levels of housing construction shown in Table 58. The low rate of return on housing investment arose in part from the housing subsidies and rent controls. This is particularly striking in the case of Norway where a large amount of housing was put in place, but the growth in the measured services of housing was relatively small.

Income Levels, 1960

The contribution of dwellings to differences in the level of national income per person employed is shown in Table 61. The Canada-U. S. housing relative was based on the stock of dwellings per person employed in each country.[1/] In 1960 there were .72 dwellings per person employed in Canada and .77 in the United States; the Canada-U. S. housing relative was 94. The income arising from housing in the United States was $240 per person employed.[2/] At U. S. price levels, the comparable Canadian income arising was $227 -- some $13 below the U. S. level. Thirteen dollars is 0.2 per cent of U. S. net national income per person employed; thus the Canadian dwelling shortfall accounts for 0.2 percentage points of the income difference between the two countries. The Canada-U. S. income shortfall in

1/ Denison's relatives for Europe were based on the Gilbert OEEC studies, op. cit. Comparable data were not available for Canada. Instead the stock of occupied dwellings in the United States and Canada was compared directly and valued in U. S. rental prices. Data on house size, facilities, rents, etc., gave no indication of a clear-cut over-all quality difference between average accommodation in Canada and the United States. See Notes.

2/ Denison, p. 129.

1960 was established in Chapter II as 18 percentage points (Table 5); a slightly lower level of housing per person employed in Canada accounted for 0.2 percentage points of this income difference (Table 61).1/

The similarity of housing densities in Canada and the United States did not provide a basis for attributing any significant part of the total difference in national income between the two countries to this source. On the other hand, a larger part of the income difference between Europe and the United States was related to housing.

Table 61

COMPARISON OF LEVEL AND CONTRIBUTION OF INCOME FROM HOUSING

TO DIFFERENCES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

	Stock of Houses in U.S. Prices per Person Employed (U.S. = 100)	Relative Income from Housing in U.S. Prices per Person Employed (U.S. = 100)	Contribution to the Gap in Net National Income per Person Employed with the United States (In percentage points)
Canada(1)	94	--	0.2
United States	100	100	--
Northwest Europe		54	1.9
Norway		48	2.1
United Kingdom		61	1.6

(1) See footnote 1, p. 93.

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Table 11-3, p. 129.

LAND AND NATURAL RESOURCES

Rental income on non-residential land2/ and natural resources was a small share of net national income in all the countries studied. It ranged from 3 per cent in the United States and the United Kingdom to 4 1/2 per cent in Norway (Table 13).3/

1/ This method of comparing the input of housing services was based on the relative volume of housing; it is equivalent to that which would be obtained using the Denison method, i.e. the net income arising from housing per person employed in Canada and an assumed Canada-U.S. price relative for net rent of 87.5, i.e. Canadian rents 12 1/2 per cent below the level in the United States.

2/ Residential land is included with housing.

3/ Small differences may not be statistically significant since land's income share is isolated, using relative asset values for fixed enterprise and inventory investment.

Measures of the contribution of land and resources to income levels and growth which were used in this Study were only those reflected in rents. Income generated by the exploitation and use of resources, which accrues to labour or to capital, is reflected in the returns to these factor inputs. The contribution of land and resources as free goods is not reflected either in factor income or output. It must be clear that this framework of analysis does not attempt to measure the total, i. e. direct and indirect, impact of Canadian resource development on economic growth in Canada.

The amount of land available in each country was assumed to be unchanged from 1950 to 1962, and the index of land input remained constant at 100. Table 62 shows only marginal changes in the amount of agricultural land in use. [1/] Given the assumption of a constant volume and quality of land, no part of the growth of total national income could be attributed to changes in land input. However, a constant total land input represented a decline in input per person employed; thus land made a small but negative contribution to the growth of income per person employed.

Table 62

INDEXES OF AGRICULTURAL LAND IN USE

(1950 = 100)

	1950	1955	1960	1962
Canada(1)	100	99.9	99.2	n.a.
United States(2)	100	99.7	96.7	n.a.
Northwest Europe	100	100.1	99.9	99.5
United Kingdom	100	99.9	99.1	98.5

(1) 1950 is 1951; 1955 is 1956; and 1960 is 1961.

(2) 1955 is 1954; and 1960 is 1959.

Source: Canada -- see Notes.
United States and Europe -- Denison, Table 14-1, p. 181.

Income Levels, 1960

Differences in the availability of land and resources have, however, contributed to international differences in the level of output and income. A meaningful comparison of these differences might include not only the land and resource base, but such additional factors as climate, location, etc. Concerning the difficulty of making meaningful comparisons, Denison wrote:

1/ It may be that some account should be taken of the contribution of mineral discoveries to production between 1950 and 1962 in Canada. The discovery and use of natural resources constitutes a saving in production over the cost of imported substitutes. In some cases, however, domestic resources are not cheaper than imported ones. Denison did not take account of discoveries in Europe or the United States, and no adjustment was made for Canada. See the discussion of this point in Denison, p. 181.

> I know of no attempt to make a comprehensive quantitative comparison of the countries being examined with respect to input of land and natural resources. An adequate effort to do so is quite beyond the capabilities of the present study, but some estimate is unavoidable. 1/

In one sense, the quantifications for the United States and Europe posed an easier problem because one can say, with reasonable certainty, that the land and resource base per person was less in Europe than in the United States. The Canadian-U. S. comparison was less clear; neither logic nor impression provided a basis for inferring even the direction of such a comparison.

In terms of total land and agricultural land per person employed Canada had, and has, a substantial volume advantage over the United States (Table 63). Canada had about twice as much farm land per person employed 2/ as the United States and the margin in nonfarm land was about 20 times the U. S. level.

Table 63

LAND PER PERSON EMPLOYED, CANADA AND UNITED STATES, 1960

(Square miles)

	Total Land	Agricultural Land	Arable Land
Canada	633	44	23
United States	52	25	10

Source: See Notes.

The land input was assumed to fall into three parts -- business site land, farm land and mineral land. The weights of the three components, based on relative U. S. earnings, were 73, 17 and 10 respectively. 3/ Land for business sites, which carried a weight of 73 in the total estimate, was assumed to be equally available per person employed in all countries and, therefore, to have contributed nothing to differences in income per person employed. The importance of site land and the assumption of parity dominated the total land comparison. As a result the divergence in the total estimate of land input was small. Since a large part of the Canadian "advantage" was in nonfarm or site land, this "advantage" is not reflected in the measure of relative land inputs. 4/

1/ Denison, p. 183.

2/ Total employment, not farm employment.

3/ Loc. cit.

4/ It is not altogether clear that the volume of land in Canada has been, or is, a "net advantage". A cost-benefit analysis would take account of the transportation, communication, and isolation costs. In addition to the difficulties of measuring some of the economic costs and benefits, an important part of the advantage would be noneconomic -- in recreation, conservation, and aesthetic and psychological gains. Data on the degree of urbanization (Table 88 and Denison, Table 17-1, p. 230) suggest that concentration is not necessarily closely related to the volume of land. The United States and Canada have the largest land area and enjoy the costs and advantages of large urban concentrations.

Agricultural land in total and per person employed varied widely among countries. Table 64 shows the relative volume of total land and arable land in 1960. The weight of arable land in the total estimate was 17.

Table 64

LAND AREA AND MINERAL PRODUCTION PER PERSON EMPLOYED, 1960(1)

(Relatives, U.S. = 100)

	Land Area per Person Employed			Value in $ U.S. of Mineral Production per Person Employed	
	All Land	Arable Land	Arable Land Adjusted(2)	Denison List	Expanded List
Canada	1,213	226	199	134	171
United States	100	100	100	100	100
Northwest Europe	13	20	16	26	26
United Kingdom	7	11	9	26	26

(1) Land area for Canada is 1961, and for the United States is 1959.

(2) Includes one-third of permanent meadows and pastures.

Source: Canada -- see Notes.
United States and Europe -- Denison, Table 14-2, p. 184.

The comparison of mineral resources raises a number of questions. Are we attempting to measure the effect of differences in the resource base on the level of income? Does the resource base include proved or estimated reserves as well as used or exploited resources? So far as the framework of this Study is concerned, the answer to both questions is "no". National income is generated as resources are produced for use. The return to land (and resources) is concerned with land as a factor input in production, and not with the labour and capital associated with its discovery or use.

To compare the contribution of mineral resources to differences in income levels, Denison measured, in U. S. prices, the production of selected and important mineral resources in Europe and the United States. A comparison of output in Canada and the United States was made, using the same list of primary products. A second list was compiled that also included nickel, asbestos and platinum; these products were not important for the U. S.-European comparison, but highly relevant for Canada and the United States. This "expanded" list provided the basis for an alternative and preferred estimate of the relative use of mineral resources in Canada and the United States.

On the basis of the expanded list, mineral output per person employed in Canada was almost 75 per cent larger than in the United States. 1/ Since the weight

1/ It is of interest to note that the volume of mineral output in Canada in 1960 was only 15 per cent of the U. S. level.

of the contribution of mineral output in the total land estimate was only 10, the large Canadian advantage in resources had little effect on the calculation of the contribution of land and resources to differences in income per person employed in Canada and the United States.

The relatives for land and resources are shown in Table 65. As noted above, site land with a weight of 73 was assumed equally available in all countries so that the enormous over-all advantage for Canada in land area was not reflected proportionately in the estimate of the relative volume of land input. Similarly, the Canadian mineral resource advantage received a very small weight. On the basis of these assumptions the larger Canadian land and resource base was estimated to account for a level of income about one-half of one percentage point higher than in the United States; that is to say, land and resources contribute negatively to the income gap between Canada and the United States. 1/

Table 65

COMPARISON OF LEVEL AND CONTRIBUTION OF LAND AND RESOURCES

TO DIFFERENCES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

	Relative Land Input (U.S. = 100)				Contribution to the Gap in Net National Income per Person Employed with the United States
	Non-Residential Site Land	Agricultural Land	Mineral Resources	Total(1)	
					(In percentage points)
Canada	100	199	171	124	-.6
United States	100	100	100	100	--
Northwest Europe	100	16	26	78	.5
Norway	100	16	10	77	.6
United Kingdom	100	9	26	77	.6

(1) Weights: non-residential site land, 73; agricultural, 17; mineral, 10.

Source: Canada -- see text and Table 64.
United States and Europe -- Denison, Table 14-3, p. 185.

The European countries all had a land and resource base substantially below that of the United States or Canada. Given the assumption of equivalent amounts of site land, the lack of land and resources did not account for any large part of their income gap with the United States.

INCOME ON FOREIGN INVESTMENTS

The framework of analysis used in this Study is based on national, not domestic, income or product. The national measure takes account of income receipts and remittances on foreign investment; it is larger than domestic income in lending

1/ The more one takes the view that the Canadian resource base is understated by these measures, the less one is able to explain the Canada-U. S. income gap.

countries and smaller in borrowing countries. [1] The most straightforward method of evaluating the contribution of income on foreign investment to national income is to adjust for the net international income flow on the basis of the difference between national and domestic output. [2]

The national income of the United States -- a net lending country -- includes a substantial amount of property income received from investments abroad. Canada and Norway are the only two countries in the group for whom a continuing capital inflow, or the use of foreign resources, is significant. In both of these countries, national income is significantly smaller than domestic income, by the amount of the (net) outflow of property income. Data are not available for a direct comparison of the role of foreign capital in Norway and Canada; however, net foreign borrowing (in current prices), over the period 1950 to 1962, represented 1.6 per cent of Norwegian GNP compared with 2.6 per cent in Canada (Table 46).

Income Growth

Table 66 sets out the contribution of income flows from foreign investment to the growth of national income. [3] The rapid growth of foreign investment in Canada has resulted in a rising level of earnings and income remittances. The share of earnings on foreign investment that is remitted abroad varies widely, however, from one year to the next, depending on a variety of factors including the need or prospects for reinvestment. The fortuitous selection of particular years for comparison in the analysis may give rise to atypical levels or may bias the time trends.

---

[1] See Notes to this Chapter for an account of the importance of undistributed profits and withholding taxes on property income accruing to non-residents. The income adjustment from domestic to national does not measure the total return on foreign direct investment, but only remitted earnings as recorded in the national accounts (profits earned by unincorporated branch subsidiaries, and interest and dividends paid by corporate subsidiaries).

[2] The return to capital is usually measured in relation to total capital in the country, both local or foreign-owned. For borrowing countries in particular, one could, in theory, make the adjustment by separating foreign-owned and resident-owned capital inputs, and relating them to the corresponding property income flows to residents and non-residents. The rates of return arising from such an estimate would only be meaningful if total income accruing to non-residents were used, as opposed to only the portion which is remitted.

[3] Based on net property income in Canada paid to, and received from, non-residents as given in DBS, National Accounts, op. cit., e.g. Table 4. The net flow was deflated, using the implicit price index of imported goods and services. The contribution to growth, based on the deflated series, was measured in the same way as for housing -- the growth rate of net national income times the ratio of the increase in net non-resident income to the increase in net national income.

There is no consensus concerning a correct or universally appropriate method of deflating these income flows, or whether they should be deflated gross or net. The use of import price indexes to deflate net flows suggests the cost of the transfer of income in terms of forgone imported goods and services. While there is large scope for differences of opinion on this point, the effect of alternative deflation methods is not likely to be large. See, for example, the discussion by J. L. Nicholson, "The Effects of International Trade on the Measurement of Real National Income", E.J., Vol. LXX, September 1960.

Canadian remittances abroad were especially large in 1950, and declined between 1950 and 1955. This does not imply a decreasing role of, or a declining return on, foreign capital. However, the calculation, which was based on remittances (not earnings), resulted in a positive contribution to income growth over that period. The negative contribution for the United Kingdom in 1950-55 also reflects wide variability in their international income and lending accounts. 1/

Table 66

CONTRIBUTION OF INCOME ON FOREIGN INVESTMENTS

TO GROWTH RATES OF NET NATIONAL INCOME

(Percentage points)

	Total Net National Income			Net National Income per Person Employed		
	1950-62	1950-55	1955-62	1950-62	1950-55	1955-62
Canada	-.03	.09	-.12	--	.12	-.08
United States	.05	.03	.06	.04	.02	.05
Northwest Europe	-.03	-.12	.03	-.04	-.13	.03
Norway	-.07	-.04	-.09	-.07	-.04	-.09
United Kingdom	-.05	-.36	.17	-.06	-.37	.17

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Table 11-4, p. 130.

Net income payments to non-residents made a negative contribution to the growth of national income in Canada from 1955 to 1962; in other words, the contribution had a "normal" sign. During this period net payments to non-residents on foreign investment reduced the growth of net national income in Norway and the Netherlands as well as in Canada by 1/10 of 1 per cent. Income on overseas investments of residents of the United States added only 1/20 of 1 per cent to U. S. income growth over the period 1950 to 1962.

1/ See Denison, p. 131.

Income Levels, 1960

The United States receives investment income from its substantial foreign investments, and Canada makes income payments to non-residents for the use of their capital. These two flows reinforce one another in explaining some of the overall difference in the level of income in the two countries. They are more important in accounting for differences in level than in growth. About two percentage points of the Canada-U. S. difference in national income per person employed in 1960 was explained by the net international income flows on foreign investments. [1/]

Table 67

COMPARISON OF LEVEL AND CONTRIBUTION OF INCOME ON FOREIGN INVESTMENTS TO DIFFERENCES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

	Relative Income on Foreign Investment in U.S. Prices		Contribution to the Gap in Net National Income per Person Employed with the United States
	Total	Per Person Employed	
	(U.S. = 100)		(In percentage points)
Canada	- 21.2	-241	2.0
United States	100.0	100	--
Northwest Europe	31.5	27	0.4
Norway	- 1.6	- 76	1.0
United Kingdom	33.2	93	0.0

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Table 11-5, p. 132.

[1/] Net property income to non-residents in 1960 was converted to U. S. dollars at the 1960 exchange rate. The difference between the net Canadian property income paid and net U. S. property income received (both in U. S. dollars) as a share of U. S. national income was two percentage points.

CHAPTER X

FACTOR INPUTS AND FACTOR PRODUCTIVITY

This Chapter brings together the estimates of factor inputs from the previous chapters and assesses their contribution to growth and output. The summary of the method, described in Chapter I, indicated that the growth rate of each factor input was weighted by its factor share to obtain the contribution of that input to income growth. Similarly, in the 1960 cross-section comparison, the relative level of input per person employed, compared with the United States, was weighted by the U. S. factor share to obtain the contribution of that input to the difference in income per person employed. 1/ Two adjustments were made to this method in the process of consolidating the factor input estimates. The first concerns the contribution of labour to growth, and the fact that national output measures invariably include estimates of output in some industries, based on factor inputs, primarily employment. As a result, these output components do not include any allowance for increased output per worker. The second adjustment takes account of interactions among factor inputs, and output per unit of input.

ADJUSTMENT TO LABOUR QUALITY FOR LIMITATIONS IN OUTPUT MEASURES

As the importance of government expenditures and output in the institutional and service industries continues to grow, the need to improve the measures of output in these industries becomes increasingly urgent. 2/ In a number of individual industries, output is measured by employment and the rate of growth of output does not take account of increases in output per person. 3/

The extent of this understatement of output in the United States and Europe was derived from the OEEC comparison of real output. 4/ Estimates for Canada on a comparable basis were not available. A recent study by B. Emery and G. Garston 5/ provided a guide to the importance of the "no productivity" component in Canadian output measures. It was suggested that some 15 per cent of 1949 real gross product

---

1/ The alternative method used for housing and property income on foreign investment was indicated in Chapter IX.

2/ A conference on "Production and Productivity in the Service Industries" held in Ottawa in 1967, sponsored by the NBER, Conference on Research in Income and Wealth, covered a wider range of problems common to measures of real output in the service industries in Canada and the United States. The papers will be published as part of that NBER series.

3/ The problem affects the volume series in the national accounts in a number of ways -- in government and construction expenditures, or in the output of services and the financial and institutional sectors.

4/ Gilbert and Kravis, op. cit., and Gilbert and Associates, op. cit.

5/ Betty J. Emery and Gordon J. Garston, "The Measurement of Constant Dollar Aggregates in Canada", mimeographed paper for Tenth General Conference of the International Association for Research in Income and Wealth, Maynooth, Ireland, August 1967.

was, on an annual basis, derived from labour input data.[1] Output in the affected sectors of the economy has, by and large, grown more rapidly than total real output, so that the importance of the affected area in total output has increased.[2]

On the basis of an examination of the Canadian and U. S. accounts, it was concluded that there was no significant difference in the incidence of this understatement in the Canadian or the U. S. accounts. Since it is doubtful whether there is more than one percentage point difference,[3] the estimate used by Denison for the United States of 15 per cent of labour input[4] was also used to adjust the Canadian labour inputs. Table 68 indicates the importance of this measurement problem.

Table 68

SHARES OF GROSS NATIONAL PRODUCT(1) IN 1950,

AND LABOUR INPUT 1950 TO 1962,

IN ACTIVITIES FOR WHICH OUTPUT IS BASED ON RESTRICTED INPUT DATA

(Percentage shares)

	Percentage of GNP at Factor Cost 1950	Percentage of Labour Input 1950 to 1962
Canada	n.a.	15
United States	11	15
Norway	14	20
United Kingdom	12	17

(1) National price weights, and excluding defence.

Source: Canada -- see text.
United States and Europe -- Denison, Table 15-1, p. 188.

Factor Inputs and Income Growth

Estimates of growth in the factors affecting labour quality were described in Chapters IV, V, and VI and summarized in VII. Assuming that the growth in output arising from improvements in the quality of labour input was not fully

1/ Ibid., p. 7.

2/ In spite of continuing improvements in the methods of estimation.

3/ For example, the share of government nonmilitary earnings in GNP at factor cost was 6 and 7 per cent in Canada and the United States respectively in 1950, and 9 per cent in both countries in 1960.

4/ Denison, Table 15-1, p. 188.

reflected in the estimates of output growth as it is currently measured, the labour input quality improvements were reduced by 15 per cent.[1/]

The growth rates of the individual factor inputs (labour-quality adjusted, and excluding housing and income on foreign investment) are shown in Table 69. The estimates of growth, the subtotals for capital and total factor input were obtained by weighting the inputs by their appropriate national factor shares as given in Table 12. Output per unit of input was estimated by dividing the growth of national income by the growth of factor inputs (both excluding income on housing and on foreign investment).

Table 69

GROWTH RATES OF FACTOR INPUTS(1)

AND OUTPUT PER UNIT OF INPUT, 1950-62

(Annual average rates)

	Canada	United States	Northwest Europe	United Kingdom
Total factor input	2.48	1.71	1.67	1.16
Labour(2)	1.90	1.42	1.08	.77
Employment	1.97	1.14	.93	.65
Hours worked(2)	- .25	- .21	- .18	- .19
Age-sex composition(2)	- .12	- .13	.04	- .05
Education(2)	.30	.62	.30	.37
Capital	5.22	3.58	4.53	3.35
Non-residential(3) structures and equipment	5.69	3.74	4.55	3.58
Inventories	3.79	3.00	4.47	2.56
Land	.00	.00	.00	.00
Output per unit of input	1.07	1.36	3.04	1.18

(1) Excludes housing and income flows on international assets which are not estimated using input growth rates.

(2) After adjustment for zero quality change in "no productivity" sectors.

(3) Average of growth rates of net and gross stocks.

Source: Canada -- Tables 41, 48, 55 and 62, and text.
United States and Europe -- Denison, Table 15-2, p. 190.

1/ Compare the labour input quality indexes for 1950-62, and the original and adjusted annual growth rates:

	Quality Index*	Growth Rate	Adjusted Growth Rate
		(Per cent per annum)	
Hours	96.6	-.29	-.25
Age-sex	98.3	-.14	-.12
Education	104.3	.35	.30

* Table 40.

In the first stage of estimating the growth contributions, the factor input growth rates were weighted by factor shares, and the contribution of output per unit of input was derived from Table 69.[1] The sum of the contribution of factor inputs and output per unit of input did not add to total growth by .02 percentage points per annum.[2] This amount, distributed proportionately among the factor inputs and output per unit of input, changed the contribution of employment and of factor productivity to the annual rate of growth by .01 percentage point. The final estimates of the contribution of factor inputs and output per unit of input (adjusted for interaction) are shown in Table 70.

Table 70

CONTRIBUTION OF FACTOR INPUTS AND OUTPUT PER UNIT OF INPUT TO GROWTH OF NET NATIONAL INCOME, 1950-62

(Contribution to growth rates in percentage points)

	Canada	United States	Northwest Europe	Norway	United Kingdom
Net national income	3.82	3.32	4.76	3.45	2.29
Total factor input	2.74	1.95	1.69	1.04	1.11
Labour	1.44	1.12	.83	.15	.60
Employment	1.49	.90	.71	.13	.50
Hours worked	- .19	- .17	- .14	- .15	- .15
Age-sex composition	- .09	- .10	.03	- .07	- .04
Education	.23	.49	.23	.24	.29
Capital	1.30	.83	.86	.89	.51
Housing	.30	.25	.07	.04	.04
Foreign investments	- .03	.05	- .03	- .07	- .05
Non-residential structures and equipment	.82	.43	.64	.79	.43
Inventories	.21	.10	.18	.13	.09
Land	.00	.00	.00	.00	.00
Output per unit of input	1.08	1.37	3.07	2.41	1.18

Source: Canada -- see text and Tables 60, 66 and 69.
United States and Europe -- Denison, Table 15-3, p. 192.

Over the period 1950-62,[3] factor inputs were a more important element in growth in Canada than in any other country except Germany. In absolute terms,

[1] The contribution to growth of income on housing and on foreign investment was derived directly as an income component (see Chapter IX). The calculation of the effect of interaction among the factors was made excluding these two factor inputs.

[2] This discrepancy, and adjustment to inputs, in the Canadian estimate was not necessarily a "real" interaction effect. It was so small that it could have been merely a statistical rounding adjustment.

[3] Data for the subperiods are given in Chapter XV. It should be noted that the percentage shares given in the text are based on unadjusted growth rates and do not necessarily correspond with those in Tables 101 and 103. The more fully articulated statements in Chapter XV are to be preferred for international comparisons.

factor inputs contributed 2 3/4 percentage points to the annual growth rate in both countries. This represented about 75 per cent of total Canadian growth, but 40 per cent of the German growth rate. Only 30 per cent of total growth was accounted for by factor inputs in Norway. In Canada and in Germany, labour represented about one-half of the growth in inputs; and capital, the other half. Compared with Canada, none of the other countries derived so much of their total growth from employment and fixed investment. Conversely, the contribution of output per unit of input to growth was smaller in Canada, both absolutely and as a share of total growth, than in any of the other nine countries. Northwest Europe derived over three percentage points a year from increases in factor productivity. The United Kingdom derived only one.

Using essentially the same methods, the contribution of factor inputs and of factor productivity to growth in output per person employed was derived (see Table 71).

Table 71

CONTRIBUTION OF FACTOR INPUTS AND OUTPUT PER UNIT OF INPUT

TO GROWTH OF NET NATIONAL INCOME PER PERSON EMPLOYED, 1950-62

(Contribution to growth rates in percentage points)

	Canada	United States	Northwest Europe	Norway	United Kingdom
Net national income per person employed	1.81	2.15	3.80	3.27	1.63
Total factor input per person employed	.73	.79	.73	.86	.45
Labour quality(1)	- .05	.22	.12	.02	.10
Capital, total	.85	.60	.65	.85	.37
Housing	.23	.21	.04	.04	.02
Foreign investments	--	.04	- .04	- .07	- .06
Non-residential structures and equipment	.54	.29	.51	.76	.35
Inventories	.08	.06	.14	.12	.06
Land	- .07	- .03	- .04	- .01	- .02
Output per unit of input	1.08	1.36	3.07	2.41	1.18

(1) The division among hours, age-sex composition and education is the same as in Table 70.

Source: Canada -- based on method used in Table 70.
United States and Europe -- Denison, Table 15-5, p. 194.

Growth of Enterprise Capital per Person Employed

By and large, the most important factor input raising the level of output per person employed in every country except Belgium was the increase in capital per worker. Although Canada had the second largest over-all increase in capital, the growth in employment was so great that the gain on a per-worker basis was not large. Table 72 compares the growth per worker in enterprise capital -- structures, equipment and inventories.

Table 72

GROWTH RATES OF ENTERPRISE CAPITAL PER PERSON EMPLOYED

(Annual average rates)

	1950-62	1950-55	1955-62
Canada	3.2	4.2	2.5
United States	2.4	2.7	2.2
Northwest Europe	3.6	2.7	4.2
France	4.1	3.5	4.4
Germany	4.3	2.9	5.3
Norway	4.0	4.5	3.7
United Kingdom	2.7	1.9	3.3
Italy	2.9	1.8	3.7

Source: Canada -- Table 69.
United States and Europe -- Denison, Table 15-4, p. 193.

In spite of the substantially larger level of investment in Canada, in six of the nine countries the growth of enterprise capital per worker was higher than in Canada. There were, however, wide variations in performance among the countries, and in the two time periods. By and large, in the years after 1955, the European countries increased the level of capital per worker by 3 1/4 to 5 1/4 per cent a year. In Canada and the United States the increase was between 2 and 2 1/2 per cent. In the earlier half of the 1950's, the investment level in Canada pushed the rate of gain to over 4 per cent a year, a significantly higher rate than in most of the European countries, with the exception of Norway and Denmark.

The growth of output per person employed (Table 71) was also closely associated with large gains in productivity. In all of the countries, except Canada and the United States, productivity, or the increase in output per unit of input, was substantially more important to growth than factor inputs. The Chapters to follow discuss some of the factors that contributed so significantly to large increases in output per unit of input; and to growth, in Europe.

Factor Inputs and Income Levels, 1960

The Canada-U. S. factor input relatives for 1960 are drawn together from the previous three Chapters and summarized in Table 73. An adjustment to the labour input quality factors for "no productivity" output was also made in this cross-section comparison. As a result, the Canada-U. S. labour quality relatives for hours, age-sex and education were reduced from 104. 5, 102. 6 and 93. 4, respectively (Table 42), to 103. 8, 102. 2 and 94. 3. The subtotal for labour is the multiple of the quality factors; the subtotals for capital and factor input per person employed were derived by weighting the individual factors with the U. S. factor share weights for the United States for 1960-62 (Table 14). Output per unit of input was obtained by dividing total output per person by total factor input per person.

Table 73

FACTOR INPUT PER PERSON EMPLOYED

AND OUTPUT PER UNIT OF INPUT, 1960

(Relatives, U.S. = 100)

	Canada	Northwest Europe	Norway	United Kingdom
Net national income per person employed	81.7	59.0	59.0	59.0
Input per person employed	98.9	89.2	94.1	90.0
Labour quality	100.1	98.3	100.5	99.0
Hours worked(1)	103.8	106.3	105.5	105.1
Age-sex composition(1)	102.2	98.1	99.7	98.9
Education(1)	94.3	94.3	95.5	95.2
Capital	90.5	49.4	67.5	51.0
Dwellings	94.5	54.0	48.5	61.4
Foreign investments	-241.2	26.7	- 76.3	93.2
Non-residential structures and equipment	107.3	44.9	82.9	39.5
Inventories	107.8	66.3	76.6	68.7
Land	124.0	78.3	76.7	77.2
Output per unit of input	82.6	66.2	62.7	65.6

(1) After adjustment for zero quality change in "no productivity" sectors.

Source: Canada -- see Tables 42, 54, 57, 61, 65 and 67, and text.
United States and Europe -- Denison, Table 15-6, p. 197.

The relatives in Table 73 provide a basis for comparing output per worker and output per unit of input. These so-called labour productivity and factor productivity measures are shown in Table 74.

Table 74

LABOUR PRODUCTIVITY AND FACTOR INPUT PRODUCTIVITY, 1960

(Relatives, U.S. = 100)

	Output per Unit of Factor Input	Output per Person Employed
Canada	83	82
United States	100	100
Northwest Europe	66	59
Germany	68	59
France	66	59
Netherlands	66	65
Norway	63	59
United Kingdom	66	59
Italy	50	40

Source: Canada -- Table 73.
United States and Europe -- Denison, p. 196.

Output per worker and per unit of input in Canada were both about 80 per cent of the level in the United States. This is not to say that the absolute levels of labour and factor productivity were similar in Canada or in the United States. It merely suggests that the difference in the productivity level according to the two alternative measures is approximately the same in Canada and the United States. This bears out the relationships shown in Table 73 which suggest that the total difference between Canada and the United States in all factor inputs except employment was negligible (a Canada-U. S. relative of 98. 9 for factor input per person employed). Differences in productivity levels were much wider in the other countries, except in the Netherlands. Germany and Italy had the largest difference. In both of these countries, factor inputs per worker were low relative to the United States. Italy in particular had a low level of labour quality input and capital per person employed.

Initially the contribution of factor inputs and factor productivity to differences in income levels, measured using the relatives in Table 73, would overaccount for the income difference because of interaction among the factors. This Study follows adjustment procedures to eliminate the effect of interaction used by Denison.

> Because my principal purpose in estimating sources of difference in level of national income per person employed is to compare them with the sources of growth, the procedure for allocation among sources should be as comparable as possible. This consideration led me to adopt a procedure that might be described as based on the use of pseudo growth rates.[14]
>
> 14. There is no uniquely correct method of dealing with the interaction and my procedure, as indicated, is related to the purpose of the study. Adoption of any other reasonable procedure would yield different numbers in the tables but would scarcely alter my broad conclusions. 1/

It was first assumed that each country would reach the U. S. level of income per person employed, of output per unit of input, and of input per person employed, of each factor by 1980. The growth rate required for each factor input (and for factor productivity) to reach this objective, weighted by U. S. factor input shares, provided a distribution of pseudo growth rates that was applied to the difference in the level of income per person employed in 1960. 2/ The distribution of the factors contributing to the income gap is set out in Table 75.

1/ Denison, p. 197, including footnote 14.

2/ The contribution to income differences from housing income and non-residential income was estimated directly in the relevant Chapters and is excluded from the income level and factor input elements of the interaction estimates.

Table 75

CONTRIBUTION OF FACTOR INPUTS AND OUTPUT PER UNIT OF INPUT TO DIFFERENCES FROM THE UNITED STATES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

(Percentage of U.S. net national income per person employed in U.S. prices)

	Canada	Northwest Europe	Norway	United Kingdom
Net national income per person employed	81.7	59.0	59.0	59.0
Difference from United States	18.3	41.0	41.0	41.0
Due to:				
Factor input per person employed	0.7	11.3	5.3	11.0
Labour quality	--	1.1	- 0.4	0.6
Hours worked	- 2.8	- 3.9	- 3.4	- 3.1
Age-sex composition	- 1.6	1.2	0.1	0.7
Education	4.4	3.8	2.9	3.0
Capital	1.3	9.7	5.2	9.9
Housing(1)	0.2	1.9	2.1	1.6
Foreign investments(1)	2.0	0.4	1.0	--
Non-residential structures and equipment	- 0.7	6.6	1.5	7.5
Inventories	- 0.2	0.8	0.6	0.8
Land	- 0.6	0.5	0.5	0.5
Output per unit of input	17.6	29.7	35.7	30.0

(1) Contribution taken directly from Tables 61 and 67.

Source: Canada -- derived from Table 73, as described in the text.
United States and Europe -- Denison, Table 15-8, p. 199.

The level of output per person employed in Northwest Europe was about 60 per cent of the level in the United States. The level in Canada (82 per cent) was about half way between Europe and the United States. In Europe factor inputs accounted for about one-quarter of the income gap with the United States. A lower level of factor productivity accounted for the balance. In Canada, on the other hand, no significant part of the income gap was attributed to a lower level of factor inputs. When the small and offsetting differences in factor inputs were taken account of, almost the whole of the Canada-U. S. gap in income per employee was accounted for by a lower level of output per unit of input or factor productivity in Canada compared with the United States.

As a matter of interest, but outside the framework of this Study, a calculation was made using Canadian factor share weights.[1/] The contributions of the various factor inputs to the gap in income per person employed did not differ in any material way from those shown in Table 75.

Some of the elements that affect levels of, and trends in, factor productivity are discussed in the next four Chapters.

1/ The contributions of factor inputs (using Canadian factor share weights) and of output per unit of input to the Canada-U. S. gap in income per person employed in Canadian price weights are set out below. There is little substantive difference in the broad results compared to Table 75. This supports the earlier comment that small differences in factor shares are not likely to alter the orders of magnitude of the contributions in a major way.

Contribution of Factor Inputs and Output per Unit of Input to Canada-U. S. Difference in Income per Person Employed, 1960

(Percentage of U. S. net national income per person employed, based on Canadian factor weights)

Difference in income per person employed with the United States	20.9
Factor input per person employed	0.6
Labour quality	--
Hours worked	- 2.7
Age-sex composition	- 1.5
Education	4.2
Capital	1.1
Housing	0.2
Foreign investments	2.0
Non-residential structures and equipment	- 0.7
Inventories	- 0.4
Land	- 0.5
Output per unit of input	20.3

CHAPTER XI

EMPLOYMENT SHIFTS

EMPLOYMENT SHIFTS AND INCOME GROWTH

One of the most important sources of productivity increase for the economy as a whole is the reallocation of resources from less to more productive use.[1/] This process is a continuing one as economies grow and change. In the post-war years, two particular developments stand out: the decline in the relative importance of employment in agriculture, and the decline in other forms of self-employment, particularly in the trade and service industries.[2/] The following quotation suggests the importance of these shifts in achieving higher levels of productivity in many European countries:

> Apart from the intractable labor surplus on the family farms of the southern agrarian countries, a disproportionately large share of Europe's labor force in other areas is still engaged in producing food for itself and the rest of the population. For the eighteen countries as a whole the nearly one fourth of the labor force engaged in agriculture in 1955, produced less than half that large a share of the gross product. The experience of Britain, which produces half of its food supply with less than 5 per cent of its labor force, and of other efficient agricultural countries is that with the favorable climate and soil of Western Europe about 10 per cent of the labor force should be able to produce enough food to supply the entire population. Fortunately the distribution of the labor force is

---

1/ This Chapter is concerned with the shift of resources out of agriculture and non-farm self-employment. These two components were an important part of the process of labour reallocation during the post-war years, but other inter- and intra-industry shifts were also taking place. See Lithwick, op. cit., Chapters 4 and 5, for an evaluation of the long-run industry shift effects in relation to growth in Canada and the United States, and Wilson and Lithwick, op. cit., for an evaluation of sectoral shift effects. This latter study (p. 46) suggests that the "inter-sectoral movements . . . would account for . . . roughly 11 per cent of the growth rate of factor productivity over the 1926-63 period". The impact on total growth would be 6.5 per cent (.238 ÷ 3.685). The estimates developed in this Chapter suggest that the impact of shifts out of agriculture and self-employment over the period 1950-62 accounted for 37 per cent of the increase in factor productivity and 27 per cent of the increase in total output (see Tables 102 and 103 in Chapter XV).

2/ Internal migration played an important role in the reallocation of labour in Canada. A large part of rural-urban and interprovincial migration arose in conjunction with the decline in the farm population. Interprovincial migration does not appear to have been associated with a narrowing of the income differentials among the provinces in Canada. See Isabel B. Anderson, Internal Migration in Canada, 1921-1961, Staff Study No. 13, Economic Council of Canada, Ottawa, Queen's Printer, 1966, p. 36.

changing for the better, as workers continue to shift from farming into more productive urban activities. Labor productivity in agriculture has also been increasing rapidly and a continuance of recent rates of gain would permit future agricultural output to more than keep up with population growth while allowing for a further substantial decline in the farm labor force. Even larger gains would be possible if greater progress could be made in overcoming such man-made deterrents to higher productivity as excessive fragmentation of farm holdings and government subsidization of uneconomic crops.

Government policy in supporting small business is also an important factor in preserving a multitude of family artisan establishments and retail shops that could not otherwise survive in competition with the large manufacturing enterprises and the chains and supermarkets in retail trade. Here again, in spite of political resistance, the trend is towards the larger and more efficient establishments, with consequent beneficial effects on labor productivity as a whole. 1/

A similar pattern of change has been, and continues to be, a source of productivity growth in Canada. Table 76 illustrates the growing importance of paid employees and the relative decline in self-employment and unpaid family workers.

1/ Dewhurst, et al., op. cit., p. 898.

Table 76

EMPLOYMENT AND SELF-EMPLOYMENT

IN AGRICULTURE AND NONAGRICULTURE SECTORS, 1950 AND 1962

(Thousands)

	Canada	United States	Northwest Europe(1)	United Kingdom(2)
1950				
AGRICULTURE				
Total	1,018	7,497	13,653	1,259
Wage and salary workers	111	1,724	3,599	824
Employers and own-account workers	628	4,346	4,431	435
Unpaid family workers	279	1,427	5,623	--
Male	217	661	1,568	--
Female	63	766	4,055	--
NONAGRICULTURE				
Total	3,958	52,251	58,046	21,320
Wage and salary workers	3,411	45,778	49,901	20,004
Employers and own-account workers	494	6,069	6,960	1,316
Unpaid family workers	53	404	1,185	--
Male	21	74	317	--
Female	32	330	868	--
1962				
AGRICULTURE				
Total	660	5,190	9,575	993
Wage and salary workers	110	1,666	2,171	580
Employers and own-account workers	414	2,619	3,856	413
Unpaid family workers	137	905	3,548	--
Male	92	388	883	--
Female	45	517	2,666	--
NONAGRICULTURE				
Total	5,565	62,656	71,485	23,713
Wage and salary workers	4,980	55,762	63,601	22,416
Employers and own-account workers	528	6,271	6,643	1,297
Unpaid family workers	57	623	1,243	--
Male	10	90	200	--
Female	47	532	1,043	--

(1) Agriculture data include forestry, hunting and fishing in the United Kingdom, and in Northwest Europe with the exception of Norway.

(2) Excludes, in 1950, persons on release from the armed forces not yet in civilian employment.

Source: Canada -- DBS, The Labour Force, Supplement to March 1965 issue, op. cit. Data on labour force for these years by detailed class of workers and sex on a revised basis were provided by DBS, Special Surveys Division. Current data in this detail are available in The Labour Force (71-001), op. cit., Table 6 (monthly).
United States and Europe -- Denison, Tables 5-1A and 5-1D, pp. 46 and 49.

Employment in Agriculture

During the 1950's and continuing into this decade, the magnitude of the farm-nonfarm shift in employment in Canada has been unprecedented. Table 77 suggests the extent of recent declines in farm employment in Canada, the United States and some European countries. In 1950, 20 per cent of total employment in Canada was in agriculture. Norway, Germany, Denmark, France and Italy had even larger proportions of their workers on farms -- from 24 per cent in Norway to 43 per cent in Italy. In 1950 the United Kingdom had only 5 per cent of total employment on farms; at that low a level there was little to gain from further shifts. Between 1950 and 1962, farm employment in Canada (and Belgium) declined more rapidly than in any of the other countries, and by 1967 less than 8 per cent of the employed labour force in Canada was in farm employment. 1/

Table 77

INDEXES AND SHARES OF AGRICULTURAL AND NONAGRICULTURAL EMPLOYMENT, (1)

1950 AND 1962

	1962 Employment Index (1950 = 100)			Agricultural Employment as Percentage of Total	
	Agriculture	Non-Agriculture	Nonagricultural Wage and Salary Workers	1950	1962
Canada	65	136	141	20	11
United States	69	118	120	12	8
France (2)	69	115	123	29	20
United Kingdom (2)	79	110	111	5	4
Italy (2)	72	133	146	43	29

(1) Including military. Employment for the United States, United Kingdom and Canada adjusted to approximately full-time equivalents for nonfarm wage and salary workers. See Denison, p. 205, footnote 9(2).

(2) Forestry, hunting and fishing included with agriculture.

Source: Canada -- Table 76.
United States and Europe -- Denison, Tables 16-2, 16-3 and 16-4, pp. 205 and 206.

The shares of net national income arising from agriculture and nonagriculture are set out in Table 78 below. By and large, average net farm income was significantly lower than nonfarm income. This is reflected in the fact that the share of national employment in agriculture was larger than the share of income arising in agriculture. The time series comparison suggests that the farm-nonfarm income gap narrowed as farm employment declined.

1/ The growth in nonfarm employment was strongest in Germany and Canada. The movement off the farm contributed in part, but other factors such as immigration were also important.

Table 78

SHARES OF NET NATIONAL INCOME FROM AGRICULTURE AND NONAGRICULTURE[1]

IN CONSTANT[2] PRICES, 1950 AND 1955

(Per cent)

	1950		1955	
	Agriculture	Nonagriculture[1]	Agriculture	Nonagriculture[1]
Canada	8.0	87.0	7.0	87.5
United States	5.4	91.6	4.6	91.6
France[3]	12.5	86.9	12.7	86.6
United Kingdom[3]	4.4	90.0	4.3	92.3
Italy[3]	28.3	69.4	21.3	74.1

(1) Income from dwellings and foreign investment has been excluded from non-agricultural net national income. The shares do not, therefore, add to 100.

(2) Canada in 1957 prices throughout; 1950 shares in 1958 prices for the United States and the United Kingdom and in 1954 prices for France and Italy; 1955 shares in 1958 prices.

(3) France, United Kingdom and Italy include forestry, hunting and fishing with agriculture.

Source: Canada -- see Notes.
United States and Europe -- Denison, Table 16-7, p. 210.

The contribution of the shift out of agriculture to the increase in national income in the 1950-55 and 1955-62 periods was estimated as the increase in non-farm income resulting from the declining share of farm employment, less the loss of farm income. (See Notes to this Chapter for details of the calculation.) Table 80 sets out the measured contribution of the shift of resources out of agriculture.

From 1950 to 1962 the movement of workers out of agriculture contributed over one-half of one percentage point to the annual rate of growth of net national income in Canada. The contribution to growth in Canada was twice as large as that in the United States, but only half as large as in Italy. In the United Kingdom, the major part of the reallocation had taken place before 1950 so that contribution to growth during the period was negligible. 1/ Since the share of farm employment in Canada is currently about 8 per cent, Canada cannot expect to obtain any large fillip to growth from this source in the future. Countries such as France and Italy have substantial gains to come.

1/ See next page.

Self-Employment in Other Industries

The decline in the importance of individual proprietors and family workers in the nonfarm sector of the economy has been conspicuous in retail trade and the service industries. The corner grocer, baker, butcher, and laundryman have for the most part disappeared, to be replaced by the large chain store. As Table 79 indicates, the number of nonfarm self-employed and family workers did not actually decline in all countries, but their share in total employment has been falling.

Table 79

INDEX AND SHARES OF SELF-EMPLOYED AND UNPAID FAMILY WORKERS IN NONAGRICULTURAL INDUSTRIES

	Self-Employed and Family Workers as Percentage of Total Nonfarm Employment(1)				1962 Employment Index of Nonfarm Self-Employed and Family Workers
	1950	1955	1962	1964	(1950 = 100)
Canada(2)	13.8	11.4	11.0	11.0	107
United States(2)	12.3	11.5	11.3	10.7	106
France	21.4	18.8	15.7	14.4	83
United Kingdom	7.7	7.3	6.8	6.7	99
Italy	31.3	29.0	24.6	24.5	104

(1) Civilian.

(2) Employment adjusted for part-time employment. See Denison, p. 205, footnote 9(2).

Source: Canada -- Table 76.
United States and Europe -- Denison, Tables 16-3 and 16-5, pp. 206 and 208.

1/ Angus Maddison, in Economic Growth in the West, The Norton Library, New York, W. W. Norton & Company Inc., 1967, p. 61, took an alternative approach to assessing the effect on productivity measures of "disguised unemployment" in agriculture, by adjusting the labour input measure to allow for the reduction in disguised unemployment. The table below compares the unadjusted and adjusted annual average percentage increase in output per man-hour from 1950 to 1960, from Maddison, op. cit., Table II-7, and the difference in these growth rates, with the contributions made by the farm-nonfarm shift to the increase in national income shown in Table 80.

	Maddison Annual Average Percentage Increase in Output per Man-Hour			Denison and Walters Contribution of Agricultural Shift
	Unadjusted	Adjusted*	Difference	
Canada	2.5	1.8	0.7	.51
United States	2.4	2.0	0.4	.25
France	3.9	3.1	0.8	.65
United Kingdom	2.0	1.9	0.1	.06
Italy	4.1	3.5	0.6	1.04

* Adjusted for disguised unemployment.

The category of self-employed individuals includes three main types of worker: (1) proprietors of unincorporated businesses who have paid employees (i. e. employers); (2) owner-operators without any paid employees; and (3) unpaid family workers. Data were not available on the composition of this group in all countries. Denison cited a Common Market study[1/] which indicated that the unincorporated proprietors who are employers made up some 4. 5 to 5. 5 per cent of total nonfarm employment in 1960. Labour force data suggested that the comparable ratio was about 5 1/2 per cent in Canada.[2/]

Between 1950 and 1962 the self-employed group declined. At the same time there was a marked increase in the importance of unincorporated proprietors with employees. These data suggest that the number of nonfarm own-account and unpaid family workers fell sharply -- in fact, in mid-1950, they represented 10 to 11 per cent of the civilian labour force; by 1960, they were only 5 to 6 per cent. The estimate of the effect of shifts out of nonfarm self-employment on productivity assumed that a large part of the decline in self-employment occurred among those who were underemployed and unproductive.

The contribution to growth of the shift from self-employment[3/] to paid employment was based on a comparison of "effective" labour input in 1950 relative to 1955, and 1955 relative to 1962. Workers moving out of self-employed occupations into paid employment will be for the most part those with low incomes and some degree of underemployment. It was assumed that a shift of four self-employed or unpaid workers required (in terms of labour output) one wage and salary worker to replace the labour output in self-employment, and generated a net increase in paid employment of three wage and salary workers. The income gain associated with the shift was based on the average nonfarm income per unit of "effective" labour input.

1/ Office Statistique des Communautés Européennes, Cahiers Trimestriels de l'Intégration Économique Européenne: Une Enquête sur les Forces de Travail dans les Pays de la C. É. E. en 1960, No. 2 bis, 1963 (Quarterly Review of Economic Integration in Europe: A Survey of the Labor Force in the E. E. C. Countries in 1960).

2/ In The Labour Force surveys, op. cit., Table 6, by class of worker for weeks ending June 18 and October 15, 1960, nonfarm unpaid workers made up some 11 per cent of nonfarm civilian employment. Of this total, about 5 1/2 percentage points were employers and just over 5 1/2 percentage points were own-account workers and unpaid family workers. In June 1950, the employer group was just over 3 per cent and all self-employment 14 per cent of total civilian nonfarm employment.

3/ The low-productivity implications are largely related to workers in categories (2) and (3), i. e. the owner-operator and his family labour. Since separate data for these groups were not available for the United States and other countries, the estimates were based on the total self-employed group.

Table 80

CONTRIBUTION OF THE SHIFT OUT OF AGRICULTURE AND NONFARM SELF-EMPLOYMENT TO GROWTH RATES OF NET NATIONAL INCOME PER PERSON EMPLOYED

(Percentage points)

	From Agriculture			From Nonfarm Self-Employment		
	1950-62	1950-55	1955-62	1950-62	1950-55	1955-62
Canada	.51	.72	.36	.13	.27	.03
United States	.25	.25	.24	.04	.09	.01
France	.65	.59	.69	.23	.25	.22
United Kingdom	.06	.07	.05	.04	.05	.04
Italy	1.04	.83	1.18	.22	.17	.26

Source: Canada — see text and Notes.
United States and Europe -- Denison, Table 16-10, p. 215.

SELF-EMPLOYMENT AND INCOME LEVELS, 1960

As Tables 77 and 79 indicated, Canada had, in 1960, a larger share of self-employed workers in agriculture, but a slightly smaller share in other industries, than the United States. 1/ Since output per person employed was generally lower in self-employment than in paid employment, a larger share of self-employment in Canada compared with the United States tended to widen the gap in total output per unit of input in the two countries. Income differences between self-employed and paid workers reflect, in part, the low-income industries in which self-employment is common. The wider the range of income earned by self-employed and paid workers, the larger the effect on the gap in income per person, and on estimated productivity differences.

Employment in Agriculture, 1960

In 1960, Canada had just under 12 per cent of the employed labour force in agriculture compared with just over 8 per cent in the United States. Table 81 indicates the relative size of total and nonfarm incomes per person employed.

Net national income per person employed in Canada was 82 per cent of the level in the United States (Table 10). The exclusion of income from dwellings and on foreign investment raised the relative by one percentage point. On this basis,

1/ The apparent fact (see Table 79) that the share of self-employed and family workers in total nonfarm employment was lower in Canada than the United States in 1960 may be due to differences in concept or measurement. A comparison of nonfarm unincorporated income in Canada and the United States indicated that this sector represented a significantly smaller share of total nonfarm income in Canada than the United States. This fact supports, but does not of course confirm, the relative size of these sectors in Canada and the United States in 1960.

net national income per person employed in the farm sector in 1960 was about 45 per cent of that in the nonfarm sector in Canada, as well as in the United States and the United Kingdom. 1/ Total income per worker reflects differences in the relative importance of the farm and nonfarm sectors, i. e. in income per worker and in employment. In Canada, total income per person employed was 7 per cent below nonfarm income; because of the smaller role of farm employment in the United States, total income was only 5 per cent below the nonfarm level. Nonfarm income per worker in Canada was 85 per cent of the level in the United States -- two percentage points lower than the relative for total income. A comparable narrowing of the income gap with the United States, based on output per worker to output per nonfarm worker, occurred in all of the European countries except the United Kingdom. 2/

Table 81

NET NATIONAL INCOME PER PERSON EMPLOYED,

TOTAL AND NONFARM IN U.S. PRICES, 1960

(Relatives, U.S. = 100)

	Total Net National Income per Person Employed	Net National Income Excluding Income from Dwellings and Foreign Investments per Person Employed		
		All Industries	Nonfarm Industries	Difference(1)
Canada	82	83	85	1.6
United States	100	100	100	--
Northwest Europe	59	60	62	2.5
United Kingdom	59	59	57	-1.4

(1) Before rounding.

Source: Canada -- Table 10, text and Notes.
United States and Europe -- Denison, Table 16-12, p. 219.

If output per person employed in the farm and nonfarm sectors were taken as a proxy for output per unit of input, the difference between the total and the nonfarm income relatives could be used to estimate the income cost of a larger share of employment in agriculture. An estimate of the contribution to differences in income per person employed, based on this assumption, is given in Table 82, column (A). If, however, one assumes, as Denison did, that inputs per person were smaller in agriculture than in nonagriculture, estimate (A) would overstate the cost of misallocation. Estimate (B) assumes that input per person was 20 per cent larger in nonagricultural industries than in agriculture. 3/ The assumption of

1/ United States and United Kingdom derived from data in Denison, p. 219.

2/ This result for the United Kingdom arises not because farm income per worker is larger than nonfarm income per worker, but because the difference between income in the two sectors is narrower than in the United States.

3/ Denison, p. 221.

input differences provides "rough estimates" of the effect of differences in labour allocation on levels of productivity. The Canadian estimate (B) suggests that about 1 1/2 percentage points of the Canada-U. S. income difference in 1960 was the result of a relative overallocation of resources to agriculture. 1/

Table 82

CONTRIBUTION OF THE ALLOCATION OF LABOUR IN AGRICULTURE AND NONFARM SELF-EMPLOYMENT TO DIFFERENCES FROM THE UNITED STATES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

	Cost of Allocation of Labour to Agriculture as Percentage of Country's National Income		Contribution to the Gap in Net National Income per Person Employed with the United States(1)	
	(A)	(B)	Agriculture	Non-agriculture
	(Per cent)		(In percentage points)	
Canada	1.9	1.6	1.5	- .6
United States	--	--	--	--
Northwest Europe	4.1	3.3	2.3	.3
France	10.2	8.0	5.8	1.9
United Kingdom	- 2.4	-1.7	-1.1	-1.7

(1) Includes an adjustment for interaction.

Source: Canada -- see text and Notes.
United States and Europe -- Denison, Tables 16-12 and 16-14, pp. 219 and 223.

Self-Employment in Other Industries, 1960

Employment data indicate that self-employment in 1960 represented some 11 1/2 per cent of the engaged nonfarm labour force in the United States and about 10 1/2 per cent in Canada. 2/ On the basis of this relationship, the lower share of nonagricultural self-employed in Canada constitutes a small but negative element (-0. 5 percentage points), contributing to the Canadian-U. S. income difference. Since the United States had a slightly larger share of its labour force in the less-productive sector, all other things being equal, output per person employed would have been higher in Canada than in the United States.

1/ Factors contributing to differences in the level of output per unit of input are adjusted for interaction using the method described in Chapter X, p. 110.

2/ See footnote 1, p. 120.

CHAPTER XII

ECONOMIES OF SCALE

Both this Chapter and the following one on resource allocation depart somewhat from the approach to measurement used thus far. This Chapter deals with the contribution of economies of scale that arise from changes in the size of national and local markets and in per capita consumption. Chapter XIII takes account of those economies of scale that arose from changes in the level of tariff protection. Data are not available for estimating in any precise way the effect of economies of scale on the growth or level of output. The measures used in this analysis to evaluate the contribution of economies of scale in different countries are assumed to reflect in a broad way the relative performance among the countries, rather than nicely measured absolutes.

NATIONAL MARKET SIZE AND ECONOMIES OF SCALE

Income Growth

In Sources of Economic Growth in the United States, Denison developed the thesis that, between 1929 and 1957, the U. S. economy operated, to a significant extent, under conditions of increasing returns to scale.[1] As the national economy and national markets grew, opportunities were created for larger plants, longer product runs, and larger transaction units. Through the resulting economies of scale, productivity or output per unit of input was increased. Hard data are not available to isolate and measure the returns to scale with precision, but a careful assessment of the work done in this field led Denison to assume that, as the U. S. national market expanded, a 1 per cent increase in input resulted in a 1.1 per cent increase in output:

> ... cost reductions resulting from economies of scale associated with the growth of the national market were credited with being the source of one-eleventh of the growth rate of national income.[2]

In Why Growth Rates Differ, the 10 per cent elasticity of output in relation to input was assumed still to be appropriate for the United States for the period from 1950 to 1962. Comparable estimates of the relative size of the European (or Canadian) national markets or of the scale effect cannot be obtained directly. Data relating to various measures of the relative size of the European and Canadian economies are set out in Table 83 (see also Table 1). The comparison does not, however, provide a basis for classifying Canada unambiguously as a large or a small country.

1/ Denison, Sources of Economic Growth, op. cit., Chapter 16, pp. 174-178.

2/ Denison, p. 226. (The reader is reminded that all page references to Denison pertain to Why Growth Rates Differ unless otherwise indicated.)

Table 83

COMPARISON OF INCOME LEVELS, FACTOR INPUTS,

TRADE AND POPULATION DENSITY, CIRCA 1960

	United States	Large[1] European Countries (Simple average)	Canada	Small[2] European Countries (Simple average)
National income as percentage of United States, 1960[2]	100	18 (12-22)	7	3 (1-4)
Factor inputs as percentage of United States, 1960	100	28 (24-33)	9	4 (2-6)
Imports plus Exports[3] as percentage of GNP (1957-59)	9	34 (27-42)	37	78 (63-95)
Population Density, 1960[4]	20	170 (83-217)	2	191 (11-346)

(1) The single figures are simple averages; the figures in brackets give the range. Large countries are Germany, the United Kingdom, France and Italy; small countries are the Netherlands, Belgium, Denmark and Norway.

(2) Relatives in U.S. prices.

(3) Imports and exports of goods and services excluding income on foreign investments as a percentage of GNP at market prices in current national prices -- average of the ratios for the three years.

(4) Population per square kilometre. [Note: The units of population density in Why Growth Rates Differ (first printing), Table 17-1, p. 230, should be population per 1/10 square mile.]

Source: Canada -- Tables 1, 10, 15 and 73, and U.N., National Accounts, op. cit. United States and Europe -- Table 1; Denison, Tables 17-1 and 17-2, pp. 230-231.

On the basis of total national income and of factor inputs, Canada was midway between the small and the large European countries. For both of these measures, the largest European country was Germany; the smallest was Norway. The importance of trade in goods and services (excluding income on foreign investments[1/]) varies from a high of 95 per cent in the Netherlands to a low of 9 per cent in the United States. By and large, the economies of the small countries (by population) were significantly oriented to international trade. Trade provided a substitute for market size. In the larger countries, on the other hand, international transactions as a share of total output were only half as important.

In terms of population density, Canada had the lowest; Norway and the United States were next in line; and the Netherlands had the highest density of all.

1/ If factor income on foreign investments were included in this calculation, the importance of trade in goods and services would rise substantially in the case of Canada and the United States.

There does not seem to be any direct correspondence between population density and the classification of countries as large or small. The range of densities indicates that both the large and small countries had high and low densities.

Assuming that the gains from scale decline as output rises -- that they are smaller in larger markets, and larger in smaller markets -- both Canada and the European countries would have larger returns to scale than the United States. The differences in market size suggested by the comparisons in Table 83 could be substantial.

All industries do not serve national or international markets; some are purely local or regional in character.[1/] These local industries include those in which goods and services are not transported or sold very far from the point of production. The remaining industries, i. e. those serving the national markets, do not represent a high proportion of total output. When the domestic market is not large enough to offer optimum scope for economies of scale in production, tariffs and other restraints on trade may be an important factor limiting both exports and imports and therefore the size of the total national and international market.

It is assumed that small countries obtain larger economies of scale through the growth of the national market. The scale effects used by Denison for the period 1950 to 1962 were 1. 1 for the United States, 1. 11 for the large European countries except Italy, 1. 115 for Italy, 1. 12 for the small European countries except Norway, and 1. 13 for Norway. The economies of scale in the larger European countries were assumed to be 10 per cent larger and in the smaller countries 20 per cent larger than in the United States. Since the Canadian economy exhibits characteristics of both a large and a small economy, as well as those of a developed and underdeveloped country, it is not the least bit obvious where Canada would fit into this framework.

It was assumed that the relative scale effect appropriate for Canada was between 1. 115 for Italy and 1. 12 for the small European countries. In fact, 1. 118 was used as a basis for calculating the contribution of scale from larger national markets to growth in Canada.[2/] This assumes that the scale effects were 18 per cent larger in Canada than in the United States. It should be noted, however, that the estimates for Canada shown in Table 84 would only change by 1/20 of a percentage point if the U. S. elasticity of 10 per cent were used, and by less than that if the other extreme of 13 per cent for Norway were used. The similarity of the results using different elasticity assumptions reflects the fact that, within the range of probable scale effects, gains from increased national market size were more affected by the differences in output growth among the countries than by differences in the scale elasticities themselves.

1/ See Denison, pp. 226-235, for a discussion of local, regional, national and international markets. Some three-quarters of the economy includes industries serving local or regional markets and those in which GDP is measured by inputs (see Chapter X). The effects of local market size are discussed later in this Chapter.

2/ The calculation was made by applying the scale relationship (e. g. . 118 ÷ 1. 118) to the growth of national income in U. S. prices. The valuation in U. S. prices excluded the effect of scale as it related to higher levels of consumption and income elasticities which are taken into account later in this Chapter. See also Denison, p. 233, footnote 16.

Table 84

CONTRIBUTION OF ECONOMIES OF SCALE ASSOCIATED WITH SIZE AND GROWTH OF THE NATIONAL MARKET TO DIFFERENCES IN INCOME GROWTH RATES AND LEVEL OF NET NATIONAL INCOME PER PERSON EMPLOYED

	Contribution to Growth Rate of Total National Income (1)			Contribution to the Gap in NNI per Person Employed with the United States, 1960	
	1950-62	1950-55	1955-62	(Before interaction)	(After interaction)
	(Percentage points)				
Canada	.40	.44	.38	4.8	4.6
United States	.30	.38	.24	--	--
Northwest Europe	.41	.47	.37	4.1	3.0
Norway	.38	.44	.35	5.5	4.2
United Kingdom	.22	.23	.21	4.0	2.8

(1) Measured using growth in U.S. prices.

Source: Canada -- see text.
United States and Europe -- Denison, Table 17-3, p. 233.

The contribution of growth in national markets to total growth in Canada over the period 1950 to 1962 was similar to the Western European experience. This similarity in the measured effect reflects the combination of a larger-scale elasticity and lower market growth in Canada, compared with a lower elasticity but much larger growth in Europe. A large potential for economies of scale requires output growth to make it effective.

Income Levels, 1960

In deriving estimates of the effect of scale on differences in levels of income per person employed in Europe and the United States, Denison noted: "Only an attempt to arrive at orders of magnitude based on combining some rational guesses is possible."[1/] An assessment of this factor in the Canada-U. S. income gap seemed even more hazardous.

The Denison assumptions for Europe were related to differences between large and small economies. Cost differences with the United States that reflect the effect of the size of the national markets were estimated to account for a 4.0 per cent[2/] productivity gap in France, Germany and the United Kingdom; 4. 5 per cent in Italy; 5. 0 per cent in Belgium, Denmark and the Netherlands; and 5. 5 per cent in Norway. If Canada were fitted into this scheme on the basis of the size of market criteria developed for the growth comparison, the appropriate range would seem to be between 4. 5 and 5. 0 per cent. It was assumed that 4. 8 per cent may be a comparable order of magnitude to use for Canada. Table 84 sets out the contribution of the size of national markets to the gap in national income per person employed in Canada and the United States, both before and after taking account of interaction of the factors. On this basis a large part of the Canada-U. S. income gap

1/ Denison, p. 234.

2/ For example, a 20 per cent cost disadvantage in industries accounting for about 1/4 of total output. See Denison, ibid.

was attributed to the effects of scale and differences in the size of the national market. In a number of European countries the impact of differences in the size of market and scale elasticities was of the same order of magnitude as in Canada before the effect of interaction was allowed for.

CONSUMPTION, INCOME ELASTICITIES AND ECONOMIES OF SCALE

Income Growth

As income and expenditure rose in Europe, a large and increasing part of incremental demand was concentrated on more expensive and income-elastic goods. These were products, household appliances for example, for which the market, and therefore output, had been relatively restricted. Rising per capita income provided a basis for a substantial expansion in the scale of output in certain industries. These were small-output and high-cost industries that derived more than the average benefit from the scale effects of a rapid expansion in output.[1/]

> The changed attitude of consumers . . . is of course a response to the fact that the economies of mass production and organization, together with the convenience of time payments, have brought automobiles, refrigerators and TV sets . . . within their financial reach. Perhaps just as important is the assurance provided by the welfare state. . . .
>
> Along with a shortening of the European consumer's time-perspective -- which still has a long way to go before becoming as short as the American consumer's -- has come the displacement of class markets by mass markets for a growing number of products. In part this reflects the very real narrowing of effective income differences . . . and the . . . effect on the lower income groups of such varied measures as minimum wage laws, housing subsidies and rent control, family allowances and maternity aid, unemployment and old-age insurance -- and the most important fact of all, that workers' wages have risen much more extensively than the cost of living since World War II.[2/]

Table 85 compares the relative levels of per capita consumption in 1950 and 1962, in U. S. and national price weights, and indexes for the period 1950 to 1962 in both sets of weights.

In 1950, consumption per capita in Canada was 73 per cent of the level in the United States, and the comparable ratios were 53 per cent in Northwest Europe,[3/] 65 per cent in the United Kingdom, and 30 per cent in Italy. Over the next 12 years consumption per head increased by over 40 per cent in the European countries, but the gains varied significantly among the countries. In Germany the increase was almost 75 per cent, while in the United Kingdom it was only 25 per cent. As a result of this expansion in European consumption, and the much slower rate of growth in the United States, by 1962 per capita consumption in Northwest Europe had risen to 63 per cent of the U. S. level. Since the rate of growth of consumption per head

---

1/ A decline in returns to scale as output increases is also implied.

2/ Dewhurst, et al., op. cit., p. 176.

3/ Based on real per capita consumption from Denison, Table 17-6, p. 244; population data from OECD, Manpower Statistics, op. cit., and Labour Force Statistics, op. cit.

in Canada was only slightly above the rate in the United States, the level in Canada rose from 73 in 1950 to 75 per cent of the U. S. level in 1962.

Table 85

LEVELS AND GROWTH OF CONSUMPTION PER CAPITA

	Per Capita Consumption Relatives (U.S. = 100)				Index of Per Capita Consumption (1950 = 100)			
	1950		1962		U.S. Prices		National Prices	
	U.S. Prices	National Prices	U.S. Prices	National Prices	1955	1962	1955	1962
Canada(1)	73	71	75	74	110	123	110	123
United States	100	100	100	100	109	119	109	119
Northwest Europe	53	40	63	50	118	143	121	153
Germany	41	28	60	47	133	174	145	203
United Kingdom	65	51	68	54	110	124	110	126
Italy	30	18	38	25	118	151	121	166

(1) The estimates for Canada are not strictly comparable with those for the European countries (see Notes).

Source: Canada -- see Notes.
United States and Europe -- Denison, Tables 17-4, 17-5 and 17-6, pp. 238 and 244. The 1950 and 1962 level estimates for Northwest Europe are described in footnote 3, p. 127.

Per capita consumption in Canada and Europe was higher relative to the United States when expressed in U. S. prices than in national prices.[1/] Items of large consumption in Europe (and to a smaller extent in Canada) were valued at lower levels in national prices, and higher levels in U. S. prices. Conversely, high income consumption in the United States was even more valuable expressed in European prices than in U. S. prices.

These differences at a point in time between the country relative using U. S. or national prices reflect the effects of differences in per capita income, and different expenditure patterns resulting from variations in taste and habits, and relative costs and prices. It would be difficult to separate the contribution of each of these factors to the difference in consumption patterns: the narrower the income difference, the smaller the difference in the consumption relative; the closer the taste and habits of the nationals, the smaller the difference; the smaller the range of prices between countries or within countries, the closer the two consumption relatives will be.

1/ For a discussion of the U. S.-European relationships, see Denison, pp. 235-251; also Gilbert and Kravis, op. cit., and Gilbert and Associates, op. cit. The Notes to Chapter II set out an illustration of output relatives in national and U. S. prices.

Table 86

EFFECT OF PRICE WEIGHTS ON CONSUMPTION GROWTH(1)

(Percentage points)

	1950-62	1950-55	1955-62
Canada	.01	.05	- .02
United States	--	--	--
Northwest Europe	.56	.51	.60
Germany	1.35	1.75	1.07
United Kingdom	.15	.02	.24

(1) Measured as the difference between annual rates of growth of consumption per capita in national and U.S. prices.

Source: Table 85 and Denison, Table 17-5, p. 244.

The consumption indexes set out in Table 85 are, for the United States and Europe, the OEEC estimates for 1950 projected to 1962. As incomes rose significantly in most of the European countries, the largest increase in consumption was in high-priced commodities (in national currencies). The use of U. S. prices (which, by and large, were relatively lower) for valuing these consumption items reduced or reversed the price disparity. Thus the contribution to European growth of the more dynamic expenditure category was smaller in U. S. prices than in national prices.

Over time, income, consumption, prices, even tastes and habits, change. The expansion of consumption associated with rising income levels permitted additional economies of scale in low-output and high-cost industries.[1/] The difference in consumption growth expressed in national and U. S. prices, shown in Table 86, suggests orders of magnitude of this income-scale effect per capita. The differences were widest in Germany, Italy and France; the smallest in Canada. The contribution of this scale effect to growth of total national income is set out below.

Table 87

CONTRIBUTION OF SCALE AND INCOME ELASTICITIES

TO GROWTH RATES OF NET NATIONAL INCOME

(Percentage points)

	1950-62	1950-55	1955-62
Canada	.01	.04	-.01
United States	--	--	--
Northwest Europe	.46	.50	.43
Germany	.91	1.21	.70
United Kingdom	.09	.01	.15

Source: Canada -- The contribution is estimated from the differentials in the growth rates of per capita consumption (Table 86) times the total population, weighted by the share of consumption in national income.
United States and Europe -- Denison, Table 17-7, p. 249.

1/ ". . . the economies of standardization and assembly-line production are so great for consumer durables that the price difference between the custom-made and the mass-produced article would be much larger than, for example, it actually is for men's shirts or women's hats." Dewhurst, et al., op. cit., p. 177.

For Canada the gains from this source were estimated to be negligible. This resulted in part from the small difference in the growth of consumption in Canada expressed in U. S. or national prices. The increase in consumption was not large enough to produce the kind of output expansion that could make a sizeable contribution to productivity. In fact, since consumption growth in Canada was only marginally higher than in the United States over this period, the relative gain to be achieved from scale and income elasticities in Canada was very small. The large gains accrued to those European countries, such as Germany, with the biggest expansion in consumption and much larger price differences with the United States.

Real Consumption Per Capita

The similarity of consumption per capita (see Table 85) in Canada, expressed in U. S. or Canadian dollars, is somewhat surprising in the light of the U. S. - European comparisons in the Gilbert and Denison studies. Tastes, patterns of consumption and habits in Canada are closer to those of the United States than to any other country. Are these similarities sufficient to account for the small difference in the Canada-U. S. per capita consumption relatives?[1/] It is tempting to argue that they are, particularly in the light of Denison's comment that:

> . . . the choice between country A's or country B's weights makes a sharply diminishing difference as real per capita consumption converges.[2/]

However, the broad conclusion of the Denison and the Gilbert analysis is that the major factors affecting the difference in consumption levels were relative income levels and prices.

In 1950, consumption per capita in Canada was 20 percentage points (or 38 per cent) above the average level in Northwest Europe. Consumption in the United States was 27 percentage points (or 37 per cent) above the level in Canada. By 1962, European consumption had moved much closer to the level in Canada (12 percentage points) but the gap between Canada and the United States had only slightly narrowed.

Data on income per capita indicated a similar pattern of change. As Table 11 suggested, the rate of growth of gross income per capita between 1950 and 1964 was lower in Canada than in any of the countries under study. The level of net income per capita in 1960 in Canada was only four percentage points higher than in Northwest Europe (Table 10). On the other hand, the structure of prices and pattern of consumption in Canada are similar to those in the United States. The range of prices in Europe, compared with the United States, is very wide. The Notes to this Chapter present some additional material on this point, but the conundrum is not resolved.[3/]

1/ In reviewing a draft of this Study, Dr. Denison noted that the difference between Canadian consumption per capita in national and U. S. prices, using his formula, would be eight percentage points, not two. This difference in the size of the gap is larger than for any European country. Denison, Table 17-4, p. 238.

2/ Denison, p. 243.

3/ It should be emphasized that the price data used in this comparison of consumption came from the detailed and thorough DBS study of consumer good prices in Canada and the United States. Segal and Pratt, op. cit.

LOCAL MARKET SIZE AND ECONOMIES OF SCALE

Income Growth

In the post-war years in Canada, the changing industrial structure, reinforced by population and labour force increases, and high levels of immigration and internal migration, resulted in a substantial growth of urban areas.[1] Between 1951 and 1961, the population in metropolitan areas increased by about 40 per cent. The largest part of this growth was in suburban areas which almost doubled in size in 10 years. By 1961, almost half the metropolitan population lived in suburban areas.[2] Table 88 shows the extent of the population shift out of rural areas and into the larger urban areas in Canada, and the distribution of population in a number of other countries in a recent year.

Table 88

DISTRIBUTION OF POPULATION

(Per cent)

	Canada(1)			United States(2)	Northwest Europe(2)	Norway(2)	United Kingdom(2)
	1951	1961	1966				
Urban centres							
500,000 and over	23	25	29	38	26	16	37
100,000 and over	37	43	47	51	39	20	50
Other	26	26	26	19	n.a.	37	28
Rural	37	30	26	30	n.a.	43	22

(1) 1961 and 1966 are based on 1961 Census definitions; 1951 is on the 1956 definition but the difference does not materially affect this comparison. Fringe areas of centres are included.

(2) Census years nearest 1960.

Source: Canada — DBS, 1961 Census of Canada, Population, Vol. I, Bulletins 1.1-6 and 1.1-7 (92-535 and 92-536), Ottawa, Queen's Printer, 1962 and 1963; 1966 Census of Canada, Population, Vol. I, Bulletin 1-8 (92-608), Ottawa, Queen's Printer, 1968; Canada Year Book, 1967, Ottawa, Queen's Printer, 1967, p. 186.
United States and Europe — Denison, Table 17-1, p. 230.

The growth of urban and suburban areas, particularly in the United States and Canada, has been accompanied by a decline in corner and general stores, and by the development of large retail units, particularly in shopping areas. The

---

1/ In 1951, the Canadian population base was 14 million. During the next decade net migration in Canada consisted of about 1.1 million immigrants (net), and a decline of 1.2 million in the farm population. As a result of this movement, urban areas grew by 1.5 million and rural nonfarm areas by 800,000. (The rural nonfarm population includes unincorporated fringe areas, and resource-based settlements.) Anderson, op. cit., Table 10.

2/ DBS, 1961 Census of Canada, Vol. VII, Part I (99-512), Ottawa, Queen's Printer, 1963, Tables VII and IX, pp. 2-14 and 2-17.

changing institutional and geographic pattern of retail distribution[1/] in Canada is suggested by Table 89. Between 1951 and 1961 there was a substantial increase in the importance of corporate retailing and a decline in the role of individual proprietors and partnerships. The shift to large-scale retailing has been even more dramatic than is indicated by changes in the form of ownership. Over the 10-year period from 1951 to 1961 the large and heavily capitalized retail outlets increased their share of total sales by a substantial amount and did so entirely at the expense of the smallest outlets.[2/]

Table 89

DISTRIBUTION OF RETAIL SALES

BY TYPE OF OWNERSHIP AND SALES SIZE OF STORES, CANADA

(Per cent)

Type of Ownership	1951	1961	Annual Sales Size of Stores	1951	1961
Individual proprietors	38	31	Over $500,000	34	42
Partnerships	12	7	$100,000 to $499,999	30	32
Corporations	45	58	$50,000 to $99,999	17	15
Co-ops and others	5	4	Under $50,000	20	12

Note: Shares may not add to 100 due to rounding.

Source: Moyer and Snyder, op. cit., Tables 3.9 and 3.11, pp. 87 and 91.

Rising levels of income provided for a tremendous growth in automobile ownership, particularly in Europe.[3/] During this period, the advent of the family car altered living patterns beyond recognition, and provided a basis for a revolution in the system of distribution.

1/ The Dominion Bureau of Statistics has recently published a statistical and analytical survey of distribution in Canada by M. S. Moyer and G. Snyder, Trends in Canadian Marketing, DBS 1961 Census Monograph, Ottawa, Queen's Printer, 1967. Some of the material in this section has been derived from the Moyer and Snyder study, but these references inadequately reflect the breadth and depth of their study.

2/ This process of change seems to have been most dynamic between 1941 and 1951. The largest and smallest sales size group served 20 and 40 per cent of total sales in 1941.

3/ The North American concern with problems created by increasing car density pale by comparison with the experience of some European countries such as Germany and the Netherlands. An estimate of the change in the number of cars per square kilometre of land area suggests that car density in many of the European countries was below the U.S. level in 1950, but by 1963 was several times larger.

	Cars per Square Kilometre	
	1950	1963
Canada	0.2	0.5
United States	4.3	7.3
Northwest Europe	3.5	17.4
France	2.9	14.5
Germany	2.5	28.3
Netherlands	4.1	25.5
United Kingdom	9.7	31.4

One consumer durable alone -- the automobile -- has had profound effects on Canada's marketing system. It has widened trading areas, eroded the geographic monopoly of the local store, encouraged retailers to shift part of the transportation function to consumers, encouraged one-stop shopping, fostered the development of shopping centres, hastened the trend to much larger retail units, spurred a new "science" of store location analysis, and spawned a large number of products and outlets tuned to the motoring shopper.[1/]

Table 90

AUTOMOBILE OWNERSHIP, 1950 AND 1963

	Population per Car		Percentage of Households Owning One or More Cars
	1950	1963	1963
Canada	7.2	4.0	72
United States	3.8	2.8	77
Northwest Europe	32.6	7.4	32(1)
France	26.0	6.0	40
Germany	81.9	8.2	26
Netherlands	73.8	13.8	26
United Kingdom	21.4	7.0	32

(1) Excluding Denmark and Norway.

Source: Household data from Denison, Table 17-9, p. 253, for the United States and Europe. Canada from DBS, Household Facilities and Equipment, May 1963 (64-202), Ottawa, Queen's Printer. Population per car derived from U.N., Statistical Yearbook, New York, and OECD, Manpower Statistics, op. cit., various issues. Data estimated from this source were used for 1950 and 1963 to provide a consistent time comparison; the differences between the Denison data for 1963, Table 17-9, p. 253, and those used here are marginal, particularly since minor differences in definition, coverage and timing affect the basic data.

A large part of the changing pattern of consumer buying in Canada may be attributed to this increase in car ownership. Distance provided little protection to the local shop, when three out of every four households had a car. The first shopping centre in Canada opened in 1950.[2/] By 1956 Canada had over 60 shopping centres with 850 retail outlets. By 1964 there were over 350 centres with 5,000 shops, and the share of retail sales taking place in these outlets had reached 7 per cent of total retail sales.

1/ Moyer and Snyder, op. cit., p. 10.

2/ Ibid., p. 181.

Table 91

SHOPPING CENTRES IN CANADA, 1956 AND 1964

	Number of Shopping Centres	Number of Retail Stores in Shopping Centres	Sales in Shopping Centres as a Percentage of Total Retail Sales
	(No.)	(No.)	(Per cent)
1956	64	857	1.6
1964	369	4,999	7.3

Source: Moyer and Snyder, op. cit., Table 8-1, p. 182.

This changing pattern of retail distribution from small to large outlets and from individual to multiple or bulk purchasing was associated with growing efficiency in the distributive system. Attempts to quantify the increase in productivity in the marketing sector are handicapped by measurement problems.[1/] The gains are nevertheless present even though they are not amenable to precise measurement.

The marketing study by Moyer and Snyder[2/] frequently refers to the efficiency aspects of recent changes in the distributive system. A few of their comments are noted below:

> One factor has been the general drive on the part of retailers to achieve the competitive advantages that go with large-scale operations. (p. 94)
>
> . . . distribution and production are not two processes but one, and . . . in marketing, as in production, the mainspring of change is the drive to increase productivity. (p. 211)
>
> There is in retailing a pervasive propensity to adopt the methods, and therefore the forms, of "big business." Applied to retailing, the formula is coming to require at least four ingredients: large outlets, large families of outlets, professional managers, and the application of scientific management to the distribution process. (p. 89)
>
> . . . the pioneers in the chain store field adopted and adapted three complementary concepts which had enhanced productivity in the manufacturing sector: routinization, centralization, and integration . . . .
>
> These arrangements have their weaknesses. Above all, they tend to make the individual chain store more impersonal and less flexible than its independent competitor. On the other hand, they have enabled the corporate chain to achieve economies of operation. (pp. 128 and 129)

1/ The measures of real output in certain of the service industries are, to an important extent, based on labour input. Estimates of productivity, using measured output and employment, are incomplete.

2/ Ibid.

> . . . as the drive for productivity in distribution has occasioned the development of specialized institutions engaged in retailing and wholesaling, it has also occasioned a functional shuffle whereby these institutions have become more specialized in the functions which they perform. (p. 54)
>
> Finally, the few empirical studies which have been done on the subject suggest that larger outlets do enjoy certain economies of scale. Certainly they have lower failure rates than small stores. Taken together, the potential advantages of scale in retailing are compelling. (pp. 94 and 96)

It is interesting to note, in passing, the restrained optimism about the prospects for distribution in the United Kingdom:

> It would seem that an increase in the importance of multiple stores would have a beneficial effect on labour productivity. However, although these stores can be expected to grow in importance it must also be remembered that there are limits to the extent to which it is feasible to extend their operation. The success of this type of shop depends on high turnover and there are a number of factors such as low income sections of the community, fragmentation of the market caused by product differentiation associated with high incomes, and low density population areas, which militate against the establishment of environments suitable for chain store operation.[1/]

By the early 1960's Canada had about the same number of cars per person as the United States had in the last few years of the 1940's. The higher density of persons per car or fewer cars per person in Canada reflects not only the difference in average income levels and the stage of growth, but also the age distribution of the population. The larger share of children and young adolescents in the Canadian population (Table 16) reduced the ratio of cars per person in Canada relative to the United States. In 1963, 72 per cent of all Canadian households had cars. In the United States, this point was reached between 1950 and 1955.

To the extent that the development of local markets related to the relative size of, and changes in, the car market in Canada and the United States, the estimates of the growth in local markets in Canada follow fairly closely those in the United States.[2/] Assuming the measured effects of productivity gain in distribution are only half the real effects, the contribution to growth of measured national income in the United States from 1950 to 1962 was estimated at 0. 06 per cent per year.[3/]

1/ K. D. George, Productivity in Distribution, University of Cambridge, Department of Applied Economics, Occasional Papers 8, Cambridge, Cambridge University Press, 1966, pp. 81-82.

2/ The estimates of the effect of local market growth in the European countries were directly related to the Denison estimates and projections for the United States for the period 1929 to 1957, and 1960 to 1980. See Denison, Sources of Economic Growth, op. cit., pp. 176-177, and Denison, Why Growth Rates Differ, pp. 29-30 and pp. 251-252.

3/ It is assumed that the deflation techniques in Canada are similar to those in the United States and that the measured effects in Canada are therefore also about half the real effects.

Table 92

INCREASE IN THE NUMBER OF CARS PER CAPITA

(Numbers)

	1950-62	1950-55	1955-62
Canada	.11	.05	.06
United States	.09	.05	.04
United Kingdom	.08	.02	.06

Source: Estimated from source data in Table 90.

The contribution of growth in local markets to growth in national income in the United States was estimated to be . 06 per cent per annum for both subperiods (Table 93). It was assumed that the comparable contribution for Canada was also about . 06 per cent from 1950 to 1955, and . 07 per cent in the later period as the rate of increase of car density in Canada accelerated slightly.

Table 93

CONTRIBUTION OF SCALE AND LOCAL MARKET SIZE TO INCOME GROWTH RATES, 1950-62, AND TO DIFFERENCES IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

(Percentage points)

	Contribution of Growth of Local Market to Growth of National Income			Contribution to the Gap in Net National Income per Person Employed with the United States, 1960(1)
	1950-62	1950-55	1955-62	
Canada	.07	.06	.07	0.6
United States	.06	.06	.06	--
Northwest Europe	.06	.04	.08	1.9
United Kingdom	.05	.03	.07	1.8

(1) After interaction.

Source: Canada -- see text.
United States and Europe -- Denison, Table 17-10, p. 255.

Income Levels, 1960

The estimate of the effect of differences in the size of local markets on the level of income is also somewhat arbitrary. As noted above, the density of automobiles in Canada in terms of persons and households lagged about 10 years behind U. S. levels. If local market growth associated with the wider and deeper local markets had not taken place, the level of U. S. income would have been about 0. 7 per cent lower in 1960 than it actually was. It is assumed that the effect of smaller scale due to less concentration and use of local market facilities in Canada was 0. 7 percentage points of the income gap in 1960. After adjustment for interaction, the contribution was 0. 6 percentage points.

SCALE AND GROWTH

The three scale factors -- national markets, income elasticities and local markets -- raised the growth rate by the percentages shown below.1/

	1950-62
Germany	28
Northwest Europe	24
United Kingdom	19
CANADA	14
United States	12

The importance of economies of scale in income growth was not as large in Canada or the United States as in Europe. Because the estimates of the effect of scale were based, to an important degree, on the growth of total output, the relationship is not readily untangled. Was the growth rate inhibited because of missed opportunities to achieve gains from scale, or were gains from scale not possible in slow-growth situations? The Denison analysis suggests that, at the levels of consumption, income and productivity that prevailed in the United States and Canada in the 1950's, the gains from scale that were enjoyed in Europe were not readily achievable in North America. Canada, with a small market, was assumed to have a larger-scale elasticity, and more potential gain from economies of scale, than the United States and the large European countries. In a situation of low growth and, as suggested in the next Chapter, tariff protection, this potential was not realized.

1/ See also Denison, p. 255.

CHAPTER XIII

RESOURCE ALLOCATION AND TRADE

Barriers to international trade affect resource allocation and involve costs. This section is focused on what may be called the (forgone) opportunity cost of restraints to trade. In Europe, during the period 1950 to 1962 there were a number of important moves towards a broader and more liberal system of international exchange. [1/] The contribution to growth of a more efficient allocation of resources as a result of these changes cannot readily be isolated and measured, but certain inferences are possible.

Table 94

RATIO OF EXPORTS AND IMPORTS(1) TO GROSS NATIONAL PRODUCT(2)

(Per cent)

		Exports		Imports	
		Total	Manufacturing	Total	Manufacturing
Canada	1950	20	6	17	10
	1955-56	19	7	21	12
	1961-63	20	8	18	11
United States	1955-56	4	3	4	1
	1961-63	4	2	4	1
Germany	1950-51	11	7	8	2
	1954-56	16	11	13	3
	1961-63	21	15	20	7
Netherlands	1950-51	34	n.a.	39	n.a.
	1954-56	42	15	44	n.a.
	1961-63	53	21	55	n.a.
Norway	1950-51	37	n.a.	43	n.a.
	1954-56	38	9	41	23
	1961-63	47	13	50	32
United Kingdom	1950-51	20	13	25	3
	1954-56	20	12	25	4
	1961-63	20	11	26	6

(1) Exports and imports include goods and services but exclude factor income on foreign investments.

(2) In 1958 constant market prices, except for Canada which is in 1957 prices.

Source: Canada and United States -- U.N., Yearbook of National Accounts Statistics, op. cit., various issues, and U.N., Yearbook of International Trade Statistics, New York, various issues.
Europe -- Denison, Table 18-1, p. 258.

1/ See the discussion in Denison, Chapter Eighteen.

Table 94 compares changes in the share of total and manufactured exports and imports in GNP during the period 1950 to 1963. It illustrates the almost negligible role of international trade in the U. S. economy, and the general tendency for small European countries, such as the Netherlands and Norway, to rely much more heavily on the exchange of goods and services than larger countries such as the United Kingdom and Germany. As a trading country, Canada falls in an intermediate position between the large and small European countries. The share of exports in output or imports in consumption is closer to the level in the United Kingdom and Germany. 1/ The differences in the importance of trade in manufactured goods were not so large as the differences for total trade but, even on this more restricted basis, the share of manufactured exports and imports in Canadian GNP was, by and large, between the comparable shares for the large industrial countries and for the smaller ones.

In Why Growth Rates Differ the contribution of the decline in protection to income growth was estimated by measuring the output sacrificed by the relatively lower level of trade in manufactured goods at the start of the period. 2/ The cost of not trading, in terms of a misallocation of resources, was assumed to be related to two-thirds of the height of the tariff on manufactures. 3/ Increases in the share of trade in GNP were weighted by the "adjusted" tariff levels in effect at the start of the period.

For Canada there was little change between 1950 and 1962 in the percentage of GNP represented by imports or exports in total, or for manufactured goods. For many European countries, however, the increases were substantial.

1/ The importance of exports and imports in GNP in Canada is, of course, significantly larger when income on foreign investments is included.

2/ Denison, pp. 256-262.

3/ The use of nominal tariff rates in this calculation does not explicitly take account of differences in resource allocation that may arise from nontariff barriers to trade or from differences in the relationship of nominal and effective tariffs. The use of the nominal tariff as a basis for measuring the "cost" change in the tariff on growth is similar to the approach used by Young and others, to estimate the consumer cost of the tariff.

If one assumes for Canada average tariff rates of 25 per cent on imports[1/] and 12 1/2 per cent on exports[2/] of manufactured goods, the contribution of tariffs to resource shifts and growth in Canada was small and negative. In effect, this calculation reinforces the conclusion that there was no significant change in the level of tariff protection facing Canada or imposed by Canada between 1950 and 1962. Thus no growth gains were enjoyed from the reallocation of resources between production for export and import replacement as a result of changes in commercial policy. The calculation was assumed not to be statistically meaningful, and has not been used.

This measure takes account only of the effect of changes in artificial barriers to trade and their impact on resource use. Other aspects of the growth stimulus arising from the development of trading blocs in Europe are not taken into account in this measure. The effects of economies of scale that arose out of growth in the national market were covered in the preceding Chapter. In fact, changes in the framework of commercial policy may be reflected in a variety of ways. The Notes to this Chapter review some of the literature relating to the cost of protection.

1/ Earlier this year, (then) Finance Minister Sharp stated that the existing (pre-Kennedy Round) rates of duty on final manufactured imports were 22 1/2 to 25 per cent. [See House of Commons, Second Session, Twenty-seventh Parliament, 1968, Standing Committee on Finance, Trade and Economic Affairs, Minutes of Proceedings and Evidence, No. 13, Tuesday, January 16, 1968, respecting Subject-matter of the proposed Customs Tariff Resolution (The Kennedy Round), Ottawa, Queen's Printer, 1968.]

The average duty paid on all dutiable imports into Canada from 1950 to 1962 was 18 per cent; using five-year moving averages to smooth the annual fluctuations, there was no apparent trend in the incidence of import duty from 1950 to 1962.

2/ This was the rate used by Denison for European exports (p. 260). Data on the average duty facing Canadian exports of manufactured goods are not readily available. Duty on exports from the United States in non-Commonwealth overseas countries is likely to be similar for Canadian exports in these markets. Duty on Canadian exports of manufactured goods to the European Economic Community is between 10 and 15 per cent. Using data on U. S. imports from Canada in 1966 and the present rates of duty on selected items of machinery and mechanical equipment, and other miscellaneous manufactured items, the average rate of duty was estimated to be 11 per cent. (See Department of Trade and Commerce, Foreign Trade, Vol. 128, No. 1, Ottawa, Queen's Printer, July 1, 1967.)

Table 95

CONTRIBUTION OF RESOURCE REALLOCATION AND REDUCTIONS IN TRADE BARRIERS TO GROWTH RATES OF NET NATIONAL INCOME

(Percentage points)

	1950-62	1950-55	1955-62
Canada	say nil	say nil	say nil
United States	.00	.00	.00
Northwest Europe	.08	.08	.08
Germany	.10	.10	.10
Netherlands	.16	.16	.16
Norway	.15	.15	.15
United Kingdom	.02	.02	.02

Source: Canada -- see text.
United States and Europe -- Denison, Table 18-2, p. 262.

OTHER FACTORS AFFECTING RESOURCE ALLOCATION

In Chapter Eighteen of Why Growth Rates Differ, Denison discussed a number of additional aspects of resource allocation that were relevant to the growth and cross-section comparisons. In none of these was it possible to isolate or to make a reasonable quantification of the effects. A similar lack of empirical evidence exists in Canada. One of the more important of these factors in Europe was the decline in the barriers to efficient transportation that has occurred in recent years. Evidence was not found to suggest that there was any substantive change in the effect of transportation facilities on real costs or resource allocation in Canada during the period from 1950 to 1962.

While mobility has been a prominent feature of the Canadian population scene in post-war years, it is not clear how one would estimate the impact of increased mobility on productivity, or measure its contribution to growth. The broad industrial shifts from agriculture and other forms of self-employment, which cover a large part of labour mobility in Canada, were taken account of in Chapter XI.

Evidence of change in the degree of competition or monopoly, and its effect on resource allocation in Canada, is almost entirely lacking.[1/] It is beyond the scope of this Study to measure the effects of industrial organization on growth in Canada. Similarly, there is no basis for evaluating any change, or lack of change, in resource allocation arising from subsidies on coal, butter, etc., during this period, or for evaluating other constraints to an efficient allocation of resources

1/ In July 1966 the Government requested the Economic Council of Canada, "in the light of the Government's long-term economic objectives, to study and advise regarding: (a) the interests of the consumer particularly as they relate to the functions of the Department of the Registrar General; (b) combines, mergers, monopolies and restraint of trade; (c) patents, trade marks, copyrights and registered industrial designs". The study is in progress. See Economic Council of Canada, Interim Report, Consumer Affairs and the Department of the Registrar General, July 1967, Ottawa, Queen's Printer.

CHAPTER XIV

VARIATIONS IN OUTPUT AND STATISTICAL ADJUSTMENTS

AGRICULTURAL OUTPUT

Annual levels of agricultural output are subject to wide fluctuations, largely as a result of favourable or adverse weather conditions. Comparisons in time or space -- that is, in rates of growth, or levels of output between countries -- may be distorted if output data for the years being compared reflect wide variations from trend.

In Canada, variations in the wheat crop from good to bad years have been significant. Estimates of the relative size of the fluctuations in agricultural production from weather effects -- deviations from the yield trend -- are shown below.

Table 96

ADJUSTMENTS TO CANADIAN CROP PRODUCTION FOR WEATHER

($1949 million)

1950	+ 75
1955	-104
1960	- 45
1962	-103

Note: Plus (+) indicates a shortfall in actual output from yield trends and minus (-) an above-average crop.

Source: Provided by L. Auer, Staff, Economic Council of Canada.

Between 1950 and 1955, and between 1950 and 1962, there was a significant change in the size of the crop. Comparing output growth, adjusted for crop variability and unadjusted, it was estimated that the higher level of farm output in 1955 compared with 1950 accounted for about one-fifth of a percentage point of the 1950-55 growth rate of total output; the adjustment for 1955 to 1962 was negligible.

In the cross-section comparison of Canada and the United States, the evidence of variability in agricultural output in the United States in 1960 did not warrant an adjustment to the U. S. output level. Using the 1960 weather adjustment figure for Canada, it was estimated that farm output was some 0. 2 per cent above normal in 1960. Since farm income represented about 10 per cent of total income, the adjustment for weather in Canada, as a factor contributing to the level of income, was not large enough to record explicitly as a source of income difference.

VARIATIONS IN THE LEVEL OF DEMAND

Similarly, the level of demand or stage of the business cycle gives rise to variations in output per unit of input, both among countries and over time. The increasing use of the measure of potential output as a standard against which to measure actual output has led to a larger interest in the level and cyclical nature of productivity. Broadly speaking, higher levels of unemployment and lower levels of economic activity are associated with lower levels of, and smaller increments in, productivity.[1/]

In Canada the average level of unemployment was higher in 1955 and 1962 than in 1950. In the United States the rate declined from 1950 to 1955, but by 1962 it had risen above the 1950 level. In Denmark, the Netherlands and the United Kingdom, the evidence suggested that the level of demand in the benchmark years contributed to differences in the rate of growth of output per unit of input. In other European countries, notably Germany, the level of unemployment in 1950 reflected structural factors rather than efficiency of resource use.

Table 97

CIVILIAN UNEMPLOYMENT RATES

(Per cent)

	1950	1955	1960	1962
Canada	3.6	4.4	7.0	5.9
United States	5.3	4.4	5.6	5.6
Northwest Europe	3.4	2.2	1.3	1.2
Belgium	5.0	4.0	3.4	2.2
Denmark	4.0	4.6	2.3	1.8
France	1.4	1.5	1.3	1.2
Germany	7.3	3.9	1.0	0.6
Netherlands	2.1	1.4	1.2	0.8
Norway	0.6	0.9	1.2	1.0
United Kingdom	1.3	0.9	1.3	1.6
Italy	7.7	6.4	4.0	3.0

Source: Canada -- based on DBS, The Labour Force, Supplement to March 1965 issue, op. cit. United States and Europe -- based on Denison, Tables 5-1A to 5-1D, pp. 46-49.

The effect of changes in the degree of utilization on output and productivity in the United States has been quantified by Arthur Okun.[2/] Denison used the Okun measurements as a basis for estimating the effects of different levels of demand

1/ The total shortfall of output below its potential level includes the effect of this productivity element and the effect of underutilization of resources.

2/ The Okun estimates for the United States indicated that for levels of unemployment from 3 to 7 1/2 per cent, a decline in the unemployment rate of one percentage point was associated with an increase in man-hours of 1.8 per cent, in output per man-hour of 1.4 per cent, and in total GNP of 3.2 per cent. See Arthur Okun, "Potential GNP: Its Measurement and Significance", 1962 Proceedings of the Business and Economic Statistics Section, American Statistical Association, Washington.

in the benchmark years of 1950, 1955 and 1962 on changes in output per unit of input. In a tentative exploration of the magnitude of the employment-output relationship for Canada, T. Schweitzer, a staff member of the Economic Council of Canada, found evidence of a broad similarity between the Okun estimate of the GNP-unemployment elasticity of 3.2 per cent for the United States and his (Schweitzer's) estimate for Canada over the 1947-60 period. In the absence of a direct estimate of the detail of this relationship for the Canadian economy, the Okun unemployment-output elasticity was taken as a starting point.

The unemployment-productivity relationship was, however, modified to reflect the fact that the man-hour and productivity responses in the United States did not appear to be relevant for Canada. The evidence on changes in hours suggests that the response of hours to changes in the level of utilization was significantly stronger in the United States than in Canada. On this basis it was assumed that changes in the employment rate in Canada gave rise to a smaller variation in hours per worker and a slightly larger variation in output per man-hour.

The higher levels of unemployment in Canada in 1955 and 1962 reflect a lower level of utilization in these years compared with 1950. As a result, the increase in productivity over the 12-year period and the two subperiods was less than would have been obtained if the level of demand and utilization had been similar in the benchmark years.[1/]

Data on the potential level of output in Canada and on hours worked indicate that the man-hour input in 1950 and in 1955 was larger, and the degree of underutilization less, relative to 1962, than the unemployment data suggest. Estimates of the effect of a lower level of utilization in 1955 and 1962 compared with 1950 were related to the ratio of actual to potential paid man-hours in the commercial nonfarm sector: 97.3 in 1950; 96.1 in 1955; and 94.3 in 1962.[2/] The estimates of the effect of lower levels of demand pressure in 1955 and 1962 on productivity growth are shown in Table 98.[3/] For the 12 years as a whole, it was estimated that the lower level of utilization in Canada in 1962 reduced the growth rate of output per unit of input by 0.4 percentage points a year.

1/ It is also assumed that the unemployment pattern in Canada during the period under consideration did not involve a significant element of change in structural unemployment. See, for example, Frank T. Denton and Sylvia Ostry, An Analysis of Post-War Unemployment, Staff Study No. 3, Economic Council of Canada, Ottawa, Queen's Printer, 1965.

2/ B. J. Drabble, Potential Output 1946 to 1970, Staff Study No. 2, Economic Council of Canada, Ottawa, Queen's Printer, 1964, Table 7, p. 29.

3/ The actual to potential gap in paid man-hours was about three percentage points lower in 1962 than in 1950. This was wider than the unemployment gap of 2.3 percentage points. The productivity effect of the lower level of utilization in 1962 was based on the difference in the degree of underutilization and a 1.6 per cent productivity gap (compared with Denison's 1.5 and Okun's 1.4 per cent). The effect of the level of demand on the growth rate of output per unit of input was estimated as 0.4 percentage points per annum. The estimates for the period 1950 to 1955 and 1955 to 1962 were related to data for the subperiods. The estimates reflect to some extent the statistical problem associated with a degree of incompatibility between changes in the level of utilization, as suggested by employment, and changes in the level of actual and potential output in the period 1950-55 (see footnote 1, page 151).

Table 98

CONTRIBUTION OF DEMAND LEVELS TO

INCOME GROWTH RATES, 1950-62, AND TO DIFFERENCES IN NET NATIONAL INCOME

PER PERSON EMPLOYED, 1960

(Percentage points)

	Contribution to Growth Rates of Net National Income			Contribution to the Gap in Net National Income per Person Employed with the United States, 1960(1)
	1950-62	1950-55	1955-62	
Canada	- .41	- .35	- .47	1.4
United States	- .04	.39	- .34	--
Northwest Europe	- .01	.06	- .07	-1.6
United Kingdom	- .09	.16	- .29	-1.3

(1) After interaction.

Source: Canada -- see text.
United States and Europe -- Denison, Tables 19-1 and 19-2, pp. 275 and 277.

In the U. S.-European income comparison for 1960 the only significant incomparability in output per unit of input associated with different levels of demand in the various countries arose from the lower level of output in the United States and the United Kingdom. Since the Denison analysis compared the levels of income in the European countries, relative to the level in the United States, the adjustments were made to the European countries (with the exception of the United Kingdom). That is to say, if Europe's productivity performance had been at the lower U. S. level, income in Europe would have been lower. Based on a 1. 6 percentage point unemployment gap (5. 6 compared with a potential rate of 4 per cent), the U.S. shortfall in output per unit of input was estimated to be 2. 4 per cent of U. S. national income. After allowance for a similar, but smaller, gap in the United Kingdom, and adjustment for interaction, this accounted for 1. 6 percentage points of the difference between U. S. and Northwest European national income per person employed.

Both the U. S. and the Canadian economies turned down early in 1960. The unemployment rate averaged 7 per cent in Canada over the year and 5. 6 per cent in the United States.[1] The difference in the level of unemployment was 1. 4 percentage points. The ratios of actual to potential output indicated that the Canadian economy was operating at 92 1/2 per cent of potential in that year compared with 94 per cent in the United States -- a gap of 1. 5 percentage points.[2]

1/ The civilian unemployment rate. The U. S. rate of 5. 6 per cent used in Why Growth Rates Differ was based on a labour force 14 years and over, compared with 5. 5 per cent under the new definition of 16 years and over.

2/ Drabble, op. cit., p. 65.

The evidence suggests a number of other differences between the performance of the Canadian and the U. S. economies in the year 1960. In Canada, employment declined between 1959 and 1960 as the unemployment rate widened from 6 to 7 per cent. In the United States the level of employment in 1960 was higher than in 1959 and the unemployment rate increased marginally from 5. 5 to 5. 6 per cent. Hours of work declined more in the United States than in Canada.[1/] By and large it would appear that the gap in man-hour input was not as wide as indicated by the 1. 5 percentage point difference in unemployment rates.

The estimate in Table 98 was based on the assumption that the productivity impact of a greater degree of underutilization in Canada, compared with the United States, was about two-thirds of the Okun-Denison employment-productivity relationship.[2/] The unemployment difference of 1 1/2 percentage points at the level of 7 per cent unemployment in Canada was associated with a difference in output per unit of input of 1. 5 percentage points. Taking account of the interaction effects, it was estimated that 1. 4 percentage points of the Canada-U. S. income gap could be explained by the lower level of activity in Canada compared with the United States.

STATISTICAL ADJUSTMENTS

Special adjustments were made in the analysis of Why Growth Rates Differ for statistical incomparability associated with deflation procedures in the national accounts of Belgium and France.[3/] In this category of adjustments, but not directly attributable to deflation procedures, a statistical adjustment was made to the Canadian estimates to reflect the difference in growth as measured by the real output series and the deflated expenditure accounts.[4/] From 1950 to 1955, the real domestic product series increased at an annual rate of 5. 3 per cent compared with a rate of 4. 5 per cent in the volume or deflated expenditure on GDP.[5/] As Table 99 indicates, the difference between the two series has not been significant since the mid-1950's.

1/ For example, hours in manufacturing declined about 1. 5 per cent from 1959 to 1960 in the United States, and less than 1 per cent in Canada.

2/ The 7 per cent level of unemployment in Canada was at the edge of the range within which the Okun estimates were relevant.

3/ Denison, p. 27.

4/ See especially, Emery and Garston, op. cit., p. 70.

5/ Gross Domestic Expenditure, excluding error, at constant market prices. The real output estimate is at factor cost, but no significant part of the difference is likely to relate to this difference in level of valuation.

Table 99

A COMPARISON OF GROWTH RATES OF REAL OUTPUT

AND DEFLATED GROSS DOMESTIC PRODUCT, CANADA, 1948 TO 1966

(Percentage increase per annum)

	National Accounts Expenditure on GDP	Real Output Series	Difference in Growth Rates
1948-50	4.2	4.3	- .1
1950-55	4.5	5.3	- .8
1955-62	3.8	3.7	+ .1
1962-66	6.5	6.4	+ .1

Source: Based on Emery and Garston, op. cit.

This comparison does not, of course, take into consideration the revisions of the Canadian national accounts or the real output series, both of which are in train. The revisions may resolve some part of this conundrum,[1] but in so far as the existing estimates reflect poor or insufficient data, the discrepancy may be a persistent feature of the output measures for the post-war years. It was not possible to make a nice evaluation of the relative merits or limitations of the two alternative series for this period, and so it was decided to split the difference and add 0.4 per cent[2] per annum to the 1950-55 output growth rate as a statistical adjustment.

In theory, the growth rate of total national income estimated in Chapter II could have been raised to include this adjustment at the outset. If this had been done, some (small) part of it would have appeared in the contribution of factor inputs. Alternatively, to the extent that overdeflation of expenditure or investment may be a factor in the difference in the output measures, the adjustment would have appeared with the factors relating to measured output per unit of input to maintain consistency with the Denison framework.[3] In the absence of knowledge of the essential cause of the understatement giving rise to the adjustment, it was included as a factor productivity component (see Tables 100 and 102).

1/ In Chapter II it was suggested that there was a strong presumption that the revisions in the national accounts would raise the growth rate of real GNP between 1950 and 1962, particularly between 1950 and 1955. This "hypothesis" provided additional weight to the decision to include a statistical adjustment for this discrepancy.

2/ Equivalent to an addition of 0.2 per cent per annum to the growth rate over the period 1950-62.

3/ In part of the summary and analysis, Denison used national income and output per unit of input series, adjusted to include and exclude (respectively) all three of the factors covered in this Chapter. See, especially, the summary tables in Chapter Twenty-One of Why Growth Rates Differ, based on the percentage distribution of sources of growth.

It should be noted, however, that this output adjustment may prove to be a minimum adjustment. The size of the residual sources of growth in the 1950-55 period provided additional support to the thesis that the growth of total output, of output per person employed, of output per unit of input, and of the residual sources of growth, must be assumed still to be understated, even after the addition of 0.4 per cent per annum to the growth rate of output and factor productivity. It should also be noted that a large part of this adjustment to the growth rate would be reflected in the residual sources of growth (see footnote 1, page 151).

CHAPTER XV

SUMMARY OF CONTRIBUTIONS TO GROWTH

The growth of net national income in Canada averaged about 4 per cent per annum from 1950 to 1962. During the first half of the 1950's, the Canadian economy was buoyant. The external environment was favourable. Continental Europe was well along the road to recovery from the destruction and dislocation of war. The countries of Northwest Europe were growing at over 5 1/2 per cent a year, and the Korean War had strengthened the demand for, and prices of, Canada's primary products. Later in the decade and into the early 1960's, a number of the industrial countries experienced a moderation in the rate of growth, but the decline in activity was most severe in Canada and the United States.

Denison's estimates of factors contributing to growth in Europe and the United States in Why Growth Rates Differ, and those in this Study for Canada, were made for two subperiods, 1950-55 and 1955-62. This summary Chapter emphasizes the 12-year period from 1950 to 1962, with only occasional references to the subperiods when the analysis requires it. 1/ Details of the subperiod estimates for Canada are given in the tables; the U. S., Northwest European and Italian estimates and analysis are fully articulated in the Denison study.

1/ The emphasis on Canadian growth performance in the 1950-62 period, rather than in the subperiods, arises largely from a statistical problem, which was raised in the previous Chapter, relating to large differences in the Canadian output estimates for the period 1950-55. Throughout this Study some of the data underlying the estimates for 1950-55 gave rise to additional doubts and concern. The difference in the size of the net residual sources of growth in the subperiods 1950-55 and 1955-62 seemed to confirm these doubts. The estimates for the subperiod 1950-55 should be treated with care and some scepticism. It is assumed that the rate of growth of total output, output per unit of input, and the residual sources of growth are likely to be understated. This implies that the difference between the residual sources of growth, in 1950-55 and 1955-62, was not as large as the estimates in the summary tables of this Chapter suggest.

The decision to emphasize the growth performance in Canada over the 12-year period has definite disadvantages in comparing Canadian and European growth. A significant part of the high rates of growth in Europe in the early 1950's arose from the special circumstances of post-war reconstruction. The Denison estimates for the European countries show marked differences in over-all performance and in the factors contributing to the differences in the two subperiods. It is assumed that, as the lesser of two evils, comparisons of the average performance over 12 years are viable even though the data suggest that Canadian growth performance is somewhat understated for statistical reasons, and that the European performance reflects in part the uniquely advantageous environment for growth during the period of economic rehabilitation.

The percentage point contribution of the factors underlying the annual average rates of growth in Canada, the United States and Northwest Europe[1/] is compared in Table 100. The percentage share contribution of each factor (adjusted to exclude the effects on growth of the statistical adjustments, variations in the pressure of demand and in agricultural output) is given in Table 101.

Factor inputs were far more important than factor productivity as a source of growth in Canada during this period. Labour and capital contributed almost equally to growth over the period as a whole, but the contribution of capital was markedly larger in the earlier part of the decade when Canada was experiencing an investment boom. The rate of increase of the Canadian labour force in the later period increased the contribution of labour to total output growth in spite of the level of unemployment that obtained in 1962. Both labour and capital were significantly less important as a source of growth in Northwest Europe -- in fact, on a percentage-share basis, about one-half as important as in Canada.

Declining hours of work reduced output in most countries. The shift to part-time employment was more dramatic in Canada and the United States and intensified the decline in average hours. Changes in the distribution of the labour force by age and sex reflect, among other things, the age structure of the population, the female participation rate and the school-leaving age. In Canada, a rapid rise in the number of women in the labour force, and an increase in young people moving into the labour force, effected a reduction in the growth rate in the latter part of the period. In Northwest Europe the female participation rate was already higher than in Canada and increased less.

1/ It should be noted that these summary tables for Canada, the United States, etc., depart in one important respect from those in Why Growth Rates Differ. In the latter study, the residual source of growth -- that is, growth not accounted for by the measured contributions of primary factor inputs and output per unit of input -- was further subdivided. In the U. S. analysis, the residual source of growth -- 0.76 per cent a year in each subperiod -- was assumed to approximate the contribution of advances in knowledge to U. S. growth. (See Denison, Chapter Twenty, for a discussion of the residual sources of growth and advances in knowledge.) Denison further assumes that "knowledge is an international commodity" and that the contribution that advances in knowledge made to growth in the United States was similarly available as a source of growth in all countries. The statistical material and the analysis in Why Growth Rates Differ included for each country a growth contribution of "advances in knowledge" of 0.76 per cent, and the net residual item "other changes in the lag in the application of knowledge, general efficiency and errors and omissions" excluded that amount. In this Study the "advances in knowledge" factor was not separately specified; the residual sources of growth category is comparable to the residual sources of growth in Denison's Table 20-1, p. 281, and includes the effect of advances in knowledge, as well as the effect of the lag in the application of knowledge for countries other than the United States.

Table 100

CONTRIBUTION OF FACTOR INPUTS AND OUTPUT PER UNIT OF INPUT

TO GROWTH OF NET NATIONAL INCOME

(Contribution to growth rates in percentage points)

	Canada			United States	Northwest Europe
	1950-55	1955-62	1950-62	1950-62	1950-62
Net National Income	4.2	3.6	3.8	3.3	4.8
Factor Inputs	3.1	2.5	2.7	2.0	1.7
Labour	1.3	1.5	1.4	1.1	.8
Employment	1.3	1.6	1.5	.9	.7
Hours worked	- .2	- .2	- .2	- .2	- .1
Age-sex composition	—	- .1	- .1	- .1	—
Education	.3	.2	.2	.5	.2
Capital	1.8	1.0	1.3	.8	.9
Housing	.4	.2	.3	.3	.1
Foreign investments	.1	- .1	—	.1	—
Non-residential structures and equipment	1.0	.7	.8	.4	.6
Inventories	.3	.1	.2	.1	.2
Land	—	—	—	—	—
Output per Unit of Input	1.1	1.1	1.1	1.4	3.1
Improved allocation of resources					
Decline in agricultural inputs	.7	.4	.5	.3	.5
Decline in nonfarm self-employment	.3	—	.1	—	.1
Reduction in international trade barriers	—	—	—	—	.1
Economies of scale					
Growth in national market	.4	.4	.4	.3	.4
Growth in local markets	.1	.1	.1	.1	.1
Income elasticities in consumption	—	—	—	—	.5
Capital adjustments[1]	—	—	—	—	.1
Statistical adjustments*	- .4	—	- .2	—	.1
Variations in pressure of demand*	- .4	- .5	- .4	—	—
Variations in agricultural output*	.2	—	.1	—	—
Residual sources of growth	.1	.7	.5	.8	1.3
		Adjusted Growth Rates[2]			
Net National Income[2]	4.7	4.1	4.3	3.4	4.7
Factor inputs	3.1	2.5	2.7	2.0	1.7
Output per unit of input	1.6	1.6	1.6	1.4	3.0

(1) Includes the effect of "reduction in the age of capital" and "balancing of the capital stock" for some countries in Northwest Europe.

(2) Adjusted to exclude the effect of starred (*) items — statistical adjustments; variations in pressure of demand; and variations in agricultural output.

Note: Detail has been rounded to tenths of a percentage point and may not add.

Source: Canada — Tables 70, 80, 84, 87, 93, 95 and 98, and pp. 143 and 148.
United States and Northwest Europe — Denison, Tables 21-1 and 21-3, pp. 298 and 300.

Table 101

DISTRIBUTION OF THE CONTRIBUTION OF FACTOR INPUTS AND OUTPUT PER UNIT OF INPUT TO GROWTH OF ADJUSTED(1) NET NATIONAL INCOME

(Percentage shares)

	Canada			United States	Northwest Europe
	1950-55	1955-62	1950-62	1950-62	1950-62
Net National Income	100	100	100	100	100
Factor Inputs	66	61	63	58	36
Labour	28	38	33	33	18
Employment	27	41	34	27	15
Hours worked	- 4	- 4	- 4	- 5	- 3
Age-sex composition	—	- 4	- 2	- 3	1
Education	5	5	5	15	5
Capital	38	24	30	25	18
Housing	9	6	7	7	1
Foreign investments	2	- 3	- 1	1	- 1
Non-residential structures and equipment	21	18	19	13	14
Inventories	7	3	5	3	4
Land	—	—	—	—	—
Output per Unit of Input	34	39	37	42	64
Improved allocation of resources					
Decline in agricultural inputs	15	9	12	7	10
Decline in nonfarm self-employment	6	1	3	1	3
Reduction in international trade barriers	—	—	—	—	2
Economies of scale					
Growth in national market	9	9	9	9	9
Growth in local markets	1	2	2	2	1
Income elasticities in consumption	1	—	—	—	10
Capital adjustments(2)	—	—	—	—	2
Residual sources of growth	2	18	11	23	27

(1) Adjusted to exclude statistical adjustments; variations in pressure of demand; and variations in agricultural output.

(2) Includes the effect of "reduction in the age of capital" and "balancing of the capital stock".

Note: Detail may not add due to rounding.

Source: Canada — calculated from unrounded data for Table 100.
United States and Northwest Europe — Denison, Tables 21-2 and 21-4, pp. 299 and 301.

The contribution of increased levels of education to output in the United States provided a striking contrast with both Canada and Europe. In absolute terms, education contributed 0.5 percentage points a year to the rate of growth in the United States. In Canada and Northwest Europe, the contribution was only half as large -- about 0.25 percentage points per annum; as a share in growth, education contributed 5 per cent in Canada and Northwest Europe compared with 15 per cent in the United States. 1/

The increase in capital contributed more to growth in Canada (30 per cent) than in the United States (25 per cent) or Northwest Europe (18 per cent). The high rate of investment in the early 1950's in Canada gave rise to growth in capital stock which contributed almost two percentage points to the annual rate of growth as compared with one percentage point in the second period. The increase in the stock of houses, and in their contribution to growth, was particularly large in the United States and Canada. In Northwest Europe as a whole, housing was of minor importance as a factor in growth. Changes in the stock of enterprise structures and equipment contributed more than any other single factor (except employment) to total income growth in Canada. Inventory accumulation contributed about one-fifth of a percentage point to the growth rates in Canada and the United States. A much larger part of the growth in stocks in Canada occurred in the earlier part of the period when output was growing more rapidly.

Over the period 1950 to 1962 the effect on the national income growth rate of income payments on foreign investments was only plus or minus 1 per cent in all countries. The quantity of available land was assumed to remain relatively unchanged over the period; it did not, of itself, make a contribution to output growth.

For some purposes the proper focus of analysis may be the total rate of growth of output. However, the potential of the economic system to provide higher levels of income and consumption to workers, and to the total population, is more readily assessed by tracing the sources of growth in output per employed person. If long-term economic policy in Canada were concerned with narrowing the gap in income per person employed or per capita between Canada and the United States, Canada would have to achieve and sustain a faster rate of growth in output per worker. A high rate of growth of total income, which is based on large labour inputs, may be an appropriate objective in itself, but it is no guarantee of higher standards of living. The focus of the discussion is turned to Tables 102 and 103 which indicate the sources of growth in income per person employed.

The contributions of the "quality" factors in labour input are the same in this framework of analysis, since the total growth measures represented averages per person employed. The total impact of labour quality on output reinforces a point made above, but worth repeating. The contribution of higher levels of education to output growth in the United States was so large that, in spite of the offsetting effects of the other quality factors -- hours, age, and sex -- increases in labour quality in the United States accounted for 10 per cent of the growth in output per person employed. In Northwest Europe, growth in the quality of the labour input contributed only 3 per cent. In Canada, the "negative" factors outweighed the small contribution of education, so that increases in labour quality contributed nothing to growth per worker over this period.

1/ This disparity seems to have existed for some time. Wilson and Lithwick, op. cit., p. 94, indicated that the increase in formal schooling based on years of education (no allowance for days) contributed about 0.17 percentage points to the annual growth rate of potential output in Canada (1926-56) compared with 0.35 percentage points in the United States over the period (1929-57).

Table 102

CONTRIBUTION OF FACTOR INPUTS AND OUTPUT PER UNIT OF INPUT TO GROWTH OF NET NATIONAL INCOME PER PERSON EMPLOYED

(Contribution to growth rates in percentage points)

	Canada			United States	Northwest Europe
	1950-55	1955-62	1950-62	1950-62	1950-62
Net National Income	2.4	1.4	1.8	2.2	3.8
Factor Inputs	1.3	.3	.7	.8	.7
Labour	.1	- .1	- .1	.2	.1
Hours worked	- .2	- .2	- .2	- .2	- .1
Age-sex composition	—	- .1	- .1	- .1	—
Education	.3	.2	.2	.5	.2
Capital	1.4	.5	.9	.6	.7
Housing	.4	.2	.2	.2	—
Foreign investments	.1	- .1	—	—	—
Non-residential structures and equipment	.7	.4	.5	.3	.5
Inventories	.2	—	.1	.1	.1
Land	- .1	- .1	- .1	—	—
Output per Unit of Input	1.1	1.1	1.1	1.4	3.1
Improved allocation of resources					
Decline in agricultural inputs	.7	.4	.5	.3	.5
Decline in nonfarm self-employment	.3	—	.1	—	.1
Reduction in international trade barriers	—	—	—	—	.1
Economies of scale					
Growth in national market	.4	.4	.4	.3	.4
Growth in local markets	.1	.1	.1	.1	.1
Income elasticities in consumption	—	—	—	—	.5
Capital adjustments(1)	—	—	—	—	.1
Statistical adjustments*	- .4	—	- .2	—	.1
Variations in pressure of demand*	- .4	- .5	- .4	—	—
Variations in agricultural output*	.2	—	.1	—	—
Residual sources of growth	.1	.7	.5	.8	1.3
	Adjusted Growth Rates(2)				
Net National Income	2.9	1.9	2.3	2.2	3.7
Factor inputs	1.3	.3	.7	.8	.7
Output per unit of input	1.6	1.6	1.6	1.4	3.0

(1) Includes the effect of "reduction in the age of capital" and "balancing of the capital stock" for Northwest Europe.

(2) Adjusted to exclude the effect of starred(*) items — statistical adjustments; variations in pressure of demand; and variations in agricultural output.

Note: Detail has been rounded to tenths of a percentage point and may not add.

Source: Canada — based on Table 100.
United States and Northwest Europe — Denison, Tables 21-1 and 21-3, pp. 298 and 300.

Table 103

DISTRIBUTION OF THE CONTRIBUTION OF FACTOR INPUTS AND OUTPUT PER UNIT OF INPUT TO GROWTH OF ADJUSTED(1) NET NATIONAL INCOME PER PERSON EMPLOYED

(Percentage shares)

	Canada			United States	Northwest Europe
	1950-55	1955-62	1950-62	1950-62	1950-62
Net National Income	100	100	100	100	100
Factor Inputs	46	18	32	36	20
Labour	2	- 6	- 2	10	3
Hours worked	- 7	-10	- 8	- 8	- 4
Age-sex composition	—	- 7	- 4	- 5	1
Education	9	11	10	22	6
Capital	47	27	37	27	17
Housing	12	8	10	10	1
Foreign investments	4	- 4	—	2	- 1
Non-residential structures and equipment	24	22	23	13	14
Inventories	7	2	4	3	4
Land	- 3	- 4	- 3	- 1	- 1
Output per Unit of Input	54	83	68	64	80
Improved allocation of resources					
Decline in agricultural inputs	25	19	22	11	12
Decline in nonfarm self-employment	9	2	6	2	4
Reduction in international trade barriers	—	—	—	—	2
Economies of scale					
Growth in national market	15	20	17	14	11
Growth in local markets	2	4	3	3	2
Income elasticities in consumption	1	- 1	—	—	12
Capital adjustments(2)	—	—	—	—	3
Residual sources of growth	2	39	20	34	34

(1) Adjusted to exclude statistical adjustments; variations in pressure of demand; and variations in agricultural output.

(2) Includes the effect of "reduction in the age of capital" and "balancing of the capital stock".

Note: Detail may not add due to rounding.

Source: Canada — calculated from unrounded data for Table 102.
United States and Northwest Europe — Denison, Tables 21-2 and 21-4, pp. 299 and 301.

The contribution of capital to growth in total output was particularly large in Canada relative to other countries. The contribution of increased capital per worker to higher levels of output per worker in Canada was even larger. Its share, as a factor in the growth of income, increased from 30 per cent in total to 37 per cent per person employed, compared with 25 to 27 per cent in the United States and 18 to 17 per cent in Northwest Europe. This was reflected in a substantial increase in the capital -- labour and capital -- output ratios in Canada, compared with the United States or Europe.

As factor inputs, the land area and the resource base were assumed not to have changed over the period 1950 to 1962. But since employment increased, the estimates show a small negative contribution of land and resources to growth in output per worker in all countries. A growing population presses on land in many ways, but the pressure is usually felt on a particular quality or type of land, such as suburban land, and is negligible on other types, such as the vast Canadian Shield. Measurement of the impact on growth of abundant or scarce resources would require a different accounting framework -- one that included the range of direct and indirect costs and benefits associated with abundance or scarcity.

The analysis of factors that contributed to gains in output per worker reemphasizes the fact that increased factor productivity or output per unit of input was crucial to growth. Using adjusted growth rates, increased output per unit of input in Canada added about 1 1/2 percentage points a year to growth of total income and income per person employed in both time periods. In the United States, more efficient resource use made a similar contribution to growth in the early period and a slightly smaller contribution in the later period. The most striking contrast was in the European performance. In Northwest Europe as a whole, almost four percentage points of a 5 1/2 per cent total growth rate between 1950 and 1955 was attributed to increases in output per unit of input. In the period 1955 to 1962, 2 1/2 percentage points of a 4 per cent rate of total growth arose from this source. These contrasts in the absolute contribution of factor productivity to growth are reflected in the share contributions: between 60 and 70 per cent of growth in Northwest Europe, over 40 per cent in the United States, and under 40 per cent in Canada.

	1950-55			1955-62		
	Annual Growth Rates		Growth in Output per Unit of Input as a Share of Output Growth	Annual Growth Rates		Growth in Output per Unit of Input as a Share of Output Growth
	Output	Output per Unit of Input		Output	Output per Unit of Input	
Canada	4.7	1.6	34	4.1	1.6	39
United States	3.8	1.5	40	3.0	1.3	44
Northwest Europe	5.6	3.8	68	4.1	2.5	61
United Kingdom	2.2	1.1	51	2.6	1.4	55

The most important specified source of productivity growth in Northwest Europe was in over-all economies of scale associated with the growth in national, international and local markets, and with the rapid rise in personal incomes. During this period, Europe was in process of reaping the advantages in production, distribution and consumption of a larger and wider European market. The United States also achieved growth from further exploitation of scale economies. As the comparison of market size suggests, there was much less to be gained in the United States from sheer size since the U. S. domestic market was as large as the total market

of the Northwest European countries. The rapid rate of growth of income per worker in Europe during this period provided a large stimulus to the mass production of a whole range of consumer durables. This income effect, and the economies in production and distribution that Europe achieved in the 1950's with the assistance of the EEC and EFTA, had occurred decades earlier in the U. S. domestic market.[1/]

Canada stood somewhere in the middle. The level of income per worker in Canada was about half way between the levels in Northwest Europe and the United States, but the pattern of tastes and consumption was broadly similar throughout North America. The domestic market in Canada was larger than the markets of the small European countries, and smaller than those of the large European countries. Northwest Europe derived one percentage point of the annual growth rate from the effects of economies of scale on output per unit of input. Canada derived one-half a percentage point.

The reallocation of labour from low-income occupations in agriculture, and other types of self-employment, provided a significant source of productivity growth in Canada and in a number of European countries. Farm employment declined from about 20 to 11 per cent of total employment in Canada over the 12-year period. The contribution of the shift in resources to higher-income alternatives contributed one-half a percentage point to the annual growth rate in Canada. The rate of decline was broadly similar -- between one-third and one-fourth -- in Northwest Europe and the United States but, even by 1962, the share of total employment in agriculture varied from 4 per cent in the United Kingdom to 20 per cent in France and 29 per cent in Italy. In the United States, the share of employment in agriculture in 1962 was down to 7 1/2 per cent. These resource shifts contributed one-quarter of a percentage point to the growth rate in the United States and one-half in Northwest Europe.

Self-employment in other low-income occupations has also been declining as a share of employment in most countries. About 1/10 of 1 per cent of the annual rate of growth in income per person employed from 1950 to 1962 derived from this source in Canada; the major part of the decline occurred in the period 1950-55. There was a decline in the actual number of self-employed workers in most countries in Northwest Europe. The contribution of this aspect of resource reallocation to growth was similar to that in Canada over the 12-year period.

The estimates in Why Growth Rates Differ of the effect of resource reallocation following the reduction of trade barriers in Europe did not suggest that there were large gains from this source. The discussion in Chapter XIII of this Study noted that, in addition to the gains from resource reallocation among industries, which tended to raise the level of both exports and imports, increased product specialization may have played an important role in the response of European firms to tariff reductions. No part of the growth in productivity in the United States or Canada was attributed to changes in the allocation of resources resulting from tariff changes during this period.

[1/] See Denison's comparison of the difference between output per worker in Northwest Europe and the United States in 1960, and the United States in 1925 and 1960, Table 21-29, p. 334.

Three final elements that were specified as factors in increased output per unit of input are statistical adjustments, irregularities in the pressure of demand, and irregularities in agricultural output. 1/ These components were, in a sense, adjustments which standardized the growth rates for special cyclical variations over time and statistical incomparabilities in the country data.

The statistical adjustment included the effect of differences in the "deflation procedures" on the output measures of France and Belgium, which were taken account of in Why Growth Rates Differ. The statistical adjustment to the Canadian output estimate, described in Chapter XIV, was also included in this category.

Variations in the level of demand or in the utilization of resources in the benchmark years did not seriously distort the measured growth of output or productivity in Northwest Europe or the United States from 1950 to 1962. It was, however, a significant factor in the Canadian growth performance. In 1950, the Canadian economy was close to its potential level of output; in 1962, it was well below potential. The lower level of productivity associated with underutilization reduced the annual rate of growth over the period by 0.4 percentage points. The effect of weather on crop production was not an important factor in productivity changes in Canada, the United States or Northwest Europe over the whole period from 1950 to 1962. The effect of variability in agricultural output and demand differed in magnitude and direction in the subperiods; 2/ the pattern of change reflected the specific conditions that obtained in the benchmark years of 1950, 1955 and 1962.

The contribution of factor inputs and the sources of factor productivity change that were separately identified and measured did not fully account for total growth. 3/ That part of growth that was not accounted for is shown in the summary tables as the residual sources of growth. 4/ As a share of adjusted national income, these residual sources accounted for about one-third of growth of national income per person employed in the United States and Northwest Europe in 1950-62. In Canada the residual and unidentified sources of growth contributed about 20 per cent of growth in income per person employed.

The contribution to growth of these residual sources varied widely in the subperiods and among the countries. In the 1950-55 period, the residual sources of growth shown in Table 100 contributed only one-tenth of one percentage point to the Canadian growth rate. The reservations that have been expressed concerning the data for this subperiod seriously limit the analytical usefulness of this component. A large part of any understatement in the over-all growth performance

---

1/ These items have been deducted from the growth in output and from the contributions to output growth in the percentage share tables (see footnote (1) in Tables 101 and 103).

2/ The statistical problems associated with the Canadian growth estimates for the period 1950-55 (footnote 1, p. 151) affect the subperiod allocation of this item.

3/ Two additional factors contributing to productivity gains in some European countries were the "balancing of the capital stock" and "reduction in the age of capital" (Denison, pp. 144-151). The "capital adjustments" item in Tables 100 to 103 includes both.

4/ It includes the items shown in Denison's analysis as "advances in knowledge" (see footnote 1, p. 152).

in this period would be reflected in the size of the residual sources of growth. On the basis of judgment alone, it appears that residual sources contributed less to growth from 1950 to 1955 than from 1955 to 1962, but the difference was not as large as Table 100 suggests.

In Europe, on the other hand, the residual sources of growth made a very significant addition to growth in the early 1950's (see Denison's text table, p. 284). The largest contributions were in Germany and Italy -- some 2 to 2 1/2 percentage points to the annual rates. The smaller contributions were in the United Kingdom and Norway -- about three-quarters of a percentage point.[1/] By and large, the experience of the early 1950's reflected rather special post-war performance in most European countries.

A good deal, if not all, of the dynamics of the European recovery was over by 1955. The residual sources of growth for the period 1955-62[2/] (in percentage points) were as follows:

France	1.56
Italy	1.30
Norway	.97
Germany	.87
United Kingdom	.87
Belgium	.77
United States	.76
Denmark	.75
Netherlands	.75
Canada	.74

Discounting small differences that are not statistically significant,[3/] the residual sources of productivity growth were broadly similar except for France, Italy and Norway. In considering the implications of these measures for the European countries, Denison concludes that ". . . the higher growth rates obtained by most European countries than by the United States were not due in any large measure to a catching-up of technique to that of the United States.".[4/]

The Canadian experience would seem also to correspond with this interpretation, and not only for the relatively short time horizon of this Study but in the longer run as well. Canadian productivity growth has for decades been growing at a rate that seems roughly comparable to that in the United States but, as Canadian productivity rises, "American productivity has itself continued to rise with advances in the "state of the arts".".[5/] The gap in productivity between the two countries remains.

[1/] The residual sources of growth in Denmark in this period were, as in Canada, insignificant. Denison suggests that this result may reflect statistical and estimating problems (p. 285).

[2/] Table 100 and Denison, p. 283.

[3/] In comparing the relative size and variation in the residual sources of growth, the statistical limitations of the basic data, as well as errors and omissions in estimating the growth contribution, must be considered a possible source of difference. The residual is assumed to consist of a variety of components contributing both positively and negatively to growth. The absolute size of the net of these unidentified sources of growth does not provide evidence of the number or size of the component elements.

[4/] Denison, p. 285.

[5/] Denison, p. 286.

What were these residual sources of growth? There is no evidence to suggest that there were important changes in the quality of labour inputs that would account for differences in the growth of output per worker. It is possible that there are differences in attitude and aptitude that affect the quality of inputs or the efficiency of resource use in Canada that were not taken into account in the specified factors. These are likely to relate more to differences in the level of productivity than to growth.

The contribution of advances in knowledge to productivity growth includes, among other things, the effect of managerial skill and know-how in the organization of workers, equipment and materials. The level of education per worker was growing more slowly in Canada during the 1950's, and was at a lower level of attainment compared with the United States. In addition, there was a significant shortfall in the share of workers with university education and particularly with business and management school training. The application of advances in technical and organizational knowledge to industry requires skilled and informed management. A growing economy not only has the capacity to absorb, but requires increasing numbers of trained and effective managers:

> . . . top management, which always made a difference, makes more difference than it used to. The more complicated the nervous system, the more important is the action of the brain. 1/

An additional factor relating to the input of labour is suggested by the contrast between the high rate of growth in labour input in Canada and the almost negligible increase in countries such as Norway and France. If output can be readily expanded by increasing employment, it may be easier in the short run to do so. On the other hand, when labour is at a premium or almost impossible to acquire, there is a large incentive to search out every means of economizing in its use with better organization or even financial and psychological incentives.

It is frequently argued that capital stock is not an adequate measure of capital input. The controversy is interesting and important, but to pursue it in this context does not seem necessary or appropriate. In this Study the effect of advances in knowledge on the productivity of capital is included in the residual sources of growth. As yet there is scarcely any reasonable alternative as a basis for international comparisons. 2/ The point at issue seems basically to be concerned with an adequate assessment of the quantity, quality and use of capital, rather than with its classification as an input or as a residual source of growth.

While fixed investment per person employed, over the period 1948 to 1963, was larger in Canada than in any of the other nine countries including the United States, investment in equipment per worker was only three-quarters of the U. S. level. Estimates of the age of equipment in Canada indicated that the average age had increased slightly over the period. This may in part be due to the slowdown in the rate of investment in Canada after 1957. These data suggest the possibility of a lengthening of the lag in incorporating the advances in knowledge that were associated with the most recent improvements in equipment.

1/ George C. Homens, "Effort, Supervision and Productivity", in Leadership and Productivity, San Francisco, Chandler Publishing Company, 1965, p. 67.

2/ This comment is not meant to suggest that there is not an urgent need for continued analysis into the question of capital input measurement. The resolution of this conundrum is an important ingredient of long- and medium-run growth analysis.

The lower level of productivity growth in Canada compared with the United States appears to be particularly related to the manufacturing sector. The Lithwick[1] and Daly[2] studies pointed out that the gap in output per worker is significantly higher in manufacturing than for the economy as a whole. In addition, the rate of growth of factor productivity in Canadian manufacturing has been below the level in the United States. Lithwick estimated the growth of factor productivity in manufacturing from 1956 to 1966 at 3.0 per cent per annum in Canada compared with 3.6 per cent in the United States.[3] At the same time, the available data suggest that gross capital per worker was rising more rapidly in Canada than in the United States. One can only agree with Professor Lithwick that "it is difficult to evaluate the source of this productivity . . . trend." He suggested that investment in research and development was of major significance. As the Fifth Annual Review of the Economic Council suggested, there is a strong presumption that the lag in innovation of new techniques rather than the lack of "pure" research activities may be the more important constraint on productivity growth in Canada. Other factors referred to earlier in this Study also suggest themselves as possible elements in the lower rate of growth of productivity in Canadian manufacturing -- organization and management, increased diversification in production, lower utilization of plant, as well as lags in the adaptation of knowledge relating to best-practice techniques in capital goods and in the production processes.

This analysis of Canada's growth performance in the context of the growth performance in other countries does not suggest that we could, or should, have matched the performance of the United States or Europe in total or in every detail. Some of the areas of achievement and shortfall in Canada have been made explicit; some remain the "measure of our ignorance".[4]

It has been suggested that a "primary concern" of policy in Canada has been the GNP growth rate.[5] On this point, Professor Dales remarked:

> Yet from an economic point of view it is such a simple type of growth that it holds almost no interest for economic theorists, who concern themselves primarily with the efficient use of a given quantity of resources, and who therefore tend to think of economic progress not in terms of amassing resources but in terms of making better use of existing resources. Fortunately, however, economic historians and economic theorists do have a common interest in an improvement of resource quality as a third path to the wealth of nations. Historians have long manifested an interest in technological change, which may be considered as a means of improving the quality of capital resources, and in such things as health, diet, training, and a wide range of institutional factors that affect the quality of human resources. Only recently have economic theorists invaded in force the fields of technology, health, education, recreation, and governmental activities, but already the power of economic analysis is beginning to make itself felt in public policies relating to these matters.

1/ Lithwick, op. cit., p. 10.

2/ Daly, et al., op. cit.

3/ Lithwick, op. cit., pp. 12 and 13.

4/ Moses Abramovitz, "Resource and Output Trends in the United States Since 1870", A.E.R., Vol. XLVI, No. 2, May 1956, p. 11.

5/ J. H. Dales, The Protective Tariff in Canada's Development, Toronto, University of Toronto Press, 1966, pp. 154-158.

> Both better resource allocation and resource improvement, but especially the latter, result in what I shall call intensive economic growth, a type of growth that has little to do with the mere multiplying of resources that is the basic characteristic of extensive economic growth. Intensive growth, as against extensive growth, involves better job opportunities rather than more job opportunities, more highly trained people rather than more people, better use of capital and land rather than more capital and land -- in brief, a better performance rather than a larger one. 1/

Canada is in process of growing into a mature industrial country. If its people are to continue to enjoy a rising standard of living, in quality as well as quantity, productivity must find a prominent place in economic policy.

There is perhaps a more immediate reason to urge a wider search for ways of stimulating productivity growth in Canada. The importance of international trade in the Canadian economy increases as more income and employment arise from, and are dependent on, export markets in manufactured goods. If the industrial sector is to grow and the economy to remain viable, its productivity performance cannot for long fall short of that achieved in other industrial countries. Expanded markets for manufactured exports are won and maintained by efficient and competitive industries. A deterioration in Canadian productivity performance over the long run would lead in the direction of balance-of-payments and exchange-rate difficulties, with the attendant constraints on growth and higher standards of living.

PROSPECTS AND POTENTIALS FOR FUTURE GROWTH IN CANADA

This analysis of past growth performance in Canada lends itself to a similar, if less detailed, evaluation of the prospects for future growth. 2/ Over the period since 1950, the strongest factor contributing to the growth in total output in Canada has been the increase in the labour force. As Table 104 indicates, the labour force in Canada is estimated to increase by 50 per cent between 1965 and 1980. If the Canadian economy achieves its employment potential, this labour force increase suggests that the rate of total growth from 1965 to 1980 may be somewhat higher than from 1950 to 1965. It should, however, be noted that a peak of new entrants into the labour force occurred in the late 1960's. In the absence of an especial event -- such as the immigration surge in the 1950's -- the rate of growth of potential output in the 1970's will be slightly lower than in the 1965-70 quinquennium.

The projections of the labour force in other countries to 1980 suggest a significantly larger growth potential in the United States, France and Norway than in the past. Germany and the United Kingdom, on the other hand, will receive less impetus to growth from an expanded employment base.

In recent years, hours of work in the manufacturing sector in Canada have been at a level comparable to that in the United States. The rate of decline in hours worked per week by full-time workers will not be as great as in the past. On the other hand, the annual labour input will be reduced by longer annual holidays. A large part of the growth in the labour force in Canada will be obtained from increased

---

1/ Ibid., p. 155.

2/ Reference was made in Chapter I (p. 10) to studies by Denison, which used this framework to evaluate the growth potentials of the U. S. and British economies, as well as to Chapter 4 of the Economic Council's Fourth Annual Review, op. cit.

participation by women. The increase in female workers and the shift to more part-time employment, particularly in the trade and service industries, will reduce the average quality of the labour input.

Table 104

POPULATION AND LABOUR FORCE GROWTH,

ACTUAL 1950-65 AND PROJECTED 1965-80

(Per cent)

	Population		Labour Force	
	1950-65	1965-80	1950-65	1965-80
Canada	43	28	39	50
United States	28	26	21	30
Belgium	10	n.a.	6	n.a.
Denmark	11	12(1)	12	n.a.
France	17	12(1)	3	14
Germany	18	7	27	6
Netherlands	22	25(1)	17	16
Norway	14	15	4	10
United Kingdom	8	11	10	4
Italy	10	12	- 1	2

Note: Including migration, except where specified.

(1) Without migration.

Source: Actual -- OECD, Manpower Statistics, op. cit., and Labour Force Statistics, op. cit.; Denison, Tables 5-1A, 5-1D and 5-1E, pp. 46, 49 and 50; U.S. Department of Commerce, Statistical Abstract of the United States, 1967, op. cit.
Potential -- OECD, Demographic Trends 1965-1980 in Western Europe and North America, Paris, 1966, Tables II and XI, pp. 18 and 60; and Economic Council of Canada, Fourth Annual Review, op. cit., Tables 3-7 and 3-15, pp. 58 and 77.

One important element of labour input will add to the Canadian growth potential -- education. Between the school years 1960-61 and 1965-66, enrolment in secondary school, as a percentage of the population age 14 to 17, increased from 66 per cent to 80 per cent. It is estimated that the rate will be about 90 per cent by 1975. 1/ At the post-secondary level of education, full-time enrolment in universities and technical institutions, as a percentage of the population age 18-24, increased from about 7 1/2 to 11 1/2 per cent in the five-year period to 1965-66, and is expected to reach 22 per cent by 1975. 2/ The growth in secondary school, technical school and university enrolments over the past five years or so, and over the period to 1975, suggests that the rapid influx of young people into the labour force between now and 1980 will be associated with a significantly higher average level of education per worker.

1/ Illing and Zsigmond, op. cit., Table 3-2, p. 28.

2/ Ibid., Tables 4-7 and 4-16, pp. 51 and 70.

The recent emphasis on the importance of education in the performance of the economy arises from two additional aspects of the educational process. Both the quantity and the quality of education are directly amenable to government policy decisions. In addition, and in relation to formal education at least, today's policy decisions will be affecting output some 15 to 20 years from now when today's pre-school children join the labour force. In the short run, adult education, technical, industrial and management training policies may be used to effect a significant upgrading of the education quality of the labour force.

The contribution of capital to future output is more difficult to assess. The rate of growth of the labour force, the trend to urban living and the low standards of housing that prevail in some areas suggest a continued need for large investments in housing and social capital. The future rate of growth of investment in structures and equipment is more difficult to anticipate but it must be sufficient to keep pace with the growing level of employment and the demand of changing technology. 1/

By and large, factor inputs would seem to indicate a high potential rate of total growth over the years to 1980. Gains in total output are not, however, a basis for higher standards of living. The basic supply potential can be reinforced by better organization and more efficient use of factor inputs to raise the level of real income per worker.

In the past two decades, Canada has achieved a significant addition to growth from the shift of resources from low-income situations on farms, etc., to more-productive use. The share of the labour force employed in agriculture in Canada declined from 20 per cent in 1950 to about 9 per cent currently. The United States and the United Kingdom had, in 1966, about 5 and 3 per cent respectively. These data suggest that Canada has already achieved a large part of the productivity gain to be derived from this source, and that its future contribution may in fact be relatively small. On the other hand, since the share of the labour force in agriculture and other forms of self-employment is still relatively high in many European countries, they are likely to have significant gains to future growth from further reductions in all forms of self-employment.

The population and labour force forecasts suggest that opportunities will exist for a significant addition to growth from economies of scale. Economies of scale, like productivity growth, do not happen automatically. Market size may increase in an environment that is inimical to efficient resource use. If the economy is to maximize the opportunity for larger productivity gains in the future, a new initiative is required.

It has already been suggested that the recent reduction, in the Kennedy Round, of barriers to international trade provides some opportunity to move in this direction. A realignment of the Canadian industrial structure could achieve significant economies of scale and specialization, particularly in manufacturing. There is a growing consensus that the cost of the tariff and other protective devices to Canada is substantial and that a reduction would give a new impetus to productivity growth.

1/ This area provides large scope for further research. At present we do not know enough about the structure of fixed capital in Canada to evolve policy conclusions related to empirical evidence. Data on the age, technological level and degree of utilization of capital in Canada are virtually non-existent.

The earlier discussion suggested other avenues to more efficient resource use -- such as increased management skills, a faster rate of technological innovation, and more intensive use of industrial capacity. If productivity growth is to proceed in the future at a faster rate than in the past, these alternative sources of growth need to be explored and exploited.

CHAPTER XVI

SUMMARY OF CONTRIBUTIONS TO DIFFERENCES IN INCOME LEVELS, 1960

The estimates of real net national income per person employed, developed in Chapter II, suggested that the level in Canada in 1960 was about 82 per cent of that in the United States. In six of the European countries included in the Denison study, Why Growth Rates Differ, income per person employed, expressed in U. S. prices, was about 60 per cent of the U. S. level. The Netherlands at 65 per cent was closer to the United States, and Italy at 40 per cent was the furthest from the United States.

A central focus of this Study was to assess the relative importance of factors contributing to the lower level of output per person employed in Canada by comparing primary factor inputs and a number of elements affecting the level of output per unit of input in Canada and the United States. The international comparisons for eight European countries were drawn from the Denison study. It was not possible even to touch on the spectrum of statistical and analytical material contained in that study, and readers interested in the U. S. and European comparisons should refer to the original work.

The results of the analysis for Canada, and the international perspective, are set out in Table 105. A striking conclusion from that comparison is that differences in the quantity and quality of primary factor inputs per worker in Canada did not account for any significant part of the Canada-U. S. income gap. In the Netherlands, which had the next highest level of output per person employed (or the next smallest income gap with the United States), the contribution of factor inputs to the gap was also small. Italy, on the other hand, had both the largest income gap and the largest shortfall in factor inputs. It would appear that the Canada-U. S. income gap, which has persisted through a large part of this century, did not derive in any important degree from inputs of labour, capital, land and resources.

Within the various factor inputs there was substantial diversity. In Canada the qualitative adjustments to the labour input for hours worked, the age, sex and education composition of the labour force were offsetting. In almost all of the European countries, however, a lower over-all level of labour input per worker accounted for a few percentage points of the income gap. Within the total labour "quality" effect, there was also similarity and difference in the impact of the individual components.

Table 105

CONTRIBUTION TO DIFFERENCES FROM THE UNITED STATES

IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

(Percentage of U.S. net national income per person employed, in U.S. prices)

	Canada	Northwest Europe	Norway	United Kingdom
Net national income per person employed	81.7	59.0	59.0	59.0
Difference from United States due to:	18.3	41.0	41.0	41.0
Factor input per person employed	.7	11.3	5.3	11.0
Labour	—	1.1	- .4	.6
Hours worked	- 2.8	- 3.9	- 3.4	- 3.1
Age-sex composition	- 1.6	1.2	.1	.7
Education	4.4	3.8	2.9	3.0
Capital	1.3	9.7	5.2	9.9
Housing	.2	1.9	2.1	1.6
Foreign investments	2.0	.4	1.0	.0
Non-residential structures and equipment	- .7	6.6	1.5	7.5
Inventories	- .2	.8	.6	.8
Land	- .6	.5	.5	.5
Output per unit of input	17.6	29.7	35.7	30.0
Resource allocation				
Agricultural inputs	1.5	2.3	6.1	- 1.1
Nonfarm self-employment	- .6	.3	2.1	- 1.7
Economies of scale				
National market	4.6	3.0	4.2	2.8
Local markets	.6	1.9	2.0	1.8
Shift work	n.a.	.1	.2	.2
Difference in pressure of demand	1.4	- 1.6	- 1.8	- 1.3
Difference in agricultural output	.0	.0	.0	.0
Residual productivity	10.1	23.7	22.9	29.3

Source: Canada -- Tables 75, 82, 84, 93 and 98, and p. 143.
Northwest Europe -- Denison, Table 21-28, p. 332.

Table 106

SHARE CONTRIBUTION TO DIFFERENCES FROM THE UNITED STATES

IN NET NATIONAL INCOME PER PERSON EMPLOYED, 1960

(Percentages of difference)

	Canada	Northwest Europe	Norway	United Kingdom
Difference in net national income per person employed from United States due to:	100	100	100	100
Factor input per person employed	4	28	13	27
Labour	--	3	- 1	2
Hours worked	-15	-10	- 8	- 8
Age-sex composition	- 9	3	--	2
Education	24	9	7	7
Capital	7	24	13	24
Housing	1	5	5	4
Foreign investments	11	1	2	--
Non-residential structures and equipment	- 4	16	4	18
Inventories	- 1	2	2	2
Land	- 3	1	1	1
Output per unit of input	96	72	87	73
Resource allocation				
Agricultural inputs	8	6	15	- 3
Nonfarm self-employment	- 3	1	5	- 4
Economies of scale				
National market	25	7	10	7
Local markets	3	5	5	4
Shift work	--	--	1	1
Difference in pressure of demand	8	- 4	- 4	- 3
Difference in agricultural output	--	--	--	--
Residual productivity	55	58	56	72

Note: Detail may not add due to rounding.

Source: Based on Table 105.

Hours of work for full-time nonfarm workers were very similar in Canada and the United States, but since the Canadian economy did not employ as many part-time workers, the average number of hours per worker was larger in Canada than in the United States. The contribution of hours appears, therefore, as a negative factor in accounting for the Canada-U.S. income gap. Since the average of hours worked by all employees in Canada was close to that in the United States, the negative effect is small. By and large, in Europe there were more full-time hours and significantly less part-time employment.

In several of the European countries, and in Northwest Europe as a whole, the level of female participation in the labour force was higher than in the United States. In addition, the share of young working adults under 20 was higher in Europe than in the United States -- 9 per cent of the labour force was under 20 in Northwest Europe in 1960, compared with 5 per cent in the United States. These two factors, reinforced by more female hours in Europe, resulted in an age-sex quality shortfall in all of the countries, except in the Netherlands where the female participation rate was significantly lower.

The female participation rate was lower in Canada than in any country except the Netherlands. The incidence of young and older workers was very similar in Canada and the United States. About 9 per cent of the Canadian labour force was in the under-20 or over-65 age group, compared with 8 1/2 per cent in the United States and 12 per cent in Northwest Europe. Largely as a result of the low female participation rate and longer hours for female workers in Canada, the contribution of the age and sex composition of the labour force to output per worker was higher in Canada than in the United States, and the effect on the income gap was negative.

A lower level and less advantageous distribution of formal education in Canada was the largest single factor input contributing to the shortfall in output per worker in Canada compared with the United States. Mean years of education were one year lower and the share of the labour force with some university education was only half as large in Canada. This difference in formal educational attainment in Canada accounted for over four percentage points or about 25 per cent of the income gap. The data for the European countries suggested that the Netherlands, Norway and the United Kingdom had a larger formal educational input per worker than Canada, and that the Northwest European countries as a whole were at about the same level as Canada.

The importance of capital as a factor contributing to income differences between Northwest Europe and the United States was about 24 per cent. In Canada the level of capital per worker was much closer to that in the United States. Its share contribution to the income gap was only about 7 per cent. By far the largest shortfall in capital per worker in Europe was in enterprise or business structures and equipment. In contrast to the European situation, the volume of enterprise capital per worker in Canada was very similar to that in the United States.[1/]

1/ The difficulties in measuring relative levels of enterprise capital input are sufficiently large that no significance should be attached to the small negative contribution of capital to the Canada-U. S. income comparison. This caution is not meant to suggest that the Canada-U. S. comparison of fixed capital is meaningless. As indicated in Chapter VIII, both methods of making this comparison gave similar results and the broad conclusions are assumed to be valid.

It was pointed out in Chapter VIII that the levels of fixed capital per worker in Canada and the United States were very different for structures and equipment. Canada appeared to have a substantially larger investment in structures, and a smaller amount of equipment per worker. The comparison of levels of total fixed enterprise investment implied equal rates of return on, and equivalent productivity effect for, each dollar's investment in structures or equipment. If, however, the rate of return on equipment is higher than on construction, enterprise capital per worker in Canada would be overstated relative to the United States.[1/] In this situation some of the income gap would be attributable to a lower input of enterprise capital. However, given the factor share weighting system and the small share of output that accrues to enterprise capital, its importance, in total or by type, in accounting for part of the Canada-U. S. income gap is predetermined to be small.

Enterprise inventories per person employed were slightly larger in Canada than in the United States. The need for a higher level of inventory holdings in Canada may arise from the concentration of industrial activity compared with the dispersion of the population, from the strong seasonal patterns of Canadian output, and from the much greater importance of imports in Canada. It is also possible that the 1960 comparison reflects a somewhat different inventory response in Canada and the United States to the low level of utilization at that time. On average, European inventories per worker were only two-thirds as large as in the United States.

In Canada, Germany, Norway and Italy there was a net outflow of income on foreign investments in 1960. The other European countries had inflows of investment income but, except for the United Kingdom, the amounts were relatively small. National income per person employed in the United States was substantially larger as a result of income received on foreign investments. Since other countries either remitted income or received small amounts, this factor made some contribution to the income gap in all countries. In Norway, the outflow of property income accounted for one percentage point or 2 1/2 per cent of the income gap. In Canada, the net income outflow accounted for 2 of the 18 percentage points, or 11 per cent of the gap. It was emphasized in Chapter IX that this measure took account of the effect of actual income flows arising from foreign investment on national, compared with domestic, income. It should not be inferred that foreign capital contributed to a lower level of output per worker in Canada.

All of the Northwest European countries and Italy had less land and mineral output per person employed than the United States. Canada, on the other hand, had substantially more of both. Because of the small share of land rent in national income, the contribution of land and resources per worker did not account for any significant part of the income gaps. In Canada it represented a small and negative factor.

1/ Data on the average and marginal rates of return on assets by type are not available. A micro investigation into the effects of direct and indirect technological change, scale, and investment on production costs in a segment of the textile industry "tended to support" the macro view expressed by Hill, op. cit., that "replacement investment is much more likely to act as a vehicle for technical progress when it consists mainly of machinery and equipment than when it is mostly construction". See Samuel Hollander, The Sources of Increased Efficiency: A Study of DuPont Rayon Plants, Cambridge, The M. I. T. Press, 1965, p. 203.

The contribution of all primary factor inputs to the Canada-U. S. gap in income per person employed was negligible. Over 95 per cent of the gap remained to be explained after taking account of factor inputs. In the comparison between Northwest Europe and the United States, 28 per cent of the productivity gap was attributed to factor inputs, leaving 72 per cent to be explained by resource allocation and efficiency.

Canada and many of the European countries had a significantly larger share of the work force employed in agriculture in 1960 than did the United States. The lower level of farm output per worker and the larger allocation of the work force to agriculture accounted for about 1 1/2 percentage points of the Canada-U. S. income gap of 18 percentage points. The large differences in the share of employment in European agriculture were discussed in Chapter XI. The importance of this factor in the Northwest European income gap was larger in absolute terms, but similar as a share of income difference. In France, Norway and Italy, one-fifth to one-third of employment was still engaged in agriculture and accounted for 14 to 20 per cent of the income gap. In the United Kingdom, the share of farm employment was significantly lower than in the United States, and the measured contribution to the difference between U. K. and U. S. output per worker was negative.

Self-employed proprietors and family workers in small trade and service establishments have declined in relative importance in North America and Europe over the years, but there are still wide differences between countries. The largest contributions to the income gap made by this labour allocation were in Italy, Belgium, Norway and France. The 1960 estimates of the number of self-employed and unpaid family workers in Canada and the United States suggested that the importance of this type of employment was slightly lower in Canada. As a result, employment in these low-income occupations in Canada did not make any contribution to the Canada-U. S. income gap per person employed.

Economies of scale arising from market size were estimated to be an important factor accounting for the income gap between Canada and the United States. The measures used in this analysis suggest that 4 1/2 percentage points or 25 per cent of the 18 percentage point productivity gap arose from scale effects related to the size of the Canadian national and international market. The discussion in Chapters XII and XIII considered the possibility that an even larger part of the traditional gap in income per person employed between Canada and the United States may be associated with protection and trade barriers. In other small market countries like Belgium, Denmark, Norway and the Netherlands, national market size was also an important factor limiting factor productivity.

Urbanization, distribution techniques, patterns of living and automobile ownership are broadly similar in Canada and the United States, although developments in Canada are somewhat less advanced than in the United States, and incomes in Canada are 18 per cent lower. Countries in Europe appear to be developing similar patterns of local distribution, but there is still considerable scope for increased efficiency in this area. The estimates of the effect of local market development on productivity suggest that the different stage of evolution of production in, and distribution for, the local markets in Europe accounted for two percentage points or 5 per cent of the income gap. Canadian patterns and practice were, by and large, similar to those in the United States. As a result, the contribution of efficiency in this area to the Canadian income gap was about one-half a percentage point.

Two final factors affecting the estimates of output per person employed were specified. The effect of differences in the pressure of demand and in the level of agricultural output in all the countries could have been standardized out of the estimates of income per person employed at an initial stage, but they have been included explicitly to emphasize their role as factors affecting productivity levels and comparisons. Productivity was higher in Northwest Europe than in the United States because the European countries were, on average, operating closer to potential than the U. S. economy in 1960. The estimates were discussed in Chapter XIV where it was emphasized that the negative estimates for European countries reflect their higher level of utilization in 1960 compared with the United States. Canada, on the other hand, was further below potential output than the United States in 1960; as a result, output per person employed was lower in Canada. About 1 1/2 percentage points of the Canada-U. S. income gap was attributed to this source.

Variations from trend in farm output did not appear to be a significant factor in the 1960 cross-section comparison for any of the countries except the Netherlands.

The major factors that contributed to lower output per person employed in Canada were a lower level of education, a larger allocation of employment in agriculture, a lower level of efficiency arising from economies of scale in production and distribution, and a lower level of demand giving rise to a less intensive and efficient use of resources. These factors accounted for almost 15 percentage points or two-thirds of the Canada-U. S. gap in output per worker, but were partially offset by other factors (totalling almost 7 percentage points) which in themselves would give rise to higher income levels in Canada. The effect of longer hours, more full-time as opposed to part-time employment, a smaller share of women in the labour force, more residential and business capital per worker, all worked to raise the level of output per worker in Canada relative to the United States. The net effect of the various identified and quantified factors accounted for 8 of the 18 percentage point gap in income per person employed in Canada. In Northwest Europe the specified factors accounted for 17 out of 41 percentage points. Both in Canada and Northwest Europe less than half the income difference was specifically accounted for; more than one-half was due to residual productivity factors.

The data below indicate the relative importance of the residual sources of productivity difference by comparing the income gap for the various countries with the contribution of the residual sources (in percentage points before adjustment for interaction).[1/]

	Difference in income per person employed	Residual sources of productivity
Canada	18	10
Northwest Europe	41	28
Belgium	39	26
Denmark	42	26
France	41	23
Germany	41	24
Netherlands	35	30
Norway	41	25
United Kingdom	41	34
Italy	60	30

1/ Table 105 and Denison, p. 289.

This comparison may be looked at from two interrelated points of view. If inputs of labour, capital and land, the allocation of resources to agriculture and other low-income activities, the efficiency effects of market size -- if all these specified inputs and sources of productivity difference -- were the same in Canada and the United States, output per person employed in Canada would move from the actual level of 82 per cent to 90 per cent of the U. S. level. Similarly, if the Northwest European countries eliminated the identified sources of difference in output per worker, the level of income per person employed would rise from 60 to just over 70 per cent of the U. S. level. The United Kingdom provides the striking and extreme case in which the elimination of the measured or specified items would narrow the gap in output per worker from 59 per cent to 66 per cent, but leave 34 percentage points of the productivity difference unaccounted for. These data suggest that, taking account of differences in factor inputs, resource allocation, market size, etc., Canadian output per worker was about 10 per cent below the level in the United States, whereas in Northwest Europe it was 28 per cent, and in the United Kingdom 34 per cent, below the United States.

What are the factors contributing to income differences that have not been caught? Comparisons of real income, factor inputs and productivity between countries are more hazardous than comparisons over time. While errors of measurement are possible and probable, it is unlikely that the broad analytical conclusion of the Canada-U. S. comparison would be changed by better data or nicer estimates.

In considering the possible reasons for the large element of residual productivity in the Europe-U. S. productivity comparison, Denison suggested a number of factors:[1/]

-- lag in the application of knowledge, especially managerial knowledge;

-- less intense competitive pressures;

-- how hard people work;

-- institutional restraints . . . against dismissal of employees and reassignment of their duties;

-- institutional restraints against a variety of business practices that could raise productivity;

-- industrial organization, including efficiency in the allocation of savings.

These factors relating to Europe may or may not be relevant to the very different economic milieu in Canada.

Are there differences in the quality of factor inputs that were not measured? Does attitude, motivation, effort and skill of workers and management affect productivity levels unfavourably in Canada? There is evidence to suggest: "It is likely that people simply work harder in some countries than in others. A common, though not uncontroverted, opinion is that at all levels of responsibility Americans work harder than their counterparts in at least several of the European countries."[2/]

[1/] Taken almost verbatim from Denison, p. 292.

[2/] Denison, p. 112.

Is a less intense application to work in Canada a factor in lower productivity in this country? If it is, it may be the expression of a conscious or unconscious choice by Canadians for a more relaxed pace -- a different "trade-off between work and income". 1/ On the other hand, the choice between a higher level of real income and a lighter pressure of work may not have been made explicitly by the average Canadian worker.

There are indications that, in addition to formal education, the level of industrial training in Canada may fall short of that achieved in the United States. The estimate in Chapter VII of the effect of "experience" on output suggested that the youth and relative inexperience of the Canadian labour force may have contributed one to two percentage points to the Canada-U. S. income gap. The substantially smaller pool of highly educated people in Canada indicates a shortage of skilled technical and managerial capital. 2/ By and large, it seems possible that some part of the unspecified productivity gap may relate to a lower level of training for workers and management in Canada.

The comparison of enterprise capital in Chapter VIII indicated that Canada had, on balance, an investment in capital per worker similar to that in the United States, but that Canada had more structures and less equipment per worker. The analysis also suggested that the stock of equipment in Canada was older than in the United States. There is also a presumption that capital may be less intensively used in Canada. No evidence was found to prove that shift work was less frequent in Canada than in the United States, but the indications are that this is so. The preliminary study of specialization in manufacturing concluded that shorter production runs and more frequent turn-arounds resulted in a lower level of capital utilization in Canadian industry. In combination, these points suggest that there are factors relating to the quality and use of capital that tend to reduce output per worker in Canada relative to the United States.

The analysis in Why Growth Rates Differ concluded that differences in the application of knowledge were important in accounting for the productivity gap among the various countries. This broad definition of knowledge includes, among other things, the application of technology to increasing the productive capacity of capital, and to the organization of men, materials and equipment in the production and distribution process.

It was suggested in Chapter XIII that tariff barriers between Canada and the United States may have been an important factor in creating and maintaining a lower level of productivity in Canada. In addition to increasing the cost of imported materials, capital and consumption goods, protection has the effect of allocating resources inefficiently. The study on scale and specialization 3/ emphasized the

1/ Ibid.

2/ In a speech to the Interprovincial Conference on Education and the Development of Human Resources, Montreal, September 8-10, 1966, Dr. D. E. Armstrong of the Graduate School of Business, McGill University, suggested that management education in Canada was an important factor contributing to lower productivity.

> Not only do Canadian managers have substantially less education in total, but the education they have is much less relevant to the problems and challenges of business. I suggest that in all but ignoring university education for management, we have lowered the efficiency of our business and government organizations and of our whole economy by a significant amount.

3/ Daly, et al., op. cit.

productivity and cost effects to Canadian plants of producing a wide range of commodities. Diversification of production at the plant level may result in substantially higher unit costs for labour and capital, and in a lower level of real productivity.

Meaningful measures of the economies of scale or of specialization are not easily made. But the weight of evidence suggests that there are substantial potential gains.[1/] A number of recent studies[2/] have suggested that the restructuring of production patterns in Europe to take advantage of specialization and longer production runs may have been a significant ingredient in the growth of productivity. There is no unanimity of even informed opinion among Canadians on the importance of scale or specialization. There is, however, a growing consensus that the Canadian tariff has been, and continues to be, a significant factor in preventing Canadian industry from achieving the benefits of scale and/or specialization and higher levels of productivity. The Wonnacotts' study[3/] carries the analysis a stage further, and suggests that access to the U. S. market through joint tariff reductions could provide the occasion for a rationalization of Canadian manufacturing production. Taking advantage of the lower level of wages in Canada and the economies of both scale and specialization in production, levels of productivity and income in Canada, would, over the long run, rise towards the U. S. level.

This emphasis on tariffs and manufacturing production is not meant to suggest that the scope for higher levels of productivity in Canada is limited to that sector. The analysis in Chapter XII indicated significant potential gains in distribution. A comparative study of agriculture in Canada and the United States[4/] concluded that net output per worker in Canadian agriculture has been about 25 per cent below the level in the United States. An important part of the productivity shortfall was attributed to a less intensive application of yield technology in Canada.[5/]

1/ The Hollander study (op. cit., p. 194) of the DuPont rayon plants, concluded that plant expansion contributed between 10 and 15 per cent of the reductions in unit cost.

2/ See the discussion and references to the literature in Daly, et al., op. cit., pp. 47-53.

3/ Wonnacott and Wonnacott, op. cit.

4/ See L. Auer, "Comparative Analysis of Canadian and United States Productivity in Agriculture", a mimeographed paper for a conference on the North American Common Market at Iowa State University, October 1967, pp. 2 and 5, as well as Chapter 5, "Productivity in Agriculture", Fifth Annual Review, op. cit.; Staff Study No. 24, Canadian Agricultural Productivity, Economic Council of Canada, forthcoming, will report on the subject in more detail.

5/ Agricultural output per worker was compared in U. S. and Canadian dollars. Differences in the price level of farm output and inputs in the two countries were not taken into account. Some price data used in this Study suggested that prices of grain and livestock were, in 1960, 10-15 per cent lower in Canada. If Canadian prices for farm products are lower, the productivity difference in real terms would not be as large as the dollar comparison suggests.

Table 107

INDEX OF GROSS NATIONAL PRODUCT(1) PER PERSON EMPLOYED

(U.S. in 1960 = 100)

	1950	1955	1960	1964	1966
Canada	70	80	85	94	98
United States	82	94	100	112	120
Northwest Europe	41	49	57	66	n.a.

(1) At factor cost in 1955 U.S. price weights.

Source: Canada — see source for Table 11.
United States and Northwest Europe -- 1950-64, Denison, Table 2-5, p. 23; 1966, author's estimate.

The part of this Study concerned with growth and the sources of growth is closely related to the comparison of levels of output per worker. By and large, total and residual productivity growth in Canada has been comparable to that achieved in the United States. On the other hand, the level of output per worker in Canada appeared to be about 18 per cent below the level in the United States, and the residual sources of difference in the level of output were 10 per cent below the United States. This historic income and productivity gap between Canada and the United States will narrow only if the rate of growth of productivity rises faster in Canada than in the United States. The estimates in Table 107 indicate that the productivity time lag in Canada vis-à-vis the United States may range from 7 to 10 years. In Europe, the level of output per worker has been, and still is, significantly below the level in the United States. Since the early 1950's or 1955, the rate of growth of European productivity has been high, and the Europe-U. S. gap has narrowed. The rate at which the European productivity and income are overtaking the Canadian levels is particularly striking.

It is not possible at this stage of knowledge to identify all the important sources of productivity growth or of differences in productivity levels. Some of the factors have been specified and measured; others have been speculated on. To close or narrow the Canada-U. S. productivity gap would require a productivity performance in Canada exceeding, on a sustained basis, the performance in the United States. To achieve this, both research and policy would have to be oriented to achieving a more efficient allocation and use of resources in all forms of economic activity -- market analysis, production programming, automated equipment, cost and financial accounting, material purchasing and inventory control, material moving and transportation, distribution, communication, and advertising.

The adaptation of the flow of knowledge into the whole economic system is a continuing process. An essential element of the application of twentieth century techniques to production and consumption is change and adaptation. A study of competitive advantage in U. S. manufacturing plants by Professor Shen indicated that ". . . initial competitive advantages by plants with more advanced technology were largely dissipated within a decade" and that a ". . . technology difference represents one of those persistent but impermanent competitive advantages".1/ Apparently one is always in the process of arriving.

1/ T. Y. Shen, "Competition, Technology and Market Shares", The Review of Economics and Statistics, Vol. L, No. 1, February 1968, p. 100.

As the introduction to this Study suggested, it has become increasingly apparent that national and international economic goals must be set and achieved in the broader context of social and human objectives. We are reminded that economics is a means to an end, not an end in itself. In periods of stagnation, the best hopes and plans become bogged down in the urgency of economic realities. An environment of strong economie growth, on the other hand, provides both the resources and the tone to facilitate the realization of any goals we choose to set. Thus the dynamics of quantities may be used as an ally in the search for quality. If the basic human needs and aspirations are to be met, we shall need this and every ally.

NOTES, SOURCES AND METHODS

CHAPTER II

The Measurement of Net National Income

National accounts data have been taken from OECD rather than from national official sources. The 1960 net national income and GNP figures from both sources for Canada, the United States, the United Kingdom and Norway are compared in Table N-1. For these countries the differences in the two sets of accounts are small. To derive the estimate of net national income used in this Study, indirect taxes (OECD definitions) and depreciation (valued at replacement cost) were deducted from GNP at market prices.

Table N-1

COMPARISON OF OUTPUT FROM OECD AND OFFICIAL SOURCES, 1960

(Current prices -- national currencies in billions)

		Net National Income at Factor Cost		Gross National Product at Market Prices	
		OECD	Official	OECD	Official
Canada	($ Can.)	27.4	27.4	36.3	36.3
United States	($ U.S.)	417.1	414.5	511.4	503.7
Norway	(Kr.)	20.9	20.8	25.7	25.7
United Kingdom	(£)	24.7	25.0	32.3	32.4

Note: The net national income figures in this Table are from the OECD and official accounts; they are not those used throughout this Study which were derived from OECD sources but adjusted for depreciation at replacement cost.

Source: OECD, National Accounts Statistics, 1956-65, op. cit.; DBS, National Accounts, op. cit.; U.S. Department of Commerce, The National Income and Product Accounts of the United States, 1929-1965, Washington, GPO, 1966; Central Statistical Office, Annual Abstract of Statistics, op. cit., 1966; and Statistisk Sentralbyra, Nasjonalregnskap (National Accounts), 1865-1960, Norges Offisielle Statistikk XII 163, Oslo, 1965.

Depreciation

The most significant adjustment to the OECD accounts for Canada and the United States was the revaluation of depreciation from its present level of valuation, based on historical or original cost, and taxation write-off allowances, to replacement cost.[1/] Table N-2 shows the 1960 valuation adjustment for Canada and the

1/ Stone and Stone, op. cit., p. 47: "Accordingly, a better estimate of the current cost of using an asset is reached if the depreciation of the year is valued not at original cost but at current, or replacement, cost."

United States. The published official total of capital consumption in Canada for the 1960 base year was divided into allowances for (1) housing, (2) capital items charged to current expenses, special valuation items and adjustments, and (3) other fixed assets.[1/] Housing depreciation was assumed to be already on a basis comparable to replacement cost, and items included as miscellaneous valuation adjustments were not adjusted. Depreciation on non-residential fixed business capital was revalued to replacement cost using 0.7 as the ratio of original to replacement cost depreciation. This ratio was derived from an examination of the relationship between original and current (replacement) cost depreciation in the Dominion Bureau of Statistics capital stock estimates prepared by Professor Rymes.[2/]

Table N-2

NET NATIONAL INCOME AND DEPRECIATION, CANADA AND UNITED STATES, 1960

(Current prices -- national dollars in billions)

	Net National Income (OECD)	Depreciation		Net National Income (Revalued)
		Book Values	Replacement Cost	
Canada	27	4.4	5.5	26
United States	417	49.1	58.1	408

Source: OECD, National Accounts Statistics, 1956-65, op. cit. Adjustment for the United States is inferred by comparing the OECD estimates of net national income and depreciation with the Denison net national income at replacement cost; for Canada, see text.

The official estimates of depreciation relative to net output indicated larger annual write-offs (including valuation adjustments) in Canada. The upward revaluation of depreciation in 1960 from original or taxation values to replacement cost was of the order of 25 per cent in Canada. In the United States it was 18 per cent. The larger adjustment in Canada reflects in part the relatively larger stock of construction in Canada.[3/]

The time series of depreciation in constant replacement cost values for the growth calculation was also based on capital stock data. The ratio of annual capital consumption allowances to capital stock (in constant prices) in manufacturing was relatively stable over this period, both in total, and for construction and equipment

1/ The detail underlying the published total was provided by the National Accounts Section, DBS.

2/ DBS, Fixed Capital Flows and Stocks, Manufacturing, Canada 1926-1960, Statistical Supplement (13-523), op. cit. Estimates for agriculture and other nonmanufacturing stocks are, as yet, not published. Preliminary figures were provided by the Business Finance Division, DBS. A more detailed reporting on the capital stock estimates is contained in Chapter VIII and Notes.

3/ The comparison of capital stock levels is made in Chapter VIII.

taken separately. The average of the ratios for the 12 years from 1950 to 1962 was applied separately for structures and equipment to the annual estimates of the enterprise capital stock in constant prices developed for use in this Study.[1] The series of the volume of depreciation was converted to an index that was used to project the base year estimate of non-residential capital consumption at replacement cost.

The time series of the volume of capital consumption in housing was based on estimates of mid-year housing stocks in constant prices made from investment data,[2] and the perpetual inventory method. Assuming that a constant proportion of the stock was written off every year, the gross stock index in constant prices was used as an index of depreciation. The base year replacement cost estimate of depreciation on housing was projected using this volume index.

The series of net income in constant prices was derived directly from the published (OECD) gross constant price series less the total of depreciation for housing and other capital including miscellaneous valuation adjustments, all at constant replacement cost.[3]

A large part of the concern about the merit of "net" estimates of output, investment and capital is related, not to conceptual or analytical issues, but to the measurement problem and the inadequacy of present depreciation estimates. This particular concern will be dispelled only with improvements in the estimates of depreciation. The use of investment data in the supply models of growth, in capital stock and capital input estimates, and in flow of funds and input-output tables, raises new (sic) questions of definition and measurement of investment, capital services, and capital consumption, etc. Reconciliation of the real and financial estimates have begun, but they are far from complete.

Indirect Taxes

Output at factor cost in 1960 was calculated by deducting indirect taxes as given in the OECD statistics.[4] In the growth analysis for Canada a constant price series of indirect taxes was estimated explicitly.[5] The basis for this estimate was

---

[1] See Chapter VIII.

[2] Department of Trade and Commerce, Private and Public Investment in Canada 1926-1951, Ottawa, 1951; and DBS, Private and Public Investment in Canada, op. cit., various issues.

[3] The estimates of factor shares are developed in Chapter III but it may be noted here that profits and net income of the unincorporated sector were also adjusted to take account of the revaluation of depreciation to replacement cost.

[4] For Canada, the difference between the official and the OECD definitions of indirect taxes is small, e.g. some 2 per cent in 1960. For the United States the adjustment (using revised U.S. accounts) is just over 2 per cent for taxes and subsidies, but the OECD does not include business transfer payments as an element in the difference between factor cost and market price.

[5] In practice, unless there is a substantial shift in the incidence or mix of indirect taxes, a deflated indirect tax series may be approximated by applying the base year share of indirect taxes to constant price output. Estimates based on this approach were negligibly different from West's estimates. One would be less safe in continuing to apply this proxy technique into the 1960's when sales taxes have increased in importance, and the incidence of taxes has both shifted and widened.

provided by E. C. West from his work in connection with deflation procedures and the impact of indirect taxes on final prices of specified output items. Output at constant factor cost prices was obtained by deducting the constant price indirect tax series from output at constant market prices.

Income Growth

The calculation of real growth rates in Table 7 was based on the OECD constant price estimates of gross national income at market prices less the constant price series of indirect taxes and depreciation at replacement cost, as described above.

Prices and Real Income Levels, 1960

The 1960 net national income in Canada in U.S. dollars was based on the Canadian dollar estimate of net national income (OECD definitions and replacement cost depreciation) converted to U.S. prices using a 1960 U.S.-Canada purchasing power equivalent. The paper by West, appended to this Study, 1/ describes the methods and the results of a comparison of the prices and the real volume of gross output in Canada and the United States for selected years from 1950 to 1966.

The detailed comparison of prices and output volumes in Canada and the United States was based on gross national output at market prices. There are two respects in which the purchasing power relative based on GNP volume weights was inappropriate for expressing net national income at factor cost in real terms. The gross expenditure deflator included the effect of depreciation and indirect taxes. Output weights and price relatives change as one moves from output gross of depreciation at market prices to net output at factor cost.

Table N-3

SHARE OF INDIRECT AND DIRECT TAXES

IN GROSS NATIONAL PRODUCT AT CURRENT MARKET PRICES

(Percentage shares)

	Indirect			Direct		
	Canada	United States	United Kingdom	Canada	United States	United Kingdom
1950	11.6	8.5	15.6	10.3	15.7	16.9
1955	12.4	8.1	13.8	11.3	16.7	15.1
1960	13.2	9.1	13.2	11.8	18.3	13.9
1962	14.0	9.3	13.5	12.0	18.3	15.9
1965	14.6	9.3	14.1	12.5	18.0	15.8

Source: OECD, National Accounts Statistics, op. cit., various issues.

1/ West, op. cit.

The importance of indirect taxes varies significantly among countries. Table N-3 compares changes in the relative importance of indirect and direct taxes in GNP at market prices in Canada, the United States and the United Kingdom. The higher incidence of indirect taxes in Canada suggests that the margin between factor cost and market prices is wider in Canada than in the United States. The impact of indirect taxes in Canada falls unevenly over the range of output and final expenditure, with some tendency to concentrate on specific goods such as alcohol, and tobacco. Taxes with a broader effect included import duties, property taxes, and sales taxes. As Table N-4 indicates, the incidence of indirect taxes in 1960 varied widely among the European countries.

Table N-4

SHARE OF INDIRECT TAXES IN GROSS

NATIONAL PRODUCT AT CURRENT MARKET PRICES, 1960

(Percentage shares)

	Indirect Taxes as Percentage of GNP	Indirect Taxes Net of Subsidies as Percentage of GNP
Canada	13.2	12.5
United States	9.1	9.0
Belgium	11.4	10.2
Denmark	12.2	11.9
France	16.3	14.8
Germany	14.4	13.7
Netherlands	9.8	8.6
Norway	14.5	10.1
United Kingdom	13.2	11.2
Italy	13.3	11.7

Source: OECD, National Accounts Statistics, op. cit., various issues.

Ideally the purchasing power price relative would be based on a comparison of prices at factor cost (i.e. excluding the effect of indirect taxes) combined with output weights at factor cost, but detailed factor cost prices and output data were not available for Canada and the United States. A special estimate for the year 1960 attempted to identify and exclude indirect taxes from the output and price comparisons of Canada and the United States (see Appendix). On the basis of factor cost price and volumes, the Canada-U.S. gross output price relative in Canadian volume weights declined from 92.8 at market prices to 90.8 at factor cost.

The description of the factor cost adjustment in the OEEC comparison of quantities (output and consumption) suggests that the larger incidence of indirect taxes in the European countries (Table N-4) may not have been fully taken into account.

> The choice between "market prices" (including indirect taxes and excluding subsidies) and "factor costs" (in which correction is made for such taxes or subsidies) depended on the type of comparison being made. For quantity comparisons the prices used as weights have been, as far as possible, adjusted to exclude significant indirect taxes and to include subsidies,

> whenever these were of special importance in determining the price of the item concerned (as in the case of alcoholic beverages and tobacco). No adjustments were made, however, for indirect taxes or for subsidies, if any, which applied to a range of products sufficiently wide to have had little effect on relative prices (as for example with general sales taxes).[1/]

The comparisons of output levels in the United States and Europe may have understated somewhat the volume in a number of European countries, such as France and Germany where the incidence of indirect taxes was much larger than in the United States.

West's output price relatives were based on gross output comparisons, and did not take account of differences in the price of capital equipment in Canada and the United States. When depreciation on structures and equipment in Canada and the United States in 1960 was valued in U.S. and Canadian prices, using investment goods prices, the price relative for net output was approximately one percentage point lower than the price relative for gross output. This was not a significant factor in the Canada-U.S. output comparison, largely because the higher price of equipment and lower price of construction in Canada were offsetting, and because the share of depreciation on equipment in Canada was lower, relative to construction, than in the United States.

A similar problem affected the U.S.-European level comparison. It is not clear how much the output relatives would change if a similar calculation were made for these countries. The evidence suggests, however, that the income gap between the United States and the European countries would narrow (as the price relative for net output declined), but not to any appreciable extent.[2/]

The 1960 comparison of real net national income in Canada and the United States (Table 10) was derived using the estimates of output in each country's national currency from OECD sources and at replacement cost. The output comparison in U.S. price weights was based on Canadian output converted to U.S. prices, using the Canada-U.S. price relative for net output at factor cost in Canadian volume weights. Conversely the level comparison in Canadian price weights expressed U.S. output in Canadian prices using the price relative in U.S. volume weights.

Table 11 was estimated using constant price time series data of gross output at factor cost per person employed in Canada and the United States. The base year price relative at market prices (Canadian volume weights) was converted from market price to factor cost using the relationship of market to factor price relatives established for 1960. In view of the similar growth of indirect taxes in Canada and the United States between 1955 and 1960 (Table N-3), it is unlikely that this assumption would introduce any bias into the output relatives.

An Illustration of Real Volume and Price Comparisons

As noted in the text to the Chapter, the method of making the level comparisons gave rise to two sets of estimates. The illustration set out below represents a highly simplified example of the changes that occur in the measures of relative output for two countries when the volumes are expressed alternatively in the prices of one country or of another. It also shows how these relationships provide a basis

---

1/ OEEC, Gilbert and Associates, op. cit., p. 19. In this connection, see also Gilbert and Kravis, op. cit., p. 92.

2/ Denison, footnote 17, pp. 20-21.

for estimating relative output prices in the two countries using each country's final expenditure pattern as weights.

Assume that final expenditure in country C consists of three loaves of bread, one television set, two buildings and one car (column (1)). The prices in C's dollars are .25, 1.00, 1.50 and 2.00 respectively (column (2)). In country U, cars and television sets are cheaper (column (4)), and relatively more is consumed than in C (column (3)). Buildings are more expensive, and relatively less is consumed. (It is preferable to think of the volume of consumption as a distribution of total consumption rather than as absolute units.) For each item of final expenditure the relative volume and the relative price in country C compared with country U may be estimated, see columns (5) and (6).

An Illustration of Volume and Price Relatives in the Weights of Countries C and U

	Country C		Country U		C/U Relatives	
	Number	Price in Dollars C	Number	Price in Dollars U	Volume	Price
	(1)	(2)	(3)	(4)	(5)	(6)
Consumption						
Bread	3	.25	2	.25	150	100
Televisions	1	1.00	2	.75	50	133
Investment						
Buildings	2	1.50	1	2.00	200	75
Cars	1	2.00	2	1.75	50	114
Total Final Expenditure						
C weights		6.75		8.00	84	93
U weights		7.25		7.50	97	107

The output of country C in its own dollars is \$6.75; U's output in U dollars is \$7.50; and the relative output volume in each country's own currency would be $\frac{6.75}{7.50}$ or 90. This comparison which is not shown in the illustration, is not of very much use since it values the output of countries C and U with prices that reflect the different price structures in the two countries as well as differences in the volume and distribution of output. The value of output in each country's national currency (\$C6.75 and \$U7.50) could also be compared, using the exchange rate, but, as noted above, this result assumes, without justification, that the exchange rate is an equilibrium one that reflects the relative "real" purchasing power of the two currencies. The results of exchange rate comparisons may be seriously misleading.

Two more meaningful volume comparisons are possible -- output in each country may be expressed in C's prices or, alternatively, in U's prices. C's output in \$C is 6.75. Because the items of more frequent expenditure are relatively cheaper in country C (and more expensive in country U), C's output is \$7.25 in U's prices. The same relationship is true for output in country U. It is cheaper in U's own prices (7.50) than in C's prices (8.00).

The volume relatives for C/U output reflect these quantity and price differences. C's output is lower relative to U's when both outputs are expressed in C's prices (84), and higher (97) when both are in U's price weights. This example is in line with the Gilbert and Kravis findings, with Denison, and with the actual comparisons between Canada and the United States in Table 10.

Using this basic data, it is also possible to derive price relatives for total output. The relatives for each component of output are shown in column (6) of the illustration. The individual price relatives may be combined using U's volume weights or C's volume weights. On this basis the C/U price relative is 93 in C's weights and 107 in U's expenditure weights. These results reflect the fact that in three out of four items, C's prices are higher than U's prices for the same good; using C's volume weights, the one cheaper price good in country C gets a weight of two, whereas in U's volume weights, the one good in which there is a price advantage for country C has a weight of only one.

If one had used different patterns of consumption and investment, and different price structures in the illustration, the specifics of the results would have been different. In most of the international price and volume estimates, however, the tendency for a country to consume or invest relatively more of its cheaper assets results in a lower-volume relative in its own currency, than in U.S. prices. This is true of the output relatives in Table 10, the investment relatives in Table 52 and the consumption relatives in Table 85.

Short List of Studies in Real Output Comparisons

Readers may be interested in the following short list of selected studies on real output comparisons and related subjects:

Beckerman, Wilfred, International Comparisons of Real Incomes, Paris, Development Centre of the OECD, 1966;

Beckerman, W., and Bacon, R., "International Comparisons of Income Levels: A Suggested New Measure", The Economic Journal, Vol. LXXVI, No. 303, September 1966;

Bennett, M. K., "International Disparities in Consumption Levels", The American Economic Review, Vol. XLI, No. 4, September 1951;

Gilbert, Milton, and Beckerman, Wilfred, "International Comparisons of Real Product and Productivity by Final Expenditures and by Industry", Output, Input and Productivity Measurement, Studies in Income and Wealth, Vol. 25, 1961;

Hill, T. P., "Growth and Investment According to International Comparisons", The Economic Journal, June 1964;

Krzeczkowska, Eugenia, "The International Comparisons of Consumption Level Carried Out by the Polish Central Statistical Office", The Review of Income and Wealth, Series 13, No. 4, December 1967;

Nicholson, J. L., "The International Comparison of National Products", The Economic Journal, June 1955;

Patel, S. J., "The Economic Distance Between Nations: Its Origin, Measurement and Outlook", The Economic Journal, March 1964;

Stoikov, V., "International Comparisons of Income Levels", The Economic Journal, December 1967 (it includes a reply by W. Beckerman and R. Bacon).

Real Output and Adult Equivalent Population[1/]

The 1960 estimates of real net national income per capita, expressed in U.S. prices, for Canada and Northwest Europe were very similar. To the extent that per capita income serves as a proxy for a standard of living, this result was rather surprising. In looking at factors relating to this comparison, it seemed relevant to take account of differences in the age distribution of the population in Canada and Europe. Net national income per capita was recalculated using a population denominator roughly standardized for age, i.e. an adult equivalent population. The results are given in Table N-5.

Table N-5

REAL NET NATIONAL INCOME PER CAPITA AND PER ADULT EQUIVALENT, 1960

	Adult Equivalent Population as Percentage of Total Population		Real Net National Income Relative U.S. = 100	
	Ratios	Relative U.S. = 100	Per Capita	Per Adult Equivalent
Canada	82.2	98.3	73	74
United States	83.6	100.0	100	100
Northwest Europe	87.4	104.5	69	66
France	86.6	103.6	66	64
Germany	88.1	105.4	73	69
United Kingdom	87.6	104.8	72	68

Note: The population equivalents used were: 0.5 of an adult for ages 0-9 years; 0.67 of an adult for ages 10-19 years; 1.0 for 20 years and over. An estimate based on more detailed adult food consumption equivalents, using five age groups between 0 and 20 years of age, was almost identical. See R. A. Holmes, "An Iterative Approach to the Pooling of Cross Section and Time Series Results in the Estimation of Demand Functions for Substitute Food Products", mimeo., University of British Columbia.

Source: Population data by age from:
Canada -- DBS, Canada Year Book, op. cit., 1963-64.
United States -- U.S. Department of Commerce, Statistical Abstract of the United States, op. cit., 1964.
Europe -- U.N., Demographic Yearbook, op. cit., 1963.

[1/] E. Kleiman, "Age Composition, Size of Households, and the Interpretation of Per Capita Income", Economic Development and Cultural Change, October 1966.

The adjustment from total population to an adult equivalent population was larger in Canada than in the other eight countries, but it was not much larger than in the United States. This reflects the especially large share of young people in the North American population in 1960. Using these adult equivalent data, the Canada-U.S. relative of net income per adult equivalent rose one percentage point from 73 to 74, while the Northwest Europe-U.S. relative fell by three percentage points, i.e. from 69 to 66. This had the effect of widening the margin between Canadian and Northwest European income per capita from four to eight percentage points.

National Accounts Revisions

Revised national accounts for the United States were published in 1966.[1] The analysis of U.S. growth and income levels in Why Growth Rates Differ was based on these new data.

The national accounts estimates for Canada are currently in the process of revision at the Dominion Bureau of Statistics. The revisions will cover the whole time horizon of the official historical estimates back to 1926. They will incorporate a number of conceptual and definitional changes in the components, and some alterations and extensions in the sectoral framework. These changes reflect the availability of new data, the changing structure of the Canadian economy, such as the larger role of government in health services, as well as the Bureau's continuing interest in revising and adapting the accounts to make them more meaningful and analytically useful, both nationally and internationally.

The more important part of the revisions will concern the estimates themselves. Since the last historical revision (published in 1958), a wide variety of new data on population, distribution, agriculture, balance of international payments, etc., has become available. A major focus of the revisions was to incorporate new benchmark data for the 1960's into the estimates for the 1950's and 1960's.

It is reasonable to assume that the accounts data used in this Study may be revised substantially with respect to both trend and level. It would be inappropriate to anticipate the revisions, but it is possible to suggest some ways in which the analysis in this Study may be changed as a result of the prospective revisions. The 1950-62 growth rate of national income is likely to increase; the revision is unlikely to be as large as half a per cent a year. A revision of this order would improve Canada's over-all growth and productivity performance. On the basis of output per person employed, the Canadian growth would be comparable to that achieved in the United States, but the large difference in growth performance between Canada and Europe would remain.

The national accounts revisions will affect the estimates of the contribution of the factors to growth. The factor weights may change, particularly in the shares going to labour and capital, but these will not alter the broad outline of calculations in this Study. Apart from the possibility of shifts in the contributions of labour and capital in output growth, the contribution of factor inputs developed in this Study are not likely to change radically.[2] By far the larger part of the revision in the accounts will affect the measures of factor productivity or output per unit of input.

1/ U.S. Department of Commerce, Income and Product Accounts 1929-1965, op. cit. Pieces of the revisions were published from time to time in the monthly U.S. S.C.B., in advance of the accounts compendium.

2/ The contribution of housing and non-resident income to growth is based directly on the rate of growth, not weighted by factor shares. These elements may therefore decline slightly in importance.

A number of the productivity components that are related to the over-all growth rates, such as scale, may increase in importance. It is altogether likely that a large part of the revision will find its way into increasing the net unspecified or residual sources of growth.

An upward revision to the level of output in 1960 would narrow the gap in output per person employed and per capita between Canada and the United States. It would also raise the level of output and consumption per capita in Canada compared with Europe.

It is unfortunate that the timing of this Study should have been inappropriate as far as the accounts revision is concerned. It appears, however, that the broad outline of estimates and the analysis will still be relevant.

CHAPTER III

Labour's Share of Net National Income

The basic component of the estimate of labour's share in net income is salaries, wages and supplementary income, including military pay and allowances, derived from National Accounts (DBS, op. cit.). The factor share representing the value of the labour contribution of farmers and nonagricultural proprietors and their families -- the noncorporate sector -- was estimated separately and added to paid remuneration.

Denison calculated the imputed income in the U.S. noncorporate sector by applying the ratio of paid labour input to net income in the nonfinancial corporate sector to national income originating in proprietorships and partnerships. The difference between this estimate of total labour input and paid remuneration in the noncorporate sector was assumed to be the value of unpaid labour, i.e. of proprietors and family workers. Since corporate sector accounts with the necessary detail are not as yet available for Canada, the Denison method could not be used in this Study.

Most of the past discussion of factor shares in Canada has been in terms of remuneration to paid employees.[1/][2/] The labour share is, however, incomplete without some measure of the contribution of unpaid workers. While the numerical importance of these workers is small, this sector, which includes the major part of agriculture and a large part of trade and services, has been subject to substantial change (see Chapter XI). The contribution of labour input arising in this sector may be important in identifying changes in the total labour input over time, and differences between countries. Estimates of the value of the labour input of unpaid workers were not available, and were developed as part of this analysis. The approach to making these estimates did not address itself to those interesting quasi-philosophical questions, such as "does the managerial component of a proprietor's input belong with the labour input or the entrepreneurial function?" So far as this Study is concerned, such questions are intriguing but unresolved.

In making an estimate of the share of net income that is generated by unpaid labour input, it is not, by and large, appropriate to assume that the input of each self-employed person or man-hour should be valued at the commercial or paid rate of remuneration. Some proprietors will put in more; some family workers will contribute less. The Denison framework is based on the presumption that relative earnings are proportional to relative productivity. Underemployed persons, or unproductive man-hours in the noncorporate sector are not valued as though they contributed to income or output to the same extent as paid workers or man-hours.

1/ See S. A. Goldberg, "Long-Run Changes in the Distribution of Income by Factor Shares in Canada", The Behaviour of Income Shares, Studies in Income and Wealth, Vol. 27, Princeton, NBER, 1963.

2/ Estimates of the value of the labour input of proprietors and unpaid family labour for Canada were made for the period 1926 to 1960 by Gérald Marion in Répartition Fonctionnelle des Revenus, Montreal, Les Presses de l'Université de Montréal, 1965. Marion assumed that a constant share of farm and of unincorporated nonfarm income accrued to labour. The enormous change in the role of labour and capital in agriculture suggests that the ratios are not likely to have been constant in the post-war period.

Imputed Labour Income in Agriculture

Since the relationship between paid and unpaid labour input in agriculture was not the same as in the nonagricultural unincorporated sector, separate estimates were made for each sector. The 1961 labour input of unpaid family workers in agriculture was valued at one-half the annual wage rate[1] for male paid employees.[2] The input of farm operators was valued at two-thirds the paid annual wage rate. On this basis, the total imputed labour input of unpaid workers in agriculture in 1961 was estimated to be about $600 million. These estimates suggest a value for unpaid farm labour of just over two-thirds of net farm income (adjusted for depreciation at replacement cost).

The annual estimates of the value of unpaid labour input in agriculture were based on the estimate for 1961, projected on an index representing the changing value of unpaid labour input. An index of the volume of labour input combined the number of own-account farmers and farm employers with unpaid family workers (mainly wives and children),[3] using weights of 2 to 1.[4] This volume index was valued by using changes in the monthly (no board) wage rate for paid workers. The value index from 1950 to 1962 was used to project the 1961 base year estimate of the value of unpaid labour input in agriculture.

A recently published paper[5] on factor shares in Canadian and U.S. agriculture provides a basis of comparison with the estimates that were developed for use in this Study. Lerohl and MacEachern (op. cit., Table 4, p. 8) estimated labour income as a share of net farm income at 68 per cent, 1951-55; 62 per cent, 1956-60; and 56 per cent, 1961-65. Alternatively, estimating the return to capital and land directly, and labour residually, the authors obtained labour input to income ratios of 59, 47 and 42 per cent for each of the three time periods.

1/ DBS, Quarterly Bulletin of Agricultural Statistics (21-003), Ottawa, Queen's Printer, April-June 1966, Table 1, p. 82.

2/ An alternative estimate for 1960-61 based on weeks worked by male and female family workers, valued at the equivalent of one-half the paid weekly rate for males, gave a similar result. Weeks worked were recorded in DBS, 1961 Census of Canada, Agriculture (96-530), Bulletin 5.1-1, Ottawa, Queen's Printer, 1963, Table 31.

3/ DBS, The Labour Force (71-001), op. cit., Table 6, various issues.

4/ The DBS productivity estimates for agriculture in Aggregate Productivity Trends, op. cit., show a decline in employment and in man-hours of 36 and 35 per cent respectively from 1950 to 1962. Labour force data on employment in agriculture (Table 76) indicate a decline of 35 per cent. This suggests that any shifts between full- and part-time labour input and any changes in hours in agriculture have been offsetting in their effect on total man-hour inputs, and that changes in the volume of labour input are close to changes in labour force data on farm employment.

5/ M. L. Lerohl and G. A. MacEachern, "Factor Shares in Agriculture: The Canada-U.S. Experience", Canadian Journal of Agricultural Economics, Vol. XV, No. 1, 1967.

The average ratio of total labour input to net income in agriculture for the period 1950 to 1962 implicit in the estimates used in this Study was 61 per cent. A recent re-evaluation of this estimate suggests that it may be somewhat low.[1/] It may also be compared with 59 per cent which is the average of the residual and computed estimates from Lerohl and MacEachern for the period 1951-60. It should be noted that, for the United States, Lerohl and MacEachern suggest lower ratios of labour input to net income -- 43 per cent -- using the average of the computed and residual approach for the years 1951-60. This implies a smaller total return to capital and a larger return to labour in Canadian than in U.S. agriculture.[2/]

Imputed Labour Income in the Nonagricultural Sector

At the time when the calculations were made, a number of the specialized reports from the 1961 Census of Canada, including the Census of Merchandising, had not been published. With additional data becoming available it is possible that one could now make a nicer estimate of the role of proprietors and family workers in nonfarm activities. At best, the estimates evolved for this Study are orders of magnitude, not refined calculations.

Two approaches were made to estimating the value of the labour input of proprietors and family workers in the nonagricultural sector. For industries in which data were available on paid employees, proprietors and other unpaid workers, the value of a unit of unpaid labour input was, as a first approximation, assumed to be equivalent to the average value of a unit of paid labour input. This approach was used for trade and services,[3/] and for manufacturing.[4/] In this group of industries, which account for about three-quarters of unincorporated business income, the share of imputed labour input was some 68 to 70 per cent of the net income. A second calculation was made using Census data on employment status and income.[5/] For occupations in which self-employment was important, the average income from employment for paid workers was attributed to the self-employed (except in those cases in which the imputed sum was larger than the total "employment income" of the self-employed for that occupation!). The estimate covered over 85 per cent of the "employment income" earned by all self-employed nonfarm workers.

1/ The net income of farm operators from farm production has been recently revised to take account of 1961 Census data. The revised estimates are not yet incorporated into the national accounts used in this Study. The new estimates of net income are more than 10 per cent lower in the years around 1961. The estimate of labour input would represent a larger share of the new lower income, and the return to capital would decline.

2/ This conclusion is also borne out by the study of Canadian and U.S. agriculture by Auer, op. cit. Table 2 of this study suggests that the share of labour in primary factor inputs (land, buildings, mechanization and labour) over the period 1947-65 was about 54 per cent in Canada and 45 per cent in the United States.

3/ See 1961 Census of Canada, op. cit., Vol. III, Labour Force, Bulletins 3.2-6, Industries by Sex, Showing Age, Marital Status, Class of Worker (94-523), and 3.3-10, Earnings, Hours and Weeks of Employment of Wage-Earners by Industries (94-542); Vol. IV, Population Sample, Bulletins 4.1-1 and 4.1-2, Incomes of Individuals (98-501 and 98-502); and Vol. VI, Census of Merchandising, Part 1, Retail Trade, and Part 2, Wholesale Trade; Services, various Bulletins.

4/ DBS, General Review of the Manufacturing Industries of Canada, 1960 (31-201), Ottawa, Queen's Printer, 1964.

5/ DBS, 1961 Census of Canada, Incomes of Individuals (98-502), op. cit.

The alternative method suggested that the imputed labour input in 1960-61 was some 85 per cent of net nonfarm unincorporated income, compared with 70 per cent suggested by the first method. It could readily be argued that both of the estimates are likely to be overstatements. Almost one-quarter of the unpaid workers in the nonfarm sector were women. Allowing for the lower level of earnings and the lower productivity of unpaid workers, and of women in particular, 60 per cent was used as the ratio of imputed labour input to net nonfarm unincorporated income in 1960-61.

The estimate for 1950-51 was even more tentative. A limited amount of detail from the 1951 Census of Canada[1/] indicated that the share of net nonfarm income that could be allocated to imputed labour was significantly lower in 1950-51 than in 1960-61. Estimates for the years around the Censuses were interpolated. Annual estimates of unpaid labour input in manufacturing and nonmanufacturing were derived by interpolating the benchmark year ratios of unpaid labour input to net unincorporated income in the two sectors.[2/]

Total Imputed Labour Income

The estimate of farm and nonfarm imputed earnings of proprietors and unpaid family workers, based on these calculations, suggested that the share of net national income that could be attributed to both the paid and unpaid labour input was some 72 per cent in 1951 and 79 per cent in 1961 (Table N-6). Paid salaries, wages and supplements were $19.5 billion in 1961, some 72 per cent of net national income. Agricultural and nonagricultural imputed labour income, according to the various methods of estimation, ranged between $1.8 and $2.0 billion, and the share of total labour income in net national income was assumed to be 79 per cent. On this basis some 61 per cent of farm and nonfarm unincorporated income was a return to the labour input in 1961. In the early 1950's the share of net unincorporated income was substantially lower. On average, over the period 1950 to 1962, imputed labour input was estimated at about 50 per cent of net unincorporated income. Denison allocated some 63 per cent of noncorporate income in the United States to labour income during the 1950's; in the early 1960's the ratio appeared to be somewhat larger.[3/]

1/ 1951 Census of Canada, Vol. IV, Labour Force - Occupations and Industries, Ottawa, Queen's Printer.

2/ DBS, National Accounts, op. cit., various issues, Table 24.

3/ In the absence of alternative information, this percentage was used in the allocation for European countries (Denison, pp. 37-39). See also Edward F. Denison, "Income Types and the Size Distribution", A.E.R., Papers and Proceedings, Vol. XLIV, No. 2, May 1954.

Table N-6

PAID AND IMPUTED SHARE OF LABOUR INPUT IN NET NATIONAL INCOME,[1] CANADA

(Per cent)

	1951	1961[2]
Paid remuneration[3]	64	72
Unpaid -- Agriculture	4	2
-- Nonagriculture	4	5
	8	7
Labour input in net national income	72	79

(1) Net income with depreciation at replacement cost.

(2) The 1961 estimate may be somewhat above the longer-term trend as the labour share in total output normally rises in periods of slack and high unemployment. In addition the level of farm output was particularly low in that year.

(3) Salaries and wages including military and supplements.

Source: See text.

This description of assumptions, methods and data used to derive the imputation for unpaid labour input in Canada indicates that they are, at best, orders of magnitude. Since unincorporated income is a small part of total national income, fairly substantial variations can be accommodated in this component with no large effect on the growth and level of the total labour share.

Property Share of Net National Income

The share of net national income that does not accrue to labour includes corporate profits, the net income of unincorporated business (excluding the imputation for unpaid labour), interest and rent. The return to property is allocated among five factor inputs -- housing, business enterprise fixed assets, inventories, non-residential land and net income on foreign investments.

The share of housing, including residential land, in national income was measured directly as net rents plus the mortgage interest component of national income.[1/] Investment income payments to, and receipts from, non-residents on foreign investment are derived from the National Accounts,[2/] and the share of this net income flow in national income may be calculated directly.[3/]

1/ Data on net rents and mortgage interest on residential property were provided by the National Accounts Section, DBS. See also footnote 1, p. 92.

2/ DBS, National Accounts, op. cit., various issues, Table 4.

3/ See the discussion of retained earnings on foreign investment in Chapter IX and Notes.

The distribution of other property income into the return on business structures and equipment, non-residential land and resources, and inventories was based on asset values. It was assumed that investment is allocated among these alternative uses in a way that results in similar rates of return. Evidence suggests that rates of return are not in fact equalized across the board.[1] The stringency of this assumption was somewhat mitigated by applying it within three sectors for which data were available to make separate estimates of the return on capital -- agriculture, manufacturing and other enterprise industries.

The first step was to derive annual estimates of net domestic income excluding housing income, from net national income, less the return on housing and net foreign investment derived as described above, and to distribute it among agriculture, manufacturing and other industries. Net domestic income in agriculture and manufacturing was obtained by deducting depreciation at current replacement cost[2] from the official estimates of GDP in each sector.[3] Net domestic income in the remaining (nonhousing) sector was derived residually. Property income arising in each sector was obtained by deducting paid remuneration and the imputation of the value of the unpaid labour input from net domestic income. The next step was to allocate domestic income among non-residential land, inventories, and structures and equipment for each of the three sectors.

A variety of data is available for agricultural capital, although differences in valuation and definitions limit its usefulness. Table N-7 illustrates some of the source material. Census data were used to establish a benchmark allocation of farm capital.[4] Farm housing was excluded from the Census total for land and buildings; land and non-residential buildings were subdivided using the relationships in the 1958 Farm Survey.[5][6] The annual data on capital[7] were used to interpolate the benchmark estimates. Assuming the return to different types of non-residential farm capital tends to equality, the distribution of annual asset values by type was used to allocate net farm income among land, fixed non-residential capital and inventories.

1/ See Lithwick, Economic Growth in Canada, op. cit., Table 23 and text for a discussion of the wide variation in factor returns by industry.

2/ Derived as a by-product of the estimates of total depreciation at replacement cost described in Chapter II and Notes.

3/ DBS, National Accounts, op. cit., various issues, Table 22.

4/ Since the asset distributions for commercial farms or all farms were very similar, the average of the two distributions was used.

5/ The Lerohl and MacEachern study (op. cit.) suggested distribution of land, buildings, and machinery and livestock in net income for 1951 to 1960 of 31, 20 and 49 per cent. The allocation of property income in this Study was among land, non-residential structures and equipment, and inventories, but, recombining the original data, the distribution comparable to Lerohl and MacEachern for the 1950-60 period, as implied in the estimates for this Study, is roughly 39, 18 and 43 per cent. A full explanation of these differences would require more detail to unravel, but it seems likely that the rental approach to valuing land used by Lerohl and MacEachern excludes some of the overstatement inherent in reported land values.

6/ DBS, 1958 Farm Survey Report No. 1 (21-506), Ottawa, Queen's Printer, 1962.

7/ DBS, Quarterly Bulletin of Agricultural Statistics, op. cit.

Table N-7

MISCELLANEOUS DATA ON FARM CAPITAL IN CANADA

($ million)

	1951 Census	1958 Farm Survey	1958 Annual	1961 Annual	1961 Census
Land	)	5,114	(		
Operators' houses	5,527)	1,942	(7,441	8,603	8,623
Other buildings	)	1,668	(		
Machinery and equipment	1,933	2,252	2,441	2,566	2,569
Livestock and poultry	2,010	1,856	1,860	1,990	1,980
	9,471	12,831	11,742	13,159	13,171

Source: DBS, 1958 Farm Survey Report No. 1, op. cit., Table 4, p. 22; Quarterly Bulletin of Agricultural Statistics, op. cit., April-June 1966, Table 1, pp. 106-107; 1961 Census of Canada, Agriculture (96-530), op. cit., Table 2, p. 2-2.

For the manufacturing sector and the rest of the enterprise economy, the allocation of property income among inventories, non-residential land, and structures and equipment was based on asset values of corporations as reported in taxation statistics.[1/] The total share of property income arising in land, non-residential structures and equipment, and inventories was derived as the sum of the individual shares in agriculture, manufacturing, and the rest of the enterprise economy.

1/ Department of National Revenue, Taxation Division, Taxation Statistics, Corporation Statistics, Ottawa, Queen's Printer, various issues.

CHAPTER IV

Employment

Data for Canada on the labour force and employment are available from The Labour Force survey (DBS, 71-001, op. cit.) and unpublished tables that are available on request. The labour force and employment data from 1956 were revised in The Labour Force, Supplement to March 1965 Report, op. cit. Military employment is given in the Bank of Canada, Statistical Summary, op. cit. Much of the employment detail is also available in OECD, Manpower Statistics, op. cit.

Table N-8

DISTRIBUTION OF THE LABOUR FORCE, 1950 AND 1962

(Percentage shares)

	Canada		United States		Northwest Europe		United Kingdom	
	1950	1962	1950	1962	1950	1962	1950	1962
Civilian employment	95.4	92.3	92.3	90.8	94.8	96.5	95.8	96.7
Male	74.6	66.6	65.2	60.1	63.0	63.0	64.4	63.4
Female	20.8	25.8	27.2	30.8	31.9	33.5	31.4	33.3
Armed forces	1.0	1.9	2.6	3.7	1.9	2.4	3.0	1.7
Total employment	96.4	94.2	94.9	94.6	96.7	98.8	98.7	98.4
Unemployment	3.6	5.8	5.2	5.4	3.3	1.2	1.3	1.6
Labour force	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Male	78.6	73.3	71.2	67.2	67.2	66.2	68.2	66.2
Female	21.4	26.7	28.8	32.8	32.8	33.8	31.8	33.8

Source: See text and Table 19.

Hours Worked, 1960

A special study[1/] of man-hours by sector, employment status and sex in 1960 provided data for the cross-section and time series calculation of hours in Canada.

In 1960, on the basis of the October 1960 comparison (Table 21), full-time nonagricultural wage and salary workers in Canada appeared to work about half an hour a week less than their U.S. counterparts.[2/] This is, in part, a reflection of

1/ The comparison of man-hours worked in Canada and the United States in 1960 was made by J. Kuiper, at the request of the Economic Council of Canada, as part of an examination by staff member, I. M. Timonin, of the labour input in the two countries.

2/ See Denison, Appendix D, for the dates of the survey weeks in the United States and Europe.

the difference in industrial structure in the two countries. Hours data for similar industries do not seem to support a general proposition of shorter hours for full-time workers in Canada. U.S. Bureau of Labor Statistics data indicated an average of 39.7 hours per week for production workers on payrolls in manufacturing in 1960;[1] average weekly hours in manufacturing in Canada were recorded as 40.4.[2] In 1964 U.S. weekly hours in manufacturing were still shorter (40.7) than in Canada (41.0), although the gap had narrowed. Another important factor in interpreting differences in the level of hours worked in various countries is the level of economic activity. The response of hours to changes in the demand for labour is by no means similar at different levels of unemployment or underutilization either in one country over time or among countries.

Time Off during the Year

The comparison of hours based on weekly survey material must be adjusted to take account of differences in time off during the year. Differences in the amount of time off for holidays and vacations, sickness, strikes, etc., did not alter the Canadian-U.S. weekly to annual hours relative in 1960. The small amount of available evidence on days away from work indicated a pattern in Canada broadly similar to that in the United States. The basis for this general conclusion is described below.

In the international comparison of days lost,[3] Denison referred to an article in the Westminster Bank Review.[4] This study indicated that Canada had three more statutory holidays annually than the United States, and on average 5 to 15 days' vacation compared with 10 to 20 days in the United States. Using this material, the time loss for holidays and vacations in moving from weekly to annual hours in Canada was estimated at 5.9 per cent. This loss was smaller than the 7.0 per cent for the United States, and would, therefore, raise the Canada-U.S. hours relative in Table 21 by 1.1 per cent. Two Northwest European countries also had fewer days off for holidays and vacations than the United States -- the Netherlands and the United Kingdom; the adjustments for these countries were 0.5 and 0.7 per cent respectively (Table N-9, Column 1). The remaining six countries had more time off; France and Italy had particularly large negative adjustments of 2.5 and 2.0 per cent for time off.

This estimate, as a basis for adjusting the Canada-U.S. labour input comparison for holidays and vacations, was considered and rejected. Instead, labour force data were used to estimate time lost on vacation in Canada[5] and the United States.[6] The difference in the number of annual statutory holidays in Canada and

---

1/ BLS, Employment and Earnings Statistics for the United States 1909-65 (Bulletin No. 1312-3), Washington, U.S. Department of Labor, GPO, 1965, p. XXV.

2/ DBS, Review of Man-Hours and Hourly Earnings 1945-64 (72-202), Ottawa, Queen's Printer, 1965, p. 14.

3/ Denison, Appendix D.

4/ Westminster Bank Review, "Wages Policy at Home and Abroad", November 1962, pp. 29-38.

5/ DBS, The Labour Force survey, op. cit., Special Table 3(e), unpublished data, Special Survey Division, available on request.

6/ See Denison, p. 363, for the U.S. calculation using BLS data.

the United States was reduced from three to two days, and the combined vacation-holiday adjustment for Canada was estimated at -0.1 per cent (Table N-9, Column 1).

Labour force data on sickness as one of the "reasons for working less than 35 hours" indicated a significantly lower level of absenteeism due to sickness in Canada. This conclusion is interesting -- if true. It was estimated that time lost on vacations, holidays and illness increased annual hours in Canada by +0.3 per cent relative to hours in the United States.

In the Denison estimates, time lost during the year because of bad weather was assumed to be about the same in all countries. The impact of winter weather on time lost in Canada is readily experienced, if not measured. However, since a comparison of northern countries with those of a more temperate clime must also take account of less regular, but more devasting, acts of God such as floods, hurricanes, earthquakes, etc., the adjustment for weather differences between Canada and the United States was assumed to be nil. However, on the basis of labour force data, the effect of weather on hours worked in the particular survey week in Canada was estimated to be -0.3 per cent (Table N-9).

The article in the Westminster Bank Review included a comparison of days lost from strikes; the results suggested that this was a negligible factor in time lost during the year, and Denison did not include it. Using a 1956-60 average to take account of the wide annual variability in the incidence of strikes, the time loss from strikes, etc., was estimated to be less than half a day per year per person employed in almost every country surveyed.[1/] On this basis the difference in the U.S. and Canadian loss from strikes would add 0.1 per cent to relative Canadian hours shown in Table N-9.

Table N-9

ADJUSTMENTS FROM WEEKLY TO ANNUAL HOURS WORKED, 1960(1)

(Per cent)

	Holidays and Vacations	Sickness	Weather	Strikes	Total
Canada	-0.1	0.3	-0.3	0.1	0.0
Belgium	-0.7	-0.6	-0.2	--	-1.5
Denmark	-1.5	-0.4	--	--	-1.9
France	-2.5	-0.6	0.0	--	-3.1
Germany	-1.8	0.5	-0.3	--	-1.6
Netherlands	0.5	0.3	-0.3	--	0.5
Norway	-1.5	-0.4	--	--	-1.9
United Kingdom	0.7	-0.4	--	--	0.3
Italy	-2.0	--	1.8	--	-0.2

(1) Percentage adjustment relative to zero adjustment for the United States.

Source: Canada -- see text and DBS, The Labour Force, op. cit.
Europe -- Denison, Table D-4, p. 365.

1/ Based on working days lost in industrial disputes, ILO, Year Book of Labour Statistics, op. cit., 1964. Data for Canada are available from the Department of Labour, Labour Gazette, Ottawa, Queen's Printer, various issues.

The adjustment to the Canada-U.S. hours relative from a weekly to an annual basis in 1960 (excluding the effect of strikes) totalled -0.1 per cent. Including the allowance for strikes, the balance of adjustments was zero. In the absence of any clear or significant difference in the U.S.-Canadian experience of "time lost", no adjustment was made. For the European countries the adjustments ranged between +0.5 per cent for the Netherlands and -3.1 per cent for France, with longer vacations and more numerous holidays the dominant element in the differences.

Productivity Offset and Hourly Output, 1960

Calculation of the productivity offset in 1960 was based on the hours-productivity relationship described in Why Growth Rates Differ.[1/] An offset profile plotted from the Denison detail was used to derive male and female quality adjustments at the level of hours for nonagricultural full-time paid workers. The calculation by sex suggested a 28 to 30 per cent offset for male nonfarm full-time paid workers in Canada. The offset for the comparable U.S. employment category was 30 per cent. Average hours worked per week were 2 per cent shorter in Canada than in the United States, and productivity per male worker per hour was 0.6 per cent (28 to 30 per cent of 2) higher in Canada. The difference in hours worked by female nonfarm full-time paid employees in Canada and the United States was too small to suggest any significant difference in hourly productivity. Using labour input weights for males and females in nonfarm full-time paid employment, the quality relative for an hour's output by this group of workers was 100.4 per cent.

The hours-productivity adjustment for nonfarm full-time paid workers does not take account of other full-time workers (largely farm), part-time workers, or the military.[2/] These excluded groups represented about 30 per cent of total employment. Differences in average hours worked per week by part-time workers in Canada and the United States largely reflected variations in the role and make-up of part-time employment in the two economies. Since they do not indicate real differences in the level of efficiency per hour arising from the length of the work week, no productivity adjustment was made. Other full-time employment (both paid and unpaid) included business proprietors and farmers. For these groups it was assumed that annual output per worker is not directly affected by the number of hours worked, and the appropriate adjustment for the quality of an hour's work was the reciprocal of the average number of hours worked per week. In other words, the hours worked by proprietors are not taken into the annual input calculation. Hours for the military of all countries are taken to be similar to those in the United States; no hours-quality adjustment is required.

The relatives for the quality per hour of civilian and total employment were obtained by weighting-in the part-time workers, proprietors and the military on the basis of their employment share. The relative for the quality of a year's work, which reflects the number of annual hours and the quality of an hour, is the product of these two component relatives (Table 22).

1/ Denison, pp. 59-64.

2/ See discussion in Denison, pp. 62-63.

Changes in Hours Worked, 1950-62

Data on changes in man-hours are available for specific industries[1] and may be derived for the commercial sector and a number of subsectors from the official productivity estimates.[2] The Labour Force data cover ranges of hours that do not readily combine into a meaningful time series. (Denison based his assessment of the changes in hours over time on hours worked by nonfarm wage and salary workers, using full- and part-time, male and female workers separately.)

The study of man-hours by Kuiper and Timonin[3] indicated a decline in average hours for all nonfarm paid workers of about 0.6 per cent per year in the 12 years 1950 to 1962. The change in total commercial nonagricultural hours implicit in the productivity estimates for the same period was similar -- 0.6 per cent per annum.[4] The Kuiper-Timonin hours index and the 1960 pattern of male and female hours were used to derive separate indexes of male and female hours. Hours for male paid nonfarm workers were extrapolated on the basis of changes in hours recorded in manufacturing and construction. Given the male-female employment weights, the male and the total hours indexes, female hours estimates could be obtained residually for 1950, 1955 and 1962. On this basis, female hours declined by 0.8 per cent per annum between 1950 and 1962; and males, by 0.5 per cent. The larger decline for women workers reflected the increase in female part-time employment in Canada. For the time series, changes in the official annual average of weekly hours were assumed to be equivalent to changes in annual hours. The hours-productivity profile used for the 1960 comparison was applied separately to the male and female hours in Canada. The weighted total index was almost identical to the Timonin index for 1955, 1960 and 1962, but the 1950 figures differed by some 5 per cent.

The arbitrariness of the estimate of female hours made this calculation by sex somewhat doubtful. It was decided therefore to use the Timonin index based on total hours (male and female). The quality of a year's work for nonagricultural paid workers (Table 24) was the multiple of annual hours and hour-quality. The index for the quality of a year's work for all employment was obtained by combining this index for paid nonfarm workers with an unchanged (100 throughout) index of hours for unpaid and farm workers using 1960 employment weights of 78 and 22.

1/ DBS, Review of Man-Hours and Hourly Earnings, op. cit., various issues.

2/ DBS, Aggregate Productivity Trends, op. cit.

3/ See footnote 1, p. 201.

4/ DBS, Aggregate Productivity Trends, ibid.

CHAPTER VI

Education and Earnings

The earnings relatives by sex, age and level of education for Canada, for the nonfarm labour force, [1] were derived from Earnings and Education, [2] supplemented by additional detail from the Bertram study. [3] The earnings weights shown in Table N-10, based on earnings standardized by age, were calculated as 60 per cent of the difference between earnings at each level of education and earnings at eight years of education. It was assumed that the other 40 per cent of the earnings differential relates to socio-economic factors other than education.

Table N-10

ADJUSTED(1) ANNUAL EARNINGS WEIGHTS APPLIED TO EDUCATION GROUPS, VARIOUS YEARS

(Eight years of education = 100)

Years of Schooling	1961 Canada Male	1961 Canada Female	1949 United States Male	1962 Northwest Europe(2) Male
0	81	93	70	70
1 - 4			79	79
5 - 7	96		88	88
8			100	100
9 - 11	109	108	109	122
12	125(3)	129(3)	124	139
13 - 15	135	154	139	152
16 +	185	189	181	194

(1) Adjusted to three-fifths of difference in actual earnings from eight-year level.

(2) Data used for Northwest Europe are, in fact, French relatives for wage and salary workers (assumed to be males only). See Denison, Tables 8-3 and F-8, pp. 85 and 379.

(3) Includes earnings with Grade 13 education.

Source: Canada -- adapted from Podoluk, op. cit., and Bertram, op. cit.
United States and Europe -- Denison, Table 8-3, p. 85.

1/ The earnings differentials for the farm labour force are assumed to be similar to those derived for the nonfarm labour force. Earnings data for the agricultural labour force by level of education are not available. Because of the uncertainties of estimating a return to the farm labour input, including the unpaid input of farm proprietors, it was assumed that no reasonable imputation of farm earnings by level of education and age was possible at this stage.

2/ Podoluk, op. cit., Tables 6 and 14, pp. 21 and 43, p. 69 and Appendix B.

3/ Bertram, op. cit., Tables 20, A-14 and A-15, pp. 48 and 90.

As Table N-10 indicates, the Canadian pattern of earnings by level of education was broadly comparable for males and females, although, as noted earlier, the difference in the level of male and female earnings was substantial. Earnings data for the United States were available only for males, and the pattern of male earnings in the United States was broadly similar to that in Canada.[1] Denison used 1949 earnings weights because the 1959 Census data were not available when he was making the estimates. A comparison of the 1959 U.S. earnings data suggests that the earnings relatives did not change appreciably over the decade.[2]

The earnings index for Northwest Europe, and the supplementary data examined by Denison,[3] indicate a broadly similar distribution of earnings by level of education in Europe and North America. The larger earnings differential for Europeans with secondary school and higher education reflects in part a relative scarcity of educated workers. On the other hand, the similarity of the earnings differentials for the more highly educated workers in Canada and the United States is curious in view of their relative scarcity in Canada. The large number of skilled and highly educated immigrants into Canada during the 1950's may have softened the pressure of demand. In recent years there would appear to be a relative increase in salaries of graduates in Canada, particularly at universities, where the effect of a highly competitive North American market is being felt. By now the scarcity may be having its expected effect. The average earnings data, however, may in part obscure differences in the type of professional training and in the level of degrees, which could only be articulated with more detailed data.

Labour Force by Level of Education

The male labour force by age group and years of education was given in the 1961 Census of Canada.[4] The female nonfarm labour force by age and education from the same source was adjusted to include the female farm labour force on the basis of data on the female farm population by age and education. The 1951 Census did not contain comparable education detail, and the distribution for that year was approximated by extrapolating 1961 data using education and age cohorts. Distribution of the labour force by sex and education group, for the base years 1950, 1955, 1960 and 1962, was based on the distribution for Census years and annual Labour Force survey data of the labour force by age and sex.

Education Quality Indexes

The labour force education distributions for benchmark years were weighted by the Canadian "adjusted" earnings differentials (Table N-10) to derive indexes of the quality, reflecting years of education, of the male and female civilian labour force. The use of only two elementary school levels, 0-4 and 5-8 years, is likely

---

1/ Denison, Table F-3, p. 375.

2/ Ibid., pp. 373-374 and Table F-2, p. 374.

3/ Ibid., Appendix F.

4/ DBS, 1961 Census of Canada, Vol. IV, Incomes of Individuals (98-502), op. cit.

to have resulted in some understatement of the quality change, since upgrading within these groups would not be caught. See comment to Table N-12.

The quality adjustment for school attendance was based on average attendance data for elementary and secondary schools in Canada[1/] (see Table N-11). It was assumed that these data relate to the average daily attendance measured over that part of the year when the school was open. That is to say, the average daily attendance figures do not, by and large, reflect the official length of the school year or the days when schools were closed for harvesting, influenza epidemics, bad weather, and so forth.[2/] At the university level of education the relationship between education quality and either the length of the term or attendance ratios is indirect at best. The "days" adjustment was, therefore, not applied to those with university education.

The length of the school year in Canada as measured by "days open" does not seem to be available for the early years of this century. It was assumed therefore that increases in the length of the school year in Canada, as weather, distance and illness became more tractable, followed a pattern similar to that in the United States. Since 1935 the length of the school year has increased very little, and the impact of this assumption largely affects those who received primary and secondary education before or shortly after the First World War. The rise in average daily school attendance in Canada and the United States and the length of the school term are shown in Table N-11. An index for the total number of days attended combined the average daily attendance and the length of the school term in days.

Table N-11

SCHOOL ATTENDANCE, CANADA AND UNITED STATES

	Average Daily Attendance (Percentage of total enrolment)		Average Length of School Term in Days
	Elementary and Secondary Schools in Canada	Public Schools in United States	Public Schools in United States
1870	--	59	132
1890	--	64	135
1910	65	72	158
1930	79	83	173
1950	87	89	178
1960	91	90	178

Source: Canada -- Bertram, op. cit., Table A-10, p. 85.
United States -- U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1957, and Continuation to 1962, Washington, GPO, 1960 and 1965, respectively, series H224, H229 and H230.

1/ DBS, Historical Statistical Survey of Education in Canada (81-D-65), Ottawa, King's Printer, 1921, Table 3, p. 21; and Bertram, op. cit., Table A-10, p. 85.

2/ It was not possible to ascertain whether the historical estimates of average attendance were based on actual "days open" or on a hypothetical school year, but the former seems more likely.

The labour force was distributed into "cell" groups by sex, age group, and level of education. The average number of days of schooling per year, corresponding to the mid-point of each group's time period of education, was assigned to each cell.[1] The total number of days of education embodied in the total labour force was obtained by weighting the days per person per year in each cell by man-years of education (labour force numbers times average number of years). The average number of days of education (per person in the labour force per year) was derived by dividing total days by total man-years. This calculation was made for each of the benchmark years, and the average number of days per person per year was converted to an index based on 1950 for 1955, 1960 and 1962. Denison reduced this measured increase in the number of days by one-third to allow for possible overstatement of the education effect of a longer school year.[2] It was assumed that a similar reduction was appropriate for Canada.

This adjusted increase in the average number of days of schooling per person per year was assumed to be equivalent, in terms of quality, to a similar percentage increase in the number of years of education. The ratio of the change in the average number of years of education per person in the labour force between 1950 and 1962 to the quality change based on earnings and years of education was derived, and applied to the change in days to obtain a quality index for days. The quality indexes for the non-university group based on years were combined with the quality indexes based on days. The university groups were weighted in on the basis of their numerical importance, with male and female indexes still separate. The education quality indexes for males and females were combined with the military index (at an unchanged level[3]) using labour input weights. These weights reflected the man-hour distribution and age-sex earnings weights given in Tables 28 and 29.

Alternative Growth Calculations

The 1951 and 1961 Census data on the labour force by sex and years of education (specifying only four levels of education) were available for cross-checking these indexes. The 1951 Census had data on the number of years attended;[4] the 1961 Census recorded the highest grade attended.[5] Using the quality adjusted earnings' weights, indexes were constructed separately for males and females. This proximate calculation gave an increase in the index of education quality of 103.0 (Table N-12), broadly confirming the more detailed calculation of 103.8 in Table 37. The smaller increase in the summary calculation of education quality resulted from the broader groupings at crucial education levels.

1/ For example, the average man in the 55-64 labour force age group in 1960 with seven years of education was (on average) born in 1900, received his education between 1906 and 1913, and was assigned a days weight of 100 days -- the average length of a year's schooling around 1909-10. The 100 days of schooling is the average length of the school term in days times the attendance ratio in 1910.

2/ See Denison, p. 382, for a discussion of this point.

3/ National measures of output equate military output with military remuneration; differences in the armed forces' education stock, over time and between countries, cannot by definition be a factor in changes in measured output. The index stayed at 100.

4/ DBS, 1951 Census of Canada, Labour Force, op. cit.

5/ DBS, 1961 Census of Canada, Vol. IV, The Labour Force, Bulletin 3.1-9, Occupations by Sex Showing Age, Marital Status and Schooling, Canada (94-509), Ottawa, Queen's Printer, 1963.

A second alternative calculation using U.S., not national, earnings weights did not give a significantly different picture of the quality effects of growth in the stock of education in the Canadian labour force. The use of U.S. earnings weights, which had a narrower range at higher levels of education, with the European education distributions substantially reduced the growth of the education quality indexes. 1/

Table N-12

DISTRIBUTION OF THE CIVILIAN LABOUR FORCE BY SEX AND YEARS OF SCHOOLING,(1)

CANADA, 1951 AND 1961, AND QUALITY INDEXES

		1951	1961
		(Percentage shares)	
Years of schooling		3.0	3.6
Females:	0 - 4	31.0	26.3
	5 - 8	52.7	51.6
	9 - 12	13.3	18.5
	13 +	100.0	100.0
Males:	0 - 4	8.3	7.1
	5 - 8	46.7	37.3
	9 - 12	35.6	40.1
	13 +	9.4	15.5
		100.0	100.0
		(1951 = 100)	
Education quality index(2)			
	Females	100.0	102.4
	Males	100.0	103.1
	Total	100.0	103.0

(1) The 1951 Census collected data on the number of years attended; the 1961 Census collected data on the highest grade attended.

(2) Using proximate earnings weights adapted for the smaller number of categories. The male and female indexes were combined using labour input weights, i.e. man-hours times earnings, for each sex.

Source: See text and footnotes.

Education Relatives in 1960

The quality relative for education in the Canada-U.S. cross-section comparison was based on the education distribution of the labour force and U.S. earnings weights. The distribution of the Canadian civilian labour force in 1960 by years of education was derived for the time series estimates discussed above. The 1949 U.S. adjusted earnings weights by level of education are shown in Table N-10.

1/ Denison, Table 8-6, p. 89.

A minor and approximate adjustment was made to the U.S. earnings relative in the 12-years-of-education category to take account of the fact that the Canadian education classification combined four and five years of high school or 12 and the non-university part of the 13-years-of-education class. The quality relative reflecting years of education combined U.S. adjusted earnings weights and the 1960 Canadian labour force education profile.

Denison assumed that a year's education currently received (circa 1960) was comparable in the eight European countries and the United States, 1/ and that current recruits to the labour force embodied similar qualities of education at each level of education. The quality relative based on years of schooling was adjusted to reflect the effect of a lower rate of school attendance and a shorter school year on the average quality of education received by older members of the 1960 labour force in the United States. A similar reduction was made in the Canadian quality relative based on years. The historical data on attendance and length of the school year that were used in this adjustment have been discussed earlier. The civilian quality relatives for males and females were combined with the military2/ using 1960 labour input weights. Table N-13 illustrates the derivation of the Canada-U.S. education relative for 1960.

1/ On the basis of present empirical knowledge, this is not an unreasonable working assumption. The quality comparisons, however, might be refined by taking account of such factors as the teacher-pupil ratio, and expenditures per pupil including teachers, salaries, etc. See, for example, Finis Welch, "Measurement of the Quality of Education", A.E.R., May 1966.

An alternative approach to assessing the quality of education and its contribution to output and growth, but one that is in an embryo state of development, is suggested by the comparative study of mathematical achievement. See Torsten Husén, Ed., International Study of Achievement in Mathematics (2 Volumes), International Project for the Evaluation of Educational Achievement (I.E.A.), Phase I, New York, Wiley, 1967. This pioneer project employed tests to assess levels of knowledge in mathematics. The study was not intended to develop "yardsticks for an international contest", but the results do have implications for international comparisons of the quality of levels of educational achievement.

2/ The education quality relative for the military was taken as 100 (see footnote 3, p. 210).

Table N-13

DERIVATION OF EDUCATION QUALITY RELATIVES, CANADA AND UNITED STATES, 1960

	Canada	United States
Average quality based on years of education (Grade 8 = 100)	110.2	118.9
Quality adjustment for changes in days per year	95.2	94.5
Average education quality: civilian labour force	104.9	112.4
Canada-U.S. quality relative, civilian	93.3	100.0
Canada-U.S. quality relative, including military	93.4	100.0

Source: Canada -- see text and Table 37.
United States -- Denison, pp. 91-92.

An Alternative Comparison

Denison approached the measurement of the contribution of education to income differences in a number of ways. Broadly speaking the U.S.-European relationships seemed to follow the same pattern in his calculations, but occasionally there were marked differences in the relatives for individual countries. Table N-14 compares quality indexes, based on years (and days) of education and on the school-leaving age.

Table N-14

EDUCATION QUALITY RELATIVES, 1960, USING U.S. EARNINGS WEIGHTS

(U.S. = 100)

	Based on Years	Based on School-Leaving Age
Canada	93.4	n.a.
United States	100.0	100.0
Northwest Europe	93.3	92.2
France	92.5	91.9
Norway	90.7	97.9
United Kingdom	96.9	90.9

Source: Canada -- see text.
United States and Europe -- Denison, Table 8-7, p. 91.

For the 1960 European-U.S. education relative, Denison took the average of the calculations based on years and the school-leaving age. The latter estimate took account of some of the institutional differences among countries in the age at which school was started. For three countries, the calculation based on age gave a lower ranking relative to the United States, particularly in the United Kingdom where students are somewhat younger at comparable levels of education than in the United States. For the other five European countries, the estimate based on the school-leaving age gave a higher relative -- notably for Norway and Denmark. The age of starting Grade 1 in Canada is normally six, 1/ although some children, particularly those in cities, enter kindergarten a year earlier. 2/ The six-year starting age corresponds to practice in the United States, Belgium, France, Germany and Italy. 3/ In Canada and the United States there are differences in educational practices among provinces and states but a large degree of similarity exists between the two countries. Data are not available to determine whether there were other quantity or quality differences in the educational systems of Canada and the United States, that would result in a significantly different labour quality relative compared with the one based on adjusted years of education.

1/ DBS, The Organization and Administration of Public Schools in Canada, Second Edition, 1960 (81-510), Ottawa, Queen's Printer, 1960, pp. 11 and 13.

2/ In 1961 enrolment in kindergarten was about 35 per cent of the population of five-year-old children in Canada as a whole. In Ontario the share was 70 per cent. In the United States the comparable figure was 56 per cent. See Denison, p. 96. Kindergarten enrolment from Illing and Zsigmond, op. cit., Appendix A; population from DBS, 1961 Census of Canada, Population, Bulletin 1.2-3 (92-543), op. cit., Table 26, p. 26-1.

3/ Denison, p. 95.

CHAPTER VIII

Capital Stock Data: Canada and the United States

The reference to the Dominion Bureau of Statistics data that provided the basis for the calculations of Canadian capital stock used in this Study is on page 75, footnote 4.[1/] The published official estimates provide detail on manufacturing capital in total and for 13 industry groups. In nonmanufacturing, preliminary and unpublished estimates were made available by Dominion Bureau of Statistics for agriculture, forestry, fishing, mining, quarrying and oil wells, construction, transport, storage and communication, utilities, and trade. Data were given separately for structures, equipment, and capital items charged to current expense.[2/] The gross and net stock series were estimated in constant 1949 dollars, at original cost, and at current (replacement) cost. Capital consumption estimates were based on the straight line method. The service life assumptions were specific to individual types of assets. The official publications provide a detailed account of the assumptions and methodology.

The estimates of capital stock in the United States that are relevant to this Study came from two sources. The growth indexes of U. S. capital stock shown in Table 48 were made by Denison.[3/] These estimates of the growth in U. S. capital stock are compared with the recently published official estimates later in this Note. The estimates of relative levels of capital stock in Canada and the United States in 1960, made for this Study, were based on the official U.S. estimates prepared by the Office of Business Economics.[4/] The official U. S. estimates of capital stock were available for three sectors: farms, manufacturing, and other private enterprises. Several service life assumptions, discard patterns, and depreciation methods, as well as alternative deflation techniques, were used in the official estimates. Out of the number of available options, series were selected for the Canada-U. S. comparison,[5/] with the major emphasis on comparability with the Canadian series.

1/ See also DBS, Daily Bulletin Supplement - 2, op. cit.

2/ The industry classification in these estimates follows that used in the survey of DBS, Private and Public Investment in Canada, op. cit., which provided basic investment data for the official stock estimates.

3/ Denison, Appendix J.

4/ U.S. Department of Commerce, S.C.B., op. cit., issues for December 1966, February 1967, and December 1967.

5/ See S.C.B., ibid., December 1966, p. 36, for a description of the variations. The availability of the alternative series seems to have been reduced in process of making statistical revisions, see ibid., December 1967.

The estimates of gross and net stock in the United States that formed the basis of the 1960 cross-section comparison were variants of the Bulletin F service lives in the nonfarm sector and special Department of Agriculture data; the service lives are specified in the text describing the sector comparisons. The estimates relate to the basic retirement pattern (at end of mean service life), straight line depreciation, and current cost (alternate 1) deflation. To make the coverage for the United States and Canada as comparable as possible, the U.S. official stock estimates were adjusted for purposes of this Study to include government enterprise stocks and to exclude stocks of private institutions.

There were three main problems in adapting the existing official estimates for use in the growth calculation and in the Canada-U.S. comparison for 1960. The first arose from the need to update the Canadian estimates from 1960 for manufacturing, and from 1959 for other industries, to 1962. A second problem related to coverage. Canadian stock estimates were not available at that time for commercial services or finance, insurance and real estate, and the U.S. estimates included private institutions and did not include stocks of government enterprises. The third, and perhaps more serious, problem involved the assumptions about service lives in Canada and the United States, and the adjustments that were made in the basic source data to make them reasonably comparable. The two latter points are discussed in more detail in connection with the level comparisons.

Projecting the Canadian Capital Stock Estimates[1/]

The extrapolation of the official Canadian series to 1962 was made separately for six components of stock -- structures and equipment in the farm, manufacturing and other enterprise sectors. The 1955-59 (and 1955-60 for manufacturing) gross stock mid-year estimates were averaged to year-end estimates, and the annual increment of net investment was derived. Annual gross investment was used to obtain the level of annual discards. The pattern of discards in the late 1950's was projected into the early 1960's and deducted from the annual gross investment series to obtain the annual increments to gross stock. The net stock series was estimated for the projection period using the share of depreciation in gross stock in the late 1950's. The projections were at best approximate.[2/]

Industry Coverage

The cross-section comparison was based on a definition of enterprise stocks that excluded stocks of general government, and public and private institutions. This enterprise sector conforms approximately to the non-residential business investment sector in the Canadian national accounts framework.[3/] The

1/ DBS is in process of updating the estimates of capital stock in manufacturing and nonmanufacturing industries and making them available.

2/ The discussion on pp. 229-230, and Tables N-21 and N-22, suggest that the difference between the annual rate of growth of gross stocks developed for this Study and alternative series was not large enough to indicate any significant bias in the projections.

3/ The coverage of the non-residential business investment sector includes investment by government enterprises and excludes investment by government departments, provincial hospitals, provincial and municipal schools. Some institutional investments by nonprofit organizations such as churches, by universities and by privately run social and welfare institutions are included in business investment. The enterprise sector, as defined for purposes of this Study, includes government enterprises but excludes all government departments and all institutions, both public and private.

Canadian data were adapted as closely as possible to this definition in the level and growth analysis. The U. S. stock estimate for the 1960 cross-section comparison was also defined in this way. The official stock estimates for Canada were adjusted to include stocks in commercial services, and finance, insurance and real estate industries. The U. S. official estimates of private stocks were supplemented by an allowance for stocks of government enterprises, and reduced to exclude stocks of private institutions.

Territorial changes in Canada and the United States introduce a minor inconsistency. The Canadian data include stocks put in place in Newfoundland only from 1949; the stock estimates for the United States include capital in Alaska and Hawaii only if it was put in place in 1960 or later.[1/]

Gross versus Net Capital Stock

There is no consensus on the relative merit of gross or net stock as a measure of capital services.[2/] The gross and net estimates for a single asset diverge as the asset grows older and depreciation accumulates. It is assumed that the gross stock represents an overstatement, particularly as maintenance and repair inputs rise in later years, and that net stock represents an understatement of capital services. In the comparison of levels of stock in each country in 1960, the average of gross and net was used. In the growth analysis, the growth rates for net and gross were averaged.

In general, except for agriculture, the use of average gross and net capital stock levels raised the Canada-U.S. relative for capital per person employed compared with the use of the gross stock alone. This implies a higher net/gross ratio in Canada than in the United States, and reflects a higher level of business investment in Canada in the post-war years. By and large, the growth rate of gross stock was larger than of net. In Canada and Northwest Europe, the difference was one percentage point over the period 1950-62, but in the United States it was only 0.1 percentage point.

The "Direct" Comparison of Capital Stock Levels, 1960

A fundamental difficulty in comparing the level of stocks in Canada and the United States related to reconciling large differences in the service life assumptions. There does not seem to be any body of hard fact on the actual lives of

---

1/ In commenting on the coverage of the U. S. capital stock series, Denison noted: "Your statement is true in principle, but in practice it is only true of construction (and there amounted to a difference of 0.4 per cent in overlap year). Producers' durables in Alaska and Hawaii were included throughout."

2/ There is of course a significant body of opinion that suggests that capital stocks are an inadequate measure of capital services (see Jorgenson and Griliches, op. cit.). Attempts to construct alternative series are, by and large, in the development stage. The Denison study relates capital input to the traditional measures of stock; it would be inappropriate to use an alternative approach in this Study.

structures or equipment in either country.[1/] Table N-15 shows the life assumptions that are implicit in the estimates used in the Canada-U. S. comparison. It is important to keep in mind that, while the selection was made from a number of alternative estimates both for Canada and the United States, it was necessary to select one, or a combination, of the life options given by the available stock series. There was no statistical or empirical basis for making nice differences.

In the absence of data or instinct about service lives in Canada or the United States, it was assumed that the Canadian estimate should reflect a life close to, but slightly longer than, the United States.[2/] If future empirical research indicates longer or shorter lives in Canada, the level of capital stock in Canada would, by and large, rise or fall compared with the United States.

Table N-15

APPROXIMATE MEAN LIFE ASSUMPTIONS FOR THE CAPITAL STOCK COMPARISON BY SECTOR, CANADA AND UNITED STATES, 1960

(In years)

	Canada		United States	
	Structures	Equipment	Structures	Equipment
Agriculture	47-48	16	45	14-15
Manufacturing	37	18-19	32	17
Other enterprises	44	16	41	16

Source: See text.

The scope of this Study did not include making new capital stock estimates, when this could be avoided. Better results could be obtained by a more comprehensive study, particularly of service lives, and of industry detail. The lives used were assumptions not estimates. In many instances, however, a reasonable alternative could have been used without changing the result significantly or invalidating the conclusion. Some of the limitations are discussed in connection with the estimates for each industrial sector.

1/ Little more than nothing is known about the service lives of capital equipment and structures in Canada. Some empirical research on this subject must be carried out if the relevance and usefulness of capital stock estimates are to be increased. In describing the U. S. estimates, Mr. Grose, et al., noted that ". . . there is no consensus as to the average useful economic lifetime of individual fixed assets. . .", U. S. Department of Commerce, S. C. B., op. cit., December 1966, p. 35. As Table N-18 suggests, differences in the life assumptions may be crucial for estimating stock levels. If the lives are long, however, as they are for structures, differences in the growth rates associated with even major changes in service life assumptions may not be large. The service lives are discussed in more detail in the industry descriptions.

2/ The basic service life estimates for the U. S. capital stock were based on the U. S. Internal Revenue Service's Bulletin F write-off procedures. It is suggested that actual U. S. service lives may now be well below this basic level -- by as much as 15 per cent or more. Ibid.

Capital Stock in Manufacturing

The official estimates of capital stock in Canadian manufacturing include a useful variety of life assumptions.[1] For building and engineering construction four sets of life assumptions were available. The average lives for the total ranged from a low of 37 in Sets 4 and 5 to a high of 55 years in Set 3,[2] although the range for individual types of structure was wider -- from 24 to 66 years. Set 4 (or 5), with an average life of 37 years, was used. The basic U. S. manufacturing construction stock series had an average life of 32 years.

The capital stock estimate based on a 37-year life in Canada was compared with 32 years in the United States. Table 53 indicated that, on this basis, construction per worker in manufacturing was almost 50 per cent higher in Canada than in the United States. If one had used a 32-year life in both countries, the 1960 Canada-U. S. relative would decline by about 7 per cent. The conclusion of much more manufacturing construction in Canada would not be altered materially by choosing a somewhat shorter (or longer) service life alternative.

The four sets of manufacturing equipment lives (weighted average) in the Canadian stock estimates were 15, 20, 24 and 29 years. The U. S. basic series had a life assumption of 17 years. The 20-year alternative was the closest Canadian estimate above the United States. Using the perpetual inventory method of cumulating investment data, an estimate was made of Canadian manufacturing stock in 1960 based on a 17-year life. The difference in the level of stock based on 20- and 17-year lives was less than 3 per cent; the two estimates were averaged -- implying a life of about 18 to 19 years.

In spite of the uncertainties surrounding this comparison, any reasonable set of alternative service life assumptions would not alter the conclusion that the level of manufacturing equipment per person employed in Canada was similar to that in the United States. It was estimated that, within the range of equipment lives from 14 to 24 years, a change in the life assumption of one year would change the gross capital stock in 1960 by some 2 per cent.[3]

There did not seem to be any need for making an adjustment for industry coverage in manufacturing. Capital items charged to current expenses were not included in the Canadian equipment totals.[4]

1/ DBS, Fixed Capital Flows and Stocks, Manufacturing (13-522), op. cit., pp. 87-90.

2/ Average lives for building and engineering, weighted by 1958 gross capital stocks for 13 manufacturing industries.

3/ DBS estimates of capital stock indicate that the shift in the life assumption from 20 years to 24 years in equipment raised the gross stock by 9 per cent. It is unlikely that the Canadian life assumptions are understated relative to the United States by as much as four years.

4/ The revised estimates of investment in producers' durables in the United States no longer include "purchases of small tools and similar items usually charged to current expense by business". See U. S. Department of Commerce, S. C. B., op. cit., August 1965, p. 13.

The comparison of U. S. and Canadian stock levels in 1960 was made by revaluing the Canadian stocks to U.S. prices separately for engineering and building construction, and vehicles and other equipment. The derivation of the price relatives is discussed in the Appendix.

The net-to-gross stock ratios in manufacturing were not very different in Canada and the United States. Both structures and equipment had a slightly higher ratio in Canada -- reflecting the levels of investment in Canada in the post-war years.

Capital Stock in Agriculture

The estimates of non-residential agricultural capital in the Canadian farm sector were based on data from Dominion Bureau of Statistics,[1/] and related to other agricultural Census and Survey data. For both structures and equipment, the average of the two stock estimates was used. The lives for structures were 35 and 60 years (average 47. 5 years)[2/] and for equipment 14 and 18 years. For the United States, the service life of agricultural structures was 45 years. (This estimate was almost identical to the average of the U. S. stock estimates using the alternative 35- and 55-year lives.) For equipment, the stock series with the basic and the 85 per cent of basic service life were averaged; the mean lives for these two series were 16 and 13. 6 years and averaged to 14. 8 years.

The comparison indicated a much larger amount of farm structures per worker in Canada than in the United States but very little difference in farm equipment per worker. The life assumptions used for the U. S. and Canadian estimates were close, but slightly longer in Canada. If farm buildings had significantly longer lives in Canada than in the United States, capital per worker in Canada would be even larger than shown in Table 53.

There was no appreciable difference in the net-to-gross ratios for agriculture in the two countries. Differences in the price of structures and farm equipment in Canada and the United States were small and did not materially affect the comparison.

Data on physical capital on farms in Canada and the United States were used to confirm the impression given by the stock estimates that the two countries have approximately comparable amounts of farm equipment per worker. Asset data are not very useful because of the valuation problem, particularly in relation to land,

---

1/ The DBS agricultural stock estimates, based on the perpetual inventory method, were of an experimental nature and reflected, for structures, very different life assumptions. One of these series for gross stock was published in the DBS, Daily Bulletin Supplement - 2, op. cit.

2/ The lack of data as a basis for selecting a specific service life for farm structures in Canada or the United States prevented any clearly or obviously meaningful comparison. The stock of structures in the United States varied between $U.S. 3,300 per person employed to about $U.S. 5,300 using 35- and 55-year service lives. In Canada the stock alternatives suggested $Can. 5,000 to $Can. 8,000 per person employed using 35- and 60-year lives. On the basis of these data, without further refinement for price, etc., it seemed that Canada had at least 50 per cent more construction capital per worker in agriculture. The Canada-U. S. relative in Table 53 was 156.

but a comparison of agricultural statistics for Canada and the United States on capital invested in machinery and equipment[1] indicated that farm workers in Canada had about 10 per cent more equipment. This figure is comparable to the estimate of about 7 per cent obtained from comparing the average gross plus net stock in Canada and the United States in national currencies.

Estimates of capital inputs in agriculture based on annual depreciation increments may give quite different results. A Canada-U.S. comparison based on this type of data has recently been made by L. Auer.[2] His analysis of total Canadian and U. S. agricultural inputs for the period 1961-65, using depreciation and expenditures on maintenance and repair in national currencies as capital inputs, suggested that Canada had a mechanization input per worker 20 per cent below the U. S. level. A similar comparison of land and buildings, which is inextricably complicated by the problem of land valuation, suggested that each farm worker in Canada had just over half the amount (dollar value) of land and buildings of his U.S. counterpart. These estimates and the stock estimates of capital in agriculture do not seem readily reconcilable at this stage.

Capital Stock in Other Enterprise Industries

The comparison of enterprise stocks outside agriculture and manufacturing was especially complex because of differences in coverage. Canadian capital stock data were available for the business sector except for commercial services, and finance, insurance and real estate (referred to as F. I. R. E.); the capital stock in these two sectors was estimated and included. The U.S. official estimates related to the private sector as defined in their National Accounts, i. e. excluding government enterprises and including private institutions. In this Study, the U. S. figures were adjusted to include capital of government enterprises and to exclude capital of private institutions.

The basis of the Canadian estimate was the DBS unpublished and preliminary estimates of capital stock in forestry, fishing, mining, quarrying and oil wells, construction industry, transport, storage and communications, public utility operations and trade. The estimated average service life implied by the DBS estimates of construction stocks in the "other industry sector" was just over 50 years (weighted by 1959 gross mid-year stocks in current dollars). This service life was long compared to the U. S. series.[3] For purposes of this comparison, the official Canadian stock estimate was arbitrarily adjusted to reflect a service life of some 44 years. The series based on a 52-year life was adjusted using a reduction ratio based on the relationship of construction stocks in manufacturing with different life assumptions.[4]

1/ Data for comparison were derived from DBS, Quarterly Bulletin of Agricultural Statistics (21-003), op. cit., April-June 1966, and U. S. Department of Agriculture, Agricultural Statistics, 1964, Washington, GPO, 1964, Table 636, p. 439.

2/ Auer, op. cit., Table 1, p. 4. See also Economic Council of Canada, Fifth Annual Review, op. cit., Chapter 5.

3/ The service lives of the various estimates of U.S. construction stocks ranged from 23 per cent below to 13 per cent above the Bulletin F life of 36 years, i. e. from 28 to 41 years. The longest life series was used.

4/ This implies similarity in the historical pattern of investment in manufacturing and "other nonfarm enterprise industries". To verify or contradict this assumption, one would need the pre-1926 annual investment data for the two sectors. If the longer Canadian life be appropriate, workers in the other enterprise industries in Canada would have even more than the 12 per cent "advantage" in structures compared with the United States (see Table 53).

The mean life (weighted as in the construction calculation) as reflected in the official Canadian data of equipment in the nonfarm, nonmanufacturing sector was about 21 years. Since 16 years was the longest life provided for in the U. S. estimates, the gap was unsupportably large. A special estimate of equipment capital in Canada was made using the perpetual inventory method and an assumed service life of 16 years. It may be that this life assumption is too low and that the estimate of the level of stocks in Canada is understated. However, a reasonable alternative assumption would not alter the conclusion that Canadians in the nonfarm and nonmanufacturing industries have substantially less equipment per worker than American workers in the same group of industries.[1/]

The additions to the stock estimates for commercial services and F. I. R. E. were based on a cumulation of investment in structures and equipment in these two industries by the perpetual inventory method. Partly because of the limitations of the annual investment data, particularly on F. I. R. E., it would be incorrect to conclude that the estimates of capital stock in these two industries were of a high quality. The addition of 1960 stock data for these two sectors added 6 per cent to nonfarm, nonmanufacturing construction stocks and 2 per cent to equipment stocks in Canada.

The estimates of U. S. nonfarm, nonmanufacturing stock included private institutions and excluded government enterprises. To derive a stock series for these two sectors it was first necessary to construct annual investment series over the assumed service lives. The estimate of U. S. government enterprise[2/] investment in structures and equipment was constructed from a variety of empirical evidence. The benchmark for construction investment was based on data of expenditures by governments and on public construction.[3/] The construction component was projected in constant prices using the volume of construction expenditure in "other public construction" back to 1929,[4/] investment in "public service enterprises"[5/] to 1915, and by "hand" to 1900. The series was cumulated using the perpetual inventory method and a service life of 50 years.

1/ If, for example, U. S. equipment stocks based on an average life of 11, not 16, years were used, the Canada-U. S. gross stock equipment relative would have been just over 80 instead of 63. A 50 per cent difference in service life is, however, an extreme assumption to make on the basis of no empirical evidence.

2/ For a discussion of the definition of U. S. government enterprises and the problems of isolating investment by these enterprises, see the comments on page 49 of the U. S. Department of Commerce, OBE, National Income, a Supplement to the S. C. B., Washington, GPO, 1954.

3/ U. S. Department of Commerce, Bureau of the Census, Census of Governments 1962, Vol. VI (Topical Studies), No. 4, Historical Statistics on Governmental Finances and Employment, Washington, GPO, 1964, Table 11, p. 51, and U. S. Department of Commerce, Income and Product Accounts, 1929-1965, op. cit., Table 5. 2, pp. 80-81.

4/ Ibid., Table 5. 3, pp. 82-83.

5/ U. S. Department of Commerce, Historical Statistics of the United States, op. cit., Series N29-54, p. 382.

Financial data were available on investment by all levels of government, both total and for construction, from 1952 to 1962.[1] An examination of these data suggested a benchmark estimate of equipment investment by government enterprises that was projected, deflated, and cumulated into a capital stock estimate for 1960.

The estimate of private U.S. institutional capital, in schools, hospitals, etc., was based largely on private construction expenditures classified as religious, educational, hospital and institutional.[2] The estimate of equipment stocks in private institutions was obtained by applying the Canadian ratio of equipment to construction in institutions that was based on a rough cumulation of annual investment data.[3] The estimated total stock of private institutional capital was deducted from the official estimates of U. S. capital stock, and the estimate of government enterprise stocks was added. The net upward adjustment to U. S. private construction for government enterprises and institutions was 11 per cent and for equipment it was negligible.

Capital Stock per Person Employed by Industry

The estimates of capital per person employed for the three sectors in Table 53 required employment figures that were consistent with the coverage of the stock measures. This was particularly important and difficult for the residual nonagricultural, nonmanufacturing sector in which ill-matched employment data could distort the comparison. Table N-16 shows the distribution of employment among the sectors.

Table N-16

ESTIMATED DISTRIBUTION OF CIVILIAN EMPLOYMENT BY INDUSTRY, CANADA AND UNITED STATES, 1960

(Percentage shares)

	Total	Agriculture	Manufacturing	Other Business Enterprises	General Government and Institutions
Canada	100	11	25	48	16
United States	100	9	26	47	18

Source: See text.

The estimates of total civilian and agricultural employment in 1960 used in Table 53 were comparable to data in Chapter IV and XI (Denison, Table 5-1C), except that Alaska and Hawaii were excluded from U. S. employment. Data for the

---

1/ U. S. Department of Commerce, Historical Statistics on Governmental Finances and Employment, op. cit., Tables 10 and 11, pp. 50-51.

2/ U. S. Department of Commerce, Income and Product Accounts, 1929-1965, loc. cit.

3/ DBS, Private and Public Investment in Canada, op. cit.

United States were estimated from the U. S. Department of Labor, Manpower Report of the President, March 1965, op. cit., and the U.S. Department of Commerce, Income and Product Accounts, 1929-1965, op. cit. For Canada, data on employment in agriculture and manufacturing came from The Labour Force, op. cit.; other business enterprise employment was derived residually after estimating employment in government departments and institutions using the 1961 Population Census, Occupation Divisions by Detailed Industries and Sex (DBS, 94-530); The Labour Force, op. cit.; Hospital Statistics, Vol. III (DBS, 83-212); Elementary and Secondary Education (DBS, 81-210); Federal Government Employment (DBS, 72-004); and Provincial Government Employment (DBS, 72-007).

The Canada-U. S. relatives of stock per person employed by industry in 1960 (Table 53) were derived by dividing the absolute levels of employment in agricultural, manufacturing, and other enterprises into the sector totals of capital stock in U.S. prices. It should be emphasized that the Canada-U. S. enterprise stock relative per person employed, used to derive the contribution of capital inputs to level of income per person employed, was based on total employment, not on this sector analysis, which is presented as an interesting by-product of the Canada-U. S. stock comparison.

Full-Time Equivalent Employment

One interesting aspect of the estimates of capital per worker arose out of differences in the use of part-time employees in the United States and Canada. It is by no means obvious whether measures of capital per worker are more meaningful in terms of total or full-time equivalent employment. The answer depends to some extent on the pattern of employment and hours. If part-time workers increase the use of plant by extending its operating day or week, no additional capital may be required for a larger output. In industries where part-time workers are used to supplement and work with full-time employees, additional capital could be required.

It was estimated that full-time equivalent employment in 1960 in the "other enterprise" category, which includes the trade and service industries, was 93 per cent of total average employment in Canada and 86 per cent in the United States. This confirms the earlier analysis indicating more part-time workers with shorter average hours in the United States than in Canada. The equivalent full-time employment measure reduces capital stock per full-time equivalent employee in Canada relative to the United States. On this basis, equipment per full-time worker, and the associated productivity implications, are even more unfavourable for Canada.

The Cumulative Investment Comparison of Capital Stock Levels, 1960

Following the general approach used in Why Growth Rates Differ to compare capital inputs, the level of fixed enterprise capital stock per person employed in Canada and the United States in 1960 was also compared on the basis of cumulated investment data in constant U. S. prices.[1/] The Canadian estimate in national prices was converted to U. S. prices using West's investment price data.[2/] The relatives for total public and private investment cumulated from 1948 to 1963, per person

---

1/ Denison based his estimate of the levels of real investment on the OEEC studies by Gilbert, op. cit. Canada was not part of this comparison, so that the identical procedure was not possible.

2/ See Appendix.

employed in 1964, are set out below for illustrative purposes. These data confirm the impression given by the direct comparison of stock levels that Canada had more construction stock and invested much more in structures per worker than other countries.

Table N-17

CUMULATED INVESTMENT IN U.S. PRICES, 1948-63,

PER PERSON EMPLOYED IN 1964

(Relatives, U.S. = 100)

	Structures	Equipment	Total
Canada	141	76	107
United States	100	100	100
Northwest Europe	37	52	45
Norway	92	73	81
United Kingdom(1)	25	47	37

(1) See note re U.K. capital estimates, Table 46.

Source: Canada -- see text.
United States and Europe -- Denison, Table 12-10, p. 164.

The relative level of gross and net enterprise capital stock was estimated for 1960 using these investment cumulatives. The relative levels of cumulated investment in two periods, and the gross and net stock levels, are shown in Table N-18.

Table N-18

LEVELS OF ENTERPRISE INVESTMENT AND CAPITAL STOCK

PER PERSON EMPLOYED,(1) BASED ON CUMULATED INVESTMENT IN U.S. PRICES

(Relatives, U.S. = 100)

	Enterprise Investment in U.S. Prices		1960 Enterprise Stock Based on Cumulation	
	1948-63 Cumulation	1955-63 Cumulation	Net	Gross
Canada	104	109	113	101
United States	100	100	100	100
Northwest Europe	49	56	47	42
Norway	90	94	86	80
United Kingdom	41	46	41	38

(1) Enterprise investment cumulations were based on civilian employment in 1964; enterprise stock, on employment (including military) in 1960.

Source: Canada -- see text and description of methods in Denison, Chapter Twelve and Appendix J.
Europe -- Denison, Tables 12-11 and 12-14, pp. 166 and 172.

The estimate of the relative level of capital input for the European countries was based on the average of the net and gross estimates in Table N-18. These are the relatives that also appear in Table 54, and that were used as the basis for estimating the contribution of capital inputs to differences between income levels in the United States and Europe. The curious, if reassuring, feature of the comparison of Tables N-18 and 54 is that the cumulative method for Canada gave the same results as the direct capital stock comparison.1/ This result is not so surprising for equipment. It suggests, however, that the pattern of construction investment in Canada and the United States has been more or less similar throughout this century, and that the post-war investment pattern is an adequate proxy for the longer term.

Growth in U. S. Capital Stock

Dr. Denison and Mr. Poullier were in the midst of the research for their study at the time the U. S. Department of Commerce was working on revised capital stock estimates.2/ A comparison of the growth performance of gross and net stocks in the United States, using the Denison series and some of the official estimates, is made in Table N-19. If the official series had been available, and Denison had used them, the contribution of capital to growth in the United States could have increased or decreased depending on which U. S. series was used. For example, the 1950-62 annual growth rate in Denison, Table 12-2, p. 137, for U. S. gross capital stock was 3. 7 per cent; the official weighted average series, Constant Cost 1, for the United States gave 3. 2 per cent per year. A reduction of 0. 5 per cent in the annual growth rate of the fixed enterprise capital stock would, in this case, have the effect of reducing the contribution to growth over the period by about 0. 05 per cent per annum.

The comparable series, using the preferred deflation technique Constant Cost 2, increased at 3. 5 per cent. This series would not be relevant for use in this context unless national income were revised using the new deflators for construction. Most countries have a similar overdeflation problem in the investment, output and stock series. The Constant Cost 1 series is therefore more acceptable on the basis of international comparability.

1/ This fact does not prove that these results are necessarily correct; errors in the basic investment data would be reflected in both estimates.

2/ The original official estimates of capital stock in the United States appeared in the U. S. Department of Commerce, S. C. B., op. cit., November 1962. The revised estimates are discussed and some estimates appear in loc. cit., December 1966, February 1967 and December 1967. The revised estimates are also based on the perpetual inventory method, and incorporate changes in the historical investment series. See U. S. Department of Commerce, Income and Product Accounts, 1929-1965, op. cit.

Table N-19

COMPARISON OF THE GROWTH IN U.S. PRIVATE CAPITAL STOCK ESTIMATES

(Index, 1950 = 100 in constant prices)

	Gross				Net			
	1950	1955	1960	1962	1950	1955	1960	1962
Department of Commerce series								
Constant cost 1[1]								
Basic service life distribution[2]								
Basic lives[3]	100.0	116.6	133.2	139.3	100.0	120.9	141.6	149.3
85 per cent of basic lives	100.0	115.9	135.3	143.5	100.0	122.8	145.3	153.2
Weighted average[4]	100.0	117.4	137.9	145.6	100.0	123.5	145.7	153.3
Constant cost 2[5]								
Weighted average[4]	100.0	119.1	141.8	150.5	100.0	124.6	149.1	157.9
Denison series	100.0	122.5	148.7	155.0	100.0	124.8	147.4	155.6

(1) Deflation by national accounts deflators.

(2) Equipment discards at mean service lives.

(3) Essentially Bulletin F.

(4) Discards not distributed around mean service lives. Lives used are 85 per cent of basic.

(5) Alternative deflators used for structures.

Source: Denison series -- Table 12-1, p. 136.
Commerce series -- data supplied by OBE. The author is grateful to the U.S. Department of Commerce, OBE, for making the material available, and to Mr. Robert Wasson whose discussion of the methods and assumptions was so helpful. See S.C.B., op. cit., November 1966, for information on "How to Obtain the Study".

It should perhaps be noted that the capital stock time series for the United States in Table N-19 are for the private sector, and exclude government enterprise activities and include private institutions. It is not likely that adjustments to include these enterprises and exclude private institutions would affect the growth analysis in a material way.

Growth in Canadian Capital Stock

Capital Stock in Manufacturing

The estimates of changes in the capital stock in manufacturing were based on the official DBS series: Set 1 was used for structures and Set 4, for equipment. Capital items charged to current account were excluded. Table N-20 compares the level and growth rates of the DBS estimates by service life variants, the estimates made by Professor Lithwick, and those used in this Study for the growth analysis.

Table N-20

ALTERNATIVE ESTIMATES OF GROSS CAPITAL STOCK IN MANUFACTURING, CANADA, 1950 AND 1960

	Value of Stocks				Annual Average Growth Rates 1950-60	
	1950		1960			
	Total	Construction	Total	Construction	Total(1)	Construction
	($1949 million)				(Per cent)	
DBS(1)						
Set 1	8,516	4,845	13,870	6,515	5.0	3.0
Set 2	9,196	5,525	14,753	7,399	4.8	3.0
Set 3	9,626	5,250	15,233	7,346	4.7	3.4
Set 4	7,156	4,079	12,221	5,609	5.5	3.2
Set 5	6,797	4,079	11,523	5,609	5.4	3.2
Lithwick	8,914	4,923	13,802	6,076	4.5	2.1
Walters	7,733	4,845	12,889	6,515	5.2	3.0

(1) Includes capital items charged to current expenses. The life assumptions are specific to individual manufacturing sectors and types of investment. (See source for details.)

Source: DBS, Fixed Capital Flows and Stocks, Manufacturing (13-523), op. cit., Tables 2, 58, 114, 170 and 226; Lithwick, Economic Growth in Canada, op. cit., Table B-5, p. 86, averaged to mid-year estimates; text and Notes.

Both the level and growth rate of gross stocks varied substantially. The differences between the DBS estimates and the ones used in this Study are more apparent than real, since the latter are a combination of Set 1 for construction and Set 4 for equipment from the DBS data.

Capital Stock in Agriculture

Estimates of the growth in farm structures and equipment used in this Study were obtained by averaging the short and long service life series. The growth rates are compared with alternative estimates in Table N-21. The difference between the estimates of the growth in farm capital related primarily to differences in the

service life assumptions for farm structures. The Lithwick estimates used service life assumptions of 40 years and 13 years for structures and equipment;[1] the calculations for this Study implied about 47 and 16 years, respectively.[2]

Table N-21

ALTERNATIVE ESTIMATES OF THE GROWTH RATE OF GROSS CAPITAL STOCK, CANADA, 1950-60

(Annual average rates)

	Agriculture		"Other" Enterprise Industries		All Enterprise Industries	
	Total	Construction	Total	Construction	Total	Construction
DBS(1)	4.4	2.8	6.3	5.5	5.7	n.a.
Lithwick	5.1	3.4	5.2	4.2	5.0	3.8
Walters	4.1	2.4	5.9	4.9	5.4	4.2

(1) 1950-59.

Source: DBS, Daily Bulletin Supplement - 2, op. cit., Tables 8, 9 and 11. The estimate for growth in "other enterprise" stock was based on preliminary stock data, made available by DBS, that excluded stocks in the commercial service and F.I.R.E. industries. Lithwick, op. cit., Appendix B; text and Notes.

Capital Stock in Other Enterprise Industries

The estimate of other enterprise capital stocks from which the growth rates in Table N-21 were calculated was based on the official DBS data for the nonfarm, nonmanufacturing industries.[3] They were adjusted to a shorter service life, and to include an estimate of stocks in finance, insurance and real estate, and commercial services. The estimates of stocks in these two industries were based on cumulative deflated investment. The growth rates of other enterprise stocks are shown in Table N-21. The coverage adjustments to the official data for use in this Study reduced the growth rates slightly. The figures used to estimate growth in this sector gave rates that were between those given by the Dominion Bureau of Statistics and Lithwick.

Growth in Total Enterprise Capital Stock

The Dominion Bureau of Statistics published a preliminary index of gross non-residential stocks for a "selected" group of nongovernment industries. This index and its growth rate are shown in Table N-22, where they are compared with similar measures based on the stocks estimated by Professor Lithwick and on those

1/ Lithwick, op. cit., p. 78.

2/ The problem of estimating farm investments excluding land in the early years of this century is specially difficult. It is possible that the level or growth rates derived for this Study, particularly for construction, may be understated.

3/ See footnotes to Table N-22.

used in this Staff Study.[1] The comparison provides a basis for assessing the effect of the various adjustments that were incorporated in the estimates used in the growth summary in Table 48. The time series are not very different in the alternative calculations. It is very doubtful if one could significantly alter the pattern of growth in the capital stock without some entirely new basis for the assumptions on service lives.

Table N-22

INDEX AND GROWTH OF GROSS CAPITAL STOCK IN CANADIAN ENTERPRISES

	Index, 1950 = 100				Annual Average Growth Rates	
	1950	1955	1959	1960	1950-59	1950-60
					(Per cent)	
DBS(1)	100	132	165	n.a.	5.7	n.a.
Lithwick(2)	100	129	158	163	5.2	5.0
Walters	100	132	n.a.	170	n.a.	5.4

(1) Includes agriculture, forestry, fishing and trapping, mining, quarrying and oil wells, construction industry, transport, storage and communications, public utility operations, trade, manufacturing, and capital items charged to current expenses. The most important exclusions are finance, insurance and real estate, and commercial services. DBS, Daily Bulletin Supplement - 2, op. cit. These preliminary figures were published subject to revision. The manufacturing index is unchanged in the full report, DBS, Fixed Capital Flows and Stocks, Manufacturing (13-523), op. cit.

(2) Includes the industries listed for DBS coverage, as well as estimates for finance, insurance and real estate, and services. The Lithwick data in constant 1949 dollars by industry were added, converted from year-end to mid-year estimates, and indexed.

Source: DBS, Daily Bulletin, loc. cit.; Lithwick, op. cit., Appendix B; text and Notes.

Investment Deflation and the Capital Stock

The conventional measures of capital stock are based on the perpetual inventory method of cumulating annual investment data. As a result they reflect the problems associated with obtaining a real volume of investment by deflation.

Investment price indexes used in deflation, particularly in the construction industry, are frequently based on labour input costs or on other selected input costs such as materials. This method of deflation has a number of limitations. Other components of cost are not taken into account, and some of these, such as profits,

[1] A capital stock series for the commercial and institutional economy was constructed in connection with the development of an econometric model at the Economic Council by Dr. L. Bakony and Mr. S. Magun. The annual growth rate of that gross stock series from 1950 to 1960 was 5.8 per cent; from 1950 to 1962, 5.4 per cent. The series estimated for this Study, which excludes institutions, grew at 5.4 and 5.1 per cent over the same time periods.

may be highly volatile. A number of other factors affecting productivity in construction are not adequately reflected by the deflation technique -- the efficiency of construction equipment that results in higher output per unit of factor input, shifts in the mix of on- and off-site construction and the effect of prefabrication techniques. As a result, the rate of growth of investment is understated.[1/] The growth of the capital stock and the level of stock are also likely to be understated. There is also some tendency, but admittedly less important, for the equipment price deflators to include an element of creeping quality improvement. In this situation, changes in the stock of capital equipment will also be understated.

To the extent that the growth in the capital stock is understated because of the limitations of the investment deflation technique, the contribution of capital to growth may be somewhat understated, and the residual sources of growth overstated. If one assumes, and there is no evidence to suggest the contrary, that the real investment data in both Canada and the United States reflect this deflation problem, the bias in the 1960 cross-section comparison may not be large. It is important, however, to note that changes in the deflators and in the real investment series would also be reflected in the total real output series.

1/ The recently revised estimates of capital stock in the United States illustrate this point. For example, using the traditional construction deflators, the growth of structures in the private sector (Bulletin F-15, Winfrey Distribution) was 32 per cent from 1950 to 1962. An alternative price index that was (to quote OBE) "less deficient" showed an increase of 39 per cent for the same period. Over the longer run the difference in the two methods was substantially larger. See U. S. Department of Commerce, S. C. B., op. cit., December 1967, Table 2.

CHAPTER IX

Housing

The number of dwellings (households) in Canada and the United States used for the estimates in Table 61 were derived from DBS, Household Facilities and Equipment, op. cit., May 1960, p. 4, and Department of Commerce, Bureau of the Census, U. S. Census of Population: 1960 (Final Report PC(1) - 1D), Washington, GPO, 1963, Table 181, p. 1-444. The "quality" comparison of Canadian and American housing was based on DBS, Household Facilities and Equipment, op. cit., and U. S. Department of Commerce, Statistical Abstract of the United States, op. cit., 1965, Table 1102, p. 759, and U. N., Statistical Yearbook, op. cit., various issues. The quality factors that were taken into account include the share of dwellings with piped water inside and outside, baths, flush toilets, the number of rooms per house, and the percentage of owner-occupied dwellings. Net income from dwellings in current prices was deflated using the Consumer Price Index of Tenant Costs (see DBS, Prices and Price Indexes (62-002), Ottawa, Queen's Printer, various issues). Data on rents, housing investment, etc., are footnoted in the relevant tables.

Land

Data on land area in the United States (Table 63) were derived from the U.S. Department of Commerce, Statistical Abstract of the United States, op. cit., 1965. The land and inland water area for 1960 included Hawaii and Alaska. The agricultural land data (Tables 63 and 64) relate to 1959; they derived from the same source, and from U.S. Department of Agriculture, Agricultural Statistics, op. cit., 1965. Total agricultural land is "land area in farms" less "farmsteads, roads and other land". Arable land is cropland plus cropland in pasture. "Arable land adjusted" includes one-third of other grass and woodland pasture. For Canada, the data on land area include the freshwater areas; they are for 1961 and come from DBS, Canada Year Book 1963-64, op. cit., Table 1, p. 2. Data on agricultural land in Canada were derived from DBS, 1961 Census of Canada, Agriculture (96-530), op. cit., Table 2, p. 2-2. Agricultural land is land in farms, excluding the category of "other improved" land (barnyards, gardens, roads, etc.). Arable land is land under crops and fallow; the adjusted total includes one-third pasture land. Unimproved land is excluded from the arable and adjusted arable totals.

Mineral Production, 1960

The list of 17 minerals used by Denison for the European-U.S. comparison of mineral resources did not include nickel, asbestos and platinum.[1/] A mineral output comparison was made with, and without, these minerals.[2/] The results are

---

1/ Denison, p. 185.

2/ The "expanded" list in Table N-23 represented 93 per cent of total mineral production in the United States (nonmetals, metals and fuels, excluding structural materials such as stone, sand and gravel, clay and cement) and 96 per cent in Canada.

shown in Table N-23. Data for Canada were obtained from Department of Mines and Technical Surveys, Mineral Resources Division, The Canadian Mineral Industry 1960, Ottawa, Queen's Printer, 1963; for the United States, from the U.S. Department of the Interior, Bureau of Mines, Minerals Yearbook, Volumes 1 and 2, Washington, GPO, various issues. Unit prices derived from the U.S. source material were used to value Canadian output at U.S. prices. Using the U.S. Minerals Yearbook, Volume 2, op. cit., and the U.N., Statistical Yearbook, op. cit., 1964, estimates of mineral output including those on the expanded list were also made for European countries. The volume relatives on this basis differed from Denison's by only one-tenth of 1 per cent. The Canada-U.S. relative based on the expanded list of minerals was substantially different, and it seemed appropriate to use it in the level estimates for these two countries.

Table N-23

MINERAL PRODUCTION, CANADA AND UNITED STATES, 1960

	Canada		United States	
	Total		Total	
	Denison List	Expanded List	Denison List	Expanded List
Output in $ U.S. billion	1.63	2.08	13.86	13.87
Output per person employed $ U.S.	268	342	200	201
Relatives per person employed (U.S. = 100)	134	171	100	100

Source: See text.

Income on Foreign Investments

Measures of national income give rise to a measurement problem that is of special importance for the Canadian estimates. The theoretical accounting framework suggests that the measure of non-resident property income should be total income arising from the use of foreign capital.[1/] At present, however, net property income from (or to) abroad, as measured in the national accounts of most countries, does not include retained earnings or "withholding" taxes on income remittances. This is the situation in Canada. If retained earnings accruing to foreigners and withheld taxes were counted as property income payments to non-residents, the net outflow would be larger, and Canadian national income would be lower.

1/ The IMF Balance of Payments Manual, Third Edition, Washington, International Monetary Fund, 1961, provides for the inclusion of reinvested earnings and taxes in the outflow of property income, and conversely, in transfer receipts and capital inflows. The United Nations, A System of National Accounts and Supporting Tables, Series F, No. 2, Rev. 1, published in 1960, recommended the inclusion of undistributed earnings of wholly or near wholly owned subsidiaries in income payments to non-residents. Proposals for revisions to this system are in train; a reversal of the early position is under consideration.

The amount of undistributed earnings on direct investments that accrues to non-residents, and of Canadian government withholding taxes on direct investment income payments, is compared to remitted income in Table N-24. Since the level of retained earnings is affected by a variety of short- and long-run considerations such as the level of profits, current investment plans, and the availability and price of money in Canada and abroad, the relationship of distributed and undistributed earnings was not stable. If retained earnings and withholding taxes on direct investment were included with property income payments to non-residents in 1960, and national income was adjusted accordingly both for Canada and the United States, 1/ the income cost of foreign investment on the Canada-U.S. income gap would be about three percentage points compared with the two recorded in Table 67. 2/

Table N-24

PROPERTY INCOME ACCRUING AND REMITTED TO NON-RESIDENTS, CANADA(1)

(Millions of dollars)

	1950	1955	1960	1962
Undistributed income	150	335	280	305
Allowance for withholding tax	25	26	28	52
Remitted income	309	274	318	398
Per cent distributed	64	43	51	53

(1) The figures represent recently published revisions of the balance-of-payments statistics. The national accounts data used in this Study do not include these revisions to the international accounts. In the estimates of the role of property income in Tables 66 and 67, the unrevised, and therefore consistent, balance-of-payments data were used. Revisions in the non-resident income account were not large.

Source: DBS, The Canadian Balance of International Payments: A Compendium of Statistics from 1946 to 1965 (67-505), Ottawa, Queen's Printer, 1967, Table 5.14, p. 174.

1/ Data are not available on the receipts side of this account. Estimates of property income accruing to, but not received by, Canada were "guesstimated" for this calculation by applying the ratio of retained to distributed earnings in "payments" to "receipts". For U.S. retained earnings, see IMF, Balance of Payments Yearbook, Vol. 16, 1959-63, Washington, International Monetary Fund, United States, pp. 5-8 issued March 1965.

2/ This estimate includes only withholding taxes on direct investments; withholding taxes on management fees, rents, royalties, etc., are not included.

CHAPTER XI

Self-Employment in Agriculture

Data on self-employment in Canada for the farm and nonfarm sectors were obtained from labour force sources (see note to Table 76). The adjustment to full-time equivalents for nonfarm wage and salary workers is described in Denison, p. 205, footnote 9(2). These adjusted employment figures are used in the growth analysis, but not the 1960 level comparison.

Income in Agriculture and Nonagriculture

The estimates of total net national income in constant prices were described in Chapter II and Notes. Total national income in constant prices was adjusted to exclude income from housing, and on foreign investments. These forms of income have almost no employment impact. The constant price series were described in Chapter IX and Notes.

Agricultural income in constant prices was estimated using data provided by L. Auer from his study on agriculture.[1] Data on gross agricultural output and farm inputs, both in current and constant prices, were available. Using this material and a double deflation approach, a price index for net farm income was derived, and used to deflate net income in agriculture in current prices.[2] Net nonfarm income in constant prices was obtained residually.

Contribution to Growth of the Shift Out of Agriculture

The method of estimating the contribution of the declining share of farm employment to growth is described by the following steps (Denison, Table 16-8, p. 211). The Canadian and U.S. figures for the period 1955 to 1962 are set out to illustrate the calculation.

Item		Canada	United States
1	Decline in farm percentage of employment	4.14	2.73
2	Decline in farm percentage as per cent of nonfarm employment percentage	4.87	3.04
3	Estimated percentage increase in nonfarm national income due to shift	3.65	2.28
4	Item 3 times nonfarm percentage of national income	3.19	2.09

[1] Auer, op. cit.

[2] Net income in agriculture as used in this Study was derived from, but does not correspond with, published net income in agriculture largely because, for purposes of this Study, depreciation was adjusted to replacement cost.

Item		Canada	United States
5	Decline in farm percentage as per cent of farm employment percentage	27.71	26.69
6	Estimated percentage reduction in farm national income due to shift	9.14	8.81
7	Item 6 times farm percentage of national income	0.64	0.41
8	Percentage increase in national income due to shift of resources from agriculture	2.55	1.68
9	Item 8 per annum (Table 80)	0.36	0.24

CHAPTER XII

Real Consumption Per Capita

The OEEC estimates of real consumption levels in nine countries for 1950 and 1955 took account of some expenditures on education, health, etc., that are classified as government, not consumption, expenditure in the Canadian national accounts. In addition, the OEEC estimates approximated a factor cost level of valuation by excluding some of the impact of indirect taxes on prices of final consumer goods and services.[1/] These adjustments both provided a nicer basis for international comparisons of real consumption. They presented a problem to this Study because it was not possible to follow the detailed OEEC method closely enough to duplicate it, using Canadian data.

Instead, a comparison of real consumption expenditure in Canada and the United States was evolved that was not identical to the Gilbert and Denison comparison for the United States and Europe. The estimates for Canada in Tables 85, 86 and 87 were made by adding to the OECD estimate of consumers' expenditure, at market prices in Canada in 1950, an allowance for current expenditures by schools and hospitals that normally appear in current government expenditures. The OEEC estimate of U. S. consumption at market prices was assumed to be comparable. The impact of indirect taxes on consumption, both in the United States and Canada, was deducted using data from the input-output studies in each country.[2/] Total consumption in Canada, based on national prices, was revalued to U. S. prices (and vice versa) using the real price relatives for consumption at factor cost. The adjustments for government expenditures on education and health were revalued using selected detail of prices relating to government current expenditure.[3/]

The basic calculation of consumption per capita was made for 1950: Table 85 compares the relative per capita consumption in Canadian and U. S. prices in that year. The time series for the United States was taken from Denison.[4/] The indexes for Canada in Canadian and U. S. prices were projected using the volume of consumption in U. S. and Canadian prices that arose as part of the real GNE time series in West's price and volume comparison.

1/ Gilbert and Kravis, op. cit., pp. 29 and 91-92, and Gilbert and Associates, op. cit., p. 19.

2/ The share of indirect taxes (less subsidies, net of enterprise profits) in personal consumption expenditure in the United States in 1958 was estimated at 10 1/2 per cent. This estimate was based on a study by Jack Alterman, "A Framework for Analysis of the Industrial Origin of Income, Product, Costs, and Prices", Conference on Research in Income and Wealth, December 1966, New York, NBER, unpublished mimeo., see particularly Table 5. The estimate for Canada was based on DBS, Inter-Industry Flow of Goods and Services, Canada, 1949, Reference Paper No. 72, Ottawa, Queen's Printer, 1956, Table 6.

3/ General government expenditure on schools and hospitals was divided into wages and other current expenditure. The two components were valued using the relative government earnings data and prices for government nondurable expenditures in Canada and the United States from the price relatives developed by West (see Appendix).

4/ Denison, Table 17-5, p. 244.

As noted in the body of the Chapter, the small difference in the relative level of real consumption per capita in Canada and the United States, using Canadian and U. S. price weights, gives rise to an interesting question. Are the similarities in consumption patterns, in tastes, and habits in Canada and the United States sufficiently important to account for the close similarity in the consumption relatives in alternative price weights? On the other hand, the effect of differences in individual prices on the pattern of consumption, and particularly on the level of output and consumption that in Canada is still significantly below the level in the United States should perhaps be reflected in a larger difference in the Canada-U. S. consumption relatives in alternative price weights. The Gilbert and Denison findings suggest that a larger difference was to be expected.

Table N-25

DISTRIBUTION OF CONSUMPTION IN FRANCE AND UNITED KINGDOM IN U.S. AND NATIONAL PRICES BY RANGE OF PRICE DIFFERENCES, 1950

(Percentage shares)

	Consumption			
	In France		In United Kingdom	
Consumption Share by Price Range	U.S. Price Weights	National Price Weights	U.S. Price Weights	National Price Weights
U.S. prices over 50 per cent higher	34	20	23	14
U.S. prices 0 to 50 per cent higher	28	24	40	35
National prices 0 to 50 per cent higher	20	22	28	37
National prices over 50 per cent higher	19	35	9	15
	100	100	100	100

Note: Shares may not add due to rounding.

Source: Denison, pp. 247-248. It should be noted that the numbers in the columns for the United Kingdom are inverted, compared with those shown in Why Growth Rates Differ, following a correction by Denison.

Tables N-25 and N-26 compare the distribution of consumption in France, the United Kingdom and Canada according to the degree of price disparity, and in both national and U. S. price weights. More than half of French consumption (34 + 19 or 20 + 35 per cent) was of goods that were 50 per cent more expensive or 50 per cent less expensive in France than in the United States. About 30 per cent of U. K. consumption was of goods that were 50 per cent cheaper or 50 per cent dearer in the United Kingdom. By contrast, the range of price differences between Canada and the United States was much smaller.[1/] Only 2 per cent of Canadian

[1/] The author appreciates the co-operation of Mr. H. Segal, Prices Division, DBS, in providing the basis of the distribution by price level using the full range of commodity and price detail; it is of interest to note that this distribution was very similar to that obtained using the 35-commodity subgroups given in Segal and Pratt, op. cit., Table 1.

consumption fell outside the range of 50 per cent price difference in Canada and the United States compared with 50 per cent in France and 30 per cent in the United Kingdom. About 70 per cent of Canadian consumption was of goods with Canadian prices that were within 20 per cent of U. S. prices.

Table N-26

DISTRIBUTION OF 1957 CONSUMPTION(1) IN CANADA

IN CANADIAN AND U.S. 1965 PRICES BY RANGE OF PRICE DIFFERENCES

(Percentage shares)

Consumption Share by Price Range	Consumption in Canada	
	U.S. Price Weights	Canadian Price Weights
U.S. prices over 20 per cent higher	18	12
U.S. prices 0 to 20 per cent higher	36	33
Canadian prices 0 to 20 per cent higher	31	36
Canadian prices over 20 per cent higher	15	20
	100	100

(1) Excludes rent and property taxes.

Source: Based on data from Segal and Pratt, op. cit., and West, op. cit.

The reweighting of each country's consumption from national to U. S. prices lowers the share of consumption on goods that are 50 per cent less expensive in the United States (e. g. from 35 to 19 per cent in France) and increases the share of goods that are 50 per cent more expensive in the United States (from 20 to 34 per cent in France). On the other hand, the shift from Canadian to U. S. price weights lowered the consumption share of that basket of goods with Canadian prices over 20 per cent higher from 20 to 15 per cent, and raised the share of goods with higher U. S. prices from 12 to 18 per cent.

The comparison of consumption and prices in Canada and the United States shows that the range of price differences in Canada and the United States is very much narrower than between the United States and most European countries. The reweighting of Canadian consumption from national to U. S. price weights resulted in relatively small changes in the distribution.

This price material suggests that the similarity of prices in Canada and the United States may be an important factor giving rise to the small difference in the relative consumption levels in U. S. and Canadian price weights. There is, however, no basis for deciding how much of the apparent similarity in the Canada-U.S. consumption per capita relatives in U. S. and Canadian price weights arose from problems of measurement, and how much was real.

The comparison of market prices of consumer goods in Canada and the United States indicated:

-- higher prices in Canada for household goods, such as floor coverings, textiles, and appliances, pharmaceuticals, clothing (particularly children's clothing), footwear, tobacco and alcohol, gasoline and automobile operation, recreation goods, and miscellaneous grocery products;

-- lower prices in Canada for almost all categories of food, local and train transportation, fuel and light, and most services, including health care, and personal services.

The Gilbert[1/] comparison of consumer prices in Europe and the United States indicated a somewhat broader tendency for services to be cheaper and goods to be more expensive in Europe compared with the United States. The comparison of prices in Canada and the United States suggested that Canada had the additional advantage of lower prices for food, fuel and light -- a not surprising result.

1/ See Gilbert and Associates, op. cit., p. 61.

CHAPTER XIII

Plant Size, Economies of Scale and Resource Allocation

In spite of Confederation and the substantial growth in population and output that has occurred in the past 100 years, the controversy about the inhibiting effects of a small national market is still with us. Does Canada now have a market that will support plants of optimal size? One of two responses is likely. "A market of 20 million people, with one of the world's highest levels of output and consumption per capita, is big enough to permit maximum economies of scale in all but the most exceptional circumstances." Or alternatively, "Canada's potential to exploit the economies of scale is seriously limited compared with the United States whose market is more than 10 times larger." The answer to the question of market size and scale is more complex than either generalization suggests. Many factors enter the equation -- resource endowment, the organization of factors in production, the tariff structure within and without, as well as the size of the market for a particular product, the level of technology, the number of plants, and the degree of product specialization.

For many processes and in many industries the rate of technological development has increased the optimum size of plants faster than the growth in market size, but this is a fact of life faced not only by small countries like Canada but by all countries. The largest fractionating column in the world has recently been put in place by Imperial Chemical Industries in the United Kingdom. Its output is estimated to be 10 times larger than that of the existing units, which may be only 10 to 12 years old; its cost is 40 per cent lower.[1/] In the face of this type of development, national markets cannot keep pace with technology. But the more dramatic examples of the effects of technological change on plant and market size tend to obscure the fact that industries and processes in this situation may in fact be the exception rather than the rule.

Establishment Size

Data on plant size do not provide a basis for measuring the effect of national market size on productivity, but they do provide a basis for some quantitative comparisons over time and among countries. Table N-27 compares plant (establishment) sizes for manufacturing in several industrial countries and Canada. Both the United States and Germany had a substantially lower share of small, and a higher share of large, establishments. By and large, the distribution of establishments by size was similar in Canada, France and Italy in the mid-1950's.

Information was not available to trace changes in plant size in Europe. Table N-28 compares shifts in the size distributions in Canada and the United States during the 1950's and early 1960's. The importance of middle-size establishments has been growing in Canada but, in 1962, those with under 100 employees in Canada took about 9 per cent more of the manufacturing labour force than the comparable group of small establishments in the United States. At the other extreme, more than 30 per cent of the U.S. labour force was employed in establishments with 1,000 or more employees; in Canada, only 20 per cent of the labour force was employed in plants of this size.

1/ The Economist, October 7, 1967, London, pp. 63 and 64.

Table N-27

DISTRIBUTION OF EMPLOYMENT IN MANUFACTURING BY ESTABLISHMENT SIZE, CIRCA 1955

(Percentage shares)

Share of Employment in Establishments Employing:	Canada	United States	Belgium	France	Germany	Italy
0 - 49	23	16	28	19	15	21
50 - 99	11	9	10	12	10	12
100 - 499	30	29	27	34	30	30
500 - 999	13	13	11	13	13	13
1,000 and over	23	33	23	22	32	24

Source: Canada -- DBS, General Review of Manufacturing Industries of Canada, 1954 (31-201), Ottawa, Queen's Printer, 1957.
United States and Europe -- Denison, Table 18-3, p. 270.

Table N-28

DISTRIBUTION OF EMPLOYMENT IN MANUFACTURING BY ESTABLISHMENT SIZE, CANADA AND UNITED STATES

(Percentage shares)

Share of Employment in Establishments Employing:	Canada					United States			
	1950	1954	1958	1962	1964	1947	1954	1958	1963
0 - 49	23	23	23	21	20	16	16	17	16
50 - 99	11	11	12	13	12	9	9	10	10
100 - 499	32	30	32	35	35	29	29	30	31
500 - 999	13	13	14	14	13	13	13	12	12
1,000 and over	21	23	20	18	20	33	33	31	31

Source: Canada -- 1962 and 1964, DBS, Canada Year Book, op. cit., 1966 and 1967; 1950, 1954 and 1958, DBS, General Review of the Manufacturing Industries of Canada (31-201), op. cit., these years.
United States -- Department of Commerce, Bureau of the Census, 1963 Census of Manufacturing, Vol. I, Washington, GPO, Table I.

In 1947, about 10 per cent of all manufacturing establishments in the United States had over 100 employees; in 1949 in Canada, the share was 6 per cent (Table N-29). By 1963, the U.S. distribution was relatively unchanged, and the share of large establishments in Canada had increased to 8 1/2 per cent. These data suggest that Canadian plant size has been changing more rapidly than the United States. By 1964 the distribution of establishments by employment size in the two countries was very similar.

Table N-29

DISTRIBUTION OF MANUFACTURING ESTABLISHMENTS

BY EMPLOYMENT SIZE, CANADA AND UNITED STATES

(Percentage shares)

Share of Number of Establishments Employing:	Canada				United States			
	1949	1954	1962	1964	1947	1954	1958	1963
0 - 49	88.7	88.7	84.6	84.0	82.1	83.3	83.3	83.1
50 - 99	5.3	5.4	7.4	7.5	7.8	7.4	7.3	7.5
100 - 499	5.0	4.9	6.9	7.4	8.2	7.5	7.8	7.9
500 - 999	)	0.6	0.8	0.8	1.1	1.0	1.0	0.9
1,000 and over	) 0.9	0.3	0.3	0.4	0.8	0.7	0.7	0.6

Source: Canada -- 1949, 1962 and 1964, DBS, Canada Year Book, op. cit., 1966 and 1967; 1954, DBS, General Review of Manufacturing Industries of Canada (31-201), op. cit.
United States -- Department of Commerce, 1963 Census of Manufacturing, Vol. I, op. cit., Table I.

The evidence indicates that the manufacturing sector in Canada compared with the United States has more small plants and less large ones; that Canadian plant size has been growing; and that the most significant increase in plant size was in the middle-size range between 100 and 500 employees. Data of this sort do not provide a basis for estimating the effect of plant size on productivity. As Denison suggested: "One is likely to be more impressed by the similarity of such distributions in different countries than by the differences, . . ."1/

1/ Denison, p. 269.

Economic analysis on questions of trade and tariffs, scale and resource allocation has recently been advanced significantly by a number of studies. It would be impossible to cover even the salient points in a summary, and it has not been attempted.[1/]

One aspect of the scale phenomenon was studied at the Economic Council of Canada, and the results of the study have recently been published.[2/] The focus of the investigation was the impact of scale and specialization on costs and productivity in Canadian manufacturing industries, with a special emphasis on product specialization. The analysis leads to the conclusion that ". . . the limited extent of specialization has turned out to be not only an important, but also a pervasive, factor adversely affecting costs and productivity in manufacturing in Canada."[3/]

In addition, there was strong evidence to suggest that other factors that played a significant role in raising costs and lowering productivity in Canada included:

> Canada's commercial policy which was historically designed, to a considerable extent, to foster a wide diversity of manufacturing activity in Canada;
>
> . . .tariffs and other trade barriers in foreign countries which have inhibited greater specialization in Canadian manufacturing on the basis of larger markets (foreign plus domestic); . . .[4/]

Cost of Protection

The impact of protection on the level of income in Canada has been, and continues to be, an important concern of economic analysis. This Study is not, however, an appropriate place for an evaluation of the theoretical or empirical aspects of this question. The effect of national and international market size and the level of protection were evaluated in Chapters XII and XIII. These two aspects are drawn together in the following section, which includes a brief discussion of recent empirical research on the cost of protection in Canada.

1/ See for example:

J. H. Dales, The Protective Tariff in Canada's Development, Toronto, University of Toronto Press, 1966.

H. C. Eastman and S. Stykolt, The Tariff and Competition in Canada, Toronto, Macmillan, 1967.

H. E. English, Industrial Structure in Canada's International Competitive Position, Montreal, Private Planning Association, 1964.

Wonnacott and Wonnacott, op. cit.

2/ Daly, et al., op. cit.

3/ Ibid., p. 16.

4/ Loc. cit.

The Denison analysis takes explicit account of the impact of two elements of tariff protection on growth and income levels. Chapter XIII[1/] was concerned with an evaluation of the effect of changes in the level of protection on the reallocation of resources from high-cost protected industries to production for export. In continental European countries, the growth in imports and exports suggested that the dismantling of some of the traditional trade barriers with the formation of EFTA and the EEC was a factor in growth during the period under study.[2/] Table 94 indicates that the importance of manufactured imports and exports in Canadian GNP did not change significantly over the period, nor was there evidence of any material alteration in the tariff structures facing Canadian imports or exports of manufactured goods. It appeared therefore that no measurable part of Canadian growth arose from this aspect of resource allocation during the 1950's. Concerning the effect of tariffs on the level of output per person, Denison concluded:

> I do not attempt to isolate the effects of trade barriers on differences in the level of national income per person employed. These effects are already covered (or nearly so) by previous estimates. In the estimation of the effect of economies of scale on the level of productivity (Section I, Chapter 17), existing trade barriers were assumed, and in the calculation of the costs (to national income in United States prices) of overallocation of resources to agriculture, overallocation due to trade barriers was not eliminated. Any additional allowance would introduce double-counting.[3/]

Chapter XII[4/] assessed the effect of the size of the national market (the domestic plus the international market) on the level of, and growth in, output. The estimates relate to the impact of a restricted market on the economies of scale achieved by those firms operating in the national market, which includes the international or export market. These measures relate to a total market size, and it is not possible to isolate the effect of the tariffs, which may be only one factor bearing on market size -- albeit an important one.

The theory of international trade and protection has not yet evolved a method for combining the actual and hypothetical elements of partial, general, static and dynamic equilibrium that relate to tariffs. Factor endowments, their prices and allocation, market and plant size, the effects of scale and specialization, nominal and effective tariff rates and other forms of protection are all part of an intricate network of relationships of tariffs with the economic system. One is tempted to agree with Viner, ". . .there is no way in which the 'height' of a tariff as an index of its restrictive effect can be even approximately measured, . . ."[5/]

1/ See Denison, Chapter Eighteen.

2/ In a review article of Why Growth Rates Differ, D. J. Daly suggested that ". . .tariff barriers and their reduction play a larger role than is allowed for in Denison's estimates." See "Why Growth Rates Differ - A Summary and Appraisal", The Review of Income and Wealth, Series 14, No. 1, March 1968, p. 92.

3/ Denison, p. 262.

4/ See ibid., Chapter Seventeen.

5/ From Bela Balassa, "Tariff Protection in Industrial Countries, An Evaluation", J.P.E., Vol. LXII, No. 6, December 1965, p. 573.

Nevertheless, techniques for measuring the cost of the tariff are being evolved. In Canada, a pioneering study was made by John Young for the Royal Commission on Canada's Economic Prospects.[1] In illustrating the restrictive effects of the tariff, Young noted:

> The loss to the economy comes from the fall in the real productivity of the resources due to their transfer to an industry for which the country is ill-suited. . . . Instead of procuring brooms by producing exports and trading for brooms, the country has now adopted the less efficient alternative of producing brooms directly. This leads to a loss of real income or an economic cost of about the same magnitude as the cash cost of the tariff.[2]

The Young estimate emphasized the cash cost of the tariff to the consumer.[3] In this calculation, prices of, and expenditure on, domestic goods that are protected by the tariff were compared to those for a similar basket of imported goods. The difference between the cost of the domestic basket and an imported basket was taken as a measure of the cash cost[4] of the tariff and equated with the economic cost.[5] The Canada-U.S. comparison suggested a cash cost of the tariff in 1954 of some 3 1/2 to 4 1/2 per cent of gross private expenditure at factor cost. Young touched on a number of reasons why this estimate could be an understatement.[6] He concluded: "It is likely, therefore, that while the range probably embraces the correct total, the true figure is close to the top of the interval."[7]

1/ John H. Young, Canadian Commercial Policy, Royal Commission on Canada's Economic Prospects, Ottawa, Queen's Printer, 1957.

2/ Ibid., p. 65.

3/ The approach used in this estimate for Canada followed that used in Australia. See Young, op. cit., p. 69, footnote 2, and A. J. Reitsma, "The 'Excess Costs' of a Tariff and their Measurement", The Economic Record, December 1961.

4/ Net of duty collected. To the extent that government income from import revenue reduces the amount collected from the public in other ways, the amount of the duty may be deducted from the cash cost estimate.

5/ See quotation from Young, op. cit., p. 65.

6/ The cash cost estimate was biased downward for three reasons: (1) estimate of the cost related to private expenditure only; (2) the alternative imputed price comparison was based on U.S. prices, which may not be the lowest available in the world markets; (3) the effect of the tariff on distributive costs was not included.

7/ Young, op. cit., p. 73.

This estimate for 1954 of the cost of protection would be subject to change if the price relationships in Canada and the United States shifted, either from differential movements in domestic prices (costs) in the two countries, or from a shift in the exchange rate.[1/] Similarly, the measured cost would change if the share of protected goods in final expenditure shifted. Some two-thirds of Young's expenditure total[2/] related to equipment and consumer durables. Recent changes in the price of these categories in Canada and the United States are shown in Table N-30.

Table N-30

PRICE INDEXES, CANADA AND UNITED STATES

	1954	1960	1966
Consumer durables			
Canada	100	103.5	100.2
United States	100	111.2	106.6
Machinery and equipment			
Canada	100	120.8	141.0
United States	100	121.7	126.4
Exchange rate (value of $ U.S. in $ Can.)	.973	.970	1.077

Source: Based on official national accounts deflators for the relevant expenditure categories. See DBS, National Accounts, op. cit., various issues; U.S. Department of Commerce, Income and Product Accounts, 1929-1965, op. cit., and OBE, S.C.B., op. cit., January 1968. Exchange rates from Bank of Canada, Statistical Summary Supplement, op. cit., various issues.

From 1954 to 1960, the increases in consumer and producer durable prices were broadly similar in Canada and the United States, and the exchange rate was almost identical in the two years. As a result the Young estimate of the cash cost of the tariff in 1954 was still relevant in 1960. By 1966, the price of consumer goods had fallen about 5 per cent in Canada relative to the United States and the price of producer durables had risen by about 12 per cent.[3/] These price movements tended to lower and to raise respectively the cost of the tariff. The decline

1/ Changes in the exchange rate do not, in themselves, affect the real cost of the tariff, but could affect cost as measured by this approach, since it is related to the money cost of imported alternatives. The cash cost may change in a period when there has been no shift in the structure of the tariff. The former measure clearly reflects a changing opportunity cost that is not caught by measures of tariff incidence.

2/ Young, op. cit., Table 8, p. 72.

3/ Some part of this increase was due to the 11 per cent sales tax on production machinery and equipment, which will not enter into the measure of the consumer cost of protection.

in the value of the Canadian dollar made imported goods more expensive for Canada to buy, and reduced the purely cash cost aspect of protection. These diverse movements, related in an approximate way to the basket of imported goods in Canada, suggest that the effect of price and exchange rate changes since 1954 was largely offsetting, and that the consumer cost of the tariff as measured by Young was still appropriate in 1966.

The cash cost approach to measuring the price of protection took account of an important part, but not all, of the economic costs. Young noted that the difference between the cash and the economic cost related to the consumption-diverting effects of higher prices resulting from the tariff.[1/2/]

More recently, an extensive study of the economic implications of free trade between Canada and the United States was made by Ronald and Paul Wonnacott.[3/] The Wonnacotts' study discussed additional elements of tariff costs and their importance under various sets of assumptions.[4/] In evaluating Young's estimate of the cost of the Canadian tariff they concluded that, in the longer run, the producers' gain from protection (an overstatement in Young's estimate) relating to higher factor returns and the inelasticity of supply was not likely to be "substantial". The Wonnacotts' examination of the cost structure of Canadian manufacturing suggested that a large part of the industry operates in the range of decreasing costs, and reinforced the view that the producers' surplus may be relatively small in Canada. The measure of the consumption bias, noted above, resulting from higher prices on protected goods requires some judgment about demand elasticities for each protected commodity. Assuming unit elasticity of price and income, the Wonnacotts suggested that Young's estimate may be understated by some 0.4 per cent of GNP.[5/] There are of course great difficulties in assessing the size of these components of tariff cost and the aggregate demand and supply functions. On the basis of adjustments to Young's estimate, the Wonnacotts conclude that the (maximum) cash cost of the Canadian tariff may be 4 to 4 1/2 per cent of GNP.

The level of protection in Canada is unlikely to be reduced in a material way except as part of negotiations for a quid pro quo from other countries.[6/] As the level of Canadian protection on imported goods was reduced and the potential

---

1/ Young, op. cit., p. 65, footnote 1.

2/ See also Harry G. Johnson, "The Cost of Protection and the Scientific Tariff", J.P.E., Vol. LXVIII, No. 4, August 1960. Professor Johnson suggests that the consumption cost is ". . .likely to be a small proportion of national expenditure. . . ." He also suggests an offsetting tariff advantage if the tariff situation sustains a higher level of wages or profits, relative to the nontariff situation, ibid., p. 338.

3/ Wonnacott and Wonnacott, op. cit.

4/ Ibid., p. 281.

5/ Ibid., p. 299 and Appendix Q.

6/ This does not preclude the possibility of unilateral reduction in Canadian protection that would provide a downward pressure on prices similar to that of exchange rate appreciation. In these circumstances, Canadian firms would be encouraged to rationalize production to obtain greater cost benefits from scale and product specialization.

export market enlarged, resources in Canada would reallocate away from production of goods in which there was a cost disadvantage to those in which Canada had a competitive advantage. The Wonnacotts' study suggested that a large part of this rationalization process would result in increased scale and specialization within industries, rather than in larger shifts from one industry to another.

> Most of the specialization in Canada resulting from free trade would occur within manufacturing industries rather than between them. Because the competitive positions of Canadian industrial sectors do not vary widely it seems unlikely that any of the broad industrial groups examined in this study would disappear from Canada. Instead it is to be expected that specialization would occur in subindustries within each broad industrial group, with Canadian concentration drifting toward labor-intensive activities. However, major gains from free trade do not depend on this type of specialization; they depend primarily on the exploitation of economies of scale, defined broadly to include not only engineering economies but also managerial and organizational efficiencies associated with specialization and competition in a larger market.[1/]

Taking account of the cost structure of Canadian industry and the export potential in a free trade environment, the Wonnacotts estimated that the total cost of the Canadian and U.S. tariff to Canada could be from 7 to 10 1/2 per cent of GNP.[2/] Some 4 per cent of the total cost to Canada of protection on both sides of the border was attributed, following Young's estimate, to the Canadian tariff.

There does not seem to be a direct way of relating Young's estimate of the cash cost of the Canadian tariff and the Wonnacotts' estimates of the cost of both the Canadian and U.S. tariffs to the level of Canadian output, with the estimates developed in the framework of this Study. It may, however, be reasonable to suggest that the (lower) level of economies of scale in Canada that arose from the (smaller) size of the national and international market available to Canadian producers was due in large part to the effect of tariffs on Canadian imports and exports. This came about in two ways. First and more obviously, the U.S. (or external) tariff limited production in Canada for export either by preventing exports altogether or taxing those that were in fact exported. Second, the major impact of the Canadian tariff on imports may have been to increase the range of items produced in Canada behind the tariff wall, rather than to generate economies of scale. The small and highly differentiated Canadian market results in a lower level of efficiency, which the estimates in Table 84 suggest may account for 4.8 percentage points of the Canada-U.S. gap in output per person employed. As a share of the level of Canadian income, this would be about 6 per cent.[3/] The assumption on which this estimate was made is too sweeping to be generally acceptable. Moreover it is not intended to put forward

---

1/ Wonnacott and Wonnacott, op. cit., pp. 336-337.

2/ Ibid., p. 300.

3/ This estimate may be widened further to take account of the fact that the removal of all tariff barriers and protective devices would also have the effect of increasing U.S. income by 1.5 per cent (Why Growth Rates Differ, op. cit., p. 257). The rationalization of output in both countries in a free trade situation that resulted in equivalent levels of productivity could raise Canadian output and income a further 2 per cent to about 8 per cent. I am indebted to Denison for indicating the possibility of this extension. He is not of course responsible for the heroic assumptions on which the author has based the calculation.

the calculation as an alternative measure of the cost of the tariff. It is intended, however, to reinforce the view that the cost of protection to productivity and income levels in Canada is high. It should be emphasized that estimates of the cost of the tariff represent the long-term potential benefits of free trade. They imply adjustments by Canadian producers to a new market situation that may not be easy or quick to achieve. On the positive side, however, tariff reductions offer an important and realistic route to increasing the level of productivity in Canada and narrowing the real income and wage gap between Canada and the United States.

APPENDIX

REAL OUTPUT COMPARISON, CANADA AND THE UNITED STATES, 1966 AND SELECTED YEARS BACK TO 1950*

by

E. C. West

The approach to making a spatial comparison of real output between Canada and the United States for 1965 was essentially that of the Gilbert and Kravis OEEC study for 1950.[1/] However, because of the time constraint under which this Study operated, their very detailed method had to be rejected in favour of short-cut approximations. The technique was to make spatial price comparisons for as many GNE components as possible. In the case of consumption, this was done at a relatively fine level of detail;[2/] however, for the remaining categories of output, reliance was on existing statistics or interviews with companies to establish price differentials for broad categories. Given the price differentials for major categories of consumption, government purchases, structures, equipment, etc., over-all GNE purchasing power equivalents and real output comparisons were obtained by weighting the relatives with GNE at market price components, of both the United States and Canada, and aggregating the detail.

The procedure in terms of the index formulae is shown in the following table. The bulk of the Canada-U. S. price comparisons came in the form of relatives from the DBS study of consumption. Price relatives were therefore used as the adjusting factor throughout the GNE components as shown by the formula for each item of detail at the top of the table. P and Q represent price and quantity and the subscripts "c" and "u" stand for Canada and the United States. Care was taken with each price relative or differential used in consumption that the price comparison was for identical products following rigid specifications so that quality differences would not affect the price comparison. The precision of the quality comparison in other components of final expenditure was, for lack of information, less certain.

---

* An abbreviated version of this note appeared in The Review of Income and Wealth, Series 13, No. 4, December 1967, as an Appendix to a paper by D. J. Daly and D. Walters, "Factors in Canada-United States Real Income Differences". Acknowledgment is made to the Prices Division of the Dominion Bureau of Statistics for their invaluable contribution to this project. They made the spatial price comparisons for consumer expenditure (see footnote 2) and provided data in connection with the housing and highway estimates. The Dominion Bureau of Statistics, as well as the Canadian Construction Association, co-operated in the listing of international builders used in connection with the non-residential building estimate.

1/ Milton Gilbert and Irving B. Kravis, An International Comparison of National Products and the Purchasing Power of Currencies, Paris, OEEC, 1954.

2/ See Herbert Segal and Frances Pratt, Comparative Urban Consumer Price Levels in the United States and Canada, Ottawa, Dominion Bureau of Statistics, Prices Division, 1967, mimeo., available on request.

Once these price adjustments had been applied to the GNE components and summed, the aggregates were arranged in the price and volume comparisons as shown in the table. Comparisons of volume and price are equally valid using either weighting system.

	U. S. Weighting	Canadian Weighting
Price relatives: the adjusting factor at detailed level	$\frac{P_c}{P_u} \cdot P_u Q_u = P_c Q_u$	$\frac{P_u}{P_c} \cdot P_c Q_c = P_u Q_c$
Price comparison	$\frac{\Sigma P_c Q_u}{\Sigma P_u Q_u}$	$\frac{\Sigma P_c Q_c}{\Sigma P_u Q_c}$
Volume comparison	$\frac{\Sigma Q_c P_u}{\Sigma Q_u P_u}$	$\frac{\Sigma Q_c P_c}{\Sigma Q_u P_c}$

Two price level comparisons between Canada and the United States can, therefore, be made by pricing output in each country with prices of the other country and comparing these with the value of output in national currencies. Alternatively, price differentials or ratios were weighted with both U. S. and Canadian GNE weights to derive two over-all price differentials or purchasing power equivalents at the total output level.

A relatively fine level of weighting was not attempted since, aside from consumption, detailed price differentials were lacking for other components of output. The breakdown of output was therefore at a fairly aggregate level, i. e. five categories of consumption, seven of government and eight of investment. This was also the level used to extrapolate the results for 1965 to 1950 and intermediate years. Price and volume indicators for these years were largely developed from official national accounts data on prices and constant dollar expenditures for the two countries.[1/]

The use of the two (U. S. and Canadian) national accounts weighting systems at this level of detail did not give significant differences in results; for 1965 the difference in the purchasing power equivalent of total output was only 2 per cent. This is a very small difference compared with that found between the United States and other countries in the Gilbert studies. The largest difference in 1965 was 4 per cent for the purchasing power equivalent of the public and private investment sector where weighting differences were the greatest between the two countries.[2/] Consumption showed only a small difference working at a four-category level of detail (food, other nondurables, durables, and services).

1/ See Milton Gilbert and Associates, Comparative National Products and Price Levels, Paris, OEEC, 1958, Technical Appendix, p. 157, for extrapolating procedures.

2/ A larger difference of 9 per cent for government purchases of goods occurred in 1965, more as a result of the difficulty of making an allocation of Canadian government purchases between durables and nondurables comparable to that of the United States than because of a true weighting difference.

Would a larger spread between the answers given by the two weighting systems have resulted if a finer level of detail had been utilized? The only available means of testing this hypothesis was to make use of the 35 spatial price relatives as published by the DBS consumer study. Aggregation of these relatives had been according to the Canadian 1957 Consumer Price Index weighting system. On reweighting the same 35 relatives with U. S. Consumer Price Index, December 1957 value weights, only a small difference in the aggregate price relative for consumption occurred. This follows from the marked similarity between the Canadian and U. S. Consumer Price Index weighting systems. The Dominion Bureau of Statistics obtained similar results, reweighting at the item level. The small difference in results using Canadian and U. S. weighting systems seems consistent with Denison's comment that "the choice between country A's or country B's weights makes a sharply diminishing difference as real per capita consumption converges".[1/]

The procedure for developing the purchasing power equivalents for the final expenditure categories is described below. The DBS material on price differences within consumption was derived primarily from data obtained for intertemporal price index purposes. Prices collected in 11 major urban centres in the United States and seven centres in Canada were averaged by the Dominion Bureau of Statistics to obtain national urban prices, utilizing population weights. Price differentials between Canada and the United States for some 200 items within consumer expenditures were derived in this manner, and aggregated according to the Canadian Price Index weighting system.[2/] Given the 35 spatial price relatives, as published by the Dominion Bureau of Statistics,[3/] it was then necessary to match them with national accounts categories of personal consumption expenditures. This was done by reaggregating the price differentials using the same weights to give purchasing power equivalents for food, durables, nondurables, and services, excluding shelter. These spatial price relatives were then aggregated on the basis of national accounts consumer expenditure weights. Since a price relative for shelter was not included in the DBS consumer comparisons, the implicit purchasing power equivalent of goods and services, excluding rent, was used for shelter.

For government, 1965 price differentials were established for the durable, nondurable, service and structures components of government expenditures on goods and services. These are the categories used by the United States for their published constant dollar estimates of government expenditure that were needed for extrapolation. The Canadian deflated series were arranged according to the same classification. For durables, the price differential for 1965 was taken to be the average of the price ratios established for motor vehicles and other machinery and equipment purchases. For nondurables, the implicit purchasing power equivalent established in consumption for goods was used. For government services, the 1965

1/ Edward F. Denison assisted by Jean-Pierre Poullier, Why Growth Rates Differ: Postwar Experience in Nine Western Countries, Washington, The Brookings Institution, 1967, p. 243.

2/ See John H. Young, Canadian Commercial Policy, Study for Royal Commission on Canada's Economic Prospects, Ottawa, Queen's Printer, 1957, for price differentials within consumption for the year 1955 developed in connection with his study of the cash cost of the Canadian tariff. It did not seem possible to cross-check the results with this Study. Aside from the need to extrapolate considerable item detail back to 1955, the valuation of products differs. The Young study compared manufacturers' prices in Canada, excluding tax, and the price of identical products laid down in Canada at the same point by a foreign supplier.

3/ Segal and Pratt, op. cit.

price ratio was derived from a comparison of the average income per worker for Canadian and U. S. federal employees. This showed Canadian earnings some 20 per cent below the American level. Except for highways, the price differentials developed for public structures, i. e. housing, non-residential building and engineering, were assumed to be identical to those developed for business investment. On the other hand, data were available to derive the price differential for highway construction between Canada and the United States. The Dominion Bureau of Statistics, in conjunction with the U. S. Bureau of Public Roads, matched price data implicit in each country's highway price index. Price ratios were developed for three major components of highway construction, i. e. earth excavation, crushed gravel and bituminous paving, on the basis of seven comparisons of adjacent U. S. states and Canadian provinces. Using these data supplied by the Dominion Bureau of Statistics, the three component ratios were combined to give an over-all price comparison. On this basis it was determined that highways were about 20 per cent cheaper to build in Canada than in the United States. This estimate has a number of statistical shortcomings. High variability between different years in the ratios for each component price necessitated the use of a four-year (1962-65) average. There were also significant level differences among these four-year ratio averages by geographic area and between the price ratios for bituminous paving and crushed gravel. The estimate is, by and large, considered weak and could possibly overstate the true price differential.

To establish price differentials for the business investment sector, reliance was predominantly on the interview technique. For construction, 16 international builders and associations were interviewed for their assessment of the price difference of identical structures built on both sides of the border. A number of different techniques were tried, including the Gilbert and Kravis "building operations method" -- an aggregation of cost comparisons of 11 different building operations. Even though identical structures are rarely built, even in the same country, it was possible to obtain a few good comparisons; one, for instance, was a cost-per-square-foot estimate for an identical store built across Canada and the Northern United States. In other cases, it was not known how successful the respondent was in adjusting for quality differences in the buildings compared, but, aside from a few extremes, there was enough central tendency, combining the results from different methods, to arrive at a real exchange rate of parity for non-residential building. Given a Canada-U. S. price ratio of 100 for non-residential building and 80 for highways, an average of 90 was assumed to be applicable for engineering construction. Lacking information to establish the purchasing power equivalent for engineering independently, it was assumed that the estimate for this type of project must lie between the estimates for interior and exterior work.

The interview technique did not prove feasible for residential construction since there are few companies in international house building. A couple of other approaches did not net any useful results, so that it was necessary to fall back on cost data for single detached dwelling units financed in the United States under the Federal Housing Administration, and in Canada under National Housing Act loans provided by Central Mortgage and Housing Corporation. However, it was not possible to exclude the cost of the site. Cost-per-square-foot comparisons were made on the basis of eight U. S. cities and seven Canadian cities weighted by population. This estimate suggested that Canadian housing prices were about 6 per cent lower than in the United States.

Time and resources would not allow the pricing of some 150 items of producers' durable equipment as done for the Gilbert and Kravis study. The international builders were therefore questioned as well on the price of machinery and equipment in Canada relative to the United States in order to supplement previous

findings of other company interviews.[1/] Almost invariably, it was suggested that Canadian machinery and equipment prices tended to meet the laid down cost in Canada of similar U. S. equipment. Depending on the item, prices in Canada could reach 40 per cent above the comparable U.S. item, reflecting 8 per cent exchange, 22 per cent duty and 11 per cent Canadian Federal Sales Tax. A figure of 30 per cent was chosen for other machinery and equipment in 1965 to approximate an average duty rate.

Agricultural machinery and vehicles were treated separately. There is a general consensus that farm machinery sells at the same price in the North American market irrespective of the Canada-U. S. border and that duty and Federal Sales Tax are not applicable on these items. Agricultural machinery and equipment would therefore be 8 per cent more expensive in Canada reflecting only the exchange rate. The extrapolation of these 1965 purchasing power equivalents for both agricultural and other machinery and equipment to other years resulted in estimates that, in most cases, were consistent with what would have been expected taking account of changes in the exchange and tax rates. Motor vehicles were given the same price differential as that established for private motor vehicles in consumer expenditures.

The remaining categories of expenditure, i. e. inventories and net exports, were given purchasing power equivalents in the base year, the same as that implicit in all the items covered in output thus far. For inventories, the 1965 results were extrapolated to other years using the U. S. and Canadian wholesale price index. Changes in the exchange rate were used to extrapolate the price of net exports to other years. Some experimentation was made with a direct estimate of the inventory price differential rather than rely on the implicit over-all purchasing power equivalent. Available price data in both countries on specific farm grains and livestock allow price differentials to be developed for agricultural inventories; however, indirect estimates were still necessary for nonagricultural inventories. Although this more direct estimate gave somewhat different results, data on prices of business inventories were such that it did not seem to warrant further development at this stage. Its effect on the over-all purchasing power equivalent was marginal due to the small weight of inventory changes in GNE.

The Appendix Table shows the results for various years in the purchasing power equivalent at the aggregate and major component level according to the two weighting systems. The intention is only to illustrate the results of weighting differences and extrapolation procedures, not to give credence to the magnitude of the detail. The consumption price relatives based on the DBS survey are assumed to be of high quality. In addition some confidence can be placed on the results at the aggregate GNE level. It will be appreciated, however, that considerably more research is needed before the other detailed component price relatives can be accepted as reliable.

The discussion thus far has related to price and real output comparisons between Canada and the United States based on market prices and a GNE-at-market-price weighting system. A primary objective of this Study was, however, to fit Canadian experience into the Denison framework where comparisons are expressed at factor cost. For this purpose, the question arose whether the relative price estimates would be significantly different if factor cost prices and weights were

---

1/ See D. J. Daly, B. A. Keys and E. J. Spence, Scale and Specialization in Canadian Manufacturing, Staff Study No. 21, Economic Council of Canada, Ottawa, Queen's Printer, 1968.

used. In the Gilbert and Kravis study, adjustments from market to factor were, in practice, limited to items such as tobacco and alcoholic beverages, where the tax incidence tends to differ from the average in each country. Such an adjustment for the Canada-U. S. comparisons did not seem to be a satisfactory solution since the level of the other indirect taxes in Canada still remained significantly above that of the United States as a proportion of output. One reason for this higher incidence is the proportionately higher revenues from custom import duties in Canada. This would cause a variety of other prices, aside from alcoholic beverages and tobacco, to need a correction from market to factor.

The lack of information on prices at factor cost and the distribution of indirect taxes meant that there was no entirely satisfactory solution to this problem. An attempt was made, however, to convert 1960 price relatives from a market-price to a factor-cost basis. The weighting system of GNE at market prices for both countries was first adjusted to factor cost by allocating indirect taxes to all final expenditure categories as accurately as possible. The total tax applicable to tobacco, alcoholic beverages and residential property taxes was determined initially since these applied to specific consumer expenditure items and were known to differ significantly between the two countries. The remaining taxes, such as sales taxes, licences and non-residential property taxes, etc., were assumed to be spread over all goods and services items roughly in proportion to expenditure. However, input-output data show that about 80 per cent of indirect taxes apply to consumer expenditure items. For Canada, indirect taxes are given separately for imported and domestic goods by final expenditure categories.[1/] Total indirect taxes on imported goods for Canada were allocated to consumer expenditure, government, investment, etc., according to the input-output relationships and allocated within these major groups according to final expenditure on goods (not services). A similar allocation was made for indirect taxes on domestic goods, other than the specific items (alcohol, etc.) already allocated. It was assumed that these taxes would apply to goods and services for consumption, to government expenditure on goods, but not services, and to all investment expenditures. An essentially similar method was used to allocated the U. S. indirect taxes.[2/]

With indirect taxes allocated, the factor cost weighting system was determined by subtracting the total tax from each expenditure item. However, the Canada-U. S. price differentials also need to be changed from market to factor. This was determined from the tax allocation as well, using the difference in tax incidence between the two countries for tobacco, alcoholic beverages, etc. Taxes as a percentage of sales calculated for each item were used to adjust the given market price differentials to a factor-cost basis.

1/ See DBS, Supplement to Inter-Industry Flow of Goods and Services, Canada, 1949 (13-513), Ottawa, Queen's Printer, 1960, Table 5, p. 16. Comparable data for the 1961 input-output study were not yet available; it was assumed that the allocation proportions did not change significantly between 1949 and 1961.

2/ See Jack Alterman, "A Framework for Analysis of the Industrial Origin of Income, Product, Costs and Prices", Conference on Research in Income and Wealth, December 1-2, 1966, NBER, Inc., New York, unpublished mimeo., Table 6, for the indirect tax proportions of final demand categories.

Given these estimates of GNE at factor cost, and factor-cost price differentials between Canada and the United States in 1960, purchasing power equivalents or aggregate price differentials at factor cost were determined for consumer expenditures, etc., and total GNE. The adjustment from market to factor lowered Canadian prices at the consumer expenditure level a further 4 per cent relative to U. S. prices. At the total GNE level, the effect of the adjustment from market to factor cost was smaller; Canadian GNE prices were 2 per cent lower using either the U. S. or the Canadian weighting systems.

Appendix Table

CANADA-U.S. PURCHASING POWER EQUIVALENTS(1)

WITH U.S. AND CANADIAN GNE AT MARKET PRICE WEIGHTS

	1950		1955		1960		1962		1964		1965		1966	
	Weighting		Weighting		Weighting		Weighting		Weighting		Weighting		Weighting	
	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.
Consumption	96.7	94.3	98.8	96.7	97.8	95.9	97.8	96.3	98.5	97.0	99.3	97.7	100.1	98.5
Goods	103.7	101.1	104.2	101.7	102.7	100.3	102.6	100.6	103.9	102.0	104.5	102.5	105.3	103.2
Services	82.3	82.0	89.3	88.6	90.2	89.5	90.7	90.1	90.7	90.2	91.8	91.3	92.5	92.0
Government	79.3	79.8	89.1	82.1	85.9	82.2	87.0	83.4	87.8	85.6	88.6	87.1	91.1	90.6
Goods	100.0	91.8	113.3	85.2	113.9	96.7	115.5	101.6	119.1	109.3	119.4	110.1	118.3	108.4
Services	70.3	70.3	75.6	75.6	73.7	73.7	76.1	76.1	76.8	76.8	77.6	77.6	82.4	82.4
Structures	88.3	87.6	93.9	93.5	88.2	86.5	82.5	81.4	85.5	81.6	90.0	85.4	89.8	87.6
Investment	91.9	89.4	97.2	94.3	98.9	94.7	101.6	96.2	107.0	102.0	108.4	105.4	110.5	105.8
Structures	79.0	80.6	87.1	86.4	88.9	86.6	89.8	87.8	93.2	91.4	95.3	94.0	97.2	95.8
Machinery and equipment	107.8	106.6	113.6	113.0	113.4	112.3	118.1	117.3	124.8	124.1	126.5	125.6	127.0	126.0
Inventories	98.2	96.5	95.0	93.4	92.7	91.1	96.4	94.8	98.7	97.0	98.7	97.0	99.0	97.3
Net exports	108.9	108.9	98.6	98.6	97.0	97.0	106.9	106.9	107.9	107.9	98.7	97.0	107.7	107.7
Gross National Expenditure at market prices	93.4	91.2	96.7	93.3	95.6	92.8	96.2	93.5	97.7	95.5	98.7	97.0	100.0	98.3

(1) The term "purchasing power equivalent" refers to relative price level comparisons between Canada and the United States. For instance, in 1950, within consumption, the basket of goods making up Canadian expenditures was estimated to be 1.1 per cent more expensive in Canada than in the United States while the somewhat different basket of U.S. consumption goods was 3.7 per cent more expensive in Canada than in the United States. On the other hand, the price of services in 1950 was about 20 per cent cheaper in Canada than in the United States, irrespective of the weighting system used.

LIST OF TABLES

TABLES IN NOTES

PUBLICATIONS OF ECONOMIC COUNCIL OF CANADA

Annual Reviews	Author—Auteur
First Annual Review: Economic Goals for Canada to 1970 (EC21-1/1964, $3.50)	Council—Conseil
Second Annual Review: Towards Sustained and Balanced Economic Growth (EC21-1/1965, $2.75)	Council—Conseil
Third Annual Review: Prices, Productivity and Employment (EC21-1/1966, $2.75)	Council—Conseil
Fourth Annual Review: The Canadian Economy From the 1960's to the 1970's (EC21-1/1967, $2.75)	Council—Conseil
Fifth Annual Review: The Challenge of Growth and Change (EC21-1/1968, $2.75)	Council—Conseil
Staff Studies	
1. Population and Labour Force Projections to 1970 (EC22-1/1, $.75)	F. T. Denton Y. Kasahara S. Ostry
2. Potential Output, 1946 to 1970 (EC22-1/2, $1.00)	B. J. Drabble
3. An Analysis of Post-War Unemployment (EC22-1/3, $.75)	F. T. Denton S. Ostry
4. Housing Demand to 1970 (EC22-1/4, $.75)	W. M. Illing
5. Business Investment to 1970 (EC22-1/5, $1.00)	D. A. White
6. Special Survey of Longer Range Investment Outlook and Planning in Business (EC22-1/6, $.25)	B. A. Keys

PUBLICATIONS DU CONSEIL ÉCONOMIQUE DU CANADA

Exposés annuels	
Premier exposé annuel: Objectifs économiques du Canada pour 1970 (EC21-1/1964F, $3.50)	
Deuxième exposé annuel: Vers une croissance économique équilibrée et soutenue (EC21-1/1965F, $2.75)	
Troisième exposé annuel: Les prix, la productivité et l'emploi (EC21-1/1966F, $2.75)	
Quatrième exposé annuel: L'économie canadienne des années 1960 aux années 1970 (EC21-1/1967F, $2.75)	
Cinquième exposé annuel: Défi posé par la croissance et le changement (EC21-1/1968F, $2.75)	
Études préparées par le personnel	
1. Projections de la population et de la main-d'œuvre jusqu'à 1970 (EC22-1/1F, $.75)	
2. Potentiel de production, 1946 à 1970 (EC22-1/2F, $1.00)	
3. Une analyse du chômage depuis la fin de la guerre (EC22-1/3F, $.75)	
4. Demande d'habitations pour 1970 (EC22-1/4F, $.75)	
5. Investissements privés pour 1970 (EC22-1/5F, $1.00)	
6. Enquête spéciale sur les intentions et la programmation à moyen terme des entreprises privées (EC22-1/6F, $.25)	

Staff Studies (continued)

7. Canada and World Trade (EC22-1/7, $.50)	M. G. Clark	
8. Export Projections to 1970 (EC22-1/8, $.75)	J. R. Downs	
9. Federal Tax Revenues at Potential Output, 1960 and 1970 (EC22-1/9, $.50)	D. J. Daly	
10. National Saving at Potential Output to 1970 (EC22-1/10, $.50)	F. Wildgen	
11. Changes in Agriculture to 1970 (EC22-1/11, $.50)	J. Dawson	
12. The Contribution of Education to Economic Growth (EC22-1/12, $1.90)	Gordon W. Bertram	
13. Internal Migration in Canada, 1921-1961 (EC22-1/13, $1.60)	Isabel B. Anderson	
14. Interregional Disparities in Income (EC22-1/14, $1.75)	S. E. Chernick	
15. An Analysis of Interregional Differences In Manpower Utilization and Earnings (EC22-1/15, $1.00)	F. T. Denton	
17. Business Cycles in Canada (EC22-1/17, $2.25)	D. A. White	
18. Manpower Planning in Industry: A Case Study (EC22-1/18, $1.00)	B. A. Keys H. H. Wright	
19. Population, Family, Household and Labour Force Growth to 1980 (EC22-1/19, $1.00)	W. M. Illing Y. Kasahara M. V. George F. T. Denton	
20. Enrolment in Schools and Universities, 1951-52 to 1975-76 (EC22-1/20, $1.25)	W. M. Illing Z. Zsigmond	
21. Scale and Specialization in Canadian Manufacturing (EC22-1/21, $1.75)	D. J. Daly B. A. Keys E. J. Spence	

Études préparées par le personnel (suite)

7. Le Canada et le commerce mondial (EC22-1/7F, $.50)
8. Projections des exportations jusqu'à 1970 (EC22-1/8F, $.75)
9. Rendement des impôts fédéraux dans l'hypothèse de la réalisation du potentiel de production 1960 et 1970 (EC22-1/9F, $.50)
10. L'épargne nationale dans l'hypothèse de la réalisation du potentiel de production pour 1970 (EC22-1/10F, $.50)
11. Changements dans le secteur agricole jusqu'à 1970 (EC22-1/11F, $.50)
12. Apport de l'éducation à la croissance économique (EC22-1/12F, $1.90)
13. Migration à l'intérieur du Canada, 1921-1961 (EC22-1/13F, $1.60)
14. Disparités interrégionales du revenu (EC22-1/14F, $1.75)
15. Analyse des différences interrégionales dans l'utilisation de la main-d'œuvre et le revenu gagné (EC22-1/15F, $1.00)
†17. Les cycles économiques au Canada (EC22-1/17F, $2.25)
18. La planification de la main-d'œuvre dans l'industrie (Étude de cas) (EC22-1/18F, $1.00)
19. La croissance de la population, du nombre de familles et de la main-d'œuvre, jusqu'en 1980 (EC22-1/19F, $1.00)
20. Inscriptions aux écoles et aux universités, 1951-1952 à 1975-1976 (EC22-1/20F, $1.25)
21. Échelle et spécialisation dans l'industrie manufacturière canadienne (EC22-1/21F, $1.75)

Staff Studies (continued)

22.	Medium-Term Business Investment Outlook: 1967 Survey (EC22-1/22, $.35)	B. A. Keys
23.	Canadian Income Levels and Growth: An International Perspective (EC22-1/23, $2.25)	Dorothy Walters
*24.	Canadian Agricultural Productivity (EC22-1/24)	L. Auer

Special Studies

1.	Immigration and Emigration of Professional and Skilled Manpower During the Post-War Period (EC22-2/1, $1.50)	L. Parai
2.	A Survey of Labour Market Conditions, Windsor, Ontario, 1964: A Case Study (EC22-2/2, $.50)	G. R. Horne W. J. Gillen R. A. Helling
3.	Perspective on Canada's International Payments (EC22-2/3, $1.60)	David W. Slater
4.	Incomes Policies—Some Foreign Experiences and their Relevance for Canada (EC22-2/4, $1.75)	David C. Smith
5.	Price Stability and High Employment: The Options for Canadian Economic Policy: An Econometric Study (EC22-2/5, $3.25)	R. G. Bodkin E. P. Bond G. L. Reuber T. R. Robinson
6.	Canadian Labour Relations in an Era of Technological Change (EC22-2/6, $1.25)	J. R. Cardin
7.	Canadian Policies for Rural Adjustment: A Study of the Economic Impact of ARDA, PFRA, and MMRA (EC22-2/7, $2.25)	Helen Buckley Eva Tihanyi
8.	Science, Technology and Innovation (EC22-2/8, $1.50)	Andrew H. Wilson
9.	Effective Protection in the Canadian Economy (EC22-2/9, $1.00)	James R. Melvin Bruce W. Wilkinson

Études préparées par le personnel (suite)

22.	Perspectives à moyen terme des investissements des entreprises: Relevé de 1967 (EC22-1/22F, $.35)
†24.	La productivité de l'agriculture au Canada (EC22-1/24F)

Études spéciales

1.	Immigration et émigration de spécialistes et de travailleurs qualifiés depuis la fin de la guerre (EC22-2/1F, $1.50)
2.	Relevé des conditions du marché du travail à Windsor (Ontario), 1964 (Étude de cas) (EC22-2/2F, $.50)
3.	Perspectives quant aux paiements internationaux du Canada (EC22-2/3F, $1.60)
4.	Politiques des revenus—certaines expériences à l'étranger et les conclusions à en tirer pour le Canada (EC22-2/4F, $1.75)
6.	Les relations du travail au Canada face aux changements technologiques (EC22-2/6F, $1.25)
†7.	Politiques canadiennes de rajustement rural: Étude des répercussions économiques des programmes ARDA, PFRA et MMRA (EC22-2/7F, $2.25)
8.	Science, technologie et innovation (EC22-2/8F, $1.50)
†9.	Protection effective dans l'économie canadienne (EC22-2/9F, $1.00)

Conference Papers and Reports

National Conference on Labour-Management Relations (1964)
(EC22-364, $2.00)

National Conference on Labour-Management Relations (1967)
(EC22-367, $2.00)

Conference on Stabilization Policies, Report of the Conference at University of Western Ontario, August 1965
(EC22-665, $3.00)

Conference on International Trade and Canadian Agriculture, Banff, Alberta, January 1966
(EC22-766, $3.00)

Conference on Government Information Systems, Ottawa, October 5 and 6, 1967
(EC22-1168, $1.50)

Documents et rapports de colloques

Colloque national sur les relations patronales-ouvrières (1964)
(EC22-364F, $2.00)

Colloque national sur les relations patronales-ouvrières (1967)
(EC22-367F, $2.00)

Colloque sur les politiques de stabilisation, Rapport du colloque tenu à l'Université Western Ontario, août 1965
(EC22-665F, $3.00)

Colloque sur le commerce international et l'agriculture canadienne, Rapport du colloque tenu à Banff (Alberta), janvier 1966
(EC22-766F, $3.00)

Papers presented at Conferences on Productivity through New Technology

Modern Management (EC22-4/1, $.50)	G. G. Fisch
Practical Application of Data Processing in Small and Medium Manufacturing Companies (EC22-4/2, $.75)	H. S. Gellman R. C. Carroll
A Practical Approach to Automatic Production (EC22-4/3, $.50)	D. J. Clough J. W. Abrams R. W. P. Anderson
Advances in Metal Working (EC22-4/4, $.75)	J. Vande Vegte
Improving Material Movement Through the Manufacturing Cycle (EC22-4/5, $.50)	J. A. Brown B. D. Beamish
The Economic Justification of New Equipment (EC22-4/6, $.75)	C. G. Edge

Documents présentés aux Colloques sur la productivité par la nouvelle technologie

La gestion moderne
(EC22-4/1F, $.50)

Application pratique du traitement de l'information dans les petites et les moyennes entreprises industrielles
(EC22-4/2F, $.75)

Manière pratique d'envisager la production automatique
(EC22-4/3F, $.50)

Les progrès dans le travail des métaux
(EC22-4/4F, $.75)

L'amélioration du mouvement du matériel à travers le cycle manufacturier
(EC22-4/5F, $.50)

Justification économique du renouvellement de l'équipement
(EC22-4/6F, $.75)

Papers presented at Conferences on Productivity through New Technology (continued)

New Technology in Materials and Processes (EC22-4/7, $.70)	J. Vande Vegte	Nouvelle technologie visant les matières premières et les procédés (EC22-4/7F, $.70)

Other Studies and Reports

Annual Report (1964) (EC1-1964, $.50)	John J. Deutsch	Rapport annuel (1964) (EC1-1964F, $.50)
Annual Report (1965) (Fo 1/1965, $.50)	John J. Deutsch	Rapport annuel (1965) (Fo 1/1965F, $.50)
Annual Report (1966) (EC1-1966, $.50)	John J. Deutsch	Rapport annuel (1966) (EC1-1966F, $.50)
Annual Report (1967) (EC1-1967)	John J. Deutsch	Rapport annuel (1967) (EC1-1967F)
Annual Report (1968) (EC1-1968)	Arthur J. R. Smith	Rapport annuel (1968) (EC1-1968F)
A General Incentive Programme to Encourage Research and Development in Canadian Industry, A Report to the Economic Council of Canada (EC22-565, $.60)	Advisory Committee on Industrial Research and Technology—Comité consultatif sur la recherche industrielle et la technologie	Programme général de stimulation des travaux de recherche et de développement dans l'industrie canadienne, Rapport présenté au Conseil économique du Canada (EC22-565F, $.60)
A Declaration on Manpower Adjustments to Technological and Other Change (EC22-866, $.75)	Council—Conseil	Une déclaration au sujet de l'adaptation de la main-d'œuvre aux changements technologiques et autres (EC22-866F, $.75)
Towards Better Communications Between Labour and Management (EC22-967, $.25)	Council—Conseil	Vers une amélioration de la communication entre patrons et travailleurs (EC22-967F, $.25)
Interim Report—Consumer Affairs and the Department of the Registrar General (EC22-1067, $.25)	Council—Conseil	Rapport provisoire sur les affaires du consommateur et le ministère du Registraire général (EC22-1067F, $.25)

*forthcoming

†en préparation

Copies of the above publications may be obtained in English and French from the Queen's Printer, Ottawa. Payment should accompany orders to avoid possible delay in shipment.

On peut se procurer des exemplaires de ces publications, en anglais et en français, chez l'Imprimeur de la Reine, à Ottawa. Afin d'éviter les retards d'expédition, prière d'envoyer les chèques en même temps que les commandes.

Canadian Income Levels and Growth:

An International Perspective

by Dorothy Walters

Economic Council of Canada