# The Contribution of Education to Economic Growth
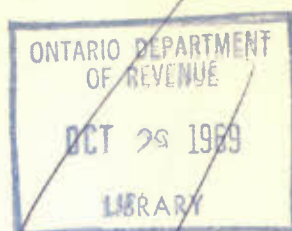
*by* Gordon W. Bertram

*prepared for the*
*Economic Council of Canada*

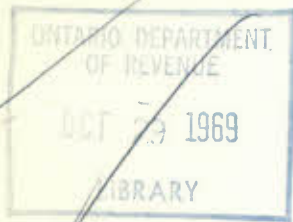# The Contribution of Education to Economic Growth
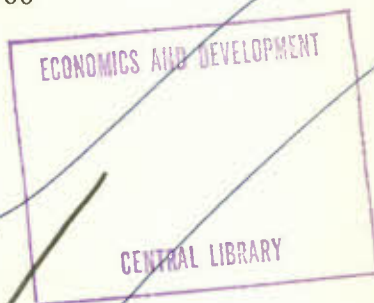
by

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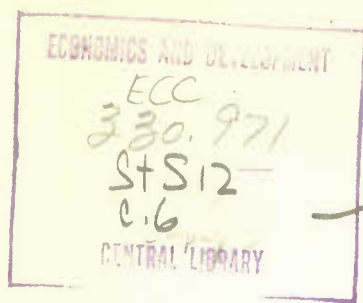
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# CHAPTER 1

## INTRODUCTION

It is universally recognized that education enhances the quality of life of individuals, as well as the quality and energy of a whole society. Education also has a significant economic dimension, and it is primarily this aspect which is the focus of attention in this study. Although the general importance of education has long been recognized, the relationship between education and economic growth has only recently become the object of empirical research, most of which has been carried out in the United States.[1]

This study represents a new analysis of Canadian experience in the field of education and economic growth.

It should be emphasized that attempts to measure the effect of changes in the level of education on economic growth in no way imply that other dimensions of education are unimportant. Given the value systems operating in a democratic society, an informed electorate and a labour force with a real opportunity for upward mobility represent important social benefits yielded by education.

The concept of "education" used here is that of formal schooling. The basic data in this study exclude certain minor parts of the formal education system, and do not take account of various forms of training after formal education — for example, vocational, technical and apprenticeship training as well as worker and management training received on the job, and other training. Although such types of education are of growing importance, especially with a view to keeping worker and management training up to date in the context of rapid scientific and technological change, data on the importance of these forms of education are not available, nor is there any Canadian information on the quantitative effect these forms of training may have on income. It is important to distinguish the effect on income due to experience from that due to formal education. However, many forms of training obtained on the job after the completion of formal schooling could not be easily distinguished statistically from the more general aspect of work experience.

At various points in this study, especially in Chapter 2, comparisons are made of levels of, and changes in, educational attainments between Canada and

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[1] See, for example, Edward F. Denison, *The Sources of Economic Growth in the United States and the Alternatives Before Us,* Supplementary Paper No. 13, Committee for Economic Development, January 1962 (subsequently referred to in this study as *The Sources of Economic Growth*).

the United States. Such comparisons are relevant and useful for analytical pur-
poses. They are based, however, on the important assumption that a given year
of schooling is equivalent for the two countries in terms of educational quality.
There exist, admittedly, major differences in the quality of education − not only
over time, but also at any given point of time between different regions and local-
ities within Canada, within the United States, and between these two countries.
There does not appear to exist any comprehensive review of evidence regarding
the over-all extent of all these differences. One can find examples of high stand-
ards of education within each country which compare favourably with standards in
various parts of the other country. Each country's educational systems offer, at
the various levels of education, examples that range from excellent to inadequate.
In the absence of any definitive study of educational standards in the two coun-
tries, we have adopted the working assumption that a year of education in each
country was, on average, approximately equivalent.[1]

Education is only one of the significant variables in economic growth. The
importance of the various sources of economic growth is different in different coun-
tries, in different periods of history. No one factor can serve as a universal key
explanation of growth; a combination of many factors appears to be required. Until
very recently, however, economists generally attempted to offer explanations of
differences in growth among countries in terms which placed a very heavy empha-
sis on the growth of physical capital and numbers of workers, and which paid
little or no attention to changes in the quality of the labour force. Yet, an increase
in the skills and knowledge of a population through education raises productivity
and real income in the same manner as an increase in the stock of physical capi-
tal (or advances in technology).[2] Moreover, the improvement in the educational
quality of human capital appears to have been very large in the twentieth century
in many countries, and various studies in recent years suggest that education is
one of the most important factors contributing to economic growth.

Part of the explanation of the neglect to analyze education and human capital
as a factor in economic growth may lie in an unwillingness to regard education as

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[1] A thorough review of this subject would require greater familiarity with curriculum con-
tent, teacher qualifications etc. and this could only be adequately gained by studies at
the state and provincial levels.

[2] Interest in growth economics is not entirely new, however. Indeed, the wealth of nations
was a dominant theme of the classical economists. Recognition of the necessity of tak-
ing into account the stock of human capital in a definition of capital is hardly new ei-
ther. Adam Smith, for example, defined fixed capital as including machinery, buildings,
improvements in land and "the acquired and useful abilities of all inhabitants or mem-
bers of the society. The acquisition of such talents, by the maintenance of the acquirer
during his education, study, or apprenticeship, always costs a real expense, which is a
capital fixed and realized, as it were, in his person. Those talents, as they may make a
part of his fortune, so do they likewise of that of the society to which he belongs. The
improved dexterity of a workman may be considered in the same light as a machine or
instrument of trade which facilitates and abridges labour, and which, though it costs a
certain expense, repays that expense with profit." (*The Wealth of Nations*, Modern Li-
brary, 1937, pp. 265-6).

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an investment in human beings.[1] Theodore Schultz has argued, however, that wealth exists only for the advantage of people, and human capital or wealth does not contradict this concept since people can enlarge the range of choice available to them by investing in themselves.

A more complete understanding of the reasons for differences in economic growth – as measured, say, by increases in per capita incomes among countries – will ultimately depend on the construction of better models of the growth process with appropriate quantification and measurement of the main variables involved where this is possible.[2] One of the very fruitful attempts to measure the variables contributing to economic growth is Denison's *The Sources of Economic Growth*.[3] Denison's method, which can be classified as one of a variety of "residual approaches",[4] is to identify and measure the changes in the inputs of labour and capital associated with the total increase in the national product over a given period of time. For example, Denison found that the increase in the growth rate in the quantity of the total identifiable inputs (but also including the change in the quality of labour input due to education and other factors) represented two thirds of the annual average growth rate in U.S. national income over the period 1929-57. The remaining third – the residual – could be due to unspecified or unidentified inputs, although Denison's approach is to describe the remaining one third as the result of increases in output per unit of input (broadly, productivity increases). He provides further separate estimates of various sources of the increase in productivity and ultimately arrives at a final residual which he terms the "advance in knowledge" and which represents approximately one fifth of the 2.93 per cent rate of growth in national income.

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See Theodore W. Schultz, "Investment in Human Capital", *American Economic Review*, March 1961, p. 2. Schultz, one of the pioneer contributors to studies of education and economic growth, noted that: "The mere thought of investment in human beings is offensive to some among us. Our values and beliefs inhibit us from looking upon human beings as capital goods, except in slavery, and this we abhor. We are not unaffected by the long struggle to rid society of indentured service and to evolve political and legal institutions to keep men free from bondage. These are achievements that we prize highly. Hence, to treat human beings as wealth that can be augmented by investment runs counter to deeply held values. It seems to reduce man once again to a mere material component, to something akin to property. And for man to look upon himself as a capital good, even if it did not impair his freedom, may seem to debase him."

[2] Since economic growth appears to be affected by a wide variety of noneconomic factors and institutions, a general theory of economic growth is dependent upon the difficult task of constructing a general theory of historical development. In societies such as Canada where positive attitudes to change and development were largely inherited from existing European cultures, attempts to measure and quantify growth variables are subject to less complications.

[3] Edward F. Denison, *op. cit.*

[4] See William G. Bowen, "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches", *Economic Aspects of Higher Education*, Organization for Economic Co-operation and Development, 1964, pp. 177-200. In the residual approach the total increase in measurable inputs is compared with the measured output of the economy over time. Since the growth in inputs turns out to be smaller than the growth in output, a portion of the remaining residual growth is usually attributable to unspecified inputs. See Chapter 3 and Appendix B-8 for a further discussion of the residual approach.

In addition, a new perspective has been gained on the relative importance of certain growth variables as a result of Denison's analysis. The contribution of change in the quantity and quality of labour inputs has been measured in Denison's system in more meaningful ways, so that the contribution of education, for example, to the improvement in the quality of labour inputs and thus its contribution to economic growth is estimated as contributing 42 per cent of the growth in income per employed person, or 23 per cent of the growth in national income, in the United States over the period 1929–57.[1] This contribution to rising output per employed person (and consequently to rising living standards) was larger in the United States than that of any other single factor over that period. As will be discussed in Chapter 3 of this study, education as a source of economic growth in Canada over the same period was also an important growth factor, although, relatively, considerably less important than in the United States.

As discussed briefly in Chapter 3, Denison's growth model and certain of his operational assumptions have been widely discussed by economists. This study takes seriously the view that Abramovitz expressed in his review of Denison's book *The Sources of Economic Growth:* "It is, at the very least, a beautifully ordered program of research and a reasonable, indeed, an indispensable, basis for discussions of policy."[2] The residual and related discussions have proceeded in the United States over the last 10 years, but there have so far been no published estimates of the magnitude of the Canadian residual. From a broader perspective, this study of the contribution of education to economic growth in Canada should be considered as a preliminary step towards the eventual development of a more complete and explicit analysis of the various factors which have contributed to past increases in the real income and living standards of Canadians. It is well known that Canada ranks very high among the nations of the world in per capita income. What is less well known is that per capita income in Canada has remained persistently about one quarter below that of the United States since the turn of the century.[3] The existence of the unfavourable differential in per capita income provides an immediate and practical reason for an investigation of the underlying causes of the income gap with the United States – a country whose economic experience is amongst the most relevant for Canada.

This study begins in Chapter 2 with a statistical analysis of the changes of education over a fifty-year period with reference to Canada's own progress in education and its performance in the light of the changes in educational attainment in the United States. Much of the information necessary for the growth computations made in Chapter 3 is established in Chapter 2. The methods and results of

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[1] For a summary table of Denison's sources of economic growth in the United States, see Appendix Table A-16.

[2] Moses Abramovitz, "Economic Growth in the United States, A Review Article", *American Economic Review*, September 1962, pp. 762-763.

[3] See Chapter 3 for a fuller discussion of Canada - United States income differentials.

the attempt to measure the contribution of education to economic growth in Canada and a comparison of education's contribution to economic growth in the United States are presented in Chapter 3. The conclusions of the study are brought together in Chapter 4. Appendix A contains the more detailed statistical tables, and Appendix B provides an explanation and evaluation of the data, and the methods and assumptions of the study.

# CHAPTER 2

## CHANGES IN EDUCATIONAL ATTAINMENTS

### BASIC ESTIMATES

The basic educational statistics required for later analysis are presented in summary form in this section of the study, together with a brief outline of their derivation. The supporting data, and discussions of the methods and assumptions underlying the basic estimates, are provided in the appendices.

This study is confined to males, since their participation in the labour force is almost continuous in the age group 25–64, whereas the participation rate of females in the labour force is much lower and varies substantially by age group. The age group 25–64 was chosen as the appropriate one for study; persons under 25 in many cases have not completed their education, and persons over 65 generally retire.

Table 1 summarizes the years of education of the male labour force by occupational groups as of 1961 (a more detailed tabulation of educational attainments by occupational and age groups in 1961 is presented in Appendix Tables A-2 and A-3).

Appendix B-1 discusses relevant information concerning the 1961 Census enumeration of years of schooling, of which one aspect should be noted here. The years of schooling in Table 1 refer to the highest grade or year *attended* (but not necessarily completed) by persons in the 1961 labour force. In the 1941 and 1951 Censuses, the years of schooling refer to the total number of years a person spent in school — a total that may include some repeated grades. It is likely that the past three Canadian Censuses (particularly the 1961 Census) represent some small overstatement, when compared with the years of education reported by the U.S. Census which registered a person's highest grade completed. As noted earlier, the working assumption of this study is that a year of education in each country was, on the average, approximately equivalent.[1]

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[1] It is possible that the quality of the education programme was higher at the urban high school level in Canada relative to the United States in recent decades when a smaller proportion of students completed high school in Canada than in the United States. This would be in keeping with the assumption that the presumably brighter children entered and completed high school, but entrance and completion of high school may have been as much a question of the socio-economic status of the student's family as the student's intellectual ability.

The very similar income differentials earned by males with high school education in Canada and the United States, while not evidence in itself that a year of schooling was equivalent in the two countries, is of interest. In Canada the education-income percentage differential for males with one to three years of high school compared to a base of 100 for males with only grade eight education, was estimated as 108.5 in Canada and 109 in the United States. For males with four years of high school, the percentage was 123 in Canada and 124 in the United States. The percentages are based on the assumption that three fifths of the education-income differential was attributable to differences in education. See Table 20 for Canada and Appendix Table A-14 for the United States.

**TABLE 1**

**Education of the Male Labour force, 25–64 Years of Age, by Occupation, 1961**

(Percentage distribution)

| | Total | Elementary School | | High School | | | Some University | University | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0–4 Years | 5–8 Years | 1–3 Years | 4 Years | 5 Years | | Some University (Incl. 5 yrs. H.S.) | Complete University |
| All Occupations ................ | 100.0 | 7.5 | 38.4 | 29.7 | 8.7 | 6.2 | 3.9 | 10.1 | 5.6 |
| Managerial................... | 100.0 | 2.6 | 21.2 | 31.8 | 14.8 | 13.0 | 8.2 | 21.2 | 8.4 |
| Professional and technical...... | 100.0 | 0.3 | 4.5 | 12.5 | 9.9 | 11.0 | 13.9 | 24.9 | 47.9 |
| Clerical ..... ............... | 100.0 | 1.4 | 21.9 | 39.6 | 16.7 | 12.4 | 5.9 | 18.3 | 2.1 |
| Sales....................... | 100.0 | 1.7 | 20.5 | 37.9 | 16.2 | 12.3 | 7.5 | 19.8 | 3.9 |
| Service and recreation......... | 100.0 | 7.4 | 38.5 | 35.7 | 8.8 | 5.0 | 2.7 | 7.7 | 1.9 |
| Transport and communication.... | 100.0 | 6.3 | 47.8 | 34.7 | 6.0 | 3.4 | 1.4 | 4.8 | 0.4 |
| Farmers and farm workers ...... | 100.0 | 13.5 | 57.4 | 22.4 | 3.7 | 1.5 | 1.0 | 2.5 | 0.4 |
| Loggers and related workers..... | 100.0 | 29.2 | 51.8 | 14.8 | 2.2 | 1.2 | 0.6 | 1.8 | 0.3 |
| Fishermen, trappers, hunters ..... | 100.0 | 36.6 | 44.7 | 15.8 | 1.7 | 0.8 | 0.4 | 1.2 | 0.1 |
| Miners, quarrymen and related .... | 100.0 | 12.1 | 52.5 | 26.7 | 4.3 | 2.4 | 1.4 | 3.8 | 0.4 |
| Craftsmen, production process and related ................... | 100.0 | 7.5 | 47.2 | 32.4 | 6.9 | 4.1 | 1.4 | 5.5 | 0.4 |
| Labourers, n.e.s................ | 100.0 | 20.1 | 56.5 | 18.5 | 2.7 | 1.4 | 0.6 | 2.0 | 0.1 |
| Occupations not stated .......... | 100.0 | 7.9 | 29.9 | 35.9 | 13.4 | 5.8 | 5.4 | 11.2 | 1.8 |

Note: Totals may not add due to rounding.

Source: Appendix Table A-2.

Since available tabulations of the Census of 1961 did not distinguish those members of the labour force with four years of high school from those with five years of high school by age groups, it was necessary to separate the two grades. Appendix B-2 and Appendix Table A-3 provide the method and data for the calculation of this estimate. It is judged that the method used somewhat overestimates the number of males in the younger age groups attending grade thirteen. The calculations were necessary, however, since students completing grade thirteen are generally accepted as second-year university students in many Canadian and U.S. universities, and their presence adds significantly to the stock of education in the Canadian labour force (see Appendix B-3). Table 1 records grade thirteen students separately and in combination with the category "some university".

In order to reconstruct the record of decennial changes in the educational attainment of the Canadian labour force over the 50-year period 1911-61, an "age cohort" method was used to move back given age groups by 10-year intervals from the Census of 1961 (see Appendix B-4). With the aid of the 1951 and 1941 Censuses of years of schooling attained by the male population, together with labour force immigration and emigration adjustments, and the use of mortality adjustments, estimates of the educational attainment of the labour force were developed for each decade 1911 through 1951.

Table 2 and Appendix Table A-4 provide estimates of the number of persons in the Canadian male labour force 25–64 years of age by years of schooling in each decade 1911-61. No information concerning the years of schooling of the labour force or population existed prior to the 1941 Census, while in the 1951 and 1941 Censuses, the educational attainment by years of high school and university education were not presented in a form comparable to the 1961 Census. Consequently, the starting point of the cohort analysis was the Census of 1961.

The methods and assumptions underlying Table 2 are discussed in more detail in Appendix B-4, but a brief description here of the construction of the table is appropriate. Since the number of persons involved in international migration in Canada was large, both in relative and absolute terms, the first step in the estimation procedure was an adjustment for migration. In Denison's study, *The Sources of Economic Growth*, no adjustment was made in the estimates of the stock of education in the U.S. labour force for migration; except for the period 1910–20, net migration in the United States constituted only a relatively small part of the total labour force. In contrast, in what became a major portion of this study, estimates were made of the number of immigrants and emigrants for each relevant age group by level of education for the male labour force in each decade 1911–61. The migration estimates for Canada made in this study must be considered only as reasonable approximations; although they lack precision, they are believed to indicate correct orders of magnitude. Particular care was taken with the 1951–61 and 1921–31 estimates of migration since the numbers involved in these two periods were very large. Estimating procedures, difficulties in obtaining data, and conflicts in data for both immigration and emigration are discussed in Appendix B-9. The implications of labour force migration in 1911–61 for Canadian economic

**TABLE 2**

Estimates of Educational Attainment of Male Labour Force, 25–64 Years of Age, 1911–61

(Thousands)

| | Total | Elementary School | | High School | | University | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | 0–4 Years | 5–8 Years | 1–3 Years | 4 Years | Some University[1] | Complete University |
| 1961 Gross labour force .......... | 3,717 | 280 | 1,428 | 1,103 | 323 | 376 | 208 |
| Net of 1951–61 migration ..... | 3,453 | 264 | 1,328 | 1,021 | 301 | 348 | 191 |
| 1951 Gross labour force .......... | 3,029 | 329 | 1,265 | 801 | 250 | 228 | 157 |
| Net of 1941–51 migration ..... | 2,954 | 322 | 1,235 | 780 | 243 | 222 | 153 |
| 1941 Gross labour force .......... | 2,520 | 364 | 1,158 | 583 | 175 | 132 | 108 |
| Net of 1931–41 migration ..... | 2,512 | 363 | 1,154 | 581 | 174 | 132 | 108 |
| 1931 Gross labour force .......... | 2,085 | 379 | 1,022 | 426 | 116 | 66 | 77 |
| Net of 1921–31 migration ..... | 2,129 | 387 | 1,043 | 434 | 136 | 51 | 79 |
| 1921 Gross labour force .......... | 1,869 | 389 | 930 | 368 | 83 | 39 | 61 |
| Net of 1911–21 migration ..... | 1,797 | 376 | 896 | 355 | 76 | 37 | 58 |
| 1911 Gross labour force .......... | 1,511 | 365 | 765 | 274 | 48 | 23 | 36 |

[1] Includes Grade 13 for provinces in which it was given for each age group in 1961, and the age groups 25–54 in 1951, 25–44 in 1941 and 25–34 in 1931.

Source: Appendix Table A-4.

development, quite aside from the influence of migration on the stock of education in the Canadian labour force, are considered later.

The central assumption made in the migration study was that the educational level of the migrant could be determined by his occupation. Since certain occupational data were available for immigrants to Canada, and for emigrants from Canada to the United States and the United Kingdom, it was assumed that the educational attainment of a migrant in a particular occupation and age group was equivalent to that of a person in a similar occupation and age group in the Canadian labour force.

Net migration, immigration and emigration by age groups and level of education are summarized in Table 3 for the decades 1911–61. The main purpose of the table is to provide the first step, involving an adjustment for migration in the cohort analysis underlying Table 2 and Appendix Table A-4. Moving back each decade from 1961 in Appendix Table A-4, the number of immigrants was subtracted in each age and educational group from the 1961 gross labour force, and the number of emigrants was added to derive the labour force net of migration.[1]

The second step in the estimation procedure was to move back each age group ten years. The educational attainment of persons who were 55–64 years of age in 1961, for example, can be used to derive the educational attainment of persons who were 45–54 years of age in 1951, 35–44 in 1941, and 25–34 in 1931. In this way the educational attainment of all but the 55–64 age group in 1951 (who were 65-plus in 1961) can be estimated from the 1961 Census by moving back one decade. The educational characteristics of the oldest age groups in 1951 – the 55–64 group – could have been estimated by using the 65-plus group of 1961, but not accurately enough. Appendix B-4 provides the details of these calculations for each decade back to 1911.

The final step in the process of estimation was to adjust for mortality. For example, persons who were 45–54 years of age in 1961 were 35–44 in 1951, but their numbers in 1961 had declined due to deaths over that 10–year period. Estimation of mortality rates used for the various age groups in different decades is discussed in Appendix B-4.

## MEDIAN AND MEAN YEARS OF SCHOOLING

Median as well as mean (average) years of schooling were calculated, since both measures can be employed to gain insight into the significance of past

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[1] For example, in Appendix Table A-4 there were 71,134 males, age 25 through 34, with university degrees in 1961. In Appendix Table A-5, the estimates show that for the same age and education level, there were 10,615 immigrants and 2,947 emigrants in the decade 1951-60. Net migration into the Canadian labour force was, therefore, 7,668 males of age 25 through 34 with university degrees. This net figure was subtracted from the 71,134 males of this type in 1961 to obtain 63,466 males of 25 through 34 years of age with university degrees in the 1961 labour force net of migration (Appendix Table A-4).

## TABLE 3
### Estimates of Net Migration of Male Labour Force
### by Educational Attainment

|  | Immigration | Emigration | Net Migration |
|---|---|---|---|
|  | (Thousands of persons) | | |
| **1951—61** | | | |
| Total ......................... | 359 | 95 | 265 |
| 0—4 years elementary school ...... | 22 | 6 | 17 |
| 5—8 years elementary school ...... | 134 | 35 | 100 |
| 1—3 years high school ............ | 112 | 30 | 82 |
| 4 years high school ............ | 30 | 8 | 22 |
| Some university education ........ | 39 | 11 | 28 |
| Complete university education ..... | 23 | 6 | 17 |
| **1941—51** | | | |
| Total ........................... | 115 | 40 | 75 |
| 0—4 years elementary school ...... | 11 | 4 | 7 |
| 5—8 years elementary school ...... | 46 | 16 | 30 |
| 1—3 years high school ............ | 32 | 11 | 21 |
| 4 years high school ............ | 10 | 4 | 7 |
| Some university education ......... | 10 | 3 | 6 |
| Complete university education ..... | 6 | 2 | 4 |
| **1931—41** | | | |
| Total ........................... | 40 | 32 | 7 |
| 0—4 years elementary school ...... | 7 | 5 | 1 |
| 5—8 years elementary school ...... | 18 | 15 | 3 |
| 1—3 years high school ............ | 9 | 7 | 2 |
| 4 years high school ............ | 3 | 3 | (—) |
| Some university education ........ | 2 | 2 | (—) |
| Complete university education ..... | 2 | 2 | (—) |
| **1921—31** | | | |
| Total ......................... | 236 | 281 | — 44 |
| 0—4 years elementary school ...... | 39 | 47 | — 8 |
| 5—8 years elementary school ...... | 112 | 133 | — 21 |
| 1—3 years high school ............ | 45 | 53 | — 8 |
| 4 years high school ............ | 19 | 23 | — 4 |
| Some university education ......... | 10 | 11 | — 1 |
| Complete university education ..... | 10 | 12 | — 2 |
| **1911—21** | | | |
| Total ......................... | 395 | 324 | 72 |
| 0—4 years elementary school ...... | 72 | 59 | 13 |
| 5—8 years elementary school ...... | 187 | 153 | 34 |
| 1—3 years high school ............ | 70 | 57 | 13 |
| 4 years high school ............ | 36 | 30 | 7 |
| Some university education ......... | 11 | 9 | 2 |
| Complete university education ...... | 18 | 15 | 3 |

Note: (—) less than 500. Numbers may not add due to rounding.

Source: Appendix Table A-5.

changes and current differences in the distribution of the labour force by educational attainment. In addition, international comparisons of educational attainment can be made with these measures. As discussed in greater detail in the appendices, a number of assumptions had to be made to derive these measures from the given statistics. For example, the educational distribution of the labour force was not always given by single years of schooling, and there were also "open-end distributions". It is believed, however, that these measures are reasonably reliable.

The *mean* years of education of the labour force represent a measure which reflects each year of school attendance by every member of the labour force. For example, the mean multiplied by the number of persons would yield the sum total of school years attended by all members of the labour force. Since each year of schooling is given equal weight, changes in this measure, in conjunction with associated changes in labour income per man associated with education, are useful in quantifying the contribution of improved education to advances in productivity. It was mainly for this purpose that the mean years of schooling were calculated in this study.

The *median*, on the other hand, is a value which divides a group into two equal parts – those with more and those with fewer years of schooling. For example, the median for the 1961 labour force was estimated to be 9.4, which indicates that half the labour force had gone to school for 9.4 or more years and half for 9.4 or fewer years. Observations of changes in the median provide another way to assess changes in the educational distribution of the labour force.

There was a sizable increase in both the median and mean years of schooling of the male labour force over the period 1911–61 although, as shown later, the change was considerably less in Canada than in the United States. Median years of schooling of the Canadian labour force increased from 7.35 years in 1911 to 9.37 years in 1961 – an increase of 27.5 per cent, or approximately a 2–year increase over the entire period (Table 4). It is apparent that improving the level of education has been a slow process thus far, requiring, over the past 50 years, an average of about 25 years to raise the median one year.

## TABLE 4
### Median Years of Schooling, Males,
### Canada 1911–61 and United States 1910–62
(Canadian labour force, aged 25–64; U.S. population, 25 years and over)

| Years | Canada | Years | United States |
|-------|--------|-------|---------------|
| | (Median year of schooling) | | (Median year of schooling) |
| 1911 | 7.35 | 1910 | 7.41 |
| 1921 | 7.75 | 1920 | 7.68 |
| 1931 | 8.04 | 1930 | 8.01 |
| 1941 | 8.43 | 1940 | 8.55 |
| 1951 | 9.74 | 1950 | 9.00 |
| 1961 | 9.37 | 1960 | 10.30 |
| | | 1962 | 11.10 |

Source: Appendix Table A-7.

TABLE 5

Mean Years of Schooling of the Canadian Male Labour Force,
Aged 25–64, 1911–61

| | |
|---|---|
| 1911 | 6.60 |
| 1921 | 7.06 |
| 1931 | 7.43 |
| 1941 | 8.02 |
| 1951 | 8.62 |
| 1961 | 9.15 |

Source: Based on estimates developed in this study (see Appendix B-5 for a discussion of assumptions).

The rise in the educational attainment of the labour force was not a constant process. The decade 1911–21 witnessed a more rapid rise in the median years of schooling (5.4 per cent) than in any other decade except 1951–61 when the change was 7.2 per cent. The 1920's and 1940's were both decades of relatively low growth rates in median years of schooling (Table 6). Some of the possible causes of these variations are considered later.

Estimates of the mean years of schooling attained by the labour force over the period 1911–61 show a generally similar trend (Table 5). It is estimated that the mean was 6.6 years in 1911 and 9.15 years in 1961, a change of 2.55 years[1] in 50 years or an increase of 38.6 per cent.

The educational attainments of the Canadian and U.S. labour forces appear to have been fairly close to each other in 1911, but the United States began to move ahead of Canada at an increasing rate after about 1920. By 1961 the difference between the median years of schooling in the two countries had widened considerably. Table 4 shows that the median was 7.35 years in Canada in 1911 and 7.41 years in the United States in 1910. By the early 1960's these medians had risen to 9.37 for Canada and 10.30 for the United States. Since the Canadian figures are for males in the labour force age 25–64, and the U.S. figures for the male population age 25 and over, the U.S. median is understated relative to the Canadian in this table (inclusion of persons in the "65 and over" group, who had lower average educational attainments, would lower the median). This would apply to a greater extent to the 1960 than to the 1910 median calculation. Appendix Table A-7 shows that the U.S. median for the male population age 25–64 was 10.9 years in 1960 and 11.9 years in 1962. Since labour force participation rates for males 25–64 are very high, it would be these higher U.S. median values which are most appropriately comparable to the Canadian median. On this basis, the difference between Canada

[1] The difference in the increases between the mean and the median years of schooling reflects changes in the structure of the educational distribution over time. The median year of schooling for Canada shown in Table 4 exceeds the mean year of schooling for Canada in each decade. In the earlier decades this result is not unlikely since the very large numbers of persons with few years of schooling was sufficient to outweigh the influence of the smaller number of persons with higher years of schooling. The difference between the median and mean gradually narrows over time and the mean would have exceeded the median in later decades if the method of estimating the median had not overestimated the median. See Appendix B-5 for a discussion of the median estimates.

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and the United States in median years of schooling at the beginning of the 1960's would appear to have amounted to approximately 2 years.[1]

TABLE 6

Decennial Changes in Median and Mean Years of Schooling, Males,
Canada and the United States

(Canadian labour force, aged 25–64; U.S. population, 25 years and over)

| Census Decades[1] | Canada | | United States | |
|---|---|---|---|---|
| | Medians | Means | Medians | Means |
| | (Percentage changes) | | | |
| 1911–21 ........... | 5.4 | 7.0 | 3.6 | 9.0 |
| 1921–31 ........... | 3.7 | 5.2 | 4.3 | 8.9 |
| 1931–41 ........... | 4.9 | 7.9 | 6.7 | 10.2 |
| 1941–51 ........... | 3.7 | 7.5 | 5.3 | 10.4 |
| 1951–61 ........... | 7.2 | 6.2 | 14.4 | 9.8 |
| 1911–31 ........... | 9.4 | 12.6 | 8.1 | 18.6 |
| 1931–61 ........... | 16.5 | 23.2 | 28.6 | 33.6 |
| 1911–61 ........... | 27.5 | 38.6 | 39.0 | 58.5 |

[1] Changes for the United States relate to 1910–60.

Source: Tables 4 and 5 above, and E.F. Denison, op. cit., Table 9.

The changes in median and mean years of schooling in Canada and the United States over the past 50 years are compared in Table 6. An analysis of the under-lying reasons for the decade-by-decade changes in median and mean years of schooling within Canada has not been attempted in detail in this study, and further research in this area might provide important additional information. However, major influences in changing the educational attainment of the labour force appear to be the following: changes in the age distribution of the labour force as a result of changes in birth and mortality rates; the effect on the average level of education of immigration and emigration; the extent of rural-urban migration; changes in provincial legislation on attendance at school and the minimum age of employment; and changes in the level of education achieved by students. This last item is obviously influenced by a wide range of considerations, depending upon such things as the financial ability of school boards and the value placed on additional years of education.

The estimates in Table 6 indicate that the decade of 1911–21 was, for Canada, one of greater educational gains than the decade of the 1920's. The latter decade appears to have been a less favourable period for Canada with respect to increases in the educational level of the labour force, not only in relation to Canadian experience in the period 1911–21 and the decades after 1931, but also relative to the experience of the United States in the 1920's. A factor influencing the stock of education possessed by the labour force, discussed more fully in a later section, was the influence of the large immigration and emigration in this decade. World War I fatalities were also a factor which might explain some of the decline in the

[1] See Appendix B-5 for a discussion of the method used to calculate the medians in this study.

rate of education growth in the 1920's, relative to the United States, since the number of deaths and permanent injuries of men, relative to the labour force, was considerably higher in Canada than in the United States. While statistically small, the effect of the loss of educational capital embodied in the younger age groups had an effect that was significant over a span of two to three decades.

Part of the explanation of the lag in education relative to the United States also may be due to the later shift, compared with the United States, in the structure of the Canadian economy, in particular the shift of the labour force from agriculture to manufacturing and service sectors. This can be important because of the marked and persistent tendency towards a lower level of educational attainment in rural areas in both countries.

The influence of immigration in the decade 1951–61 (as discussed below) was to raise the median years of schooling very slightly, although there is a widespread impression that its influence in raising the quality in Canadian education had been much larger. It appears correct to conclude that the contribution of immigration to the stock of education was mainly to duplicate the existing distribution of education by age groups in Canada, with about the same distribution of low years and high years of schooling, except that there were proportionately somewhat more immigrant males with university degrees than in the total domestic male labour force.

It would appear from this study that the lag in the percentage change in years of schooling in Canada, relative to the United States, began in the 1920's, became more apparent by the end of the 1930's, continued to widen in the 1940's, and became substantial in the 1950's, so that the absolute gap in terms of median years of schooling had widened to approximately two years at the beginning of the 1960's.

A contrast by age groups of educational attainments in Canada and the United States at the beginning of the 1960's is shown in Tables 7 and 8. These data relate to the male labour force in the 25–64 age groups for both countries. In both tables the contrast can be made of the differences in educational attainment of the younger age groups with the older age groups. For example, in Canada the median for the 25–34 age group was 10.0 years while the oldest age group of 55–64 years had a median of 8.3 years – a difference of almost two years. Mean years of schooling were 9.7 years for the 25–34 age group and 7.6 years for the oldest age group, a difference of 2.1 years between age groups separated by an average of 30 years (Table 8).

TABLE 7
Median Years of Schooling, Male Labour Force
Canada 1961 and United States 1962

|  | Canada | United States |
|---|---|---|
|  | (Median years of schooling) | |
| 25–34 | 10.0 | 12.4 |
| 35–44 | 9.6 | 12.2 |
| 45–54 | 9.0 | 11.1 |
| 55–64 | 8.3 | 9.0 |

Source: Appendix Table A-8.

TABLE 8
Mean Years of Schooling of the Canadian Male Labour Force,
by Age Groups, 1961

|  | Mean Years |
| --- | --- |
| 25—34 ................................... | 9.68 |
| 35—44 ................................... | 9.22 |
| 45—54 ................................... | 8.57 |
| 55—64 ................................... | 7.57 |
| 25—64 ................................... | 9.15 |

Source: Based on estimates developed in this study (see Appendix B-5 for a discussion of the esti-
mates).

Three major observations may be made with respect to the data in Table 7. First, as would be expected, the medians for the older age groups are lower than those for the younger age groups in both countries. Second, the Canadian medians are lower than the U.S. medians in each of the age groups shown. Third, the difference in the medians between Canada and the United States are larger for the younger age groups than for the older. Two central implications of these estimates are (1) a rising level of educational attainments in both countries over time and (2) a widening gap in educational attainments between the two countries.

Table 8, showing mean years of schooling for the Canadian male labour force, also shows the improvement in educational attainment of the younger age groups in relation to the older groups. The difference in mean years of schooling between the oldest age group (55–64) and the youngest age group (25–34) in the labour force was 2.1 years. This difference can be viewed as approximating the change in the average level of education over an average of 30 years, and demonstrates that the average level per man rose over this period by about 28 per cent. This measurement needs to be distinguished, however, from the change in the mean years of schooling of the male labour force which increased in terms of years of educational attainment at the slower rate of 23 per cent in 1931–61 (Table 6).

## THE STOCK OF EDUCATION, PAST CHANGES, AND FUTURE TRENDS

The "stock of education" of the labour force may be defined as the total amount of formal schooling attained by all members of the labour force, including employees, farmers, managers, professional workers, owners, and all others. This section will first focus attention on the stock of education embodied in the Canadian male labour force in 1961, the changes in this stock over the past five decades, and the difference between the Canadian and U.S. stocks of education at the beginning of the 1960's. The most effective way of analyzing this stock is to first show each group of persons with a given level of educational attainment (such as years of schooling) as a percentage of the total labour force.

Changes in the stock of education are mainly determined by the combined effects of three *flows* – the flows of younger people into the labour force after leaving school, the outflows resulting from retirements and mortality, and the net flows from immigration and emigration. The inflows of younger persons tend to

## TABLE 9

### Educational Attainment of the Male Labour Force by Age Groups, 1911 and 1961

(Percentage distribution)

| Age Group | Total | 0–4 Years Elementary School | | 5–7 Years Elementary School | | 8 Years Elementary School | | 1–3 Years High School | | 4 Years High School | | Some University Education | | Complete University Education | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1911 | 1961 | 1911 | 1961 | 1911 | 1961 | 1911 | 1961 | 1911 | 1961 | 1911 | 1961[1] | 1911 | 1961 |
| Total............. | 100.0 | 24.2 | 7.5 | 34.5 | 20.8 | 16.1 | 17.6 | 18.1 | 29.7 | 3.2 | 8.7 | 1.5 | 10.1 | 2.4 | 5.6 |
| 25–34............. | 100.0 | 18.4 | 3.9 | 33.2 | 14.6 | 18.3 | 19.5 | 21.3 | 33.8 | 4.3 | 8.7 | 1.8 | 13.5 | 2.7 | 6.0 |
| 35–44............. | 100.0 | 23.4 | 6.1 | 34.9 | 21.4 | 16.1 | 15.0 | 18.2 | 31.6 | 3.2 | 9.5 | 1.6 | 10.1 | 2.5 | 6.3 |
| 45–54............. | 100.0 | 28.7 | 9.5 | 35.8 | 23.4 | 14.2 | 17.8 | 15.7 | 27.3 | 2.3 | 8.5 | 1.3 | 8.4 | 2.0 | 5.0 |
| 55–64............. | 100.0 | 34.6 | 15.3 | 35.7 | 29.1 | 12.4 | 18.3 | 12.7 | 20.3 | 1.7 | 7.4 | 1.1 | 5.3 | 1.7 | 4.2 |

[1] Includes Grade 13 for provinces in which Grade 13 is given. See Appendix A-4.

Source: Table 2 and further estimates of this study. See also Appendix B-4 for discussion of estimates of specific years of schooling.

raise the stock of education, since they generally have more schooling than their elders. Similarly, the outflows, especially those due to retirement of older persons, also tend to increase the average level of the stock of education for the remaining labour force, since older persons typically have relatively less schooling than the over-all average. Of particular interest is the level of education of young persons entering the labour force. This aspect of past flows will be analyzed later on the basis of retention rates.

Over any one year, the net flow of people into or out of the labour force is generally very small in relation to the over-all size of the labour force. Even over a decade, the new entrants or the departures do not constitute a dominant proportion of the labour force. For this reason, the net change in the average educational level in the labour force is not great in any one year or decade. This will be true even during the next few years when there will be an extraordinarily large influx of younger people with educational attainments far above those who will be departing. Later in this chapter, an attempt is made to analyze future trends in educational output and their possible effects on the increase in the stock of education, particularly in relation to the United States.

The effect of net migration on the stock of education depends on the level of schooling of migrants in relation to the average level of schooling of the total labour force. Educational changes resulting from immigration and emigration are examined later in this section.

### The Stock of Education

Table 9 indicates the improvements in the stock of education of the Canadian male labour force between 1911 and 1961. A prominent feature of the changes shown in this table is the decline in the proportion of persons with only elementary schooling from about 75 to 46 per cent, a decline which was even more marked among the younger age groups than among the older groups.

Table 10 indicates that both Canada and the United States have reduced the proportions of persons with only zero to four years of schooling to a small percentage of the total labour force stock (7.5 per cent for Canada in 1961 and 5.8 per cent for the United States in 1960). Both countries had succeeded in decreasing this low-attainment category to between 3 and 4 per cent for the 25–34 age group – a considerable improvement over the oldest age group. Moreover, the decline in the proportion of persons with only zero to four years of schooling in the 25–34 group compared with the 55–64 group was larger in Canada than in the United States. The experience of the two countries for persons with only five to seven years of schooling was less similar. The proportion of members in the Canadian labour force with only five to seven years of schooling still remained quite high (20.8 per cent) relative to the United States (12.4 per cent), and in the youngest age group in Canada, the percentage was about twice as high as in the United States.

# TABLE 10

## Educational Attainment of the Male Labour
## Force by Age Groups, Canada 1961 and United States 1960
(Percentage distribution)

| Age Group | Total | 0–4 Years Elementary School | | 5–7 Years Elementary School | | 8 Years Elementary School | | 1–3 Years High School | | 4 Years High School | | Some University Education | | Complete University Education | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Can. | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can.[1] | U.S. | Can. | U.S. |
| Total, 25–64....... | 100.0 | 7.5 | 5.8 | 20.8 | 12.4 | 17.6 | 16.0 | 29.7 | 20.5 | 8.7 | 24.6 | 10.1 | 9.5 | 5.6 | 11.1 |
| 25–34 ............ | 100.0 | 3.9 | 3.2 | 14.6 | 7.9 | 19.5 | 9.8 | 33.8 | 21.9 | 8.7 | 30.8 | 13.5 | 11.7 | 6.0 | 14.7 |
| 35–44 ............ | 100.0 | 6.1 | 4.5 | 21.4 | 9.9 | 15.0 | 12.9 | 31.6 | 21.4 | 9.5 | 29.5 | 10.1 | 9.9 | 6.3 | 11.9 |
| 45–54 ............ | 100.0 | 9.5 | 6.9 | 23.4 | 15.3 | 17.8 | 20.1 | 27.3 | 20.7 | 8.5 | 20.0 | 8.4 | 8.3 | 5.0 | 8.8 |
| 55–64 ............ | 100.0 | 15.3 | 11.1 | 29.1 | 20.1 | 18.3 | 26.1 | 20.3 | 16.6 | 7.4 | 12.2 | 5.3 | 6.9 | 4.2 | 7.0 |

[1] Includes Grade 13 for provinces in which Grade 13 is given.

Source: Table 9, Appendix Table A-9, and Appendix B-2.

As pointed out above, there has been a marked decline in the proportion of persons with less than a grade eight education, reflecting the growing number who have achieved or moved beyond grade eight in their educational attainment, along with the rising retention rate in elementary school. This is illustrated in Table 11 showing the cumulated totals, by age groups, of those who in 1961 had completed at least eight years of schooling, nine years of schooling, etc., through twelve years. The achievement of at least grade eight is seen in Table 11 to have been reached by 71.6 per cent of the total Canadian male labour force, but with a marked spread from 55.5 per cent for the 55–64 age group to 81.5 per cent in the 25–34 age group. At the same time, the differences between Canada and the United States narrowed somewhat over time for those who had at least eight years of schooling: of those in oldest age group of 55–64 years of age in 1961, there were 55.5 per cent with at least eight years of schooling, compared with over 66 per cent in the United States. In contrast, among the youngest age group of 25–34 years of age, 81.5 per cent in Canada and 88.0 per cent in the United States had achieved at least eight years of schooling.

TABLE 11

Minimum Years of Educational Attainment of Males Aged 25–64,
Canada 1961 and United States 1960

(1961 Canadian labour force; 1960 U.S. population)[1]

| Minimum Years of Schooling | Total, 25–64 | | 25–34 | | 35–44 | | 45–54 | | 55–64 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. |
| | (Per cent of total) | | | | | | | | | |
| Eight years ........ | 71.6 | 80.0 | 81.5 | 88.0 | 72.4 | 84.5 | 67.0 | 76.4 | 55.5 | 66.2 |
| Nine years ......... | 54.1 | 63.7 | 62.1 | 78.1 | 57.4 | 71.4 | 49.2 | 56.3 | 37.3 | 40.5 |
| Ten years ......... | 43.0 | 57.1 | 50.5 | 71.1 | 45.9 | 64.8 | 38.5 | 49.4 | 28.0 | 34.5 |
| Eleven years ....... | 31.0 | 49.2 | 37.7 | 62.8 | 33.1 | 56.5 | 26.7 | 41.4 | 18.5 | 28.3 |
| Twelve years[2] ...... | 24.4 | 43.4 | 28.2 | 56.4 | 25.9 | 50.0 | 21.9 | 35.9 | 16.9 | 24.5 |

[1] U.S. data for male population are shown in this table since this particular breakdown is not available for the male labour force in published form. Appendix Table A-9 compares U.S. educational attainments for male population and male labour force. Very little differences exist between the two groups because of the high labour force participation rates for males in the age groups shown in this table.

[2] In certain provinces students may enter university after completion of Grade 11, but the percentages shown for Canada assume that all persons with education above Grade 12 had already completed Grade 12 in their progress through the schools. Consequently the percentages shown for at least 12 years for Canada are overestimated relative to the comparable U.S. percentages.

Source: Canada — Table 9 and additional estimates (Appendix B-2); United States — Bureau of the Census, 1960 Census of Population, *Supplementary Reports* (PC (S1)–37, Table 173).

The differences in school attainment of the labour force in Canada and the United States appear to have widened appreciably over the period from just before 1920 to just before 1950. Table 12 compares the differences in educational attainment between Canada and the United States for the oldest age group in the labour force (55–64) and a younger age group (25–34). These two age groups in the labour force are separated on the average by 30 years in the time period in which they received their schooling, and their respective levels of schooling illustrate

educational changes within each country over time, as well as changes between
the two countries.

Minimum Years of Educational Attainment of
Male Labour Force, Aged 25–34 and 55–64, Canada 1961
and Unites States 1960

| Minimum Educational Attainment | Age Group | Per Cent of Male Labour Force | | Percentage by which U.S. Exceeds Canada |
|---|---|---|---|---|
| | | Canada | United States | |
| 8 years elementary school............. | 25–34 | 81.5 | 88.9 | 9 |
| | 55–64 | 55.5 | 68.8 | 24 |
| 4 years high school................... | 25–34 | 28.2 | 57.2 | 103 |
| | 55–64 | 16.9 | 26.1 | 54 |
| University degree ................... | 25–34 | 6.0 | 14.7 | 145 |
| | 55–64 | 4.2 | 7.0 | 67 |

Source: Calculated from data in Table 10 above.

A number of significant observations can be made on the basis of the data in
Table 12. First, the younger age group in Canada has attained a level of schooling
which is substantially higher than that of the older age group. The improvement of
the younger over the older group is particularly large at the high school level.
Second, for all age groups, at every level of schooling, the U.S. attainments are
above the Canadian. The differences are particularly large at the university level.
Third, the comparable attainments in the United States are proportionately much
greater for the younger age group than for the older, and the differences become
larger the higher the level of schooling. In fact, the margin by which the United
States exceeds Canada at the university level for the 25–34 age group amounts to
145 per cent. These figures clearly illustrate the existence of an educational gap
which is wider between the two countries for the 25–34 age group than for the
55–64 age group.

The achievement of at least high school education could be considered a
minimum objective for the educational preparation of the labour force, or at least
for a very substantial proportion of it. Since grade eleven has represented the year
of high school completion in a number of Canadian provinces, it is useful to exam-
ine again the relative achievement of Canada and the United States in this area.
Table 11 shows that 31 per cent of the Canadian labour force had at least eleven
years of schooling compared with 49 per cent of the U.S. labour force. In the young-
est age group, 38 per cent had at least eleven years of schooling in Canada,
compared with 63 per cent in the United States.

**Retention Rates**

One of the most striking features in the history of Canadian and U.S. education
is the similarity in years of schooling of the labour force completing at least ele-

mentary school since about World War I through the 1950's, and the growing disparity between the two countries as regards those who completed high school or achieved a university degree.

A comparison of the attainment of high school in Canada and the United States is again appropriately analyzed by considering the proportions of males who had at least a given year of high school. The percentage of persons who achieved, for example, one to three years of high school (see Table 10) has the appearance of being larger in Canada, with 29.7 per cent for the total 25–64 age group, than for the United States with 20.5 per cent. These figures, however, refer to the proportion of the labour force having attained one to three years of high school, and partly reflect the proportionately greater educational attainments in the U.S. labour force at still higher levels of education. As seen in Table 11, the proportions of males in the labour force 25–64 years of age who completed at least nine, ten or eleven years of schooling by 1961 were much lower in Canada than in the United States. Moreover, these differences appear to be most pronounced in the younger, rather than in the older, age groups. This suggests that although high school attainment has been rising in Canada over recent decades, it has tended to fall progressively below comparable attainment in the United States.

The extent of the progression of the labour force from elementary school to high school can be seen by comparing the proportion having at least grade eight with that having grade nine or more. For example, Table 13 shows that the proportion of the total labour force in Canada moving to at least nine years of schooling, after completing at least eight years of schooling, was 75.6 per cent in 1961 — a proportion not far below the U.S. percentage of 79.6 in 1960. However, the United States had higher absolute proportions at each of these levels, as was seen in Table 11.

TABLE 13

Implied Retention Rates Through Selected Grades of Schooling, for Males by Age Groups, Canada 1961 and United States 1960

(1961 Canadian labour force; 1960 U.S. population)

| | Total, 25–64 | | 25–34 | | 35–44 | | 45–54 | | 55–64 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. |
| | | | | | (Per cent) | | | | | |
| Grade 8 to Grade 9[1] ........ | 75.6 | 79.6 | 76.2 | 88.8 | 79.3 | 84.5 | 73.4 | 73.7 | 67.2 | 61.2 |
| Grade 8 to Grade 11 ........ | 43.3 | 61.5 | 46.3 | 71.4 | 45.7 | 66.9 | 39.8 | 54.2 | 33.3 | 42.7 |
| Grade 9 to Grade 11 ........ | 57.3 | 77.2 | 60.7 | 80.4 | 57.7 | 79.1 | 54.3 | 73.5 | 49.6 | 69.9 |

[1] Read: the percentage of those having at least Grade 8, entering and completing at least Grade 9.

Source: Table 11.

Table 13 also shows how the Canadian and the U.S. labour force progressed through schooling from at least eight years through at least eleven years and from at least nine years through at least eleven years. Only 43 per cent of the total

Canadian male labour force 25–64 years of age as of 1961 had moved from at least eight years of schooling to at least eleven years, compared to 62 per cent for the United States in 1960, while 57 per cent had moved from at least nine years of high school through at least eleven years in Canada, and 77 per cent in the United States.

Changes in the retention rates are also implicitly indicated by the data for age groups in Table 13. For example, rising Canadian retention rates are reflected in the data on the proportion of those with eight years of schooling who went on to complete nine years – showing an upward shift from 67.2 per cent in the 55–64 age group to 76.2 per cent in the 25–34 age group. Even slightly more pronounced improvements over time in retention rates are implied among those in high school – that is, among those who were retained beyond grades eight or nine through grade eleven in Canada. Yet, when this experience is compared with that of the United States, it is a striking fact that not only were comparable U.S. retention rates consistently higher for all age groups and for all levels of schooling shown in Table 13 (with the exception of the eight-year to nine-year rate in the 55–64 age group), but the improvements in U.S. retention rates have been generally greater than in Canada over recent decades. For example, over the 30 years reflected in the spread between the youngest (25–34) and oldest (55–64) age groups shown in Table 13, the retention rates from grade eight to grade nine moved up from 67.2 to 76.2 per cent in Canada, but from 61.2 to 88.8 per cent in the United States. Similarly, the retention rates from grade eight through grade eleven moved up from 33.3 per cent to 46.3 per cent in Canada, but from 42.7 to 71.4 per cent in the United States. On the other hand, for the grade nine through grade eleven experience, the improvements were more similar – an upward shift from 49.6 to 60.7 per cent in Canada, compared with a shift from 69.9 to 80.4 per cent in the United States.

The achievement of the 25–34 age group is of special interest as an indication of more recent performance. Yet it should be noted that this group, on the average, passed through high school some years ago, just prior to the 1950's. In that period about 61 per cent of the 25–34 age group in Canada with at least grade nine moved to grade eleven or beyond (Table 13). This retention rate may be compared, however, with an even younger age group who moved from grade nine through grade eleven just prior to 1958. The Dominion Bureau of Statistics study, *Student Progress Through the Schools, 1960,*[1] provided data which yielded the estimate that the retention rate was approximately 60 per cent for male and female students moving from grade nine through grade eleven in the period 1948–58. It would appear that high school attainment through grade eleven for the younger age group considered above remained approximately unchanged compared with the experience of the 25–34 age group.

The high school attainments of the 20–24 male age group derived from the Census of 1961 show a similar pattern. The proportion of males in this age group who

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[1] This study shows total enrolment figures by grade of school for all the ten provinces in the period 1947-48 through 1957-58. An approximate estimate of retention rates for grade 9 through grade 11 can be calculated by using groups of three successive years. The retention rate was estimated as near 60 per cent, grade 9 through grade 11, in this period with little sign of a tendency to rise (Catalogue 81-513, Table 1, p. 25).

had at least nine years of schooling and moved through at least eleven years, was 63 per cent[1] – only slightly higher than the proportion found for the 25–34 age group in Table 13.

The Dominion Bureau of Statistics study on school retention estimated that 50 per cent of the students who entered their first year of secondary school moved through the junior year of leaving (junior matriculation) in high school (see Table 14). Since this estimate was based on junior matriculation at both grade eleven and grade twelve, it is lower than the 60 per cent noted above as the retention rate for grades nine through eleven.

TABLE 14

Estimated Retention Rates in Canada by Specified Levels of Education

(Representative of the period 1946—58)

| Level of Education | Estimated Rate of Retention |
|---|---|
| Grade 2 ................................................ | 100 |
| Grade 3 ................................................ | 99 |
| Grade 4 ................................................ | 96 |
| Grade 5 ................................................ | 94 |
| Grade 6 ................................................ | 91 |
| Last year of elementary ................................. | 81 |
| First year of secondary ................................. | 66 |
| Second year of secondary ............................... | 55 |
| Year of junior leaving.................................. | 33 |
| Year of senior leaving ................................. | 14 |

Note: "Retention rates for Canada are based on the weighted averages for the provinces. It is not expedient, however, to attempt to provide figures for Canada by grade, since the grade numbering system varies somewhat from province to province; for instance, Grade XIII in Ontario or British Columbia and Grade XII in Quebec or Alberta designate the final high school year. For this reason, retention rates for Canada are shown only for such significant levels beyond Grade VI as 1st year secondary, Junior Matriculation, etc., which are computed from data for appropriate grades from the provinces." (Quote from publication cited below.)

Source: Dominion Bureau of Statistics, Education Division, *Student Progress Through the Schools, 1960* (Catalogue 81-513), p. 29.

Table 15 shows retention as of the late 1950's in the elementary and high schools by provinces. Although a review of educational trends in each of the provinces was not possible within the time limits of this study, the wide disparities in high school retention rates should be noted. Ontario, which was the initiator of much of the early progress in the Canadian educational system, had a surprisingly low retention rate of 53 per cent from grade nine through grade eleven. In fact, moving from Quebec, the farther west a province is located, the higher appears to be the retention rate, measured from grade nine through grade eleven. Quebec Catholic high schools (though starting from a considerably lower base of entrance into high school) had retention rates from grade nine through to grade eleven not much lower than Ontario at 47 per cent, while the retention rate was 48 per cent in the Quebec Protestant schools. The Western Provinces' retention rates, grade nine through eleven were as follows: Manitoba, 63 per cent; Saskatchewan, 65 per cent; Alberta, 75 per cent; and

[1] Calculated from *Census of Canada, 1961* (Catalogue 92-557, Tables 99 and 102).

British Columbia, 76 per cent. Table 15 shows that while relatively low high school retention rates also prevail in the Eastern Provinces, some were higher than in Central Canada. Although New Brunswick and Nova Scotia had smaller retention rates through grade eight, their high school retention rates were near 62 per cent for grade nine through grade eleven. Prince Edward Island and Newfoundland, however, were lower than Ontario at 51 and 53 per cent respectively for grade nine through grade eleven.

TABLE 15

### Estimated Retention Rates from Grade Two to Senior High School Leaving Level, by Provinces

(Representative of the period 1946—58)

| Province | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Retention Rate Grade 9 through Grade 11 (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Newfoundland.........100 | 98 | 96 | 92 | 84 | 81 | 66 | 54 | 44 | 29 | 2 | — | 54 |
| Prince Edward Island..100 | 99 | 97 | 95 | 91 | 90 | 83 | 68 | 60 | 35 | 22 | — | 51 |
| Nova Scotia ..........100 | 99 | 98 | 94 | 91 | 88 | 79 | 65 | 55 | 40 | 17 | — | 62 |
| New Brunswick .......100 | 99 | 96 | 93 | 88 | 85 | 75 | 57 | 50 | 35 | 27 | 5 | 61 |
| Quebec — Catholic ....100 | 99 | 97 | 93 | 88 | 73 | 48 | 38 | 27 | 18 | 7 | — | 47 |
| — Protestant...100 | 99 | 98 | 96 | 96 | 95 | 90 | 70 | 51 | 34 | 3 | — | 48 |
| Ontario ..............100 | 98 | 95 | 93 | 92 | 91 | 87 | 78 | 63 | 41 | 34 | 15 | 53 |
| Manitoba .............100 | 98 | 95 | 93 | 92 | 91 | 82 | 73 | 62 | 46 | 19 | — | 63 |
| Saskatchewan.........100 | 98 | 95 | 93 | 88 | 85 | 83 | 72 | 62 | 47 | 30 | — | 65 |
| Alberta ..............100 | 99 | 99 | 98 | 98 | 97 | 90 | 80 | 70 | 60 | 41 | — | 75 |
| British Columbia ......100 | 99 | 99 | 98 | 98 | 97 | 96 | 90 | 83 | 68 | 50 | 5 | 76 |

Note: DBS points out that ''It is important to keep in mind the limitations of [Table 15]. It does not take into account those students who are continuing their formal education in other types of institutions, such as universities, teachers' colleges, schools for nurses, or technical institutes. The sharp drop in the retention rate to Grade XIII (or Grade XII in Newfoundland, Nova Scotia, Quebec and Manitoba) means simply that these grades are not provided on a provincial-wide basis, or they are not a prerequisite for entrance to university. Many students bypass Grade XIII (or XII in the provinces listed above) in proceeding to university. On the other hand, senior matriculation is required for university entrance in Saskatchewan and Alberta, which explains the relatively high retention to Grade XII in those provinces. In Prince Edward Island there is no senior matriculation level in the secondary schools.'' (Quote from publication cited below.)

Source: Dominion Bureau of Statistics, Education Division, *Student Progress Through the Schools, 1960* (Catalogue 81-513), p. 28.

Retention rates of students moving through high school grades disclose one of the most important aspects of the process of producing an educated labour force. The earlier discussion demonstrated that elementary schooling through grade eight in Canada has been attained by a very large proportion of the youngest age group of 25—34 years in the labour force. With a very high degree of elementary school completions, retention rates in high school become a most relevant measure of the change in the average level of education. While the flow of students through high school has become much higher over time, retention *rates* do not appear to have

changed very rapidly.[1] The Canadian historical record of retention rates from high school grade nine through eleven indicates only a slow upward movement through the 1950's. Table 13 indicated, for example, that in the 55–64 age group as of 1961, about 50 per cent of those with at least grade nine proceeded to grade eleven or further. On the average this age group moved through high school just prior to the 1920's. The relative size of the flow from grade eight into high school was of course smaller in this period, but after the elapse of 30 years, the retention rate of the 25–34 age group for grade nine through grade eleven had risen to only 61 per cent.

The performance of student progress through the high schools in Canada is again in sharp contrast with the U.S. experience. Table 16 shows that the retention rate in U.S. high schools from grade nine through grade eleven rose from 63 per cent in 1927 to 80 per cent in 1957 and to 83 per cent in 1962. As indicated above, the similar retention rate in Canada estimated for grades nine to eleven was approximately 60 per cent around 1958. It would therefore appear that the Canadian high school retention rate from grade nine through grade eleven around 1958 was about the same as that prevailing in the United States during the 1920's.

TABLE 16
Retention Rates in Public High Schools of United States
from Grade 9 through Grade 11 and Grade 12

| Retention Rate 9–11 | Retention Rate 9–12 | Year of Graduation from High School |
|---|---|---|
| 62.8 | 53.5 | 1928 |
| 62.7 | 56.2 | 1932 |
| 66.9 | 59.1 | 1934 |
| 67.7 | 58.7 | 1936 |
| 68.7 | 60.1 | 1938 |
| 72.5 | 64.9 | 1940 |
| 76.0 | 63.8 | 1942 |
| 66.0 | 50.7 | 1944 |
| 66.8 | 55.8 | 1946 |
| 72.5 | 64.9 | 1948 |
| 74.9 | 66.8 | 1950 |
| 76.7 | 64.7 | 1952 |
| 73.5 | 66.9 | 1954 |
| 81.8 | 71.7 | 1956 |
| 80.0 | 71.3 | 1958 |
| 83.1 | 74.5 | 1961 |
| 83.1 | 74.4 | 1962 |

Source: U.S. Office of Education, *Biennial Survey of Education in the United States, 1954–56* (Chapter 1, Table 6, p. 13); and *Digest of Educational Statistics, 1963* (p. 94). Retention rates for Grade 11 and Grade 12 high school students graduating in 1928 estimated from U.S. Office of Education, *Biennial Survey of Education, 1928–30*, Vol. II (Table 7, p. 705).

The high productivity of university-trained members of the labour force is clearly reflected in the increased incomes associated with university education.

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[1] Census evidence, however, of a very rapid change in high school enrolment in more recent years is available from a comparison of the proportion of the male age group 15-19 years of age enrolled in school in 1951 and 1961. See Table 18 and Chart 1.

While this relationship is considered in detail in Chapter 3 of this study, it is noted at this point in order to emphasize the significance attached to the proportion of the labour force with university degrees. The earlier general survey of education presented a brief comparison of university attainment in Canada and the United States, the main finding (see Table 10) being that the proportion of the total labour force with university degrees was 5.6 per cent in Canada (1961) and 11.1 per cent in the United States (1960).

Some knowledge of the comparative history of the attainment of university education by the labour force in Canada and the United States can be gained by comparing the achievement of different age groups within the labour force. These comparisons can be interpreted to show the changes in the production of university students in the two countries. For the oldest age group (55–64 years) in the labour force, the proportions who achieved university degrees were not so very far apart in the two countries, Canada having 4.2 per cent as of 1961 and the United States 7.0 per cent as of 1960 (Table 10). For the 25–34 age group comparison, the difference in the proportion with university degrees is far greater, with Canada having 6.0 per cent as of 1961 and the United States reaching 14.7 per cent in 1960. The absolute differences between the proportions in the two countries appear to have almost tripled over the 30 years from around the early 1920's to around the early 1950's.

### TABLE 17
Estimates of Years of University Education
Attained by Males Aged 25–64, Canada 1961 and United States 1960
(1961 Canadian labour force; 1960 U.S. population)

| Canada | Per cent of male labour force aged 25–64 |
| --- | --- |
| Grade 13 high school .................................. | 6.17 |
| Highest year of university attained: | |
| First ............................................. | 2.00 |
| Second............................................ | 1.05 |
| Third............................................. | 0.88 |
| Degree............................................ | 5.59 |
| Total............................................. | 15.69 |

| United States | Per cent of male population aged 25–64 |
| --- | --- |
| Highest year of university attained: | |
| First ............................................. | 3.42 |
| Second ........................................... | 3.97 |
| Third ............................................ | 1.87 |
| Degree ........................................... | 10.64 |
| Total............................................. | 19.90 |

Source: For Canada, Appendix Table A-2 and Appendix B-2. For United States, Appendix Table A-9 and U.S. Department of Commerce, Bureau of the Census, 1960 Census of Population, Supplementary Reports "Educational Attainment of the Population of the United States, 1960" (PC(S-1)-37, Table 173).

The comparison of Canada and the United States with respect to the attainment of the categories of "some university" and "university degree" can be more

clearly shown by considering the percentage of the labour force attending each year of university (see Table 17). If the comparison is made on the basis of persons who have attained years of schooling above the first year of university (which is considered to include grade thirteen in Canada), the proportion was 7.5 per cent in Canada in 1961 and 16.4 per cent in the United States in 1960.

The conclusions respecting university attainment based on the 1961 Census is that the proportion of Canadian males in the youngest age group (25–34) in the male labour force who completed a university degree was 6 per cent, while in the United States the proportion of males in the population of the same age group was almost 15 per cent.[1]

### Trends in Education Output

School enrolment figures can help illuminate some important aspects of rising educational attainments of the labour force. Such figures are set forth in Table 18 and Chart 1, based on decennial census studies made in Canada and the United States over the period 1921–61. The table shows males enrolled in school as a proportion of the total number of males in particular age groups. It is apparent that for the 10–14 age group, who were mainly in elementary school, the Canadian record was about equal to that of the United States in every decade from 1941 forward, and was only slightly below the U.S. record in 1921 and 1931.

The age group 15–19 years, representing mainly students enrolled in high school, represents a much less satisfactory comparison for Canada. In 1921, 38 per cent of the age group 15–19 were enrolled in school in the United States, compared with 23 per cent in Canada — a difference of 15 percentage points. This difference subsequently widened considerably before narrowing in 1951–61 to 10 percentage points (see Chart 2). Thus, it was not until the 1950's that Canada started to move energetically towards closing the large educational gap with the United States in the education of children of high school age. Yet, even in 1961 Canada had only 62 per cent of the 15–19 age group enrolled in school, compared with 72 per cent in the United States. It should be noted that this is a smaller difference, relatively, than at any time since 1921, when the data for comparison became available. This type of analysis, however, probably overemphasizes somewhat the growth in school enrolment since it does not indicate the distribution of years in high school within the age group. In addition, since the data are based on 10–year intervals, they do

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[1] In the previously mentioned Dominion Bureau of Statistics study, the conclusions respecting university attainment in Canada for males and females in the population give (for a younger age group) magnitudes of a similar order to the above conclusions based on the 1961 Census data for the male labour force 25–34 years of age (a somewhat older age group). The Dominion Bureau of Statistics findings were summarized as follows: "The proportion of Grade 11 students in Canada who eventually reach college or university was estimated at 9 percent. Applying a 67 percent retention rate through university to graduation, it follows that of every hundred students in Grade 11 of elementary schools, 9 would go to college or university and 6 would graduate with a degree." The Dominion Bureau of Statistics, *Student Progress Through the Schools, 1960* (Catalogue 81-513, p. 42).

not show at what particular year in the period 1951–61 the acceleration in enrolment actually began. The previous analysis of the 20–24 and 25–34 age groups, as of 1961, indicated that the proportion of high school students completing at least eleven years, and the high school retention rate as of 1958, were both much smaller in these age groups in Canada than in the United States. Despite these limitations, we can conclude that a major shift in the enrolment is underway. The enlarged share of younger persons attending school in 1961 has very likely increased in more recent years and as a consequence, (discussed in the next section) the level of educational attainment of the labour force will rise at a higher rate than in the past.

TABLE 18

Males Enrolled in School as a Percentage of Total Male Population
by Age Groups, Canada 1921–61 and United States 1920–60

| | Canada | United States |
|---|---|---|
| | (Per cent) | |
| | 1961 | 1960 |
| Age  5– 9[1] ......................... | 75.20 | 83.35 |
| 10–14............................ | 97.11 | 97.41 |
| 15–19............................ | 61.47 | 71.83 |
| 20–24............................ | 11.53 | 19.55 |
| | 1951 | 1950 |
| Age  5– 9[1] ......................... | 65.11 | 78.66 |
| 10–14............................ | 93.14 | 95.61 |
| 15–19............................ | 40.89 | 62.08 |
| 20–24............................ | 6.54 | 18.52 |
| | 1941 | 1940 |
| Age  5– 9[1] ......................... | 66.57 | 73.75 |
| 10–14............................ | 94.32 | 94.68 |
| 15–19............................ | 33.86 | 56.91 |
| 20–24............................ | 4.51 | 8.18 |
| | 1931 | 1930 |
| Age  5– 9[1] ......................... | 68.42 | 72.79 |
| 10–14............................ | 93.51 | 96.10 |
| 15–19............................ | 32.47 | 50.24 |
| 20–24............................ | 3.62 | 8.44 |
| | 1921 | 1920 |
| Age  5– 9[1] ......................... | 65.34 | 67.96 |
| 10–14............................ | 88.66 | 91.71 |
| 15–19............................ | 22.86 | 37.51 |
| 20–24............................ | – | – |

[1] Percentages shown for age group 5–9 years are biased by the general absence of kindergartens for 5-year-olds in Canada. Enrolment ratios would be more accurately represented if the 5-year-old group was excluded from the data.

Source: Appendix Table A–12.

CHART I

MALE ENROLMENT IN SCHOOL
AS A PERCENTAGE OF TOTAL MALE POPULATION
IN AGE GROUP, CANADA AND UNITED STATES
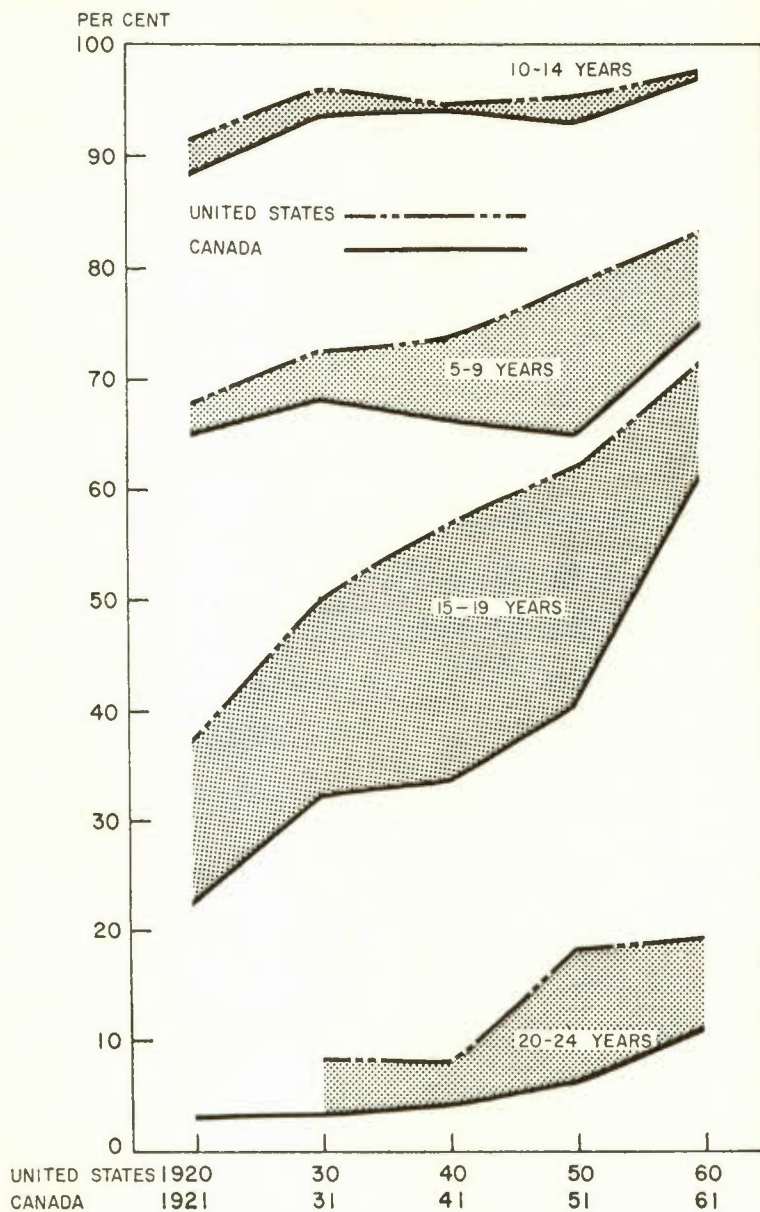


Source: Table 18.

Enrolment ratios of males 20–24 years of age, who were mainly in universities, can be compared between Canada and the United States for the decennial years 1931–61. The data show that the comparative proportion for Canada was lowest in 1951, with Canadian university enrolment amounting to only 35 per cent of the U.S.

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proportion. By 1961, the Canadian proportion had risen to 59 per cent of the U.S. proportion – higher than any previous decade in the period 1931–61. On the basis of the recent changes in the output of university students in Canada, it is apparent that a new phase in university education has now been entered. However, increases in the output of more highly educated younger persons affect the level of education in the whole labour force stock only over a long period of time.

Census studies also provide interprovincial comparisons of educational production for different age groups in the decades 1921 through 1961 (Table 19). For the age group 10–14 (mainly elementary students), all nine provinces shown in Table 19 were quite close together in each decade 1921–61, with relatively high proportions of males attending school. But the same type of comparison for the age group 14–19 (mainly high school students) reveals considerable differences among the provinces, showing British Columbia as the highest (70 per cent) and Quebec and Prince Edward Island the lowest in 1961 (54.1 and 50.7 per cent, respectively). This interprovincial pattern was fairly stable throughout the preceding 30–year period, with British Columbia first and Quebec ninth among the provinces in each decennial year from 1921 to 1951.

For the age group 20–24 (mainly university students) the proportion of males attending school, for the country as a whole, rose from 3.1 per cent in 1921 to 11.5 per cent in 1961. Ontario had the highest proportion in 1921 and 1931, fell to third highest in 1941 and was second highest in 1951 and 1961. British Columbia had moved to the leading position in 1941 and remained there. Quebec placed second highest in 1921, but by 1961 it ranked sixth among the nine provinces.

TABLE 19

Males Enrolled in School as Percentage of Male Population in Each Age Group, by Provinces, 1921–61

| Province | 5–9 | 10–14 | 15–19 | 20–24 | Enrolled 20—24 Group as Percentage of Population Aged 5—24 |
|---|---|---|---|---|---|
| **1961** | | | | | |
| British Columbia ......... | 74.5 | 97.6 | 70.3 | 13.3 | 2.3 |
| Alberta................... | 71.4 | 97.9 | 67.8 | 11.0 | 2.0 |
| Saskatchewan ............ | 71.4 | 96.8 | 65.4 | 11.6 | 2.0 |
| Manitoba ................ | 75.7 | 97.5 | 64.5 | 11.7 | 2.1 |
| Ontario.................. | 82.0 | 97.4 | 65.8 | 12.6 | 2.2 |
| Quebec.................. | 69.4 | 96.5 | 54.1 | 10.9 | 1.9 |
| New Brunswick........... | 68.7 | 97.0 | 56.5 | 9.0 | 1.4 |
| Nova Scotia.............. | 82.7 | 97.1 | 57.4 | 7.6 | 1.3 |
| Prince Edward Island ..... | 71.0 | 96.8 | 50.7 | 8.4 | 1.3 |
| Total .............. | 75.2 | 97.1 | 61.5 | 11.5 | 2.0 |
| **1951** | | | | | |
| British Columbia ......... | 64.9 | 94.7 | 51.7 | 7.8 | 1.8 |
| Alberta.................. | 63.9 | 95.7 | 47.9 | 5.7 | 1.3 |
| Saskatchewan ............ | 64.4 | 96.0 | 46.6 | 5.0 | 1.0 |
| Manitoba ................ | 66.2 | 94.8 | 42.9 | 6.3 | 1.4 |
| Ontario.................. | 69.6 | 94.0 | 43.6 | 7.1 | 1.8 |
| Quebec.................. | 60.0 | 90.1 | 32.7 | 6.6 | 1.4 |
| New Brunswick........... | 63.2 | 93.7 | 40.0 | 5.1 | .9 |
| Nova Scotia.............. | 76.3 | 94.9 | 43.4 | 4.8 | 1.0 |
| Prince Edward Island ..... | 67.2 | 95.9 | 35.7 | 4.9 | .9 |
| Total .............. | 65.1 | 93.1 | 40.9 | 6.5 | 1.5 |

TABLE 19 (Concluded)

| Province | 5—9 | 10—14 | 15—19 | 20—24 | Enrolled 20—24 Group as Percentage of Population Aged 5—24 |
|---|---|---|---|---|---|
| **1941** | | | | | |
| British Columbia .......... | 64.9 | 96.2 | 46.1 | 5.7 | 1.5 |
| Alberta.................... | 61.2 | 96.5 | 42.9 | 5.0 | 1.2 |
| Saskatchewan ............. | 62.4 | 96.2 | 39.6 | 4.5 | 1.1 |
| Manitoba ................. | 67.3 | 95.2 | 37.6 | 3.9 | 1.0 |
| Ontario................... | 72.9 | 95.6 | 36.1 | 4.7 | 1.2 |
| Quebec................... | 63.2 | 91.8 | 26.3 | 4.4 | 1.0 |
| New Brunswick........... | 63.5 | 91.8 | 28.3 | 3.2 | .8 |
| Nova Scotia.............. | 70.2 | 96.1 | 31.5 | 3.7 | .9 |
| Prince Edward Island ..... | 68.6 | 95.4 | 27.7 | 3.4 | .8 |
| Total .............. | 66.6 | 94.3 | 33.9 | 4.5 | 1.1 |
| **1931** | | | | | |
| British Columbia ......... | 69.3 | 95.6 | 40.6 | 3.4 | .8 |
| Alberta.................. | 64.2 | 95.7 | 37.3 | 2.9 | .6 |
| Saskatchewan ............ | 65.6 | 96.0 | 31.4 | 2.4 | .5 |
| Manitoba ................ | 68.9 | 95.0 | 36.9 | 3.3 | .7 |
| Ontario.................. | 73.5 | 96.3 | 37.4 | 4.5 | 1.0 |
| Quebec.................. | 65.5 | 88.8 | 24.5 | 3.4 | .7 |
| New Brunswick.......... | 63.4 | 90.6 | 27.4 | 3.4 | .7 |
| Nova Scotia.............. | 71.1 | 94.3 | 30.8 | 3.1 | .6 |
| Prince Edward Island ..... | 68.0 | 93.2 | 24.9 | 3.6 | .8 |
| Total ............... | 68.4 | 93.5 | 32.5 | 3.6 | .8 |
| **1921** | | | | | |
| British Columbia ......... | 63.4 | 90.9 | 30.3 | 3.3 | .7 |
| Alberta.................. | 58.0 | 91.4 | 28.9 | 1.9 | .4 |
| Saskatchewan ............ | 60.8 | 89.5 | 21.9 | 1.5 | .3 |
| Manitoba ............... | 62.6 | 90.9 | 25.7 | 2.5 | .5 |
| Ontario.................. | 69.5 | 91.7 | 24.3 | 3.9 | .8 |
| Quebec.................. | 67.6 | 84.5 | 18.6 | 3.3 | .6 |
| New Brunswick.......... | 56.4 | 83.8 | 20.8 | 1.2 | .4 |
| Nova Scotia.............. | 63.1 | 88.7 | 23.8 | 2.9 | .6 |
| Prince Edward Island ..... | 62.3 | 89.3 | 25.5 | 3.1 | .6 |
| Total .............. | 65.3 | 88.7 | 22.9 | 3.1 | .6 |

Source: Appendix Table A-13.

One final question which arises in connection with trends of education output relates to the extent of prospective improvements in the stock of education in Canada and to the future pattern of Canada—U.S. differences. In the light of the importance of the possible effect of the current increase in school enrolment for the very large numbers of young persons who will soon be entering the labour force, a further study is planned of the future educational qualifications of the labour force in Canada and the United States. An appropriate assessment, in quantitative terms, of the rates of growth of the stock of education in the two countries would require the construction of a model based on demographic and labour force forecasts and the projection of such education-related variables as enrolment ratios by age in each country, retention rates by years of schooling, and estimates of completions by age and grade. On the basis of such information it would be possible to judge whether the Canadian stock of education may display a more rapid rate of increase than the U.S. stock, and how long it would require, under certain conditions, to close the gap between the two countries. However, some brief comments can be made on this question provided that the above caution about the requirements for quantitative precision is kept in mind.

As was pointed out, the stock of education of the labour force changes constantly through the inflow of young members who are generally better educated, and through the retirement of older members who, on average, are less well educated. (A similar influence is exerted by the flow of migrants when their educational attainments vary significantly from those of the entire labour force.) The rate of improvement, however, depends on two circumstances. The first is the number of persons who are entering or leaving the labour force in relation to the total number of persons in the labour force. The second is the level of education of those entering and leaving in relation to the average educational attainment per member of the labour force.

Recent population projections have shown that the rate of inflow of new members into the labour force in the period ahead will be higher for Canada than for any period during the present century. It is also evident from more recent records and the plans of the educational authorities in a number of provinces that far-reaching improvements have taken place in more recent years, and are still taking place, in Canadian education. The data in the preceding sections of this study were mainly based on the average level of education of the labour force in existence in 1961, and generally the youngest age group examined was the 25–34 group – that is, persons who reflect a level of education obtained as of 1961, on the average some 8 to 16 years earlier, or as of 1965, some 12 to 20 years ago. The enrolment ratios in Chart 1 and Tables 18 and 19 are based on census data up to 1961 and indicate rising average enrolment for each age group up to 1961, including those in the important 15–19 age group. In this group, there was a much greater increase in the proportion attending school between 1951 and 1961 than over any previous decade in the present century. This group is moving into the 25-and-over age group during the current decade. The number of males between 15 and 25 in 1961 was between two and three times as large as those between 45 and 65 and would add significantly to the male labour force over 25 years of age in the years ahead.[1] This very large addition to the existing stock would raise the average educational level at a more rapid rate than at any time since 1921. Taking into account both the relatively large numbers of young persons who will flow into the labour force, and their higher average level of schooling, substantial improvements in the average level of education of the entire Canadian labour force can be expected during the next two decades.

In relation to changes in the stock of education in the United States, these Canadian developments will probably initiate a narrowing of the educational gap. Judging by the data in Chart 1, U.S. enrolment ratios have been above the Canadian ratios for all age groups since 1921, but Canadian ratios increased more rapidly between 1951 and 1961. The more rapid Canadian labour force growth, together with significantly higher levels of average educational attainments of new labour force entrants, suggest that a narrowing of the differences in the stock of education between the two countries may be emerging. This would be a reversal of the trend from 1911 to 1961, when the stock of education embodied in the male labour force aged 25–64 appears to have risen more rapidly in the United States than in Canada.

[1] See Frank T. Denton, Y. Kasahara and S. Ostry, *Population and Labour Force Projections to 1970*, Staff Study No. 1, Economic Council of Canada, Ottawa, Queen's Printer, 1965, Table 2, p. 10.

Despite the reversal of this trend for young people in recent years, it would nevertheless require years to narrow the gap between the two countries for the labour force as a whole to any significant degree. An acceleration of this process would be possible only through strong and sustained efforts to raise the average education of young people in Canada to even higher levels and to introduce measures to raise the educational level of the existing labour force. A reliable estimate of the actual number of years involved in closing this gap, however, must await further research, considering the numbers of variables involved.

### International Migration and Educational Changes

The possibility that international migration over the period 1911–61 may have significantly affected the educational quality of the Canadian labour force is too important a question to be ignored in this study of the contribution of education to economic growth. The estimates made in this study, however, of the educational attainments of immigrant additions to, and emigrant subtractions from, the Canadian labour force can only be regarded as first approximations, given the quality of the underlying data and the assumptions that were considered necessary. (Data, methods and assumptions underlying this section of the study are presented in Appendix B-9.)

The estimates of net labour force migration (Table 3 and Appendix Table A-5) in each decade 1911–61 were positive except for the 1920's, when emigrants appear to have exceeded immigrants among the male labour force. Moving back by decades, the record in brief is that positive net migration of 265,000 males 25–64 years of age in 1951–61 raised the average educational attainment of the labour force by a small amount in the 1950's mainly through net immigration of males with a university degree. The small improvement in the 1940's in educational attainment of the labour force due to net migration (75,000 males 25–64 years of age) resulted from slightly higher proportions of the net migrants having high school and some university training. The small net migration of the 1930's of 7,400 appears to have had no appreciable effect on the educational quality of the labour force, while the negative net migration of the 1920's of 44,000 appears to have slightly reduced the educational attainment of the labour force. While the estimates indicate that the positive net migration of the decade 1911–21 increased the educational quality of the labour force, it is likely that this was not large (see Appendix B-9).

The following comments relate to the experience of the two decades 1951–61 and 1921–31 – decades in which particularly important changes occurred in the Canadian male labour force as a result of international migration. The quality of the Canadian male labour force 25–64 years of age in 1961, measured in terms of schooling, appears to have been only slightly increased as a consequence of net migration in the period 1951–61. For example, the estimated median years of schooling for the 1961 male labour force in Canada was 9.37. If the 1961 Canadian labour force were considered net of migration (immigrants subtracted and emigrants added back), the median is estimated at 9.35 years, instead of the actual 9.37. The medians were 9.64 for labour force emigrants and 9.56 for labour force immigrants during this period, and although the immigrants in this age group outnumbered emigrants by almost four to one, the median for the net labour force migrants of 1951–61 was 9.53 years of schooling.

It is estimated that a relatively high proportion of the Canadian labour force net of migration in 1951–61 had grade eight or less education in 1961. In 1951–61, however, migrants also appear to have had almost comparably high proportions of grade eight or less schooling – 44 per cent among immigrants into the labour force, and 43 per cent among emigrants out of the labour force. At the university level of training, the immigrant addition to the Canadian labour force was significant. While 5.59 per cent of the 1961 male labour force had university degrees, it was estimated that 6.28 per cent of the immigrant addition to the labour force had university degrees. According to the estimates of this study, a slightly smaller proportion (5.84 per cent) of the emigrants had university degrees. Since male labour force immigrants with university degrees were 4.1 times more numerous than comparable emigrants, the proportion of males with degrees for the net migrants was 6.44 per cent, which may be compared with the 1961 labour force net of migration of 5.52. The net addition by migration of males with university degrees was estimated at 17,039 or 8.9 per cent of the total number of males 25–64 years of age (190,744 Appendix Table A-4) net of migration, in 1961.

In summary, we may conclude that while a "brain drain" is hardly evident on the basis of these estimates, the closeness with which the distribution by years of schooling of the immigrant labour force tended to match the educational distribution of the Canadian labour force without the immigration meant only a relatively small net addition to the quality of the Canadian labour force in terms of years of schooling. It should be emphasized, however, that the immigrant contribution to the quality of Canadian life cannot be measured solely through years of schooling. Further, the total output of the Canadian economy was larger as a result of the additional inputs from the immigrant addition to the labour force, in the same manner in which any addition of labour and capital inputs would account for a portion of the increase in total output. Our interest in this study is relating the change in total output of the economy to the change in the quality of labour input. It is only in this context that the contribution of the immigrant labour force is estimated to be relatively small.

It should also be noted that since the estimate of years of schooling of immigrants was provided by the immigrant labour force stock as of 1961 (that is, including those arriving in Canada in the period 1951–61), it is likely that some of the younger immigrants received part of their education in Canada.[1]

A comparison of the educational attainment of labour force immigrants, 25–34 years of age, who arrived in Canada in the period 1951–61, with that of the 1961 Canadian labour force in that age group net of migration, indicates that in each educational category the immigrant percentage was less favourable than that of the Canadian labour force, except for those with university degrees (6.1 per cent of immigrants compared with 6 per cent for the Canadian labour force net of migration).[2] The significance of this comparison is that the educational quality of the total labour force was somewhat lowered by immigration in this age group and that

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[1] The other alternative of using the intended occupations of arriving immigrants as the basis for estimating the educational attainment of immigrants to the labour force would have substantially understated immigrant educational attainment, since their intended occupations were generally below their attained occupations.

[2] See Appendix B-9.

its influence will continue to be felt in successive decades as this age group proceeds through the older age groups. Moreover, the immigrant addition to the labour force in 1951–61 represented approximately 15 per cent of the 1961 gross labour force 25–34 years of age.

In the age groups 35–44 and 45–54, the comparison of immigrant and Canadian labour force educational attainment showed that the percentage distribution of the immigrant educational attainment almost matched that in the Canadian labour force, except that the proportion of immigrants with university degrees was higher, particularly in the 45–54 group. Immigrant additions to the labour force for the 55–64 age group indicate that, in general, they had a higher educational attainment than the Canadian labour force, particularly in the category of university degrees. The influence of emigration on net migration for the decade of the 1950's appears to have been more limited, especially since emigrants from the labour force represented only about one quarter of the number of immigrants.[1] In general, for the age groups 35–54, the percentage distribution of educational attainment for emigrants was much like the Canadian labour force, except that the proportion with university degrees was slightly higher, while in the youngest and oldest age groups the educational attainment distribution of emigrants was approximately the same as the Canadian labour force.

Estimates of immigration and emigration of labour force males in 1921–31 are shown in Table 3 above and Appendix Table A-5. The net emigration of some 44,000 males in the labour force 25–64 years of age to the United States and the United Kingdom reduced both the size and the average quality of the Canadian labour force (see Appendix B-9 for an alternative estimate based on a higher number of returning Canadians). A comparison of the percentage distribution of the net migrants by educational attainment with either the gross labour force of 1931 or the labour force of 1931 net of migration shows that there was a smaller percentage of the net migrants (leaving the Canadian labour force) with zero to eight years of schooling than in the Canadian labour force, and accordingly more among the net migrants with high school and university training.[2]

The reasons behind the net labour force emigration from Canada in the 1920's, which appear to have lowered the educational attainment of the Canadian labour force, is of some interest in the economic history of Canada. Immigration in the United States was generally restricted for the first time after World War I and part of the immigration to Canada prior to 1924 likely occurred because many immigrants of European origin had originally planned to reside in Canada as an expedient enabling them to be admitted ultimately to the United States. Total immigration to the United States declined significantly in the 1920's, relative to the previous decade, and immigrants from Canada and Newfoundland represented almost one quarter of total U.S. immigrants.

The large emigration of the early 1920's from Canada to the United States may have reflected, at least in part, declining economic opportunities in Canada compared with the United States. However, another important, but quite different,

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[1] The available emigration data are less comprehensive than those for immigration. The limitations of the emigration data are noted in Appendix B-9.

[2] Based on Appendix Tables A-4 and A-5.

reason for the large number of emigrants (200,690) from Canada to the United States in 1924 (compared with only 117,001 in 1923) was the new immigration legislation in the United States which became effective July 1, 1924, requiring visas of all immigrants. Moreover, while persons born in Canada and Newfoundland continued to be admitted as immigrants to the United States without being subject to quota, persons not born in Canada were only admitted, after July 1, 1924, under their original national-status quota.[1]

### Improvements in Daily School Attendance

The increase in the average and median years of schooling in Canada has been accompanied by a large rise in average number of days of school attended by Canadian students (see Chart 2). It is estimated that average daily attendance per school year increased from about 44 per cent in 1867 and 64 per cent in 1911 to 92 per cent in 1961 (Appendix Table A-10). Since a regular school year of approximately 200 days appears to have been in effect for most of Canada since the turn of the century and has not changed significantly (see Appendix B-6), these percentages imply an increase in average daily attendance from about 130 days in 1911 to 184 days in 1961.

CHART   2

AVERAGE DAILY ATTENDANCE AS A PERCENTAGE OF ENROLMENT,
CANADIAN PUBLIC SCHOOLS
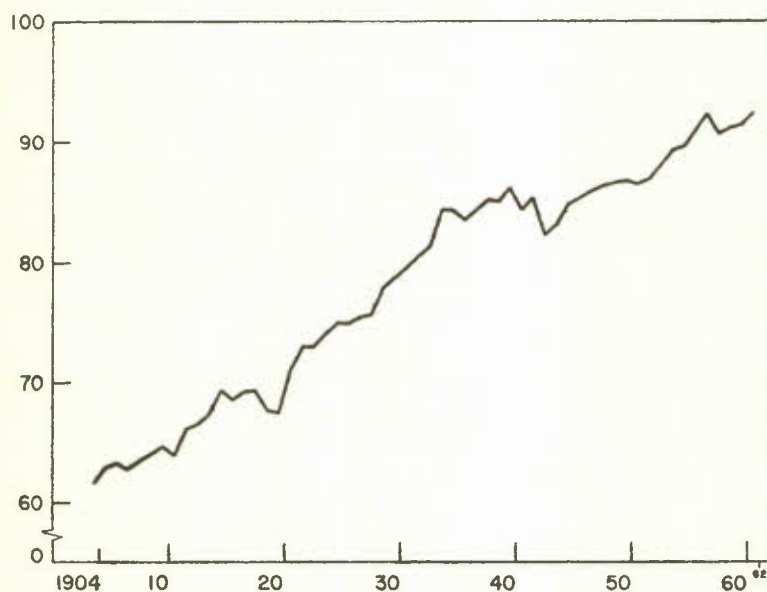


Source: Appendix Table A—10.

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[1] The U.S. Immigration Act of 1921 had permitted immigrants who had established five years of residence in Canada to enter the United States as exceptions to the quota system (see U.S. Department of Labor, *Annual Report of the Commissioner General of Immigration*, 1924, p. 5). The expiration of the 1921 Act ended this opportunity. The Montreal office of the U.S. Immigration Office reported in 1925 that "there are thousands of Europeans in Canada who came here to wait five years for exception under the Act of 1921, or to smuggle across the border" (U.S. Department of Labor, *Annual Report of the Commissioner General of Immigration*, 1925, p. 17).

The 1961 labour force was composed mainly of persons who had received their education some years previously. Thus a person of 50 years of age in 1961 was born in 1911 and presumably commenced his education about 1917. Similarly, a person of 50 years of age in 1911, when our analysis begins, was born in 1861 and commenced his education about 1867. It can be seen, therefore, that the changes in daily school attendance over some five previous decades affect the average quality of education of the labour force studied in any given decennial year. The average education of the labour force in any one decade is the result not only of different age groups with different years of schooling, but different age groups with longer or shorter days of schooling in the school years they attended. In order to study the changes in days of schooling of the labour force for each decade in the period 1911–61, it was necessary to examine records of school attendance going back to the 1860's. Since the data necessary to estimate average days of school attended for all Canadian public schools was available only as far back as 1904, the solution adopted was to use the attendance records of elementary and high schools for the Province of Ontario, which were available from 1867, as an approximate indication of daily attendance for the country as a whole (see Appendix Table A-10). As described in Appendix B-6, an estimate of days of school attended for Canada from 1867 through 1961 was derived, yielding the average days of school attended as approximately 90 days in 1867 and 184 days in 1961, or an average increase per year of about one day of school attended. The calculation of the changes in days of school attended was confined to persons with elementary and high school education, while all persons with 13 years of schooling or more, at all census dates, were assumed to have attended full school years from elementary school through their entire formal schooling.

The average number of school days per school year attended per person in the labour force was computed by estimating for each census year the number of days per year spent in school at the time each age group was attending school. These computations resulted in an estimate of an average of 105 days of school in 1911 and 157 days of school in 1961 attended per person in the labour force per school year attained (see Appendix B-6). The percentage increases based on these estimates are shown below in Table 22, col. (3).

Over the period 1911–61, the average number of days of school attended per year of school completed by the male labour force is estimated to have increased by about 50 per cent. Particularly important in explaining this considerable rise in the actual time spent in school was the continuing shift in the population from rural to urban areas. This movement, clearly discernible in Canada from the 1870's onward, represented the process of urbanization as commercial and industrial localization and specialization developed in the economy. In a predominantly rural society, the real cost of sending children continuously to school for the entire school term consisted of the work which they could otherwise do on the farm. The shift to urban communities, however, did not end the competing opportunity of employment, for in the cities, industrial employment was still a possible alternative to attending high school in the early part of this century. Provincial legislation restricting the employment of children and establishing compulsory school attendance laws was a significant source of increases in the average days of school attended.

# CHAPTER 3

## THE CONTRIBUTION OF EDUCATION TO GROWTH

### THE ANALYTICAL APPROACH

While a review of the rapidly accumulating literature concerned with the measurement of economic growth need not be made here,[1] it is useful to give a brief account of how some of the more recent attempts to measure the contribution of education to economic growth fit into the wider subject of growth analysis.

A good deal of the contemporary literature in this field deals with improvements in the measurement of the growth variables. A meaningful indication about the improved efficiency and productivity of resources employed in the production process obviously can only be obtained if inputs are measured on a comparable basis over time. For example, an average worker of today differs in many important respects from a worker some 50 years ago. He works shorter hours, he possesses different skills, and he is generally better educated. It would be quite misleading to use simply the increase in the number of workers in employment as a measure of increased labour input in the economy. Similar considerations would apply to the changed nature of the other basic inputs.

A significant impetus to further investigations of the sources of economic growth is associated, along with the contributions of many others, with the work of Solow and Kendrick and Denison. In 1957, Solow, in an important article, concluded that in the United States over the period 1901-49 when gross output per man doubled, 12.5 per cent of the increase was attributable to the increased use of capital and the remaining 87.5 per cent was attributable to a whole range of factors which account for changes in productivity and which Solow called "technological change".[2] Solow emphasized later[3] that technological change was not independent of changes in the use of capital and was actually closely related to the rate of investment in new capital goods, since the efficiency of capital depends upon its age, and since investment in capital goods serves as a vehicle for introducing more efficient industrial technology.

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[1] See Appendix B-8 for further references to the discussion of the residual and economic growth.

[2] Robert M. Solow, "Technological Change and the Aggregate Production Function", *Review of Economics and Statistics*, August 1957. This article provided a method of separating shifts in the aggregate production function, attributed to technological change, from movements along the production function. In the November 1958 *Review of Economics and Statistics*, Solow accepted a correction of 10 per cent attributable to the increased use of capital.

[3] Solow, "Technical Progress, Capital Formation and Economic Growth", *The American Economic Review*, May 1962.

Kendrick's valuable study for the National Bureau of Economic Research on productivity in the United States (available in part in 1958) provided another variant of the residual approach to economic growth which in particular made significant improvements in the measurement of the change in the quantity and quality of labour inputs as well as developing a measure of labour and capital inputs combined.[1] Kendrick's method is to compare the growth of the labour and capital inputs combined (each input weighted by its constant base period price) with the growth in real output. His refinements of real output estimates also represented a major contribution to the analysis of economic growth in the United States.

The result was to construct a much more meaningful, though imperfect, measure of productivity, i.e., productivity was measured as output per unit of total inputs of weighted man-hours and tangible capital combined, in contrast to the conventional technique of measuring productivity as output per unit of labour input. Labour inputs in Kendrick's system were also more refined than previously available, since the usual index of changes in labour input made no correction for changes in the composition or quality of labour and therefore assumed that all man-hours were equivalent. Kendrick's solution was to provide weighted man-hours in which higher-paying industries were given more man-hour weight than lower-paying industries. (Denison's approach, as noted below, is to measure differences in the productivity of the labour force associated with differences in education, rather than taking account of interindustry wage differentials.)

Over the period 1889-1957, according to Kendrick's findings, combined labour and capital inputs rose at an average rate of 1.9 per cent per year and real output rose at a rate of 3.5 per cent per year.[2] The difference of 1.6 per cent per year between the rates of growth of the combined labour and capital inputs and the rate of growth of output was attributed to the increase in the productivity of the inputs or to what Kendrick called the increase in "total factor productivity" -- another variant of the residual measurement.

The very large influence (46 per cent of the increase in real output, 1889-1957) ascribed by Kendrick to increases in combined factor productivity reinforced the view that the convention of giving changes in the quantity of labour and capital an overwhelming role in economic growth is inadequate.

As Bowen has subsequently emphasized, "the size of the residual certainly does serve as a mandate to explore in detail the economic effects of activities

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[1] John W. Kendrick, *Productivity Trends in the United States*, National Bureau of Economic Research, Princeton University Press, 1961. An earlier summary version of Kendrick's study (and other studies) appeared in Solomon Fabricant, *Basic Facts on Productivity Change*, Occasional Paper 63, National Bureau of Economic Research, 1958. For a penetrating review of Kendrick's work see Evsey D. Domar "Total Productivity and All That", *Journal of Political Economy*, sec. 1962.

[2] Kendrick, *ibid.*, Table 6, p. 79. Fabricant, *ibid.*, shows from data based on Kendrick's study, that in the period 1929-57, real output in the United States rose at an annual average rate of 3.1 per cent, while weighted labour and capital inputs combined grew at the annual rate of 1 per cent, yielding a residual rate of 2.1 per cent per year.

often neglected."[1] Kendrick and his National Bureau associates were well aware that their more precise measures of weighted man-hours of work and tangible capital excluded other unspecified inputs, and that to an unidentified extent their measure of productivity was therefore overstated. Fabricant, in his summary of Kendrick's work on productivity, as well as that of the National Bureau of Economic Research, argued that the main variables not specified were included in society's intangible capital.[2]

In *The Sources of Economic Growth*, Denison took further important steps in developing the residual approach to economic growth. As discussed in Chapter 1, his method was to identify and estimate the contribution to economic growth of many of the unspecified inputs as well as the conventional inputs. Denison's study has evoked a large and far-reaching response, with some economists commending his work and others criticizing his methods or assumptions.[3]

The methods employed by Denison are somewhat similar to the underlying framework employed in much of the recent literature analyzing economic growth and the residual -- a framework typically involving the use of a Cobb-Douglas

[1] William G. Bowen, "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches", *Economic Aspects of Higher Education*, OECD, Paris, 1964, p. 184.

[2] "In an important sense, society's intangible capital includes all the improvements in basic science, technology, business administration and education and training, that aid in production — whether these result from deliberate individual or collective investments for economic gain or are incidental by-products of efforts to reach other goals. If intangible capital were so defined, it would probably follow that much (not all) of the increase in product would reflect increase in resources. But so wide a definition of intangible capital would get us no closer to determining the causes of increase in product.

With the statistics presently available we have been able to measure the direct effects, on output, of increase in labor time and increase in volume of tangible capital. The indirect effects of the increases in these resources, and the effects of all other causes, we have been forced to lump together under the heading of productivity and to measure as a whole. The residue includes the contributions of the several forms of intangible capital mentioned; the economies resulting from increased specialization within and between industries, made possible by growth in the nation's resources and its scale of operations generally; the improvement (or falling off) of efficiency in the use of resources resulting from change in degree of competition, in volume, direction and character of government activities and regulation; and the greater (or smaller) benefits resulting from change in the volume, character, and freedom of commerce among nations." Fabricant, *op. cit.*, p. 22.

[3] For example, see Moses Abramovitz, "Economic Growth in the United States, A Review Article", *American Economic Review*, September 1962, for an excellent commentary on Denison's work, Essays by Friedrich Edding, Edmond Malinvaud, Erik Lundberg and Jan Sandee, representing mainly a European point of view, as well as a lucid summary by Denison of his work and his Reply are contained in *The Residual Factor and Economic Growth*, OECD, Paris, 1964, Part I. Some further discussion by Denison concerning his study and comments by Robert Solow, Otto Eckstein and Seymour Harris appear in Seymour Harris and Alan Levensohn, Eds., *Education and Public Policy*, Berkeley, McCutchan Publishing Co., 1965, Chapter 16.

type of aggregate production function. This tool of analysis, on the basis of certain assumptions,[1] can be used to identify the various factors which have contributed to past increases in the national income of a country and to measure their quantitative importance.

The aggregate production function method involves comparing increases in inputs used (labour, capital and resources) with the resulting increases in total output. For example, if all inputs increase by 1 per cent, then output rises proportionately by 1 per cent. Further, an increase in, say, labour inputs by 1 per cent, other inputs being held constant, would increase output by the elasticity of output with respect to the input of labour -- .76 per cent in the Canadian case discussed below. Under conditions of competitive equilibrium and a number of other assumptions, the share of labour in national income will be equal to this elasticity.[2] The elasticity of output with respect to the inputs of capital and resources would thus be .24 per cent in this formulation, with the sum of the elasticities equal to one. This production function therefore assumes constant returns to scale.

Denison's model of economic growth, however, does not maintain the assumption of constant returns to scale since he adjusts for increasing returns to scale in his residual category described as "increase in output per unit of input".[3] A 1 per cent increase in total inputs may therefore lead to a larger than 1 per cent increase in output.

Although we are interested here only in explaining the approach used in this study to measure the contribution of education to economic growth, the methods used require that reference be made to the general model underlying Denison's entire study. While an estimate of the Canadian residual cannot be attempted here (since much more information is required), an aggregate-production-function frame-

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[1] See Appendix B-8 for a discussion of the underlying assumptions of the Cobb-Douglas production function.

[2] See Appendix B-8.

[3] See Appendix Table A-16 for a summary of Denison's sources of economic growth. This particular "first" residual category in Denison's work is unlike the Kendrick residual category described earlier, in that more complete quality adjustments are already made in labour input, mainly via the change in the educational attainment of the labour force. In an informal discussion Denison stated his approach as follows: "Let me say just a few words about my general approach in that part of the study which is concerned with sources of past growth. It is essentially a marginal-productivity approach, which starts with the assumption that total output increases for two reasons — because we increase the amount of resources that we put into production, and because we increase productivity.

As a first approximation, one may suppose that if we increased by one per cent the quantity of labor, capital, land entrepreneurship — that is, of all inputs, according to whatever classification you like — output would be one per cent higher, other things being equal. In my study I actually assume that, because of economies of scale, we get a little more; taking the economy as a whole, a one per cent increase in all inputs would actually yield a 1.1 per cent increase in output during the recent period in the United States. In my estimates for the past, I just let that extra amount ride separately as a contribution of economies of scale, rather than counting it in the contributions of labor, capital and so on." Comments of Edward F. Denison, in Harris and Levensohn, *op. cit.*, p. 330.

work is also employed in this study for estimating the contribution of education to economic growth. The general properties and limitations of this framework therefore apply to our estimates of the contribution of education to economic growth in Canada. However, it appears that Denison's technique of measuring the contribution of education to economic growth (which involves adjusting the rate of change in labour input by the rate of change in labour quality) could be incorporated in other aggregate-production-function formulations of growth models. Thus, Solow's model (1962) employing an aggregate-production-function which takes account of improvements in the quality of the capital stock could be amended, for example, to take account of Denison's method of handling the improvement in the quality of labour.[1] Further studies of the sources of economic growth in Canada could use the education estimates of this study as one step in completing the Denison approach to growth measurement, or alternative aggregate-production-function formulations could be used as well.

In this part of the study, an attempt is made to estimate the quantitative contribution of improved education as a factor in Canada's economic growth over the half century from 1911 to 1961. There are two steps involved in computing the share of education in growth within the context of this conceptual framework. The first is to determine the growth in average labour income per man due to improved education. This is done by asking the question, "What would have been the level of average income in, say, 1961 if the labour force were assumed to have possessed the educational qualifications of the 1911 labour force?"[2] As will be shown, average income per man was about 30 per cent higher in 1961 than it would have been if, other things being equal, there had been no improvement in the level of education.[3]

The second step involves relating this calculated rise in labour income per man to over-all economic growth, since labour is only one of several factors which have contributed to growth, although it is by far the most important. The relative importance of each factor employed in the production process may be determined by its share in total income. On this basis, it can be shown that labour constituted 76 per cent of total inputs, or factors employed in production, the remaining 24 per cent being made up of "property income" reflecting inputs of capital, including net foreign investment, and land. Estimation of the change in total factor inputs can be regarded as the calculation of an index number of all factor inputs, with their shares in total income being used as weights. In the case of Canada, these shares are estimated to have been fairly stable over the past 50 years.[4] It is therefore implied that a 1 per cent rise in labour output, for example, would have resulted in a .76 per cent rise in total output (with other factor outputs unchanged).

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[1] See for example, Richard R. Nelson, "Aggregate Production Functions and Medium Range Growth Projections", *American Economic Review*, Sept. 1964, pp. 587-590; and Appendix B-8.

[2] Or alternatively, how much change in average income per man would have occurred if the education-income differentials of 1961 were applied to the existing distribution of education by years of schooling of the labour force in each decade 1911 through 1961?

From Table 22, col. (5) 29.50 per cent.

[4] See Appendix B-8 for a discussion of the distribution of national income to various factors of production, and of the assumption regarding the elasticity of factor substitution.

Historical records indicate that total output per employed person had increased by 1.67 per cent per year from 1911 to 1961. Improved education of the labour force, as will be shown, has raised average labour productivity at the rate of 0.52 per cent per year over the same period.[1] Given the labour share, improved education has thus contributed almost one quarter to the productivity growth per employed person from 1911 to 1961.[2]

Similar calculations are shown in this part of the study for other time periods, and the comparable U. S. experience is cited in the appropriate places for comparison. An estimate is also made of the extent to which educational differences affect income differences in the two countries.

## EDUCATION AND INCOME

As in other countries, the evidence in Canada also points to a close relationship between a person's education and earnings. Chart 3, based on the Census of Canada of 1961, illustrates this relationship for various age groups.

CHART 3

### INCOMES BY AGE GROUP AND EDUCATION LEVEL
### MALE NONFARM LABOUR FORCE, 1961
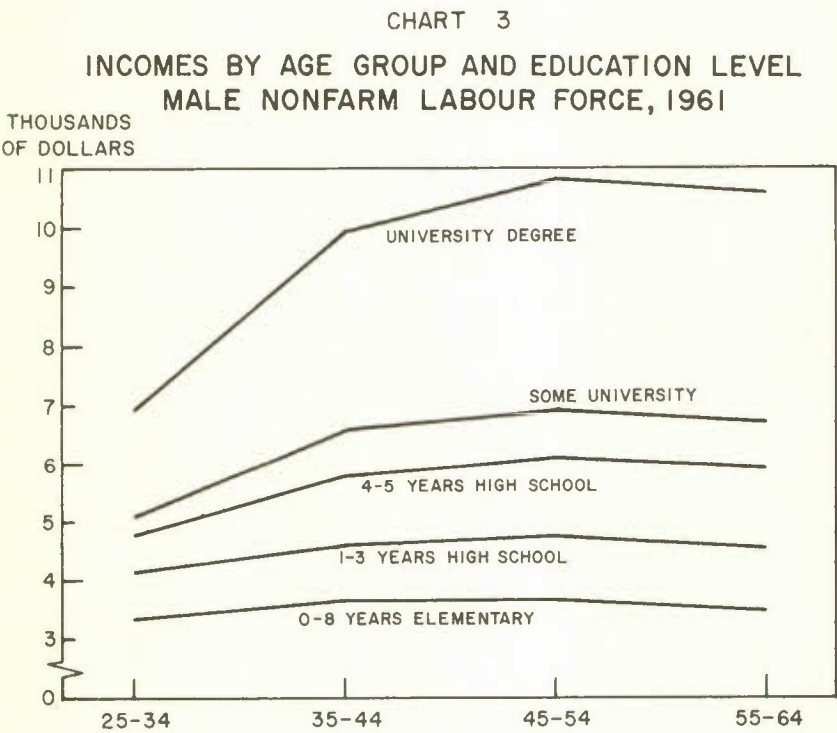


Source: Dominion Bureau of Statistics,
        *1961 Census of Canada* (Catalogue 98-502, Table B-6).

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[1] From Table 22, col. (6).

[2] Calculated as $100 \frac{(.52) \times (.76)}{1.67}$

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Differences in incomes earned by persons with different levels of schooling in 1961 provide a convenient "weighting" system by which it is possible to combine each educational distribution of the labour force at the past five censuses. The average income per man in the male labour force in 1961, for example, is a weighted composite of the earnings of persons with university degrees, high school education, and elementary schooling. Applying the 1961 education-income differential weights to the educational distribution of the 1911 male labour force, a lower over-all average income per man would be obtained, because there were proportionately fewer high-income university graduates and proportionately more low income persons with elementary-school education in that distribution. Thus this calculation shows what the average income per man would have been in 1961 if no improvements in the educational distribution had taken place since 1911. The difference between this calculated average income and the actual average income in 1961 can be viewed as the contribution of education to increased labour income per man.

An attempt is made in this section to establish a suitable set of such weights based on education-income differentials. In particular, it seeks to clarify to what extent income differentials are due to education, and also how reasonable an approximation it is to assume constant 1961 income differentials for the period back to 1911.

While the 1961 *Census of Canada* provides basic information on education-income relationships, additional estimates were necessary to establish income by specific years of schooling (Table 20), Given this breakdown, consideration must be given to the extent to which differences in incomes are related to the differences in the years of schooling attained. For example, it is recognized that the incomes of individuals are also influenced by many other factors, such as native ability, intelligence, effort, the socio-economic status of an individual's family, chance, and other factors. There is, undoubtedly, some relationship between the level of education and these other factors. Denison's solution to this question was to assume that only three fifths of the differences in income were due to differences in education. This procedure is also followed in the Canadian calculations in this study.

Table 20 shows the estimates of the average income per person of the male labour force 25-64 years of age by years of schooling; it also shows the average income for persons with different years of schooling, expressed as a percentage of the average income earned by persons with eight years of schooling. The data in Table 20 are based on the nonfarm labour force, since the 1961 *Census of Canada* did not collect income data for the farm labour force. As noted further in Appendix B-7 it was assumed that the income-education *differentials* which prevailed for the 1961 nonfarm male labour force also applied to the total male labour force.[1]

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[1] An effort was made to supplement the above nonfarm data with information from a sample survey of farm income by years of schooling and age groups conducted by the Dominion Bureau of Statistics in the late 1950's. Unfortunately, results from this survey could not be used here since a large part of the incomes reported for the farm population appear to have been earned in nonfarm occupations. The accuracy of possible future studies in this area would be considerably increased if the next Canadian Census of 1971 included an income-education sample by age groups for the whole labour force.

## TABLE 20

### Average Annual Income per Male Person in the Nonfarm Labour Force, by Years of Schooling, 1961

| Years of Schooling | Mean Incomes | Mean Income as Per Cent of Income for Persons with 8 Years of Schooling | Assuming that only three fifths of education-income differentials are attributable to differences in education | |
|---|---|---|---|---|
| | | | Mean Income as Per Cent of Income for Persons with 8 Years of Schooling | Mean Incomes, Representing Assumed Effect of Education Only |
| | (dollars) | (per cent) | (per cent) | (dollars) |
| 0—4 years elementary school .............. | 2,758 | 69.5 | 81.7 | 3,243 |
| 5—7 years elementary school .............. | 3,439 | 86.6 | 92.0 | 3,651 |
| 8 years elementary school ............... | 3,970 | 100.0 | 100.0 | 3,970 |
| 1—3 years high school................ | 4,530 | 114.1 | 108.5 | 4,306 |
| 4 years high school................. | 5,469 | 137.8 | 122.7 | 4,870 |
| 5 years high school................. | 5,878 | 148.1 | 128.8 | 5,115 |
| Some university..................... | 6,332 | 159.5 | 135.7 | 5,387 |
| Some university, including 5 years high school.. | 6,080 | 153.2 | 131.9 | 5,236 |
| University degree.................... | 9,576 | 241.2 | 184.7 | 7,334 |
| Total (weighted).................. | 4,602 | | | 4,341 |

Note: Annual income refers to wages, salaries, commissions and tips (before deductions) from employment, and net income received from own business or professional practice, excluding net income earned from the operation of a farm. Only the 25—64 year age group is included.

Source: Dominion Bureau of Statistics, Census of Canada, 1961 (Catalogue 98—502, Table B6); Incomes of persons with grades 0—4, 5—7, 8 elementary schooling, 4 years and 5 years high school and some university were estimated in Appendix B—7.

Additional estimates of incomes received by male members of the labour force for certain years of schooling not originally provided for in the Census were necessary in order to construct percentage differentials of income by years of schooling relative to incomes of persons with eight years of schooling. Appendix B-7 provides the methods used for estimating the incomes for the years of schooling shown in Table 20. The income estimate for males 25-64 years of age with eight years of schooling was the most important of the income estimates, since it provides the base for the percentage earnings differentials of all others. Fortunately, further 1961 Census data reporting the earnings by age and by somewhat more detailed years of schooling for wage and salary earners only was available. An upward adjustment for the omission of owner income permitted an estimate of incomes in the labour force with 0-4 years of education, 5-7 years of education and grade eight education (see Appendix B-7). If grade eight income would have been estimated as lower than it appears in Table 20, the whole range of differentials above grade eight, and the imputed productivity of further years of schooling, would be greater. The opposite would hold if grade eight income were to have been estimated as higher than shown in Table 20.

As noted earlier, the income-education differential should not be attributed entirely to differences in education. For example, although the average income for members of the male labour force with university degrees was $9,576 and the percentage earnings differential, relative to those with grade wight equal to 100, was 241, this differential should not be taken to imply that the additional income above grade eight was entirely due to additional years of schooling. Other factors, suggested above, were also involved. Denison chose "to make the explicit assumption that three-fifths of the reported income differences represent differences in income from work *due to* differences in education as distinguished from associated characteristics."[1] The earnings differentials associated with education on three-fifths assumption are shown for Canada in Table 20. Denison's calculations of these differentials for the United States are shown in Appendix Table A-14.

More recently (after the publication of his *Sources of Economic Growth*), Denison has shown that considerable empirical support exists for this assumption on the basis of information provided by a survey of the income history of a sample of Illinois, Minnesota and Rochester males of various class standings graduating from high school and proceeding through college to employment.[2] This survey estimated the determinants of income differentials between the college-trained and high-school graduates although the direct evidence of this survey covered only income differentials attributable to university education. One finding, for example, was "the clear implication that among high-school graduates without college training, ability as measured by high-school class standing has little effect on salary. At least this is true of the upper three fifths in class standing, the group from which nearly all the college educated are drawn."[3]

[1] Edward F. Denison, *The Sources of Economic Growth*, p. 69.

[2] Dael Wolfle and Joseph G. Smith, "The Occupational Value of Education for Superior High-School Graduates", *Journal of Higher Education*, April 1956.

[3] See Edward F. Denison, "Appendix to Edward F. Denison's Reply", *The Residual Factor and Economic Growth*, OECD, Paris, 1964, p. 92.

The completion of four and five years of high school was associated, using this assumption, with an earnings differential of 23 and 29 per cent above incomes of grade eight graduates, while males with only one to three years of high school had earnings about 8.5 per cent higher than males with grade eight. The attainment of a university degree in Canada is estimated to raise the earnings differential 85 per cent above grade eight, 51 per cent above the four-years-of-high-school level, and 36 per cent over the some-university level. A university degree in Canada results, apparently, in higher earnings relative both to males with grade eight education and to males with some university training, than in the United States. In the United States the attainment of a university degree raised the earnings differential 81 per cent above grade eight and 30 per cent above some university. The differences between Canadian and U.S. estimates may reflect the relatively greater scarcity in Canadian labour markets of individuals who have acquired university degrees.

For purposes of the calculation made in the subsequent sections of this study, it was assumed that constant percentage earnings differentials associated with education prevailed over the period 1911-61 in Canada. Denison regarded his use of the constant-differential assumption as defensible on the grounds that the little evidence available seemed to indicate that in the United States "demand for labor has shifted toward a requirement for more education at about the same rate as the labor supply has become better educated."[1]

## EDUCATION AND GROWTH

### Changes in Income Due to Increased Years of Schooling

Average income per man in the male labour force 25-64 years of age rose some 12 per cent due to improved education over the 50 years. The change in average income, as recorded in Table 21, is determined by the change in the proportion of persons with various levels of education in the labour force and the use of constant 1961 education-income differentials over the 50—year period; it should not be confused, for example, with a series showing changes in real income per person over the same period. The data in Table 21 can also be interpreted to mean, for example, that the average income per man in the labour force was 12 per cent higher in 1961 than it would have been if the labour force had possessed the same years of schooling as the 1911 labour force.

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[1] Edward F. Denison, *The Sources of Economic Growth*, p. 70. The assumption affects the calculation of the contribution of education to economic growth in the folllowing manner: "The procedure assumes that percentage earnings differentials (measured before taxes) associated with education have not changed in the period covered. If they have increased my procedure would overstate the contribution of education to past growth while if they have decreased it would understate the contribution of education. What little evidence is available suggests that there may have been some small increase in percentage differentials since 1939 but perhaps not in the longer run. Evidently demand for labor has shifted toward a requirement for more education at about the same rate as the labor supply has become better educated. Most of the evidence is given by Herman P. Miller in 'Annual and Lifetime Income in Relation to Education: 1939-1959,' *American Economic Review*, December 1960, pp. 962-985."

The change in average income per male member of the labour force was derived for each decade in Table 21 on the above-mentioned assumptions that the income-education differentials which applied in 1961 also applied in the earlier decennial years back to 1911, and that three fifths of the 1961 income differentials are attributable to differences in years of education. Income differentials so defined were then applied to the educational distributions of the labour force at the various census dates (see Appendix Table A-15). As discussed above, this operation is analogous to assigning "base-period weights" (based on 1961 income differences) to the changing educational structure of the labour force over the past five decades (see Appendix B-7 for an outline of the calculations).

## TABLE 21
### Rise in Mean Income Per Man Due to Increases in Years of Schooling, 1911–61
#### (1911 = 100)

| | |
|---|---|
| 1911 | 100.0 |
| 1921 | 102.2 |
| 1931 | 103.8 |
| 1941 | 106.5 |
| 1951 | 109.5 |
| 1961 | 112.0 |

Source: Calculated from data in Appendix Table A-15.

The effects of longer education per man are compared in Table 22 with the estimates made by Denison for the United States. Col. (1) of this table shows the percentage changes from decade to decade in income per male member of the labour force, considering only changes in the years of education.

The percentage changes in income per man, considering only years of education, were higher for the United States in every decade, although the percentage changes were fairly close for both countries in the decade 1911-21. The decade of the 1920's in Canada had the least change in income attributable to changes in years of schooling of any of the five decades.

Percentage changes by decades in mean years of schooling in Canada and the United States are shown in col. (2) of Table 22. While the percentage changes in col. (1) and (2) move in the same direction, they do not move in an identical manner. The variations are due to the fact that the income-education differentials between different years of schooling are larger for certain years of schooling than for others (see Table 20). In addition, the influence of higher years of education has a greater weight in the calculation for col. (2) than have higher income differentials in the calculations for col. (1). The change in average years of schooling was higher in the United States in each decade, with the 1920's again having the lowest change for any decade in Canada.

TABLE 22
Calculation of the Effect of Longer Education on
Labour Earnings Per Man
Canada and United States, 1911–61

| | Per Cent Change | | | | | | | | | Annual Rate of Change (per cent) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | | (4) | | (5) | | (6) | |
| | Labour income per man considering only years of education | | Average number of years of school attended | | Average number of days of school attended per year of school completed | | Average total number of days of school attended | | Labour income per man based on total days of education | | Labour income per man based on total days of education | |
| Period[1] | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. | Can. | U.S. |
| 1911–21 | 2.17 | 2.7 | 6.97 | 9.0 | 10.5 | 6.7 | 18.18 | 16.3 | 5.66 | 4.9 | .56 | .48 |
| 1921–31 | 1.62 | 3.3 | 5.24 | 8.9 | 7.8 | 8.8 | 13.41 | 18.4 | 4.16 | 6.9 | .41 | .67 |
| 1931–41 | 2.59 | 4.1 | 7.94 | 10.2 | 8.8 | 10.8 | 17.43 | 22.0 | 5.70 | 8.8 | .56 | .85 |
| 1941–51 | 2.81 | 4.4 | 7.48 | 10.4 | 8.8 | 10.9 | 16.96 | 22.4 | 6.37 | 10.4 | .62 | 1.00 |
| 1951–61 | 2.27 | 4.7 | 6.15 | 9.8 | 6.1 | 9.3 | 12.59 | 20.0 | 4.65 | 10.3 | .45 | .99 |
| 1911–31 | 3.83 | 6.1 | 12.58 | 18.6 | 19.05 | 16.1 | 34.03 | 37.8 | 10.06 | 12.1 | .48 | .57 |
| 1931–61 | 7.87 | 14.2 | 23.15 | 33.6 | 25.60 | 34.2 | 54.68 | 79.3 | 17.66 | 32.6 | .54 | .94 |
| 1911–61 | 11.99 | 21.2 | 38.64 | 58.5 | 49.50 | 55.8 | 107.27 | 147.0 | 29.50 | 48.6 | .52 | .79 |

[1] 1910–20, etc., for the United States.

Source: The Canadian data are calculated from Table 5, and Appendix Tables A-4, A-10, A-11, and A-15. The U.S. data are based on Edward F. Denison, *op. cit.* (Table 9, p. 72).

Over the period 1911-61, income per man, considering only years of schooling, increased almost twice as much in the United States (21.2 per cent) as in Canada (12 per cent). The percentage change in average years of schooling in the same period was 58.5 per cent in the United States and 38.6 per cent in Canada — the Canadian achievement being two thirds of the U.S. achievement. The comparisons of percentage changes in col. (1) and (2) for 1951-61 are of particular interest since the contribution to economic growth through improved education reached its highest percentage change in that decade.

### Improved Daily School Attendance

The very large changes in the days of school attended over the 50-year period in both Canada and the United States were discussed in Chapter 2. Denison made the important assumption that "it is reasonable to suppose that increasing the number of days spent in school per year raises a man's contribution to production just as much as will an equal percentage increase in the number of years spent in school."[1] While this assumption has raised a certain amount of controversy

[1] Edward F. Denison, *The Sources of Economic Growth*, p. 71.

among economists,[1] empirical evidence has not yet been accumulated to provide an appropriate test of the effects of days of schooling on labour productivity. It could be persuasively argued that increases in daily school attendance have an influence on productivity, but that gains in productivity are not likely to be proportional to increases in the days of school attended after a certain daily attendance per school year has been attained. At what point this may occur is difficult to judge, however.[2] Denison's assumption is accepted in this study, since changes in days of schooling appear to be far too important to be neglected. The increase in the days of school attended serves as an important method of making a quantity adjustment to the increase in the years of schooling attained by the labour force. In addition, no allowance has been made in this study for past improvements in the educational preparation of public school teachers, or the advances in the quality of the academic curriculum that have occurred in a number of areas, particularly in mathematics and the sciences.

Col. (3) of Table 22 indicates the percentage change by decade in the average number of days attended per completed school year in Canada and the United States. The percentage changes for Canada and for the United States are quite close during the whole period 1911-61, at 50 and 56 per cent respectively. Progress appears to have been made in lengthening the number of days of school attended at an earlier date in Canada than in the United States.

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[1] See, for example, Moses Abramovitz, *op. cit.*, p. 770; and Edward F. Denison's reply in "Measuring the Contribution of Education to Economic Growth", *The Residual Factor and Economic Growth*, OECD (Paris, 1964), p. 31.

[2] The estimates of this study show that in Canada the labour force stock possessed an average of 105 days of school attended per person per school year achieved in 1911, and by 1961 the labour force stock possessed an average of 157 days of school attended per person per school year achieved. As Denison has argued, the rural-urban shift was a powerful historical influence in raising the days of school attended.

The most recent new additions to the labour force by 1961 had approximately 185 days of school attended per person for each year of elementary and secondary school attended. Further increases in the proportion of days attended, therefore, cannot be very large, given the present provincial standards of around 200 days in the school year. A portion of the influence on labour productivity resulting from more recent increases in the days of school attended will continue to operate for some decaded into the future, however, since given the days of school attended as of 1961, the average days of school attended per person per school year achieved will eventually rise to around 185 days per year for the whole labour force stock.

There is support for even longer prescribed school days in at least one province. In the report of the British Columbia Royal Commission on Education, 1960, there was a strong conviction expressed that more days of schooling were desirable, although the basis of their reasoning was not indicated. "It will be seen that a number of prescribed school-days for the 1959-1960 'school year' is 190, while the number for the 1960 'calendar year' is 193. A survey conducted by the Research Staff of the British Columbia School Trustees' Association revealed that the number of prescribed school-days in British Columbia was less than for any other province in Canada with the exception of Newfoundland. The Commission has found no valid reason why this should be so." The Commission recommended that "the school-year be lengthened to a minimum of 200 days".

Col. (4) shows the percentage change in the total number of days of school attended per man (product of indexes of years of school attended and number of days of school attended per year). The percentage change in *total* days of school attended per man rose 107 per cent in Canada and 147 per cent in the United States over the past 50 years.

Col. (5) shows the full contribution of the combined increase in years and days of schooling to labour income per worker.[1] The decade percentage changes in this column constitute the first part of the calculation of the contribution of education to growth. These data show, for example, that income per man in 1961 was 4.7 per cent higher than it would have been in the absence of any improvements in the level of education in the labour force since 1951. In contrast, the comparable figure for the United States is 10.3 per cent. Over the whole 50-year period, income per man, based on the increase in total days of education, rose by 29.5 per cent in Canada and 48.6 per cent in the United States. Within the first 20 years of this period, income per man rose by 10.1 per cent in Canada and 12.1 per cent in the United States due to this factor, but in the more recent 30-year period, the increases were 17.7 per cent in Canada compared with 32.6 per cent in the United States. We may conclude that the contribution of education to increasing the productivity of the U.S. labour force was almost double the Canadian record in the last 30 years.

Col. (6) translates col. (5) into annual average rates of percentage change in labour output per member of the labour force based on the change in years and days of education in Canada and the United States. Two points stand out in the Canadian record: the 1920's experienced the lowest annual rate of change in labour output, and the annual rate of change in labour output per man in the 1950's of .45 per cent was less than half the U.S. rate of .99 per cent.

### The Effect on the Growth Rate

The portion of the rise in *labour* productivity, which was due to improvements in the education of the labour force, may now be related to the rise in *total* productivity. Total *labour income* comprises the costs paid to acquire all labour inputs (including wages and salaries, and an allowance for the work of the owners of unincorporated farm and nonfarm businesses). These costs constitute a certain share of net national income at "factor cost", which is the sum of all factor incomes. This sum is also equivalent to net national product at factor cost, or put in another way, to the total net *output* of a country. It follows from this that the difference in growth rates over time between total output and employment refers to total productivity growth *per man*. Similarly, the growth difference between total labour income (which constitutes a large portion of total output) and employment refers to labour output growth per man, or labour productivity

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[1] Col. (5) is computed by multiplying "... the percentage increase in labor earnings per man ascribed to increases in the number of years spent in school (col. (1) ...) by the ratio of the percentage increase in the average total number of days spent in school (col. (4) ) to that in the average number of years spent in school (col (2) ) to obtain the full contribution of the increase in the amount of education to labor output per worker...", Edward F. Denison, *op. cit.* (p. 71).

growth per man. If labour productivity, defined in this manner, increases over time, total productivity also rises, but only to the extent of the labour share in total output.

Total output per employed person, or total productivity per man, is estimated to have risen at a compound rate of 1.67 per cent per annum in Canada from 1911-61.[1] It was further calculated that the labour share in net national output amounted to some 76 per cent in the years for which comparisons are made.[2] According to Table 22, *labour* productivity (income) rose by 0.52 per cent per year over this period as a result of improved education. Consequently, *total* productivity per man rose by 0.40 per cent per annum as a result of improved education (76 per cent of 0.52). Educational improvements thus accounted for almost one quarter of the rise in productivity per employed person from 1911-61.[3]

To avoid distortions in the rate of economic growth caused by business cycles, Denison selected two high-employment years for a similar comparison in the United States. These years were 1929 and 1957. According to Denison's findings, improvements in education contributed 42 per cent to productivity per employed person in the United States.[4] A calculation for Canada, covering the same period (1929-57), showed that the comparable figure amounted only to some 20 per cent of the productivity growth per employed person, or less than half the U.S. figure.[5]

The calculation of the contribution of education to the growth rate of total national income involves a method similar to that used in the above discussion of the contribution of education to the growth in output per employed person. Improvements in the quality of labour input are considered equivalent to an increase in the quantity of labour input and the rate of growth in real national income in Canada for the periods 1911-61 and 1929-57 are again approximated by the rate of growth in GNP.[6]

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[1] This is based on real GNP, the sources for which are given in Appendix Table A-1. The rate of increase of this aggregate is estimated to have been parallel to the growth rate of real net national product, on the assumption that capital consumption allowances and indirect taxes less subsidies have been approximately of equal proportionate importance. Employment is based on Urquhart and Buckley, *Historical Statistics for Canada* (Series C47-55); and Dominion Bureau of Statistics, *1961 Census of Canada* (Catalogue No. 94-501, Table 1). The 1911 employment figure was obtained by a downward adjustment of the "gainfully employed" figure (1911 *Census*) by the ratio of "gainfully employed" (1921 *Census*) to "persons in the labour force with jobs" (1921 labour force, *Historical Statistics*).

[2] See Appendix B-8 for a more detailed discussion of this calculation.

[3] 0.40 as a per cent of 1.67. See Appendix B-7 for a discussion of a possible bias in the calculation.

[4] Edward F. Denison, *op. cit.*, p. 73.

[5] The underlying Canadian figures for 1929-57 are: average annual rate of growth in productivity per employed person 2.0 per cent; average annual rate of growth in labour income per man based on *total* days of education, 0.53 per cent for the period 1929-57 rather than .54 per cent for the period 1931-61 shown in col. (6), Table 22; labour coefficient, 0.76.

See footnote above.

Over the longer period 1911-61, the contribution of education is estimated as accounting for 12 per cent of the growth in national income, while in the period 1929-57 the contribution of education to the growth in national income was estimated as 11.4 per cent.[1] In the United States, the contribution of education to the growth of national income over the 1929-57 period was estimated by Denison as 23 per cent,[2] approximately double the Canadian figure.

CHART   4

COMPARISON OF GROSS NATIONAL PRODUCT
PER CAPITA, CANADA AND UNITED STATES
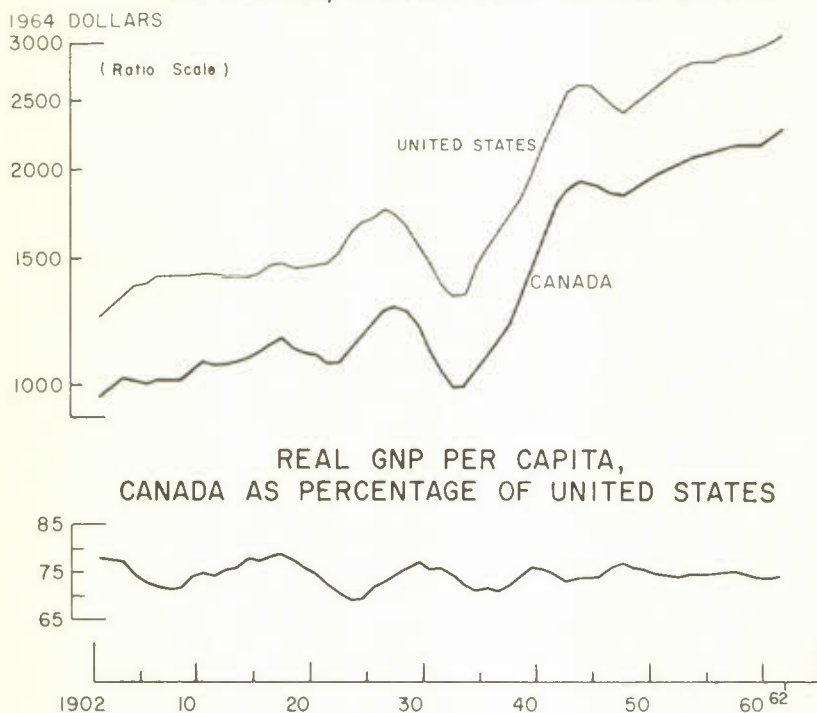


Source: Appendix Table A-1.

## EDUCATION AND CANADA-U.S. INCOME DIFFERENTIALS

It was noted in Chapter 1 that while it is well known that Canada ranks very high among the nations of the world in per capita income, it is less well known that per capita income in Canada has remained persistently about one

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[1] The underlying figures for 1911-61 are: average annual rate of growth in national income (actually GNP), 3.3 per cent; average annual rate of growth in labour income based on *total* days of schooling, .52 per cent; labour coefficient, .76. For 1929-57, average annual rate of growth in national income (actually GNP), 3.52 per cent; average annual rate of growth in labour income based on *total* days of schooling, .53 per cent; labour coefficient, .76.

[2] Edward F. Denison, *op. cit.,* p. 73.

quarter below that of the United States since the turn of the century.[1] Chart 4 compares real Gross National Product per capita between Canada and the United States over the period 1902-62, while Table 23 indicates real Gross National Product per capita for selected years in Canada and the United States.

TABLE 23

Real Gross National Product Per Capita, Selected Years 1910–62,
Canada and United States

(1964 dollars)

| Years | Canada | United States | Canada as Per Cent of United States |
|---|---|---|---|
| 1910 .................... | 1,047 | 1,421 | 73.7 |
| 1920 .................... | 1,105 | 1,464 | 75.5 |
| 1929 .................... | 1,271 | 1,682 | 75.6 |
| 1939 .................... | 1,338 | 1,820 | 73.5 |
| 1946 .................... | 1,886 | 2,551 | 73.9 |
| 1950 .................... | 1,917 | 2,552 | 75.1 |
| 1957 .................... | 2,149 | 2,879 | 74.6 |
| 1962 .................... | 2,276 | 3,082 | 73.8 |

Source: Appendix Table A-1.

A fundamental reason for the persistent differences in real per capita income between Canada and the United States can be attributed to differences in the quantity and quality of inputs, and the efficiency with which they are used in the Canadian economy. Differences in the relative *quality* of labour inputs is the focus of this study, but it is important to note that differences in the relative *quantity* of inputs compared with the United States, reflecting significant differences in the population structure and labour force characteristics of Canada, reduce the proportionate quantity of labour inputs in production. As a consequence, when a comparison is made between Canada and the United States on the basis of incomes per member of the labour force, the 25 per cent gap is reduced to almost 20 per cent as of 1961.[2] Under certain conditions, the higher the proportion of income-earners in the total population, the higher will be the average real income of its people. In recent years Canada, relative to the United States, has had a lower percentage of its population in the labour force, as well as a lower percentage of employment in relation to total population. The relatively larger size of the population under working age and the smaller labour force participation rates for women are the main explanations.[3]

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[1] Increases in real income per capita in the period after the Second World War in Canada and in the United States have been well below those achieved in Western Europe (see Economic Council of Canada, *First Annual Review: Economic Goals for Canada to 1970*, Ottawa, Queen's Printer, 1964, Chart 6).

[2] Economic Council of Canada, *Second Annual Review: Towards Sustained and Balanced Economic Growth*, Queen's Printer, Ottawa, 1965, p. 58.

[3] For a more complete discussion of the sources stemming from relative differences in the quantity of labour inputs that assist in explaining the differences in Canadian and U.S. per capita incomes, see *ibid.*, pp. 57-58.

If the gap in real income per member of the labour force between Canada and the United States is taken as 20 per cent in 1961, then the estimates made in this study concerning the relative differences in the educational attainment or quality of the labour force in the two countries indicate that the quality difference is a source of about a third of the 20 per cent difference. The basis for the calculation is a set of "weights" derived from Canadian education-income differentials (Table 20), and the percentage distributions of the Canadian and U.S. male labour forces by level of schooling (Table 10). The average income per member of the Canadian labour force was recalculated by assuming that it had the same level of education as the U.S. labour force, and this reweighted income was then compared with the actual income. The reverse procedure of using U.S. education-income differentials was also performed. According to these calculations, Canadian average income would be from 7 to 8 per cent higher, other things being equal, if the Canadian labour force had attained the educational levels prevailing in the United States. The argument is predicated on the finding that there is a close relationship between income and level of education, and that differences in incomes are related to differences in the level of schooling, at least to a large extent (the working assumption used here, as above in the calculations of the contribution of education to long-term growth, is that three fifths of income differences are due to differences in schooling).

It would be interesting to pursue the implication of this point-in-time comparison in a historical context. For example, it was shown that Canadian income per man has been consistently lower than U.S. income for the past 50 years, and that the gap has remained about the same. On the other hand, starting from approximately the same average level of education at about 1911, the United States has experienced a much more rapid improvement in education than Canada since then. Some questions which arise are:

What explains the income differential between the two countries in 1911 when both had approximately the same educational attainments?

What explains the fact that, despite the more rapid educational improvements in the United States over the past five decades, the income differential has persisted at about the same level, rather than having widened even further?

To answer these questions adequately, considerably more historical and contemporary research is necessary. The initial gap in real per capita income in the early 1900's between the two countries could have been due to a wide variety of causes. Among these may well have been a number of factors relating to the later development of industrialization in Canada, implying that in this earlier period Canada had relative disadvantages associated with relatively lower capital intensity (despite very large capital inflows), a smaller stock of applied industrial technology,[1] a relatively much larger agricultural sector, a relatively less efficient domestic market mechanism in the allocation of resources, and relatively less entrepreneurship and management skill. Relative disadvantages as regards economies of scale associated with localization, specialization, and size of markets

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[1] The rapid transmission of new industrial techniques and processes from the United States to Canada at the close of the nineteenth century is suggested by evidence from numerous archival records of Canadian business firms, so that there may have been a fall in the "lag" in the application of knowledge in Canada in the early 1900's.

for industry may also have been very important, perhaps partly reflecting the possibility that the Canadian tariff may have had a more significant influence on the level of real income in Canada than the U.S. tariffs had in the United States.

Such factors as the above may have retained their important influence over time, but over the 50-year period it has been shown that the difference in real per capita incomes between Canada and the United States has been fairly constant. Since the gap in the educational quality of the Canadian labour force has been growing relative to the United States, other factors working to the advantage of Canada have obviously tended to prevent the further widening of the initial gap. These favourable factors appear at least in more recent years to be associated with the relatively higher rates of increase in Canadian capital intensity, a relative growth in inputs of natural resources[1], and relatively larger industry shifts, especially out of agriculture.

## ADDITIONAL BENEFITS

Benefits of education accruing to individuals other than the measured income benefits also need to be recognized. Further years of schooling provide what has been termed a "financial option" return, or the value of the opportunity to obtain still further education. Two other benefits that appear to be important are non-monetary "opportunity options" involving wider individual employment choices which education permits, and opportunities for " 'hedging' against the vicissitudes of technological change".[2]

In addition, the estimates made in this part of the study of the contribution of education to economic growth have not been concerned with certain "external benefits" from education which, while they appear in a "broad amorphous form", may be of great significance for the whole economy even though a particular community may not be able to recognize them. External benefits of education may take the form of the contribution that higher levels of literacy make to the efficient functioning of the market mechanism through communication, information, and mobility of factors. A supply of skilled workers in the labour market may also contribute external benefits to employers. Of some significance would be the influence of the educational attainment of parents on the values and aspirations of their children. Other types of external benefits have been mentioned in the literature. Weisbrod, for example, defines the wider benefits from education as:

> ...anything that pushes outward the utility possibility function for the society. Included would be (1) anything which increases production possibilities, such as increased labor productivity; (2) anything which reduces the need to incur costs such as for law enforcement, thereby releasing resources for alternative uses; and (3) anything which increases welfare possibilities directly, such as the development of public-spiritedness or social consciousness of one's neighbor.[3]

[1] See Economic Council of Canada, *Second Annual Review: Towards Sustained and Balanced Economic Growth*, Queen's Printer, Ottawa, 1965, pp. 59-61 and pp. 63-67.

[2] See Burton A. Weisbrod, *External Benefits of Public Education*, Princeton, Princeton University, 1964, p. 17.

[3] *Ibid*, p. 17.

The external effects of education which could be encompassed in the above definition of benefits are obviously extremely wide-ranging, and probably subject only to limited quantitative measurement. It can usually be agreed, however, that given the value systems operating in a democratic society, an informed electorate and a labour force with a real opportunity of vertical mobility are important external benefits of education. To the extent that decision-makers at various levels of public authority fail to recognize the existence of certain external benefits associated with education, there could be a misallocation of resources in the economy, for social benefits (including external benefits) may exceed the direct benefits which decision-makers compare with education costs.

Finally, no attempt has been made in this study to consider the effect on productivity in the labour force from such other improvements in the educational system as increased quality of instruction, increasing rationalization of educational capital facilities, improved organization, changing academic curricula, specialization, and many other factors. To take these improvements into account as well would probably show education to be an even more important source of economic growth than the calculations in this study have shown.

## CHAPTER 4

## CONCLUSIONS

Canada appears to have made spectacular gains in education in the latter part of the nineteenth century through to the First World War. In this period, literacy and elementary education for all citizens was strongly promoted.[1] But the record of Canadian educational achievement seems to taper off by 1920. It appears as though the democratic spirit which had promoted universal elementary education in Canada failed to operate to the same extent in secondary education efforts, and education beyond the elementary school continued to be more the prerogative of an elite. The high schools were excellent, but their output was small. With a limited production of high school students, university education was even less available to large numbers who were potential university students.

Thus, despite the fact that there has been a significant long-term rise in the educational attainments of the labour force, the extent of this rise has been considerably below that for the United States since the First World War. This has resulted in the emergence of a widening educational gap between the two countries, as was shown on the basis of various measures of educational attainment for the period 1911-61. For example, by the beginning of the 1960's, the median year of schooling of the Canadian male labour force was about two years below that of the U.S. male labour force, at least for the age group 25-64 which constitutes the bulk of the existing labour force. 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.

The apparent renewed vigour in Canadian educational efforts in recent years, combined with the relatively larger influx of better-educated young persons into the labour force, may have checked the past tendency for the educational gap to become wider between the two countries. In fact, some narrowing of this gap is likely on the basis of these relatively favourable factors. However, it was demonstrated that this is a slow process. Even under very favourable assumptions, it would require many years to eliminate the differences in the average levels of education between Canada and the United States.

Accumulating evidence and analysis point more and more to education as a pervasive and basic element contributing to the real earnings potential of people, and therefore also of a whole economy or society. Past improvements in education have raised this potential considerably by increasing the quality and skills of the

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[1]The later nineteenth century record of educational achievement in Ontario is especially noteworthy, for it seems that in that province a vigorous and dedicated provincial department of education established the standard for Canada. Ontario's Department of Education annual reports in the 1870's through the 1890's display a remarkable knowledge of the progress of public education in the more recently established American states south of the Great Lakes, and show a firm desire to stay abreast of North American educational developments.

labour force. Estimates have shown that better education appears to have raised labour earnings per man by about 30 per cent from 1911-61 in Canada, and that this has contributed almost one quarter to the rise in output growth per employed person. However, this represents merely about one half of the comparable achievement in the United States, reflecting the widening gap in the average level of schooling in terms of economic growth. It was also estimated that about one third of the income difference per man, prevailing in the two countries at the beginning of the 1960's, appears to have been the result of lower Canadian educational attainments. The major policy implication is that increasing efforts in the area of education are a prerequisite not only for the maintenance or acceleration of productivity growth in Canada, but also for the narrowing of the existing differences in the absolute level of productivity, and therefore the living standard, between Canada and the United States.

Although education is a major factor responsible for differences in living standards in the two countries, it is of course not the only one. The gap in current relative productivity levels is the net result of a number of interacting influences, favourable as well as unfavourable. The progress of educational attainment in Canada from 1911-61 appears to have been such that, in the absence of certain influences favourable to Canada, per capita income differences would be even wider today than they actually are. Among the factors preventing even greater disparity in living standards between the two countries were faster growth of capital intensity in Canada, and a relatively heavier use of natural resources. In addition, Canada appears to have benefited from relatively more pronounced inter-industry shifts.[1]

While education appears to have been an important factor holding back Canadian growth in relation to U.S. growth, it was of course not the only factor involved. For example, Canada appears to have been less able to benefit to the same extent from the economies of larger scale, due to its smaller market size. Restrictive tariff policies and protection of inefficient firms and industries may have been, and may continue to be, important obstacles in the attainment of potential benefits from large-scale production. Other unfavourable factors, associated indirectly with education, may have been relatively slower development and adoption of industrial and technical knowledge, and quality of management.[2]

This study has emphasized mainly the role of education as a factor influencing the quality of the labour force, and as a significant source of past and future productivity growth. A number of other recent studies[3] in Canada and the United

[1]For a fuller discussion of the role of capital, natural resources and industry shifts see Economic Council of Canada, *Second Annual Review: Towards Sustained and Balanced Economic Growth*, Queen's Printer, Ottawa, 1965, pp. 59-61 and pp. 63-67.

[2]This important aspect of Canada-U.S. productivity differentials is analyzed by Bruce W. Wilkinson, *Studies in the Economics of Education*, Occasional Paper No. 4, Department of Labour, Ottawa, Queen's Printer, 1966. Wilkinson found, for example, that on the basis of educational requirements for occupations studied by the U.S. Department of Labor, male owners and managers had, according to the *1961 Census of Canada*, deficiencies relative to the United States amounting to some four years in education attainment — the lowest educational performance of the 13 major occupational groups studied.

[3]See J.R. Podoluk, *Earnings and Education*, Dominion Bureau of Statistics, December 1965; Gary S. Becker, *Human Capital*, National Bureau of Economic Research, New York, 1964; W. Lee Hansen, "Total and Private Rates of Return to Investment in Schooling", *Journal of Political Economy*, April 1963.

States have analyzed an additional aspect of education which is of great importance in the formulation of policies relating to the allocation of expenditures among alternative possibilities. These studies have compared the "rates of return" from an increased amount of investment on education with rates of return from investment on other types of assets (for example, physical capital goods), and indicated that expenditures on education, viewed as investment in human capital, represent a "profitable" allocation of a country's resources.

The profitability of investing in higher education is estimated by measuring the additional income associated with a higher level of schooling, such as a university education, compared with the additional expenses involved in obtaining such schooling. The *social* rate of return on a university education was estimated at between 8 and 11 per cent per annum in the United States,[1] falling within the range of rates of return on business capital. The additional income benefits were based on *before-tax* income differentials adjusted downward to allow for the fact that education is not the only factor which raises a person's earnings potential. The associated costs in this calculation included the sum of the university student's private expenses (also forgone earnings), and other university costs, borne by governments and others, such as current educational expenditures, capital consumption, forgone earnings from employed capital, and property taxes that would have been levied if schools were not exempt.

*Private* returns to educational investment, i.e. extra benefits accruing to *an individual* as a consequence of obtaining additional schooling, were established in the United States to be somewhat higher than social rates of return, and exceeded 12 per cent per annum in the case of a university education.[2] The costs to an individual include his current expenses and his forgone earnings while attending university, and the extra benefits are based on the *after-tax* income in excess of the income of a person with only high school education. Again, this income differential was reduced to remove possible effects on higher income due to factors other than education. The private rate of return also appears to compare favourably with rates of return from other types of assets.

Calculations for Canada have shown that private returns on the human investment in high school and university education are in the range of 15 to 20 per cent per year, with slightly higher rates for an investment in a university education than in a high school education.[3] Adjustments in such calculations, to make them more comparable with U. S. measures of similar private rates of return (assuming that U.S. experience can serve as a reasonably reliable guide in such adjustments) would probably not invalidate the conclusion that these Canadian rates of return to education compare favourably, not only with those on alternative returns typically accruing from total capital investment in physical and financial assets, but also with the similar U.S. rates of return to education.[4] Further research is needed

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[1] Gary S. Becker, *op. cit.*, p. 121.

[2] Gary S. Becker, *op. cit.*, p. 114.

[3] J. R. Podoluk, *op. cit.*, p. 61.

[4] Among such adjustments would be those aimed at removing the effects of factors other than education in the determination of additional earnings and the adjustment of incomes from a *before-tax* to an *after-tax* basis.

to clarify such comparisons of Canadian and U.S. rates of return -- both for private and social rates of return to education.

Such calculations of rates of return should be considered minimum estimates for a number of reasons. In the above calculations, all costs of education are treated as investments; if some part of these costs were to be treated as consumption rather than investment, the rates of return would be higher. It has also been argued that the above calculations are based on lifetime earnings derived from cross-section data and therefore fail to take future growth into account.[1] Further, such calculations do not reflect the indirect impact of higher education on such other growth factors as the development of improved research and technology, better organization for production, and the general advance of knowledge. The implications of the research done in the area of education up to now appear to be not only that education is a significant factor in raising productivity and living standards, but also that a relative increase in expenditures on education would contribute to an efficient allocation of resources.

[1]See Herman P. Miller, "Lifetime Income and Economic Growth", *The American Economic Review*, September 1965. The author shows that estimates based on cross-section data differ from those based on age cohort data. "Census data show that the differences in real income for a given age cohort in two successive decennial censuses (e.g., men 25 to 34 years old in 1950 and 35 to 44 years old in 1960) are far greater than those obtained for men in the same age groups at a given point in time. The main reason for the difference is that the income measures obtained ten years apart reflect economic growth which is entirely excluded from the cross-section surveys. The use of income averages by age based on the cross-section surveys therefore produces lower values than would be obtained by the use of averages based on successive censuses. Moreover, the impact of growth appears to be greater for young men than for those past the prime working years. This fact suggests an additional source of downward bias in the currently available estimates, since the discounting procedures used to convert estimated lifetime income to present values attach greater weight to incomes expected early in life than to those expected later on." (p. 834)

APPENDIX A


STATISTICAL TABLES

### Real Gross National Product Per Capita,
### Canada and United States, 1902–62[1] Five-Year Moving Averages, 1964 Dollars

| Year | United States | Canada | Canada as Per Cent of U.S. | Year | United States | Canada | Canada as Per Cent of U.S. |
|------|------|------|------|------|------|------|------|
| 1902 | 1,244 | 966 | 77.7 | 1920 | 1,464 | 1,105 | 75.5 |
| 1903 | 1,289 | 998 | 77.4 | 1921 | 1,475 | 1,099 | 74.5 |
| 1904 | 1,332 | 1,024 | 76.9 | 1922 | 1,484 | 1,073 | 72.3 |
| 1905 | 1,365 | 1,011 | 74.1 | 1923 | 1,537 | 1,077 | 70.1 |
| 1906 | 1,383 | 1,003 | 72.5 | 1924 | 1,633 | 1,124 | 68.8 |
| 1907 | 1,411 | 1,012 | 71.7 | 1925 | 1,687 | 1,168 | 69.2 |
| 1908 | 1,417 | 1,011 | 71.3 | 1926 | 1,710 | 1,218 | 71.2 |
| 1909 | 1,413 | 1,012 | 71.6 | 1927 | 1,756 | 1,275 | 72.6 |
| 1910 | 1,421 | 1,047 | 73.7 | 1928 | 1,740 | 1,238 | 74.3 |
| 1911 | 1,437 | 1,077 | 74.9 | 1929 | 1,682 | 1,271 | 75.6 |
| 1912 | 1,432 | 1,066 | 74.4 | 1930 | 1,584 | 1,208 | 76.3 |
| 1913 | 1,420 | 1,067 | 75.1 | 1931 | 1,482 | 1,113 | 75.1 |
| 1914 | 1,423 | 1,079 | 75.8 | 1932 | 1,383 | 1,041 | 75.3 |
| 1915 | 1,411 | 1,097 | 77.7 | 1933 | 1,349 | 998 | 74.0 |
| 1916 | 1,431 | 1,106 | 77.3 | 1934 | 1,381 | 999 | 72.3 |
| 1917 | 1,465 | 1,142 | 78.0 | 1935 | 1,473 | 1,045 | 70.9 |
| 1918 | 1,482 | 1,163 | 78.5 | 1936 | 1,553 | 1,103 | 71.0 |
| 1919 | 1,454 | 1,126 | 77.4 | 1937 | 1,634 | 1,158 | 70.9 |
| 1938 | 1,718 | 1,233 | 71.8 | 1951 | 2,634 | 1,969 | 74.8 |
| 1939 | 1,820 | 1,338 | 73.5 | 1952 | 2,707 | 2,001 | 73.9 |
| 1940 | 1,957 | 1,479 | 75.6 | 1953 | 2,774 | 2,037 | 73.4 |
| 1941 | 2,170 | 1,630 | 75.1 | 1954 | 2,811 | 2,084 | 74.1 |
| 1942 | 2,391 | 1,776 | 74.3 | 1955 | 2,838 | 2,104 | 74.1 |
| 1943 | 2,569 | 1,874 | 72.9 | 1956 | 2,837 | 2,112 | 74.4 |
| 1944 | 2,620 | 1,920 | 73.3 | 1957 | 2,879 | 2,149 | 74.6 |
| 1945 | 2,607 | 1,908 | 73.2 | 1958 | 2,893 | 2,164 | 74.8 |
| 1946 | 2,551 | 1,886 | 73.9 | 1959 | 2,908 | 2,156 | 74.1 |
| 1947 | 2,456 | 1,851 | 75.4 | 1960 | 2,954 | 2,177 | 73.7 |
| 1948 | 2,413 | 1,846 | 76.5 | 1961 | 3,015 | 2,218 | 73.6 |
| 1949 | 2,472 | 1,871 | 75.7 | 1962 | 3,082 | 2,276 | 73.8 |
| 1950 | 2,552 | 1,917 | 75.1 | | | | |

[1] The comparisons relate to U.S. dollar and Canadian dollar GNP per person respectively, and the effects of the exchange rate are taken to be reflected in relative price levels in the two countries. There is evidence that relative prices, at least for consumer goods, are, on the average, the same in each currency, so that this straight dollar-for-dollar comparison can be assumed to reflect differences in real living standards.

Source: Based on *Historical Statistics of Canada*, M. C. Urquhart and K.A.H. Buckley, Eds., The Macmillan Company, Toronto, 1965. Dominion Bureau of Statistics, *National Accounts*, 1926–56, and various subsequent annuals. K.A.H. Buckley, unpublished estimates of real GNP, 1900–25. U.S. Bureau of the Census, *Historical Statistics of the United States*, Washington, 1960. Department of Commerce, *Survey of Current Business*, August 1965. Department of Commerce, *U.S. Income and Output, 1958*. N. Potter and F. T. Christy, *Trends in Natural Resource Commodities*, Johns Hopkins 1962. Revisions in U.S. real GNP data by the U.S. Department of Commerce from 1909 to 1929 and by Potter and Christy for earlier years substantially change the levels and trends of U.S. real output — and hence any Canada-U.S. comparisons — from those appearing in the earlier historical estimates.

## APPENDIX TABLE A-2
### Education of Canadian Male Labour Force
### by Age and Occupation, 1961

| Occupations | Total | Elementary School | | High School | | | Some University | Some University (Incl. 5 Yrs. H. S.) | Complete University |
|---|---|---|---|---|---|---|---|---|---|
| | | 0—4 Years | 5—8 Years | 1—3 Years | 4 Years | 5 Years (Grade 13) | Some University | | |
| **All Occupations** | | | | | | | | | |
| 25—34.......... | 1,181,693 | 46,162 | 402,237 | 399,997 | 102,362 | 105,418 | 54,383 | 159,801 | 71,134 |
| 35—44.......... | 1,121,449 | 68,432 | 409,254 | 353,824 | 106,224 | 67,198 | 46,123 | 113,321 | 70,394 |
| 45—54.......... | 879,585 | 83,936 | 362,865 | 240,489 | 74,517 | 44,223 | 29,947 | 74,170 | 43,608 |
| 55—64.......... | 534,740 | 81,949 | 253,454 | 108,767 | 39,654 | 12,679 | 15,590 | 28,269 | 22,647 |
| 65+ .......... | 191,249 | 34,725 | 90,702 | 40,088 | 11,307 | — | 5,554 | 5,554 | 8,873 |
| 25—64.......... | 3,717,467 | 280,479 | 1,427,810 | 1,103,077 | 322,757 | 229,518 | 146,043 | 375,561 | 207,783 |
| **Managerial** | | | | | | | | | |
| 25—34.......... | 94,245 | 992 | 14,984 | 31,904 | 3,370 | 26,169 | 8,784 | 34,953 | 8,042 |
| 35—44.......... | 142,824 | 2,211 | 26,230 | 46,664 | 24,470 | 16,871 | 12,477 | 29,348 | 13,901 |
| 45—54.......... | 133,836 | 3,967 | 30,600 | 42,556 | 25,174 | 11,100 | 10,087 | 21,187 | 10,352 |
| 55—64.......... | 70,625 | 4,169 | 21,813 | 19,281 | 12,215 | 3,225 | 4,970 | 8,195 | 4,952 |
| 65+ .......... | 25,509 | 2,634 | 8,995 | 6,111 | 4,901 | — | 1,508 | 1,508 | 1,360 |
| 25—64.......... | 441,530 | 11,339 | 93,627 | 140,405 | 65,229 | 57,365 | 36,318 | 93,683 | 37,247 |
| **Professional & Technical** | | | | | | | | | |
| 25—34.......... | 115,309 | 240 | 3,541 | 13,661 | 11,861 | 15,146 | 18,422 | 33,568 | 52,438 |
| 35—44.......... | 94,794 | 252 | 3,796 | 11,992 | 9,017 | 9,570 | 12,412 | 21,982 | 47,755 |
| 45—54.......... | 58,527 | 262 | 3,427 | 7,929 | 5,336 | 6,352 | 7,276 | 13,628 | 27,945 |
| 55—64.......... | 30,242 | 287 | 2,540 | 3,711 | 3,226 | 1,912 | 3,571 | 5,483 | 14,995 |
| 65+ .......... | 11,809 | 163 | 1,020 | 1,147 | 1,739 | — | 1,364 | 1,364 | 6,376 |
| 25—64.......... | 298,872 | 1,041 | 13,304 | 37,293 | 29,440 | 32,980 | 41,681 | 74,661 | 143,133 |

## Clerical

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 25—34............ | 79,288 | 490 | 11,970 | 31,496 | 15,107 | 12,668 | 5,606 | 18,274 | 1,951 |
| 35—44............ | 62,245 | 755 | 12,894 | 26,277 | 9,688 | 8,050 | 3,442 | 11,492 | 1,139 |
| 45—54............ | 48,990 | 911 | 12,651 | 19,534 | 7,041 | 5,408 | 2,436 | 7,844 | 1,009 |
| 55—64............ | 32,145 | 1,052 | 11,147 | 10,986 | 5,266 | 1,526 | 1,571 | 3,097 | 597 |
| 65+ ............ | 11,560 | 427 | 3,868 | 3,574 | 2,693 | — | 682 | 682 | 316 |
| 25—64............ | 222,668 | 3,208 | 48,662 | 88,293 | 37,102 | 27,652 | 13,055 | 40,707 | 4,696 |

## Sales

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 25—34............ | 72,761 | 629 | 11,870 | 28,313 | 11,818 | 10,801 | 6,010 | 16,811 | 3,320 |
| 35—44............ | 59,454 | 837 | 11,211 | 23,232 | 10,224 | 7,061 | 4,533 | 11,594 | 2,356 |
| 45—54............ | 40,848 | 893 | 9,892 | 15,268 | 6,334 | 4,579 | 2,663 | 7,242 | 1,219 |
| 55—64............ | 20,327 | 881 | 6,706 | 6,524 | 3,037 | 1,313 | 1,270 | 2,583 | 596 |
| 65+ ............ | 9,243 | 572 | 3,389 | 2,698 | 1,812 | — | 531 | 531 | 241 |
| 25—64............ | 193,390 | 3,240 | 39,679 | 73,337 | 31,413 | 23,754 | 14,476 | 38,230 | 7,491 |

## Service & Recreation

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 25—34............ | 100,045 | 3,656 | 30,556 | 43,869 | 9,575 | 7,139 | 3,040 | 10,179 | 2,210 |
| 35—44............ | 83,652 | 3,795 | 28,744 | 32,701 | 9,118 | 4,242 | 2,842 | 7,084 | 2,210 |
| 45—54............ | 61,466 | 6,085 | 27,443 | 18,413 | 4,533 | 2,758 | 1,367 | 4,125 | 867 |
| 55—64............ | 49,453 | 8,235 | 26,688 | 10,066 | 2,749 | 729 | 727 | 1,456 | 259 |
| 65+ ............ | 25,466 | 5,154 | 13,848 | 4,343 | 1,678 | — | 315 | 315 | 128 |
| 25—64............ | 294,616 | 21,771 | 113,431 | 105,049 | 25,975 | 14,868 | 7,976 | 22,844 | 5,546 |

## Transport & Communication

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 25—34............ | 112,266 | 4,155 | 52,132 | 43,044 | 6,431 | 4,543 | 1,594 | 6,137 | 367 |
| 35—44............ | 91,647 | 5,788 | 42,352 | 32,839 | 6,188 | 2,796 | 1,314 | 4,110 | 370 |
| 45—54............ | 58,906 | 5,164 | 29,091 | 18,466 | 3,239 | 1,972 | 799 | 2,771 | 175 |
| 55—64............ | 28,230 | 3,301 | 15,591 | 6,744 | 1,593 | 517 | 371 | 888 | 113 |
| 65+ ............ | 4,819 | 823 | 2,714 | 893 | 315 | — | 62 | 62 | 12 |
| 25—64............ | 291,049 | 18,408 | 139,166 | 101,093 | 17,451 | 9,828 | 4,078 | 13,906 | 1,025 |

# APPENDIX TABLE A-2 (Concluded)

| Occupations | Total | Elementary School | | High School | | | Some University | Some University (Incl. 5 Yrs. H. S.) | Complete University |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | 0–4 Years | 5–8 Years | 1–3 Years | 4 Years | 5 Years (Grade 13) | Some University | | |
| **Farmers & Farm Workers** | | | | | | | | | |
| 25–34 | 89,599 | 4,872 | 48,556 | 27,232 | 4,367 | 2,811 | 1,310 | 4,121 | 451 |
| 35–44 | 114,681 | 11,128 | 65,735 | 29,692 | 4,694 | 1,816 | 1,164 | 2,980 | 452 |
| 45–54 | 118,265 | 18,418 | 70,158 | 23,288 | 3,798 | 1,202 | 963 | 2,165 | 438 |
| 55–64 | 93,697 | 21,958 | 54,675 | 12,945 | 2,541 | 337 | 911 | 1,248 | 330 |
| 65+ | 56,887 | 14,528 | 31,929 | 7,726 | 1,879 | — | 593 | 593 | 232 |
| 25–64 | 416,242 | 56,376 | 239,124 | 93,157 | 15,400 | 6,166 | 4,348 | 10,514 | 1,671 |
| **Loggers & Related Workers** | | | | | | | | | |
| 25–34 | 21,477 | 4,046 | 12,565 | 3,796 | 558 | 288 | 147 | 435 | 77 |
| 35–44 | 15,544 | 4,830 | 7,778 | 2,283 | 328 | 184 | 89 | 273 | 52 |
| 45–54 | 11,273 | 4,287 | 5,207 | 1,399 | 177 | 116 | 71 | 187 | 16 |
| 55–64 | 6,674 | 2,881 | 2,950 | 634 | 125 | 45 | 34 | 79 | 5 |
| 65+ | 1,147 | 522 | 489 | 95 | 33 | — | 6 | 6 | 2 |
| 25–64 | 54,968 | 16,044 | 28,500 | 8,112 | 1,188 | 633 | 341 | 974 | 150 |
| **Fishermen, Trappers, Hunters** | | | | | | | | | |
| 25–34 | 7,779 | 2,325 | 3,671 | 1,511 | 116 | 115 | 34 | 149 | 7 |
| 35–44 | 7,701 | 2,853 | 3,374 | 1,264 | 120 | 61 | 27 | 88 | 2 |
| 45–54 | 7,040 | 2,791 | 3,028 | 1,020 | 141 | 34 | 20 | 54 | 6 |
| 55–64 | 4,392 | 1,881 | 1,951 | 449 | 77 | 10 | 22 | 32 | 2 |
| 65+ | 1,609 | 719 | 696 | 157 | 33 | — | 3 | 3 | 1 |
| 25–64 | 26,912 | 9,850 | 12,024 | 4,244 | 454 | 220 | 103 | 323 | 17 |
| **Miners, Quarrymen & Related** | | | | | | | | | |
| 25–34 | 20,145 | 1,259 | 10,406 | 6,416 | 1,027 | 619 | 322 | 941 | 96 |
| 35–44 | 16,732 | 2,054 | 8,851 | 4,430 | 720 | 361 | 245 | 606 | 71 |
| 45–54 | 11,175 | 1,856 | 5,810 | 2,649 | 390 | 271 | 145 | 416 | 54 |
| 55–64 | 5,847 | 1,377 | 3,241 | 916 | 191 | 52 | 59 | 111 | 11 |
| 65+ | 750 | 232 | 372 | 105 | 32 | — | 6 | 6 | 3 |
| 25–64 | 53,899 | 6,546 | 28,308 | 14,411 | 2,328 | 1,303 | 771 | 2,074 | 232 |

## Craftsmen, Production and Related

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 25—34.............. | 365,805 | 14,070 | 157,845 | 138,505 | 27,593 | 20,900 | 5,494 | 26,394 | 1,398 |
| 35—44.............. | 342,490 | 22,277 | 156,221 | 117,705 | 26,139 | 13,525 | 5,198 | 18,723 | 1,425 |
| 45—54.............. | 263,763 | 25,717 | 131,771 | 76,487 | 16,182 | 8,953 | 3,571 | 12,524 | 1,082 |
| 55—64.............. | 148,806 | 22,507 | 82,978 | 30,841 | 7,540 | 2,639 | 1,747 | 4,386 | 554 |
| 65+ .............. | 32,692 | 5,740 | 18,484 | 5,813 | 2,131 | — | 390 | 390 | 134 |
| 25—64.............. | 1,120,864 | 84,571 | 528,815 | 363,538 | 77,454 | 46,017 | 16,010 | 62,027 | 4,459 |

## Labourers n.e.s.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 25—34.............. | 66,465 | 8,215 | 38,185 | 15,782 | 2,327 | 1,205 | 640 | 1,845 | 111 |
| 35—44.............. | 55,397 | 10,256 | 31,825 | 10,772 | 1,436 | 752 | 289 | 1,041 | 67 |
| 45—54.............. | 45,188 | 11,609 | 24,965 | 6,837 | 933 | 566 | 224 | 790 | 54 |
| 55—64.............. | 31,165 | 9,822 | 17,070 | 3,301 | 652 | 145 | 135 | 280 | 40 |
| 65+ .............. | 7,550 | 2,569 | 4,001 | 733 | 202 | — | 36 | 36 | 9 |
| 25—64.............. | 198,215 | 39,902 | 112,045 | 36,692 | 5,348 | 2,668 | 1,288 | 3,956 | 272 |

## Occupations Not Stated

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 25—34.............. | 36,509 | 1,213 | 5,956 | 14,468 | 8,212 | 3,014 | 2,980 | 5,994 | 666 |
| 35—44.............. | 34,288 | 1,396 | 10,243 | 13,973 | 4,082 | 1,909 | 2,091 | 4,000 | 594 |
| 45—54.............. | 20,308 | 1,976 | 8,822 | 6,643 | 1,239 | 912 | 325 | 1,237 | 391 |
| 55—64.............. | 13,137 | 3,598 | 6,104 | 2,369 | 442 | 229 | 202 | 431 | 193 |
| 65+ .............. | 2,208 | 642 | 897 | 363 | 189 | — | 58 | 58 | 59 |
| 25—64.............. | 104,242 | 8,183 | 31,125 | 37,453 | 13,975 | 6,064 | 5,598 | 11,662 | 1,844 |

APPENDIX TABLE A-3

Estimation of Grade 12 and Grade 13 for Male Nonfarm Labour Force 25—64 Years of Age
By Schooling of Male Nonfarm Labour Force 15 Years and Over, 1961

| Occupation | Grade 12 15 years and over | Grade 13 15 years and over | Total, Grade 12 and 13 15 years and over | Per Cent Grade 12 | Per Cent Grade 13 | Total, Grade 12 and 13 25—64 years | Grade 12 25—64 years (implied) | Grade 13 25—64 years (implied) |
|---|---|---|---|---|---|---|---|---|
| All Occupations................ | 402,576 | 296,485 | 699,061 | 57.59 | 42.21 | 498,684 | 287,192 | 211,492 |
| Managerial.................. | 70,324 | 61,973 | 132,297 | 53.16 | 46.85 | 119,075 | 63,300 | 55,775 |
| Professional and technical | 37,305 | 41,928 | 79,233 | 47.10 | 52.90 | 59,296 | 27,928 | 31,368 |
| Clerical.................... | 59,435 | 44,342 | 103,777 | 57.27 | 42.73 | 63,003 | 36,082 | 26,921 |
| Sales...................... | 41,273 | 31,233 | 72,506 | 56.92 | 43.08 | 54,059 | 30,770 | 23,289 |
| Service ................... | 36,402 | 20,558 | 56,960 | 63.91 | 36.09 | 35,233 | 22,517 | 12,716 |
| Transportation and communication ........... | 22,259 | 12,467 | 34,726 | 64.10 | 35.90 | 26,872 | 17,225 | 9,647 |
| Farmers .................. | 23,596 | 9,448 | 33,044 | 71.41 | 28.59 | 3,575 | 2,553 | 1,022 |
| Loggers .................. | 1,868 | 1,005 | 2,873 | 65.02 | 34.98 | 1,531 | 995 | 536 |
| Fishermen and trappers .. | 672 | 298 | 970 | 69.28 | 30.72 | 629 | 436 | 193 |
| Miners.................... | 3,088 | 1,692 | 4,780 | 64.60 | 35.40 | 3,162 | 2,043 | 1,119 |
| Craftsmen................. | 97,378 | 57,968 | 155,346 | 62.68 | 37.32 | 117,908 | 73,905 | 44,003 |
| Labourers................. | 2,560 | 6,248 | 8,808 | 29.06 | 70.94 | 6,897 | 2,004 | 4,893 |
| Not stated ............... | 6,416 | 7,325 | 13,741 | 46.69 | 53.31 | 11,019 | 5,145 | 5,874 |

Note: Calculation of distribution of Grade 12 and Grade 13 levels of education for the labour force 25—64 years of age is based on the assumption that the proportion was the same as the 15-years-and-over labour force age group.

Source: Based on special tabulations of 1961 Census data by Dominion Bureau of Statistics.

## APPENDIX TABLE A-4

### Estimation by Cohort Method of the Number of Persons in the Male Labour Force, 25–64 Years of Age, by Years of Schooling, 1911–61

| Decade | Age Group | Total | Elementary School | | High School | | University | |
|---|---|---|---|---|---|---|---|---|
| | | | 0–4 Years | 5–8 Years | 1–3 Years | 4 Years | Some University[1] | Complete University |
| **1961** Gross Labour Force | 25–34 | 1,181,693 | 46,162 | 402,237 | 399,997 | 102,362 | 159,801 | 71,134 |
| | 35–44 | 1,121,449 | 68,432 | 409,254 | 353,824 | 106,224 | 113,321 | 70,394 |
| | 45–54 | 879,585 | 83,936 | 362,865 | 240,489 | 74,517 | 74,170 | 43,608 |
| | 55–64 | 534,740 | 81,949 | 253,454 | 108,767 | 39,654 | 28,269 | 22,647 |
| | Total | 3,717,467 | 280,479 | 1,427,810 | 1,103,077 | 322,757 | 375,561 | 207,783 |
| **1961** Net of Migration 1951–61 | 25–34 | 1,056,418 | 41,024 | 357,864 | 357,940 | 92,041 | 144,082 | 63,466 |
| | 35–44 | 1,033,933 | 62,721 | 376,195 | 326,755 | 98,585 | 105,229 | 64,448 |
| | 45–54 | 839,697 | 79,992 | 346,282 | 229,923 | 71,595 | 70,879 | 41,025 |
| | 55–64 | 522,764 | 80,229 | 247,916 | 106,398 | 38,828 | 27,588 | 21,805 |
| | Total | 3,452,812 | 263,966 | 1,328,257 | 1,021,016 | 301,049 | 347,778 | 190,744 |
| **1951** Gross Labour Force | 25–34 | 1,055,734 | 64,043 | 384,127 | 333,645 | 100,663 | 107,447 | 65,807 |
| | 35–44 | 888,333 | 84,625 | 366,339 | 243,240 | 75,742 | 74,984 | 43,401 |
| | 45–54 | 608,042 | 93,317 | 288,358 | 123,754 | 45,162 | 32,088 | 25,362 |
| | 55–64 | 476,747 | 86,577 | 226,121 | 99,926 | 28,176 | 13,826 | 22,121 |
| | Total | 3,028,856 | 328,562 | 1,264,945 | 800,565 | 249,743 | 228,345 | 156,691 |
| **1951** Net of Migration 1941–51 | 25–34 | 1,020,612 | 61,897 | 371,311 | 322,564 | 97,337 | 103,900 | 63,601 |
| | 35–44 | 863,025 | 82,208 | 355,899 | 236,324 | 73,598 | 72,851 | 42,146 |
| | 45–54 | 596,274 | 91,515 | 282,780 | 121,361 | 44,289 | 31,465 | 24,863 |
| | 55–64 | 473,636 | 86,012 | 224,646 | 99,377 | 27,889 | 13,737 | 21,977 |
| | Total | 2,953,548 | 321,632 | 1,234,636 | 779,623 | 243,113 | 221,953 | 152,587 |

Number of Males in Labour Force by Years of Education

APPENDIX TABLE A-4 (concluded)

|  |  |  | Elementary School | | High School | | University | |
|---|---|---|---|---|---|---|---|---|
| Decade | Age Group | Total | 0–4 Years | 5–8 Years | 1–3 Years | 4 Years | Some University[1] | Complete University |
| 1941 Gross Labour Force | 25–34 | 888,800 | 84,663 | 366,528 | 243,382 | 75,796 | 75,026 | 43,405 |
|  | 35–44 | 636,026 | 97,616 | 301,632 | 129,452 | 47,241 | 33,562 | 26,521 |
|  | 45–54 | 554,609 | 100,717 | 263,051 | 116,366 | 32,657 | 16,085 | 25,734 |
|  | 55–64 | 440,122 | 80,982 | 226,355 | 93,624 | 19,135 | 7,811 | 12,215 |
|  | Total | 2,519,557 | 363,978 | 1,157,566 | 582,824 | 174,829 | 132,484 | 107,875 |
| 1941 Net of Migration. 1931–41 | 25–34 | 887,407 | 84,529 | 365,954 | 243,001 | 75,678 | 74,908 | 43,336 |
|  | 35–44 | 629,388 | 96,600 | 298,486 | 128,101 | 46,749 | 33,211 | 26,239 |
|  | 45–54 | 553,300 | 100,479 | 262,432 | 116,135 | 32,538 | 16,047 | 25,673 |
|  | 55–64 | 442,020 | 81,326 | 227,256 | 93,959 | 19,310 | 7,866 | 12,303 |
|  | Total | 2,512,118 | 362,934 | 1,154,128 | 581,196 | 174,275 | 132,032 | 107,551 |
| 1931 Gross Labour Force | 25–34 | 652,216 | 100,104 | 309,312 | 132,747 | 48,445 | 34,416 | 27,191 |
|  | 35–44 | 594,148 | 107,897 | 281,806 | 124,708 | 34,940 | 17,231 | 27,568 |
|  | 45–54 | 575,926 | 94,923 | 265,253 | 109,669 | 22,539 | 9,182 | 14,360 |
|  | 55–64 | 322,507 | 75,950 | 165,220 | 58,882 | 9,586 | 5,020 | 7,849 |
|  | Total | 2,084,797 | 378,874 | 1,021,591 | 426,006 | 115,510 | 65,849 | 76,968 |
| 1931 Net of Migration 1921–31 | 25–34 | 652,036 | 100,076 | 309,227 | 132,711 | 64,732 | 18,106 | 27,183 |
|  | 35–44 | 607,321 | 110,290 | 286,054 | 127,033 | 36,155 | 17,613 | 28,180 |
|  | 45–54 | 539,435 | 99,192 | 276,403 | 113,818 | 24,707 | 9,864 | 15,451 |
|  | 55–64 | 330,373 | 77,379 | 168,950 | 60,270 | 10,311 | 5,248 | 8,215 |
|  | Total | 2,129,165 | 386,937 | 1,042,634 | 433,832 | 135,905 | 50,831 | 79,029 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1921 Gross Labour Force** | | | | | | | |
| 25–34 | 634,775 | 115,275 | 301,075 | 132,775 | 37,789 | 18,409 | 29,453 |
| 35–44 | 580,193 | 106,687 | 297,287 | 122,418 | 26,574 | 10,610 | 16,618 |
| 45–54 | 383,374 | 89,793 | 196,055 | 69,939 | 11,965 | 6,090 | 9,533 |
| 55–64 | 270,320 | 77,582 | 135,160 | 42,369 | 6,180 | 3,521 | 5,508 |
| Total | 1,868,662 | 389,337 | 929,577 | 367,501 | 82,508 | 38,630 | 61,112 |
| **1921 Net of Migration 1911–21** | | | | | | | |
| 25–34 | 596,161 | 108,263 | 282,761 | 125,960 | 34,236 | 17,289 | 27,661 |
| 35–44 | 543,229 | 99,975 | 279,755 | 115,894 | 23,166 | 9,538 | 14,902 |
| 45–54 | 387,468 | 90,536 | 197,997 | 70,662 | 12,344 | 6,209 | 9,723 |
| 55–64 | 270,275 | 77,574 | 135,138 | 42,362 | 6,176 | 3,519 | 5,505 |
| Total | 1,797,133 | 376,348 | 895,651 | 354,878 | 75,922 | 36,555 | 57,791 |
| **1911 Gross Labour Force** | | | | | | | |
| 25–34 | 569,906 | 104,884 | 293,493 | 121,585 | 24,304 | 10,006 | 15,634 |
| 35–44 | 418,491 | 97,785 | 213,850 | 76,320 | 13,332 | 6,706 | 10,498 |
| 45–54 | 314,273 | 90,202 | 157,137 | 49,258 | 7,181 | 4,092 | 6,403 |
| 55–64 | 208,282 | 72,149 | 100,121 | 26,540 | 3,619 | 2,283 | 3,570 |
| Total | 1,510,952 | 365,020 | 764,601 | 273,703 | 48,436 | 23,087 | 36,105 |

[1] Includes Grade 13 for provinces where it was given for each age group in 1961, the age group 25–54 in 1951, 25–44 in 1941, and 25–34 in 1931.

Source: Based on Dominion Bureau of Statistics, *Census of Canada, 1961, 1951, 1941*, and Appendix B–2, which provides a detailed explanation of the methods used to construct this table.

## APPENDIX TABLE A-5

### Estimates of Immigration, Emigration and Net Migration
### of Canadian Male Labour Force, by Age and Education

| Age | 1951—61 | | | | |
|---|---|---|---|---|---|
| | Immigration | Emigration to U.S. | Emigration to U.K. | Emigration | Net Migration |
| **All Ages** | | | | | |
| Total ............... | 359,465 | 72,061 | 22,749 | 94,810 | 264,655 |
| 0—4 elementary ...... | 22,219 | 4,178 | 1,528 | 5,706 | 16,513 |
| 5—8 elementary....... | 134,213 | 26,155 | 8,505 | 34,660 | 99,553 |
| 1—3 high school ...... | 111,889 | 22,862 | 6,966 | 29,828 | 82,061 |
| 4 high school ...... | 30,039 | 6,359 | 1,972 | 8,331 | 21,708 |
| Some university* ..... | 38,532 | 8,269 | 2,480 | 10,749 | 27,783 |
| University degree .... | 22,573 | 4,237 | 1,297 | 5,534 | 17,039 |
| **25—34 Years** | | | | | |
| Total ............... | 174,233 | 37,897 | 11,061 | 48,958 | 125,275 |
| 0—4 elementary ...... | 7,052 | 1,482 | 432 | 1,914 | 5,138 |
| 5—8 elementary ...... | 61,038 | 12,900 | 3,765 | 16,665 | 44,373 |
| 1—3 high school ...... | 58,629 | 12,828 | 3,744 | 16,572 | 42,057 |
| 4 high school ...... | 14,561 | 3,282 | 958 | 4,240 | 10,321 |
| Some university* ..... | 22,338 | 5,124 | 1,495 | 6,619 | 15,719 |
| University degree .... | 10,615 | 2,281 | 666 | 2,947 | 7,668 |
| **35—44 Years** | | | | | |
| Total ............... | 114,490 | 21,510 | 5,464 | 26,974 | 87,516 |
| 0—4 elementary ...... | 7,359 | 1,314 | 334 | 1,648 | 5,711 |
| 5—8 elementary ...... | 42,902 | 7,849 | 1,994 | 9,843 | 33,059 |
| 1—3 high school ...... | 35,579 | 6,786 | 1,724 | 8,510 | 27,069 |
| 4 high school ...... | 10,193 | 2,037 | 517 | 2,554 | 7,639 |
| Some university* ..... | 10,817 | 2,173 | 552 | 2,725 | 8,092 |
| University degree .... | 7,640 | 1,351 | 343 | 1,694 | 5,946 |
| **45—54 Years** | | | | | |
| Total ............... | 52,841 | 9,627 | 3,326 | 12,953 | 39,888 |
| 0—4 elementary ...... | 5,181 | 919 | 318 | 1,237 | 3,944 |
| 5—8 elementary ...... | 21,926 | 3,971 | 1,372 | 5,343 | 16,583 |
| 1—3 high school ...... | 14,107 | 2,632 | 909 | 3,541 | 10,566 |
| 4 high school ...... | 4,019 | 815 | 282 | 1,097 | 2,922 |
| Some university* ..... | 4,383 | 812 | 280 | 1,092 | 3,291 |
| University degree .... | 3,225 | 477 | 165 | 642 | 2,583 |
| **55—64 Years** | | | | | |
| Total ............... | 17,901 | 3,027 | 2,898 | 5,925 | 11,976 |
| 0—4 elementary ...... | 2,627 | 463 | 444 | 907 | 1,720 |
| 5—8 elementary ...... | 8,347 | 1,435 | 1,374 | 2,809 | 5,538 |
| 1—3 high school ...... | 3,574 | 616 | 589 | 1,205 | 2,369 |
| 4 high school ...... | 1,266 | 225 | 215 | 440 | 826 |
| Some university ..... | 994 | 160 | 153 | 313 | 681 |
| University degree .... | 1,093 | 128 | 123 | 251 | 842 |

| Age | 1941—51 | | | | |
|---|---|---|---|---|---|
| | Immigration | Emigration to U.S. | Emigration to U.K. | Emigration | Net Migration |
| **41—51 Years** | | | | | |
| Total .............. | 115,494 | 29,744 | 10,442 | 40,186 | 75,308 |
| 0—4 elementary ...... | 10,527 | 2,564 | 1,033 | 3,597 | 6,930 |
| 5—8 elementary ...... | 46,319 | 11,748 | 4,262 | 16,010 | 30,309 |
| 1—3 high school ...... | 32,249 | 8,486 | 2,821 | 11,307 | 20,942 |
| 4 high school ...... | 10,217 | 2,665 | 922 | 3,587 | 6,630 |
| Some university* ..... | 9,846 | 2,613 | 841 | 3,454 | 6,392 |
| University degree .... | 6,337 | 1,670 | 563 | 2,233 | 4,104 |
| **25—34 Years** | | | | | |
| Total .............. | 56,396 | 16,728 | 4,546 | 21,274 | 35,122 |
| 0—4 elementary ...... | 3,446 | 1,022 | 278 | 1,300 | 2,146 |
| 5—8 elementary ...... | 20,579 | 6,104 | 1,659 | 7,763 | 12,816 |
| 1—3 high school ...... | 17,793 | 5,278 | 1,434 | 6,712 | 11,081 |
| 4 high school ...... | 5,341 | 1,584 | 431 | 2,015 | 3,326 |
| Some university* ..... | 5,696 | 1,690 | 459 | 2,149 | 3,547 |
| University degree .... | 3,542 | 1,051 | 285 | 1,336 | 2,206 |
| **35—44 Years** | | | | | |
| Total .............. | 36,981 | 8,551 | 3,122 | 11,673 | 25,308 |
| 0—4 elementary ...... | 3,532 | 817 | 298 | 1,115 | 2,417 |
| 5—8 elementary ....... | 15,255 | 3,527 | 1,288 | 4,815 | 10,440 |
| 1—3 high school ...... | 10,111 | 2,338 | 854 | 3,192 | 6,919 |
| 4 high school ...... | 3,132 | 724 | 264 | 988 | 2,144 |
| Some university* ..... | 3,117 | 721 | 263 | 984 | 2,133 |
| University degree .... | 1,834 | 424 | 155 | 579 | 1,255 |
| **45—54 Years** | | | | | |
| Total .............. | 16,412 | 3,028 | 1,616 | 4,644 | 11,768 |
| 0—4 elementary ...... | 2,513 | 464 | 247 | 711 | 1,802 |
| 5—8 elementary ...... | 7,779 | 1,435 | 766 | 2,201 | 5,578 |
| 1—3 high school ..... | 3,338 | 616 | 329 | 945 | 2,393 |
| 4 high school ..... | 1,218 | 225 | 120 | 345 | 873 |
| Some university* ..... | 868 | 160 | 85 | 245 | 623 |
| University degree .... | 696 | 128 | 69 | 197 | 499 |
| **55—64 Years** | | | | | |
| Total .............. | 5,705 | 1,437 | 1,157 | 2,594 | 3,111 |
| 0—4 elementary ...... | 1,036 | 261 | 210 | 471 | 565 |
| 5—8 elementary ...... | 2,706 | 682 | 549 | 1,231 | 1,475 |
| 1—3 high school ..... | 1,007 | 254 | 204 | 458 | 549 |
| 4 high school ..... | 526 | 132 | 107 | 239 | 287 |
| Some university ..... | 165 | 42 | 34 | 76 | 89 |
| University degree .... | 265 | 67 | 54 | 121 | 144 |

| Age | 1931—41 | | | | |
|---|---|---|---|---|---|
| | Immigration | Emigration to U.S. | Emigration to U.K. | Emigration | Net Migration |
| **31—41 Years** | | | | | |
| Total .............. | 39,808 | 3,470 | 28,899 | 32,369 | 7,439 |
| 0—4 elementary ...... | 5,693 | 459 | 4,190 | 4,649 | 1,044 |
| 5—8 elementary ...... | 18,081 | 1,541 | 13,102 | 14,643 | 3,438 |
| 1—3 high school ..... | 8,678 | 800 | 6,250 | 7,050 | 1,628 |
| 4 high school ..... | 3,302 | 293 | 2,515 | 2,808 | 494 |
| Some university* ..... | 2,226 | 215 | 1,559 | 1,774 | 452 |
| University degree .... | 1,829 | 163 | 1,342 | 1,505 | 324 |
| **25—34 Years** | | | | | |
| Total .............. | 12,854 | 1,708 | 9,753 | 11,461 | 1,393 |
| 0—4 elementary ...... | 1,228 | 163 | 931 | 1,094 | 134 |
| 5—8 elementary ...... | 5,302 | 705 | 4,023 | 4,728 | 574 |
| 1—3 high school ..... | 3,514 | 467 | 2,666 | 3,133 | 381 |
| 4 high school ..... | 1,089 | 145 | 826 | 971 | 118 |
| Some university* ..... | 1,034 | 144 | 822 | 966 | 118 |
| University degree .... | 638 | 85 | 484 | 569 | 69 |
| **35—44 Years** | | | | | |
| Total .............. | 15,083 | 833 | 7,612 | 8,445 | 6,638 |
| 0—4 elementary ...... | 2,309 | 128 | 1,165 | 1,293 | 1,016 |
| 5—8 elementary ...... | 7,149 | 395 | 3,608 | 4,003 | 3,146 |
| 1—3 high school ..... | 3,068 | 169 | 1,548 | 1,717 | 1,351 |
| 4 high school ..... | 1,119 | 62 | 565 | 627 | 492 |
| Some university* ..... | 798 | 44 | 403 | 447 | 351 |
| University degree .... | 640 | 35 | 323 | 358 | 282 |
| **45—54 Years** | | | | | |
| Total .............. | 7,890 | 613 | 5,971 | 6,584 | 1,309 |
| 0—4 elementary ...... | 1,433 | 111 | 1,084 | 1,195 | 238 |
| 5—8 elementary ...... | 3,742 | 291 | 2,832 | 3,123 | 619 |
| 1—3 high school...... | 1,393 | 108 | 1,054 | 1,162 | 231 |
| 4 high school ..... | 727 | 57 | 551 | 608 | 119 |
| Some university ...... | 229 | 18 | 173 | 191 | 38 |
| University degree .... | 366 | 28 | 277 | 305 | 61 |
| **55—64 Years** | | | | | |
| Total .............. | 3,981 | 316 | 5,563 | 5,879 | − 1,898 |
| 0—4 elementary ...... | 723 | 57 | 1,010 | 1,067 | − 344 |
| 5—8 elementary ...... | 1,888 | 150 | 2,639 | 2,789 | − 901 |
| 1—3 high school ..... | 703 | 56 | 982 | 1,038 | − 335 |
| 4 high school ..... | 367 | 29 | 513 | 542 | − 175 |
| Some university ...... | 115 | 9 | 161 | 170 | − 55 |
| University degree .... | 185 | 15 | 258 | 273 | − 88 |

| Age | 1921-31 | | | | |
|---|---|---|---|---|---|
| | Immigration | Emigration to U.S. | Emigration to U.K. | Emigration | Net Migration |
| **All Ages** | | | | | |
| Total .............. | 235,685 | 238,357 | 41,696 | 280,053 | −44,368 |
| 0−4 elementary ...... | 38,802 | 39,750 | 7,115 | 46,865 | − 8,063 |
| 5−8 elementary ...... | 111,743 | 113,015 | 19,771 | 132,786 | −21,043 |
| 1−3 high school ..... | 45,372 | 45,408 | 7,790 | 53,198 | − 7,826 |
| 4 high school ..... | 19,205 | 19,743 | 3,556 | 23,299 | − 4,094 |
| Some university* ..... | 10,187 | 9,877 | 1,592 | 11,469 | − 1,282 |
| University degree .... | 10,374 | 10,563 | 1,871 | 12,434 | − 2,060 |
| **25−34 Years** | | | | | |
| Total .............. | 140,256 | 124,065 | 16,011 | 140,076 | 180 |
| 0−4 elementary ...... | 21,473 | 18,994 | 2,451 | 21,445 | 28 |
| 5−8 elementary ...... | 66,481 | 58,807 | 7,589 | 66,396 | 85 |
| 1−3 high school ..... | 28,528 | 25,235 | 3,257 | 28,492 | 36 |
| 4 high school ..... | 10,407 | 9,205 | 1,188 | 10,393 | 14 |
| Some university* ..... | 7,420 | 6,563 | 847 | 7,410 | 10 |
| University degree .... | 5,947 | 5,260 | 679 | 5,939 | 8 |
| **35−44 Years** | | | | | |
| Total .............. | 63,093 | 63,665 | 12,601 | 76,266 | −13,173 |
| 0−4 elementary ...... | 11,457 | 11,562 | 2,288 | 13,850 | − 2,393 |
| 5−8 elementary ...... | 29,925 | 30,196 | 5,977 | 36,173 | − 6,248 |
| 1−3 high school .... | 11,136 | 11,237 | 2,224 | 13,461 | − 2,325 |
| 4 high school ..... | 5,817 | 5,870 | 1,162 | 7,032 | − 1,215 |
| Some university ..... | 1,829 | 1,846 | 365 | 2,211 | − 382 |
| University degree .... | 2,927 | 2,954 | 585 | 3,539 | − 612 |
| **45−54 Years** | | | | | |
| Total .............. | 24,276 | 37,970 | 9,815 | 47,785 | −23,509 |
| 0−4 elementary ...... | 4,408 | 6,895 | 1,782 | 8,677 | − 4,269 |
| 5−8 elementary ...... | 11,514 | 18,009 | 4,655 | 22,664 | −11,150 |
| 1−3 high school ..... | 4,285 | 6,702 | 1,732 | 8,434 | − 4,149 |
| 4 high school ..... | 2,238 | 3,501 | 905 | 4,406 | − 2,168 |
| Some university ..... | 704 | 1,101 | 285 | 1,386 | − 682 |
| University degree .... | 1,126 | 1,762 | 455 | 2,217 | − 1,091 |
| **55−64 Years** | | | | | |
| Total .............. | 8,060 | 12,657 | 3,269 | 15,926 | −7,866 |
| 0−4 elementary ...... | 1,464 | 2,299 | 594 | 2,893 | −1,429 |
| 5−8 elementary ...... | 3,823 | 6,003 | 1,550 | 7,553 | −3,730 |
| 1−3 high school ..... | 1,423 | 2,234 | 577 | 2,811 | −1,388 |
| 4 high school ..... | 743 | 1,167 | 301 | 1,468 | − 725 |
| Some university ..... | 234 | 367 | 95 | 462 | − 228 |
| University degree .... | 374 | 587 | 152 | 739 | − 365 |

| Age | 1911—21 | | |
| --- | --- | --- | --- |
| | Immigration | All Emigration | Net Migration |
| **All Ages** . . | | | |
| Total ........................ | 395,110 | 323,582 | 71,528 |
| 0—4 elementary ............... | 71,752 | 58,763 | 12,989 |
| 5—8 elementary ............... | 187,401 | 153,475 | 33,926 |
| 1—3 high school .............. | 69,736 | 57,113 | 12,623 |
| 4 high school .............. | 36,428 | 29,835 | 6,593 |
| Some university ............... | 11,458 | 9,383 | 2,075 |
| University degree .............. | 18,335 | 15,014 | 3,321 |
| **25—34 Years** | | | |
| Total ........................ | 207,038 | 168,424 | 38,614 |
| 0—4 elementary ............... | 37,598 | 30,586 | 7,012 |
| 5—8 elementary ............... | 98,198 | 79,884 | 18,314 |
| 1—3 high school ............... | 36,542 | 29,727 | 6,815 |
| 4 high school .............. | 19,082 | 15,529 | 3,553 |
| Some university ............... | 6,004 | 4,884 | 1,120 |
| University degree .............. | 9,607 | 7,815 | 1,792 |
| **35—44 Years** | | | |
| Total ........................ | 123,393 | 86,429 | 36,964 |
| 0—4 elementary ............... | 22,408 | 15,696 | 6,712 |
| 5—8 elementary ............... | 58,525 | 40,993 | 17,532 |
| 1—3 high school ............... | 21,779 | 15,255 | 6,524 |
| 4 high school .............. | 11,377 | 7,969 | 3,408 |
| Some university ............... | 3,578 | 2,506 | 1,072 |
| University degree .............. | 5,726 | 4,010 | 1,716 |
| **45—54 Years** | | | |
| Total ........................ | 47,453 | 51,547 | −4,094 |
| 0—4 elementary ............... | 8,618 | 9,361 | − 743 |
| 5—8 elementary ............... | 22,507 | 24,449 | −1,942 |
| 1—3 high school ............... | 8,375 | 9,098 | − 723 |
| 4 high school .............. | 4,374 | 4,753 | − 379 |
| Some university ............... | 1,376 | 1,495 | − 119 |
| University degree .............. | 2,202 | 2,392 | − 190 |
| **55—64 Years** | | | |
| Total ........................ | 17,227 | 17,182 | 45 |
| 0—4 elementary ............... | 3,128 | 3,120 | 8 |
| 5—8 elementary ............... | 8,171 | 8,149 | 22 |
| 1—3 high school ............... | 3,040 | 3,033 | 7 |
| 4 high school .............. | 1,588 | 1,584 | 4 |
| Some university ............... | 500 | 498 | 2 |
| University degree .............. | 800 | 797 | 3 |

*Includes fifth year high school.

Source: See Appendix B-9 for a discussion of sources and methods of estimation.
    (Appendix Table A-6 provides alternative estimates of net migration for 1921—31.)

## APPENDIX TABLE A-6

### Alternative Method of Estimating Net Migration of
### Canadian Male Labour Force, 25–64 Years of Age, 1921–31[1]

| Age | Immigration | Emigration to U.S. | Emigration to U.K. | Net Migration |
|---|---|---|---|---|
| **All Ages** | | | | |
| Total .................. | 235,685 | 144,096 | 41,696 | 49,893 |
| 0–4 elementary .......... | 38,802 | 24,031 | 7,115 | 7,656 |
| 5–8 elementary .......... | 111,743 | 68,322 | 19,771 | 23,650 |
| 1–3 high school.......... | 45,372 | 27,452 | 7,790 | 10,130 |
| 4 high school.......... | 19,205 | 11,935 | 3,556 | 3,714 |
| Some university * ........ | 10,187 | 5,972 | 1,592 | 2,623 |
| University degree ........ | 10,374 | 6,386 | 1,871 | 2,117 |
| **25–34 Years** | | | | |
| Total .................. | 140,256 | 75,002 | 16,011 | 49,243 |
| 0–4 elementary .......... | 21,473 | 11,483 | 2,451 | 7,539 |
| 5–8 elementary .......... | 66,481 | 35,551 | 7,589 | 23,341 |
| 1–3 high school.......... | 28,528 | 15,256 | 3,257 | 10,015 |
| 4 high school.......... | 10,407 | 5,565 | 1,188 | 3,654 |
| Some university * ........ | 7,420 | 3,968 | 847 | 2,605 |
| University degree ........ | 5,947 | 3,180 | 679 | 2,088 |
| **35–44 Years** | | | | |
| Total .................. | 63,093 | 38,488 | 12,601 | 12,004 |
| 0–4 elementary .......... | 11,457 | 6,990 | 2,288 | 2,179 |
| 5–8 elementary .......... | 29,925 | 18,255 | 5,977 | 5,693 |
| 1–3 high school.......... | 11,136 | 6,793 | 2,224 | 2,119 |
| 4 high school.......... | 5,817 | 3,549 | 1,162 | 1,106 |
| Some university .......... | 1,829 | 1,116 | 365 | 348 |
| University degree ........ | 2,927 | 1,786 | 585 | 556 |
| **45–54 Years** | | | | |
| Total .................. | 24,276 | 22,954 | 9,815 | − 8,493 |
| 0–4 elementary .......... | 4,408 | 4,168 | 1,782 | − 1,542 |
| 5–8 elementary .......... | 11,514 | 10,887 | 4,655 | − 4,028 |
| 1–3 high school.......... | 4,285 | 4,052 | 1,732 | − 1,499 |
| 4 high school.......... | 2,238 | 2,116 | 905 | − 783 |
| Some university .......... | 704 | 666 | 285 | − 247 |
| University degree ........ | 1,126 | 1,065 | 455 | − 394 |
| **55–64 Years** | | | | |
| Total .................. | 8,060 | 7,651 | 3,269 | − 2,860 |
| 0–4 elementary .......... | 1,464 | 1,390 | 594 | − 520 |
| 5–8 elementary .......... | 3,823 | 3,629 | 1,550 | − 1,356 |
| 1–3 high school.......... | 1,423 | 1,351 | 577 | − 505 |
| 4 high school.......... | 743 | 705 | 301 | − 263 |
| Some university .......... | 234 | 222 | 95 | − 83 |
| University degree ........ | 374 | 355 | 152 | − 133 |

[1] Higher estimates of Canadians returning from the United States were used in this table.

* Includes Grade 13 high school.

Source: See Appendix B–9.

Estimates of Median Years of Schooling, Males,
Canada 1911–61 and United States 1910–60
(Canadian labour force and U.S. population, selected age groups)

| Canada | | | | United States | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | 20–64 | 25–64 | Per cent change by decade (25–64 group) | Year | 20–64 | 25–64 | 25 & over | Per cent change by decade (25 & over group) |
| 1911 | | 7.35 | | 1910 | | | 7.41 | |
| | | | 5.44 | | | | | 3.64 |
| 1921 | | 7.75 | | 1920 | | | 7.68 | |
| | | | 3.74 | | | | | 4.30 |
| 1931 | | 8.04 | | 1930 | | | 8.01 | |
| | | | 4.85 | | | | | 6.74 |
| 1941 | | 8.43 | | 1940 | | | 8.55 | |
| | | | 3.68 | | | | | 5.26 |
| 1951 | | 8.74 | | 1950 | | 9.53 | 9.00 | |
| | | | 7.21 | | | | | 14.44 |
| 1961 | 9.53 | 9.37 | | 1960 | 11.26 | 10.90 | 10.30 | |
| | | | | 1962 | 12.06 | 11.93 | 11.10 | |
| 1911–61 | | | 27.48 | 1910–60 | | | | 39.00 |

Note: The method of computing Canadian medians is discussed in Appendix B–5. It should be pointed out that the U.S. male population median is shown in this table rather than the median of the male labour force, since the historical data are available only for the former. In 1959, the male labour force median was significantly higher in each age group, 25–64 years, than the male population median in 1960 for each corresponding age group. In 1962, there was virtually no difference by age groups in the medians of the male population and male labour force. It therefore appears that the comparison of the U.S. male population median with the Canadian labour force median may underestimate the years of schooling attained by the U.S. labour force prior to 1962. The U.S. historical education data for 1910–50 are for the male population and, in order to be consistent, the U.S. male population is used again for 1960 data.

The 1962 estimates for the United States were derived from the Census Current Population Survey. The Bureau of the Census noted in this publication that differences in sampling results and definitions may be responsible for some of the difference in 1960 medians computed from the Census of 1960, but the comment was also made that "the small group of Current Population survey enumerators were more experienced and had more intensive training and supervision than the large number of temporary decennial census enumerators and may have more often obtained more accurate answers from respondents." The extent of the difference in the median years of schooling between the Canadian and U.S. educational achievements is an important issue of fact, which requires further discussion. The large change in the U.S. median years of schooling over a two-year period must be qualified as partially due to differences in sampling techniques and in definitions used in the census and sample surveys. However, even in a two-year period the education of the male labour force stock shifts somewhat, since the 25–64 age group in 1962 was not composed of the same persons measured in 1960. A fraction of the oldest age group with the least education dropped out of the count, while a fraction of the youngest age group with the highest education was added.

Source: The Canadian medians are based on estimates developed in this study. The U.S. medians are estimated from data given by Edward F. Denison, "Measuring the Contribution of Education to Economic Growth", *The Residual Factor and Economic Growth*, OECD, Paris, 1964. Table 2, for decades 1910, 1920, 1930 and 1940. The estimates given for the U.S. median years of schooling, 1910, 1920 and 1930 are approximate, since the data available gave the percentage distribution of Grade 7 and Grade 8 as a total, rather than separately for each year. The actual median falling within 7 and 8 years in 1910 and 1920 and between 8 and 9 years in 1930 was estimated by applying the proportions of Grade 7 and 8 in the Canadian labour force in these periods. The year in which the median falls is clear, but the fractional value of those medians is likely an underestimate, in view of the data from the U.S. 1960 Census available for older age groups. Medians were calculated for 1950, 1960 and 1962 from U.S. Department of Commerce, Bureau of the Census, 1960 Census of Population, *Supplementary Reports*, "Educational Attainment of the Population of the U.S., 1960", PC (S1)–37, Table 173, for 1950 and 1960; and Bureau of the Census, Current Population Reports, *Population Characteristics*, Series P–20, No. 121, Table 1, for 1962.

## APPENDIX TABLE A–8

### Median Years of Schooling, Males, by Age Groups, Canada and United States

(1961 Canadian labour force; 1960 and 1962 U.S. population;
1959 and 1962 U.S. labour force)[1]

| Canada | | United States | | | | | |
|--------|--|---------------|--|--|--|--|--|
| Male Labour Force | | Male Population[3] | | | Male Labour Force[4] | | |
| Age | 1961 | Age | 1960 | 1962 | Age | March 1959 | March 1962 |
| 20–24[2] | 10.05 | 20–24 | 12.3 | 12.5 | 18–24 | 12.1 | 12.3 |
| 25–34 | 10.04 | 25–34 | 12.1 | 12.4 | 25–34 | 12.3 | 12.4 |
| 35–44 | 9.64 | 35–44 | 11.0 | 12.2 | 35–44 | 12.1 | 12.2 |
| 45–54 | 8.96 | 45–54 | 9.9 | 11.0 | 45–54 | 10.4 | 11.1 |
| 55–64 | 8.30 | 55–64 | 8.6 | 9.0 | 55–64 | 8.8 | 9.0 |
| 25–64 | 9.37 | 25–64 | 10.90 | 11.93 | | | |
| 20–64 | 9.53 | 20–64 | 11.26 | 12.06 | | | |

[1] See Appendix B–5 for method of computing median.

[2] Estimate computed from male population educational attainment, *1961 Census of Canada, Population, Schooling By Age Groups*, Catalogue 92–557, Table 102. To compute the median, the division of high school into Grades 9 and 10 was based on the male age group enrolled in high school in Canada and reaching their fourth year in 1958; Dominion Bureau of Statistics, *Student Progress Through the Schools, 1960*, Table 1, p. 25, ten provinces.

[3] Computed from U.S. Department of Commerce, Bureau of the Census, 1960 Census of Population, *Supplementary Reports*, "Educational Attainment of the Population of the U.S. in 1960", PC(S1)–37, Table 173; and Bureau of the Census, *Current Population Reports, Population Characteristics*, Series P–20, No. 121, Table 1, for 1962. See Note in Appendix Table A–7 for comment on comparison of 1960 and 1962 medians.

[4] *Manpower Report of the President* and U.S. Department of Labor, *A Report on Manpower Requirements, Resources, Utilization, and Training*, 1964, Table B13, p. 219.

# APPENDIX TABLE A-9

## United States Educational Attainments, Males, by Age Groups, 1960 and 1962
### (Percentage distribution)

| Age Group | Total | Elementary School 0–4 Years Male Labour Force | 0–4 Years Male Population | 0–4 Years Male Population | 5–7 Years Male Labour Force | 5–7 Years Male Population | 5–7 Years Male Population | 8 Years Male Labour Force | 8 Years Male Population | 8 Years Male Population | High School 1–3 Years Male Labour Force | 1–3 Years Male Population | 1–3 Years Male Population | 4 Years Male Labour Force | 4 Years Male Population | 4 Years Male Population | University Some University Male Labour Force | Some University Male Population | Some University Male Population | University Degree Male Labour Force | University Degree Male Population | University Degree Male Population |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1960 | 1960 | 1960 | 1962 | 1960 | 1960 | 1962 | 1960 | 1960 | 1962 | 1960 | 1960 | 1962 | 1960 | 1960 | 1962 | 1960 | 1960 | 1962 | 1960 | 1960 | 1962 |
| 25–34 | 100.0 | 3.2 | 3.7 | 3.1 | 7.9 | 8.3 | 6.3 | 9.8 | 9.9 | 8.3 | 21.9 | 21.7 | 18.6 | 30.8 | 30.1 | 34.4 | 11.7 | 11.7 | 12.2 | 14.7 | 14.6 | 17.1 |
| 35–44 | 100.0 | 4.5 | 5.2 | 4.9 | 9.9 | 10.4 | 8.6 | 12.9 | 13.0 | 11.5 | 21.4 | 21.3 | 19.9 | 29.5 | 28.8 | 31.0 | 9.9 | 9.7 | 10.1 | 11.9 | 11.6 | 14.0 |
| 45–54 | 100.0 | 6.9 | 7.8 | 6.4 | 15.3 | 15.8 | 13.2 | 20.0 | 20.1 | 17.7 | 20.7 | 20.4 | 19.5 | 20.0 | 19.5 | 24.8 | 8.3 | 8.0 | 9.3 | 8.8 | 8.4 | 9.1 |
| 55–64 | 100.0 | 11.1 | 12.9 | 11.1 | 20.1 | 20.8 | 17.3 | 26.1 | 25.8 | 24.8 | 16.6 | 16.0 | 16.5 | 12.2 | 11.6 | 15.7 | 6.9 | 6.5 | 6.1 | 7.0 | 6.4 | 8.5 |
| Total | 100.0 | 5.8 | 6.9 | 5.9 | 12.4 | 13.1 | 10.8 | 16.0 | 16.3 | 14.8 | 20.5 | 20.2 | 18.8 | 24.6 | 23.6 | 27.4 | 9.5 | 9.3 | 9.7 | 11.1 | 10.6 | 12.6 |

Note: The U.S. *Census of 1960*, and *Current Population Reports* of 1962, give the number of years of university completed, but the number of persons with degrees is not listed. The classification "university degree" in the 1961 *Census of Canada*, must refer to the first degree obtained and would be awarded after 4 years of university or, in some cases, notably engineering degrees and degrees with honors, after 5 years of university. In the U.S. data, persons reporting completion of 17 or more years of schooling would not also report 16 years of schooling. Consequently, the category "university degree" for the United States refers to the sum of persons with 16 years of schooling and 17 or more years of schooling. This procedure assumes that persons completing 4 years of university did in fact receive university degrees, since the U.S. census question regarding educational attainment was in terms of years of schooling completed. The above assumption is likely correct in most cases, since the four-year university programme leading to the first degree is the usual pattern in the United States. On the other hand, the 1961 *Census of Canada* did not enumerate the number of years of schooling completed, but rather the highest year attended, for educational attainment other than university degree, which may serve to overestimate the educational attainment of the labour force, exclusive of those with university degrees, relative to the United States. The calculation of the average years of schooling in Canada shown in Table 8 is adjusted by an estimate of males with 16 years and 17 or more years of schooling.

Source: Based on data from the U.S. Department of Commerce, Bureau of the Census, 1960 Census of Population, *Supplementary Reports*, "Educational Attainment of the Population of the U. S. 1960" (PC (S1)–37, Table 173); Bureau of Census, Current Population Reports, Population Characteristics (Series P–20, 1962, No. 121, Table 1); and U.S. male labour force: U.S. Bureau of the Census, *Census of Population, 1960, Educational Attainment* (Table 4).

## APPENDIX TABLE A-10

### Average Daily Attendance as a Percentage of
### Total Enrolment in Elementary and Secondary Schools,
### Ontario 1867–1903, Canada 1904–61

| Ontario | | Canada | | | | | |
|------|----------|------|----------|------|----------|------|----------|
| Year | Per Cent | Year | Per Cent | Year | Per Cent | Year | Per Cent |
| 1867 | 43.7 | 1904 | 61.8 | 1923 | 73.1 | 1942 | 85.5 |
| 1872 | 44.4 | 1905 | 63.0 | 1924 | 74.1 | 1943 | 82.3 |
| 1877 | 47.4 | 1906 | 63.4 | 1925 | 75.0 | 1944 | 83.3 |
| 1882 | 48.6 | 1907 | 63.0 | 1926 | 75.0 | 1945 | 85.0 |
| 1887 | 53.3 | 1908 | 63.6 | 1927 | 75.5 | 1946 | 85.6 |
| 1892 | 56.0 | 1909 | 64.1 | 1928 | 75.8 | 1947 | 86.0 |
|      |      | 1910 | 64.8 | 1929 | 78.0 | 1948 | 86.5 |
| 1896 | 60.2 | 1911 | 64.0 | 1930 | 78.6 | 1949 | 86.7 |
| 1897 | 60.5 | 1912 | 66.2 | 1931 | 79.6 | 1950 | 86.9 |
| 1898 | 61.1 | 1913 | 66.6 | 1932 | 80.5 | 1951 | 86.5 |
| 1899 | 60.9 | 1914 | 67.6 | 1933 | 81.2 | 1952 | 86.9 |
| 1900 | 60.7 | 1915 | 69.4 | 1934 | 84.6 | 1953 | 88.2 |
| 1901 | 60.9 | 1916 | 68.8 | 1935 | 84.6 | 1954 | 89.5 |
| 1902 | 61.5 | 1917 | 69.3 | 1936 | 83.7 | 1955 | 89.8 |
| 1903 | 61.7 | 1918 | 69.4 | 1937 | 84.4 | 1956 | 91.0 |
|      |      | 1919 | 67.8 | 1938 | 85.3 | 1957 | 92.6 |
|      |      | 1920 | 67.6 | 1939 | 85.2 | 1958 | 90.8 |
|      |      | 1921 | 71.2 | 1940 | 86.4 | 1959 | 91.1 |
|      |      | 1922 | 73.1 | 1941 | 84.6 | 1960 | 91.4 |
|      |      |      |      |      |      | 1961 | 92.4 |

Source: For Ontario, Appendix Table A-11; for Canada, Dominion Bureau of Statistics, *Survey of Elementary and Secondary Education, 1950—54* (Tables 7 and 8, pp. 32-33), and later years of the *Survey.*

## APPENDIX TABLE A-11

### Ontario: Change in Average Attendance at Elementary and Secondary Schools

| Year | Elementary Public Schools Including Roman Catholic Separate Schools | | | High Schools and Collegiate Institutes | | | Elementary and Secondary Schools | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total Attendance | Average Attendance | Average Attendance to Total Attendance | Total Attendance | Average Attendance | Percentage | Total Attendance | Average Attendance | Percentage |
| 1867 .......... | 401643 | 163974 | 41.0 | 5696 | 3132 | 55.0 | 407339 | 167106 | 41.0 |
| 1872 .......... | 455662 | 188701 | 42.0 | 7968 | 4462 | 56.0 | 463630 | 193163 | 41.7 |
| 1877 .......... | 490860 | 217184 | 44.0 | 9229 | 5168 | 56.0 | 500089 | 222352 | 44.5 |
| 1882 .......... | 471512 | 214176 | 45.0 | 12348 | 6544 | 53.0 | 483860 | 220720 | 45.6 |
| 1887 .......... | 493212 | 245152 | 50.0 | 17459 | 10300 | 59.0 | 510671 | 255452 | 50.0 |
| 1892 .......... | 485670 | 253830 | 52.0 | 22837 | 13702 | 60.0 | 508507 | 267532 | 52.6 |
| 1897 .......... | 482777 | 273554 | 56.0 | 24390 | 14878 | 61.0 | 507167 | 288432 | 56.9 |
| 1898 .......... | 478194 | 275451 | 57.0 | 23301 | 13980 | 60.0 | 501495 | 289431 | 57.7 |
| 1896 .......... | 481948 | 271354 | 56.3 | 24567 | 14999 | 61.1 | 506515 | 286353 | 56.5 |
| 1897 .......... | 482777 | 273544 | 56.7 | 24390 | 14714 | 60.3 | 507167 | 288258 | 56.8 |
| 1898 .......... | 478394 | 273451 | 57.2 | 23301 | 14066 | 60.4 | 501695 | 287517 | 57.3 |
| 1899 .......... | 471023 | 269092 | 57.1 | 22460 | 13273 | 59.1 | 493483 | 282365 | 57.2 |
| 1900 .......... | 462494 | 263181 | 56.9 | 21723 | 12956 | 59.6 | 484217 | 276137 | 57.0 |
| 1901 .......... | 458606 | 262010 | 57.1 | 22523 | 13224 | 58.7 | 481129 | 275234 | 57.2 |
| 1902 .......... | 454088 | 261480 | 57.6 | 24472 | 14430 | 59.0 | 478560 | 275910 | 57.7 |
| 1903 .......... | 450278 | 260268 | 57.8 | 25722 | 15317 | 59.6 | 476000 | 275585 | 57.9 |
| 1904 .......... | 444621 | 257085 | 57.8 | 27709 | 16730 | 60.4 | 472330 | 273815 | 58.0 |

Source: Province of Ontario, *Report of the Minister of Education, 1897* (Table 2, p. vii), and subsequent *Reports*.

# APPENDIX TABLE A-12

## Number of Males Aged 5–24 Enrolled in School as a Percentage of the Male Population Aged 5–24 by Decade, Canada 1921–61, United States 1920–60

| | Males Enrolled | Male Population | Males Enrolled | Male Population | Males Enrolled | Male Population | Males Enrolled | Male Population | 5–9 E/P | 10–14 E/P | 14–19 E/P | 20–24 E/P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aged 5–9 | | Aged 10–14 | | Aged 15–19 | | Aged 20–24 | | | Per Cent Enrolled | | |
| **United States** | | | | | | | | | | | | |
| 1960 ............ | 7,863,944 | 9,434,914 | 7,077,524 | 7,265,790 | 4,774,007 | 6,646,330 | 1,025,091 | 5,243,581 | 83.35 | 97.41 | 51.83 | 19.55 |
| 1950 ............ | 5,290,690 | 6,726,179 | 5,437,495 | 5,687,210 | 3,303,255 | 5,320,568 | 1,031,495 | 5,568,488 | 78.66 | 95.61 | 62.08 | 18.52 |
| 1940 ............ | 3,997,541 | 5,420,346 | 5,633,609 | 5,950,364 | 3,516,540 | 6,179,251 | 466,895 | 5,711,127 | 73.75 | 94.68 | 56.91 | 8.18 |
| 1930 ............ | 4,643,127 | 6,379,004 | 5,832,107 | 6,068,489 | 2,890,820 | 5,754,181 | 459,728 | 5,446,044 | 72.79 | 96.10 | 50.24 | 8.44 |
| 1920 ............ | 3,909,607 | 5,752,915 | 4,922,612 | 5,367,381 | 1,752,973 | 4,673,914 | Not reported | Not reported | 67.96 | 91.71 | 37.51 | Not reported |
| **Canada** **(9 provinces)[1]** | | | | | | | | | | | | |
| 1961 ............ | 773,637 | 1,028,803 | 889,577 | 916,084 | 433,877 | 705,807 | 65,699 | 569,904 | 75.20 | 97.11 | 61.47 | 11.53 |
| 1951 ............ | 448,658 | 689,084 | 517,641 | 555,778 | 210,926 | 515,828 | 34,185 | 522,485 | 65.11 | 93.14 | 40.89 | 6.54 |
| 1941 ............ | 351,592 | 528,134 | 523,960 | 555,519 | 191,161 | 564,548 | 23,331 | 517,145 | 66.57 | 94.32 | 33.86 | 4.51 |
| 1931 ............ | 391,232 | 571,845 | 507,174 | 542,358 | 170,427 | 524,913 | 16,761 | 463,378 | 68.42 | 93.51 | 32.47 | 3.62 |
| 1921 ............ | 345,433 | 528,679 | 409,010 | 461,303 | 92,383 | 404,127 | 10,923 | 351,656 | 65.34 | 88.66 | 22.86 | 3.11 |

[1] Provinces: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island

Source: Based on data from U.S. Bureau of Census, *1960 Census of Population*, "School Enrollment by Single Years of Age 1920–1960" (pp. 1–372); Dominion Bureau of Statistics, *1961 Census of Canada* Vol. I, Part 3, Bulletin 1.3–6, Table 99; Vol. I, Part 2, Bulletin 1.2–2, Table 20.

## APPENDIX TABLE A-13

### Number of Males Enrolled in School, and Male Population, Aged 5-24
### Nine Provinces, 1921-61

| | Aged 5-9 | | Aged 10-14 | | Aged 15-19 | | Aged 20-24 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Males Enrolled | Male Population | Males Enrolled | Male Population | Males Enrolled | Male Population | Males Enrolled | Male Population |
| **1961** | | | | | | | | |
| British Columbia | 65,441 | 87,860 | 75,026 | 76,904 | 40,561 | 57,726 | 6,337 | 47,758 |
| Alberta | 58,285 | 81,633 | 65,247 | 66,680 | 34,085 | 50,296 | 4,894 | 44,403 |
| Saskatchewan | 39,103 | 54,785 | 46,586 | 48,122 | 24,482 | 37,461 | 3,355 | 28,973 |
| Manitoba | 39,288 | 51,902 | 45,292 | 46,439 | 23,416 | 36,287 | 3,484 | 29,714 |
| Ontario | 283,280 | 345,308 | 296,044 | 303,966 | 146,831 | 223,059 | 23,954 | 190,368 |
| Quebec | 221,365 | 319,002 | 279,576 | 289,651 | 127,649 | 235,792 | 19,773 | 181,076 |
| New Brunswick | 26,567 | 38,666 | 35,893 | 37,003 | 15,495 | 27,437 | 1,695 | 18,777 |
| Nova Scotia | 35,888 | 43,419 | 39,888 | 41,098 | 19,032 | 33,166 | 1,931 | 25,543 |
| Prince Edward Island | 4,420 | 6,228 | 6,025 | 6,221 | 2,326 | 4,583 | 276 | 3,292 |
| Total | 773,637 | 1,028,803 | 889,577 | 916,084 | 433,877 | 705,807 | 65,699 | 569,904 |
| **1951** | | | | | | | | |
| British Columbia | 33,107 | 50,996 | 37,739 | 39,838 | 18,474 | 35,767 | 3,065 | 39,407 |
| Alberta | 30,358 | 47,528 | 37,328 | 39,008 | 18,160 | 37,882 | 2,193 | 38,333 |
| Saskatchewan | 26,951 | 41,837 | 36,077 | 37,564 | 16,109 | 34,538 | 1,577 | 31,377 |
| Manitoba | 24,642 | 37,195 | 29,056 | 30,645 | 12,258 | 28,555 | 1,787 | 28,437 |
| Ontario | 142,311 | 204,576 | 155,804 | 165,701 | 69,836 | 160,190 | 12,637 | 176,929 |
| Quebec | 141,832 | 236,287 | 165,510 | 183,612 | 54,919 | 167,765 | 10,792 | 164,499 |
| New Brunswick | 19,152 | 30,289 | 23,550 | 25,127 | 8,444 | 21,088 | 880 | 17,217 |
| Nova Scotia | 26,744 | 35,074 | 27,996 | 29,505 | 11,237 | 25,867 | 1,091 | 22,941 |
| Prince Edward Island | 3,561 | 5,320 | 4,581 | 4,778 | 1,489 | 4,176 | 163 | 3,345 |
| Total | 448,658 | 689,084 | 517,641 | 555,778 | 210,926 | 515,828 | 34,185 | 522,485 |
| **1941** | | | | | | | | |
| British Columbia | 18,144 | 27,969 | 29,409 | 30,580 | 15,543 | 33,727 | 1,956 | 34,153 |
| Alberta | 23,500 | 38,425 | 37,810 | 39,198 | 16,863 | 39,335 | 1,894 | 37,527 |

# APPENDIX TABLE A-13 (concluded)

## 1941 – (Cont.)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Saskatchewan | 27,904 | 44,683 | 46,422 | 48,231 | 19,350 | 48,857 | 2,000 | 44,204 |
| Manitoba | 21,315 | 31,657 | 32,468 | 34,095 | 13,802 | 36,675 | 1,348 | 34,898 |
| Ontario | 111,514 | 152,909 | 157,297 | 164,605 | 62,091 | 172,133 | 7,724 | 163,579 |
| Quebec | 110,680 | 175,179 | 166,925 | 181,899 | 46,227 | 175,941 | 6,512 | 148,355 |
| New Brunswick | 15,358 | 24,176 | 21,987 | 23,957 | 7,001 | 24,679 | 714 | 22,026 |
| Nova Scotia | 19,838 | 28,268 | 27,032 | 28,120 | 8,990 | 28,523 | 1,030 | 27,934 |
| Prince Edward Island | 3,339 | 4,868 | 4,610 | 4,834 | 1,294 | 4,678 | 153 | 4,472 |
| Total | 351,592 | 528,134 | 523,960 | 555,519 | 191,161 | 564,548 | 23,331 | 517,145 |

## 1931

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| British Columbia | 20,904 | 30,155 | 28,918 | 30,252 | 12,952 | 31,928 | 999 | 29,165 |
| Alberta | 26,141 | 40,717 | 38,711 | 40,462 | 14,070 | 37,687 | 998 | 34,710 |
| Saskatchewan | 36,969 | 56,367 | 53,381 | 55,613 | 16,212 | 51,673 | 1,068 | 43,980 |
| Manitoba | 26,322 | 38,206 | 37,017 | 38,972 | 14,282 | 38,667 | 1,070 | 32,695 |
| Ontario | 124,116 | 168,761 | 155,587 | 161,648 | 61,159 | 163,371 | 6,715 | 147,719 |
| Quebec | 115,639 | 178,204 | 140,531 | 158,196 | 36,150 | 147,614 | 4,463 | 130,786 |
| New Brunswick | 16,256 | 25,627 | 21,525 | 23,758 | 6,005 | 21,949 | 605 | 17,631 |
| Nova Scotia | 20,633 | 29,027 | 27,039 | 28,666 | 8,445 | 27,392 | 705 | 22,826 |
| Prince Edward Island | 3,252 | 4,781 | 4,465 | 4,791 | 1,152 | 4,632 | 138 | 3,866 |
| Total | 391,232 | 571,845 | 507,174 | 542,358 | 170,427 | 524,913 | 16,761 | 463,378 |

## 1921

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| British Columbia | 17,379 | 27,391 | 20,774 | 22,819 | 5,816 | 19,189 | 593 | 18,204 |
| Alberta | 22,361 | 38,518 | 27,671 | 30,279 | 7,341 | 25,409 | 448 | 23,705 |
| Saskatchewan | 32,921 | 54,134 | 37,060 | 41,422 | 7,198 | 32,943 | 455 | 29,961 |
| Manitoba | 25,375 | 40,558 | 30,411 | 33,461 | 7,102 | 27,582 | 600 | 23,992 |
| Ontario | 108,133 | 155,623 | 127,913 | 139,423 | 31,075 | 128,093 | 4,526 | 116,327 |
| Quebec | 103,589 | 153,326 | 116,275 | 137,563 | 22,416 | 120,793 | 3,209 | 98,480 |
| New Brunswick | 13,343 | 23,677 | 18,610 | 22,207 | 4,098 | 19,674 | 351 | 15,920 |
| Nova Scotia | 19,249 | 30,503 | 25,985 | 29,302 | 6,194 | 25,978 | 631 | 21,545 |
| Prince Edward Island | 3,083 | 4,949 | 4,311 | 4,827 | 1,143 | 4,466 | 110 | 3,522 |
| Total | 345,433 | 528,679 | 409,010 | 461,303 | 92,383 | 404,127 | 10,923 | 351,656 |

Source: Based on Dominion Bureau of Statistics, *1961 Census of Canada*, (Bulletin 1.3-6, Table 99; and 1.2-2, Table 20).

## APPENDIX TABLE A–14
### Average Annual Income as a Per Cent of Average
### Grade 8 Income of United States, 1949

| Years of Schooling Completed | Mean Income as Per Cent of Mean Income of Eighth Grade Graduates (Full differential) | Mean Income Differentials Used to Represent Effect of Education (Per Cent of Income of Eighth Grade Graduates) (Differentials reduced to three fifths) |
|---|---|---|
| | (per cent) | (per cent) |
| None............... | 50 | 70 |
| 1–4 elementary school........ | 65 | 79 |
| 5–7 elementary school........ | 80 | 88 |
| 8 elementary school........ | 100 | 100 |
| 1–3 high school............. | 115 | 109 |
| 4 high school............. | 140 | 124 |
| 1–3 university............. | 165 | 139 |
| 4 or more university........ | 235 | 181 |

Source: Edward F. Denison, *The Sources of Economic Growth*, Table 8, p. 68.


## APPENDIX TABLE A-15
### Calculation of Incomes 1911–61, Based on 1961 Education-Income Weights
### and 1911–61 Educational Distribution

| Years of Schooling | 1961 Mean Incomes, Representing Effect of Education Only | Percentage Distribution of the Male Labour Force, 25–64 Years of Age | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1961 | 1951 | 1941 | 1931 | 1921 | 1911 |
| | (dollars) | (per cent) | | | | | |
| 0–4 elementary school.. | 3,243 | 7.5 | 10.8 | 14.4 | 18.2 | 20.8 | 24.2 |
| 5–7 elementary school.. | 3,651 | 20.8 | 24.9 | 27.9 | 31.1 | 32.5 | 34.5 |
| 8 elementary school.. | 3,970 | 17.6 | 16.8 | 18.1 | 17.9 | 17.2 | 16.1 |
| 1–3 high school ....... | 4,306 | 29.7 | 26.4 | 23.1 | 20.4 | 19.7 | 18.1 |
| 4 high school ....... | 4,870 | 8.7 | 8.2 | 6.9 | 5.5 | 4.4 | 3.2 |
| 5 high school ....... | 5,115 | 6.2 | 4.1 | 2.4 | 0.7 | – | – |
| Some university education ............... | 5,387 | 3.9 | 3.5 | 2.9 | 2.4 | 2.1 | 1.5 |
| University degree ...... | 7,334 | 5.6 | 5.2 | 4.3 | 3.7 | 3.3 | 2.4 |
| Total............ | | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Based on Table 20, Appendix A-2, and Appendix B-2.

## APPENDIX TABLE A-16

### Sources of Growth of Real National Income of the United States

| Source of Growth | Share of National Income (Per Cent Distribution) | | Growth Rate (Per Cent per Year) | | Contribution to Growth Rate of Real National Income (Percentage Points) | | Contribution to Growth Rate of Real National Income per Person Employed | |
|---|---|---|---|---|---|---|---|---|
| | 1909-29 | 1929-57 | 1909-29 | 1929-57 | 1909-29 | 1929-57 | 1909-29 | 1929-57 |
| 1. Real National Income | 100.0 | 100.0[1] | 2.82[2] | 2.93 | 2.82[3] | 2.93 | 1.22 | 1.60 |
| 2. Increase in total inputs, adjusted | – | – | 2.24 | 1.99 | 2.26 | 2.00 | 0.66 | 0.67 |
| 3. Adjustment | – | – | -0.09 | -0.11 | – | – | – | – |
| 4. Increase in total inputs, unadjusted | – | – | 2.33 | 2.10 | – | – | – | – |
| 5. Labour, adjusted for quality change | 68.9 | 73.0 | 2.30 | 2.16 | 1.53 | 1.57 | 0.42 | 0.57 |
| 6. Employment and hours | – | – | 1.62 | 1.08 | 1.11 | 0.80 | 0.00 | -0.20 |
| 7. Employment | – | – | 1.58 | 1.31 | 1.11 | 1.00 | – | – |
| 8. Effect of shorter hours on quality of a man-year's work | – | – | 0.03 | -0.23 | 0.00 | 0.20 | 0.00 | -0.20 |
| 9. Annual hours | – | – | -0.34 | -0.73 | -0.23 | -0.53 | -0.23 | -0.53 |
| 10. Effect of shorter hours on quality of a man-hour's work | – | – | 0.38 | 0.50 | 0.23 | 0.33 | 0.23 | 0.33 |
| 11. Education | – | – | 0.56 | 0.93 | 0.35 | 0.67 | 0.35 | 0.67 |
| 12. Increased experience and better utilization of women workers | – | – | 0.10 | 0.15 | 0.06 | 0.11 | 0.06 | 0.11 |
| 13. Changes in age-sex composition of labour force | – | – | 0.01 | -0.01 | 0.01 | -0.01 | 0.01 | -0.01 |
| 14. Land | 7.7 | 4.5 | 0.00 | 0.00 | 0.00 | 0.00 | -0.11 | -0.05 |
| 15. Capital | 23.4 | 22.5 | 3.16 | 1.88 | 0.73 | 0.43 | 0.35 | 0.15 |
| 16. Nonfarm residential structures | 3.7 | 3.1 | 3.49 | 1.46 | 0.13 | 0.05 | 0.07 | 0.01 |
| 17. Other structures and equipment | 14.6 | 15.0 | 2.93 | 1.85 | 0.41 | 0.28 | 0.17 | 0.10 |
| 18. Inventories | 4.8 | 3.9 | 3.31 | 1.90 | 0.16 | 0.08 | 0.08 | 0.03 |
| 19. United States-owned assets abroad | 0.6 | 0.7 | 4.20 | 1.97 | 0.02 | 0.02 | 0.02 | 0.01 |
| 20. Foreign assets in United States (an offset) | 0.3 | 0.2 | -1.85 | 1.37 | 0.01 | 0.00 | 0.01 | 0.00 |

APPENDIX TABLE A-16 (concluded)

| Source of Growth | Share of National Income (Per Cent Distribution) | | Growth Rate (Per Cent per Year) | | Contribution to Growth Rate of Real National Income (Percentage Points) | | Contribution to Growth Rate of Real National Income per Person Employed | |
|---|---|---|---|---|---|---|---|---|
| | 1909-29 | 1929-57 | 1909-29 | 1929-57 | 1909-29 | 1929-57 | 1909-29 | 1929-57 |
| 21. Increase in output per unit of input.......... | — | — | 0.56 | 0.92 | 0.56 | 0.93 | 0.56 | 0.93 |
| 22. Restrictions against optimum use of resources ............................ | — | — | — | — | n. e. | -0.07 | n. e. | -0.07 |
| 23. Reduced waste of labour in agriculture....... | — | — | — | — | n. e. | 0.02 | n. e. | 0.02 |
| 24. Industry shift from agriculture ............ | — | — | — | — | n. e. | 0.05 | n. e. | 0.05 |
| 25. Advance of knowledge................... | — | — | — | — | n. e. | 0.58 | n. e. | 0.58 |
| 26. Change in lag in application of knowledge.... | — | — | — | — | n. e. | 0.01 | n. e. | 0.01 |
| 27. Economies of scale - independent growth of local markets ......................... | — | — | — | — | n. e. | 0.07 | n. e. | 0.07 |
| 28. Economies of scale - growth of national market ................................ | — | — | — | — | 0.28 | 0.27 | 0.28 | 0.27 |

[1] For 1930-40 and 1942-46 interpolated distributions rather than the actual distributions for these dates were used. Estimates are 1929-58 averages.

[2] This rate, like that for 1929-57, derives from Department of Commerce estimates. Estimates by John W. Kendrick, based on adjustment to Department of Commerce concepts of estimates by Simon Kuznets, yield a growth rate of 3.17, which would result in a figure for output per unit of input (line 21) of 0.91.

n. e. Not estimated.

Source: Study Group in the Economics of Education, *The Residual Factor and Economic Growth*, OECD, Paris, 1964 p. 15.

APPENDIX B


# SOURCES, METHODS AND ASSUMPTIONS

## Introductory Note

An investigation of certain long-term sources of economic growth in Canada is not hindered by an absence of basic data. In fact, Canada is one of the few nations which have produced a wide range of information relevant to economic issues over a long period of time. Such data originate often in sessional papers and departmental reports of provincial and federal agencies. The difficulty facing most investigations concerned with the historical development of particular sectors of the Canadian economy is not the absence of data, but the lack of prior processing and summaries of the data. In this study, for example, it was necessary to develop, from almost unexplored materials, estimates of Canadian labour force immigration and emigration over a period of 50 years. The Education Division of the Dominion Bureau of Statistics has been producing excellent data since its establishment around 1921 (the U.S. Office of Education, which produces similar information, was established in the 1860's), but aside from the efforts of the Bureau in producing certain analytical papers with respect to Canadian educational progress, very little attention appears to have been paid by economists to these materials. It is true, of course, that the relation of education to economic growth has only recently become the subject of closer study by economists, but migration analysis, for example, is hardly a new subject of inquiry. In this study, therefore, it was necessary to develop a number of estimates of magnitudes and relationships, many of which are deserving of further research effort. The publication, however, of the volume *Historical Statistics of Canada*,[1] represents the development of a new, sustained effort in the study of economic history in Canada.

[1] *Historical Statistics of Canada*, M.C. Urquhart and K.A.H. Buckley, eds., Toronto, The Macmillan Company, 1965.

APPENDIX B–1

*Data on Education in the Canadian Censuses of 1941, 1951, and 1961*

The Census of 1961 represents the first attempt in Canada to provide the detailed basic data necessary for the study of the influence of education on income and economic growth. In the United States, a comparable compilation of data was first made in the Census of 1950. Two types of questions on education were included in the 1961 Census. One ascertained the highest grade of schooling attended, and the other determined attendance at school in the scholastic year before June 1, 1961.

The question regarding the number of years of schooling of the population and the labour force was somewhat different than the years-of-schooling question asked in the 1941 and 1951 Censuses. In 1961, years of schooling referred to the highest grade or year attended, while in 1941 and 1951, years of schooling referred to the total number of years the person spent in school, implying that school years completed were measured. On the other hand, such data could also include repeated years of schooling. The 1961 question, however, clearly means that completion of any year attended was not necessary for that year to be counted. All three Censuses, therefore, contain data on educational attainment which would somewhat overstate Canadian years of schooling in relation to the data collected in the U.S. Census. The U.S. data refer to the highest grade completed.

The 1961 Census question on years of schooling made no provision for distinguishing years of university training beyond the term "degree", so that no information is available from this Census on the significant question of the extent of graduate training of the labour force or population.

The 1941 Census provided a study of the educational attainment of the population which was superior in coverage in some respects to the later Census studies. Years of schooling by age groups and sex for the population 10 to 90 years of age and over were provided (*1941 Census of Canada*, Population, Vol. III, Table 47, p. 659). The class intervals of the age distribution are similar to the later Census studies, and the range in the age groups made it possible to complete the cohort analysis back to 1911, while the detailed presentation of years of schooling (0, 1–4, 5–6, 7, 8, 9, 10, 11–12, 13–16, 17+) made it possible to estimate with much greater precision the average and median years of schooling for an age group.

*Estimates of Specific Years of Schooling*

### Elementary Schooling

The required research for this study would have been considerably simplified if the 1961 Census of Canada had provided a more detailed tabulation of years of schooling attained. The relevant question in the 1961 Census, however, required the enumerator to group persons with less than five years in one category and more than five years elementary in a second category, without recording the precise number of years completed at each level in elementary schooling. Consequently, estimates of more detailed distributions by years of school for elementary schooling by age groups were necessary. Persons with zero years of schooling, however, were identified in the 1961 Census.

A satisfactory historical distribution of males who completed only one through four years of schooling was not possible from either a study of school retention rates or census records. The record of years of schooling attained in the 1941 Census, though detailed for some years of schooling, did not include a distribution of one to four years of schooling. Retention rates which can be roughly constructed from historical estimates of enrolment records in various provinces present difficulties for the first few years of schooling, since they frequently show enrolment rising rather than declining in these years. Consequently, an arbitrary assignment of the distribution of males attaining only one to four years of schooling was made for the decades 1911–61.

A distribution of the specific years of schooling among those with only five to eight years of elementary schooling was important, since the numbers in this group were fairly large, and the distribution was needed in order to compute the average years of schooling for the Canadian labour force as well as to compute average incomes by decades attributable to changes in educational attainment.

The distribution of persons 25–34 years of age in 1961 having attained only seven and only eight years of schooling within the five-to-eight-year group was estimated on the basis of retention rates for grade seven and grade eight published by the Dominion Bureau of Statistics, *Student Progress Through the Schools, 1960* (Catalogue 81–513, Tables 1, 2 and 3) for the younger members in the 25–34 year age group. Similar calculations were made for the older members of this age group, based on the 1941 Census age group which was closest to males 34 years of age in 1961. An average between these two results was then taken to compute the proportion of males 25–34 years old with seven and eight years of elementary schooling. The proportion of males 25–34 years of age in 1961 with only five or six years of education was derived as a residual. The remaining age groups (35–44 to 55–64) were obtained from moving forward the age cohort from the detailed years of schooling by age groups provided in the *1941 Census of Canada* (Vol. III, Table 47, p. 659). The proportions given by the 1941 Census for males reaching

each year of schooling were applied to the absolute numbers in the five-to-eight years-of-schooling group of the 1961 Census data.

The use of the 1941 Census to establish the proportions of persons attaining various grades of elementary school assumes that mortality rates did not vary significantly by years of education, and that Canadian immigration and emigration since 1941 did not disturb significantly the distribution of males completing a given year of elementary school. The use of the Dominion Bureau of Statistics retention rate for the 25—year age group within the 25—64 age group may over-estimate the proportion of those persons who attained grades seven and eight. The retention rates used applied to all students passing through the educational system, many of whom moved eventually to considerably higher levels of education. In effect, the retention rates of the whole group moving through the school system were attributed to those students who completed only five to eight years of school-ing. The effect of this method is to overstate somewhat the proportions of students in the five-to-eight-years-of-schooling group who completed only grade eight, although compulsory school attendance legislation and employment legislation affecting minors would tend to cause larger completions of elementary school even for those who did not proceed further.

### Distribution of Years of High School Attainments

The labour force data from the 1961 Census provide a classification by age groups of persons completing one to three years of high school and four to five years of high school. The separation of persons completing four and five years of high school is explained below in a separate discussion.

The numbers of males in the youngest age group (25—34) with nine, ten and eleven years of high school attendance was estimated with the aid of the Dominion Bureau of Statistics retention study noted above, and the movement of the male age cohort groups by years of education attained by the male population as of the Census of 1941. For this age group 25—34, the proportion of students 25 years of age in 1961 who attained each grade in the grades nine through twelve was determined on the basis of retention rates through the high school grades, computed on the basis of Table 1 in the above-mentioned study. This particular table showed enrolment, by grade, for the periods 1947—48 through 1957—58. The experience of the years 1950—51 through 1953—54 was used to estimate high school attainments of males 25 years of age in 1961, since males of this age were on the average commencing grade nine of high school in 1950. High school attainments of males aged 34 years in 1961 were obtained from data on years of schooling in the 1941 Census. An average of the proportions for the 25— and the 34—year age groups was used to represent the high school attainments for grades nine through eleven of the 25—34—year age group. Males 34 years of age were on the average enrolled in grade nine of high school in 1941, and the nearest age group in the 1941 Census old enough to represent completion of high school was used to determine the proportion in each grade, nine through twelve. The 1941 Census provided the number of males by age groups with only nine and only ten years of schooling, and the attainment of eleven and twelve years of schooling were shown together. The attainment of the twelfth year of schooling was already estimated for the various age groups in the total labour force as described below, and the proportion attaining only the eleventh year

was obtained as a residual from the 1941 Census data relating to the group with grades eleven and twelve years of high school.

The proportions completing each year of high school for the older age groups (35–44 to 55–64) in 1961 were determined from the proportions in the 1961 Census for the school years nine through eleven, the grade twelve estimates described below, and from the 1941 Census, from which the grade nine and grade ten proportions for the older age group in 1961 could be determined. Grade eleven proportions were again determined as a residual. The absolute numbers given in the 1961 Census for one to three years of high school were then distributed by age groups on the basis of the above-estimated proportions.

From the estimates of specific years of high school attained by age groups as of 1961, the attainment of the education of only a limited number of age groups in earlier decades could be obtained by moving the age cohort back in successive decades. Thus, at the limit of the backward movement, the age group 55–64 in 1961 was 25–34 in 1931. The oldest age group in each decade of 55–64 years of age could not be derived from the previous decade, nor could the open-end interval of 65 and over in 1961 be accurately used as an approximation of the 65–74 group in 1961 and thus be available as the 55–64 group in 1951. The same limitation of the 1941 Census applied again; the number of males by age groups whose highest year of schooling was only nine or only ten years was provided, but eleven and twelve years were grouped together. The solution for separating the eleven-and-twelve-year group was obtained through a study of high school enrolment records of the Province of Ontario, which yielded a limited amount of data available in groups of four consecutive years in the decades of 1870 through 1890 and the 1920's. From this data, a continuous curve was fitted by inspection to represent the proportions of persons completing the twelfth year of schooling in the period 1870–1926. The proportion completing the twelfth year of schooling in this estimate covering the 1870's through the 1920's was obtained from the sporadic enrolment records of Forms 1 through 4 in Ontario's secondary schools. These were interpreted to represent nine through twelve years of schooling, and these classifications were used in the nineteenth century estimates necessary for estimation of high school attainments of the older age groups in earlier census years. In the 1920's, the classifications "lower school", "middle school" and "upper school" were used to describe enrolments in the secondary schools in Ontario. In the early 1920's, lower school consisted of two years, while middle school and upper school each consisted of one year. The Dominion Bureau of Statistics publication *Statistical Report on Education in Canada, 1921* (p. 21) describes Ontario's schools as follows: "In secondary schools the pupils are graded into 'Lower', 'Middle' and 'Upper' schools, corresponding roughly to grades nine through twelve." Other information indicated that in later years lower and middle schools in Ontario both occupied two years each, and upper school referred to the fifth year school.

The important distinction for this study is the number of years of schooling attained rather than the grade level attained. The 1941 Census may have included in twelve years of schooling those persons who had actually had five years of high school training commencing after grade seven, rather than commencing after grade eight.

### Separation of Four- and Five-Year High School Attainments

Appendix Table A–2 provides an estimated distribution of males, by age groups, having attained four years and five years of high school. The available tabulations from the 1961 Census did not provide a separation of four and five years of high school. The number of males in the labour force 15 years and over with grade twelve and grade thirteen education by occupation was provided by the Dominion Bureau of Statistics from unpublished cross-tabulations of the 1961 Census (Appendix Table A–3). It was assumed that the proportion of grade twelve and grade thirteen attained by the 15-years-and-over age group was the same as that for the 25–64 group. This assumption tends to overestimate the number of males with grade thirteen education, since the absolute numbers of males enrolled in grade thirteen for the age group 15–24 were increasing rapidly in the years during which persons in this age group were being educated. If the average age of students at the time of senior matriculation is between 18 and 19 years, then males 24 years of age in 1961 would have been enrolled in grade thirteen in 1956–57. However, enrolments in grade thirteen were rising rapidly in Canada after the mid-1950's.

The additional 1961 Census data, while providing a separation of the male labour force between grade twelve and grade thirteen, did not provide an age distribution for this stock. It was, therefore, necessary to analyze the preparation of grade thirteen students over the period 1916–61 (for example, the age group 55–64 in 1961 would have been enrolled in grade thirteen in approximately 1916–25). Enrolment records of male students in grade thirteen in the Province of Ontario, British Columbia and New Brunswick were obtained from various issues of *Survey of Elementary and Secondary Education*, and for earlier years from *Biennial Survey of Education in Canada* and *Annual Survey of Education in Canada*, publications of the Dominion Bureau of Statistics.

The bulk of the preparation of grade thirteen students, according to these studies, took place in Ontario. Prior to 1932, the year when the Province of British Columbia apparently commenced a grade thirteen programme, only Ontario had students enrolled in grade thirteen. The preparation of grade thirteen students in New Brunswick was very limited, beginning apparently only in 1952. From such enrolment records, spanning the period 1916–61, an age distribution (corrected by appropriate mortality rates) was estimated for males 25–64 years of age in the 1961 labour force who had grade thirteen schooling. The following percentage distribution was obtained: 25–34 years, 45.6 per cent; 35–44 years, 29.4 per cent; 45–54 years, 19.5 per cent; and 55–64 years, 5.5 per cent. No attempt was made to estimate the numbers of persons with grade thirteen education in 1961 who were over 64 years of age, so that the division of grade twelve and grade thirteen in Appendix Table A–4 extended back to 1931 when the 55–64 age group was 25–34 years of age.

Appendix Table A–2 provides the revised estimate of the 1961 Census tabulation of years of schooling of the male labour force, on the basis of these adjustments. Males with four years of high school are shown separately and males with five years of high school were included in the category "some university". Appendix Table A–4, showing the results of the cohort method of estimation, likewise includes males with five years of high school in the category "some university"

for each age group from 1931–61. The computation of the median year and average years of schooling of the labour force is also based on adjustments for persons with five years of high school, as was also the case for the computation of average income per member of the labour force (see Table 20).

The above estimates of persons with four and five years of high school constitute an attempt to measure the stock of education in the labour force in terms of years of schooling, but since years of schooling are not equivalent among the various provinces, the problem of differences in quality of a year of schooling in high school remains unresolved. As indicated in Appendix B–3, senior matriculation may be obtained in some provinces after completion of twelve years of schooling, while junior matriculation may be obtained after eleven years. The 1961 Census enumerated educational attainments on the basis of years of schooling, but did not attempt to enumerate educational attainments in terms of "junior" or "senior" matriculation.

### University-Level Attainments

The Dominion Bureau of Statistics study on student progress through the schools provided an estimate of the retention rates of university students through each year to graduation. Studies of the *Annual Reports* of the President of the University of Toronto at the close of the nineteenth century and in the early twentieth century, and the *Annual Reports* of the Governors, Principal and Fellows of McGill University, 1910–24, indicated, from limited enrolment records in certain successive four-year periods, that retention rates of university students through years of university attended were likely not very different from those shown by the above-mentioned Dominion Bureau of Statistics study. It was therefore assumed that the university achievement of age groups not obtainable by moving back the age cohorts of the 1961 Census were the same as that given in this Dominion Bureau of Statistics study (p. 41). This study estimates that 79 per cent of first-year students proceeded to second year, 68 per cent to third year, and 61 per cent graduated with a bachelor's degree. These rates imply that of those entering university, 21 per cent completed no more than the first year of university, 11 per cent completed no more than two years, 7 per cent no more than three years, and 61 per cent received university degrees in the fourth year.

The 1961 Census splits the number of persons with university education only into two groups: those with "some university", and those completing university. Persons completing university as a percentage of all persons with university schooling at the 1961 Census were the following: age group 25–34, 57 per cent; 35–44, 60 per cent; 45–54, 59 per cent; 55–64, 59 per cent. These proportions appear to confirm, in an approximate way, the assumptions made above concerning the proportions of university students completing university in the earlier decades of the twentieth century.

The number of males aged 25–64 in the labour force with university degrees is given in the 1961 Census. This information was used to estimate the number of males with university degrees in earlier census years by the age-cohort method, again making appropriate allowances for migration and mortality. The distribution of university students within the 1961 Census classification "some university" by

single years was estimated on the basis of the above-mentioned Dominion Bureau of Statistics study of retention rates for the first three years, treating the third year of university as a residual for the small adjustments necessary to have the percentage distribution add to 100 per cent.

*Junior and Senior Matriculation in Canadian Schools*

In estimating the influence of senior matriculation on the stock of education possessed by the labour force in Canada, problems are encountered due to inter-provincial differences in high school systems. The publication *World Education Series*, "Canada, A Guide to Academic Placement of Canadian Students in United States Educational Institutions", 1957, summarizes the prevailing view of U.S. institutions accepting Canadian students as follows:

> A majority of United States colleges and universities appear to give freshman standing on junior matriculation, and advanced standing to as much as 30 units for senior matriculation... If the grades are at the level indicating probable success in a partic-ular United States college, credit may safely be allowed for the senior matriculation year up to as high as 30 units. (p. 7).

It should be noted that the completion of junior matriculation and senior matric-ulation in certain provinces was at one time, or in many cases still is, accomplished in eleven and twelve years respectively. Alberta, Saskatchewan, Manitoba, Quebec, Nova Scotia and Newfoundland provided junior matriculation at the end of eleven years of schooling in 1960–61. New Brunswick and Prince Edward Island apparently had the same arrangement until recent years. The *World Education Series* recommended that Canadian junior and senior matriculation, where grade levels were satisfactory, could be considered as equivalent to U.S. high school graduation and first year college credit. Similar standards, with close attention to subject areas completed, are also established by Canadian universities for students of provinces possessing senior matriculation from grade thirteen, but senior matriculation from grade twelve does not always appear to provide standing equivalent to the achievement of first year university.

As of the school year 1960–61, the variations in the years of schooling, and the granting of senior matriculation, in the provincial high schools were as follows:

Eleven grades, no senior matriculation — Newfoundland.
Eleven grades, plus senior matriculation year — Nova Scotia, Manitoba, Alberta, Quebec, Saskatchewan.
Twelve grades, no senior matriculation — Prince Edward Island.
Twelve grades, plus senior matriculation year — Ontario, British Columbia, New Brunswick.

The above tabulation, from Dominion Bureau of Statistics *Survey of Elementary and Secondary Education*, 1960–61 (p. 12), originally included New Brunswick in the category "twelve grades, no senior matriculation", yet enrolment by grade statistics of the Dominion Bureau of Statistics *Survey of Elementary and Secondary Education* (various issues since 1952) indicate that New Brunswick had small numbers of students in grade thirteen.

APPENDIX B—4

*Method of Calculating Educational Attainments at Past Census Years*

### Age-Cohort Technique

The procedure for deriving estimates of the educational attainments of the male labour force for the period 1911—61 relied upon the technique of moving age cohorts back in time by 10-year intervals from the Censuses of 1961, 1951 and 1941.

The first step in this procedure was to move age groups by level of schooling backward from the 1961 Census. The basic information was obtained from unpublished tabulations (as of September 1965) prepared by the Dominion Bureau of Statistics, and provided a further breakdown of elementary school attainments of the male labour force by age groups into groups with zero to four and five to eight years of schooling. Further classifications were made in this study to show separately the educational attainment of males with four years and five years of high school. The group with five years of high school was added to the category "some university".

Second, from the category described as "1961 Gross Labour Force" in Appendix Table A—4, the estimate of net migration (Appendix Table A—5) was subtracted if net migration was positive, or added if negative. From this second step, an estimate was derived of the 1961 labour force net of 1951—61 migration.

Third, the labour force net of migration was adjusted by Canadian mortality rates to arrive at the 1951 gross labour force by educational attainment and years of schooling.

The three steps described above were undertaken for each decade back to 1911, except that the backward movement from the age groups provided by the 1961 Census could not be used to establish the number of males by educational attainment for the oldest age group of 55—64 in 1951, the 45—54 and 55—64 age groups in 1941, etc. Therefore, the limit of this particular operation was to estimate the schooling of the 1931 age group 25—34 on the basis of schooling of the 1961 age group 55—64.

The educational characteristics of the 55—6 4 -year age group for the years 1911—51 were derived from 1941 Census data. For example, the years of schooling of males in the 55—64 age group in the 1951 labour force could not be derived from the 1961 Census age group of "65 and over"; since this is an "open-end" class interval, a mortality adjustment could not be applied to this age group to derive the 55—64 age group of 1951. The number of males shown in Appendix Table A—4 for the age group 55—64, in the line "1951 Gross Labour Force", was therefore taken from the 1951 Census. The educational characteristics of this age group were distributed according to the proportions given for the 45—54 age group in the 1941 Census information on educational attainment of the male population *(1941 Census of Canada*, Vol. III, Table 47). In a similar manner, except as noted below, numbers and educational attainments were estimated for the oldest age groups for each

earlier census year. The 55—64 age group, as estimated, was adjusted for the net migration of the preceding decade to arrive at a number net of migration for each census year. Mortality rates were then applied to this age group, which, when moved back one decade, represented the 45—54 age group one decade earlier.

In the years 1921 and 1911, the Census did not group the labour force by age classifications parallel to later censuses. For example, the only age classification roughly applicable to the 55—64—year age group was the classification 50 to 60. The method used for determining the total number of males 55 to 64 in the 1911 and 1921 labour force was through an examination of the proportion of this age group in the Censuses of 1931, 1941, 1951, and 1961. A consistent 13 to 15 per cent of the total male labour force was in the 55 to 64 age classification at these census years. In 1921 and 1911, therefore, the total number of males 55 to 64 was assumed to be 14 per cent of the labour force. A division of the total in this age group by years of schooling was made as in previous decades.

There may be some slight distortion in the estimates of the years-of-schooling proportions for the 55—64 age group, due to the fact that the proportions in each decade from 1951 backwards had to be based on the educational attainments of the appropriate age groups in the 1941 Census. The distortion would arise, for example, from the fact that the educational distributions of the age group 55—64 in 1931 and 1921 were derived from the 1941 age groups 65—74 and 75—84. The educational attainments in 1941 were those of a particular age group in that year and not neces-sarily those of the respective age groups as of 1931 or 1921. A better estimate of the educational attainments for the 55—64—year age group in 1921 would require that the influence of migration in the 1930's and 1920's could be eliminated. However, the influence could not have been large, since the proportion of the 55—64 age group in migration during both decades was small — in the 1920's, for example, immigrants 55—64 years of age were 3.4 per cent of the total, and emigrants were 5.3 per cent of the total. In addition, migration in decades after 1921 would have little effect on the estimated 55—64 age group in 1921, since only a negligible number of persons falling in the age group 65—74 in 1931 would have been involved in migration. This would be even less likely for persons who survived to become 75—84 in 1941. The 1941 Census, it can be concluded, is a fairly satisfactory guide to the educational attainments of the 55—64 age group in 1921 and 1931, in so far as mortality rates do not vary significantly by years of schooling.

The total male gross labour force derived as described above from the cohort method, migration adjustments and mortality adjustments in each decade matched the actual census count in each decade fairly well with the exception of 1931[1].

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[1] In 1951, the estimate (Appendix Table A-4) was 2.4 per cent lower than the actual census count of 1951: *1951 Census of Canada*, Vol. IV, Table III, 3,104,133 labour force males 25—64; estimate for 1951, 3,028,856. In 1941 the estimate was 2.1 per cent lower: *1941 Census of Canada*, Vol. VII, Table 18, 2,524,973; estimate for 1941, 2,519,557. In 1931 the estimate was 10.9 per cent lower: *1931 Census of Canada*, Vol. VII, Table 40, 2,340,297; estimate for 1931, 2,084,797. In 1921, 3.2 per cent lower: *1921 Census of Canada*, Vol. IV, Table XIV, 1,930,855; estimate for 1921, 1,868,662. In 1911 the esti-mate was 6.7 per cent lower: *1911 Census of Canada*, Vol. VI, Table 20, 1,620,033; esti-mate for 1911, 1,510,952.

The divergence of the 1931 estimate from the actual record of the 1931 Census indicates a possible error in the migration adjustment for the decade 1931–41, since the estimating procedure was to work backwards from the 1941 gross labour force by deducting net migration to arrive at the 1941 labour force net of migration. Mortality rates were then applied to the 1941 age groups (except for the 55–64 age group in 1941) to yield the numbers in 1931 by age groups. Since the procedure to arrive at the 1941 labour force net of migration involves subtracting immigrants and adding back emigrants in the 1930's, the number of labour force emigrants from Canada in the 1930's was apparently larger than estimated, either because the deduction of returning Canadians (See Appendix B–9) was too large or the estimated number of emigrants from Canada was too small.

As noted below, the mortality rates used to estimate the 1911 gross labour force from the 1921 labour force net of migration were taken from the mortality experience of 1921–31 and therefore may be too low.

If the mortality rates used were too low, the result is to arrive at an understatement of the numbers in the 1911 gross labour force, since the higher the mortality rate for each age group, the larger would be the gross labour force in 1911 as derived from the 1921 labour force net of migration. Part of the 6.7 per cent discrepancy, noted above, between the estimate of the numbers in the 1911 labour force and the actual 1911 Census count for the labour force, may be due to the mortality rate assumption. Since the same mortality rate for an age group was applied to each education attainment category, the distribution of years of schooling held by the 1911 labour force was not influenced by the mortality adjustment.

While the estimates indicate that the positive net migration of the decade 1911–21 increased the education quality of the labour force, it is likely that the years of schooling estimating procedure for this decade equally overstated the educational achievement of both the immigrant and emigrant labour force and thus overstated the quality of the net addition from immigration in this period (see Appendix B–9).

The effect of the overstatement of the educational attainment of net immigrants added to the labour force in the period 1911–21 is to cause a small understatement in the estimate of the educational attainment of the gross labour force of 1911, with the consequence that the 1911–61 and 1911–21 percentage changes in average years of schooling are overstated by a small amount. From this it follows that the contribution of education to economic growth in 1911–61 is also overstated by a small amount.

### Mortality Adjustment

The number of males in the "gross labour force" by age groups and years of schooling at each Census from 1911–51 was determined, except for the 55–64 age group, from the labour force net of migration at the subsequent census year by applying mortality rates calculated from Dominion Bureau of Statistics *Vital Statistics, 1961* (Catalogue 84–202, Table D–6). For example, persons in the age group 35–44 in 1961 were 25–34 years of age in 1951. Since mortality rates for males were available in 5-year age intervals in the above-mentioned publication, an average of mortality rates for the 25–29 to 30–34 age groups in 1952 and the 35–39 to 40–44 age groups in 1961 was taken to represent the mortality experience of this

particular age group for the 1950's. The calculation showed, for example, that of 100,000 individuals in this age group in 1951, some 97,935 were still alive ten years later. This implies that if there were 1,033,933 males 35—44 years of age in the 1961 labour force net of migration, there were 1,055,734 males 25—34 years of age in the 1951 "gross labour force". Mortality rates for a given age group were assumed to apply to all persons in that age group regardless of level of education.

Mortality rates of the quality provided in the above-noted source were not available prior to 1921, and it was consequently assumed that the same rates, by age groups, that existed in the decade 1921—31 also applied to 1911—21. This assumption may cause an understatement in the actual numbers in the "gross labour force" of 1911 (see above comparison of the cohort estimate for 1911 and actual census count for 1911), although it does not affect the distribution of the 1911 labour force by years of schooling.

As noted earlier in this Appendix, the number in the male labour force 55—64 years of age, at each census earlier than 1961, could not be determined by moving back an age cohort from the labour force net of migration from a later census year. The actual numbers of males in the gross labour force 55—64 years of age at the census years 1911—51 were taken directly from the appropriate decennial censuses.

## APPENDIX B–5

### Computation of Median and Mean Years of Schooling

#### Median Years of Schooling

The method used in calculating the median years of schooling by the U.S. Bureau of the Census was also used in the calculation of the Canadian median years of schooling. One of the reasons for this was that it facilitates comparison of this important measure of educational attainment between the two countries. A further, less obvious reason for following the U.S. method is the nature of the given data. The available distributions are given only in terms of discrete, single years of schooling or in groups of years of schooling. For purposes of calculating the median, therefore, the data are given in an ambiguous manner. For this reason, the U.S. Bureau of the Census accepted the following method:

> The median number of school years completed is defined as the value which divides the population group into two equal parts — one-half having completed more schooling and one-half having completed less schooling than the median. This median was computed after the statistics on years of school completed had been converted to a continuous series of numbers (e.g., completion of the 1st year of high school was treated as completion of the 9th year and completion of the 1st year of college as completion of the 13th year). The persons completing a given school year were assumed to be distributed evenly within the interval from .0 to .9 of the year. In fact, at the time of census enumeration (generally April or May), most of the enrolled persons had completed at least three-fourths of a school year beyond the highest grade completed, whereas a large majority of persons who were not enrolled had not attended any part of a grade beyond the highest one completed. The effect of the assumption is to place the median for younger persons slightly below, and for older persons slightly above, the true median.

> The same procedure for computing this median has been used in the 1940, 1950, and 1960 Censuses. Because of the inexact assumptions as to the distribution within an interval, this median is more appropriately used for comparing groups and the same group at different dates than as an absolute measure of educational attainment.[1]

In the case of those still enrolled in school in the United States at the time of enumeration, which took place generally in April or May, this procedure would result in an understatement of the true median. At that point in time, these persons had already completed at least three quarters or more of the school year, but this method credits them only, on average, with another one-half year. Thus the minimum underestimate for this group would be 0.25 of one year, and the maximum underestimate would be 0.50 of one year. The influence of this group is not considered in this study, since the relevant age group is 25–64.

In the case of those not enrolled in school at the time of enumeration in the United States, this method would result in a slight *overestimate* in relation to the true median, since the majority in this group would probably not have gone any

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[1] *United States Census of Population: 1960* [PC(1)-1D], p. xix.

further than the indicated highest year completed. The maximum overestimate in this case would be 0.50 of one year (if no one in this group had attended another partial year). The true overestimate for this group, which would mainly apply to the 25–64-year age group, is probably somewhat lower than 0.50 of one year, since some have actually attended another partial year, or still were attending university at the time of enumeration.

By using the above U.S. method for Canadian data, an overestimate of the median also occurs, but the overestimate based on Canadian data would tend to be somewhat larger than the overestimate for the United States, due to the definition of the basic data. The U.S. Census distributions are compiled on the basis of highest year or grade completed.[1] Further partial years beyond this, which were attended, but not completed, do not enter into the U.S. distribution. The *1961 Census of Canada*, on the other hand, enumerated the highest grade or year of school *attended*, but the year of school did not have to be completed in order to be registered as that particular year in the distribution. The 1941 and 1951 Censuses of Canada asked for the *number* of years of schooling attended, but this question, already noted, also was not entirely free of ambiguity, since some persons may have repeated one or several years of schooling. The educational data by years of schooling in the past three decennial Censuses of Canada, therefore, tend to be slightly overstated in relation to the educational data in the U.S. Census. It is mainly for this reason that the median, though higher in both countries because of the method of calculation, is overestimated to a somewhat greater extent for Canada. It should be emphasized, therefore, that the estimated difference in the median years of schooling between the two countries shown in this study may well underestimate the actual difference.

### Mean Years of Schooling

The mean year of schooling arbitrarily used to represent the classification one-to-four years of schooling by age groups as of 1961 was as follows: 25–34, 3.5 years; 35–44, 3.3 years; 45–54, 3.1 years; and 55–64, 3.0 years. In 1931, the assignment of the average years of schooling by age groups was: 25–34, 3.0 years; 35–44, 2.9 years; 45–54, 2.8 years; and 55–64, 2.3 years. In 1911, each age group in the one-to-four years of schooling classification was assumed to have attained 2.7 years of schooling. Further research is required to test these assumptions. If the "mean year of school" assumptions for 1911 are too high, or the one for 1961 is too low, the percentage changes in the average years of schooling 1911–61, as calculated in this study, would be slightly understated. On the other hand, if the assumption for 1911 is too low, or the 1961 assumption too high, the percentage change in mean years of schooling would be slightly too high.

In the absence of any historical information concerning the proportion of persons completing either five or six years of schooling (five and six years of schooling were given as a total in the 1941 Census), it was assumed throughout the period 1911–61 that in each age group the mean years of schooling was 5.5

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[1] The U.S. census question on education was in two parts: "What is the highest grade (or year) of regular school this person has ever attended?" and "Did he *finish* the highest grade (or year) he attended?" *(U.S. Census of Population: 1960*, [PC(1)-1D], p. xviii).

years. This assumption may introduce a small bias which underestimates the percentage change in the average years of schooling for the labour force 1911—61. Offsetting the possible underestimate which may follow from the assumptions used for both the one-to-four year and five and six years of schooling classifications was the likely overestimate of males in the younger age groups who had attained five years of high school, the possible overestimate made of males who had attained grade eight (see Appendix B—2), and the general overestimate of years of schooling held by the Canadian labour force as of 1961. The last item resulted from the assumption made in this study that the 1961 Census enumeration of years of schooling attained actually could be interpreted as years of schooling completed.

A further problem in the calculation of the mean arose out of the fact that a proportion of males with university degrees in the decades 1911—61 had 17 or more years of schooling, representing either a university degree obtained in five years of schooling or university post graduate training. Proportions of the male population in each age group from 1911—61 with 17 or more years of schooling were computed on the basis of data from the 1941 and 1951 Censuses. In the absence of any further census tabulation, the category "17 or more years of schooling" was taken to average 17 years. In addition, the proportion of 25—64 males in the 25—34 age group at the 1951 Census, with 17 or more years of schooling, was taken to apply also to the 25—34 age group in 1961. The computations of the mean years of schooling of the labour force by decades, therefore, took into account the proportion of those who had either 16 or 17 years of schooling.

## Daily School Attendance

In order to calculate the change in the average days of school attended per year of school completed per member of the labour force, it was first necessary to determine total enrolment and the number of days in which elementary and secondary schools were actually open for pupils to attend during the period under study. The second requirement was information about the average number of days of school actually attended. As explained below, a school year of 200 days was taken as the estimate for the actual length of the school year in Canada 1861–1961, and an index of the annual change in the number of days of school attended was constructed from the change in the proportion of average daily attendance in elementary and secondary public schools to total enrolment (up to 1903, on the basis of Ontario's records; 1904–61, on the basis of records for Canada).

The 200-day school year was taken as representative of the period 1861–1961 in the light of considerable supporting evidence, although 200 days in the nineteenth century very likely represented a standard, rather than the number of days that schools were actually open for pupils to attend in many rural communities in Ontario. Annual reports on public education in Ontario in the later nineteenth century indicate that a school year of at least 200 days was in effect in some Ontario communities. The 1871 report *(The Annual Report of the Normal, Model, High and Public Schools of Ontario, 1871*, Chief Superintendent of Education, p. 123) provides a frequency distribution of attendance by days of school, in which the highest interval is 200 days and over. A small proportion of students did attend elementary school for more than 200 days in 1871. Later annual reports of the Ontario Department of Education in the nineteenth century indicate, in the same manner, that approximately a 200-day school year was in operation for at least some Ontario communities in the last three decades of the nineteenth century.

Frequency distributions of the number of days during which schools were open were available for the Provinces of Nova Scotia, Alberta and Saskatchewan. Such records provided information for at least one year for each of these provinces in the first decade of the twentieth century (see Dominion Bureau of Statistics, *Historical Statistical Survey of Education in Canada*, 1921, Tables 12, 13 and 14). Nova Scotia elementary schools were open an average of 198 days in 1904. In Saskatchewan and Alberta in 1904 and 1905 the number of elementary schools, which were open 200 days and over, accounted for 37 per cent and 41 per cent respectively of all schools in each province. The above-mentioned *Historical Statistical Survey* (p. 25) noted that, as of 1921, "a full year of school in most provinces has about 200 teaching days, or slightly more, over and above holidays". It is concluded that an estimate of 200 days of school 1861–1961 approximates the historical standard in the Canadian provinces.

An index of the annual change in the days of school attended was derived from the change in the proportion of average daily attendance to total enrolment in Ontario

before 1903, and in Canada as a whole for the years 1904–61 (Appendix Table A–10). The use of total enrolment figures creates year-to-year inaccuracies which are not likely to seriously distort the long-run measurement of days of school attended. The Dominion Bureau of Statistics commented on this problem in 1921. Attention was also drawn to the very large differences in actual amount of instruction obtained by pupils with equal years of schooling but with much lower days of schooling attended.

> As it is almost impossible to ascertain how many pupils are counted twice in the total enrolment — that is, the number of pupils who are enrolled in one school for a part of the year and in another for another part — it gives an underestimate of the actual time spent by the pupils in school. For example: if 100 pupils attended 100 days in one school and then 100 days in another, their real attendance would be 100 per cent, but they would appear in the reports as 200 pupils with an aggregate attendance of 20,000 days, an average attendance of 100 a day and a percentage attendance of 50. It is possible that the duplication mentioned prevails to a considerable extent, especially in these days of influx from rural communities into urban. Hereafter, great care will be exercised to eliminate one possibility of duplication — the case of pupils transferred from one classroom or grade to a higher being counted twice.

> There is reason to believe that most departments provide against this form of duplication; the question is whether inexperienced teachers strictly conform to the instructions of the departments. The importance of ascertaining a true percentage of attendance is great. If a province showed a percentage of attendance of 60, where the average number of days schools were open was 150, it would mean that the children in that province were present on an average only 90 days out of the 200 or more days the schools were expected to be open. In eight such years the pupils would receive on an average but 720 days of instruction, that is 3.6 years. They could not be expected to be as well advanced as pupils in a province where the schools were open on an average of 190 days and where the percentage of attendance was 80, or 152 days a year attendance for each child, or 6 years attendance out of the eight. The low percentages in the western provinces are possibly due in a large measure to the duplication mentioned. They are also due to the severe winter climate and other causes. As these percentages, however, are assumed to be computed on the same basis from year to year, a historical table of this kind will be valuable as indicating improvements or fluctuations from year to year, and as a record of the times. In 1918 and 1919 there was an epidemic of Spanish influenza. The effects upon attendance at school can easily be seen in a historical table of this kind. In the case of an old province like Nova Scotia the effect can be seen in an enrolment table in the drop in the enrolment from 109,000 to 106,000, but in new provinces where the school enrolment is growing so rapidly there was a larger enrolment than in previous years. The table of percentages of attendance, however, shows a serious drop.[1]

A partial check on the validity of using the proportion of average daily attendance to total enrolment as the basis for calculating nineteenth century changes in the days of school attended, was possible from frequency distributions of pupil attendance by days of schooling, available for Ontario, 1871–1900.

The *1871 Annual Report* of the Superintendent of Education for Ontario, referred to above, provided a frequency distribution showing attendance in elementary schools by uneven intervals of 0–20 days, 20–50 days, 50–100 days, 100–150 days, 150–200 days and 200 days and over. If attendance is taken to be evenly distributed within each interval so that the mid-point is representative, and if the mid-point of the open-end interval is taken as 205 days, then in 1871 the average attendance of

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[1] Dominion Bureau of Statistics, *Historical Statistical Survey of Education in Canada,* 1921, pp. 22, 24.

Ontario elementary schools was 94 days, or an average attendance of 47 per cent out of a possible 205 days. The 47 per cent can be compared with the 42 per cent derived from the proportion of average daily attendance to total enrolment for Ontario elementary schools in 1872, shown in Appendix Table A−11. The comparison indicates that the percentages are of similar magnitude and the difference could be attributable mainly to the rough estimating procedure used to determine the average days of school attended from the frequency distribution.

Further evaluations of the average daily attendance-total enrolment proportion were possible. For example, the 1898 *Report by the Minister of Education, Ontario* (Table 1A, p. 9) provided a similar distribution to the one noted above for 1871. On the basis of similar assumptions, an average of 115 days was attended in 1897 by Ontario elementary school pupils out of a possible 205 days, or 57 per cent of possible days. Appendix Table A−11 indicates that the proportion of average daily attendance to total enrolment for Ontario elementary schools was 56 per cent. Further comparisons between the percentage of days of school attended derived from frequency distribution and from average daily attendance-enrolment figures indicated that for the few provinces, where both sources were available during the period 1900−20, there was a general correspondence in the two estimates. After the 1920 Conference of Dominion and Provincial Officials on Education Statistics, sponsored by the Dominion Bureau of Statistics, many of the difficulties in enrolment and average daily attendance statistics were overcome, with the consequence that the data used to represent daily school attendance after 1920 (noted in Appendix Table A−10) are more precise.

The computation of average days of school attended per man in the labour force per school year involved matching each age group in the labour force in each decade to the days of attendance applicable to the years in which school was attended. Males in all census years with thirteen or more years of schooling were assumed to have attended the same number of days of school during their entire school careers as comparable students in 1961. It was conservatively estimated, by moving back the Ontario percentage of "days of school attended" figure from 1867 to 1859 (when the 55−64 age group in 1911, who had attended one to four years of schooling, were actually in school), that 41 per cent of a possible 200-day school term was attended. If 42 per cent of the possible 200 days, or 84 days, is taken as representative of school attendance in Canada in 1861, then by 1961, days attended for persons with twelve or less years of schooling had risen by 100 days.

It was assumed, because the observations of days attended for Ontario were not on an annual basis in the nineteenth century, and also to simplify the computations, that daily attendance rose, on average, one day a year over this 100-year period. This assumption is not far from the actual historical experience. Decade percentage changes in the average number of days of school attended per year of school attended (Table 22, col. (3)) thus reflect changes in past daily attendance of all males in the labour force. The daily attendance figure for a given census year was weighted by the numbers in the male labour force in given age groups with particular educational attainments. For example, in 1911 the estimate of this study was that 104,000 males 25−34 years of age completed only eight years of schooling. On the average,

this age group was born in 1881, was enrolled in grade eight in 1895, and attended an estimated 57 per cent, or 114 days, of the possible days of school. In a similar manner, each age group, by years of schooling, was matched with the appropriate percentage of days of school attended and weighted by the number of males in that cross-classification.

APPENDIX B–7

## Technical Note on the Calculation of
## Changes in Growth Attributable to Education

### Income Weights

Census information on average annual income from employment by years of schooling for the non farm labour force did not provide separate data for persons with zero to four years of schooling, five to eight years of schooling, four years of high school or five years of high school. Estimates of annual incomes for these classifications of schooling (in addition to the classifications given by the Census of 1961) are shown in Table 20. The estimate of income earned by male members of the labour force with grade eight education is of particular importance, since it serves as the base for differentials in incomes earned by persons with lower and higher levels of schooling. However, the Dominion Bureau of Statistics provided, in unpublished tabulations, annual incomes for male wage and salary workers with zero to four and five to eight years of elementary schooling; and for workers with four years and five years of high school. The wage and salary income was adjusted upward to take account of omission of owner income and an allowance was made for a rise in income per year of additional elementary schooling which was more than proportional to the rise in elementary years of schooling. The resulting estimates of average annual income by age groups for zero to four, five to seven, and eight years of elementary school, described further below, were then weighted by the total number in the labour force in each age group attaining that level of education which yielded an average income for males with zero to eight years of school at $3,530 – almost exactly the same as the average income recorded by the census for males aged 25–64 in the 1961 Census with zero to eight years of schooling *(1961 Census of Canada*, Catalogue No. 98–502, Table B–6). While this does not imply that the calculations of incomes for persons with grade eight schooling, or those for persons with lower levels of elementary schooling, are entirely correct, they are believed to be near the right order of magnitude. Some other combination of incomes associated with elementary schooling was possible, although no other set of numbers in each education category provided an internally consistent weighting result.

In more detail, the procedure for estimating annual incomes associated with elementary school year classifications consisted of computing a weighted average income for zero to eight years of schooling for each age group in 1961 on the basis of wage and salary income for zero to four and five to eight years of schooling. The ratios of average annual income of the zero-to-four and five-to-eight classification to zero-to-eight average annual income were applied to the annual income of the non farm labour force 25–64 years of age already calculated for the census report. For example, since the wage and salary income data from the 1961 Census omitted owner income, then to correct for this omission the calculation was as follows: the proportion of average income for the 25–34 age group with zero to four years of schooling to the average income of the same age group with zero to eight years of

schooling (both wage and salary income) is 74.98 per cent; this ratio was then in turn applied to the average income figure of $3,311 for the non farm labour force (which included owner income) 25—34 years of age with zero to eight years of schooling (*1961 Census of Canada*, Catalogue 98—502, Table B—6) to yield the estimate of $2,483. This figure, along with similarly derived incomes for each age group in the zero-to-four-years classification, were averaged to obtain the income of $2,758 shown in Table 20.

This procedure was also used to derive the annual income of the labour force with five to eight years of schooling. Annual income associated with eight years of schooling was determined by taking the average income for the zero-to-four classification as equal to the income of persons with three years of schooling and the average income for the five-to-eight classification as equal to the income of persons with about seven years of schooling. The distribution of the numbers in the labour force by years of elementary school was considered in arriving at about seven years of schooling. The difference in average incomes of the zero-to-four and five-to-eight classifications, separated by approximately four years, provided an estimate of the addition to income associated with a change in one year of schooling at this level of elementary schooling.

Denison's study of percentage earnings differentials associated with education (Appendix Table A—14) indicated that, as years of elementary schooling completed rose, higher differentials existed for higher years of elementary school completed. It was assumed in this study that completion of the eighth year of elementary school added one and one half times more to annual income than the completion of each year of the four lower years of elementary schooling. The above series of calculations deriving the additions to income of the four successive years of schooling grades three to seven and, as well, taking the addition to income for grade eight at one and one half times this yearly increment, were repeated for each age group, yielding an annual average income for grade eight of $3,970 (Table 20).

Annual average incomes from employment for members of the labour force with both four years and five years of high school (grouped together in the *1961 Census of Canada*, Catalogue 98—502, Table B—6) were estimated from the incomes of non-farm male wage and salary workers with either four or five years of high school in a similar manner to the incomes of persons with elementary schooling. The operation again involved making an upward adjustment for average incomes, for each age group, necessitated by the omission of owner income. Average incomes for the 25—64 age group with either four or five years of high school are shown in Table 20.

### Outline of Calculations

As shown in Table 20, average incomes by level of schooling derived in the manner just described, were expressed as percentages of the average income for persons with eight years of schooling. For reasons explained elsewhere in this study, the percentage *differences* in the incomes by level of schooling were reduced to three fifths of their original extent. For example, if the income of a person with a certain higher level of schooling was 200 per cent of the income of a person with only eight years of schooling, then the percentage difference was 100 per cent.

This latter figure is reduced to three fifths, or to 60 per cent, so that the new index would read 160 in relation to 100 for grade eight income. Indexes derived in this manner are shown in the third column of Table 20. The products of these indexes and the dollar figure for average income associated with grade eight provide mean incomes by level of schooling, representing the assumed effect of education only (Column 4, Table 20). This special set of incomes should be considered only as a suitable weighting device in the procedure of combining groups of persons with different levels of schooling (such as the 1911–61 male labour force). The important aspect of this process is to enable us to quantify the effect of educational differences in a single measure, such as percentage changes in average income over time. The following is the weighting scheme underlying the calculations in Table 21 and Appendix Table A–15:

Increase in income per man due to education: $100 \, \dfrac{y^{1961}}{ya^{1961}} - 100,$[1]

where $ya^{1961} = \sum\limits_{j} e_j{}^a \, w_j{}^{1961}$

$y^{1961}$ is the weighted mean income per man in 1961, calculated from the reduced income differentials to reflect education only.

$e_j{}^a$ is the distribution of the labour force by specified years of schooling in each census year a; a = 1911–61.

$w_j{}^{1961}$ are the income weights described above.

It was noted that the educational distribution ($e_j$) relates to the male labour force aged 25–64, while the income weights ($w_j{}^{1961}$) are based on incomes earned from employment by the non farm male population aged 25–64 in the current labour force. Data availability dictated the use of these two sets of statistics. In the absence of information on education-income differentials for employed persons in the farm population, it was assumed that, although the *level* of average incomes earned from farming is lower, more-highly-educated persons would earn more than persons with less education. It is plausible to assume that income *differentials* in non farm incomes would be similar to those in incomes from farming. Because of the relatively small proportion of farm employment in total employment by 1961, it would require a major divergence in the pattern of farm and non farm education-income differentials to affect this assumption to a measurable extent. The percentage change in average income earned due to education would be affected to an even smaller extent, since the overwhelming element in a weighting scheme with 1961 base period weights is the changing structure; in this case, the changes in the educational distribution are the main determinants of the changes shown in Table 21. The use of somewhat different income weights (as a consequence, for example, of the inclusion of farm

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[1] The data in Table 21 were rebased with 1911 = 100.

income weights, if they were available) would not likely have a very significant effect on the changes shown in Table 21.[1]

The discrepancy between a conceivably more correct measure of the contribution of education to economic growth and the measure actually made in this study would be shifted, in the context of an aggregate production function approach, into a residual (if it was computed) containing all types of errors and "unexplained" productivity effects. In this study, the use of male labour force aged 25–64 in deriving the estimates of the contribution of education to the increase in output per employed person and to the growth of national income appears to contribute both to an overstatement and to an understatement which should be noted even though these errors may be largely off setting in effect. The following discussion dealing with the framework used to calculate the contribution of education to the growth in output per employed person is designed to clarify the problem introduced by the omission in the calculations of employed women and employed males under 25 years of age.

In an aggregate production function approach it can be stated, in simplified terms, that

$$p = \alpha \sum_{i=1}^{n} l_i + \beta k + \gamma r + a$$

when p is labour output per man

l represents labour input per man

k, r and a stand for inputs of capital, land and technological change.

p, l, k, r and a are in terms of compound annual growth rates

$\alpha$, $\beta$, and $\gamma$ are defined to add to unity, and represent factor income shares in national income.

$\sum_{i=1}^{n} l_i = l +_1 l_2 + l_3 \text{ --- } + l_n$, where each subscribed l represents a quantifiable characteristic of labour input per man, such as better schooling, shorter hours worked, age-sex composition changes, etc.

Assume that $l_1$ represents the rate of growth in labour income per man due to improved education, which can be viewed as the equivalent of an increase in the amount of labour used. It follows that the contribution of education, as defined in this study, to the rise in output per man, can be expressed as $100 \frac{\alpha l_1}{p}$

Since p, the actual growth of output per employed person, was computed on

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[1] The average educational attainments of the farm labour force are typically lower than those for the nonfarm labour force, and the net effect is reflected in the educational structure of the entire labour force. The inclusion of farm incomes by level of education, based on an educational distribution of the farm labour force containing proportionately more persons in the lower levels of schooling than the nonfarm labour force, would slightly reduce the average income per person with lower educational attainments in relation to those with higher educational attainments. Thus, to the extent to which this would result in a widening of education-income differentials, the contribution of improved schooling to growth in labour income, as shown for example in Table 21, would be understated.

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the basis of total labour force employment, but $l_1$, only on the basis of males aged 25—64, two further assumptions are implied in this ratio:

1.   The education-income weights used to determine $l_1$, in the numerator of the term $\frac{al_1}{p}$   also apply to the whole labour force, including both sexes, 15 years and over. This assumption has relevance for the weighting system in two ways. First, it implies that the education-income *differences* of persons in the 15—24 age group were the same as in the 25—64 age group. This assumption, *a priori*, does not appear to be unrealistic. Second, the assumption implies that the education-income differentials of female members of the labour force were the same as those of males. The 1961 Census data indicate that for female members in the non farm labour force attaining elementary, secondary and university education, average incomes from employment for the 25—64 age group were considerably less than males with similar educational preparation, although the differences decline with higher levels of education. Three important explanations of the male-female income differential by years of schooling are found in the different occupational structure of the two groups, the shorter work experience of females, and in the fact that in the data available, the number of part-time female members of the labour force was much higher than was the case for male members. This last point may also provide part of the explanation for the apparent decline in the male-female income differentials with higher levels of education.[1]

On the other hand, the education-income differentials of male and female members in the labour force were surprisingly similar for the percentage differences in incomes which high school completion and university completion registered when compared with incomes earned by their respective members with only elementary education. For example, for the age group 25—64, with average annual earnings from employment of males with only elementary school equal to 100,[2] the percentage earnings differential was 43.9 per cent higher for high school completion, and 165.1 per cent higher for university completion. For females in the labour force, using the annual average earnings from employment for women with only elementary education equal to 100, the percentage earnings differential was 58.6 per cent higher for high school completion and 164.6 per cent higher for university completion.[3]

Female members of the Canadian labour force were better educated than male members in 1961 for all age groups within the category 25—64. Even though the proportion of males in the 25—54 age groups with university training was slightly

[1] For an analysis of male-female absolute income differentials by years of education and age groups, see J. R. Podoluk, *Earnings and Education*, Dominion Bureau of Statistics, Catalogue 91-510, pp. 16-29.

[2] The information necessary to calculate the base year as grade eight income equaling 100, used for calculation of male education-income differentials in this study, was not available for female members of the labour force.

[3] Calculated from Podoluk, *op. cit.*, Table 6, p. 21.

higher, the proportions of females with more than elementary education was considerably higher than for males.[1]

The inclusion of female workers' income by level of education, based on an educational distribution of female workers containing proportionately more persons in the higher levels of schooling than in the male labour force, would tend to reduce the average income per person with higher educational attainments in relation to those with lower educational attainments. This conclusion follows from the two factors of considerably lower absolute level of incomes by years of schooling of female workers relative to males, and the higher proportion of better educated females in the labour force. The inclusion of females in the calculation of average incomes by level of education would result in average income per person employed having a proportionately greater downward adjustment for more highly educated persons than the downward adjustment in the average income per person with less education. To the extent that this would result in a narrowing of the education-income differentials, the contributions of education to output per employed person is overstated by calculating income weights only on the basis of average incomes of males, as was done in this study.[2]

2. The second assumption implied in the ratio $\frac{a_1}{p}$ is that the mean years of schooling of all persons in employment are similar to those of males aged 25–64. Divergences from this assumption would have relevance for changes in the educational distribution of the labour force over time. The mean years of schooling of the male labour force were used to compute column 4 and column 5 of Table 22, resulting in an estimate of the influence of both changes in the years and days of schooling on labour output per man. Since female members of the Canadian labour force were better educated than male members in 1961 for all age groups within the category 25–64 and the proportion of females in the total labour force doubled over the 50-year period with more than half the increase occurring in the 20-year period 1941–61, the inclusion of females in the labour force could have a tendency for the mean years of schooling of the total labour force to rise more rapidly than the mean calculation for males used in this study.

There is some evidence, however, that the educational superiority of female members of the Canadian labour force has been declining from the 1920's through

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[1] Computed from Dominion Bureau of Statistics, *1961 Census of Canada*, Catalogue 94-513, Table 19. The following proportion of males and females in the labour force, by age groups as of 1961, had more than elementary education; 25-34, males 62.1 per cent, females 74.0 per cent; 35-54, males 53.8 per cent, females 65.8 per cent; 55-64, males 37.3 per cent, females 54.1 per cent.

[2] The 1961 Census indicated that the ratio of annual income from female employment to male employment was lower, for example, at the elementary school attainment level than at the high school attainment level. Though the data are distorted by the presence, relative to males, of more part-time women workers (who would likely be relatively more numerous in the elementary classification), the more the female-male differential narrows with higher education, the less would be the influence of the inclusion of women workers in reducing the education-income differential.

the 1950's, relative to male members.[1] If the trend suggested by this evidence is correct, then in the earlier years the relatively few, but better educated female workers must be compared in their influence on the mean years of schooling, with the influence of increasing numbers of female workers with declining superiority in years of schooling. Since the female superiority still persisted for the 25–34 age group in 1961, the rise in the mean years of schooling has been understated to some extent in the calculation based on the male labour force and consequently, on this basis, the contribution of education to economic growth is slightly understated.

To complete the quantification of the influences which determine the quality change in labour input would require further studies of the change in age-sex structure and female work experience in the Canadian labour structure. Changes in the age structure and in the ratio of male-female employment are also important factors in average productivity growth. These do not enter into the calculation of the effects of better education, but would be computed as separate changes in the quantity of labour input over time. This latter analysis, such as performed by Denison in an additional undertaking,[2] is not within the scope of this study, however.

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[1] The percentage change in the proportion of male members of the labour force with more than elementary schooling increased by 66.4 per cent, moving from the 55–64 age group to the 25–34 age group. For female members the comparable proportion increased by 36.9 per cent. Calculated from Dominion Bureau of Statistics, *1961 Census of Canada,* Catalogue 94–513, Table 19.

[2] See Denison, *The Sources of Growth,* Chapter 8.

APPENDIX B–8

## Note on the Aggregate Production Function Approach
## and the Labour Share in National Income

The underlying analytical framework of Denison's study (and this study) of the contribution of education to economic growth is based on a type of Cobb-Douglas aggregate production function—a tool of analysis which permits an exploration of the relationship between the growth of output and the growth of inputs. This production function takes the form.

$$O = AL^{\alpha} K^{1-\alpha}$$

where O is real output, L and K are, respectively, labour and capital inputs, A is an index of total factor productivity and $\alpha$ and $1-\alpha$ are the elasticities of output with respect to labour and capital. The term A in the production function is a constant through time. If technological advance occurs, A will increase at some rate $(1 + t)^n$ where t is the increase in the productive efficiency of the factors of production and n is time. Under the assumption of perfect competition, constant elasticities of output with respect to labour and capital, constant elasticity of capital and labour substitution (the elasticity of substitution between capital and labour is unity)[1] and neutral technological change (the effect of technological change is to shift the production function without changing its shape), this linear

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[1]     The assumption of constant unitary elasticity of factor substitution between capital and labour follows from the previous assumption of constant elasticities of output with respect to labour and capital. Thus, if the elasticity of factor substitution between labour and capital were other than unity, the proportion of the income share of labour in national income would change with a change in the price of capital inputs. However, this assumption of unitary elasticity of factor substitution is not of critical importance in the calculations. Denison, in answering a comment concerning this assumption, agreed that the elasticity of substitution is probably less than unity but stated:

"Note, first, that elasticity of substitution makes no difference if labour input and capital input grow at the same rate; it is only to the difference between their growth rates (which is small in both my 1929-57 estimates and 1960-80 projections) that the question of elasticity is relevant.

"Secondly, and more important, Richard R. Nelson has shown that the contribution of a given per cent increase in capital or labour, the other being held constant, is lower by only a trifling amount if the elasticity of substitution between capital and labour is only .5 rather than 1. If it is even .3, the assumption that it is 1 will overstate the effect on output by only 1/30. Elasticity has to approach zero to make a substantial difference. Similarly if elasticity of substitution is greater than 1, this makes hardly any difference either. For changes in the relative proportions of the factors of a size worth examining, at least, my estimates are not sensitive to the assumption about elasticity of substitution within a very wide range." Denison, "Reply," *The Residual Factor and Economic Growth*, OECD, Paris, 1964, p. 82. The reference to the study of R. R. Nelson, not identified in the above source is R. R. Nelson, "Aggregate Production Functions" *American Economic Review*, Sept., 1964, p. 577, from his paper "Aggregate Production Functions and Medium Range Production Functions," RAND RM-3912-PR. Santa Monica, 1963.

and homogenous production has the property that the exponent $\alpha$ of L is exactly equal to the ratio between total wage income and total output O (estimated as .76 in this study).

More specifically, under competitive conditions and equilibrium, any given factor of production of similar quality will tend to receive the same income, and this income will tend to be equal to the factor's marginal product. Under these conditions, the average income per unit and the marginal income per unit would be the same and both would equal the value of the marginal product of a unit of the factor.[1]

If labour is paid a wage equal to the value of its marginal product, it can be shown that, mathematically, a Cobb-Douglas type of production function will yield a share of wages relative to total output which is fixed and independent of the other variables in the production function. The ratio between total wage income and total output is then equal to $\alpha$, the exponent of L in the Cobb-Douglas type of production function. Empirical evidence respecting the constancy of labour's share in national income does not appear to contradict the Cobb-Douglas production function hypothesis.[2]

The share of labour in national income, derived below, is used to approximate the exponent $\alpha$—the elasticity of output with respect to a change in labour input. As Denison indicated (*Sources of Economic Growth*, pp. 30 and 32), estimates of the distribution of national income by factor shares serves two key purposes in estimating the sources of economic growth. First, use of factor shares in national income permits a measurement of how much a small increase in the quantity of one factor would increase national income. Second, such shares can be used as a set of weights

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[1]     Denison's comment on these conditions is that "the basic assumption of my approach is that the economy of the United States is not so different from this description as to invalidate the use of average return per unit of each factor as a measure of its marginal value product....The chief requirement for its validity is that firms tend to employ each validity is that firms tend to employ each factor up to the point where its marginal value product equals the price of its services (however that price may be established) and that departures from this practice tend to be offsetting", *Source of Economic Growth*, p. 31. In a similar manner, we can suppose that in the long run, competitive factors are likely to operate in a market economy such as Canada's with considerable effect in establishing a wage structure such that wages do reflect differences in the marginal productivity of labour. If employers did not set wages so as to maximize profits, then the relationship between incomes and the marginal productivity of labour would be distorted. For example, it has been suggested that employers might engage in "conspicuous production" in the sense that they may hire high school graduates or college graduates and pay them accordingly even though these jobs do not require higher levels of training, such employer behavior may not be at all non-profit maximizing, since in the long run, recruitment of a higher trained individual may be the best guide in indicating his higher future productivity contribution in employment. See also William G. Bowen, "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches," *Economic Aspects of Higher Education*, Paris, 1964, Organization for Economic Co-operation and Development, pp. 186-187.

[2]     For a proof that the ratio between total wage income and total output must be exactly equal to the exponent of labour input in the Cobb-Douglas production function and for further reference to the literature on empirical evidence, see W. J. Baumal, *Economic Theory and Operations Analysis* (Prentice-Hall, 1961), p. 293.

which serve to combine a group of various types of inputs into a single measure of the total resources used in production.

Our interest in this study is limited to the first application. As calculated below if the share of labour earnings is taken as 76 per cent of national income, an increase in the quantity of labour input of 1 per cent will result in an increase in total output of 0.76 per cent. Similarly, an increase in the quantity of all inputs by 1 per cent would yield a 1.0 per cent rise in total output. Over a period of time, an increase in the quantity of factor inputs of 1 per cent may actually result not in an increase in output of 1 per cent, but in a somewhat higher increase due to increasing returns to scale. As noted in the text, Denison estimated the effect of increasing returns to rising economies of scale as a separate growth source.

Calculations indicate that on the basis of *National Accounts* data since 1926, labour received, on average, a little over three quarters of net national income. Net national income at factor cost in current dollars was taken from Dominion Bureau of Statistics, *National Accounts, Income and Expenditure*, Table 1. Labour income, based on the same source, was defined to include compensation to employees and a proportion of the income from unincorporated business, both farm and non farm, which may be considered as the return to the owner's labour. The proportion used for this purpose was 63 per cent. For example, total labour income defined in this manner constituted 76.4 per cent of net national income in 1929 and 76.7 per cent in 1957. The average of the labour share for all years from 1929–57 amounted to 76.4 per cent. Any other plausible assumption about the proportion of unincorporated income assigned to labour (see Table B–1, below) would not have resulted in a significantly different average labour share, nor in a significant change in the proportion of productivity growth per employed person attributable to better education over the period 1929–57:

#### APPENDIX TABLE B-1
The Effect of Different Assumptions in Computing
the Labour Income Share, 1929-57

| Assumed Proportion of Unincorporated Income Assigned to Labour | Average Total Labour Share in Net National Income | Proportion of Productivity Growth per Employed Person Due to Improved Education |
|:---:|:---:|:---:|
| | (Per cent) | |
| (1) | (2) | (3) |
| 50 | 74.3 | 19.7 |
| 63 | 76.4 | 20.2 |
| 75 | 78.9 | 20.9 |

While Denison has not specifically stated his underlying model in the form of an aggregate production function equation, it is useful to interpret Denison's model in this manner. Richard R. Nelson, in a paper concerned with the use of the Cobb-Douglas production function in a more general analysis of economic growth, has provided a formulation of both the Denison and Solow models within the framework of an aggregate production function.[1] Not only is the technique of

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[1] Richard R. Nelson, "Aggregate Production Functions and Medicin-Range Growth Projections," *American Economic Review*, Sept. 1964, pp. 575-606.

measuring the contribution of education to economic growth more apparent in Nelson's discussion, but in addition, he suggests how the measure of quality change in labour inputs might be incorporated in other aggregate production function formulations.

Denison's model can be interpreted (with slight changes in Nelson's symbols to keep the terms consistent with earlier discussions in the paper) as

$$O_t = A_t^* (L_t \, q_t)^\propto K^{1-\propto}$$

$$\text{or } \frac{\Delta O_t}{O_t} = \frac{\Delta A_t^*}{A_t^*} + \propto \Delta \frac{(L_t \, q_t)}{L_t \, q_t} + (1-\propto) \frac{\Delta K_t}{K_t}$$

where $\frac{\Delta A^*}{A^*}$ is the rate of growth of output per unit of input, $\propto$ and $\propto$-1 are the elasticities of output with respect to labour and to capital and $\frac{\Delta K_t}{K_t}$ is the rate of growth of capital inputs (not specifically adjusted for quality change). $A^*$ is a more limited concept than the term A in the equation $O = AL^\propto K^{1-\propto}$ noted earlier in this Appendix, since the rate of improvement in the average quality of the labour force is treated as a rate of change in the quality of labour inputs in the term $\Delta (L_t \, q_t)$. Therefore, $\frac{\Delta A^*}{A^*}$ represents, in Denison's model, the rate of growth in the $L_t \, q_t$ advance of knowledge and certain organizational (disembodied) improvements in efficiency; included are the negative influence of an adjustment for restrictions against optimum use of resources and positive adjustments for reduced waste in agriculture, changes in lag in the application of knowledge, economies of scale, and advance of knowledge—the last item being Denison's final residual (see Appendix Table A—16 for a summary of Denison's estimates of the sources of economic growth).

To examine further the Denison adjustment for quality change improvement in labour inputs, the above equation can be written in the form

$$\frac{\Delta O_t}{O_t} = \frac{\Delta A_t}{A_t^*} + \propto \lambda \, \Delta L + \propto \frac{\Delta L_t}{L_t} + (1-\propto) \frac{\Delta K_t}{K_t}$$

The rate of improvement in the average quality of labour, $\lambda L$, has three components in Denison's study; $\lambda L^E$ for changes in the total years and days of schooling of the labour force, $\lambda L^C$ for changes in age-sex composition and $\lambda^Q$ for changes in labour productivity per man-hour as the average work week declines. Only the first component was estimated in this study.

A further analysis of the sources of growth in the Canadian case requires considerably further research, not only to enable the completion of estimates for the remaining large list of growth variables in Denison's framework, but also for exploring the suitability of using other formulations of the Cobb-Douglas type of production function which involve a differing account of the complementarity between technical change and investment. For example, Solow's model can be expressed as

$$O_t = A_t' \, L_t^\propto J^{1-\propto}$$

The J term refers to Solow's adjustment for quality change in capital inputs expressed by "a quality-weighted number of machines with new machines given a greater

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weight than old machines, reflecting the newer technology embodied in them".[1] In the above form, Solow's model, while differing in its emphasis on growth factors, resembles Denison's model. However, A' in Solow's model is different than $A^*$ in Denison's because of the quality adjustment for capital input and the lack of an adjustment for changes in the quality of the labour force. It would no doubt be fruitful to consider both labour and capital quality adjustments in a further analysis of the sources of Canadian economic growth. It is also possible that there exists a significant complementarity among the three main contributors to the growth in total factor productivity—technological change, improved education attainment and levels, and improved efficiency in allocation. To note just one case which Nelson has emphasized "one might seriously propose the hypothesis that the need for and return to educated people generally, not just research and development personnel, are in large part functions of the desired and actual rate of technological change".[2]

[1] *Ibid.*, p. 581. The Solow model given above and accompanying discussion is also from *Ibid.*, p. 581.

[2] *Ibid.*, p. 591.

APPENDIX B–9

## The Educational Attainments of Immigrants and Emigrants

Since international migration in Canada has been significant in every decade since 1911, except during the 1930's, it was necessary to attempt a measurement of the effects of net migration on the educational attainments of the Canadian male labour force. In his study, *The Sources of Economic Growth*, Denison was fortunately able to ignore the effects of international migration, since it had a small effect on the U.S. labour force after the 1920's. To undertake this measurement for Canada proved to be a formidable task, and the results presented here can only be regarded as first approximations. The estimates were essential for this study, however, in view of the large flows of immigration and emigration during certain decades. This appendix provides a detailed review of the estimation procedures to indicate the approximate nature of the results and to serve as a reference for further research in this area.

Precise information on certain characteristics of immigrants and emigrants for Canada is not available. No information appears to exist which states the educational attainments of immigrants in a form which could be used in the type of age-cohort analysis employed in this study. The *1961 Census of Canada* did, however, publish a summary of the educational attainments of all immigrants, male and female, for the period 1946–61.[1] This material relates to both males and females, and does not correspond with the time-period definition used in this study. As yet no official statistics are published in Canada on emigration, and the immigration statistics of United States and Great Britain had to be used to estimate Canadian emigration. Existing studies on Canadian net migration (notably Nathan Keyfitz, "The Growth of Canadian Population", *Population Studies*, June 1950) were not addressed to questions involving the labour force as such, but rather to questions about net population movements. The sources, gaps, difficulties and assumptions of estimating the educational attainment of migrants by age, summarized in Appendix Table A–5, are discussed, by decade, in this Appendix.

Of the 1,605,000 immigrants who entered Canada from January 1, 1951 to May 31, 1961 (records of the Department of Citizenship and Immigration, *Canadian Immigration Bulletin*), 1,203,000 were residents in Canada in 1961 according to the *1961 Census* (Catalogue 92–548, Table 58). There was therefore an apparent disappearance of immigrants arriving in Canada in the period 1951–61 of 403,000. Deaths are estimated to account for about 30,000 of these, while the records of the U.S. Immigration and Naturalization Service show that immigrants to the United States from Canada who arrived as quota immigrants in 1951–61, and who were therefore not born in Canada, amounted to 99,280 in the period July 1, 1951 through June 30, 1961, but some portion of these may have arrived in Canada in decades prior to 1951–61. In addition, emigrants from Canada to the United Kingdom, who

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[1] Catalogue 99-520, Table XIX.

had resided in Canada for more than 12 months, and who arrived directly *by sea* amounted to about 93,000, from July 1, 1951 to June 30, 1961 (Board of Trade Jour-, nals, U.K.). Some portion of the above emigrants to the U.S. from Canada may have arrived in Canada in decades prior to the 1950's, while some portion of the emigrants to the U.K. (which omits arrivals by air), may have been Canadian-born or immigrants to Canada in an earlier decade. Consequently, a figure probably in excess of 181,000 immigrants can not be accounted for other than that most may have returned to their country of origin, or a few emigrated to countries other than the U.S. or the U.K.

However, data on immigrants to Canada returning home are not available, and this lack of information was one reason for the decision not to use the immigrant arrival data as a basis of our calculation.

A second reason for the reluctance to use immigrant arrivals as the basis of our estimates is that this migration study is designed primarily to determine the *educational* characteristics of immigrants and emigrants, and this was, of necessity, based on the occupational distribution of these immigrants and emigrants. The basic assumption made is that an immigrant or emigrant in a given occupation in a particular age group had the same years of education as a person in the existing Canadian labour force in the comparable occupation and age group. Immigrant arrivals to Canada from 1946 on were required to state their intended occupation. However, it was determined that the intended occupation of the immigrant and his actual occupation, according to the Census of 1961, diverged considerably. Discussions with officials in the research department of the Department of Citizenship and Immigration revealed that case studies they had made of particular immigrants showed that a marked upgrading in actual occupation occurred in relation to the "intended occupation" originally declared. Consequently, derivation of educational attainments on the basis of "intended occupations" of immigrants to Canada would have considerably underestimated their educational attainments.

In view of the above considerations, it was decided to measure labour force immigration by the Census enumeration, as of 1961, which provided the number and occupational distribution by age groups and sex of immigrants who had arrived in Canada in the period 1951–61. However, the use of the 1961 Census information (and similar Census information for earlier decades) presented the difficulty that, while the 1961 Census information represented the stock of immigrants at a point of time, the emigration data was based on annual flows of emigrants. Data on labour force emigration from Canada to the United States and the United Kingdom were available in the form of immigration statistics for the U.S. and the U.K. on an annual basis by occupation and age groups. Consequently the age distribution of these emigrants during a decade of emigration was estimated by taking, say for the age group 25–34 years, the number of emigrants who arrived in say 1951–61, within the age group 25–34 *in their year of arrival.* If the average age of the 25–34 group is taken as 30 years, then by the end of the decade (1961), if these emigrants are viewed as a stock, their average age would have risen to 35 years. If both immigrants and emigrants were measured as a portion of the labour force stock, emigrants would be, on the average, five years older.

Since the objective of the migration operation was to measure the change in the quality of education possessed by the Canadian male labour force attributable

to net migration, the effect of the above method of determining emigrant age distribution is to overstate the educational preparation of the emigrants. The emigrant age group of 25–34 was assigned the years-of-schooling characteristics by occupation of the 25–34 age group in comparable Canadian labour force occupations, but as noted, the average age of the 25–34 emigrant group moved from 30 to 35 years by the end of the decade. Males in the Canadian labour force 25–34 years of age, from which the emigrant educational characteristics were taken were not, however, much better educated than Canadian males in the 35–44 age group.[1] Since the average age by the end of the decade of the emigrant 25–34 age group was 35 years, the differences in educational preparation were even smaller than in the differences in education between the 25–34 and 35–44 age groups. An offset to the small overstatement of the years of schooling estimated for the emigrant labour force was the overstatement involved in measuring the educational preparation of the labour force immigrants 25–34 years of age. In this latter case, a portion of the younger immigrants 25–34 years of age in 1961 undoubtedly were not in the labour force in the earlier years of 1950's and probably gained further education in Canada.

### Immigration, 1951–61

Since an age distribution of male immigrants in the *labour force* who had arrived in Canada in the period 1951–61 was not available from the 1961 Census, the age distribution of male immigrants in the *population* who had entered in the same period was determined from the 1961 Census (Catalogue 92–562, Table 125), yielding a total of 396,410 males 25–64 years of age, and 495,516 males 15–69 years of age. Unpublished cross-tabulations of the Dominion Bureau of Statistics from the 1961 Census gave a total of 449,115 males 15 years of age and over who had arrived in the period 1951–61 and were in the labour force. It was assumed that the effective age range of this labour force was 15–69 years of age, and on this basis the 449,115 males in the immigrant labour force constituted 90.6 per cent of the 495,516 males in the immigrant population. Applying this ratio to the known male immigrant population of 396,410 in the 25–64-year age group, the figure of 359,465 male immigrants aged 25–64 in the labour force was obtained.

The age distribution of the male *population* of immigrants to Canada in the period 1951–61 was as follows:

| Age Group | Per Cent |
|-----------|----------|
| 25–34 | 48.49 |
| 35–44 | 31.85 |
| 45–54 | 14.70 |
| 55–64 | 4.98 |
| 25–64 | 100.00 |

It was assumed that male *labour force* immigrants arriving in this same period were distributed in this same manner.

1961 Census data, available in additional tabulations from the Dominion Bureau of Statistics, provided an occupational distribution of the stock of immigrants as

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[1] The median years of schooling of males 25-34 years of age in the Canadian labour force, as of 1961, was 10.04 years, while the median for males 35-44 years of age was 9.64 years.

of 1961 who had arrived in Canada in the period 1951–61, for the age group 15 years and over, without a further breakdown by various age groups. It was assumed that the distribution of occupations given for the age group "15 and over" was applicable to the age group 25–64, as follows: managerial, 6.95 per cent; professional, 10.35 per cent; clerical, 5.1 per cent; sales, 3.89 per cent; service, 10.34 per cent; transportation, etc., 3.55 per cent; farm, 5.15 per cent; loggers, .74 per cent; fishermen, .00056 per cent; miners, 1.65 per cent; craftsmen, 39.76 per cent; labourers, 10.02 per cent; occupations not stated, 2.09 per cent.

Data in Appendix Table A–2 provides the necessary information on education by occupation and age group for the determination of the educational characteristics, by age group and occupation, of the immigrants. Appendix Table A–5 provides a summary of the estimated years of schooling of labour force immigrants for each decade from 1911–61.

### Emigration to the United States, 1951–61

The total number of emigrants to the United States from Canada (including Newfoundland) as the last country of permanent residence was 399,542 in the period July 1, 1951, through June 30, 1961, according to the U.S. Department of Justice, *Annual Report of the Immigration and Naturalization Service*, for the fiscal years 1952–61. Of this total, 288,164, or 71.62 per cent, were born in Canada, while most of the remaining 28.38 per cent (99,280) had been immigrants to Canada, permanently residing in Canada, who had been admitted to the United States under "quota" arrangements. Canadians returning from residence in the United States for the calendar years 1951–60 totalled 47,345 *(Canada Year Book, 1960* and 1963–64, pp. 227, 209). The age, sex and occupational characteristics of these returning Canadians were not available, and on the assumption that they had, on the average, the same characteristics as the emigrants from Canada to the United States in this period, they were deducted from the total emigrants, providing a net emigration figure of Canadians to the United States 1951–61 of 352,197.

On the basis of information in the *Annual Report of the Immigration and Naturalization Service* in the fiscal years 1952–61, it was determined that, of the Canadian-born emigrants to the United States during this period, 44.25 per cent were males of all ages. The male-female distribution by age class intervals was not available for all emigrants from Canada to the United States; that is, those whose country of last permanent residence was Canada. According to the Annual Reports already noted, Canadian-born emigrant males 20–69 years of age, arriving in the United States in 1951–59, constituted 59.3 per cent of all Canadian-born male emigrants to the United States during this period. In the absence of a sex-age distribution for all emigrants (Canadian-born and other) to the United States from Canada in this period, this proportion of 59.3 per cent males 20–69 years of age was used as a basis for determining the male labour force emigrants 25–64 years of age. Since the Annual Reports provide an age distribution of 20–29, 30–39, etc., rather than 25–34, 35–44, etc., used in the Canadian census and in this study, the procedure for translating the former into estimates of the latter was to use the five-year age intervals of immigrants to Canada from the Department of Citizenship and Immigration, *Immigration Statistics*, years 1956 through 1961, as guides to the proportion of males 25–29 years of age, for example, in the 20–29-year age group

from the data in the *Annual Reports of the Immigration and Naturalization Service,* etc.

The first result of the above operation was to provide the estimate that, of the male emigrants aged 20–69 from Canada to the United States in 1951–61, some 78 per cent were 25–64 years of age. The second result was to provide the age distribution of these males by 10-year intervals, such as 25–34, 35–44, etc. Since the accuracy of the age distribution estimate is of significance in assigning the educational characteristics of the emigrant males 25–64 by major occupations and age groups, the age distribution data from which the estimate was made are given in Appendix Table B–2.

### APPENDIX TABLE B-2
#### Age Distribution Estimates of Male Immigrants and Emigrants

| Age Intervals | Percentage Distribution of Canadian-Born Male Emigrants to the U.S. 1951-61 | Percentage Distribution of Male Immigrants to Canada 1956-61 | Age Intervals | Percentage Distribution of Male Immigrants to Canada 1956-61 | Percentage Distribution of Canadian-Born Male Emigrants to the U.S. 1951-61, Adjusted to Age Intervals in (4) | Percentage Distribution of Canadain-Born Male Emigrants to the U.S. 1941-51, Based on 1950 Actual Data |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 20–29 | 41.28 | 54.48 | 25–34 | 61.55 | 52.59 | 56.24 |
| 30–39 | 34.23 | 28.40 | 35–44 | 24.30 | 29.85 | 28.75 |
| 40–49 | 16.76 | 10.71 | 45–54 | 10.27 | 13.36 | 10.18 |
| 50–59 | 5.72 | 4.47 | 55–64 | 3.88 | 4.20 | 4.83 |
| 60–69 | 2.01 | 1.94 | | | | |
| | 100.0 | 100.0 | | 100.0 | 100.0 | 100.0 |

Source: See accompanying text.

The estimates resulting from adjusting the U.S. *Annual Report of the Immigration and Naturalization Service* data by the proportions in five-year age intervals of the Canadian immigration data appear to give results much closer to the known age distribution of Canadian-born male emigrants to the United States for the single year of 1950. The estimate in col. (6) of Appendix Table B–2 was adopted for the period 1951–61. Males aged 25–64 constituted 78 per cent of the total males 20–69 years of age. Accordingly, of the total net emigration to the United States during 1951–61, amounting to the already-noted figure of 352,197, 44.25 per cent, or 155,847, were males of all ages. Males 20–69 years of age constituted 59.28 per cent of all males, or 92,386.

Of the males 20–69 years of age, it is estimated, by the method noted above, that 78 per cent, or 72,061, were in the 25–64 age group. While the labour force participation rates of male emigrants from Canada to the United States are not known, it may be surmised that they would be higher than those for males in this age group

in Canada. No correction, therefore, was made to adjust the male emigrants to the United States for labour force participation.

We may summarize the data accumulated up to this point as follows:

1.  Total emigrants to the United States from Canada, 1951–61 . . . . . . . . 399,542
2.  Canadians returning to Canada, 1951–61 . . . . . . . . . . . . . . . . . . . . . . . 47,345
3.  Canadian net emigration to the United States, 1951–61 . . . . . . . . . . . . 352,197
4.  Males of all ages, 44.25 per cent of line 3 . . . . . . . . . . . . . . . . . . . . . . 155,847
5.  Males 20–69 years of age, 59.28 per cent of line 4 . . . . . . . . . . . . . . . 92,386
6.  Males 25–64 years of age, 78 per cent of line 5 . . . . . . . . . . . . . . . . . 72,061

The age distribution of this group of males 25–64 years of age was given in col. (6) of Appendix Table B–2.

The next step was to determine the educational attainments of this male labour force from its occupational distribution. The U.S. Department of Justice issued a mimeographed release of occupational classifications of male and female immigrants from Canada each year in the period 1951–61 entitled: "Immigrant aliens admitted to the United States whose country of last permanent residence was Canada, by occupation". Males and females were not distinguished in the occupational classifications, and it was not possible to separate the number of males and females on the basis of occupational categories. Consequently, the proportion of males to total workers in the occupational classifications of the *1961 Census of Canada* was used to determine the number of males in each occupational classification. This proportion, applied to the total numbers in each occupation, yielded the percentage occupational distribution of the labour force migrating to the United States. No information was available to determine the age distribution of these migrants by occupational group. Consequently, it was considered necessary to make the assumption that the age distribution within each occupation was the same as the age distribution given above for total male emigration to the United States in the 15–64 age group.

The final operation for the 1951–61 emigrants to the United States was to estimate the years of schooling of the emigrant labour force by assuming that males in a given occupation and given age group would have the same educational preparation as males in the Canadian labour force, as determined by the 1961 Census. The 1961 Census provided the education by years of schooling and age groups for major occupational classifications (Appendix Table A –2). The years of schooling by age groups were converted into percentage distributions for each major occupation.

### Emigrants to the United Kingdom, 1951–61

Total emigrants from Canada to the United Kingdom, who had resided in Canada for more than 12 months and arrived directly *by sea*, amounted to approximately 93,000 from July 1, 1951 through June 30, 1961 *(Board of Trade Journals)*. Arrivals of such persons *by air* in this period likely represented a significant additional number, and consequently the figure used here is an underestimate, the extent of which is unknown. On the basis of the age distribution of emigrants to the United

Kingdom from Canada in 1950, available from the *Board of Trade Journal*, 43.5 per cent, or 40,500, were males of all ages, and 56.17 per cent, or 22,749, were males between the ages of 25 through 64. Of these male immigrants, 48.6 per cent were 25—34 years of age; 24.02 per cent were 35—44; 14.6 per cent were 45—54; and 12.7 per cent were 55—64 years of age. The *Board of Trade Journal* discontinued publication of the occupations of immigrants in the post-war years, and the occupational characteristics of male emigrants from Canada to the United Kingdom for 1946 and 1947, available from the July 10, 1947 and September 27, 1948 *Board of Trade Journals*, were used to distribute the occupations.[1] No attempt was made to correct the number of 25—64-year-old male emigrants to the United Kingdom for labour force participation rates. The occupational descriptions given in the *Board of Trade Journal* were considerably broader in some respects than was the case for emigrants to the United States, and this necessitated some arbitrary divisions to obtain similar occupational groups. The same procedures were used to determine the educational attainments by occupational groups as were used in the emigrants to the United States. Appendix Table A—5 summarizes the educational attainments by age group of these emigrants.

### Immigration, 1941—51

The educational attainment of immigrants in the decade 1941—51 was estimated in the same manner as 1951—61 immigration. The number of immigrants in the male population aged 25—64, as of the 1951 Census, amounted to 122,774 *(1951 Census of Canada*, Vol. 2, Table 13). The proportion in the labour force was determined from a comparison of male immigrants in the labour force *(1951 Census of Canada*, Vol. 4, Table 12) with male immigrants in the population for the 15—69-year age group, indicating that 94.07 per cent, or 115,494 males 25—64 years of age, were in the labour force as of 1951. (To compute this participation rate, it was again assumed, as in the 1951—61 immigration estimates, that the effective age limit of the male immigrants in the labour force was from 15—69 years of age.) The age distribution of these immigrants in the male *labour force*, derived from the age distribution of immigrants in the male *population*, was estimated as follows:

| Age Group | Per Cent |
|-----------|----------|
| 25-34 | 48.83 |
| 35-44 | 32.02 |
| 45-54 | 14.21 |
| 55-64 | 4.94 |
| 25-64 | 100.00 |

It was assumed again, because of the absence of any information, that the age distribution derived for immigrants in the male labour force aged 25—64 also applied to each major occupational group. It was also assumed that the occupational distribution, pertaining to immigrants in the male labour force aged 15 and

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[1] It has been discovered in the meantime that a separate publication on the occupation of immigrants does exist. It is published by the Director of Statistics, Statistics Division, Board of Trade, United Kingdom, but has not become available in time for use in this study.

over as of the 1951 Census, also applied to the age group 25–64, as follows: managerial, 5.68 per cent; professional, 7.15 per cent; clerical, 4.50 per cent; saies, 2.97 per cent; service, 6.60 per cent; transport, etc., 4.36 per cent; farm, 13.39 per cent; loggers, etc., 1.72 per cent; fishermen, etc., .08 per cent; miners, etc., 2.91 per cent; craftsmen, 33.59 per cent; labourers, 14.99 per cent; occupations not stated, 2.06 per cent.

The educational attainment of the 1941–51 immigrants was derived by moving the age groups of Appendix Table A–2 back one decade to obtain the years of education, by age and occupation, for age groups ten years earlier. Thus the educational distribution of a given occupation in the age group 35–44 in 1961, for example, was used as the distribution for the 25–34-year age group in 1951. It was not possible to correct for changes which immigration and emigration may have made in this occupational distribution by years of schooling when making this assumption, since no previous census in Canada had provided occupations by years of schooling and age groups. Appendix Table A–5 provides a summary for the educational attainments of 25–64-year-old male immigrants to Canada during 1941–51, by age groups.

### Emigrants to the United States, 1941–51

The number of emigrants to the United States whose country of last permanent residence was Canada amounted to 181,891 in the period July 1, 1941 through June 1, 1951 (excluding Newfoundland). With the inclusion of Newfoundland in the decade, the total is 186,125. Of the 181,891 immigrants to the United States from Canada, an estimated 28,792 were born outside of Canada (presumably immigrants to Canada), while 153,099 were born in Canada (U.S. Department of Justice, *Annual Report of the Immigration and Naturalization Service*, years 1941–51). Canadians returning from the United States, calendar years 1941–50, amounted to 41,656 *(Historical Statistics of Canada,* Series A338–341), leaving an estimated total of 144,469 emigrants of both sexes and all ages from Canada to the United States net of returning Canadians. On the basis of data provided in the June 30, 1951 *Annual Report of the Immigration and Naturalization Service,* 41.9 per cent of the 1951 emigrants to the United States born in Canada were males. This proportion was used, in the absence of data by sex, for all emigrants to the United States from Canada as the country of last permanent residence in the whole decade, providing an estimate of 60,590 males. The annual number of emigrants from Canada to the United States during the war years 1941–45 was less than half the annual rate in the years 1946–51, and 1951 had the largest emigration from Canada to the United States of any year in that decade.

The number of males in the labour force 25–64 years of age was estimated as 29,744 (which amounted to 20.59 per cent of the total emigrants from Canada to the United States in 1941-51) on the basis of data from the *Annual Reports of the Immigration and Naturalization Service,* 1950 and 1951. The 1950 *Report* provided an age distribution of emigrants from Canada, sex not specified, by five-year age intervals (20–24, 25–29, etc.), while the 1951 *Report* provided a separate distribution of male and female emigrants from Canada by 10-year age intervals (20–29, 30–39, etc.). It was assumed that the sex composition of the 1951 age groups, given in 10-year age intervals, could be used to determine the sex distribution of

the 1950 age groups given in five-year age intervals. The proportions so derived were used to obtain an estimate of the 1941–51 Canadian male emigrants to the United States aged 25–64 by 10-year age groups. (The previously estimated number of 29,744 was therefore apportioned as follows: 25–64, 56.24 per cent; 35–44, 28.75 per cent 45–54, 10.18 per cent; 55–64, 4.83 per cent.) It was assumed that the above estimate of 29,744 males in the age group 25–64 were all in the labour force. The implied overstatement could only be a minor one. For example, the proportion of males aged 25–64 in the Canadian labour force represented 21.51 per cent of the total population in 1951, while, according to our estimates, 25–64-year-old male emigrants from Canada to the United States represented only 20.59 per cent of total emigrants from Canada to the United States. Further, it might be expected that labour force participation rates among emigrant males would be somewhat higher than among non-emigrating males.

The final operation was to estimate the distribution of males aged 25–64 for each major occupation. The U.S. Immigration and Naturalization Service provided, in a mimeographed series, an occupational description of emigrants from Canada for the fiscal years 1948–51, although this was not given by sex. The period 1948–51 represented 53 per cent of the total emigration from Canada to the United States in the decade 1941–51. The procedure adopted was to apply the ratio of males to females by occupational groups existing in the Canadian labour force, to the same occupational groups listed for the emigrants to the United States from Canada. While the U.S. occupational descriptions approximated the Canadian ones, certain occupations in the U.S. Immigration and Naturalization Service major occupational groups had to be reclassified to conform to the 1961 Census of Canada labour force occupational groupings. In the cases where it was possible to judge whether occupations were usually male or female, the proportion of males to total persons in the occupation listed in the U.S. Immigration and Naturalization Service bulletins was close to the proportion in the occupations listed in the Canadian labour force.

To summarize the estimates made for this period, emigrants from Canada to the United States totalled 181,099 in the period 1941–51,

1. of which, born in Canada ........................................153,099
2. born outside of Canada ........................................ 28,792
3. returning Canadians .......................................... 41,656
4. net emigration from Canada to the United States ................. 144,469
5. Males of all ages, 41.94 per cent of line 4 ..................... 60,590
6. Males, 25–64 years of age.................................... 29,744

The occupational distribution of the male emigrants to the United States were estimated as follows: managerial, 8.71 per cent; professional, 22.25 per cent; clerical, 11.66 per cent; sales, 4.95 per cent; service, 7.13 per cent; transport, 4.00 per cent; farm, 5.38 per cent; craftsmen, 29.17 per cent; labourers, 5.22 per cent; occupations not stated, 1.53 per cent.

The final operation was to obtain data on years of schooling by occupation and age from the 1961 Census (Appendix Table A–2), convert this to a percentage

distribution by education by years of schooling and age, and apply it to the emigrating male labour force by moving the distribution back one decade. A summary is provided in Appendix Table A—5.

### Emigration to the United Kingdom, 1941—51

The total number of emigrants from Canada to the United Kingdom was obtained from Great Britain Central Statistical Office, *Annual Abstracts of Statistics*, 1938—49 and 1954, which provided data for emigrants to the United Kingdom arriving directly *by sea*. The data were available only for the years 1946—50. While the excluded years 1941—45 were not likely years of large emigration to the United Kingdom because of the war, it is likely that the arrival of emigrants by air was also significant in the period 1946—50. The total number of emigrants from Canada and Newfoundland was estimated at 38,700 — the sum of the years 1946—50. including only those arriving by sea — and consequently do not represent a full estimate of emigration from Canada to the United Kingdom for the period 1941—51. The proportion of the emigrants to the United Kingdom from Canada in the male labour force 25—64 years of age was estimated from data in the *Board of Trade Journals* on the basis of issues in 1946, 1947 and 1950.

From this source, it was estimated that of all Canada-United Kingdom emigrants from 1941—51, 44.8 per cent, or 17,376, were males. Of these males of all ages, 60.1 per cent, or 10,442 were between the ages of 25 and 64, and were distributed by age group as follows: 25—34, 43.54 per cent; 35—44, 29.9 per cent; 45—54, 15.48 per cent; and 55—64, 11.08 per cent. The occupational distribution of the 25—64 age group was estimated cn the basis of data for the years 1946 and 1947 from the *Board of Trade Journals* of July 10, 1948 and September 27, 1949, respectively.

The occupational distribution of the emigrants to the United Kingdom from Canada was presented in the *Board of Trade Journals* in less detailed occupational groups than in the Canadian census. It was estimated that the percentage distribution of occupations of the male emigrants to the United Kingdom from Canada were as follows: managerial, 6.3 per cent; professional, 8.51 per cent; clerical, 9.53 per cent; sales, 4.6 per cent; transportation, 5.59 per cent; farm, 9.4 per cent; miners, 1.56 per cent; craftsmen, 27.01 per cent; labourers, 7.26 per cent; occupations not stated, 20.24 per cent. The educational characteristics of the emigrants to United Kingdom from Canada were derived in the same manner as emigrants to the United States from Canada in the decade 1941—51, and are summarized in Appendix Table A—5.

### Immigration, 1931—41

The procedures used for 1951—61 and 1941—51 were used again for 1931—41 in estimating the number of male labour force immigrants, who arrived in Canada in the period 1931—41, as they appeared in the 1941 Census. The *1941 Census of Canada*, (Vol. 7, Table 12) recorded 53,615 males in the labour force, gainfully employed, who were 14 years of age and over and had arrived in Canada in the period 1931—41. We assume again that this figure represented an age group of 14—69 years of age. Male immigrants in the population aged 15—69 amounted to

67,207 as of 1941 *(1941 Census of Canada*, Vol. 3, Table 28), while immigrants in the labour force of the same age in this period amounted to 53,615, consisting 79.77 per cent of the immigrant male population. Applying this ratio to male immigrants in the population 25—64 of 49,760, yields 39,808 estimated immigrant males in the labour force 25—64 years of age.

The age distribution of the 39,808 male immigrants in the labour force aged 25—64 was derived from the age distribution of immigrants in the male population *(1941 Census of Canada*, Vol. 3, Table 28) as follows: 25—34, 32.29 per cent; 35—44, 37.89 per cent; 45—54, 19.82 per cent; 55—64, 10.00 per cent. The occupational distribution of these immigrants was determined from the occupational distribution of male immigrants arriving in Canada in 1931—41 *(1941 Census of Canada*, Vol. 7, Table 12) as follows: managerial, 9.43 per cent; professional, 9.21 per cent; clerical, 4.59 per cent; sales, 4.34 per cent; service, 6.19 per cent; transportation, 5.10 per cent; farm, 24.90 per cent; loggers, 1.62 per cent; fishermen, .94 per cent; miners, 2.65 per cent; craftsmen, 23.80 per cent; labourers, 6.90 per cent; occupations not stated, .35 per cent. The years of schooling of each occupational group was determined as in previous decades from Appendix Table A—2, except that in this decade the age groups were moved back 20 years, which meant that the age group 65 and over in 1961 was used to represent both the age groups 45—54 and 55—64 in 1941. A summary is provided in Appendix Table A—5.

### Emigration to the United States, 1931—41

In the period July 1931 through June 1941, total emigration from Canada to the United States amounted to 97,817, according to the U.S. Department of Labor, *Annual Report of the Commissioner General of Immigration*, for individual years 1931—41.

If the estimates are correct for Canadians returning from the United States in the decade 1931—41 as provided in *Historical Statistics of Canada* (Series A338—341, 0. 29), then net emigration from Canada to the United States in this decade was very small, and net labour force emigration almost negligible. The above-noted source indicates that in the years 1931—41 (adjusted to a fiscal basis) 78,631 Canadians returned to Canada from the United States leaving total net emigration of 19,186.

On the basis of the U.S. Department of Labor *Annual Reports of the Commissioner General of Immigration*, years 1931, 1932 and 1938, it was estimated that 42.8 per cent of these emigrants were males, or a total of 8,212. The age distribution of these emigrants was obtainable only indirectly from data for 1931 fiscal year emigrants from Canada to the United States. This distribution was checked against the age distribution of male immigrants to Canada and male English-speaking immigrants to the United States from 1931—41, confirming that the 1931

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[1] Derived from the age distribution of immigrants in the male population *(1941 Census of Canada*, Vol. 3, Table 28) as follows:

[2] From the occupational distribution of male immigrants arriving in Canada in 1931-41. *(1941 Cencus of Canada*, Vol. 7, Table 12) as follows:

distribution was acceptable. On this basis, it was estimated that 42.26 per cent of the male emigrants were in the age group 25–64. Applying this ratio to the total number of males of all ages of 8,212, yielded 3,470. These were distributed by age as follows: 25–34, 49.2 per cent; 35–44, 24.02 per cent; 45–54, 17.66 per cent; 55–64, 9.10 per cent.

The occupational distribution of major occupational groups was estimated from the *Annual Reports* referred to above as follows: managerial, 2.69 per cent; professional, 10.58 per cent; clerical, 10.03 per cent; sales, 1.22 per cent; service, 13.94 per cent; transportation, 1.43 per cent; farm, 18.1 per cent; fishermen, 1.7 per cent; miners, .3 per cent; craftsmen, 25.9 per cent; labourers, 11.2 per cent; occupations not stated, 2.54 per cent.

The educational attainment of this emigrating labour force was derived in the same manner as in the previous decades, except that the cohort was moved back an additional decade, which necessitated using the 1961 age group "65 years and over" as the basis for estimating the years of schooling of both the 45–54 group and 55–64 group.

### Emigrants to the United Kingdom, 1931–41

Data on emigrants from Canada to the United Kingdom were obtained from the Board of Trade, *Statistical Abstract for the United Kingdom,* 1938. In the period 1931–39, 119,459 emigrants from Canada with at least 12 months' residence in Canada arrived direct by sea. This figure was accepted for the whole decade 1931–41, in view of the limited immigration during the commencement of World War II. It was estimated from *Board of Trade Journal* data that 28.8 per cent, or 34,404, of the emigrants were males aged 25–64. It was furthur estimated that 84 per cent of these participated in the labour force. On this basis it was estimated that 28,899 labour force males emigrated from Canada to the United Kingdom in 1931–41. This number would have to be reduced by the number of Canadians returning from the United Kingdom during this period, but data on this flow of persons are not available.

The age distribution was based on *Board of Trade Journal* reports for 1933–38, and it was assumed that the age distributions for these years applied to the years 1931–41. The *Board of Trade Journals* of 1937 and 1938 provided estimates of the occupational distribution of Canadian emigrants to the United Kingdom, and this sample of two years was also applied to the whole decade. The occupational distribution by major occupational groups for this decade was estimated as follows: managerial, 4.31 per cent; professional, 9.04 per cent; clerical, 16.07 per cent; sales, 1.96 per cent; transportation, 4.55 per cent; miners, 3.04 per cent; craftsmen, 25.20 per cent; labourers, 10.34 per cent; occupations not stated, 25.49 per cent.

The educational attainments of this labour force emigrating to the United Kingdom was derived in the same manner as the emigrant labour force to the United States discussed above for the decade 1931–41.

### Immigration, 1921–31

The stock of immigrants was again selected on the basis of the calculations. Immigrant arrivals to Canada of both sexes and all ages totalled, according to

*Canada Year Book* sources, 1,166,004 in the period July 1, 1921 through June 30, 1931, while the Census of 1931 reported 752,513 immigrants who had arrived in Canada 1921–31.[1] These records imply a "disappearance" of 413,491 persons. The stock of immigrants as of 1931, who had arrived in Canada in 1921–31, was used as the basis of the net migration estimates, but in view of the large "disappearance" of immigrants noted above, a possible error may arise from using this stock figure. The difficulty is apparent when it is recalled that net migration has been calculated from a census stock of immigrants and an annual outflow of emigrants. It is therefore possible that emigrants from Canada to the United States who had arrived as immigrants to Canada in the period 1921–31 were already deducted in the figure shown for the stock of immigrants in Canada in 1931. It appears, however, that only a relatively small number of emigrants from Canada to the United States in the period 1921–31 actually also immigrated to Canada in the same decade. Out of 874,384 emigrants from Canada to the United States (of both sexes and all ages) in 1921–31, immigrants entering the United States on national quotas from Canada totalled 78,962 *(Annual Reports of the Commissioner General of Immigration)*, and some unknown portion of these may have arrived in Canada as immigrants in the 1920's.

It is our understanding of the operation of the U.S. legislation covering emigrants from Canada that, in the period 1921–24, persons from Canada who were not born in Canada would be permitted to enter the United States as immigrants if they had resided in Canada for five years. Consequently, those persons who left Canada to enter the United States in 1921–24 must have begun their residence in Canada five years previously, which would make them immigrants to Canada in a decade prior to 1921. Commencing in fiscal year 1925 (July 1, 1924 through June 30, 1925), emigrant aliens from Canada who were not born in Canada or Newfoundland were required to enter the United States on their respective national quotas as emigrants to the United States. In this case, therefore, emigrants from Canada, who were not born in Canada, entering United States over the fiscal years 1925–31, amounted to 78,962 persons. These quota immigrants from Canada could have arrived in Canada in the 1920's or in earlier decades. The technique of using the census stock as of 1931 is, therefore, not invalidated in a significant degree by a flow-through of persons immigrating to Canada and emigrating from Canada to the United States in the decade 1921–31.

Data on the male immigrant *labour force* recorded as having entered Canada in the period 1921–31 as of the *1931 Census of Canada* were not broken down by age and occupation. Consequently, the age distribution of male immigrants in the *population*, reported in the *1931 Census of Canada* (Vol. I, Table 29, p. 624), was used to derive the total number of male immigrants in the 25–64 age group. The figure obtained on this basis is 265,620. Male labour force immigrants for the period 1921–31 were recorded only for the age group "10 years and over". By assuming that the labour force age effectively ended with 69 years, the ratio of male immigrant labour force aged 10–69 to male immigrant population aged 10–69 was calculated to be 88.73 per cent. On this basis, it was estimated that 88.73 per cent of the

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[1] *1931 Census of Canada,* Vol. I, Table 29, p. 624.

265,620 persons in the male immigrant population aged 25–64 were in the male immigrant labour force of the same age, yielding a figure of 235,685. The distribution of this figure by occupations was assumed to be the same as that of the immigrant male labour force of all ages *(1931 Census of Canada*, Vol. 7, Table 45, p. 372). It was necessary to reclassify certain occupational groups in the 1931 Census for reasons of comparability with the 1961 occupational groups. The main reclassification involved determining the managerial occupations in the 1931 Census which were listed in each major occupation rather than separately.

The age distribution of the male immigrant labour force, 25–64 years of age, was derived from the age distribution of the male immigrant population *(1931 Census of Canada*, Vol. 1, Table 29) as follows: 25–34, 59.51 per cent; 35–44, 26.77 per cent; 45–54, 10.30 per cent; 55–64, 3.42 per cent. In the absence of any further information, this age distribution was applied to each occupational group. The distribution by occupational groups was estimated as follows: managerial, 3.53 per cent; professional, 2.82 per cent; clerical, 2.15 per cent; sales, 3.28 per cent; service, 5.67 per cent; transportation, 5.13 per cent; farmers, 30.08 per cent; loggers, 2.00 per cent; fishermen, .48 per cent; miners, 4.27 per cent; craftsmen, 18.23 per cent; labourers, 21.90 per cent; occupations not stated, nil.

The distribution of years of schooling of this immigrant male labour force was estimated again from Appendix Table A–2 by moving each age group back 30 years. For example, males in a given occupation in the 1961 age group of 55–64 would have been 25–34 in 1931. The three age groups older than 25–34 were each assigned the educational attainments of persons in 1961 who were 65 years and over. The effect of using the years of schooling of the 1961 age group "65 years and over" on the 45–64 age groups in 1931 could involve some overestimate of their years of schooling attained. Since the same step was necessary with respect to emigrants, the net migration result would not be affected to a significant extent. However, the adjustment of the educational attainments to the "gross labour force" in Appendix Table A–4 by net migration is overstated to the extent that the older age groups among the migrants were assigned an educational achievement larger than the average educational achievement of the labour force in 1931. The *educational attainments* of the labour force by occupation in earlier decades was based on moving back the occupation-age groups shown in Appendix Table A–2, while the educational attainments of the total male labour force was calculated from the cohort analysis shown in Appendix Table A–4. The extent of the overstatement is not large, however, since the variation in the median years of schooling of the four age groups within the labour force aged 25–64 was small. Assignment of the educational attainment of the 1961 "65 and over" age group to the 35–44, 45–54 and 55–64 age groups likely gives a slightly lower attainment to the 35–44 age group than merited, since the 65 and over group is an open-end class interval. The median years of schooling of the 35–44 age group in the total labour force, estimated from the cohort analysis, was 8.1 years; for the 45–54 age group, 7.9 years; and for the 55–64 age group, 7.4 years. It therefore appears that in only the oldest age groups would there be a significant overstatement of educational attainment involved by assigning this group the same educational attainment as the 35–44 and 45–54 groups. The numerical size of the oldest age group, however, was very small, constituting only 3.4 per cent and 5.3 per cent of the total immigrants and emigrants in the period 1921–31. Finally, the

two youngest groups, aged 25–34 and 35–44, constituted 86 per cent of the immigrants and 79 per cent of the emigrants in the 1920's, and the educational attainment assigned these age groups did not overestimate their years of schooling. We conclude that the adjustment of the gross labour force in 1931 by net migration in Appendix Table A–4 involves only a minor over-adjustment of educational attainments.

### Emigration to the United States, 1921–31

The total number of emigrants to the United States from Canada and Newfoundland as the country of last permanent residence was 874,384 in the period July 1, 1921 through June 30, 1931, according to the U.S. Department of Labor, *Annual Report of the Commissioner General of Immigration* (fiscal years 1921–31). Based on information available for each of the ten years, 55.6 per cent, or 486,199, of this total were males of all ages. Information on the age distribution of these male emigrants from Canada and Newfoundland to the United States was not available directly from any of the published statistical tables in the *Annual Reports of the Commissioner General*, although in the years 1929 and 1931 the text of these Reports noted that of the total emigrants entering the United States from Canada (approximately the same figure as the total immigrants from Canada as the country of last permanent residence), 53 per cent were males 22 years and over in 1929, and 42.26 were males over 22 years in 1931. The proportion of males and females 22 years and over was given as 61.89 per cent in 1928, 62.5 per cent in 1929, and 62.7 per cent in 1931 (all references are to fiscal years), from which it can be concluded that the age distribution of males and females together is not a satisfactory guide to the age distribution of males in these three years, particularly since the proportion of adult males in this group changed significantly with the advent of the depression. While the records show that 53 per cent of emigrants from Canada to the United States were males 22 years of age and over, this information is available only for 1929. Consequently, a further choice was to consider the age distribution which was given in the *Annual Reports* for the years 1925–31 of all English male immigrants to the United States from every country, the largest proportion of which were likely from Canada as the country of last permanent residence. Of 128,941 male English emigrants to the United States from all countries during the period 1925–31, 62.27 were males 22 years and over. Unfortunately, similar information was not available for 1924 (or earlier years of the decade), which was the year of largest emigration from Canada and Newfoundland to the United States in that decade; 200,690 persons emigrated to the United States in that year from Canada.

The lack of an age distribution for males in 1924 and in the earlier years back to 1921 meant that 364,511 (42 per cent) of the total emigrants of 874,381 could not be taken into account in the derivation of the number of males 25–64 years of age. But, since emigration to the United States was so large, other indirect evidence was used to derive the number of male emigrants aged 25–64. Known data indicate that, for the period July 1, 1921 to June 30, 1931, the proportion of males of all ages emigrating to the United States from Canada rose from 51.7 per cent in 1921–22 to the maximum of 59.6 per cent in 1924, and gradually declined to 51.5 per cent in 1929–30, falling to a low for the decade of 41.6 per cent in 1930–31.

The known comparable figure for males "22 years and over" of 53 per cent in 1929, therefore, appears in a year when the proportion of males of all ages was low. The 1925–31 estimated proportion of 62.7 per cent for males "22 years and over", based on persons classified as English in the U.S. immigration statistics, is higher than the proportion for males in all age groups in this period. It is possible that English emigrants to the United States consisted of relatively more males due, possibly, to smaller size families and fewer dependents, and this may also have been the case for total emigrants from Canada to the United States. The proportion of males in English migrants to the United States was accepted for this study. Correcting for the inclusion of males aged 22–24 in the data, by assuming that the age group 22–29, obtained from records on immigrants classified as English, had an equal number in each year of age, the total number of male emigrants from Canada to the United States aged 25–64 in the period 1921–31 was estimated as 51.66 per cent of all males (486,199), or 251,170. The male labour force 25–64 years of age, as estimated, therefore, accounted for 28.7 per cent of the total emigrating population of 874,381 leaving Canada to reside in the United States — a proportion somewhat higher than in later decades as could be expected from the proportion of males in the emigrant population.

The most difficult question to be determined in arriving at a tenable estimate of Canadian net emigration to the United States in 1921–31 is the variance in the estimates of Canadians returning from the United States in this period. It was not possible within the scope of this study to solve this problem, and consequently our procedure was to prepare two alternative methods of "returning Canadians". If we accepted the data on returning Canadians from the United States presented in *Historical Statistics of Canada* (Series A338-341, p. 29), then, for the seven calendar years which are available in that series for 1925–31, the total of returning Canadians was 260,917, or an annual average of 37,274. Method 2 of this study uses this annual average for the 10-year period 1921–31. By applying this average, returning Canadians would then have amounted to some 372,740 persons of all ages, male and female. Total emigration from Canada and Newfoundland to the United States from 1921–22 through to 1030–31 was recorded as 874,381, so that net emigration (after deducting the above estimates of returning Canadians) to the United States was an estimated 501,641.

In Method 1, on the other hand, we assume that *all* the alien emigrants and naturalized citizens leaving for Canada and Newfoundland from the United States were returning Canadians. Alien emigrants leaving for Canada and Newfoundland were 12,402, a combined total of 42,043 in the period 1921–31 *(Annual Reports of the Commissioner General of Immigration)*. Of the total emigrants from Canada to the United States in the period 1921–31 of 874,381, therefore, 4.18 per cent. were regarded as returning to Canada. Male emigrants aged 25–64 of 251,170, less 4.18 per cent, yielded an estimate of net male emigrants to the United States of 238,357 recorded in Appendix Table A-5.

The investigator is left with the alternatives that either the data provided in *Historical Statistics of Canada* are incorrect (perhaps due to some confusion over the U.S. immigration categories of immigrant alien, non-immigrant alien, emigrant alien and non-emigrant alien), or that the U.S. Immigration Service was unable to record properly the departure of aliens who were originally Canadian citizens,

emigrated to the United States, continued to reside there as aliens, or became naturalized citizens, and then eventually left again for Canada. While the departure of emigrant aliens or naturalized citizens was not recorded by country of birth in the U.S. statistics for the period 1921—31, the total aliens and naturalized citizens who left for Canada must have included the Canadian-born who left the United States to return to Canada. Of course, not all of the aliens or naturalized citizens departing for Canada would be Canadian-born. The *Annual Reports of the Commissioner General of Immigration* indicate that total alien emigrants to Canada and Newfoundland in the period 1921—31 amounted to 29,635; presumably, not all of these were of Canadian birth. In addition, naturalized citizens (originally immigrants to the United States) who left for Canada and Newfoundland amounted to 12,408. Added to the above figure, a total of 42,043 is obtained. It is not clear what proportion of these two categories of immigrants to Canada from the United States were actually returning Canadians. However, the 1920 *Report of the Commissioner General of Immigration* indicated that, in the two-year period 1918—19 and 1919—20, Canadian citizens returning to Canada totalled 17,718 out of a sum of 25,993, which included 8,275 other aliens leaving for Canada, while in another tabulation for 1919—20, according to U.S. Immigration Reports, emigrant aliens departing for Canada consisted of 18,394 Canadian citizens and 5,496 other aliens. It is possible, then, that emigrant aliens departing from Canada in the period 1921—31 comprised mainly Canadian citizens returning to Canada. A record of immigrants to Canada leaving the United States as "aliens" was available in the Annual Reports of the Commissioner General of Immigration, which indicated that over the fiscal year period 1911—31, the total number declined very sharply from 49,373 in 1911 to 5,456 in 1921, and eventually to 2,895 in 1931. This 20-year record of aliens departing for Canada diverges very markedly from the record of returning Canadians provided in *Historical Statistics of Canada*.

In Method 2, noted above, returning Canadians were estimated as 372,740 for the 10-year period. Therefore, of total emigrants of 874,381, 501,641 were estimated in Method 2 as net emigrants to the United States in the period 1921-31. Returning Canadians amounted to 42.63 per cent of emigrants, and this ratio was used to reduce total male emigrants aged 25—64 by 107,074, yielding an estimate of 144,096 males aged 25—64 emigrating to the United States in 1921—31, net of returning Canadians; this figure is recorded in Appendix Table A—6. The estimates of Method 1, however, were used in this report and the results are shown in Appendix Tables A—4 and A—5.

The age distribution of 25—64-year-old male emigrants to the United States was estimated as follows for both Method 1 and 2: 25—34, 52.05 per cent; 35—44, 26.71 per cent; 45—54, 15.93 per cent; 55—64, 5.31 per cent. As in previous decades, it was assumed that this age distribution applied to each occupational group, since no age distribution by occupation of these emigrants to the United States was available. On the basis of *Annual Reports of the Commissioner General of Immigration* for the fiscal years 1925—31, it was estimated that the distribution of occupations for male emigrants to the United States from Canada was as follows: managerial, 2.34 per cent; professional, 5.82 per cent; clerical, 8.74 per cent; sales, 2.58 per cent; service, 4.32 per cent; transportation, 1.86 per cent; farm and farm workers, 15.33 per cent; fishermen, etc., 1.09 per cent; miners, 1.24 per

cent; craftsmen, 30.15 per cent; labourers, 19.44 per cent; occupations not stated, 7.09 per cent.

As in previous decades, the estimates of the years of schooling by occupation of the emigrants to the United States was obtainable on the basis of data in Appendix Table A–2. Each earlier decade required a further reliance upon the 1961 "65 and over age group". For example, males who were 55–64 years in 1961 would have been 25–34 in 1931. The years of schooling of the remaining age groups were also derived on the basis of the years of schooling possessed by the age group "65 and over" in 1961 – an assumption which slightly overestimates the educational attainments of the 1921–31 emigrants to the same extent as the 1921–31 immigrants. The results of this operation are shown in Appendix Tables A–5 and A–6.

### Emigration to the United Kingdom, 1921–31

In the period July 1, 1921 to June 30, 1931, a total of 141,644 persons emigrated from Canada to the United Kingdom, as recorded in *Board of Trade Journals* for this decade. These persons had arrived directly by sea, and had residence in Canada for at least 12 months preceding entry into the United Kingdom. On the basis of Board of Trade records for the period 1921–29, 70,185 of this total, or 53.58 per cent, were males. Of these males, 59.51 per cent, or 41,696, were 25 years and over. The *Board of Trade Journal* age distributions did not provide the same class intervals as were used in this study. The given figures were converted to class intervals used in this study, on the assumption that persons were equally distributed in each year in a given age interval. On this basis, the male age distribution was estimated as follows: 25–34, 38.40 per cent; 35–44, 30.22 per cent 45–54, 23.54 per cent; 55–64, 7.84 per cent.

According to *Board of Trade Journal* data for the years 1924–29, the following occupational distribution was recorded for emigrants from Canada to the United Kingdom: managerial, 2.34 per cent; professional, 5.82 per cent; clerical, 8.74 per cent; sales, 2.58 per cent; service, 4.32 per cent; transportation, 1.86 per cent; farm, 15.33 per cent; fishermen, 1.09 per cent; miners, 1.24 per cent; draftsmen, 30.15 per cent; labourers, 19.44 per cent, occupations not stated, 7.09 per cent. This distribution was applied to the whole decade 1921–31. The educational characteristics by years of schooling for these male emigrants to the United Kingdom was derived in the same manner as for emigrants to the United States in the same period.

### Immigration and Emigration, 1911–21

Total immigrant arrivals in Canada July 1, 1911 through June 30, 1921, were estimated at 1,812,836 from the *Canada Year Book 1926* (p. 171). On the other hand, the 1921 Census indicates that there were 854,890 persons in Canada at that time who reported to have immigrated to Canada during 1911–21. The implied "disappearance" of immigrants amounts to the remarkably high figure of 957,946. Deaths would explain only a very small portion of this reduction. No information is available to determine to what extent these immigrants returned to their original country or re-emigrated to other countries, such as the United States. It is possible

that a large proportion of these persons represented a flow of migrants via Canada on their eventual way to the United States. In view of the apparently easy illegal entry to the United States from Canada in this period, the actual number entering the United States may have been quite large.

Recorded emigration from Canada to the United States in the period July 1, 1911 through June 30, 1921, amounted to 363,208 persons, according to the *Annual Report of the Commissioner General of Immigration*. It was concluded that for this decade a more reasonable approach to estimating male labour force net migration would be to base the computations on the estimates of total immigration and emigration. Estimates of Duncan McDougal, "Immigration into Canada, 1851–1920", *Canadian Journal of Economics and Political Science* (May 1961, Table 3, p. 172) gave immigration as 1,373,000 and emigration as 1,067,000 in the period 1911–21; this implies a net inflow of 306,000 persons. These estimates were accepted as the starting point for calculating the years of schooling of the 25–64-year-old male emigrant labour force for the decade 1911–21.

The 1921 Census reports that 52.1 per cent of the immigrants who had entered Canada 1911–21 were males. An age distribution of the 1911–21 immigrants was not available from the 1921 Census, and consequently this information was derived from the *1931 Census* (Vol. I, Table 29, p. 624), which reported male immigrants by age groups who were in Canada in 1931 and who reported to have arrived in Canada during 1911–21. These age groups were moved back a decade so that, for example, immigrants who were 35–44 in 1931 were taken as 25–34 years of age in 1921. On this basis, the following age distribution of 1911–21 immigrants was estimated: 25–34, 52.4 per cent; 35–44, 31.23 per cent; 45–54, 12.01 per cent; 55–64, 4.36 per cent. The labour force participation rate for males in the 25–64 age group was taken as 88.7 per cent – the same proportion as computed earlier for the 1921–31 immigrants. The occupational distribution of male immigrants aged 25–64, who had arrived during 1911–21, was derived from the occupational distribution of male immigrants who reported in 1931 to have arrived in Canada in 1911–21 (*Census of Canada, 1931*, Vol. 7, Table 45, p. 372).

On this basis, the number of male immigrants 25–64 years of age in the period 1911–21 was estimated as 395,710. The breakdown of this figure by age and level of schooling is shown in Appendix Table A–5.

The characteristics of emigrants from Canada to the United States were used for describing the labour force emigrating from Canada to all countries in the period 1911–21. Data on the age distribution and occupational distribution of emigrants from Canada to the United States and the United Kingdom were not available for this period, and the age distribution and occupational distribution of the decade 1921–31 for emigrants from Canada to the United States were used as a substitute. On the basis of 1921–31 estimates of emigrants to the United States, 51.6 per cent were males aged 25–64, of which 88.73 per cent were assumed, on the basis of Canadian labour force participation rates, to be in the labour force; this yields an estimate of 323,582 male emigrants aged 25–64 from Canada to all countries. On the basis of these extremely rough calculations, net labour force migration into Canada during the decade 1911–21 totalled 71,528 males aged 25–64.

The distribution of years of schooling of both immigrants and emigrants was estimated again from Appendix Table A–2 in the same manner as that of the labour force migrants of the 1920's, except that the educational attainments of the 1961 age group "65 and over" were applied to all 1911–21 net male immigrants aged 25–64. Since the 1961 age group "65 and over" would have been "25 and over" in 1921, the educational attainment assigned to the 25–34 age group was probably slightly understated. The age groups 35–64 were assigned an educational attainment which likely overstates to some extent their actual attainment. The data from the cohort analysis given in Appendix Table A–4, supplemented by estimates of specific years of schooling, provided the basis for estimates of the median year of schooling by age groups for 1921 as follows: 25–34, 8.1 years; 35–44, 7.9 years; 45–54, 7.4 years; 55–64, 6.9 years. While the differences in the median year by age groups was less pronounced than in later decades, the assignment of the same educational attainment to each age group resulted in a small overestimate in the education of the net immigrants added to the labour force in 1911–21.

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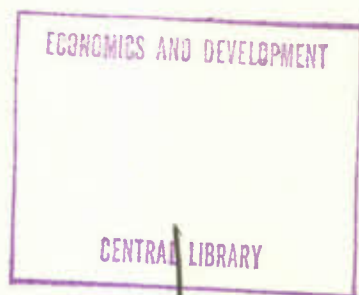cherche industrielle et
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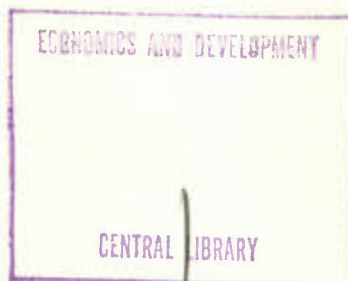
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