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Expenditures, Output and Productivity in Canadian University Education

by

Walter Hettich

prepared for the
Economic Council of Canada

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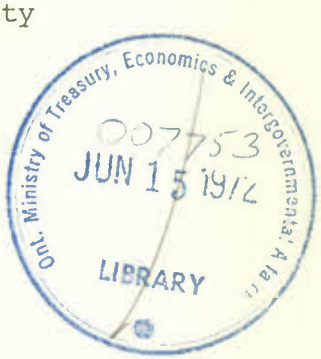

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FOREWORD

Rising living standards in modern societies are associated with rising consumer demands both for new products and for services such as health care, education and recreation. Since the end of the Second World War, Canada has become a predominantly urbanized, service-oriented society. The service industries have increased their share of Canadian employment from about 40 per cent in 1946 to about 60 per cent at the present time.

In its *Seventh Annual Review*, published in September 1970, the Council analysed growth and productivity change in the service sector. Health care and higher education, the two areas which had experienced the most rapid expansion, were singled out for special attention.

In 1969 the Council requested Prof. W. Hettich to prepare a study on inputs, output and productivity change in the university sector, in order to provide information and an analytical basis for the *Seventh Annual Review*. In addition it was felt that the development of a conceptual framework broad enough to encompass a large and representative group of universities, and the presentation of data for such a group of institutions, would be useful to further research. The Council is fully aware, of course, that the economic aspects are not the only ones relevant for policy formulation in education. Analysis of how effectively resources are used in the educational sector is important, however, and is becoming increasingly more so with the tremendous growth in the volume of productive resources being allocated to education.

As is the usual practice with a study commissioned by the Council, the contents are the responsibility of the author. Publication under our auspices means that the Council considers the present study to be a worthwhile contribution to public knowledge and to the understanding of key economic issues.

Arthur J. R. Smith
Chairman,
Economic Council of Canada

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Finally, I would like to thank the Economic Council of Canada for initiating and sponsoring this Study and for maintaining a constant interest in the research while it was in progress.

CHAPTER 1

INTRODUCTION

Three years ago a conference attended by economists and statisticians and organized by the National Bureau of Economic Research was held in Ottawa. The participants met to discuss a group of topics summarized in the title "Production and Productivity in the Service Industries". Work for the conference grew out of the realization that the services have been a neglected area of economic research. Yet it is a well-known fact that the service sector in the developed countries has been expanding more rapidly than the primary or manufacturing industries, which have traditionally received more attention.

The service sector includes a wide range of economic activities. Important service industries, such as banking, insurance and retail trade, form part of the private sector. A second group of activities, equal or larger in size, is carried out in the public sector or provided by nonprofit organizations that receive governmental support. It is in the public sector that services have expanded most rapidly in recent years. In Canada, health and education are among the major growth industries. Expenditures in both areas have expanded faster than GNP throughout the 1960's -- a trend that is expected to continue into the present decade.

The researcher who tries to deal with production processes or productivity in the service industries must face a host of problems not encountered elsewhere. A reading of the papers and proceedings from the Ottawa conference makes it clear that any discussion of productivity in the services runs head on into the question of output measurement.[1] While the conceptual and statistical difficulties that must be solved to measure output in an industry such as banking are considerable, the problems can become truly formidable when we study productivity in the public sector where most services are not

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[1] Victor R. Fuchs, ed., *Production and Productivity in the Service Industries*, National Bureau of Economic Research, Studies in Income and Wealth, vol. 34 (New York: Columbia University Press, 1969).

marketed or sold. Measurement problems go far in explaining the relative neglect of the service sector.

Despite the difficulties that pose themselves, work on productivity in the service industries is necessary and should proceed. While early attempts may have to resort to crude measures, it seems imperative to evaluate the performance of a sector that makes a steadily growing claim on the nation's resources. Research on productivity trends in the public sector is particularly needed, both because public funds are involved and because the statistical and conceptual basis for informed discussion is often lacking. As long as their limitations are kept in mind, even rough and ready measures can be helpful.

It should perhaps be pointed out that research on productivity in the public sector cannot use the national income accounts as its statistical basis. The approach used in the accounts relies mainly on the costs of inputs to serve as estimates of output when dealing with nonmarketable goods and services. Clearly, it is not possible to relate output to inputs if we cannot measure output independently. The lack of a readily available statistical base suggests that it is best to deal with a particular component of public service output at a time. By limiting himself to a specific industry or activity, the researcher is most likely to make a useful contribution.

Output and Productivity in University Education

Higher education occupies a dominant place in the public sector. In Canada, higher education has been passing through a phase of very rapid development and expansion. Most of the available statistical indices -- enrolment, degrees, faculty members, investment in buildings and equipment -- have grown at annual rates of 10 to 15 per cent or more during the past decade. Nor has the period of expansion come to an end. Enrolment projections point to further growth for the 1970's. While the population of college age will increase at a slower rate than in the recent past, a growing proportion of young people in the relevant age group will go on to college or university.

In Canada, institutions of higher education are financed predominantly through public funds. As a result, higher education has claimed a steadily growing share of provincial budgets and intergovernmental transfers. To understand its full impact, one must look beyond public budgets, however. Resource use includes the economic value of student time, usually measured by forgone earnings. If we take *total* resource use as the criterion, higher education ranks as a major industry. It has been estimated that activities related to universities and colleges in Canada now account for about 5 per cent of aggregate national economic activity.[1]

In spite of the economic importance of higher education, little research on performance or productivity has been undertaken so far. As one observer recently remarked: "It is surprising how little and how spotty has been the professional economic analysis of the main working base of academic economists."[2] One should point out, perhaps, that work is hampered by a lack of statistical information on the operation of universities and colleges. In addition, there are certain gaps in the published data on student enrolment and degree production. Considerable resources are needed to assemble the data required for productivity research.

The present Study is an attempt to extend productivity analysis, as traditionally applied at the industry level, to the Canadian university sector. Our main interest is in productivity *trends*, i.e. movements in the ratio of total output to total inputs. In dealing with the university sector, we distinguish between two main activities: instruction and research. No attempt is made to evaluate productivity trends in research activity; the analysis is confined to instruction only. Spanning the years 1956-57 to 1967-68, the Study covers the recent period of rapid expansion in the university sector. It throws light on a central and much asked question: How has productivity been affected during the rapid increase in student enrolments?

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[1]David W. Slater, "Economics of Universities and Colleges", Notes for Presentation to the Meetings of the Canadian Economic Association, Winnipeg, 4 June 1970.

[2]*Ibid.*, p. 1.

Together with the analysis of productivity trends, the Study also pursues a second purpose. We have mentioned the data problems that beset the researcher in this area. The difficulties existing in the matching of information on inputs with information on output may serve as an illustration. To date, statistics on student enrolments and degree production have been published for a different sample of institutions than that used for statistics on university operating expenditures. Thus it has not been possible to match the two sides of the production process without considerable guesswork. In the present Study we develop a set of statistical data which are consistent and which, at the same time, apply to a large and broadly representative group of 49 Canadian universities. All major tabulations of data are given for the group of 49 institutions as a whole, as well as for regional groupings in the Atlantic Provinces, Quebec, Ontario, the Prairie Provinces and British Columbia.[1] It is hoped that this information will be of use to other researchers interested in the economics of education.

While little or no work on productivity in higher education has been carried out in Canada, we have a pioneering study on productivity trends in British university education that points the way to research in other countries.[2] As mentioned, the most difficult problems generally arise in defining and measuring output. These problems are compounded in education where the production

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[1]The sample was chosen to be representative in the last year of the period covered, 1967-68. All the larger universities in existence at that time were included, together with most medium-sized ones. Nine new universities were added as they came into existence. The sample also contains a good representation of small institutions. (It does *not* include any community colleges, however.) It is estimated that the institutions covered in the Study account for 85 per cent of total enrolment in Canadian universities and degree-granting colleges. All institutions are listed in Appendix D, together with the years in which data on their operation have been included. The same Appendix also contains a discussion of the problems encountered in matching statistics on operating expenditures with those on enrolment and degrees.

[2]Maureen Woodhall and Mark Blaug, "Productivity Trends in British University Education, 1938-62", *Minerva*, vol. 3, no. 4, Summer 1965.

process is poorly understood and where intangible elements can play an important role. The authors of the British study, Maureen Woodhall and Mark Blaug, cut through the Gordian knot by postulating that universities produce two types of output -- graduates and research. This assumption, which will be examined in detail in the second chapter, also provides the basis for the present Study. In addition, we follow the two British authors in their treatment of research. Since no quantitative measure of research output is available, we limit ourselves to measuring productivity change as it relates to graduates. Taking an independent study conducted under the direction of the Association of Universities and Colleges of Canada as our starting point, we proceed to estimate the costs of creating research for the sample of 49 institutions. These costs are then subtracted from aggregate expenditures. They are thus excluded from the final index of inputs that is used to calculate the desired measure of productivity change.

While the conceptual framework has been derived largely from the British study, a major modification had to be introduced. Data on university expenditures are available on an annual basis only. They apply to the institution as a whole and are related therefore to enrolment rather than to the number of graduates. In an educational system that is undergoing rapid and uneven growth, the ratio of graduates to the total student body will change from year to year. This means, in turn, that there is no simple relation between inputs, as measured by university expenditures, and output, as defined in our Study. The resultant matching problem, perhaps the most interesting aspect of the analysis, will be dealt with in a separate chapter. A model of student flows will be presented and used as a basis for the adjustment of inputs so as to make them comparable to annual measures of instructional output.

The material of the Study is organized into six chapters. First, we deal with the definition and measurement of output (Chapter 2). This is followed by a chapter on inputs and resource use in the university sector. The procedure of adjusting inputs for system growth is explained in Chapter 4. Finally, we present productivity indices and a discussion of results. The Study ends with a brief chapter of conclusions.

CHAPTER 2

THE MEASUREMENT OF OUTPUT

One can divide the activities carried on in universities into two major categories -- instruction and research. Both terms must be interpreted broadly. Instruction stands for all activities associated with the teaching and learning process. It results in the formation of human capital, one of the main outputs of universities. Research activity, on the other hand, leads to the creation of new knowledge. In addition, it includes the management of the existing stock of knowledge, which must be kept accessible in order to retain its usefulness.

Graduates as a Measure of Output

Economists have generally looked on education as an investment process. By attending university, students acquire knowledge and skills that remain useful for many years after graduation. In benefit-cost analysis -- the most common approach to education taken by economists -- it is assumed that such skills carry over directly into the labour market, resulting in higher earnings for university graduates. Benefit-cost studies have estimated rates of return on investment in human capital through education by combining statistical information on income streams, level of education, and the expenditures associated with schooling.

While the investment aspect of higher education has attracted the most comment, one should also draw attention to the long-term consumption benefits that result from education. Some skills acquired at university, such as skills in foreign languages, sports, music, and the arts, may not be directly useful in the labour market -- at least not for those students who do not specialize in these fields. Yet they may allow the educated person to enjoy a wide range of leisure activities which remain closed to others lacking such skills. Education is both an investment good and a consumer durable. Both the skills useful in the labour market and those enhancing consumption are part of human capital formation.[1]

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[1]One should perhaps also mention the immediate consumption benefits that students enjoy from attending university. No doubt, there are aspects of college life that have entertainment value.

It has often been suggested that education creates social benefits or externalities in addition to the private benefits mentioned so far. Such benefits cannot be captured by the individual himself but accrue to society at large. Thus it has been claimed that the presence of an educated or skilled person may raise the productivity of those working with him on the same project or task. A somewhat different argument relates externalities to the quality of political and social life. In Canada, it is felt, for example, that a widespread knowledge of both official languages will lead to an improvement of the political process. While social benefits are often discussed in the literature, they have not so far been integrated into the quantitative work on the economics of education. Their intangible nature renders them elusive to the researcher who is trying to measure actual benefits.

The discussion would seem to suggest that the concept of human capital formation provides the most promising approach to the measurement of output in education. It has been pointed out that our Study deals with university education at the industry level. The goal is to measure total output or value added for the industry on an annual basis. The work on human capital would suggest that the total formation of human capital in a given year should be defined as the system's output from instructional activities.

Unfortunately, it is not possible to quantify such a concept of output for the system as a whole. To make use of the available statistical information, we must adopt a simpler measure. While we cannot estimate the value of the human capital being created, we can count the students who leave the university system, carrying the knowledge and skills that they have acquired with them into the labour market. Thus our index of output is based on the number of graduates produced by the system each year. In addition, we adopt a weighting procedure reflecting the market value of different degrees.[1] Our output measure thus reflects both quantity and relative prices.

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[1]Some graduates, most of them women, will not enter the labour force. In calculating our weighted measure of output, we abstract from this problem, treating all graduates as entrants into the labour market.

The use of degrees as a measure of output gives rise to some problems of interpretation which should be briefly mentioned. (They will be dealt with in more detail in Chapter 5.) We are interested primarily in tracing productivity change over time. Ideally, we would like to base our analysis on a unit of output that remains constant over the years. Does a degree in engineering, science or liberal arts represent the same thing in 1967-68 as it did in 1956-57? The answer is difficult to provide. If we consider that a degree is a composite unit of output containing some investment in human capital, some durable consumption benefits, some immediate consumption which was enjoyed in the years preceding graduation, and a component of external or social benefits, we have to realize that any one of these elements could change over time. In addition, the balance among the four components may alter. It is impossible to measure such changes in a quantitative manner. In the analysis of productivity indices in Chapter 5, we shall advance some indirect evidence to throw light on possible changes in the unit of output.

Growth in the Number of Degrees

Between 1956-57 and 1967-68, the number of degrees granted annually increased very rapidly. This can be seen from Table 2-1 where data on degree production are presented for the group of 49 universities. (Statistical tables giving the same data for the five regions are contained in Appendix E.) As is apparent, the composition of total degree output changed considerably over the 12 years. If we calculate average rates of growth, we notice marked differences between levels of study and among fields or disciplines. Graduate degrees increased more rapidly than undergraduate degrees -- at 16.6 compared with 11.6 per cent. However, very rapid expansion took place in some areas of undergraduate study. The output of general degrees in science grew at an average rate of 16.9 per cent; in arts, at 15.6 per cent. In the honours programs, the rates were 16.1 and 14.7 respectively. Education also showed rapid advance with an average rate of 15.6 per cent. On the other side of the spectrum, we note engineering with a growth rate of only 3.9 per cent. Relatively slow growth also occurred in commerce (9.7 per cent) and the health disciplines (7.6 per cent).

Table 2-1

DEGREES AWARDED AT 49 CANADIAN UNIVERSITIES AND COLLEGES

	UNDERGRADUATE											
	Arts		Science		Applied	Educa-	Com-	Health	Agricul-ture &		Other	
Year	General	Honours	General	Honours	Science	tion	merce	Fields	Forestry	Law	Fields	Total
1956-57	3,428	645	684	254	1,533	1,179	758	1,730	326	463	1,428	12,428
1957-58	3,710	694	747	294	1,683	1,534	844	1,802	350	385	1,442	13,485
1958-59	3,800	816	848	373	1,822	1,625	937	1,814	464	458	1,504	14,461
1959-60	4,507	768	903	428	1,868	1,822	973	1,871	391	487	1,102	15,120
1960-61	4,514	840	1,097	515	2,031	2,120	1,019	2,032	443	494	1,195	16,300
1961-62	5,454	988	1,342	536	1,991	2,628	1,042	2,364	474	521	1,369	18,709
1962-63	6,506	1,384	1,659	563	1,775	3,028	1,118	2,437	483	478	1,466	20,897
1963-64	8,196	1,540	1,937	694	1,926	3,553	1,300	2,691	496	575	1,609	24,517
1964-65	8,749	2,174	2,144	801	1,843	4,521	1,524	3,206	574	611	1,871	28,018
1965-66	10,721	1,742	2,675	867	1,918	4,938	1,662	3,224	565	781	2,044	31,137
1966-67	13,755	1,869	3,182	841	1,999	5,239	1,622	3,391	620	919	1,711	35,148
1967-68	16,347	2,523	3,744	1,229	2,272	5,689	2,041	3,808	663	1,023	1,911	41,250

	GRADUATE				
	Master Level		Doctoral Level		
	Arts & Science	Other	Arts & Science	Other	Total
1956-57	614	667	234	59	1,574
1957-58	611	787	208	59	1,665
1958-59	710	898	201	63	1,872
1959-60	833	1,153	235	51	2,272
1960-61	988	1,290	236	75	2,589
1961-62	1,124	1,677	223	97	3,121
1962-63	1,364	2,028	302	124	3,818
1963-64	1,386	2,084	338	147	3,955
1964-65	1,651	2,309	411	159	4,530
1965-66	2,359	2,798	465	210	5,832
1966-67	2,750	3,467	528	254	6,999
1967-68	3,255	4,077	705	294	8,331

Source: See Appendix D.

The uneven pattern is repeated if we compare rates of growth from one year to the next. Table 2-2 gives annual rates of increase in degree output for the graduate and undergraduate programs. For graduate degrees, the rates vary from 3.6 to 28.7 per cent; for undergraduate degrees, the lowest rate is 4.6 per cent while the highest is 17.4.[1]

Table 2-2

ANNUAL RATES OF GROWTH IN DEGREE PRODUCTION
49 CANADIAN UNIVERSITIES AND COLLEGES

Year	Under-graduate Degrees	Annual Rate of Growth	Graduate Degrees	Annual Rate of Growth	Total Number of Degrees	Annual Rate of Growth
1956-57	12,428		1,574		14,002	
1957-58	13,485	8.5	1,665	5.8	15,150	8.2
1958-59	14,461	7.2	1,872	12.4	16,333	7.8
1959-60	15,120	4.6	2,272	21.4	17,392	6.5
1960-61	16,300	7.8	2,589	14.0	18,889	8.6
1961-62	18,709	14.8	3,121	20.5	21,830	15.6
1962-63	20,897	11.7	3,818	22.3	24,715	13.2
1963-64	24,517	17.3	3,955	3.6	28,472	15.2
1964-65	28,018	14.3	4,530	14.5	32,548	14.3
1965-66	31,137	11.1	5,832	28.7	36,969	13.6
1966-67	35,148	12.9	6,999	20.0	42,147	14.0
1967-68	41,250	17.4	8,331	19.0	49,581	17.6

Source: Table 2-1.

Weighting Degrees

How can we combine degrees in different fields and at different levels into a composite output measure? Since we are seeking a measure reflecting economic valuation in this Study, we look to the labour market for an indication of value. It is well known that university

[1]Annual rates of growth in enrolment also fluctuate, although somewhat less violently. For undergraduate programs, rates vary from 7.9 to 16.8 per cent. Graduate enrolment varies from 11.0 to 33.2 per cent. For a discussion of the data on enrolment, see Chapter 4.

graduates command different starting salaries, depending on what type of degree they hold. Engineers generally earn more than holders of a general arts degree; applicants with a doctoral degree are offered a higher salary than candidates with a master's degree.

In constructing the index of total output, we make use of information on starting salaries.[1] Such data are published on an annual basis by the Department of Manpower and Immigration.[2] In calculating weights, we have used the starting salary of a graduate with a degree in general arts as our base, setting it equal to one. Other starting salaries are expressed as multiples of this base, and degrees in each category are multiplied by the appropriate weight.

Other Components of Instructional Output

In addition to degrees, universities and colleges award diplomas in a variety of disciplines. Information on the number of diplomas granted, by field, was obtained from records made available by the Dominion Bureau of Statistics. The data are presented in Table 2-3. The output of diplomas grew at a rate of 13.6 per cent, slightly below the rate of increase in degrees. It is likely that the recent emergence of community colleges, which offer competing diploma courses in most fields, will slow down the growth of diploma production in universities.

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[1] In theory, the weights should reflect discounted lifetime earnings *differentials* rather than starting salaries. The assumption implied in our discussion is that the two are roughly proportional. Such proportionality would be violated if lifetime earnings profiles were to differ drastically among fields. While there is some variation in the earnings profiles of different graduates, such differences do not seem important enough among the college-educated to affect our conclusions. It would be quite impossible to obtain enough data on lifetime earnings profiles to use these as a basis for the weighting procedure.

[2] A complete list of sources is given in Appendix A.

Table 2-3

DIPLOMAS AWARDED AT 49 CANADIAN UNIVERSITIES AND COLLEGES

Year	Arts and Science	Applied Science	Education	Commerce	Health Fields	Agriculture and Forestry	Other Fields	Total
1956-57	666	231	669	198	1,794	91	1,224	4,873
1957-58	790	273	678	279	1,931	66	753	4,770
1958-59	807	225	475	323	1,900	68	1,151	4,949
1959-60	157	332	228	206	2,165	55	441	3,584
1960-61	210	447	225	207	2,262	71	525	3,947
1961-62	413	163	321	443	2,799	79	1,159	5,377
1962-63	360	161	197	658	2,941	62	1,082	5,461
1963-64	347	180	528	374	3,191	124	1,029	5,773
1964-65	121	199	620	354	3,870	453	1,119	6,736
1965-66	39	179	642	232	1,796	226	560	3,674
1966-67	98	189	812	268	1,565	259	462	3,653
1967-68	91	163	1,340	370	2,246	284	741	5,136

Source: See Appendix D.

Some major difficulties arise when we try to combine the data on diploma output with information on the number of degrees. There are apparently great differences in the requirements for diplomas of various kinds. It is not easy, therefore, to establish some equivalence between degrees and diplomas. Furthermore, we have no data on the starting salaries of diploma-holders. In making our calculations, we have used the somewhat arbitrary rule of counting three diplomas in a given field as equal to one undergraduate degree in the same area of study. For lack of better information, the relative weights derived from starting salaries for degree-holders were applied also to diplomas.[1]

While diplomas can be counted, there is another component of output about which we lack all necessary information. The available education statistics contain no data on withdrawals, i.e. students who complete part of a degree program but do not remain to earn their degree. The education obtained by these students obviously has some value; human capital is being created while they attend university. Ideally, we should adjust our index of output upwards to account for withdrawals.

While no official statistics exist, it would be possible to make some rough estimates of withdrawal rates, based on information from one or two studies at the micro-level. This procedure is followed in Chapter 4, although for a different analytical purpose. Estimates of the level of withdrawal rates will not be enough in the present context, however; it would be necessary, in addition, to draw inferences about changes in such rates over time. To simply adjust output upwards by a fixed percentage will not affect the Study's findings. Only an adjustment that alters the rate of growth in output will have an impact on productivity indices. Since we lack any information on changes in withdrawal rates, we have refrained from making an adjustment in our measure of output.

Measures of Total Output

We are now in a position to construct measures for total output from instructional activities. Four series will be used in the analysis of productivity trends. The first two are unweighted, representing simply the sum

[1]Most diplomas are given at the undergraduate level. It was not possible to separate out those which are awarded for graduate work.

of degrees, and the sum of degrees together with converted diplomas. They will be used as a counterpart to the weighted measures. While the latter two come closer to realizing the concept of output discussed above, they are based on purely economic weights and on weights that reflect only the investment component of degrees. In addition, it should be noted that a simplifying assumption about labour force participation forms part of these measures. Since it is not known how many graduates actually enter the labour market and obtain a position, one must assume that all graduates do so. Our approach thus forces us to treat women who withdraw from the labour force in order to get married and become housewives in the same manner as college graduates with an average labour force career pattern. Since we shall introduce a parallel assumption on the input side, this treatment does not, however, result in inconsistent measurement. The four output series, totalled for the group of 49 institutions, are given in Table 2-4.

Table 2-4

MEASURES OF OUTPUT FROM INSTRUCTIONAL ACTIVITIES

	Sum of		Weighted Sum of	
Year	Degrees	Degrees plus Converted Diplomas	Degrees	Degrees plus Converted Diplomas
1956-57	14,002	15,626	15,814	17,649
1957-58	15,150	16,740	17,075	18,885
1958-59	16,333	17,983	18,421	20,284
1959-60	17,392	18,587	19,645	21,058
1960-61	18,889	20,205	21,364	22,865
1961-62	21,830	23,622	24,619	26,620
1962-63	24,715	26,535	28,143	30,207
1963-64	28,472	30,396	31,595	33,758
1964-65	32,548	34,793	36,481	39,247
1965-66	36,969	38,194	41,716	43,179
1966-67	42,147	43,365	47,654	49,081
1967-68	49,581	51,293	55,727	57,758

Note: Diplomas are counted as one-third of one degree in the same field of study.

Source: Tables 2-1 and 2-3, and Appendix A.

Research

There are many indications that research activity has grown as rapidly as the production of degrees. Unfortunately, there is no readily available statistical material with which this growth can be documented. Some attempts have been made in the past to use the number of publications as an index of research output. A recent compilation shows, for example, that at the University of Toronto the ratio of publications to faculty members has been rising steadily.[1] Although informative, such indices are often hard to interpret. How does one aggregate different types of publications into a single meaningful measure? Should three articles be counted as the equivalent of one book? Does it matter in what journals they have been published? In order to answer such questions in a satisfactory manner, one would need to be acquainted with many fields and disciplines. It should also be noted that information on the number of publications is scattered in a great many different places. The best available sources of information -- the annual reports of universities -- are often incomplete and out of date when published.

In this Study, we make no attempt to construct an index of research output. Instead, we shall try to determine the amount of resources used for the production of research and subtract it from total inputs. The adjustment procedure is discussed in more detail in the next chapter.

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[1]Committee of Presidents of Universities of Ontario, "Brief to the Committee on University Affairs", December 1969, p. 21.

CHAPTER 3

THE MEASUREMENT OF INPUTS

University education is an expensive process, even if we limit consideration to those costs which are borne by the university budget. Yet the budgetary statements of educational institutions, while of interest to the taxpayer, do not account for the total of inputs. To measure total resource use, one must include the contribution of students who, as participants in the educational process, incur both direct expenses and indirect costs. The latter, generally measured by forgone earnings, add up to more than twice the amount spent for the operation of educational institutions. Finally, it is necessary to take account of the resources that derive from the communities in which universities and colleges are located; these institutions generally receive municipal services, necessary for their proper functioning, without paying full compensation. In order to measure productivity, all such resource costs must be added together so that we can contrast total input or resource use with total educational output for the university system.

University Resource Use

The bulk of resources used by educational institutions is reflected in annual operating expenditures. The Dominion Bureau of Statistics (DBS) and the Canadian Association of University Business Officers (CAUBO) both collect and publish information on university expenditures. The researcher who wants to make use of their figures is faced with a number of problems, however. Both organizations publish only the consolidated accounts for a large group of institutions. Since the size of this group is altered over time, the researcher is prevented from establishing a representative historical picture, or from choosing his own sample as a basis for analysis. In the present Study, it has been possible, with the co-operation of the Dominion Bureau of Statistics, to establish time series data on expenditures for a consistently defined sample. This was accomplished by going back to the original questionnaire forms for the years 1959-60 to 1967-68. Beyond 1959-60, use was made of the data collected by the Canadian Association of University Business Officers.[1]

[1]Data sources are discussed in more detail in Appendix B.

Table 3-1

OPERATING EXPENDITURES IN 49 CANADIAN UNIVERSITIES AND COLLEGES

(Thousands of dollars)

Year	Academic and Library	Assisted Research	Adminis-tration	Plant Maintenance	Scholar-ships	Other Expendi-tures	Total
1956-57	42,073	10,072	3,882	9,330	659	2,514	68,531
1957-58	51,583	11,139	4,784	10,535	899	3,112	82,052
1958-59	61,088	14,439	5,264	11,429	1,003	3,254	96,477
1959-60	72,409	18,325	6,101	13,235	1,398	3,857	115,325
1960-61	86,223	20,907	7,234	15,697	1,455	4,824	136,341
1961-62	101,712	26,130	8,711	17,566	1,713	5,919	161,752
1962-63	118,992	29,649	10,173	19,732	2,160	6,079	186,784
1963-64	142,223	35,564	11,782	22,940	3,134	7,011	222,654
1964-65	178,431	47,225	15,946	28,851	4,221	8,349	283,021
1965-66	226,813	60,912	19,616	36,078	7,122	10,323	360,864
1966-67	303,887	79,604	25,602	48,130	8,043	14,623	479,889
1967-68	398,906	103,158	34,124	63,778	8,550	18,275	626,788

Note: "Other Expenditures" include expenditures on alumni affairs, public relations, and placement service, as well as the net deficit on ancillary enterprises and miscellaneous expenses.

Source: See Appendix D.

Table 3-1 presents operating expenditures for the sample of 49 universities. All figures are in current dollars. The table, which is broken down by major category, points to very rapid growth. Expenditures in the largest category, called "Academic and Library", increased at an annual rate of 22.7 per cent. Rates of growth in the other categories are of similar magnitude; average annual increase in total operating expenditures was 22.3 per cent.

Expenditures for Research

We have pointed out that our final measure of productivity will concern instruction only; research, the second major activity in universities, is to be excluded from consideration. As a result, we must find some way of isolating the proportion of resources used for the production of research.

Table 3-1 includes the category "Assisted Research". It consists of those funds which the universities receive from outside sources, mostly from the federal research councils and selected federal agencies, to carry out research projects. It is clear that this item must be removed if we want to identify instructional expenditures. It is equally clear, however, that funds in this category do not tell the whole story. Thus the research councils will support projects through grants that cover research expenses, but they do not, in general, pay the salary of the academic researcher who devotes a part of his time to the project. He is considered an employee of the university which pays him both to teach and to conduct research. Thus a part of his regular salary should be allocated to research activity. A similar argument applies to the use of office space and university facilities.

To conduct a careful study of the allocation of resources between teaching and research is a large-scale undertaking. Not much can be learned from published statistics; information suitable for an analysis of this type must be collected separately from a large number of universities, whose co-operation is required. Such a study must ask questions about the allocation of faculty time among such different activities as teaching, supervision, administration and research. It must deal with the role of research in graduate instruction. Finally, information on the use of university facilities must be analysed.

While it was not possible to make an independent investigation of the allocation of resources between

instruction and research, we were fortunate in obtaining an estimate of total resource use for research from the unit cost study sponsored jointly by the Association of Universities and Colleges of Canada (AUCC), the Canadian Association of University Business Officers (CAUBO), and the Canadian Association of University Teachers (CAUT). This study, which is based on data for 1966-67 from 23 Canadian universities, represents one of the most comprehensive projects yet undertaken. All costs are distributed among three basic activities (instruction, student research and thesis supervision, and research) and broken down by faculty and department. Different methods of allocation are used: salaries are distributed on the basis of a questionnaire on the use of faculty time; plant maintenance is allocated on a per-square-foot basis; expenditures on administration are assigned in accordance with a percentage distribution derived from other direct costs. Expenditures on library facilities and library use are broken down into four categories and allocated according to separate formulas.[1] In this Study, we take all direct and indirect costs assigned to the third activity -- research. It should be noted that our figure of total resource use for research does not include expenditures on student research and thesis supervision.[2]

The authors of the unit cost study prepared, for each institution in their sample, an estimate of total research costs. Our use of these data involved two steps. First, a regression analysis was conducted in order to determine whether research expenditures as calculated in the

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[1]For a more detailed discussion of allocation procedures, see *An Exploratory Cost Analysis of Some Canadian Universities* (Ottawa: Association of Universities and Colleges of Canada, 1970).

[2]Where the division between the two activities was in doubt, respondents were asked to favour research. The instructions contained the following sentences: "It is recognized that there may be difficulty at times in deciding whether the directing of a graduate student's research activity should be allocated to research or to supervision of thesis work. When the research activity of the graduate student contributes to the research program of the faculty member, the larger proportion of the supervision may be allocated to the research programme."

unit cost study were related systematically to other variables describing the institutions. The following regression was fitted:[1]

$$RE = .9172\ AR + .2191\ OE$$
$$\quad\quad (4.870) \quad\quad (7.119)$$
$$\bar{R}^2 = .983$$

The symbols *AR* and *OE* stand for assisted research and total operating expenditures. T-ratios are given in brackets. As the value of $\bar{R}^2$ indicates, the regression is highly successful in explaining variations in total resources for research (*RE*).

Next it was assumed that the relationship fitted for these institutions would apply also to the larger sample including 49 universities. The regression coefficients were taken as given and combined with information on *AR* and *OE* for the larger group. It was estimated that total resources for research amounted to $178,156,000 in 1966-67. The same approach was used in calculating *RE* for the remaining years on the assumption that the relationship between *RE* and the two independent variables did not change over the period. The results of these calculations are presented in Table 3-2.

Table 3-2

ESTIMATE OF TOTAL RESOURCE USE FOR RESEARCH
49 CANADIAN UNIVERSITIES AND COLLEGES

(Thousands of dollars)

Year	Resource Use for Research
1956-57	24,253
1957-58	28,194
1958-59	34,382
1959-60	42,075
1960-61	49,048
1961-62	59,406
1962-63	68,119
1963-64	81,403
1964-65	105,325
1965-66	134,934
1966-67	178,156
1967-68	231,946

Source: See text.

[1]Authorization to use institutional data was obtained from each university included in the regression analysis.

Depreciation and Imputed Interest

University operating expenditures, as reported by DBS and CAUBO, do not include any allowance for depreciation.[1] Yet educational institutions are no different from establishments in the private sector in their use of buildings and equipment. Educational structures, while somewhat more durable than commercial buildings, deteriorate through use and have to be replaced eventually. The same applies to machinery and equipment in universities. In addition, obsolescence may be rapid for certain types of specialized research equipment. In order to arrive at an estimate of total resource cost, one has to make allowance for the use of the capital stock.

Realistic estimates of depreciation are difficult to obtain. The universities have paid little attention to the capital stock in their financial reporting. As a result, the value of buildings and equipment remains unknown for the large majority of institutions.

For the present Study, an attempt was made to build up a capital stock series for the 49 universities, using reported book value and reported insured value. (The results are given in Appendix B.) This series was then compared with one compiled by DBS and the Department of Trade, Industry and Commerce. It was judged that the two series were sufficiently close to be both applicable for the present purpose.[2] In the following analysis, the DBS series has been used since it extends over the whole period, while information on book value and insured value were available only from 1960-61 on. Estimates of depreciation are those made by DBS and are based on an assumed life of 50 years for structures and 20 years for machinery and equipment. A straight-line method of depreciation has been used. Table 3-3 gives total depreciation in current dollars for the 12-year period.

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[1]The questionnaires sent out by the two organizations instructed the responding universities and colleges to include depreciation, if it was charged, among extraordinary expenditures.

[2]The DBS sample includes a number of small institutions which do not form part of the universities and colleges. While depreciation is somewhat overstated as a result, the difference appears to be unimportant.

Table 3-3

DEPRECIATION AND IMPUTED INTEREST
CANADIAN UNIVERSITIES AND COLLEGES

(Millions of dollars)

Year	Depreciation		Imputed Interest	Total
	Build-ings	Equip-ment		
1956	7.80	1.70	21.20	30.70
1957	8.32	1.95	22.75	33.02
1958	9.22	2.20	25.25	36.67
1959	10.36	2.60	28.50	41.46
1960	11.88	3.15	32.85	47.88
1961	13.50	3.85	37.60	54.95
1962	15.40	4.60	43.10	63.10
1963	17.68	5.65	49.85	73.18
1964	20.26	6.85	57.50	84.61
1965	25.58	8.50	72.45	106.53
1966	32.30	10.55	91.30	134.15
1967	37.20	13.20	106.20	156.60

Source: Dominion Bureau of Statistics and estimates by the Economic Council of Canada.

While depreciation estimates reflect the use and deterioration of the capital stock, additional costs are involved in the provision of buildings and equipment. Account must be taken of imputed interest on the funds necessary for capital construction.

There has been much discussion about the interest rate appropriate for analysing government projects, and opinions on the subject remain divided. It is not possible here to summarize the highly technical debate. In our calculations, we have chosen a rate of 5 per cent which places us somewhere between the advocates of low rates for public projects and those who argue for the use of rates derived from the commercial sector.[1] Imputed interest in Table 3-3

[1]Five per cent is approximately equal to the average rate at which provincial governments were able to borrow during the 12-year period. See David Stager, "Monetary Returns to Post-Secondary Education in Ontario", unpublished Ph.D. dissertation, Princeton University, 1968, pp. 85-91, for a more detailed discussion, and for alternate estimates applying to Ontario.

thus consists of an amount equal to 5 per cent of the gross stock of equipment and buildings.[1]

Resource Contribution by Students

Students incur both direct and indirect resource costs by attending university. Direct expenses include expenditures on books and supplies, expenditures for travel to the university, and a differential in living costs for those who live away from home. (Living expenses that would have to be incurred regardless of whether the person is in college or not are not counted as resource costs.)

Indirect expenses arise mainly because students are prevented from earning an income while in school. Forgone earnings are thus a measure of resource costs -- both to the student in his decision-making and to society as a whole, which loses economic output because of smaller labour force.

When we construct estimates of forgone earnings, an interesting question arises concerning the treatment of scholarships or financial assistance. Should forgone earnings be reduced by the amount that students receive in financial support? It is clear that the individual student's opportunity costs are reduced when he receives a scholarship. However, the costs to society are in no way diminished; economic output forgone remains unchanged. This suggests that no adjustment should be made. It also suggests, however, that we must be careful to avoid double-counting. If scholarships are *not* deducted from forgone earnings, it is not proper to include scholarships as an item in operating expenditures. As a result, we have to subtract column 5 in Table 3-1 from the expenditure

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[1] In addition to interest, we should also impute rent on university-occupied land. Unfortunately, there are no records to estimate land values for our group of institutions. It may be noted, however, that some studies have placed the value of land at around 15 per cent of total fixed assets (Stager, *loc. cit.*). As pointed out, the figures used in Table 3.3 are somewhat overstated because the sample of institutions used by DBS in estimating capital stock is more inclusive than the group of 49 institutions. Checks on the data suggest that the difference is in the neighbourhood of 10 per cent. Thus it is reasonable to assume that the estimate of imputed interest in Table 3.3 includes an allowance for imputed rent.

total. In the calculations of resource use that follow, this exclusion has been consistently made.

Table 3-4 presents estimates of direct expenses and forgone earnings in current dollars for the 12-year period. Forgone earnings have been estimated separately for graduates and undergraduates. For graduate students, information on annual starting salaries for college graduates was used. Forgone earnings of undergraduate students, on the other hand, represent the average income of labour force participants in the relevant age group with a completed high school education. An allowance for summer earnings has been subtracted for both graduates and undergraduates.[1] Forgone earnings have *not* been adjusted by sex. Since our weighted output measures do not take male-female salary differences into account, we must base our estimates of wages forgone on data for males only in order to maintain consistency.

Table 3-4

FORGONE EARNINGS AND DIRECT EXPENDITURES OF STUDENTS

(In current dollars)

	FORGONE EARNINGS					DIRECT EXPENDITURES	
		Graduate					
		Master's Level		Doctoral Level			
Year	Undergraduate	Arts and Science	Other	Arts and Science	Other	Undergraduate	Graduate
1956-57	1,921	2,791	3,007	2,947	3,355	271	354
1957-58	2,048	3,010	3,250	3,238	3,658	300	399
1958-59	2,181	3,240	3,504	3,552	3,984	332	449
1959-60	2,323	3,495	3,783	3,903	4,335	367	506
1960-61	2,472	3,760	4,084	4,276	4,720	406	570
1961-62	2,623	4,049	4,397	4,685	5,129	448	642
1962-63	2,756	4,127	4,535	5,099	5,111	466	659
1963-64	2,894	4,226	4,598	5,102	5,246	485	677
1964-65	3,039	4,538	5,006	5,354	5,654	505	695
1965-66	3,190	4,906	5,314	5,782	6,070	526	714
1966-67	3,349	5,499	6,039	6,363	6,975	547	733
1967-68	3,517	5,729	6,365	6,857	7,265	569	753

Note: Forgone earnings are equal to annual earnings minus summer earnings.

Source: See Appendix B.

[1]The estimate of summer earnings takes account of student unemployment during vacation time. For a detailed discussion of methodology and a description of the statistical sources, see Appendix B. Because of data problems, estimates of forgone earnings have not been adjusted for receipts from part-time work.

Resource Contribution by Municipalities

In most communities with a university, the municipal government provides the university with certain services for which no direct reimbursement is received. This includes services such as police and fire protection, both necessary for the functioning of an educational institution and thus contributing to the resource costs of higher education. It may include such additional services as street lighting and snow removal although universities will generally pay the total or part of the costs in this case. Finally, it will include the use of the community's recreational facilities by students if it can be argued that the university would have to provide such facilities in the absence of those existing in the community.

So far, not much work has been carried out on the costs of municipal services provided to universities. A number of institutions were approached for information on the subject, but no publishable statistical data could be obtained. Most universities have not concerned themselves with the problem. Those which have taken an interest have done so because of pressures from the local community and they tend to consider information on the subject politically sensitive.

The estimates used in this Study are derived from data on municipal expenditures in the City of Ottawa, which has two universities within city limits. Total municipal expenditures on those functions which seemed relevant to the operations of the two universities were calculated. A share of these expenditures was then allocated to the two institutions in proportion to the total assessed value of their property.[1] The result -- total resource use from municipal services for Carleton University and the University of Ottawa -- was further divided by enrolment in order to arrive at a per-student cost. Finally, the per-student figure for each year was multiplied by enrolment in all 49 institutions, thus giving an estimate for Canada as a whole. The results of these

[1]Some studies have used estimates of "forgone property taxes" to indicate the value of municipal resource use by universities. This would not be correct in the present context since taxes include redistributive elements. What is needed is a determination of the costs that communities incur in supplying universities with services. For a further discussion of methodology, see Appendix B.

calculations are presented in Table 3-5. While it is clear that the method of estimation is crude, it may be noted that per-student costs, as calculated for Ottawa, did not diverge greatly from the somewhat fragmentary data that were obtained from administrators. However, the topic requires further study and research.

Table 3-5

VALUE OF MUNICIPAL SERVICES
49 UNIVERSITIES AND COLLEGES

(Thousands of dollars)

Year	Value of Municipal Services
1956-57	3,087
1957-58	3,425
1958-59	3,735
1959-60	4,205
1960-61	4,532
1961-62	4,714
1962-63	5,171
1963-64	5,700
1964-65	6,947
1965-66	9,181
1966-67	12,161
1967-68	11,404

Source: See text and Appendix B.

Total Inputs

In this chapter we have discussed the major inputs into the educational production process. Total input is merely the sum of these components. However, before we can compare inputs to output to arrive at a measure of productivity, we must make a series of adjustments to reflect the consequences of growth in the educational system. In Chapter 4 we shall develop the theoretical basis for these adjustments and present the final estimates of resource input.

CHAPTER 4

ADJUSTING INPUTS FOR SYSTEM GROWTH

The main purpose of our Study consists of measuring inputs and output for the Canadian university system and of relating the two in order to arrive at indices of productivity change over time. As outlined in the second chapter, output is defined as the weighted number of degrees or graduates in a given year. Inputs, on the other hand, are measured by total resource use for the system in the *same* year. The major conceptual problem inherent in this approach was summarized succinctly by Tore Thonstad when he discussed the work on productivity measurement by Woodhall and Blaug:

> ... costs in a given year should be compared to the number of pupils in that year rather than to the number of graduates. Suppose, for the sake of argument, that costs per pupil were constant over time. Then the annual costs in relation to the number of graduates would be higher in an expanding system than in a stationary one.[1]

Thonstad's criticism can be stated in a different manner. If output consists of the number of degrees in a given year, we should relate it to a measure of input that includes the total of expenditures necessary for the complete education of the graduating class. It is not correct to relate output to total annual resource costs for the system as a whole.

Unfortunately, it is not possible to estimate the total cost of educating a particular graduating class. Enrolment statistics do not allow us to follow the passage of students through the system from their freshman year to graduation. More important yet, the data on university expenditures are reported only on an annual basis and for the institution as a whole. A breakdown by level (year of study) or by program is not available. The researcher is forced to make use of aggregated annual totals.

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[1]Tore Thonstad, *Education and Manpower: Theoretical Models and Empirical Applications* (London: Oliver and Boyd, 1969), p. 14.

In the present chapter, we develop a simple model of student flows. The model is then used to make an adjustment for system growth. Since Canadian universities have expanded rapidly during the 1960's, the method of measuring inputs used so far overstates the true costs of annual degree production. Inputs as discussed in the preceding chapter must undergo a downward revision.[1]

Inputs and Output in a Stationary Educational System

A stationary educational system may be defined as one that accepts the same number of new students each year. In addition, such a system will have constant retention rates and, as a result, it will produce the same number of graduates each spring. In Figure 4.1 we give a schematic representation of a stationary system. Each year, S new students are accepted. The program lasts three years after which time k_3S students are graduated. The symbols k_1 and k_2 should be interpreted as the retention rates at the beginning of the second and third years. We may note that there are no repeaters in this system; students who withdraw leave the program for good. All those who graduate complete their program within the three-year period.

We may illustrate the operation of the system with a numerical example. Let us assume retention rates of .80 and .70. Then, if S equals 100, 80 students will continue into the second year and 70 into the third. If we assume, in addition, that the value of k_3 equals .65, we know that the system will graduate 65 students in each year, beginning in 1957.

We can now relate the discussion of inputs to the flow of students. We have argued that output (65 graduates in 1957) should be related to the total cost of educating the graduating class (the Class of 1957). At the same time we have pointed out that expenditures and enrolments are available only as annual totals.

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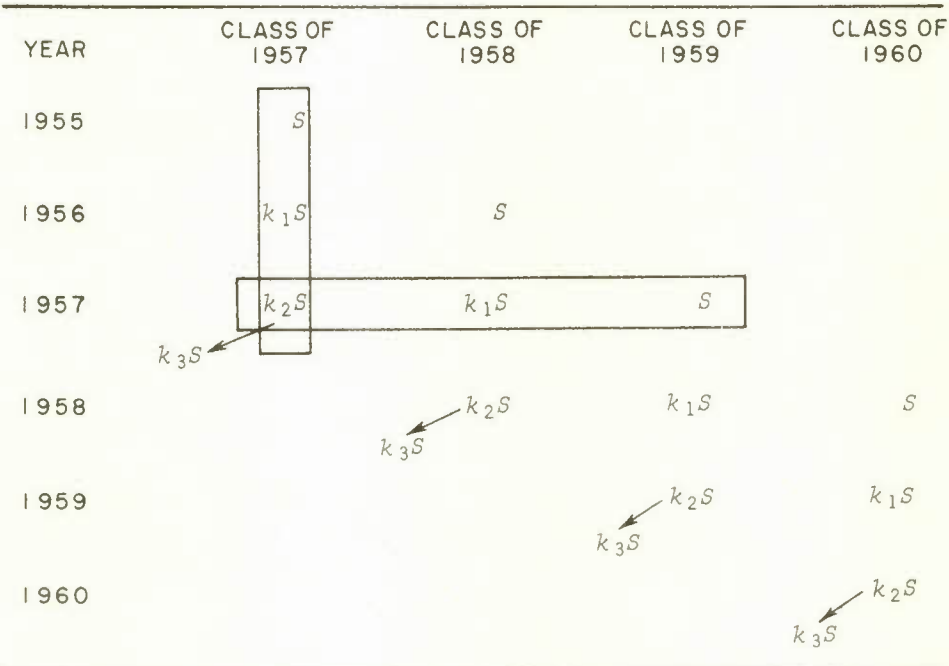
[1]As pointed out before, productivity trends are affected only by adjustments that change the annual rate of growth either in the measure of output or in the measure of inputs. In the present case we deal with an adjustment that will affect input growth from year to year, a fact that becomes quite clear if we refer back to the uneven increase of degree output and enrolment mentioned in Chapter 2.

It is not possible, therefore, to calculate the number of students in the first, second and third year for a given graduating class. Nor can costs be allocated on this basis.

FIGURE 4.1

STUDENT FLOWS IN A STATIONARY SYSTEM

(THREE-YEAR PROGRAM)



If we deal with a stationary system, the problem can be overcome. We may note from Figure 4.1 that the total number of students enrolled in a given year is equal to the "vertical count" of students in the graduating class of that year. In the Figure, the equality has been indicated graphically for enrolment in 1957 and the Class of 1957. It will also hold in a similar manner for all subsequent years.

If we now make the assumption that costs per student remain unchanged from year to year, we can calculate total expenditures for educating the Class of 1957 in two ways. We can either take the sum of costs for the class in each of the three years from 1955 to 1957 or we can take *total* expenditures for the system

in 1957; both methods must yield the same result.[1] This equality forms the basis for the method of adjustment.

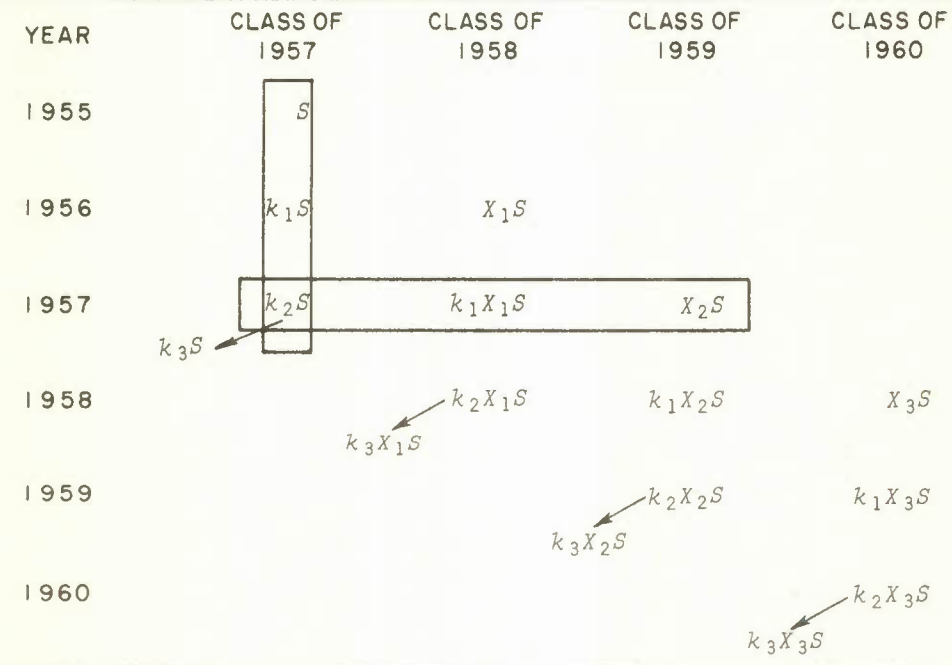
Inputs and Output in a Growing Educational System

In a growing system, the vertical count of students in any class is smaller than total enrolment in the year when the class graduates. Figure 4.2 gives a schematic representation of a growing system.

FIGURE 4.2

STUDENT FLOWS IN A GROWING SYSTEM

(THREE-YEAR PROGRAM)



[1]Both methods yield the same answer if we assume a zero interest rate. With a positive interest rate i, a dollar spent two years ago is equal to $\$1.00(1 + i)^2$ today. Because our adjustment will of necessity be a rough approximation, we shall disregard the interest rate. We shall also assume that costs per student remain unchanged for the duration of the degree program. Since costs per student typically increase over time, the effects of these two assumptions will tend to counterbalance.

As in Figure 4.1, we assume that S students enter the system in 1955. However, the freshman class in 1956 has grown to X_1S where $X_1 = 1 + r_1$. Similarly, the enrolment of second-year students in 1957 has increased to k_1X_1S from k_1S in 1956. To simplify the use of subscripts in later discussion, we define r_i to equal the rate of growth in second-year enrolment. Expressed in general terms,

$$(1) \quad X_i = \prod_{i}^{j=0} (1 + r_i) \qquad (X_0 = 1).$$

If we can calculate the number of students by which total enrolment for the system in year i (E_i) exceeds the vertical count for the class graduating in year i (C_i), we have a basis for adjusting expenditures. The latter can then be reduced in proportion to the excess number of students. In other words, we may write

$$(2) \quad EXA_i = \frac{C_i}{E_i} EX_i .$$

EX_i stands for total expenditures in year i; EXA_i is the symbol for adjusted expenditures. It should be recalled that this procedure implies an assumption about unit costs. We assume that costs per pupil remain the same over the program period and that they do not vary among years of study.[1]

From Figure 4.2 we can derive an expression for Q_i, the adjustment factor, which eliminates C_i and excludes S -- variables for which we lack any data.[2]

$$(3) \quad Q_i = \frac{C_i}{E_i} = \frac{X_{i-1}(1 + k_1 + k_2)}{k_2X_{i-1} + k_1X_i + X_{i+1}}.$$

---

[1]In a stationary system, it is not necessary to assume that costs per student do not vary among years of study. In a growing system, the composition of total enrolment and of the vertical count of the graduating class are different, however. Since the differences will be minor, the assumption is of small consequence.

[2]In 1957, the first "complete" year,

$$Q_1 = \frac{C_1}{E_1} = \frac{S + k_1S + k_2S}{k_2S + k_1X_1S + X_2S} = \frac{1 + k_1 + k_2}{k_2 + k_1X_1 + X_2}.$$

One may note that Q_i will be a constant if enrolment grows at a *constant annual rate* (r^*). With a fixed growth rate, $C_{i+1} = C_i(1 + r^*)$ and $E_{i+1} = E_i(1 + r^*)$. As a result, $Q_{i+1} = Q_i = Q^*$.

In addition, our model allows us to use information on the total number of degrees in a given year as a basis for determining X_i. Because it is assumed that retention rates remain constant over time, X_1 will be equal to the ratio of degrees in 1958 to degrees in 1957.[1] X_i is computed by the following formula:

$$(4) \quad X_i = \frac{\text{Degrees in } (1957 + i)}{\text{Degrees in } 1957}.$$

Equation (3) can thus be solved if we have values for the k's. Unfortunately, there are no adequate data on retention rates available for the Canadian university system. It was necessary therefore to use values for the k's which were derived from micro-studies of particular universities. The absence of data on retention rates is one of the most serious shortcomings of educational statistics.[2]

In applying Figure 4.2 and Formulas (3) and (4), one must note one further point. In Canada, the academic year typically starts in the fall and ends late in the spring of the following year. Enrolment statistics refer to the fall semester. Thus we may interpret the date 1955 in Figure 4.2 as the start of the academic year 1955-56. S will then be equal to fall enrolment in the freshman class. The expression k_1S, in turn, refers to the number of students in this group who enrol again in the fall of the academic year 1956-57. As Figure 4.2 indicates, k_3S of the same group will graduate in the spring or summer of 1958. Thus, while the academic and the calendar years differ, no additional conceptual problems arise from this fact.

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[1] Our previous assumption that the system has no repeaters is also necessary.

[2] It can be argued that retention rates are in themselves a type of productivity measure, although different from the measure we are trying to establish. Certainly, they throw light on the performance of the system.

Adjustment and Program Duration

To simplify matters of exposition, the discussion has been confined so far to a three-year program. The model is more general, however; it can be extended to programs of longer or shorter duration. In applying the model to the Canadian data, we distinguish among four different programs. Undergraduate degrees are grouped into two categories: general B.A. and B.Sc. degrees, assumed to result from a three-year program, and all other undergraduate degrees, which are treated as the result of a four-year program.[1] Regarding graduate degrees, we distinguish between the master's program (two years) and the doctoral program (three years).

Adjustment factors for the three-year undergraduate program and the doctoral program are calculated with the use of formula (3). The following two formulas apply to the remaining programs:

Four-year program:

$$(5) \quad Q_i = \frac{X_{i-1}(1 + k_1 + k_2 + k_3)}{k_3X_{i-1} + k_2X_i + k_1X_{i+1} + X_{i+2}}$$

Master's program:

$$(6) \quad Q_i = \frac{X_{i-1}(1 + k_1)}{k_1X_{i-1} + X_i}.$$

A separate set of retention rates (k) has been estimated from micro-studies for each of the four programs.

[1]This grouping was decided on, after studying a large sample of university calendars. While there are considerable differences in degree requirements among universities and provinces, the use of the two categories leads to only minor distortions.

Adjusting University Expenditures

Taking account of the breakdown into four separate programs, we can rewrite the equation for adjusted expenditures:

$$(7)\quad EXA_i = Q3_i EX3_i + Q4_i EX4_i + QM_i EXM_i + QP_i EXP_i.$$

The symbols $Q3_i$ and $EX3_i$ represent the adjustment factor and the total expenditures for the three-year undergraduate program. Similarly, $Q4_i$ and $EX4_i$ refer to the four-year undergraduate program, while QM_i, EXM_i, QP_i and EXP_i relate to the master's and the doctoral programs. Equation (7) thus states that total adjusted expenditures for the system as a whole are equal to the sum of adjusted expenditures in each program.

Equation (7) would give us our final procedure if we had information on expenditures broken down by program. Unfortunately, we have no such information; only data on total expenditures for the university system as a whole are available. As a result, we must make use of information on enrolment by program in order to allocate expenditures by program.

Table 4-1 presents data on full-time enrolment for the group of 49 universities and colleges. (Statistical tables for the five regional groupings are contained in Appendix E.)[1] As far as possible, data on enrolment have been broken down in the same manner as the statistics on degrees. However, it was not possible to obtain separate information on enrolment in the three-year degree program. Similarly, the data on full-time enrolment at the graduate level are not given separately for master's and doctoral students. In these cases, a simple formula was used to calculate the missing figures.[2] Thus it was possible to distribute enrolment among the four degree programs used in the analysis.

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[1]Data on part-time enrolment are not available for the whole period. For the years where such statistics have been collected and published (1962-63 to 1967-68), no breakdown according to faculty is given. As a result, our analysis relies on full-time enrolment only.

[2]See Appendix C.

Table 4-1

FULL-TIME ENROLMENT AT 49 CANADIAN UNIVERSITIES AND COLLEGES

	UNDERGRADUATE									
Year	Arts	Science	Applied Science	Education	Commerce	Health Fields	Agriculture & Forestry	Law	Other Fields	Total
1956-57	16,663	4,912	11,320	4,384	3,876	8,908	1,332	1,564	4,530	57,489
1957-58	18,611	5,749	12,605	5,290	4,347	8,923	1,681	1,634	4,592	63,432
1958-59	20,588	7,244	12,578	7,034	4,473	9,084	1,740	1,701	4,764	69,206
1959-60	22,276	7,827	12,613	8,643	5,135	9,414	1,768	1,823	5,219	74,718
1960-61	25,891	8,786	12,771	10,359	5,696	10,227	1,846	1,920	5,809	83,305
1961-62	30,714	11,660	12,197	12,774	6,492	10,936	2,041	2,148	6,300	95,262
1962-63	34,943	13,765	11,930	14,051	6,923	11,828	1,990	2,354	6,437	104,221
1963-64	37,443	17,988	12,333	15,642	7,945	12,932	2,184	2,588	6,691	115,746
1964-65	43,146	20,593	12,765	18,028	8,763	14,126	3,130	2,847	7,677	131,075
1965-66	55,076	23,998	13,992	20,991	9,352	14,655	3,298	3,354	8,347	153,062
1966-67	63,093	27,851	15,843	23,582	10,550	15,955	3,575	3,917	9,192	173,558
1967-68	65,941	31,305	17,960	24,013	11,528	17,349	3,778	4,502	10,845	187,221

	GRADUATE		
	Arts & Science	Other	Total
1956-57	1,611	1,421	3,032
1957-58	1,970	1,664	3,634
1958-59	2,246	1,789	4,035
1959-60	2,595	2,022	4,617
1960-61	3,130	2,426	5,556
1961-62	4,133	3,083	7,216
1962-63	4,570	3,623	8,193
1963-64	6,355	4,560	10,915
1964-65	8,477	5,181	13,658
1965-66	10,811	6,140	16,951
1966-67	12,368	7,110	19,478
1967-68	15,163	8,808	23,971

Source: See Appendix D.

Expenditures, Output and Productivity

In calculating expenditures by program, the most simple approach would merely make use of total enrolment in each program and allocate costs in proportion. It is well known, however, that it costs more to educate a graduate student for one year than to educate an undergraduate for the same period. In addition, there are important cost differences among disciplines and types of study at the same level. A knowledge of per-student costs for the major programs and disciplines would allow us to allocate expenditures in relation to the *weighted* number of students.

The Province of Ontario takes unit cost differences into account in its formula of university grants. Educational institutions receive different amounts per student depending on the program and discipline in which the student is enrolled. It is generally accepted that the formula weights used in Ontario give a reasonably accurate picture of the *relative* costs of educating various types of students. We make use of these weights to allocate expenditures on the basis of weighted enrolment.[1] We write

$$(8) \quad EX3_i = W3_i EX_i$$

where $W3_i$ is defined as weighted enrolment in the three-year undergraduate program divided by total weighted enrolment. The other weights, $W4_i$, WM_i, and WP_i, apply to the remaining three programs and are defined in an analogous manner. Adjusted expenditures thus become

$$(9) \quad EXA_i = EX_i \ (W3_i Q3_i + W4_i Q4_i + WM_i QM_i + WP_i QP_i).$$

In Table 4-2, we present the values of Q_i and W_i used in calculating adjusted expenditures of universities.[2]

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[1] Our use of the Ontario weights implies that there has been no change in relative costs among programs from 1956-57 to 1967-68. The importance of the weights for the final productivity index are discussed in Chapter 5 where the results of sensitivity analysis are reported. For a discussion of the weights and their adaptation to the present use, see Appendix C.

[2] The calculation of the values for X_i, and therefore Q_i, requires data on degrees for several years after 1967-68. Estimates of degree output were made for 1968-69. In the programs where data for later years were required, the average rate of growth in degrees for the whole period was used together with formula (1) in order to calculate the missing values.

Separate values are given for each program and the assumed retention rates have been indicated at the bottom of the table. Retention rates for the two undergraduate programs have been derived from a study on student flows at Carleton University.[1] Those for the two graduate programs are based on information obtained from two large Canadian universities with established graduate schools. While the values used should be regarded only as tentative, it may be noted that the Q_i's are not affected in any major way when the k's are varied within reasonable limits. This aspect will be explored further in the next chapter where the results of sensitivity analysis are discussed.

Table 4-2

ADJUSTMENT FACTORS AND ENROLMENT WEIGHTS BY PROGRAM

	Three-Year Undergraduate Program		Four-Year Undergraduate Program		Master's Program		Doctoral Program	
Year	$Q3_i$	$W3_i$	$Q4_i$	$W4_i$	QM_i	WM_i	QP_i	WP_i
1956-57	0.924	0.170	0.890	0.724	0.948	0.063	1.074	0.043
1957-58	0.905	0.173	0.907	0.714	0.917	0.072	0.974	0.041
1958-59	0.877	0.178	0.914	0.709	0.875	0.076	0.909	0.037
1959-60	0.892	0.185	0.841	0.696	0.918	0.083	0.929	0.036
1960-61	0.793	0.189	0.837	0.683	0.878	0.091	0.858	0.037
1961-62	0.785	0.207	0.820	0.650	0.887	0.106	0.759	0.036
1962-63	0.820	0.217	0.797	0.633	0.986	0.109	0.844	0.041
1963-64	0.861	0.221	0.837	0.602	0.921	0.124	0.820	0.052
1964-65	0.764	0.210	0.904	0.598	0.845	0.134	0.824	0.058
1965-66	0.771	0.242	0.840	0.554	0.889	0.146	0.799	0.057
1966-67	0.821	0.257	0.773	0.536	0.902	0.150	0.799	0.057
1967-68	0.837	0.238	0.802	0.532	0.923	0.163	0.889	0.067

Note: The following retention rates were used in calculating the adjustment factors:

-- Three-year undergraduate program, $k_1 = 0.75$, $k_2 = 0.60$
-- Four-year undergraduate program, $k_1 = 0.75$, $k_2 = 0.65$, $k_3 = 0.50$
-- Master's program, $k_1 = 0.65$
-- Doctoral program, $k_1 = 0.70$, $k_2 = .50$.

Source: See text.

[1] Retention rates were estimated from unpublished material prepared for the Carleton University Commission on Undergraduate Teaching and Learning.

It is assumed that retention rates remain constant over the 12-year period.

It may be recalled from Chapter 3 that we are interested mainly in that portion of expenditures which is used for instruction. To determine EX_i, we must subtract scholarships and total funds for research while adding depreciation and imputed interest allocated to instruction.[1] Equation (9) is then used to adjust total instructional expenditures for system growth. The results of these operations are presented in Table 4-3. It contains the instructional component of total resource use by universities in current dollars.

Table 4-3

ADJUSTED UNIVERSITY EXPENDITURES FOR INSTRUCTION

(Thousands of dollars)

Year	Adjusted University Expenditures for Instruction
1956-57	57,479
1957-58	67,810
1958-59	76,461
1959-60	84,279
1960-61	96,907
1961-62	110,425
1962-63	128,892
1963-64	156,720
1964-65	194,929
1965-66	235,528
1966-67	304,078
1967-68	404,684

Note: University expenditures for instruction are equal to university operating expenditures minus scholarships, minus resources for research, plus depreciation and imputed interest allocated to instruction.

Source: Tables 3-1, 3-2, and 3-3.

[1]The sum of depreciation and imputed interest is allocated to instruction according to the formula $ADI = \{(OE - S - RE)/(OE - S)\}DI$ where ADI stands for allocated depreciation and imputed interest, OE for operating expenditures, S for scholarships, RE for resources for research, and DI for total depreciation and imputed interest.

Adjusting Other Inputs

As pointed out, the students' contribution makes up a large proportion of total inputs. In Chapter 3, estimates of direct expenses and forgone earnings were presented. There remains the question of how the total student contribution for all graduates in Canada should be calculated.

There are two basic possibilities. First, one may start from the number of graduates. Making an assumption about the average length of the program, one can calculate forgone earnings and direct expenses for each graduate and multiply it by the number of graduates. The same procedure is applied to the estimated number of withdrawals, and the results are then summed for all 49 universities.

The second method, and the one which has been used here, extends the reasoning underlying our model to the calculation of student resources. Forgone earnings and direct expenses in the year of graduation are multiplied by the adjusted number of enrolled students.

$$(10)\quad EA_i = Q3_i E3_i + Q4_i E4_i + QM_i EM_i + QP_i EP_i.$$

Equation (10) gives the formula for calculating adjusted enrolment (EA_i). The symbols $E3_i$ and $E4_i$ stand for enrolment in the three- and four-year undergraduate programs in the i-th year while EM_i and EP_i refer to enrolment in the programs for master's and doctoral students.[1] The results of (10), combined with the information in Table 4-4, yield an estimate of the total annual student contribution to resource use.

It was pointed out earlier that appropriate data on part-time enrolment were not available for this Study. As a result, only full-time enrolment is used to calculate EA_i. This means, in turn, that our estimates of the total student resource contribution do not include

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[1] $QM_i EM_i$ and $QP_i EP_i$ apply to the master's and doctoral programs. In practice, each of these terms was broken down further since data were available separately for the forgone earnings of students in arts and science and students in other fields. Enrolments for the two subgroups were estimated in accordance with the proportion of degrees in each.

the forgone earnings and direct expenses of part-time students. The figures in Table 4-4 are thus understated to some extent.

Table 4-4

TOTAL ADJUSTED RESOURCE CONTRIBUTION BY STUDENTS

(Thousands of dollars)

Year	Undergraduate Program	Master's Program	Doctoral Program	Total
1956-57	113,383	6,968	2,813	123,164
1957-58	135,225	9,176	2,939	147,340
1958-59	156,987	10,873	2,973	170,833
1959-60	172,194	14,531	3,418	190,143
1960-61	197,400	18,271	4,012	219,683
1961-62	236,401	26,760	4,374	267,535
1962-63	270,503	34,199	6,314	311,016
1963-64	330,851	42,608	9,037	382,495
1964-65	397,145	52,270	12,260	461,676
1965-66	462,005	73,602	14,639	550,246
1966-67	536,287	96,557	18,016	650,860
1967-68	624,584	125,577	27,957	778,118

Source: See text and Appendix C.

The treatment of part-time students raises problems in any analysis, even if complete and detailed information on enrolment can be obtained. Most students in this category have regular employment. While it is likely that many earn somewhat lower salaries because a proportion of their time is devoted to study, it is next to impossible to arrive at a good estimate of the differential. The concept of forgone earnings, while applicable, is difficult to implement.

It is possible to speculate briefly about the effects that omission of part-time enrolment is likely to have on the total measure of inputs. We have emphasized that our main interest is in productivity *trends*. Thus it is the effect on input growth that will be crucial. One can assemble information on part-time enrolment, although only in aggregated form, for the years 1962-63 to 1967-68. During this time, part-time enrolment of undergraduate students grew at an average rate of 18 per cent while for graduate students the figure was 15 per cent.

Average rates of growth in full-time enrolment for the same period were 12 and 24 per cent respectively. Thus, for the student body as a whole, part-time enrolment grew somewhat faster than full-time enrolment. If we now assume that the resource contribution of a part-time student is a fixed fraction of the contribution made by a full-time student, we may conclude that the use of data on part-time students would have increased the rate of input growth to some extent. As the discussion in Chapter 5 will show, such an increase would have merely reinforced the conclusions of our Study.

To complete the adjustment of inputs for system growth, we must deal finally with municipal expenditures. The procedure is analogous to the one used for the student resource contribution. EA_i, derived from Formula (10), is multiplied by municipal expenditures per student. The adjusted municipal resource contribution, resulting from these calculations, is given in Table 4-5.

Table 4-5

ADJUSTED MUNICIPAL RESOURCE CONTRIBUTION

(Thousands of dollars)

Year	Adjusted Municipal Expenditures
1956-57	2,896
1957-58	3,228
1958-59	3,432
1959-60	3,691
1960-61	3,790
1961-62	3,829
1962-63	4,227
1963-64	4,873
1964-65	5,930
1965-66	7,465
1966-67	9,651
1967-68	9,067

Source: See text.

Deflation

After all the components have been adjusted for system growth, the measure of total inputs is arrived at simply by summing the individual parts. This gives us an index of inputs in *current* dollars; so far there has been no adjustment for price changes. It would not be correct

to compare this index with our measure of output, however, since the latter is given in *real* terms. Before the two indices can be contrasted, we must adjust inputs for changes in the price level.

Several different price indices were used in deflating input components. University operating expenditures and depreciation were deflated on the basis of unpublished information obtained from the appropriate divisions of the Dominion Bureau of Statistics.[1] For the student resource contribution, the Consumer Price Index was used. Finally, we relied on the implicit price index for current government expenditures on goods and services for the deflation of municipal expenditures.

Table 4-6

TOTAL ADJUSTED RESOURCE USE FOR INSTRUCTION

(Thousands of constant 1961 dollars)

Year	Total Adjusted Resource Use for Instruction
1956-57	208,197
1957-58	241,978
1958-59	264,126
1959-60	286,971
1960-61	325,755
1961-62	318,875
1962-63	437,474
1963-64	525,403
1964-65	627,572
1965-66	726,627
1966-67	842,920
1967-68	997,852

Source: See text.

[1]The Deflation Section, National Income and Expenditure Division, provided the information used in deflating university operating expenditures. The index is the same one used for the education component in personal expenditure on goods and services as reported in the National Accounts. For depreciation, data were obtained from the National Wealth and Capital Stock Section, Business Finance Division.

In Table 4-6 we present the final result of all the preceding data manipulations -- total adjusted resource use for instruction in constant dollars. It should be recalled from the discussion in Chapter 2 that the term "instruction" must be understood in its broadest sense; it includes all university activities that contribute to the production of degree output. The data given in Table 4-6 constitute our final measure of inputs. In the following chapter, they will be combined with the measures of degree output in order to obtain productivity indices for the system as a whole.

CHAPTER 5

TRENDS IN PRODUCTIVITY

In education, as in other industries in the service sector, the major difficulties in productivity analysis are encountered when inputs and output are being defined and measured. Once measurement has been accomplished, the task is nearly completed. It is simply necessary to divide output by inputs in order to obtain the desired index of productivity. Movements in this index or ratio over time will indicate productivity *trends*.

In the preceding chapters of this Study, we have developed and presented data on total output and total adjusted inputs. For convenience of analysis, these data are summarized in index form in Table 5-1.

Table 5-1

INDICES OF TOTAL OUTPUT AND TOTAL INPUTS
49 UNIVERSITIES AND COLLEGES

(1956-57 = 100)

	Indices of Output				Indices of Inputs	
	Degrees		Degrees plus Converted Diplomas			
Year	Unweighted	Weighted	Unweighted	Weighted	Total Adjusted Inputs	Total Adjusted Inputs excl. Student Resource Contribution
1956-57	100.00	100.00	100.00	100.00	100.00	100.00
1957-58	108.20	107.97	107.13	107.00	116.23	116.73
1958-59	116.65	116.49	115.95	114.93	126.86	119.34
1959-60	124.21	124.23	118.95	119.32	137.84	126.29
1960-61	134.90	135.10	129.30	129.55	156.46	141.71
1961-62	155.91	155.68	151.17	150.83	183.42	155.68
1962-63	176.51	177.96	169.81	171.15	210.12	177.20
1963-64	203.34	199.79	194.52	191.27	252.36	209.75
1964-65	232.45	230.69	222.66	222.38	301.43	254.68
1965-66	264.03	263.79	244.43	244.65	349.01	291.78
1966-67	301.01	301.34	277.52	278.10	404.87	352.20
1967-68	354.10	352.39	328.25	327.26	479.28	440.57

Source: Tables 2-4 and 4-6.

There are four indices of output, based on the four measures developed in the second chapter; two include converted diplomas together with degrees while two others rely on degrees only. Each set of measures is given in both weighted and unweighted form. In addition to the measures of output, the table also contains two indices of inputs. The first one shows total resource use in instructional activities. The second one is more limited in scope; it does not include the resource contribution made by students. Both indices are based on data in constant dollars.

What trends can we observe in the productivity of the university sector? Was the large expansion of higher education from 1956-57 to 1967-68 accompanied by a decrease in productivity? Our first set of productivity measures is obtained by dividing the four indices of output by the index of total adjusted inputs. The measures, which show trends in *total* productivity, are presented in Table 5-2 and are shown in graphic form in Figure 5.1.

Table 5-2

PRODUCTIVITY INDICES
49 UNIVERSITIES AND COLLEGES

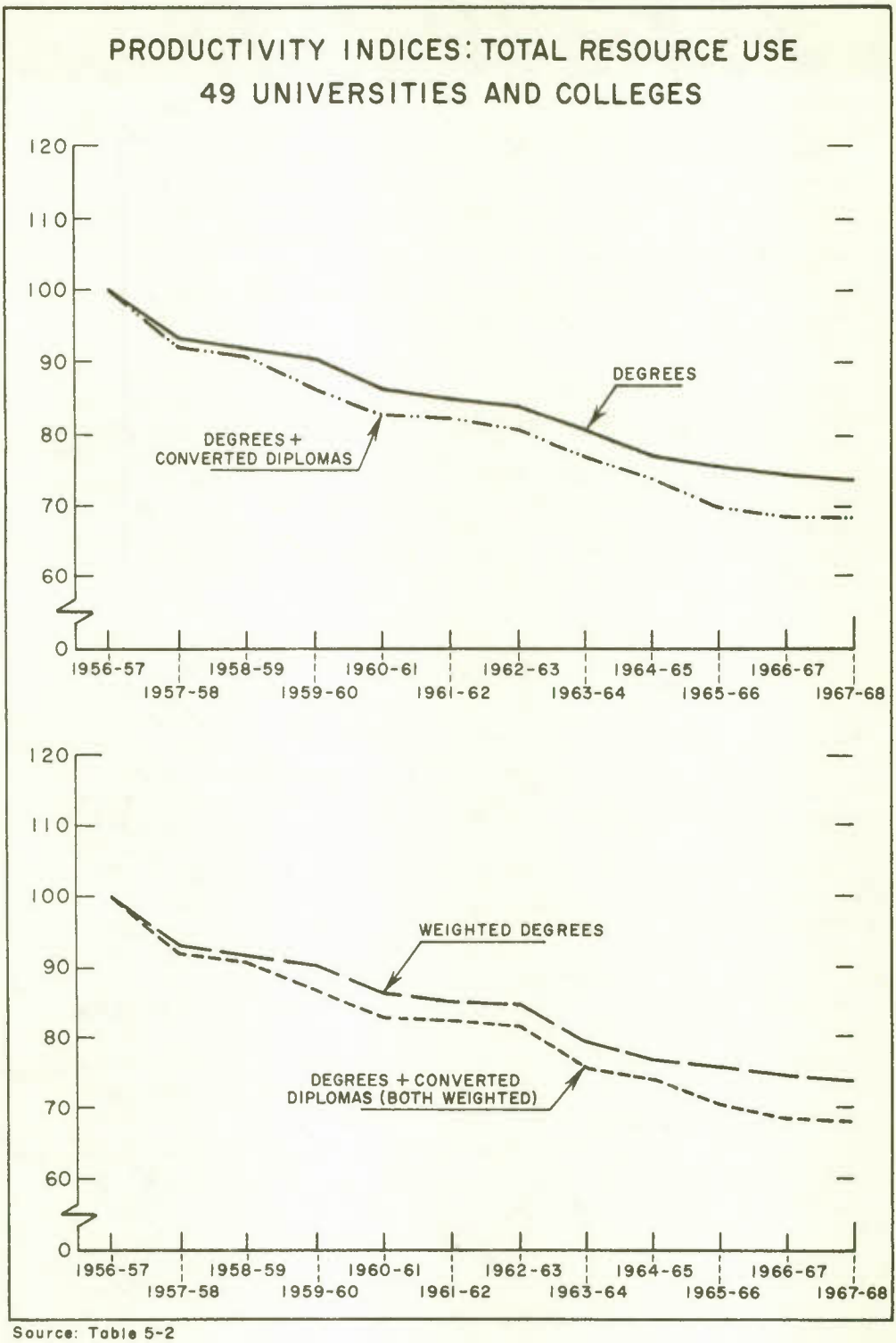
	Indices Including the Student Resource Contribution				Indices Excluding the Student Resource Contribution			
Year	A	B	C	D	E	F	G	H
1956-57	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1957-58	93.09	92.89	92.17	92.06	92.69	92.50	91.78	91.66
1958-59	91.95	91.83	90.71	90.60	97.75	97.61	96.43	96.30
1959-60	90.11	90.13	86.30	86.56	98.35	98.37	94.19	94.48
1960-61	86.22	86.35	82.64	82.80	95.19	95.34	91.24	91.42
1961-62	85.00	84.88	82.42	82.23	100.15	100.00	97.10	96.88
1962-63	84.00	84.69	80.82	81.45	99.61	100.43	95.83	96.59
1963-64	80.58	79.17	77.08	75.79	96.94	95.25	92.74	91.19
1964-65	77.12	76.53	73.87	73.78	91.27	90.58	87.43	87.32
1965-66	75.65	75.58	70.04	70.10	90.49	90.41	83.77	83.85
1966-67	74.35	74.43	68.55	68.69	85.47	85.56	78.80	78.96
1967-68	73.88	73.52	68.49	68.28	80.37	79.99	74.51	74.28

Note: Indices A to H are based on the following output measures:

(1) Sum of degrees -- A and E
(2) Weighted sum of degrees -- B and F
(3) Sum of degrees and converted diplomas -- C and G
(4) Weighted sum of degrees and diplomas -- D and H.

Source: Table 5-1.

FIGURE 5.1



Source: Table 5-2

The curves in Figure 5.1 all point to the same conclusion -- total productivity in instructional activities declined steadily from 1956-57 to 1967-68. The downward movement occurs regardless of the measure of output being used. Inclusion of diplomas and weighting of degrees do not alter the basic pattern. One may note that addition of diplomas makes the decline somewhat more marked, a fact that is not surprising when we recall that diploma output expanded less rapidly than degree production.

Forgone earnings of students are a large proportion of total inputs. In fact, their quantitative importance is such that they could easily determine the pattern in Figure 5.1. It is useful to ask, therefore, what productivity trends would be like if the student resource contribution were excluded from the index of inputs. By using a more restrictive input measure, we can throw light on the productivity of university expenditures.[1]

In Figure 5.2, we plot productivity trends based on an index of inputs that does not take account of the student resource contribution. The pattern that results is rather different from the one observed before. While the choice of the output measure remains unimportant, productivity no longer declines in a steady manner. After an initial drop in 1957-58, the productivity index starts to climb again, regaining its starting point in 1961-62. Only afterwards does a steady decline set in. The fall in productivity is marked in the final five years with a drop of close to 20 per cent. It is interesting to note a correspondence with the data in Table 2-2, giving rates of increase in degree production. The period of productivity decline in Figure 5.2 coincides with a higher level of output growth. While the rate of growth in degree production does not exceed 8.6 per cent until 1960-61, it rises to 15.6 per cent in the following year, staying well above 13.0 per cent for the remainder of the period.

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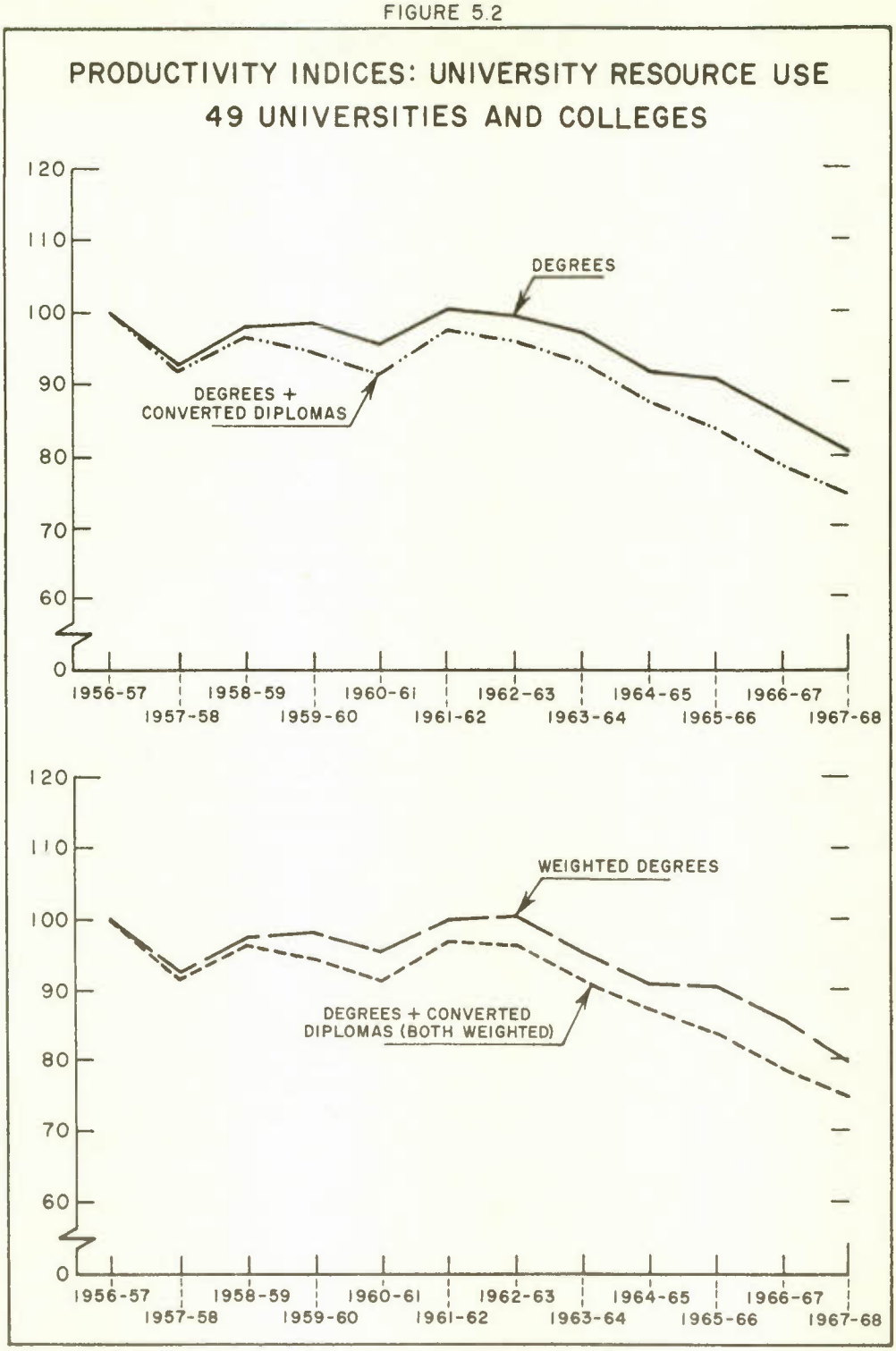
[1]Strictly speaking, the exclusion of the student resource contribution is justified only if we assume that there is no substitution between the use of student time and the use of other inputs. Such an assumption is not unreasonable, since it can be argued that the structure of degree programs is largely fixed. The implications of the two input measures are discussed further in Chapter 6.

FIGURE 5.2



Source: Table 5-2

The coincidence may suggest that very rapid expansion in university education does lead to declining productivity of university expenditures.[1]

Productivity Trends by Region

Education is a provincial responsibility. While policies on the development of higher education are affected by federal grants-in-aid, they are established and carried out by provincial governments. Studies on the growth and characteristics of university faculties have demonstrated considerable variations in the rate of expansion among regions. Development has not been uniform throughout Canada. It is useful, therefore, to extend the analysis down to the regional level and to contrast differences in productivity trends among regions.

It is not possible to disaggregate all the data on inputs and output. In particular, we do not possess sufficient information to calculate forgone earnings by region for the 12-year period. As a result, our analysis must be confined to a measure of inputs excluding the student resource contribution. Other data which are not broken down on a geographic basis include information on diploma production, depreciation, the capital stock and the various price indices used in deflation. In the calculation of regional productivity trends, variables related to the capital stock have been allocated in proportion to operating expenditures. To arrive at weighted degree output, we have assumed a constant structure of starting salaries across all regions. No attempt was made to break down diploma production or to construct regional price indices.

Figure 5.3 presents productivity trends for four main regions -- the Atlantic Provinces, Quebec, Ontario and the Western Provinces. It is based on Table 5-3 giving the indices in numerical form.[2]

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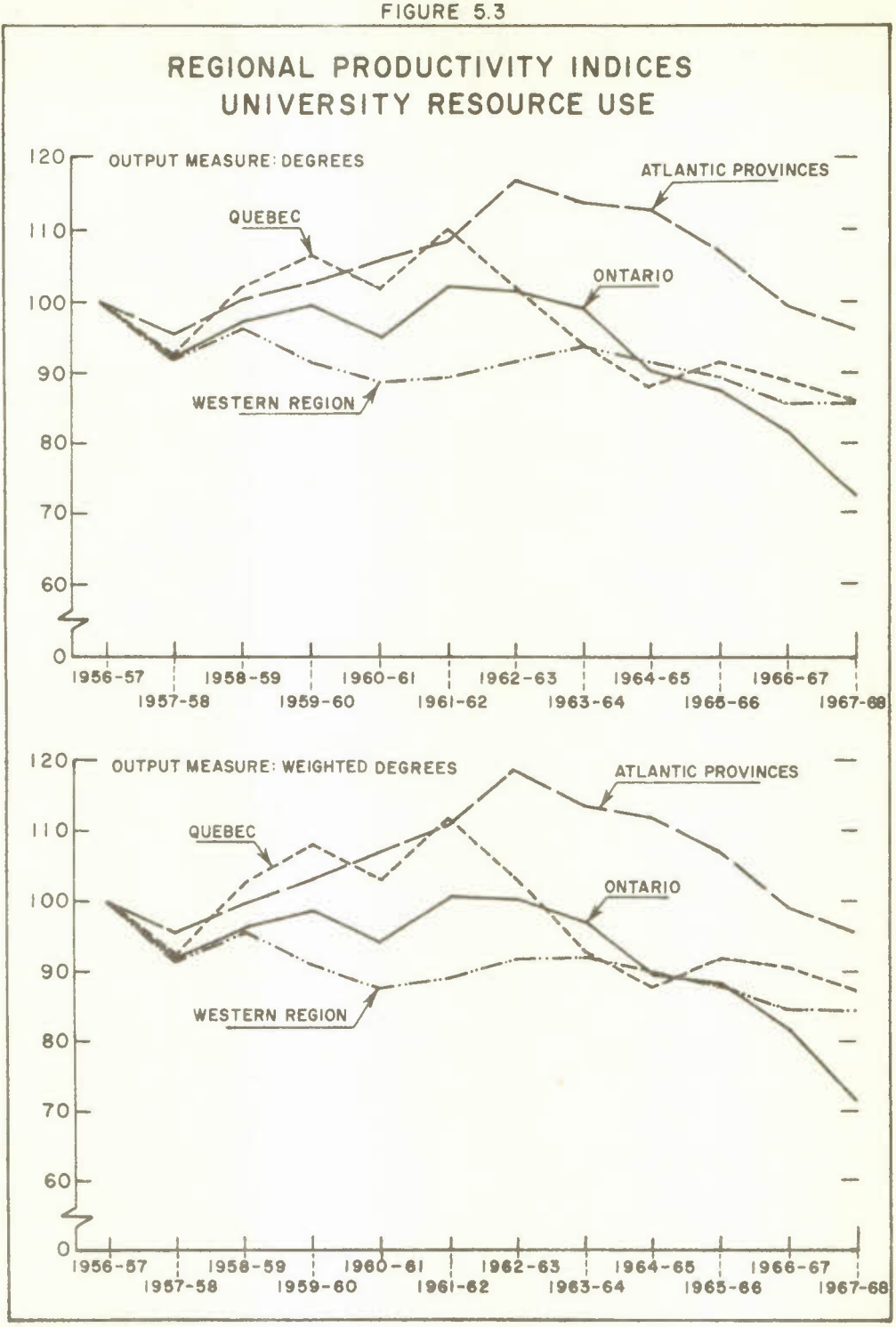
[1]Other explanations for the downturn are also possible, of course. More study and a different approach would be needed to establish a direct causal relationship.

[2]Since it was not possible to separate operating expenditures for British Columbia from those of the Prairie Provinces during the first three years, the Western Provinces are dealt with as a group.

FIGURE 5.3



Source: Table 5-3

Table 5-3

REGIONAL PRODUCTIVITY INDICES
UNIVERSITY RESOURCE USE

Year	11 Universities and Colleges in the Atlantic Region		9 Universities and Colleges in Quebec		18 Universities and Colleges in Ontario		11 Universities and Colleges in the Western Region	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
1956-57	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1957-58	95.17	95.37	92.49	92.35	92.46	92.29	92.00	91.62
1958-59	100.05	99.84	102.04	102.29	97.16	96.83	96.01	95.86
1959-60	102.50	103.15	106.47	107.92	99.40	98.87	91.50	90.98
1960-61	105.65	106.82	101.39	102.77	95.01	94.76	88.26	87.67
1961-62	108.48	110.65	110.08	111.36	102.06	100.47	89.43	89.19
1962-63	116.82	118.85	101.85	103.34	101.38	100.36	91.53	91.35
1963-64	113.58	113.61	94.00	92.85	99.20	97.01	93.75	91.80
1964-65	112.77	112.02	87.89	87.88	90.25	89.72	91.29	89.89
1965-66	107.68	107.28	91.26	91.60	87.66	88.41	89.56	88.32
1966-67	99.29	99.22	88.86	90.27	81.55	81.86	85.66	84.54
1967-68	96.18	95.92	86.17	87.19	72.32	71.76	85.70	84.53

Note: The two indices for each region are based on two different output measures. Output for the first index consists of the sum of degrees; for the second index, output is measured by the sum of weighted degrees. Input measures exclude the student resource contribution in both cases.

Source: Appendix E and Chapter 4.

There is considerable variation in regional trends. Universities in Ontario, the largest group, show a pattern of productivity change similar to the national pattern. After an initial drop in 1957-58, the index starts to climb, regaining the reference point of 100 in 1961-62 The second half of the period is marked by a steady decline which accelerates towards the end. By 1967-68, the index has fallen to 72. Quebec shows a turning point in 1962-63. While productivity stays above the base point during four of the six years up to that date, it declines afterwards, falling to 86 in the final year.

The two smaller regions have different patterns. Productivity for the group of Western universities never regains the starting point of 100. While the index fluctuates, the trend is downward. The last four years register a steady drop, to an index value of 85 in 1967-68. Institutions in the Atlantic region show a record of marked improvement in the first half of the period. After a steady climb from 1957-58 on, the index reaches a peak of 113 in 1963-64. This year marks a turning point, however; a steady decline sets in afterwards, leading to a value of 96 in the final year.

Some caution is necessary in comparing patterns of productivity change for regional groups of institutions. Since indices are calculated separately for each group, they start from different benchmarks. A higher productivity index for the Atlantic region than for Ontario does not imply that it is more efficient to educate a student in the Maritimes than in Ontario. The analysis allows us to compare trends only, not absolute levels. In addition, it should be recalled that not all data were broken down on a regional basis; some inputs had to be divided among regional groups in an approximate manner.

While caution is appropriate, one main conclusion stands out, nevertheless. All four regional groupings show a downturn in productivity in the second half of the period. Thus the national downward trend after 1962-63 is based on widespread and consistent experience.

Some Problems of Interpretation

Changes in the Quality of Inputs

In evaluating the results of the empirical analysis, some problems of interpretation remain, requiring a more detailed discussion. Most of the conceptual difficulties stem from the way in which output was defined. As pointed out in Chapter 2, the analysis assumes that the quality of degrees in a given field remains constant over time. If degrees in 1968 are of higher quality than those in 1957, we have understated the growth of output.

Why should the quality of degrees increase over time? Improvement in the nature of inputs is one possible explanation. A degree in 1968 can be a better type of output because the quality of inputs has been raised over the period. While the Study takes account of price changes, we do not hold the quality of inputs constant.

In discussing possible improvements, it is useful to distinguish three broad categories of inputs that form part of the educational process -- faculty, buildings and equipment, and students. Is there any evidence of an improvement in the average quality of the first group -- the faculty? While it is difficult to measure the quality of the teaching staff, there are some indicators which throw light on changes in average quality. In Table 5-4, we present information on the proportion of full-time faculty members holding a doctoral degree. The data are for a group of institutions corresponding closely to our sample of 49 universities and colleges.

Table 5-4 does not lend support to a belief in the overall improvement of the faculty. While there was a steady increase in the proportion of doctorates among the physical and biological scientists, the picture is different in the other fields. In the humanities and the pure social sciences, an increase occurred in the first half of the period. However, after 1960-61 the proportion holding Ph.D.'s started to fall. As a result, only 40 per cent of faculty members in pure humanities had a doctorate in the final year while the

proportion had been 45 per cent in 1956-57.[1] It is interesting to note that the decline coincides with the period of falling productivity for university expenditures shown in Figure 5.2.

Table 5-4

PERCENTAGE OF FULL-TIME UNIVERSITY TEACHERS IN CANADA HOLDING A DOCTORAL DEGREE 1956-57 TO 1967-68

Field	1956-57	1958-59	1960-61	1963-64	1965-66	1967-68
Pure Humanities	45	47	47	41	39	40
Applied Humanities	26	27	34	31	24	20
Pure Social Sciences	51	53	59	53	53	53
Applied Social Sciences	17	16	18	20	19	22
Pure Biological Sciences	62	65	66	67	69	75
Applied Biological Sciences	29	33	36	35	38	36
Pure Physical Sciences	67	68	70	68	71	73
Applied Physical Sciences	20	20	22	30	35	48

Note: Includes university teachers with rank of lecturer or higher rank.

Source: Walter Hettich, *Growth and Characteristics of University Teaching Staff in the Social Sciences and the Humanities, 1956-57 to 1967-68*, A Report by the Canada Council (Ottawa: Canada Council, May 1969), Table 3, p. 13.

[1]The proportion of doctorates in *all* pure fields was 56 per cent in both 1956-57 and 1967-68. The increase in the sciences was thus counterbalanced by the decline in other fields. There was an increase in the proportion of doctorates in the applied fields from 41 to 47 per cent. However, the Ph.D. is not a good quality indicator for this group since it includes disciplines (medicine, dentistry) where other professional degrees are more common, and fields (fine arts, performing arts) where professional competence is measured differently.

The information in Table 5-4 thus gives at best a mixed picture. If we also keep in mind that the rapid expansion of universities required the hiring of a large number of young and inexperienced teachers, as well as the admission of many scholars from abroad who had little or no knowledge of Canadian circumstances, we have to conclude that there is little evidence of a marked improvement in the overall quality of the faculty.

Before we leave the discussion of faculty inputs, attention should be drawn to changes in the student-teacher ratio. It can be argued that a decrease in the number of students per university teacher represents evidence of an improvement in the instructional process. In the last column of Table 5-5, we give data on full-time students per full-time academic staff. As the figures indicate, no steady decline did occur. After an initial increase, the ratio of full-time students to full-time university teachers stayed constant for most of the period. Only in the final year can a decrease be observed. Cost trends cannot be explained, therefore, with arguments about the student-teacher ratio.

The second major category of inputs into the educational process -- buildings and equipment -- has a somewhat less direct influence on degree quality than the teaching staff. While good facilities are a help in the learning process, capital expenditures may also serve to enhance immediate consumption benefits by providing amenities to students and faculty. Thus they may affect mainly the consumption component of degrees. Finally, there is much research that is capital-intensive, particularly in the science fields. Since we know little about the use of buildings and equipment for research, it is difficult to judge the impact of quality changes on student degrees.

We have no quality index for the capital stock. However, we can study the value of buildings and equipment (in constant dollars) in relation to the number of students. In Table 5-5, we present data on the capital stock per full-time student. The table also contains capital per full-time faculty member. Both series indicate a process of capital deepening. Thus the quantity of capital did rise in relation to the other inputs.

Table 5-5

CAPITAL STOCK IN RELATION TO THE NUMBER OF FULL-TIME STUDENTS AND FACULTY, AND STUDENT-TEACHER RATIO

Year	Full-Time Students per $Million of Capital Stock	Full-Time University Teachers per $Million of Capital Stock	Full-Time Enrolment per Full-Time University Teacher
1956-57	141.0	10.1	13.9
1957-58	146.0		
1958-59	143.8	9.7	14.8
1959-60	137.2		
1960-61	134.8	9.0	14.9
1961-62	136.2		
1962-63	130.8		
1963-64	129.7	8.7	14.9
1964-65	129.1		
1965-66	129.2	8.6	15.0
1966-67	124.6		
1967-68	117.0	8.9	13.2

Note: Capital stock equals gross stock in constant (1961) dollars.

Source: Tables 4-1 and 5-2, and Dominion Bureau of Statistics.

Finally, we turn to the students as participants in the educational process. Student input is measured mainly by forgone earnings. As before, we face the question: Should part of the increase in annual input costs be assigned to an increase in input quality? Or, to reformulate the question: Does the growth of forgone earnings between 1956-57 and 1967-68 reflect an improvement in the quality of the student body?

If we consider the expansion in enrolments that occurred during the period, it is difficult to argue for an increase in average student quality. With growing participation rates, a larger proportion of the college age group attended university in 1967-68 than in 1956-57. Thus it is quite possible that average levels of intelligence and motivation decreased rather than improved. Unfortunately, we have no data measuring the change in these levels.

Whatever changes did occur are not likely to be reflected in forgone earnings. Data on forgone earnings for undergraduates are derived from average wage and salary figures for young people in the same age group

having only a high school education. For graduate students, forgone earnings are calculated from the starting salaries of college graduates with a first degree. In neither case is there a direct link between average student quality and input costs.

How should we interpret a change in student quality *not* reflected in our input measures? If the average quality of the student body did indeed increase between 1956-57 and 1967-68, both forgone earnings and the measures of output should have been adjusted to reflect this fact. The same argument would apply if average quality had decreased during this period, although a downward adjustment would now be required. In both instances, the impact on overall productivity trends would likely be minimal since both indices of inputs and measures of output would undergo adjustment. The problem would disappear altogether if average quality had remained the same. To this author, personal observation suggests that constant average quality of the student body is both the best and the most reasonable assumption.

Knowledge as an Input

It is at times alleged that the nature and quality of university degrees change over time because the quality of knowledge improves. Research leads to new methods of analysis and to a new understanding of facts which are then transmitted to students.

In the present Study, we have excluded the costs of research, confining the analysis to resource use in instructional activities. The costs of producing new knowledge do not enter into the indices of total inputs. Nor are the measures of output adjusted for improvements in knowledge content. The problem thus remains largely outside the scope of the analysis.

Any attempt to integrate improvements in knowledge into the study of university productivity raises a host of difficult problems. On the one hand, it would be necessary to make some quality adjustment in university degrees. This raises questions about the impact of progress in knowledge on different fields. Are engineering and the sciences affected more strongly than the social sciences or the humanities? Does the nature of degrees in fields such as history and philosophy change over time?

On the cost side, the problems are no less formidable. While the creation of new knowledge can be linked to research, the progress of knowledge cannot be tied directly to research expenditures in the group of 49 institutions. The advancement of knowledge is an international enterprise and one which is carried on outside the universities as well. Furthermore, it is a time-consuming activity; research will often bear fruit only many years after the initial expenditures are made.

It is important to realize that the problems raised by the progress of knowledge are not confined to education. The advance of knowledge affects production functions in all industries and, in so doing, changes marginal products of other factors of production. Traditional productivity analysis is not equipped to properly deal with this impact. To capture the full effect of progress in knowledge, a different conceptual framework must be developed.[1]

Deflation Bias

Productivity analysis requires that *real* output measures be related to measures of *real* inputs. In other words, changes in the price level must be eliminated from all indices. If this is not done, changes in actual productivity cannot be determined with reliability.

There are two basic methods for constructing "real" indices. Both are used frequently by economists. The simplest approach puts the focus on the physical dimensions of inputs and output. Materials are measured in tons, gallons or yards, depending on their nature. Labour services are counted as hours per week or months per year. While it is often difficult to convert a certain type of output or input into physical units of

[1]See Harry Johnson's comment on the article by Woodhall and Blaug in *Minerva*, vol. IV, no. 1, Autumn 1965, and the reply by the authors in the same issue. The debate turns on the question of how much has been explained and how much is left for the unexplained "residual" which is so familiar to all students who have tried to account for the causes of economic growth. The whole problem is of lesser importance for our analysis, which covers a period of only 12 years, than for the British study which made comparisons between 1938 and 1962.

standard quality, this is, on occasion, possible and physical productivity measures are then the most appropriate ones.

As is readily apparent, physical measures have serious limitations. The greatest problem in their use arises because we lack a common denominator; tons, gallons and yards cannot be added in a meaningful way. If we need composite measures, we must evaluate all components in money terms. Once this is done, inflationary price changes must be eliminated by the use of the appropriate price indices so that we obtain real series in the end.

While both methods are appropriate, certain problems can arise when they are used in combination. This is in effect what we have done in the present Study. Output is measured in "physical" terms -- by the number of degrees or the number of weighted degrees. Inputs, on the other hand, are evaluated in current dollars and then deflated by a set of price indices. The problems which a combination of the two methods can introduce will best be understood if we imagine a world where degrees can be evaluated in monetary terms. In such a world, the "price" of degrees would likely rise over time, much like the prices of other things. Output could then be measured by the total monetary value of degrees, deflated by an appropriate price index. What is important in this context is the following: it is quite possible that the value of a degree expressed in constant dollars would also rise (although by less than the price in current dollars). One may note, in this connection, that forgone earnings of students in Canada did rise substantially in *real* terms during the period from 1956-57 to 1967-68.

In benefit-cost analysis, economists do in fact put a monetary value on degrees. The benefits of a college education are set equal to the difference in the lifetime earnings of a college graduate and a high school graduate, discounted at some appropriate rate of interest. If the real purchasing power of this discounted earnings differential did increase between 1956-57 and 1967-68, we may expect that the economic value of degrees, expressed in constant dollars, would also have risen. Since such increases are not reflected in our output measures, we may have underestimated output growth.

Earnings differentials between college and high school graduates are affected by a group of factors, two

of which are of particular importance in the present context. As the supply of college graduates increases in relation to those without a university education, we may expect a narrowing of the differential. There is some preliminary evidence suggesting that this is occurring in Canada. The second factor of importance relates to changes in the interest rate. As pointed out, benefits are equal to the discounted earnings differential. The interest rate which is used in discounting income streams has a decisive influence on present values. It is well known that interest rates have been increasing for much of the period under study, a development that would have counteracted a rise in the "price" of degrees.

Our discussion makes it clear that no simple adjustment is available to deal with what may be called "deflation bias". On balance, it is probable that the bias leads to some understatement of output growth. The problem has more importance for our measure of total productivity which is influenced decisively by the growth of forgone earnings. Trends and turning points in productivity measures which exclude the student resource contribution are less affected and can be interpreted without special reservations.

Sensitivity Analysis

In the course of the Study, it was necessary to make a number of assumptions in order to overcome limitations in the available data. Since such assumptions may exercise a decisive influence on the final results, it is useful to explore their impact systematically.

The sensitivity of the final indices was tested with regard to several assumptions. It may be recalled that the lack of information on retention rates made it necessary to derive such rates from micro-studies. Because of the narrow coverage on which the estimates were based, it was considered useful to test a whole series of alternative k-values. The analysis revealed that changes in k exercised a minor influence on Q, the adjustment factor, and, as a result, did not affect indices of inputs in a significant way. A second data problem concerned enrolment by program. It was necessary to use information on the pattern of degrees in order to calculate enrolment in the three-year undergraduate program and in the master's

and doctoral programs. Two methods, both discussed in Appendix C, were used in estimating enrolment by program. Testing revealed, however, that the choice of method was unimportant for the final index of inputs. Finally, sensitivity analysis was conducted to determine the importance of the Ontario formula weights used in allocating expenditures among programs. While the use of such weights has some bearing, the basic pattern of productivity change in Figures 5.1 and 5.2 is not affected. Thus none of the assumptions about data had a decisive influence on productivity trends.

CHAPTER 6

CONCLUSIONS

In introducing the Study, we have drawn attention to the difficulties facing the investigator who wants to apply productivity analysis to the service industries. Most of these problems are encountered in an analysis devoted to higher education. They are joined by a group of others that arise from the special nature of the educational process and from the type of data that can be obtained. We have dealt with the main difficulties one by one in the preceding chapters and we shall refrain from cataloguing them once more. The reader should keep the main assumptions of the Study in mind, however, when assessing the results.

Before we proceed to the main findings and their implications, it will be useful to recall one limitation imposed on the analysis from the start. The present Study is confined to the measurement of productivity change in instructional activities. Research and the costs of research have been excluded from consideration. Our Study is a partial evaluation; it does not assess the performance of the university sector as a whole.

The main results can be summarized in brief. From 1956-57 to 1967-68, total productivity in instructional activities declined steadily for the group of 49 universities and colleges. Forgone earnings of students were a major factor in this decline. As noted in Chapter 5, the downward trend may be overstated because of technical problems in deflation procedures.

If we disregard the student resource contribution, restricting the analysis to university-related inputs, we no longer have a clear downward trend. Rather, we can distinguish two separate periods of productivity change. During the first six years, the index fluctuates, regaining its starting point in 1961-62. Only after 1962-63 does a consistent decline set in. When the analysis is carried out for regional groupings of institutions, four different patterns emerge. While the index for Ontario resembles the national one, productivity measures in Quebec and the Atlantic region rise above the base point

of 1956-57 in several subsequent years. For the group of institutions in the Western region, no such rise occurs. All regional groupings experience a productivity decline in the final years of the period.

How should we interpret these findings? At the end of their article on productivity trends in British university education, Maureen Woodhall and Mark Blaug contrasted the performance of the university sector (where they found declining productivity) with performance in other industries. According to the two authors:

> One of the outstanding differences between universities and conventional industries ... is that in almost every industry new and more efficient methods of production have been introduced, while the technology of teaching has remained unchanged. It is still true to say that, in the field of education, the last dramatic innovation was the printed book.[1]

They went on to criticize British universities for a lack of innovation and a failure to adopt new technology, such as television teaching. Should we follow Woodhall and Blaug; do their strictures apply to the Canadian case?

It would be difficult to claim that Canadian universities are widely known for innovation. Nevertheless, a failure to embrace technical change does not appear to explain the downward trend in the total productivity measure. As pointed out, forgone student earnings play the dominant role. If technological improvements are to affect *total* productivity trends, they must lead to large economies in the use of student time. One may question whether there are known methods of instruction that would make it possible to shorten the period of study substantially without affecting the nature or the quality of university degrees. The use of teaching aids such as television has not generally produced the favourable results predicted by early advocates and the true impact of such aids on university costs remains to be determined.

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[1]Woodhall and Blaug, *op. cit.*, p. 497.

The dominant role of forgone earnings in the analysis does raise some fundamental questions. Only a change in the accepted structure and length of academic degree programs would reverse the downward trend in *total* productivity. Some educators and some critics of the universities have at times raised the question of whether traditionally defined programs are appropriate in a time of rapidly expanding participation in higher education. It is only fair to say that the answer is not known; the costs and the benefits that can be expected from a change in program structure have never been evaluated in a systematic manner. One cannot simply blame the universities for the downward trend in *total* productivity observed in this Study. While it may be true that universities have been reluctant to undertake a re-examination of existing degree programs, such programs are rarely questioned by other groups in society. Both government and private industry use traditional university degrees to determine qualifications for employment. Any successful redefinition of programs would require the support of all major groups in society.[1]

An important point remains, however, even in the absence of program changes. It is often said that education is a labour-intensive industry. Those making the statement generally think of the importance of faculty time in the educational process. One must realize, however, that student time is an even larger and, in total, even more costly input. It is imperative that those who make decisions on educational matters take full account of the value of student time.

If we take the structure of academic programs as given, or as subject to only minor change, the second set of productivity measures becomes the relevant one. Based on input indices that exclude the student resource

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[1]On April 15, 1969, the Government of Ontario appointed a Commission on Post-Secondary Education in Ontario. The Commission has raised a number of fundamental questions about the role and function of higher education. Among them are questions concerning the length and structure of academic degree programs. It remains to be seen how the community will react to these queries. A good summary is contained in the background paper "Post-Secondary Education in Ontario: A Statement of Issues", published by the Commission in 1970.

contribution, these measures throw light on the management of university resources in instructional activities. There is nothing irreversible about trends derived from this set of measures; productivity both improved and declined over the 12-year period. The fall in productivity after 1962-63 does raise concern about performance in the middle and late years of the 1960's.

Industry-wide studies of productivity such as the present one are diagnostic in character; they produce a record of performance, but they do little to explain turning points in productivity trends. A different approach must be used to identify the factors that account for changing performance. One limitation of such studies stems from the broad coverage necessary for the analysis. Thus all our measures apply to the group of 49 institutions or to one of the four regional groupings. It is possible -- indeed it is likely -- that some universities show a better individual record after 1962-63 than the group as a whole. Others, no doubt, were lagging behind the average.[1] It is not possible to analyse the performance of individual institutions within the scope of this Study. Nor is it clear that our approach would be appropriate at the institutional level. Our results suggest, however, that further work on university productivity is warranted. There is a definite need to re-examine the use of resources in the university sector.

There exists a growing literature of cost-effectiveness studies that deal with resource use in education. While it is not possible to offer a systematic review of this work, it may be useful to indicate briefly the main methods or approaches. One group of studies, so far confined mostly to investigations of primary and secondary education, stresses the application of production functions to education.[2] The work is of

[1]It is known, for example, that new and emerging institutions have higher unit costs. See Elizabeth Arthur, et al., "Report to the Minister of University Affairs on a Special Study of Operating Support for the Emerging Universities in Ontario for the Fiscal Year 1968-69", July 1968 (mimeo.).

[2]The articles by Samuel Bowles and Martin T. Katzman, and the report by Herbert J. Kiesling, listed in the Selected Bibliography at the end of this Study, are good examples of this approach. See also the report by J. A. Kershaw and R. N. McKean (1959), and the article by David A. A. Stager (1968).

particular interest because it is based on output measures that differ from those adopted in our analysis. Test scores and indices of scholastic achievement are used to quantify output which is then related to a set of input variables. The same approach also lends itself to the estimation of cost functions and to unit cost analysis.

A second group of studies focuses more specifically on decision-making within educational institutions and other nonprofit organizations. Here the researcher tries to determine a set of goals for the university and to analyse how they can be achieved through the allocation of resources. Alternatively, he may develop a descriptive model of an institution and analyse the implications of administrative decisions by using simulation techniques.[1]

Both general approaches are valuable for more detailed work on cost-effectiveness. In addition, they may provide a way to test the conclusions of the present Study. We have repeatedly emphasized that our work represents a first attempt at measuring phenomena which can be quantified only with difficulty. Our conclusions remain tentative until they are confirmed by further work. Cost-effectiveness studies offer an independent way to verify the results of our analysis.

We have repeatedly drawn attention to the statistical problems that face the researcher who studies higher education in Canada. At the same time, we have attempted to prepare and make available a consistent set of data on both inputs and output for a large group of universities and colleges. There is a need to re-examine the allocation of resources in higher education. It is hoped that the statistical information presented in this Study will assist those who want to analyse the many problems that remain.

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[1]For examples, see the articles by Richard W. Judy (1969) and H. H. Jenny, and the report by A. P. Van Wijk, et al., as listed in the Selected Bibliography.

APPENDIX A

NOTES ON THE MEASUREMENT OF OUTPUT

The Weighting of Output

In this Study, output is measured by the number of degrees conferred, appropriately weighted to reflect the monetary value of different types of degrees. The weights employed are the relatives of average starting salaries according to major categories of instruction. In order to calculate the weights, it was necessary to obtain starting salaries in each year for the following categories of instruction:[1]

Undergraduate:	General Arts	
	Honours Arts	
	General Science	
	Honours Science	
	Applied Science	
	Education	
	Commerce	
	Health Fields	
	Agriculture and Forestry	
	Law	
	Other Fields	
Graduate:	Master's level	Arts and Science
		Other
	Doctoral level	Arts and Science
		Other

[1]The data were obtained from the following sources: Canada, National Employment Service, Unemployment Insurance Commission, *Supply and Demand, University Graduates* (Ottawa: Queen's Printer, annually 1961 to 1964); Canada, Department of Labour, *Supply and Demand, University Graduates, 1965-66* (Ottawa: Queen's Printer, 1965); and Canada, Department of Manpower and Immigration, *Career Outlook, University Graduates* (Ottawa: Queen's Printer, annually 1966 to 1968).

Where data on starting salaries were available according to a finer breakdown, an average figure for a representative group of disciplines was used as the salary for the major category. Once starting salaries had been obtained, the relatives were calculated for each year by dividing the average starting salary for each of the above categories by the average starting salary of graduates with a General B.A. degree.[1]

In addition to degrees, diplomas are counted as output. For the present purpose, diplomas are said to be equivalent to one-third of a degree in the same field of study. The categories for converted diplomas are as follows:

Arts and Science
Applied Science
Education
Commerce
Health Fields
Agriculture and Forestry
Other

The converted diplomas have been weighted by the relatives calculated for regular degrees and summed to produce a total. This procedure has been followed for each year between 1956-57 and 1967-68.

[1]No information was available on starting salaries for graduates in 1957, 1958, 1959 and 1960. For these years, the relatives were obtained by averaging the relatives of the available years in each major category. This procedure was also followed for a small number of major categories for the years after 1960 when data were incomplete or lacking.

APPENDIX B

NOTES ON THE MEASUREMENT OF INPUTS

The Adjustment of CAUBO Financial Data to Conform to the 49-University Sample

The adjustment involves two main steps.

1. To the CAUBO financial data[1] itself, the following adjustments have been made:

   (a) data included in the 49-university sample but not in the sample of CAUBO institutions have been added;

   (b) data included in the CAUBO sample but not in the 49-university sample have been deleted.

Table B-1

ADJUSTMENTS TO THE CAUBO FINANCIAL DATA

Year	Added	Deleted
1956-57	St. Dunstan's University St. Mary's University University of Ottawa	Huron College Nova Scotia Technical College
1957-58	St. Dunstan's University St. Mary's University	Huron College Nova Scotia Technical College
1958-59	St. Dunstan's University St. Mary's University	Huron College Nova Scotia Technical College

[1]Canadian Association of University Business Officers, "Analysis of Statements of Operating Income and Expenditure of University and Colleges", in *Minutes of the Annual Conference, Annual Report*, 1958 to 1969.

The following method has been employed in making estimates of operating expenditures for the missing years. Where no financial information was available (St. Dunstan's University, St. Mary's University, and Huron College for the years 1956-57 - 1958-59), the formula below has been applied:

$$EX_i = \frac{Ex_{i+1}}{En_{i+1}} \cdot \frac{1}{1 + r} \cdot En_i$$

where Ex stands for expenditure and En for enrolment; i represents the year for which the expenditure data are required; and r is equal to average annual rate of growth in per-student expenditure for a three-year period immediately adjacent to i.

The formula yields an estimate of total operating expenditures. The components (academic, administration, etc.) have been calculated by applying the percentage distribution in the closest complete year. The latter method was used also for the University of Ottawa where total operating expenditures but not the appropriate breakdown could be obtained for 1956-57.

In the case of Nova Scotia Technical College, information on expenditures was available but not in the format established by CAUBO. These data have been adjusted to fit the CAUBO format.

2. A second main step involves the deletion of enrolment for Prince of Wales (to 1964) and for Notre Dame (to 1961) from the enrolment tables for Canada and the regions.

Procedure 2 is designed to eliminate some data that are not valid in our framework. The affected institutions either had separate budgets during the years in question, did not offer senior-level university courses, or did not have an affiliated status.

Capital Stock Data

An attempt was made to build up a capital stock series from information contained in the DBS/CAUBO questionnaire forms. Both organizations ask universities and colleges to report book value and estimates of current value for buildings and contents. However, the answers provided by the institutions have not so far been tabulated

or made available in published form, mostly since their accuracy or meaning may be questioned. In this Study, the answers from the 49 universities and colleges in the sample were compiled into two series. Data were available for the years 1960-61 to 1967-68 only; for the earlier years, questionnaire returns could no longer be located.

Table B-2 gives the two series of capital stock estimates -- one based on reported book value, the other on insurance valuation. Both have been deflated with a price index obtained from the National Wealth and Capital Stock Section, Business Finance Division. Deflators were given separately for construction and machinery and equipment. As a result, the reported value of capital stock had to be divided into the two components. The split was accomplished by applying the ratio of capital stock to machinery and equipment from the series on capital stock developed by the National Wealth and Capital Stock Section in conjunction with the Department of Trade, Industry and Commerce.

Table B-2

CAPITAL STOCK
49 UNIVERSITIES AND COLLEGES
(Millions of 1961 dollars)

Year	Capital Stock	
	Book Value (Buildings & Contents)	Estimated "Current" Value
1956-57		
1957-58		
1958-59		
1959-60		
1960-61	454	616
1961-62	519	668
1962-63	601	756
1963-64	721	952
1964-65	925	1,160
1965-66	1,177	1,338
1966-67	1,389	1,567
1967-68	1,681	1,849

Source: See text above.

As mentioned, the main bases for the series are book value and insurance appraisals. Since insurance appraisals are not repeated annually, the second series may include additions at current costs or various estimates. For both series, there were institutions that did not report in some years. In these cases, estimates were made, based on a six-year average growth rate, or, if only one series was missing, by using the reported information in the other as a guide.

Calculation of the Annual Resource Contribution by Students

The resource contribution per student is composed of forgone earnings and direct expenditures. It was calculated by subtracting the summer earnings from annual forgone earnings and by adding an estimate of direct expenditures paid for by the student. Separate calculations were made for undergraduates and for students at the master's and doctoral levels.

Forgone earnings were estimated from the best available measure of earning potential. For undergraduate students, it was possible to obtain information on the income of high school graduates in the 20-24 age bracket for the years 1961[1] and 1967.[2] Data for the missing years were calculated on the assumption that the annual rate of growth had been constant for the period. Graduate students were grouped by level (master's and doctoral) and by type of program (Arts and Science, and "Other"). The earnings of students at the master's level were based on average starting salaries of graduates with an Honours degree.[3] Starting salaries were obtained and averaged as follows:

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[1]Dominion Bureau of Statistics, Census Division, *Income of Canadians*, by Jenny Podoluk (Ottawa: Queen's Printer, 1968), p. 119.

[2]Dominion Bureau of Statistics, *Survey of Family Income*, 1968, unpublished study. This source does not contain data on the age group 18-20. As a result, the age group 20-24 had to be chosen as the reference group.

[3]Canada, Department of Manpower and Immigration, *Career Outlook, University Graduates* (Ottawa: Queen's Printer, annually, 1960 to 1967).

Arts and Science	-- 2 in Social Science (usually Economics and Political Science, and Psychology)
	-- 2 in Pure Science (usually Biology and Physics)
"Other"	-- 2 in Engineering
	-- 1 in Agriculture or Forestry
	-- 1 Commerce
	-- 1 discipline in the Health Fields.

For doctoral students, the starting salaries of graduates with a master's degree were used.[1] As pointed out in Appendix A, data on starting salaries are available only from 1961-62 to 1967-68. To obtain information for the years back to 1956-57, it was necessary to calculate the annual rate of growth in earnings for a five-year period subsequent to 1961-62 and to apply this rate in making estimates for the missing years. Since starting salaries are given on a monthly basis, it was necessary to multiply them by 12 to place them on an annual basis.

Summer earnings were derived by multiplying average monthly earnings obtained by students in the summer by the number of months worked and by the percentage of students employed. The summer earnings of undergraduate and graduate students were calculated separately. Data on summer earnings were available for only a few of the years in question. Information on undergraduate earnings were available for 1956-57[2] and for 1961-62,[3] while data for graduate students were available for 1956-57.[4]

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[1] *Ibid.*

[2] Dominion Bureau of Statistics, *University Student Expenditure and Income in Canada, 1956-57* (Ottawa: Queen's Printer, 1959), p. 27.

[3] Dominion Bureau of Statistics, *University Student Expenditure and Income in Canada, 1961-62, Canadian Undergraduate Students*, Part II (Ottawa: Queen's Printer, 1965), p. 27.

[4] Dominion Bureau of Statistics, *University Student Expenditure, 1956-57, loc. cit.* An estimate of the summer earnings of graduate students in 1961-62 was made by applying the ratio of graduate to undergraduate earnings in 1956-57.

For the year 1968-69, data for a combined group of graduates and undergraduates were available.[1] To obtain data for the missing years, the annual rates of growth for the periods 1956-57 to 1961-62 and 1961-62 to 1968-69 were calculated and applied to the existing information. The average number of months worked was calculated as 2.5.[2] The percentage of students employed was estimated to be 87 per cent.

Direct expenditures by students involve four major items: books, school supplies, transportation costs to and from home (for students who are attending a university located in a municipality other than their hometown), and the differential in living expenses for out-of-town students. These items were calculated for both undergraduate and graduate students. Data were available only for certain years, however.

For undergraduate students, expenditure data were available for books and school supplies for the years 1956 (Arts and Science only),[3] 1961[4] and 1968;[5] for transportation, for the years 1956 (Arts and Science only),[6] 1961[7]

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[1]Canada, Department of Manpower and Immigration, *Summer Employment Survey of Post-Secondary Students in Canada, 1969*, Ottawa, 1970.

[2]Calculated on the basis of data presented in Department of Manpower and Immigration, *Summer Employment Survey, op. cit.*

[3]Dominion Bureau of Statistics, *University Student Expenditure, 1956-57, op. cit.* This source lists only expenditures for arts and science students. Expenditures for all undergraduate students were estimated on the basis of the 1961 breakdown.

[4]Dominion Bureau of Statistics, *University Student Expenditure, 1961-62*, Part II, *op. cit.*

[5]Dominion Bureau of Statistics, *Post-Secondary Student Population Survey* (Ottawa: Queen's Printer, 1970). The data presented in this source include tuition and fees; these two items were removed by calculating and subtracting the average amount spent on them (see Dominion Bureau of Statistics, *Tuition and Living Costs at Canadian Degree-granting Universities and Colleges, 1968-69*, Ottawa, 1969).

[6]Dominion Bureau of Statistics, *University Student Expenditure, 1956-57, op. cit.* Expenditures for all undergraduate students were estimated on the basis of the 1961 breakdown.

[7]Dominion Bureau of Statistics, *University Student Expenditure, 1961-62*, Part II, *op. cit.*

and 1968,[1] and for the differential in living expenses for 1968.[2] For graduate students, expenditure data were available for books and supplies for 1961;[3] and for transportation, 1961.[4] No information on the differential in living expenses for graduates could be obtained.[5]

The years 1956, 1961 and 1968 were used as the terminal points for the calculation of the annual rates of growth used in estimating data for the missing years. Since actual data were not available for all the variables in each of the terminal years, it was necessary to make estimates based on the ratios of already known variables. Amounts were then summed to produce total direct expenditures per student. This procedure was repeated at both the undergraduate and graduate level for each academic year between 1956-57 and 1967-68.

Calculating the Value of Municipal Services Rendered to Universities

As outlined in the text of Chapter 3, we allocate municipal expenditures in Ottawa to the two universities in proportion to assessed property value. The method has some basis in the economic literature. In recent years, a considerable number of studies have analysed the determinants of municipal expenditures.[6]

[1] Dominion Bureau of Statistics, *Post-Secondary Student Population Survey, op. cit.*, p. 50.

[2] *Ibid.*, p. 37. The ratio of the differential in living expenses to other direct expenses in 1968 was used to make estimates for 1956-57 and 1961-62.

[3] Dominion Bureau of Statistics, *University Student Expenditure and Income in Canada, Canadian Graduate Students, 1961-62*, Part III (Ottawa: Queen's Printer, 1964). The ratio of graduate expenditures on books and supplies to undergraduate expenditures on these items was used to make estimates for 1956 and 1968.

[4] *Ibid.*, p. 32.

[5] Data for undergraduates on the ratio of differential living expenses to other direct expenses were used to make estimates.

[6] For a discussion of the analysis of determinants and bibliographical material, see Frederic L. Pryor, *Public Expenditures in Communist and Capitalist Nations* (Homewood, Ill.: Richard D. Irwin, 1968), pp. 53-55; and Richard M. Bird, *The Growth of Government Spending in Canada* (Toronto: Canadian Tax Foundation, 1970), Appendix B.

They have generally found that variations in assessed property values among communities explain much of the variation in the expenditure on certain municipal functions. It would thus appear that the demand for some municipal services, such as fire and police protection, is related to assessed valuation. The studies also suggest that the demand for certain other services is related to the number of persons to be served rather than to the value of property. It would have been possible to use a more complicated formula in allocating municipal expenditures to Carleton University and the University of Ottawa, i.e. a formula that included the number of students, expressed as a proportion of the total population in Ottawa. Some experimentation showed, however, that this would result in only marginal changes in our estimates. Our conclusions on productivity trends would, furthermore, not have been affected in any way whatsoever.

It must be pointed out that the data on assessment may not reflect the true value of the property of the two universities. Since educational institutions do not pay property taxes, municipal assessors make only a *pro forma* effort when dealing with such institutions. This may well explain the fact that the assessment of the two universities declined as a proportion of the city's total assessment over the 12-year period. As a result of this decline, estimated expenditure per student increased only in a marginal way.

Expenditures on the following functions were allocated to the two universities: general government, protection of persons and property, sanitation and waste removal, recreation and community services, and deficits of utilities and other enterprises.[1]

For the years 1957 to 1959, assessment data for the two universities were lacking.[2] Average expenditures per student for the rest of the period were substituted for the missing years.

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[1]Ontario Department of Municipal Affairs, *Annual Report of Municipal Statistics* (Toronto: Queen's Printer, 1956 to 1968).

[2]For the years 1960 to 1968, data were obtained from the Tax Department of the City of Ottawa.

APPENDIX C

NOTES ON ADJUSTING INPUTS FOR SYSTEM GROWTH

Calculating Enrolment by Program

Statistics on enrolment are not broken down between general and honours degree programs in Arts and Science and between master's and doctoral degree programs at the graduate level. To estimate enrolment in each of these categories, we made use of statistics on degrees which give the necessary detail. Annual enrolment in the general degree program for undergraduates in Arts and Science ($E3$) was calculated according to the formula:

$$E3 = \frac{3 \times (\text{Number of General B.A. (\& B.Sc. Degrees)})}{3 \times (\text{Number of General B.A. (\& B.Sc. Degrees)}) + 4 \times (\text{Number of Honours Degrees (in Arts \& Science)})} EAS$$

where EAS stands for total enrolment in Arts and Science. The weights of three and four reflect the length of each degree program in years. At the graduate level, an equivalent formula was used to calculate annual enrolment in the master's program. In this case, weights of two (for the master's program) and of three (for the doctoral program) were employed.

In addition to the formula described above, a second method of estimation was used. Assumptions about the length of each program remained the same. However, the second method makes use of information on degrees for a number of years after the year of enrolment. Thus it reflects the fact that most students enrolled in 1956-57 graduated in a later year, etc. The formula for $E3$ then becomes:

$$E3_i = \frac{(\text{Sum of General B.A. \& B.Sc. Degrees in Years } i \text{ to } (i+2))}{(\text{Sum of General B.A. \& B.Sc. Degrees in Years } i \text{ to } (i+2)) + (\text{Sum of Honours Degrees in Years } i \text{ to } (i+3))} EAS_i$$

While the two methods give somewhat different estimates, it was found that productivity trends were unaffected by the choice of procedure. Only results based on the first method have been reported in the text of the Study.

The Weighting of University Enrolment

The following weights, derived from the Ontario formula for operating grants, have been applied to undergraduate and graduate enrolment:

Undergraduate

Arts (General)	= 1*
Arts (Honours)	= 1.5*
Science (General)	= 1.5*
Science (Honours)	= 2*
Applied Science (all years)	= 2
Education (all years)	= 1.5*
Commerce & Business Administration (all years)	= 1.5
Dentistry, Medicine, Veterinary Science (all years)	= 3
Nursing, Optometry, Pharmacy (all years)	= 2
Physical & Health Education and Physiotherapy and Occupational Therapy (all years)	= 1.5
Agriculture & Forestry (all years)	= 2
Law (all years)	= 1.5
Journalism, Secretarial Science, Social Work, Theology (all years)	= 1
Fine and Applied Arts and Library Science (all years)	= 1.5
Household Science, Architecture, Music (all years)	= 2
Others (all years)	= 1*

Graduate

Master's level (all programs and all years)	= 3*
Ph.D. level (all programs and all years)	= 6*

Asterisks indicate some modification in actual formula weights. Modifications were necessary in those cases where enrolment statistics were broken down according to categories that differed from those used in Ontario grants.[1] The following paragraphs explain the modifications.

Arts and Science

The formula treats first-year honours students differently from honours students in later years. In Arts, they are given a weight of "1" in the first year and a weight of "1.5" later on. In Science, the weights are "1" and "2". Since enrolment figures by year of study are not available, all students in a particular program have been assigned the same weight.

Education

The Ontario formula does not weight students in education separately. An estimated weight of "1.5" has been used.

Others

Since the programs involved are not specified and since most heavy-capital-investment courses have already been considered in the preceding weights, an estimated weight of "1" has been assigned to this category.

Graduate

The Ontario formula ranges from a low weight of "2" to a high of "6" for graduate students. Since the enrolment data used in this Study are considerably more aggregated than those used by Ontario, it has been necessary to estimate the graduate weights. At the master's level, the weight "3" represents the median (low "2" and high "4") in the Ontario formula; Arts students, the largest single master's level grouping, are assigned a weight of "3". For Ph.D.'s, the Ontario weight of "6" (including all Ph.D. students except first-year Ph.D. direct from Baccalaureate) has been used.

[1]For a list and further discussion of Ontario formula weights, see R. W. Judy, et. al. "Analysis of the Effects of Formula Financing on Ontario Universities, Part I: Summary, Analysis and Conclusions", Office of Institutional Research, University of Toronto, October 1966 (mimeo.).

APPENDIX D

COVERAGE OF INSTITUTIONS AND MATCHING OF DATA

Complete and consistent coverage for a large group of institutions was one of the main objectives of the present Study. In selecting the sample of 49 universities and colleges, we took account of data availability from two sources: the Dominion Bureau of Statistics and the Canadian Association of University Business Officers (CAUBO) returns and publications for operating expenditures, and the DBS returns and publications for enrolment and graduation data. In addition, an effort was made to include as many institutions as possible that were members of both the Association of Universities and Colleges of Canada and the Canadian Association of University Business Officers.

The data on enrolment used in the Study were taken from annual publications on university enrolment prepared by the Education Division of DBS.[1] The information on degrees and diplomas was obtained by consulting the individual returns submitted to the Education Division. Finally, the data on operating expenditures were taken both from the DBS/CAUBO financial returns submitted to the Education Division and from the annual financial statements published by CAUBO.[2]

In some years, information on one or more variables was missing for a particular institution. Where coverage was partial or incomplete, estimates were made for the missing years. Problems were not confined to an occasional lack of data, however. In addition, it was necessary to ascertain complete correspondence between data on the student body (enrolment, degrees) and data on operating expenditures. Thus enrolment and degrees for affiliated colleges had to be removed from the figures

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[1] Dominion Bureau of Statistics, *Survey of Higher Education, Part I: Fall Enrolment in Universities and Colleges*, Cat. No. 81-204 (Ottawa: Queen's Printer, annually). In the case of Quebec universities, where special adjustments were necessary to make enrolments comparable to expenditures, information was obtained from the Education Division of DBS.

[2] See Appendix B for a further discussion of the CAUBO data.

for Laval University and the University of Montreal since the expenditure data reported by these two universities did not cover the affiliated institutions. Similar problems of matching information occurred for some of the newer institutions that were transformed from colleges with affiliated status into independent universities.

The tables that follow give a complete record of data coverage by institution and year. All universities and colleges have been grouped by region. The symbols used in the tables should be interpreted in the following way:

E -- Enrolment

D -- Degrees

X -- Operating Expenditures (actual; taken from DBS/CAUBO returns)

X^c-- Operating Expenditures (actual; taken from combined regional breakdowns given in CAUBO annual financial statements)

X^e-- Operating Expenditures (estimated).

Table D-1

COVERAGE OF INSTITUTIONS AND DATA IN THE ATLANTIC PROVINCES

Institution	1956-57			1957-58			1958-59			1959-60			1960-61			1961-62			1962-63			1963-64			1964-65			1965-66			1966-67			1967-68		
Newfoundland																																				
Memorial University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Prince Edward Island																																				
Prince of Wales College[1]																									E		X	E		X	E		X	E		X
St. Dunstan's University	E	D	X[e]	E	D	X[e]	E	D	X[e]	E	D	X	E	D	X[e]	E	D	X	E	D	X	E	D	X[e]	E	D	X	E	D	X	E	D	X	E	D	X
Nova Scotia																																				
Acadia University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Dalhousie University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Mount St. Vincent University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
St. Francis Xavier University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
St. Mary's University	E	D	X[e]	E	D	X[e]	E	D	X[e]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
New Brunswick																																				
Université de Moncton[2]																			D			E	D		E	D		E	D	X	E	D	X	E	D	X
Mount Allison University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
University of New Brunswick	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X

(1) Prince of Wales College became a degree-granting institution in 1964. The first degrees were to be awarded in 1969.

(2) The Université de Moncton was founded in 1963.

Table D-2

COVERAGE OF INSTITUTIONS AND DATA IN QUEBEC

Institution	1956-57			1957-58			1958-59			1959-60			1960-61			1961-62			1962-63			1963-64			1964-65			1965-66			1966-67			1967-68		
Bishop's University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Université Laval[1]	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
McGill University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Université de Montréal[2]	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Collège Ste-Marie[3]																						E		X	E	D	X	E	D	X	E	D	X	E	D	X
Loyola College[4]			X[c]			X[c]			X[c]	E		X	E		X	E		X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Marianapolis College[5]																E			E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Université de Sherbrooke[6]	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Sir George Williams University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X

(1) All data for the classical colleges affiliated with Université Laval have been excluded. As well, enrolment and degree data in Baccalauréat en pédagogie programs have been excluded as there are no corresponding expenditure data.

(2) All data for the classical colleges affiliated with Université de Montréal have been excluded. Enrolment and degree data in Baccalauréat en pédagogie programs have been excluded since there are no corresponding expenditure data. Since the École Polytechnique and École des Hautes Études Commerciales have operating budgets separate from the Université de Montréal, the data on their enrolment and degrees granted have been excluded.

(3) Collège Ste-Marie is affiliated with Université de Montréal. Data for 1956-57 to 1962-63 and information on degrees in 1963-64 are included in the information for the parent institution.

(4) Loyola College is affiliated with Université de Montréal. Enrolment data for 1956-57 to 1958-59 and degree data for 1956-57 to 1961-62 are included in the information for the parent institution.

(5) Marianapolis College is an affiliate of the Université de Montréal. Data for the early years are included in the information for the parent institution.

(6) All data for the classical colleges affiliated with Université de Sherbrooke have been excluded. Also, enrolment and degree data in Baccalauréat en pédagogie programs have been excluded as there are no corresponding expenditure data.

Table D-3

COVERAGE OF INSTITUTIONS AND DATA IN ONTARIO

	1956-57			1957-58			1958-59			1959-60			1960-61			1961-62			1962-63			1963-64			1964-65			1965-66			1966-67			1967-68		
Brock University[1]																									E		X	E		X	E	D	X	E	D	X
Carleton University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
University of Guelph[2]																									E	D[3]	X	E	D[3]	X	E	D[3]	X	E	D[3]	X
Lakehead University[4]	E			E			E			E			E			E		X	E		X	E		X	E	D	X	E	D	X	E	D	X	E	D	X
Laurentian University of Sudbury[5]													E	D	X[e]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
McMaster University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Université d'Ottawa	E	D	X	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Queen's University of Kingston	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
University of Toronto	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
St. Michael's College	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Trinity College	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Victoria University	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Trent University[6]																															X	E		X	E	D	X
University of Waterloo[7]										E		X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Waterloo Lutheran University[8]	E		X[c]	E		X[c]	E		X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
University of Western Ontario	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
University of Windsor[9]	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
York University[10]												X[11]	E		X	E		X	E		X	E		X	E		X	E	D	X	E	D	X	E	D	X

[1] Brock University was created in 1964.

[2] Guelph University was established by an Act passed in the Ontario Legislature in 1964.

[3] These degrees were awarded by the University of Guelph even though the students were enrolled prior to 1964-65 in the following colleges affiliated with the University of Toronto: Ontario Veterinary College, Ontario Agricultural College, and Macdonald Institute.

(cont'd.)

(4) Lakehead University was created as a degree-granting institution in 1962. Prior to this date, the institution was known as the Lakehead College of Arts, Science and Technology and it offered junior division courses in Arts and Science. Information on degrees and expenditures is included with other institutions in the sample in the early years.

(5) Laurentian University of Sudbury was established in 1960.

(6) Trent University was created as a degree-granting institution in 1960. The first class of students was enrolled in 1964.

(7) The University of Waterloo was incorporated as a degree-granting institution in 1959 by the Province of Ontario. Classes in the engineering program started in 1957 while the institution was still a part of Waterloo College.

(8) Waterloo Lutheran University was incorporated and given degree-granting rights in 1959. Prior to this date, Waterloo College had been affiliated with the University of Western Ontario; until 1959, all students who graduated from Waterloo College had their degrees awarded by the University of Western Ontario.

(9) Prior to 1963, when the University of Windsor was incorporated, the data refer to the operations of Assumption University of Windsor.

(10) York University was founded in 1959 as an affiliate of the University of Toronto. Until 1965, all degrees from York University were conferred by the University of Toronto.

(11) There was no enrolment for this year. The expenditures for the year were for administration.

Table D-4

COVERAGE OF INSTITUTIONS AND DATA IN THE PRAIRIE PROVINCES

Institution	1956-57			1957-58			1958-59			1959-60			1960-61			1961-62			1962-63			1963-64			1964-65			1965-66			1966-67			1967-68		
Manitoba																																				
Brandon University[1]	E			E			E			E		X	E		X	E		X	E		X	E		X	E		X	E		X	E		X	E	D	X
University of Manitoba	E	D	X[a]	E	D	X[a]	E	D	X[a]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
St. John's College[2]	E	D		E	D		E	D		E	D		E	D		E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
University of Winnipeg[3]	E	D		E	D		E	D		E	D		E	D		E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Saskatchewan																																				
University of Saskatchewan	E	D	X[a]	E	D	X[a]	E	D	X[a]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Alberta																																				
University of Alberta	E	D	X[a]	E	D	X[a]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
University of Calgary[4]																															E	D	X	E	D	X

[1] Brandon University was established in 1967. Until then, it was known as Brandon College and was affiliated with the University of Manitoba which granted degrees to its students. Expenditure data for the years 1956-57 to 1958-59 and degree data for all years except 1967-68 have been included under the University of Manitoba.

[2] St. John's College is affiliated with the University of Manitoba. Since 1877, the College has been empowered to confer degrees in theology; all other degrees, however, are awarded by the parent institution. Expenditure data for the years 1956-57 to 1960-61 have been included under the University of Manitoba.

[3] The University of Winnipeg was known as United College (an affiliate of the University of Manitoba until 1967) until July 1967 when it was granted university status. Expenditures for the years 1956-57 to 1960-61 have been included under the University of Manitoba.

[4] The University of Calgary was established as a degree-granting provincial university in 1966. Prior to that date, it was known as the University of Alberta at Calgary; all data for the pre-1966 period have been listed under the University of Alberta.

Table D-5

COVERAGE OF INSTITUTIONS AND DATA IN BRITISH COLUMBIA

Institution	1956-57			1957-58			1958-59			1959-60			1960-61			1961-62			1962-63			1963-64			1964-65			1965-66			1966-67			1967-68		
University of British Columbia	E	D	X[c]	E	D	X[c]	E	D	X[c]	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Notre Dame University of Nelson[1]																E		X	E		X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X
Simon Fraser University[2]																											X[3]	E		X	E		X	E	D	X
University of Victoria[4]	E			E			E			E			E		X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X	E	D	X

[1] Notre Dame University of Nelson became a degree-granting university in 1963. Prior to that date, (when it was known as Notre Dame College) it was affiliated with, and had its degrees awarded by, St. Francis Xavier University of Antigonish, Nova Scotia.

[2] Simon Fraser University was established as a degree-granting university in 1963.

[3] The expenditures for this year were for administrative purposes.

[4] The University of Victoria was created as a degree-granting institution in July 1963. Before 1963, it was known as Victoria College and was affiliated with the University of British Columbia. Expenditures for the years 1956-57 to 1959-60 and degree data for the years 1956-57 to 1961-62 have been included under University of British Columbia.

APPENDIX E

STATISTICAL TABLES

Table E-1

DEGREES AWARDED AT 11 UNIVERSITIES AND COLLEGES IN THE ATLANTIC PROVINCES

	UNDERGRADUATE											
	Arts		Science		Applied	Educa-	Com-	Health	Agricul- ture &		Other	
Year	General	Honours	General	Honours	Science	tion	merce	Fields	Forestry	Law	Fields	Total
1956-57	354	32	175	32	35	153	87	66	20	68	72	1,094
1957-58	377	24	188	38	78	162	98	82	17	55	84	1,203
1958-59	400	41	208	28	84	203	99	74	27	65	88	1,317
1959-60	394	48	197	34	103	253	111	76	31	40	99	1,386
1960-61	405	47	206	50	102	293	118	94	20	35	84	1,454
1961-62	502	47	238	32	103	383	122	112	32	49	106	1,726
1962-63	651	30	269	29	98	507	159	115	26	33	107	2,024
1963-64	771	47	273	59	106	567	177	130	28	43	84	2,285
1964-65	1,050	66	278	62	112	668	227	146	29	52	103	2,793
1965-66	1,353	77	356	53	119	773	265	173	39	55	99	3,362
1966-67	1,382	83	381	62	75	907	256	207	30	72	103	3,558
1967-68	1,864	99	498	80	89	1,028	325	193	39	81	110	4,406

	GRADUATE				
	Master Level		Doctoral Level		
	Arts & Science	Other	Arts & Science	Other	Total
1956-57	46	17	6	0	69
1957-58	44	23	3	0	70
1958-59	41	9	2	1	53
1959-60	51	36	5	0	92
1960-61	58	54	3	2	117
1961-62	48	70	8	0	126
1962-63	94	50	3	0	147
1963-64	101	67	9	0	178
1964-65	102	78	13	0	193
1965-66	119	109	15	1	244
1966-67	156	90	20	0	266
1967-68	229	95	16	2	342

Source: See Appendix D.

Table E-2

DEGREES AWARDED AT 9 UNIVERSITIES AND COLLEGES IN QUEBEC

	UNDERGRADUATE											
	Arts		Science		Applied	Educa-	Com-	Health	Agricul-ture &		Other	
Year	General	Honours	General	Honours	Science	tion	merce	Fields	Forestry	Law	Fields	Total
1956-57	532	130	295	81	355	302	296	576	81	200	791	3,639
1957-58	667	139	284	91	357	384	295	664	80	119	761	3,841
1958-59	424	169	294	108	363	462	389	614	98	163	850	3,934
1959-60	599	173	303	117	365	567	363	612	104	184	366	3,753
1960-61	558	208	358	115	406	686	410	658	113	198	410	4,120
1961-62	746	312	430	130	391	937	415	815	121	177	455	4,929
1962-63	1,003	436	435	116	332	1,056	404	836	136	157	450	5,361
1963-64	1,499	411	513	202	321	1,360	468	912	113	187	557	6,543
1964-65	1,243	672	594	185	343	1,807	578	1,214	136	217	714	7,703
1965-66	1,944	393	811	255	374	1,775	655	1,021	146	280	742	8,396
1966-67	2,417	501	974	266	359	1,574	500	914	143	255	457	8,360
1967-68	2,561	649	1,059	376	478	1,722	542	1,097	185	356	561	9,586

	GRADUATE				
	Master Level		Doctoral Level		
	Arts & Science	Other	Arts & Science	Other	Total
1956-57	226	207	100	27	560
1957-58	252	242	90	27	611
1958-59	317	264	91	19	691
1959-60	292	454	97	25	868
1960-61	352	543	99	26	1,020
1961-62	435	778	76	30	1,319
1962-63	482	982	87	34	1,585
1963-64	456	862	103	57	1,478
1964-65	558	806	118	50	1,532
1965-66	878	1,186	122	49	2,235
1966-67	841	1,630	158	68	2,697
1967-68	1,021	1,941	168	61	3,191

Source: See Appendix D.

Table E-3

DEGREES AWARDED AT 18 UNIVERSITIES AND COLLEGES IN ONTARIO

	UNDERGRADUATE											
	Arts		Science		Applied	Educa-	Com-	Health	Agricul-ture &		Other	
Year	General	Honours	General	Honours	Science	tion	merce	Fields	Forestry	Law	Fields	Total
1956-57	1,681	393	60	105	608	151	199	614	97	53	324	4,285
1957-58	1,812	452	59	106	649	163	241	618	111	55	353	4,619
1958-59	2,045	522	60	163	732	173	257	662	124	58	348	5,144
1959-60	2,378	438	64	159	681	198	255	698	99	110	395	5,475
1960-61	2,342	478	146	233	734	230	272	792	122	102	445	5,896
1961-62	2,737	500	150	225	712	188	270	864	153	124	489	6,412
1962-63	3,181	746	250	257	695	211	280	971	135	139	543	7,408
1963-64	3,773	860	365	244	809	206	310	1,043	152	186	549	8,497
1964-65	4,206	1,082	415	316	712	245	333	1,161	199	191	602	9,462
1965-66	4,675	1,078	483	371	829	218	329	1,293	165	249	665	10,355
1966-67	6,489	1,095	664	347	880	163	404	1,399	175	300	703	12,620
1967-68	7,725	1,443	920	505	976	123	561	1,532	172	353	727	15,040

	GRADUATE				
	Master Level		Doctoral Level		
	Arts & Science	Other	Arts & Science	Other	Total
1956-57	219	291	99	26	635
1957-58	199	372	98	24	693
1958-59	231	411	84	34	760
1959-60	328	479	94	21	922
1960-61	371	486	112	35	1,004
1961-62	388	569	99	45	1,101
1962-63	445	722	146	49	1,362
1963-64	533	726	140	51	1,450
1964-65	694	844	164	63	1,765
1965-66	934	922	214	96	2,166
1966-67	1,272	1,142	213	118	2,745
1967-68	1,443	1,319	331	151	3,244

Source: See Appendix D.

Table E-4

DEGREES AWARDED AT 7 UNIVERSITIES AND COLLEGES IN THE PRAIRIE PROVINCES

	UNDERGRADUATE											
	Arts		Science		Applied	Educa-	Com-	Health	Agricul- ture &		Other	
Year	General	Honours	General	Honours	Science	tion	merce	Fields	Forestry	Law	Fields	Total
1956-57	485	32	154	36	357	430	65	343	75	90	166	2,233
1957-58	546	43	164	41	427	507	97	301	64	84	168	2,442
1958-59	653	41	215	48	431	505	90	317	95	99	138	2,632
1959-60	730	63	223	60	530	607	116	338	59	90	152	2,968
1960-61	833	53	252	62	573	677	104	344	102	82	154	3,236
1961-62	1,009	81	350	83	559	831	125	389	104	96	175	3,802
1962-63	1,167	116	482	89	466	876	124	391	120	89	193	4,113
1963-64	1,472	112	473	92	470	952	226	463	127	95	235	4,717
1964-65	1,545	145	524	131	485	1,201	250	521	114	90	223	5,229
1965-66	1,936	72	604	70	437	1,488	275	562	135	113	264	5,956
1966-67	2,558	73	712	52	480	1,811	352	711	193	186	265	7,393
1967-68	3,120	183	759	146	534	2,015	402	805	188	133	342	8,627

	GRADUATE				
	Master Level		Doctoral Level		
	Arts & Science	Other	Arts & Science	Other	Total
1956-57	73	91	21	4	189
1957-58	49	81	4	6	140
1958-59	64	125	13	9	211
1959-60	99	110	15	2	226
1960-61	124	117	13	9	263
1961-62	148	160	27	19	354
1962-63	245	142	31	35	453
1963-64	171	268	52	31	522
1964-65	157	387	72	38	654
1965-66	273	341	64	47	725
1966-67	321	370	68	56	815
1967-68	339	433	117	59	948

Source: See Appendix D.

Table E-5

DEGREES AWARDED AT 4 UNIVERSITIES AND COLLEGES IN BRITISH COLUMBIA

	UNDERGRADUATE											
	Arts		Science		Applied	Educa-	Com-	Health	Agricul-ture &		Other	
Year	General	Honours	General	Honours	Science	tion	merce	Fields	Forestry	Law	Fields	Total
1956-57*	376	58	--	--	178	143	111	131	53	52	75	1,177
1957-58	308	36	52	18	172	318	113	137	78	72	76	1,380
1958-59	278	43	71	26	212	282	102	147	120	73	80	1,434
1959-60	406	46	116	58	189	197	128	147	98	63	90	1,538
1960-61	376	54	135	55	216	234	115	144	86	77	102	1,594
1961-62	460	48	174	66	226	289	110	184	64	75	144	1,840
1962-63	504	56	223	72	184	378	151	124	66	60	173	1,991
1963-64	681	110	313	97	220	468	119	143	76	64	184	2,475
1964-65	705	209	333	107	191	600	136	164	96	61	229	2,831
1965-66	813	122	421	118	159	684	138	175	80	84	274	3,068
1966-67	909	117	451	114	205	784	110	160	79	106	183	3,218
1967-68	1,077	149	508	122	195	801	211	181	79	100	171	3,594

	GRADUATE				
	Master Level		Doctoral Level		
	Arts & Science	Other	Arts & Science	Other	Total
1956-57	50	61	8	2	121
1957-58	67	69	13	2	151
1958-59	57	89	11	0	157
1959-60	63	74	24	3	164
1960-61	83	90	9	3	185
1961-62	105	100	13	3	221
1962-63	98	132	35	6	271
1963-64	125	161	34	8	328
1964-65	140	194	44	8	386
1965-66	155	240	50	17	462
1966-67	160	235	69	12	476
1967-68	223	289	73	21	606

*Science General and Science Honours are included in Arts General and Arts Honours, respectively.

Source: See Appendix D.

Table E-6

OPERATING EXPENDITURES IN 11 UNIVERSITIES AND COLLEGES IN THE ATLANTIC PROVINCES

(Thousands of dollars)

Year	Academic and Library	Assisted Research	Adminis-tration	Plant Maintenance	Scholar-ships	Other Expendi-tures	Total
1956-57	3,144	252	535	935	131	508	5,505
1957-58	3,683	253	683	1,378	171	217	6,385
1958-59	4,558	499	721	1,354	200	292	7,622
1959-60	5,418	639	838	1,353	291	347	8,886
1960-61	6,167	797	952	1,483	284	446	10,128
1961-62	7,303	967	1,098	1,788	326	539	12,021
1962-63	8,654	1,156	1,086	1,732	500	648	13,776
1963-64	10,310	1,610	1,390	2,405	588	965	17,268
1964-65	13,834	1,903	1,277	2,324	837	848	21,024
1965-66	17,380	2,426	1,930	3,208	1,117	1,440	27,501
1966-67	23,781	3,456	2,237	3,872	1,358	2,365	37,069
1967-68	31,405	4,893	3,029	5,469	1,875	2,745	49,415

Note: "Other Expenditures" include expenditures on alumni affairs, public relations, placement service, as well as the net deficit on ancillary enterprises and miscellaneous expenses.

Source: See Appendix D.

Table E-7

OPERATING EXPENDITURES IN 9 UNIVERSITIES AND COLLEGES IN QUEBEC

(Thousands of dollars)

Year	Academic and Library	Assisted Research	Adminis-tration	Plant Maintenance	Scholar-ships	Other Expendi-tures	Total
1956-57	9,817	3,780	1,090	2,255	117	750	17,810
1957-58	11,759	3,965	1,218	2,497	251	1,142	20,832
1958-59	13,014	4,919	1,241	2,643	338	1,118	23,273
1959-60	14,990	5,644	1,525	3,013	539	1,068	26,779
1960-61	19,023	6,444	1,847	3,096	544	1,393	32,348
1961-62	22,814	8,141	2,224	3,662	607	1,746	39,194
1962-63	28,008	8,839	2,668	4,387	703	1,823	46,428
1963-64	33,769	10,601	2,862	5,057	1,050	1,990	55,328
1964-65	41,023	12,723	4,183	6,161	926	2,139	67,156
1965-66	51,086	16,472	5,220	7,765	1,068	2,586	84,197
1966-67	64,540	20,731	6,828	10,636	848	3,211	106,793
1967-68	80,379	24,177	7,744	13,241	593	4,397	130,531

Note: "Other Expenditures" include expenditures on alumni affairs, public relations, placement service, as well as the net deficit on ancillary enterprises and miscellaneous expenses.

Source: See Appendix D.

Table E-8

OPERATING EXPENDITURES IN 18 UNIVERSITIES AND COLLEGES IN ONTARIO

(Thousands of dollars)

Year	Academic and Library	Assisted Research	Adminis-tration	Plant Maintenance	Scholar-ships	Other Expendi-tures	Total
1956-57	15,421	3,623	1,317	3,539	355	905	25,158
1957-58	19,336	3,997	1,565	3,698	392	1,341	30,330
1958-59	22,886	4,824	1,913	4,237	392	1,223	35,475
1959-60	26,672	6,301	2,145	4,818	419	1,569	41,924
1960-61	30,435	7,050	2,446	6,357	462	1,913	48,665
1961-62	35,005	9,296	2,916	6,340	537	2,086	56,180
1962-63	40,760	10,441	3,361	6,972	629	2,364	64,527
1963-64	50,091	11,957	4,037	7,759	1,070	2,233	77,146
1964-65	64,963	19,561	6,091	11,080	1,342	3,476	106,513
1965-66	83,427	26,052	7,209	13,545	1,841	4,543	136,616
1966-67	116,235	33,869	10,087	19,137	1,729	6,193	187,249
1967-68	161,297	44,918	14,674	27,522	823	7,623	256,857

Note: "Other Expenditures" include expenditures on alumni affairs, public relations, placement service, as well as the net deficit on ancillary enterprises and miscellaneous expenses.

Source: See Appendix D.

Table E-9

OPERATING EXPENDITURES IN 7 UNIVERSITIES AND COLLEGES IN THE PRAIRIE PROVINCES

(Thousands of dollars)

Year	Academic and Library	Assisted Research	Adminis-tration	Plant Maintenance	Scholar-ships	Other Expendi-tures	Total
1956-57*	13,691	2,417	940	2,601	57	452	20,158
1957-58*	16,805	2,924	1,318	2,962	84	573	24,667
1958-59*	20,630	4,197	1,389	3,196	73	679	30,165
1959-60	16,203	3,676	960	2,389	49	607	23,883
1960-61	19,367	4,028	1,172	2,844	57	725	28,193
1961-62	23,353	4,860	1,526	3,621	127	1,058	34,545
1962-63	26,597	5,951	1,984	4,185	156	743	39,616
1963-64	30,731	7,789	2,333	4,938	203	1,024	47,018
1964-65	37,980	8,488	2,719	5,872	266	1,317	56,642
1965-66	46,160	10,253	3,220	7,432	1,864	955	69,884
1966-67	60,195	14,087	4,025	9,328	2,427	1,667	91,728
1967-68	76,705	19,310	5,663	11,293	3,015	2,010	117,995

* For these years, data for British Columbia are included.

Note: "Other Expenditures" include expenditures on alumni affairs, public relations, placement service, as well as the net deficit on ancillary enterprises and miscellaneous expenses.

Source: See Appendix D.

Table E-10

OPERATING EXPENDITURES IN 4 UNIVERSITIES AND COLLEGES IN BRITISH COLUMBIA

(Thousands of dollars)

Year	Academic and Library	Assisted Research	Adminis-tration	Plant Maintenance	Scholar-ships	Other Expendi-tures	Total
1956-57*	--	--	--	--	--	--	--
1957-58*	--	--	--	--	--	--	--
1958-59*	--	--	--	--	--	--	--
1959-60	9,126	2,066	633	1,662	101	266	13,854
1960-61	11,230	2,588	817	1,918	109	346	17,008
1961-62	13,237	2,867	947	2,156	116	489	19,811
1962-63	14,973	3,262	1,074	2,457	172	500	22,437
1963-64	17,322	3,609	1,161	2,781	222	799	25,893
1964-65	20,630	4,550	1,675	3,412	851	568	31,686
1965-66	28,760	5,709	2,037	4,129	1,232	799	42,666
1966-67	39,135	7,462	2,426	5,157	1,682	1,188	57,049
1967-68	49,120	9,860	3,014	6,252	2,244	484	71,990

* For these years, this information is included in Table E-9.

Note: "Other Expenditures" include expenditures on alumni affairs, public relations, placement service, as well as the net deficit on ancillary enterprises and miscellaneous expenses.

Source: See Appendix D.

Table E-11

FULL-TIME ENROLMENT AT 11 UNIVERSITIES AND COLLEGES IN THE ATLANTIC PROVINCES

	UNDERGRADUATE									
Year	Arts	Science	Applied Science	Educa-tion	Com-merce	Health Fields	Agricul-ture & Forestry	Law	Other Fields	Total
1956-57	1,717	1,229	1,657	531	604	401	136	206	364	6,845
1957-58	1,820	1,330	1,803	736	689	457	165	179	412	7,591
1958-59	2,096	1,366	1,760	826	743	454	172	158	405	7,980
1959-60	2,526	1,309	1,666	848	791	504	172	140	422	8,378
1960-61	2,895	1,445	1,727	976	853	586	191	135	461	9,269
1961-62	3,429	1,659	1,648	1,369	1,039	670	262	148	478	10,702
1962-63	4,073	1,738	1,559	1,531	1,050	752	217	156	485	11,561
1963-64	5,071	2,059	1,544	1,631	1,336	982	207	173	521	13,524
1964-65	5,623	2,334	1,652	1,961	1,459	1,097	217	211	580	15,134
1965-66	6,135	2,803	1,711	2,108	1,757	1,218	217	260	633	16,842
1966-67	6,769	3,195	1,846	2,362	2,044	1,378	249	328	603	18,774
1967-68	7,892	3,402	2,087	2,556	2,375	1,544	306	385	861	21,408

	GRADUATE		
	Arts & Science	Other	Total
1956-57	84	34	118
1957-58	101	26	127
1958-59	133	65	198
1959-60	150	87	237
1960-61	166	96	262
1961-62	198	134	332
1962-63	277	157	434
1963-64	338	143	481
1964-65	504	204	708
1965-66	647	217	864
1966-67	768	222	990
1967-68	1,024	292	1,316

Source: See Appendix D.

Table E-12

FULL-TIME ENROLMENT AT 9 UNIVERSITIES AND COLLEGES IN QUEBEC

	UNDERGRADUATE									
Year	Arts	Science	Applied Science	Education	Commerce	Health Fields	Agriculture & Forestry	Law	Other Fields	Total
1956-57	1,869	1,686	2,546	1,214	1,187	2,998	520	757	2,033	14,810
1957-58	1,982	2,048	2,827	1,669	1,424	2,908	605	727	1,957	16,147
1958-59	2,235	2,313	2,686	2,417	1,561	2,802	667	747	2,068	17,496
1959-60	2,224	2,576	2,808	2,841	1,962	2,866	677	790	2,362	19,106
1960-61	2,775	2,581	3,031	3,406	2,178	3,054	667	877	2,648	21,217
1961-62	3,548	3,508	2,695	4,292	2,441	3,261	711	1,038	2,977	24,471
1962-63	4,999	3,692	2,518	4,681	2,510	3,439	638	1,150	2,821	26,448
1963-64	5,338	4,238	2,740	5,224	2,790	3,856	762	1,194	2,772	28,914
1964-65	6,065	5,216	2,551	5,457	2,959	4,063	832	1,205	3,019	31,367
1965-66	10,339	5,989	2,711	6,508	2,820	4,090	957	1,362	3,249	38,025
1966-67	11,441	6,744	3,128	7,573	2,937	4,411	1,003	1,552	3,363	42,152
1967-68	6,588	7,412	3,614	6,450	2,954	4,639	992	1,829	3,609	38,087

	GRADUATE		
	Arts & Science	Other	Total
1956-57	640	447	1,087
1957-58	714	662	1,376
1958-59	771	636	1,407
1959-60	825	774	1,599
1960-61	1,008	973	1,981
1961-62	1,264	1,033	2,297
1962-63	1,492	1,249	2,741
1963-64	2,168	1,645	3,813
1964-65	2,922	1,652	4,574
1965-66	3,672	2,060	5,732
1966-67	4,211	2,228	6,439
1967-68	5,009	2,649	7,658

Source: See Appendix D.

Table E-13

FULL-TIME ENROLMENT AT 18 UNIVERSITIES AND COLLEGES IN ONTARIO

	UNDERGRADUATE									
Year	Arts	Science	Applied Science	Education	Commerce	Health Fields	Agriculture & Forestry	Law	Other Fields	Total
1956-57	6,806	1,069	3,504	371	1,091	3,489	79	189	1,185	17,783
1957-58	7,451	1,421	3,844	285	1,188	3,545	73	274	1,209	19,290
1958-59	8,535	1,522	3,927	431	1,082	3,649	76	347	1,201	20,770
1959-60	9,175	1,668	4,141	535	1,141	3,676	89	437	1,215	22,077
1960-61	10,639	2,117	4,066	602	1,260	4,031	97	445	1,379	24,636
1961-62	11,898	3,415	4,113	763	1,399	4,256	99	506	1,392	27,841
1962-63	13,339	3,924	4,233	719	1,529	4,519	105	587	1,441	30,396
1963-64	15,524	4,571	4,560	724	1,735	4,590	95	739	1,515	34,053
1964-65	18,429	5,574	4,931	820	1,902	5,068	941	893	1,999	40,557
1965-66	22,449	6,753	5,631	914	2,009	5,050	860	1,104	1,977	46,747
1966-67	26,585	8,861	6,493	1,000	2,415	5,524	893	1,167	2,354	55,292
1967-68	31,276	10,831	7,380	1,198	2,862	6,164	953	1,317	2,868	64,849

	GRADUATE		
	Arts & Science	Other	Total
1956-57	756	801	1,557
1957-58	970	787	1,757
1958-59	1,103	840	1,943
1959-60	1,263	852	2,115
1960-61	1,502	992	2,494
1961-62	1,633	1,155	2,788
1962-63	1,714	1,470	3,184
1963-64	2,405	1,670	4,075
1964-65	3,264	2,137	5,401
1965-66	4,284	2,452	6,736
1966-67	4,624	2,963	7,587
1967-68	5,822	3,806	9,628

Source: See Appendix D.

Table E-14

FULL-TIME ENROLMENT AT 7 UNIVERSITIES AND COLLEGES IN THE PRAIRIE PROVINCES

	UNDERGRADUATE									
Year	Arts	Science	Applied Science	Educa-tion	Com-merce	Health Fields	Agricul-ture & Forestry	Law	Other Fields	Total
1956-57	2,763	928	2,590	1,154	415	1,434	322	184	629	10,419
1957-58	3,207	950	2,988	1,235	433	1,420	366	207	685	11,491
1958-59	2,913	2,043	3,139	1,555	481	1,631	415	200	733	13,110
1959-60	3,237	2,274	2,964	2,219	572	1,768	484	211	861	14,590
1960-61	3,729	2,542	2,900	2,886	756	1,926	545	223	915	16,422
1961-62	4,541	2,924	2,761	3,557	986	2,080	597	231	977	18,654
1962-63	5,507	3,375	2,651	4,134	1,203	2,343	658	234	1,082	21,187
1963-64	6,220	3,693	2,562	4,713	1,447	2,673	734	239	1,179	23,460
1964-65	7,367	3,773	2,708	6,069	1,666	3,037	770	263	1,336	26,989
1965-66	8,785	3,812	2,980	7,372	1,867	3,375	866	322	1,657	31,036
1966-67	9,853	3,955	3,333	8,163	2,137	3,676	1,013	537	1,916	34,583
1967-68	11,209	4,420	3,771	8,731	2,223	3,981	1,112	574	2,490	38,511

	GRADUATE		
	Arts & Science	Other	Total
1956-57	131	139	270
1957-58	185	189	374
1958-59	239	248	487
1959-60	357	309	666
1960-61	454	357	811
1961-62	606	385	991
1962-63	673	530	1,203
1963-64	898	805	1,703
1964-65	1,053	863	1,916
1965-66	1,322	987	2,309
1966-67	1,652	1,194	2,846
1967-68	1,861	1,504	3,365

Source: See Appendix D.

Table E-15

FULL-TIME ENROLMENT AT 4 UNIVERSITIES AND COLLEGES IN BRITISH COLUMBIA

	UNDERGRADUATE									
Year	Arts	Science	Applied Science	Education	Commerce	Health Fields	Agriculture & Forestry	Law	Other Fields	Total
1956-57[1]	3,508	--	1,023	1,114	579	586	275	228	319	7,632
1957-58[1]	4,151	--	1,143	1,365	613	593	472	247	329	8,913
1958-59[1]	4,809	--	1,066	1,805	606	548	410	249	357	9,850
1959-60[1]	5,114	--	1,034	2,200	669	600	346	245	359	10,567
1960-61[2]	5,853	101	1,047	2,489	649	630	346	240	406	11,761
1961-62[2]	7,298	154	980	2,793	627	669	372	225	476	13,594
1962-63	7,025	1,036	969	2,986	631	775	372	227	608	14,629
1963-64	5,290	3,427	927	3,350	637	831	386	243	704	15,795
1964-65	5,662	3,696	923	3,721	777	861	370	275	743	17,028
1965-66	7,367	4,641	959	4,089	899	922	398	306	831	20,412
1966-67	8,445	5,096	1,043	4,484	1,017	966	417	333	956	22,757
1967-68	8,976	5,240	1,108	5,078	1,114	1,021	415	397	1,017	24,366

	GRADUATE		
	Arts & Science[3]	Other[3]	Total[3]
1956-57	--	--	--
1957-58	--	--	--
1958-59	--	--	--
1959-60	--	--	--
1960-61	--	8	8
1961-62	432	376	808
1962-63	414	217	631
1963-64	546	297	843
1964-65	734	325	1,059
1965-66	886	424	1,310
1966-67	1,113	503	1,616
1967-68	1,447	557	2,004

[1] Undergraduate science enrolment is included under Arts.

[2] Some undergraduate science enrolment is included under Arts.

[3] No information is available for the years 1956-57 to 1959-60; only partial data are available for 1960-61.

Source: See Appendix D.

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by Walter Hettich

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