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Full Name of Author — Nom complet de l'auteur

ARDESHIR NOORDEH

Date of Birth — Date de naissance

June 18 / 1949

Country of Birth — Lieu de naissance

IRAN

Permanent Address — Résidence fixe

45 Silversprings Blvd. , APT. PH-4
SCARBOROUGH, ONT. , M1V 1R2

Title of Thesis — Titre de la thèse

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Professor W. I. GILLESPIE

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Ardeshtir Noordeh

The Redistributonal Effects of Investment
In Post-Secondary Education in Ontario
Community Colleges: A Life Cycle Analysis

by

© Ardeshir Noordeh, B.A., M.A.

A Thesis submitted to the Faculty
of Graduate Studies and Research in Partial
fulfilment of the requirements for the degree of

Doctor of Philosophy

Department of Economics

Carleton University
Ottawa, Ontario
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The undersigned hereby recommend to the Faculty of
Graduate Studies and Research acceptance of the thesis,
"The Redistributinal Effects of Investment in Post-Secondary
Education in Ontario Community Colleges: A Life Cycle Analysis"
submitted by Ardeshir Noordh, B.A., M.A.
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the degree of Doctor of Philosophy.

Chairman, Department of Economics

Thesis Supervisor

Thesis Co-Supervisor

External Examiner

Carleton University

April 29, 1983

ABSTRACT

One of the main objectives of the government is to make adjustments in the distribution of income in favor of more unfortunate and poor people. The government subsidization of post-secondary education is one of the channels through which such a goal, among others, is intended to be obtained. The question now is whether the government has been able to achieve its redistributive goal through such a subsidization program or not.

The purpose of this thesis is to investigate such a redistributive effects in the context of a life-cycle model with a new body of data relating to Community Colleges in Ontario.

The question of income redistributive effects of investment in post-secondary education arises because of the fact that, on one hand, the higher education institutions are substantially financed by the government via proceeds from tax payments borne by different income groups; and on the other hand, the beneficiaries of the system from different income groups are not necessarily the same as the tax payers in these groups. Therefore, two categories of people could be distinguished. First, those who, via their tax payments contribute to the financing of post-secondary education and at the same time benefit from it by having their children attend these institutions (whom we call users), and second, those who support the system via their tax payments but do not receive any direct benefit from it because either they do not have children or their children have chosen not to attend these institutions (whom we call non-users).

For the first category (users), our findings indicate that there is no redistribution of income associated with post-secondary education. All the users of the system from all income groups gain. So far as the second group of people (non-users) are concerned, our results indicate that not only is there a redistribution of income from non-users to users in each income group, there also is a redistribution of income from non-users in the lower income groups (\$2000-\$4000) as well as non-users in the middle and upper middle income groups (\$5000-\$15000) to the users of the system in the lowest (less than \$2000); lower middle (\$4000-\$5000) and highest income groups (\$15000 and over). In other words, it is the lower and middle income groups, not the rich people, who mostly carry the burden of such a subsidization program which is in contrast with the government's goal.

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CHAPTER II

THE METHODOLOGY

As mentioned earlier in Chapter I, the major objective of this dissertation is to present a comprehensive and systematic analysis of income redistributive impact of investment in post-secondary education in Ontario Community Colleges in a life-cycle framework. The crux of the problem which results in such a redistributive effect arises from the fact that money derived from a particular tax structure to support part of post-secondary education inflicts a given distribution of burdens upon the various income classes of a society which in turn gives certain individuals enhanced earning power.

The model which is designed to analyze such income redistributive effects breaks down the contribution of the users, as well as non-users, of the system in support of post-secondary education in Ontario Community Colleges according to different income groups. It also shows the distribution of users of the system by income classes, calculates income class-specific direct costs and benefits and, as a final step, compares the results of income class-specific total costs and benefits attributable to the users of the system. This should reveal whether investment in post-secondary education in Ontario Community Colleges is regressive, progressive or neutral.

CHAPTER I

INTRODUCTION

The appropriation of public funds in support of individual, industry or social service could produce a redistribution of income.

The importance of these income redistributive effects is best explained by James T. Bonnen:

The distributional impacts of both public and private decision making increasingly are being questioned. Despite our society's equity commitments, many public programs are administered with little attention to their distributional impact. It should not surprise us then when those programs exhibit perverse distributional consequences. Yet, surprised we are at nearly every turn because we almost always fail to collect information on distributional impacts of programs..... Without such knowledge we often work at cross purposes, we waste resources, and we fail to attain program objectives.¹

Any government program undoubtedly results in some costs incurred and benefits received by the public, and the evaluation of such programs requires a benefit-cost analysis. However, the benefit-cost analysis of this sort would be void of much significance if the distributional aspect of such government programs are left out. It is the duty of the economist to determine the distributional effects of such programs, as well explained by Walter Hettich:

What the economist can do, however, is to help the elected or appointed official to make more consistent choices according to the latter's own goals. In addition, he can provide information on the distributional effects of the government programs to the voters and the public. Both activities conform to the main objectives of benefit-cost analysis, i.e. the improvement of decision-making in the public sector.²

There are a number of studies which have estimated the effect of public expenditures on the distribution of income.³ Among the most rigorous studies in this regard are the studies done by W.I. Gillespie in which he has empirically analysed the distributional impacts of various expenditure policies. In addition, his studies combine the expenditure analysis with tax analysis at various levels of government (federal, provincial and local) in order to determine the redistributional impacts of the entire budget structure in the United States for 1960 and Canada for 1961 and 1969.

In his words:

It may well be argued that it is this redistributional result which matters in the end, and which must be considered in appraising "progressive" or "regressive" value of fiscal operations at various levels of government.

In other words, when a public sector is introduced into a private economy, each family finds that its income position relative to others is altered both by tax payments it makes and by the value of the benefits that it receives from government expenditure. It is in this sense that fiscal incidence can be defined as the changes in relative income positions of families due to the tax and expenditure policies of the public sector.⁴

The nature of income redistribution effects resulting from government support of post-secondary education in Ontario Community Colleges constitutes the main subject of this dissertation.

To evaluate the desirability of such income redistributional effects, however, requires that we know, and be able to measure thoroughly, the benefits and the costs of subsidizing such a public program.

So far as the benefits are concerned, it may be argued that investment expenditures on post-secondary education could be regarded as investment in

human capital by producing more knowledge and know-how which, in turn, improve the productivity of the investors (i.e., the recipients of post-secondary education). Such an improvement in productivity is reflected in the lifetime increase in the level of income that these people receive relative to their income if they had not invested in higher education. The real net (after tax) present value of these income differentials is considered to be the main benefit received by these individuals and/or their families.⁵

While the benefits of post-secondary education may be substantial, these benefits are not obtained without cost. Individuals and/or their families must make payments for tuition fees and other academic expenses; in addition, their incomes are greatly reduced during the period of college attendance.⁶ At the same time, society diverts a portion of its resources to provide financial support for post-secondary education. These financial supports can be regarded as a tax burden on the public since a portion of the proceeds from the tax payments by the public is used to subsidize this program.

Being able to measure such benefits and costs, the question now is; what is the direction of income redistributional effects of the present system of financing post-secondary education in Ontario Community Colleges? Is it progressive (pro-poor), regressive (pro-rich) or neutral?

To investigate such a problem and make it comparable with other related studies, we pursue the analysis within the conventional terms of public finance - which focusses almost entirely on income groups.⁷

Before we discuss the scope and the purpose of this study in more detail it is worthwhile to examine the role of the government in subsidizing post-secondary education.

THE GOVERNMENT ROLE IN HIGHER EDUCATION

It may be asked; is there a need for the government interference to subsidize higher education? Is it not better for the government to stay away and let the freely operating market system work and determine the full cost of higher education per student? To answer these questions, we should first see what are the general functions of the government and how these functions are related to post-secondary education.

Generally, government exists to serve the public interest and interference of government and objectives of budget policies are justified and designed, as the advocates of such policies argue, on the basis of the conflict between the freely operating market system and the public interest.

Richard Musgrave has grouped the objectives of such government policies under three headings: (1) adjustments in the allocation of resources; (2) adjustments in the distribution of income; and (3) adjustments to secure economic stabilization.⁸ Since, however, the main purpose of this study is an investigation into the income redistributional impact of government subsidization of post-secondary education in Ontario Community Colleges, we only discuss the relevance and importance of the role of the government in adjusting the distribution of income.

The market mechanism rewards individuals according to their productivity. There are, however, many different factors such as ability, health, demand and supply conditions, etc., which are beyond the control of a worker. Nevertheless, they are the major determinant of the worker's income. A freely operating market system seldom takes into account such fortunate or misfortunate factors in rewarding an individual. For such reasons individuals may choose their government in order to redistribute income in favor of the most unfortunate people.

It has been argued that higher education increases the gap between the rewards which are received by the recipients and the non-recipients of the program. L.C. Thurow and R.E.B. Lucas have shown the demand for college educated labor increases as technical progress occurs (while such a technical progress is, itself, the fruit of research and development conducted in the higher education institution).⁹ In other words, higher education, under the freely operating market mechanism, results in higher demand and consequently higher wages and income for its recipients. G. Psacharopoulos and K. Hinchliffe also arrived at the same conclusion. In their words:

In economically advanced countries....it appears that the capital intensity of production rather than relative quantities of labor is the main determinant of relative wages. Seen in another way, physical capital accumulation shifts the demand schedule for highly educated labor to the right, resulting in larger wage differentials for any given distribution of educated labor.¹⁰

It appears then that a large increase in the number of post-secondary educated people will lead to a more unequal distribution of income. Put differently, under a freely operating market system, those who can afford to pay the full cost of higher education (normally from the more fortunate and wealthy families) will be rewarded, after they graduate from such institutions, by much more than they would have received if the demand for college and/or university graduates had not increased at the same time. Those who cannot afford to pay the full cost of higher education (normally more unfortunate and poor families) would become not only deprived of such an opportunity but relatively even more poor and unfortunate.

For these reasons, government interference and policy (via, say, financing higher education) is believed to be needed to provide the most unfortunate and poor people in the society an equal opportunity for benefiting from higher education.

It should be noted, however, that there are opposite views by some economists concerning the potency of government to secure equality of opportunity by financing higher education.¹¹ E.G. West states:

It is obvious that the need to call in government to secure something that people are not already securing by their own private endeavours implies a need for some sort of legal restraints or coercion. Thus, ..., particularly strong administrators will be needed to enforce the new system. The first consequence to notice is that these officials will be in unique positions of influence. The new situation, in other words, is one of inequality of income. The danger is that the desire of some parents to exert themselves to do the best for their children will now express, not in the form of the extra work to earn money for private education, but in personal manoeuvres to court special favours from those, such as state education officers, who are increasingly flattered by the strategic positions of influence in which they find themselves.

It follows that whatever one's definition of equality of opportunity, the state's attempt to secure it, at least from English experience, involves not only this sort of failure but also the strong probability that these things will be made worse than before.¹²

SCOPE AND PURPOSE OF THE STUDY

Given the role of the government in making adjustments in the distribution of income, the question now is whether the government has been able to achieve its redistributive goal through public financing of post-secondary education in Ontario Community Colleges or not.

A number of studies have tried to measure and analyze the income redistributive effects of such subsidization policy for colleges and universities in different areas.¹³ Yet, there is not enough information available about the income redistributive effects of such a public policy on a lifetime basis. In particular there is no study analyzing such effects on users and non-users of the post-secondary education system separately.

The essence of the methodologies adopted in the pioneering works in this area by Hansen-Weisbrod/Pechman (1969/70), as well as other major studies such as studies by Windham (1970) and the Commission on post-secondary education in Ontario (1972), can be summarized as follows: since 100 per cent of the costs incurred by the public in a given year is the total subsidy made available to the whole student body, it equals by definition 100 per cent of the benefits distributed. So if an income group bears a fraction t_j of the costs and receives the fraction s_j of the subsidies in the system, the measure of its net benefit is $(s_j - t_j)$.

These studies are based on cross-section data and the major common characteristics of their methodologies are:

- (i) use of the conventional terms of public finance which focus almost entirely on income groups as a framework for income redistributional analysis.
- (ii) attribution of all costs incurred and benefits received to the parents of students,
- (iii) use of the "equiproportional assumption": the fraction t_j of the public costs which is incurred by income group j is the same as the fraction of all taxes which is borne by that income group. Also the percentage distribution of subsidies (benefits) among income groups is the same as the percentage distribution of students in these income groups.
- (iv) no distinction is made between the users of the system of post-secondary education and the non-users of the system.

In Chapter V a more detailed analysis of the methodologies adopted in the previous studies along with their major results will be discussed.

It is the purpose and contribution of this thesis to:

1. improve the methodological aspect of the analysis by introducing a life-cycle model; 2. separate the users of the system from the non-users; and 3. provide the relevant information concerning such income redistributional effects with a new body of data relating to Ontario Community Colleges.

The importance of the life-cycle framework rests on the fact that, on the one hand, people pay taxes over their life time, (part of which is being used to subsidize post-secondary education in Ontario Community Colleges) and, on the other hand, such a higher education system creates an additional flow of income (due to increased productivity) which is to be captured throughout the lifetime of the individuals. Therefore, it would be more appropriate to look at the redistributional impact of such a subsidization over the life-time of a generation rather than analysing the problem at a point in time. Furthermore, a clear distinction should be made between those who directly benefit from the system (the users) and those who do not gain from it (the non-users). The impact of the government subsidization of post-secondary education in Ontario Community Colleges on the latter group would be far different than its effects on the former (the users) group.

We have chosen Community Colleges in Ontario as the sector of the post-secondary education that warrants analysis on a distribution of income level.

At the beginning of 1967-68 school year, the former institutions of technology along with provincial vocational centres were incorporated into 20 colleges of Applied Arts and Technology. The Colleges which are known by the acronym "CAAT" were set up in 20 regions both at the post-secondary and occupational levels. One of the main objectives for the establishment of these colleges was to make post-secondary vocationally oriented education more widely available in Ontario. In other words "CAAT s" were designed to provide new and alternative programs to those traditionally offered by the Universities.

Other objectives were to make available programs such as retraining, apprenticeship and training in business and industry in order to meet the educational needs of adults and out-of-school youth, whether or not they were secondary-school graduates. One of the more specifically stated objectives of the programs offered by these Colleges (which is extracted from a set of guidelines offered to the colleges to assist them in the preparation of multi-year plans) indicates that the main focus of the programs offered by the colleges should be on enhancing the socio-economic mobility of the students and their potential contribution to the productivity of human resources in the college region.¹⁴

In order to achieve the state goals, "CAATs" offer seven broad categories of programs: 1- post-secondary regular; 2- Nurse Training; 3- other non-post secondary programs; 4- Apprentice Training; 5- Retraining; 6- Training in Industry and 7- Ontario Management and Supervisory Development.¹⁵ Since more than 60 per cent of CAATs' students are enrolled in the post-secondary program of these institutions and a major portion of the government subsidies of CAATs (about 80 per cent) are used to support these students, we analyze the income redistributational impact of such a financing policy with regard to only the post-secondary program of these colleges.¹⁶ Thus, the amount of subsidies used in support of other CAATs' programs are netted out.

The emphasis of this study is on the investment nature of higher education. Since the investment nature of Community Colleges seems to dominate the consumption nature to a greater extent than education in Universities in general the use of Community Colleges as a reference group would likely fit in our model better. The reason,

it may be argued, is in the characteristics of the programs and courses that are offered in the Community Colleges vis à vis Universities. Most of the programs in the Community Colleges are designed to develop skills and know-how. An individual who decides to go to Community College is expecting to acquire the skill and add to his or her human capital by which he or she can earn more income. This is exactly what the investment nature of higher education is all about.

So far as the Universities are concerned, however, although there are programs and courses whose investment nature is as strong and important as those of Community Colleges, yet there are many programs and courses whose nature is such that they yield more of a consumption benefit rather than elevating skills and know-how. For this reason, it is reasonable to expect that, the Community Colleges system of higher education can be usefully analysed within a life-cycle model of human investment behaviour.

In addition, although the role of Community Colleges has become more and more important in recent years, there has not been much attention concerning public financing of such institutions and the income redistributive impacts in Ontario. The ratio of government expenditures on Community Colleges to expenditures on Universities, for instance, has increased from approximately 16 per cent in 1969-1970 to about 30 per cent in 1975-76. During the same period, the ratio of full-time enrolment in Community Colleges in Ontario to full-time undergraduate enrolment in Ontario Universities has increased from 28 per cent in 1969-70 to 44 per cent in 1975-76. In other words, there has been an increasing number of people being affected by public financing of Community Colleges in Ontario in recent years (see Table I-1).

Therefore, it is as important to be aware of the income redistributive impacts of public financing of Community Colleges alone, as it is to acquire knowledge about the redistributive effects of public financing of the University education system.

TABLE I-1
GOVERNMENT EXPENDITURES AND FULL TIME ENROLMENT.
ONTARIO UNIVERSITIES AND COMMUNITY COLLEGES,
1969-77.

Year	1 Universities		3 Community Colleges		4 Ratios	
	Expenditures 000	Enrolment	Expenditures 000	Enrolment	3/1	4/2
1969-70	567,675	87,585	91,030	24,742	.16	.28
1970-71	659,193	97,966	95,781	30,382	.15	.31
1971-72	607,605	107,418	165,413	34,354	.27	.32
1972-73	599,330	109,646	163,242	39,823	.27	.36
1973-74	656,613	115,163	182,727	51,878	.28	.45
1974-75	742,380	124,443	222,209	55,038	.30	.44
1975-76	853,017	131,678	252,759	58,236	.30	.44
1976-77	960,893	147,637	257,888	58,757	.27	.40

Note: The expenditures figures are raw figures not being adjusted for imputed interests on capital stocks, depreciation allowances, etc. Therefore the ratios presented should be considered as approximations.

Sources: Calculated from survey of educational finance, Statistics Canada, Cat. No. 81-208 (various years); Canadian Community Colleges and related institutions, Statistics Canada, Cat. No. 81-222, (various years), and Table A-1 in Appendix A.

Finally, we chose Community Colleges as a reference group in order to keep the analysis within manageable bounds. The existence of the new body of data on Community Colleges from several different sources makes possible a quantitative analysis that up to quite recently was not possible.

Ideally, the costs and benefits of public expenditures on post-secondary education should be analyzed from the social point of view. However, given the data limitation at the time of this study, it is probably impossible to measure the social value of the costs and benefits to the public thoroughly. Nevertheless, the attempt is made to take account of those factors which play a crucial role in the determination of the costs and benefits of post-secondary education in Ontario Community Colleges and their redistributive impacts.

FINDINGS

The results of our calculation are particularly interesting because contrary to some of the previous major results regarding redistributive effects of financing post-secondary education in general, the present system of financing post-secondary education in Ontario Community Colleges does not seem to have any income redistributive effect across income groups for the users of the system.

However, our results indicate a different kind of income redistribution effect, namely redistribution of income from non-users to the users of the system. It is also shown that such income redistribution does not affect all income groups uniformly. Non-users in the lower, middle and upper middle income groups pay a higher tax share to support post-secondary education in Ontario Community Colleges than non-users in the lowest, lower middle and highest income groups. In other words, there seems to be an income redistribution from the lower, middle and upper middle income groups to other income groups of the society.

It should be noted that since the findings of this thesis are related to income redistributional impact of public financing of post-secondary education in Ontario Community Colleges, they will provide additional information which will be of use to policymakers, even if policymakers' primary goal may not be to secure adjustment in income distribution. On a positive ground, however, without the findings of this thesis, the analysis of income redistributional effects of any changes in the financing policy of the government with regard to the post-secondary education in Ontario Community Colleges (for whatever reason) will not be possible.

The thesis is organized as follows. Chapter II presents the basic methodology and definitions. Costs and benefits of investment in post-secondary education in Ontario Community Colleges and their distribution by family income groups are discussed in Chapters III and IV, respectively. Chapter V presents the net incidence findings and reviews the results of previous major studies. Details of the calculations and computational procedures are provided in the Appendices.

FOOTNOTES TO CHAPTER I

1. James T. Bonnen, "The Absence of Knowledge of Distributional Impacts: An Obstacle to Effective Policy Analysis and Decision", in R.H. Haveman and J. Magolic (eds.), Public Expenditure and Public Analysis (Chicago: Markham Publishing Company, 1970), p. 419.
2. Walter Hettich, "Distribution in Benefit-Cost Analysis: A Review of Theoretical Issues", Public Finance Quarterly, Vol. 4, No. 2, April 1976, p. 144.
3. One of the earliest studies in analysing the distributional impacts of public expenditures is done by Tibor Barna, Redistribution of Income Through Public Finance in 1937 (London: Oxford, University Press, 1945). Other examples are: W. Irwin Gillespie, "Effects of Public Expenditures on the Distribution of Income", in Richard A. Musgrave (ed.), Essays in Fiscal Federalism (Washington, D.C.: The Brookings Institute, 1965), pp. 122-186, and The Redistribution of Income in Canada, Carleton Library, No. 124 (Gage Pub., Ottawa, 1980); Rufus S. Tucker, "The Distribution of Government Burdens and Benefits", American Economic Review, papers and proceedings, Vol. 43, May 1953, pp. 518-43; and Alfred H. Conrad, "Redistribution Through Government Budgets in the United States", in Alan T. Peacock (ed.), Income Redistribution and Social Policy (London: Cape, 1954), pp. 178-268.
4. W. Irwin Gillespie (1965), ibid., pp. 123, 125.
5. In general the benefits of post-secondary education may take many forms. Some are private and accrue to the direct recipients of higher education; such as higher income, direct enjoyment of the educational process and its related activities, greater ability in allocating time as well as money and more satisfying job. Some benefits are social and accrue to non-recipients as well as to direct recipients of higher education; among the gains are greater economic growth based on general advancement of knowledge and elevation of skills, greater social effectiveness of society through the resultant better understanding and mutual tolerance among individuals and groups, greater political awareness and effectiveness of a democratic society based on the more adequate knowledge and more active participation of citizens, the greater ability of individuals to accept and adjust to rapid change, and greater potential, contribution of educated parents to the welfare of their children.

These social (or external) benefits, however are subject to debate which will be discussed shortly.
6. Still, there are some other costs (non-monetary) which are not measurable but should be mentioned, such as psychic costs of long hours of study and the risk of failure. In this study, however, these non-monetary costs are ignored.

7. The alternative approach not taken in this study is in the context of modern public choice analysis which states: "Most government actions have the characteristics of giving a rather intense benefit to a small group at a small cost to each member of a large group". See; Gordon Tullock, "Why so much stability?" Public Choice, Vol. 37, No. 2, 1981, p. 190.
8. Richard A. Musgrave, The Theory of Public Finance (New York: McGraw-Hill Publishers, 1959), pp. 5-27
9. L.C. Thurow and R.E.B. Lucas, The American Distribution of Income: A Structural Problem (Washington, D.C.: Joint Economic Committee, 1972), pp.26-28.
10. G. Psacharopoulos and K. Hinchliffe, "Further Evidence on the Elasticity of Substitution among Different Types of Educated Labor", Journal of Political Economy, Vol. 8, July/Aug. 1972, pp. 786-91
11. For an excellent discussion on opposing views about government interference and education, the reader is referred to E.G. West's book on this matter, Education and the State, (London: Institute for Economics Affairs, 1970).
12. E.G. West, Education and the State, Ibid., pp. 60-61
13. The pioneering work in this area is the study by W.L. Hansen and B. A. Weisbrod, Benefits, Costs and Finance of Public Higher Education (Chicago: Markham, 1969), in which they investigated the income redistributive effects of public financing of higher education systems for the case of California. Other major studies are D.M. Windham, Education, Equity and Income Redistribution (Lexington, Massachusetts: Heath, 1970); R.W. Judy, "The Income Redistributive Effects of Aid to Higher Education", in L.H. Officer and L.B. Smith (eds.), Canadian Economic Problems and Policies (Toronto: McGraw-Hill, 1970), pp. 302-17; P.D. Machilis, The Distributional Effects of Public Higher Education in New York City (Unpublished Ph.D. Dissertation, Rutgers University, The State University of New Jersey, 1971); System Research Group, Cost and Benefit Study of Post-Secondary Education in the Province of Ontario (Study prepared for the Commission on post-secondary education in Ontario, 1972); I.J. Rubin, Some Income Distribution Effects of Higher Education: The Case of New Jersey (Unpublished Ph.D. Dissertation, Duke University, 1975); O. Mehmet, "Who Benefits from Ontario University System?", Ontario Economic Council, Occasional Paper 7, 1978; G.M. Vredereld, op. cit., Carnegie Commission on Higher Education, Higher Education: Who Pays? Who Benefits? Who Should Pay?, a report and recommendations (New York: McGraw Hill, 1973); R. Bharath, The Income Redistribution Effects of Public Expenditure on Higher Education (Unpublished Ph.D. Dissertation, University of Simon Fraser, B.C., Canada, 1976), and A. Noordeh, M. Anam and S.S. Rahman, "The Distribution Effects of Public Expenditure in Post-Secondary Education: A Case Study of Ontario, 1969", Carleton University Economic Papers, No. 79-11, March 1979.

14. A more comprehensive and detailed set of objectives are presented in: Commission on post-secondary Education in Ontario; The Ontario Colleges of Applied Arts and Technology; Monograph, system research group Inc., 1971, pp. 12-18
15. For the detailed description of these programs, see; Commission on Post-Secondary Education in Ontario....., Ibid., pp. 56-58
16. See Commission on Post-Secondary Education in Ontario...., Ibid, Table III-1 p. 37; and Public Account of Ontario, for the percentages of post secondary students and subsidies, respectively.

CHAPTER II

THE METHODOLOGY

As mentioned earlier in Chapter I, the major objective of this dissertation is to present a comprehensive and systematic analysis of income redistributive impact of investment in post-secondary education in Ontario Community Colleges in a life-cycle framework. The crux of the problem which results in such a redistributive effect arises from the fact that money derived from a particular tax structure to support part of post-secondary education inflicts a given distribution of burdens upon the various income classes of a society which in turn gives certain individuals enhanced earning power.

The model which is designed to analyze such income redistributive effects breaks down the contribution of the users, as well as non-users, of the system in support of post-secondary education in Ontario Community Colleges according to different income groups. It also shows the distribution of users of the system by income classes, calculates income class-specific direct costs and benefits and, as a final step, compares the results of income class-specific total costs and benefits attributable to the users of the system. This should reveal whether investment in post-secondary education in Ontario Community Colleges is regressive, progressive or neutral.

The basic features of the methodology which distinguish our study from the previous works in this regard are as follows:

- (i) User Versus Non-Users: The analysis is divided into two cases with more emphasis on the first case. In the first case we only consider the income distributional impact of investment in post-secondary education in Ontario Community Colleges for the users of the system. Therefore, only the tax burdens incurred by the users of the system from different income groups are taken into account. That is, only a fraction of total tax support for post-secondary education in Ontario Community Colleges is considered to be relevant for the calculation of income-class specific costs.¹ In the second case we investigate the impact of those taxes incurred by the non-users of the system, to subsidize the users, on the distribution of income.
- (ii) Life-Cycle Nature of the Model: The intention of this study is to investigate the income redistributional effects of investment in post-secondary education within a lifetime of a generation (rather than a specific point in time). Therefore, we should find out the costs which are incurred by the users, as well as non-users, of the system over their lifetime and the benefits which are received over the lifetime of these individuals as a result of post-secondary education.
- (iii) Ontario Community Colleges as a Reference Group: For reasons explained in Chapter I we have restricted our analysis to the users of Community Colleges in Ontario. Furthermore, since Ontario Community Colleges started to operate in 1967, we use this year as a base year for our analysis.²

Other definitions and assumptions of the methodology adopted in this study can be summarized as follows:

1. Family Income

One of the most important and crucial terms which should be carefully defined is the concept of family income. Ideally, a measure of income should entail a measure of consumption. If consumption is assumed to affect the utility or satisfaction enjoyed by a person who consumes goods and services, the concept of income should include non-monetary elements as well as monetary elements of income. This leads to an income concept that allows, for example, for leisure enjoyed for its own sake, imputed rent of owner-occupied dwellings, real capital gains, and those forms of unpaid employment which yield products or services of direct utility. It is, however, very difficult and almost an impossible task to measure and include all imputations and non-money income. Thus, the proper definition of income and the process of including and excluding certain activities become at best arbitrary.³

In this study, however, the family income is defined to be the average lifetime income of the family. The family is considered to be the same as the parents, in the sense that they can transfer general purchasing power to all other members of the family because they care about their welfare.

Given the definition of income in the above sense, it is further assumed that both costs incurred and benefits received are transferable to the parents of the family to which the students belong. The reason for this is based on the specification of the parents utility functions (i.e. a case of additive utilities). This is a reasonable assumption since, in general, the parents' concern about the welfare of their children provide them with some insurance

against disasters. For example, if the income of a child is reduced, the parents would increase their contribution to the child by reducing their own consumption and thereby offset, to some extent, the decline in the child's income. This implies that the redistribution of income from parents to children is not sufficiently important to affect the utility of the parents, while an increase in the income of either the parents or the children will directly increase the utility of the parents. In other words, it can be said that as a result of parents' concern and care about their children, all the family members' utility functions could be integrated into one consistent family function. Therefore, if there is an increase in the income of the children due to post-secondary education, the utility of the parents would be affected in exactly the same way as if there was an equal increase in their own money income. In this sense, it is quite legitimate to attribute the costs and benefits of post-secondary education to the parents (hereafter referred to as the family) of the students.

2. Family Income Groups and Their Tax Share

Family income groups are chosen to be based on Gillespie's data (1980). Such income groups, however, imply those from which the users have been deducted. Also, the adjustment is made to transform his data on the tax share of different income groups, which is based on a cross-section study, into new data which represent the average tax share of these income groups over their lifetime.

3. Costs

Costs are defined to constitute the following: (a) "direct private costs"--those costs which are borne by students and/or their parents such as tuition fees, books and supplies, and other academic expenses; (b) "indirect private costs"--the opportunity costs (foregone income) of attending college (they represent the earnings that could have been obtained if individuals had

chosen not to continue their education into post-secondary studies and had taken a job right after graduation from high school); (c) "direct public costs"--the amount of tax burdens being inflicted upon the family of the users, as well as non-users, of the post-secondary education in community colleges to support such a system; (d) "indirect public costs"--the share² of the imputed interest on the capital stock of colleges and depreciation allowances which are attributable to the family of the users, as well as non-users, of the post-secondary education in Ontario Community Colleges.

4. Benefits

Although post-secondary education may provide society with aesthetic benefits and individuals with psychic and prestige benefits, our model is restricted to those kinds of benefits which can be explicitly measured and documented. Such benefits are direct economic benefits which are expressed as the expected increase in lifetime earnings associated with different levels of post-secondary education. It is assumed that the increase in lifetime earnings reflects the gains in economic productivity associated with investment in post-secondary education and human capital formation.⁴ This point is well discussed in the literature. For example, Jacob Mincer, who has provided a pioneering work in the life cycle analysis of income and earnings related to investment in human capital concludes that, according to the available data on the variation of earnings and incomes by age within broad population groups classified by educational and occupational status, earnings are not only higher but also increase more rapidly with age (or decline more slowly after the peak of earnings is reached) in the more highly trained groups than in the less trained ones.⁵ A statistical study by decennial census of population for 1939

and 1949 income data in the United States supports the conclusion reached by J. Mincer. According to this study the income differential between young men and those who have reached the age of peak income is much greater for college graduates (that is, "formally" trained labor force) than for men with less schooling.⁶

Gary S. Becker's study on age, earnings, wealth and human capital also supports the idea that average annual earnings at each age class are strongly related to education.⁷ That is, the higher the level of education, the greater are the average incomes at each age class. He also shows that incomes tend to be relatively low at the beginning of labor force participation and rise throughout later ages, although at a decreasing rate (see Table II-1). Following the foregoing discussion by Mincer and Becker, there seems to exist an income differential between the earnings of individuals with high school degree and those with a college degree which could be attributed to

TABLE II-1

Annual Rates Of Income Change Between
Successive Age Classes For 1939 Cohorts.
At Different Educational Levels

Age class Education (Years)	t=23 t'=18	t=27 t'=23	t=32 t'=27	t=40 t'=32	t=50 t'=40	t=60 t'=50	t=60 t'=18
16+	.43	.19	.10	.06	.03	.01	.05
12	.17	.09	.07	.05	.03	.01	.04
8	.14	.08	.06	.04	.03	.01	.04
Simple Average	.25	.12	.08	.05	.03	.01	.04

Source: G.S. Becker, Human Capital, op.cit., Table 21, p. 222.
The entries are computed from the formula

$$\frac{Y_t - Y_{t'}}{Y_t + Y_{t'}} \times \frac{2}{t - t'}, \text{ where } Y_t \text{ is income at age } t, \text{ and } Y_{t'} \text{ is income at age } t'.$$

investment in post-secondary education. This point is specifically supported by J.R. Podoluk's study based on cross-sectional data from the 1961 Canadian Census. It asserts that the education of the individual is the most important factor in explaining the earnings differentials by occupations. The same study then shows that, on the average, the university graduates are expected to earn 1.6 times as much as the high school graduates over their lifetime.⁸

In this study, however, we employ the cross-sectional data from 1971 Census of Canada to generate the life cycle pattern of earnings by education level and we make no adjustment for the secular growth of income to project the expected future earnings of individuals. In other words, we assume a zero growth rate of real output over time. This assumption does not affect our results to a considerable degree if we assume that the growth in real output will not affect the earnings differentials to a great extent, even though it may shift upward the actual age-earnings profiles for different schooling levels.

Before we continue our discussion about the measurement and evaluation of such income differentials, it is worthwhile to bear in mind the following points.

There have been several studies questioning the importance and legitimacy of attribution of all of the income differentials, between individuals with high school degrees and those with college or university degrees, to investment in higher education. Normally the recipients of post-secondary education could be considered to have greater ability and ambition, to be from better educated and more successful parents and so forth, in comparison with those high school graduates who could not make it, or did not choose to go (for whatever reason), to colleges or universities. These are, however, important factors, per se, in affecting the earnings differentials. For if

these people (i.e., more talented, abler, etc.) had not gone to colleges or universities, they would have earned more than the average earnings by high school degree holders. W. L. Hansen and B. A. Weisbrod argue that:

There is strong reason to believe that those persons who go on to college, and especially those who graduate, are in general more able and ambitious than are those who do not enter college. Thus, college going students would subsequently be expected to earn more than non-college-going students even if they did not continue their education. Recent work suggests that approximately 25 percent of the observed differential in earnings between college and high school graduates is attributable not to schooling at all, but to these other factors of ability and motivation.⁹

G.S. Becker also supports the above argument. In his words:

Thus the earnings differential between college and high school graduates does not measure the effect of college alone since college graduates are abler and would earn more even without the additional education.¹⁰

However, he concludes that differences in these and related traits explain a relatively small part of the earnings differentials between college and high school graduates.¹¹

In this study, however, we intend to attribute earnings differentials between high school and community college graduates to investment in post-secondary education, particularly because of our choice of reference group (Community Colleges in Ontario) for empirical analysis. It was discussed earlier in chapter I that education in Community Colleges enhances mostly those programs and courses which are crucial in the production of skilled labor. For this reason, the earnings differentials between colleges and high school graduates are mainly assumed to be positively correlated with the increase in labor productivity that higher education in Ontario Community Colleges brings about. Such earnings differentials in real terms, and after

adjustment for tax payments are made, would be considered as the main benefits resulting from post-secondary education in Ontario Community Colleges.¹²

Summary of the Methodology

The summary of our methodology can be best explained by referring to Charts 1, 2, 3 and Figure 1 which are designed for Case 1 of our analysis (the users of the system). These charts and figure are intended to give a general picture of the model which is adopted in this study. The detailed methodology underlying the charts and figure follows directly. The next three chapters discuss in turn the costs component of the model (chart 1) the benefits component of the model (chart 2) and the net incidence component of the model (chart 3).

CHART 1

COSTS

CHART 2

BENEFITS

CHART 3

NET INCIDENCE

Figure 1

* Base year (for the calculation of present values) is chosen to be 1967, because Community Colleges in Ontario started to operate in that year. Therefore, people started to incur extra tax costs to finance post-secondary education in Community Colleges from 1967.

Formulation of the Methodology

Let us first define the set of variables which are used in the model:

- TC_j^r = total costs (in present value) of financing post-secondary education in Ontario Community Colleges for an r-year program incurred by the users of the system from the j^{th} income group over their lifetime
- $V_j^r(s)$ = total public costs (in present value) incurred by the users of the system from the j^{th} income group and for an r-year program
- $V_j^r(c)$ = total private costs (in present value) incurred by the users of the system from the j^{th} income group and for an r-year program
- β^r = share of the public costs attributable to an r-year program (representing the share of the resources which are used up to support an r-year program)
- λ_j = average proportion of the users of the post-secondary education system in Ontario Community Colleges out of total population (tax payers) in the j^{th} income group.
- $V_j(s)$ = total public costs (in present value) incurred by the users of the system from the j^{th} income group for all programs
- Q = number of years that all families (users and non-users) incur public costs over their lifetime
- S_j^t = public costs incurred by the j^{th} income group in a given age-cohort at time t for all programs
- S_j = total public costs incurred over the lifetime of the j^{th} income group in a given cohort
- a_j^l = share of the public costs incurred by the l^{th} age group within the j^{th} family income group
- m^{lt} = number of years in the l^{th} age group. Superscript t represents the year (age).

- γ_j = share of the total public costs borne by the j^{th} income group in a given cohort (= average lifetime tax share of the j^{th} income group)
- S = total public costs incurred by all income groups in a given cohort over their lifetime
- i = discount rate
- ϕ = adjustment coefficient (discounting factor) to make the present values of private costs and benefits which are occurred several years after the time at which the present value of the public cost is calculated, consistent and comparable with the latter
- α_j^r = student share (participation rate) by the j^{th} income group in an r -year program
- N^r = average number of "graduate equivalent" from an r -year program (See Appendix E for the definition of "graduate equivalent")
- C_k = private costs per student incurred in the k^{th} year of study
- r = length of the program
- c = annual direct private costs per student
- $V_j^r(c_1)$ = direct private costs (in present value) incurred by the j^{th} income group for an r -year program
- $V_j^r(c_2)$ = indirect private costs (in present value) incurred by the j^{th} income group for an r -year program
- X_k = real net (after tax) foregone earnings for a student in year k of an r -year program in college
- Y_k = real net (after tax) student's income in year k while attending an r -year program in college
- TB_j^r = total benefits (in present value) received by the users of the system in the j^{th} income group as a result of investment in an r -year program in Ontario Community Colleges

$V^r(d)$ = net income differentials: monetary benefits (in present value) per graduate as a result of investment in an r-year program

μ = adjustment factor for ability, mortality, etc.

$V^r(y)$ = real net (after tax) expected income of a graduate (in present value) from an r-year program over his/her lifetime

$V(X)$ = real net (after tax) expected income of a high school graduate (in present value) over his/her lifetime

n = number of working years

Y_t^r = expected earnings (after tax) by year t given graduation from an r-year program

X_t = expected earnings (after tax) by year t given graduation from high school

NB_j^r = net benefits (benefits minus costs) attributable to the users of the system from the jth income group for an r-year program

(1) Cost Model

The total costs incurred by the proportion of the families in the jth family income group who are the users of the post-secondary education system in Ontario Community Colleges can be specified as:

$$TC_j^r = V_j^r(s) + V_j^r(c) \quad (1)$$

Calculation of $V_j^r(s)$:

$$V_j^r(s) = \beta^r \lambda_j V_j(s), \quad (2)$$

where:

$$V_j(s) = \sum_{t=1}^Q \frac{s_j^t}{(1+i)^t}, \quad (3)$$

$$S_j^t = \frac{a_j^t S_j}{m^t}, \quad (4)$$

and $S_j = \gamma_j S^{13} \quad (5)$

As a result, substituting equations (5) into (4) and (4) into (3) and (3) into (2), we get:

$$V_j^r(s) = \beta^r \gamma_j \sum_{t=1}^Q \frac{a_j^t \gamma_j S}{m^t (1+i)^t} \quad t=1,2,3,\dots,Q \quad (6)$$

Calculation of $V_j^r(c)$:

$$V_j^r(c) = \phi \alpha_j^r N^r \sum_{k=1}^r \frac{C_k}{(1+i)^k} \quad (7)$$

Equation (7) can be divided into two equations;
equation for direct private costs:

$$V_j^r(c_1) = \phi \alpha_j^r N^r \sum_{k=1}^r \frac{C}{(1+i)^k} \quad (7.1)$$

and equation for indirect private costs:

$$V_j^r(c_2) = \phi \alpha_j^r N^r \sum_{k=1}^r \frac{X_k - Y_k}{(1+i)^k} \quad (7.2)$$

(ii) Benefit Model

The total benefits received by those families of the j^{th} family income group who are the users of the post-secondary education systems in Ontario Community Colleges can be specified as:

$$TB_j^r = \alpha_j^r N^r \mu V^r(d) \quad (8)$$

$$\text{where: } V^r(d) = V^r(y) - V^r(x) = \rho \left[\sum_{t=r+1}^n \frac{Y_t^r}{(1+i)^t} - \sum_{t=r+1}^n \frac{X_t^r}{(1+i)^t} \right]$$

$$= \rho \sum_{t=r+1}^n \frac{Y_t^r - X_t^r}{(1+i)^t} \quad t=r+1, \dots, n \quad (9)$$

(iii) Fiscal Incidence

To determine the net redistributive effects of investment in post-secondary education in Ontario Community Colleges we can utilize the results from equations (1) and (8) above in the following ways:

(1) Net Benefits:

$$NB_j^r = TB_j^r - TC_j^r, \quad (10)$$

(2) Actual Benefit-Cost Ratios:

$$(B/C)_j^r = \frac{TB_j^r}{TC_j^r}, \quad (11)$$

and (3) Standardized Benefit-Cost Ratios:

$$(B/C)_j^{*r} = \frac{(B/C)_j^r}{TB^r/TC^r}, \quad (12)$$

$$\text{where; } TB^r = \sum_{j=1}^z TB_j^r, \quad (12.1)$$

$$\text{and } TC^r = \sum_{j=1}^z TC_j^r. \quad (12.2)$$

Footnotes to Chapter II

¹ This fraction is determined by the share of the population (taxpayers) who use the post-secondary education system in Ontario Community Colleges.

² Since, however, students' data are collected from the post-secondary student survey (PSSS) undertaken by Statistics Canada in 1975, those calculation results which are based on 1975 data are adjusted such that they would be consistent with the rest of the calculations which are estimated as of 1967.

³ For further discussion on the concept of income, see; W. Irwin Gillespie, The Redistribution of Income in Canada, The Carleton Library, No. 124 (Gage Pub., Ottawa, 1980) p. 18.

⁴ This direct measure of economic benefits, however, excludes any measure of post-secondary education's indirect contribution to economic wealth through external economies, which cannot easily be measured.

⁵ Jacob Mincer, "Investment in Human Capital and Personal Income Distribution," Journal of Political Economy, August 1958, p. 292.

⁶ For further details, see H. P. Miller; Income of American People (New York, John Wiley and Sons, 1955) pp. 65-68.

⁷ Gary S. Becker, Human Capital (Chicago, The University of Chicago Press, 1975) pp. 214-223.

⁸ J. R. Podoluk, Incomes of Canadians (Ottawa, Queen's Printer, 1968) pp. 43, 86.

⁹ W. L. Hansen and B. A. Weisbrod, Benefits, Costs, and Finance of Public Higher Education (Chicago, Markham, 1969) pp. 18-19.

¹⁰ Gary S. Becker, Human Capital, op. cit., p. 85.

¹¹ Other major studies, with more or less similar conclusions as Becker's are: Orel Ashenfelter et al., "Graduate Education, Ability, and Earnings," Review of Economic Statistics, February 1968, pp. 78-86; Zvi Griliches and W. M. Mason, "Education, Income and Ability," Journal of Political Economy, 80, May-June 1972, pp. S74-S103. W. L. Hansen, B. A. Weisbrod, and W. J. Scanlon, "Schooling and Earnings of Low Achievers," American Economic Review, 60(3), June 1970, pp. 409-18; B. A. Weisbrod and P. Karpoff, "Monetary Returns to College Education, Student Ability and College Quality," Review of Economic Statistics, November 1968, pp. 491-97; G. Chamberlain, "Education, Income and Ability Revisited," Journal of Economics, 5, 1977, pp. 241-57; G. Chamberlain and Zvi Griliches, "Unobservables with a Variable Components Structure: Ability, Schooling and the Economic Success of Brothers," International Economic Review, 16, June 1975, pp. 422-49; and J. D. Welland, "Schooling and Ability as Earnings Complements," Canadian Journal of Economics, May 1980, pp. 356-67.

¹² To test the sensitivity of the results, however, we allow for further adjustments to be made in order to take account of ability and other factors. These adjustments are discussed in Chapter IV.

¹³ Total public costs of financing post-secondary education in Ontario Community Colleges which are incurred by a given age-cohort of parents over their lifetime (S) can be shown to be the same as the total public costs incurred in a given year by all age-cohorts. The proof is provided below:

Assume that in each period (year) the working lifetime of one age-cohort begins and the working lifetime of another age-cohort (e.g., those who reach the age of 65) terminates. Thus, total number of cohorts in each period would be equal to the total number of working years (say; n).

Now if:

S = total annual public costs

a_{ij}^t = tax share of the j^{th} income group in the i^{th} age cohort in period t

S_i^t = the share of the public costs incurred by the i^{th} cohort in period t , and

S_i = total public costs incurred over the working lifetime of all income groups in the i^{th} cohort,

then:

$$S_i = \sum_{t=1}^n S_i^t \quad (1)$$

where:

$$S_i^t = \sum_{j=1}^z a_{ij}^t S \quad (11)$$

Furthermore:

$$\sum_{i=1}^n \sum_{j=1}^z a_{ij}^t = 1 \quad (111)$$

As a result, substituting (11) into (1) and utilizing the results from (111),

we get:

$$S_i = \sum_{t=1}^n \sum_{j=1}^z a_{ij}^t S = S \sum_{t=1}^n \sum_{j=1}^z a_{ij}^t = S \quad (iv)$$

That is, total public costs incurred by a given age-cohort (S_i) over the working lifetime of that cohort equals the annual public costs (S) of financing post-secondary education in Ontario Community Colleges.

CHAPTER III
DISTRIBUTION OF COSTS

The real costs of post-secondary education in Ontario Community Colleges, in fact, is the loss of goods and services that must be sacrificed in order to put resources into education in community colleges. These costs are borne partly by tax payers through their share of tax payments which is used to support the post-secondary education in Ontario Community Colleges and partly by direct expenditures by students and/or their parents for tuition fees and other academic expenses (direct private costs), as well as foregone earnings of students while attending school (indirect private costs). Let us call the tax share of the total real costs as "public (or subsidy) costs" and the rest of the costs as "private costs".

It is our intention in this chapter to determine first, the components of the "public costs" as well as "private costs". That is, to investigate the share of the total real costs of post-secondary education in Community Colleges in Ontario which is borne by the tax payers vis-à-vis students and/or their parents' share of such costs. Secondly, we are interested in knowing how such "public costs" and "private costs" are allocated among different income classes. In other words, we want to determine the distributional pattern of these costs; that is, whether, on average, the incidence of total costs of investment in post-secondary education in Ontario Community Colleges is progressive (rich incurs more costs) or regressive (poor incurs more costs).

PUBLIC COSTS

"Public (or Subsidy) Costs" can be divided into two major categories:

(a) "Direct Public Costs", which is the direct subsidy received by Ontario Community Colleges from different levels of the government (federal, provincial and local); (b) "Indirect Public Costs", which includes the imputed interest on capital stock of community colleges and depreciation allowances.

DIRECT PUBLIC COSTS

This item of the "Subsidy Costs" constitutes: direct contribution of both federal and provincial governments to community colleges and the conditional federal transfer to provincial governments to support these institutions.¹ Direct expenditures by federal and provincial governments on the Ontario Community College system of post-secondary education can be calculated from the available information in Public Accounts of Ontario and Canada.

Table III-1 below shows the results of federal and provincial government contributions to Ontario Community Colleges by function for 1969-1980.²

INDIRECT PUBLIC COSTS

There are two distinct indirect costs which are related to the public (government) financing of Community Colleges in Ontario, namely, the opportunity cost of imputed interest on capital stock of these institutions and depreciation allowances. All of the resources which are used to construct community colleges in Ontario could have been employed in other ways before they were committed to the construction of the former. Hence the benefits foregone by not using these resources in an alternative way has to be certainly considered as an opportunity (indirect) cost.

In order to estimate such indirect costs, we should first calculate the current value of fixed assets of Community Colleges in Ontario. Since the collection of such data is a daunting task and an almost impossible chore, we employed the perpetual inventory approach used by Raymond W. Goldsmith

to estimate the value of capital stocks of these institutions.³ Thus, the book value of fixed assets of Colleges of Applied Arts and Technology (representing Ontario Community Colleges) as at March 31, 1977 (the only available data) was used as a base for calculating the value of the fixed assets for other years. To estimate these values; first, the adjustment for inflation was made by using CPI (excluding food), and then the results were further adjusted for annual capital grants. The results for 1969-70 to 1979-80 are shown in Table III-2. We now turn to the calculation of depreciation allowances and imputed interest of fixed assets of Ontario Community Colleges.

Depreciation Allowances

Depreciation allowances are based on the assumptions used in Robert Rude's study "Assets of Private Nonprofit Institutions in the United States, 1890-1948" (N.B.E.R., April 1954, unpublished), cited by T. W. Schultz.⁴ Rude used a depreciation rate of zero percent for land, two percent for buildings and ten percent for fixed equipment. These rates were applied to the values of land, buildings and fixed equipment, etc. of Ontario Community Colleges to calculate depreciation allowances.

The unpublished printout by the financial services branch of Ontario Ministry of Colleges and Universities shows that the ratio of value of land, buildings and fixed equipment, etc. to total value of fixed assets of community colleges in 1976-77 (the only available data) was .036, .660 and .304, respectively. These proportions, then, were used to estimate the book values of land, buildings and fixed equipment, etc. of Ontario Community Colleges and hence depreciation allowances of these assets were calculated. The results of such calculations are shown in Table III-3.

Imputed Interest

Ideally, in calculating imputed interest, we should use an "appropriate" social discount rate. The social discount rate is defined as the minimum rate of return that a public investment must earn if it is to be worthwhile undertaking.

TABLE III-1

**Direct Federal and Provincial Government Expenditures on Post-Secondary Education in
Community Colleges in Ontario, * 1969-1980**
(thousands of dollars)

No.	Year	PROVINCIAL GOVERNMENT						FEDERAL GOVERNMENT						
		1	2	3	4	5	6	7	8	9	10	11	12	13
		Basic Operating Grants	Program Admin. Costs	OSAP (grants and costs of loans)	Ministry Admin. Expenses	Municipal Tax Grants	Sub-total (1+2+3+4+5)	(Less) Fed. Govt. Transfers	Total (6 - 7) Current \$	Total 1971\$	Cost of Loan	Fed. Govt Transfers	Total (10 + 11) Current \$	Total 1971 \$
1	1969-70	54218	435	6035	144	0	60829	40164	20665	22197	684	40164	40848	43875
2	70-71	68939	864	7080	104	0	76587	53201	23386	24184	1408	53201	54609	56473
3	71-72	90418	648	7136	188	766	99155	74370	24785	24785	2277	74370	76647	76647
4	72-73	107229	636	6159	445	873	115342	79130	36212	34920	2730	79130	81860	78939
5	73-74	129593	4064	9702	852	1937	146147	93937	52400	47899	3420	93937	97357	89318
6	74-75	170793	4375	12408	1110	2477	191163	114120	77043	64960	4357	114120	118477	99896
7	75-76	204674	4608	15460	1147	2617	228526	141109	87417	66986	4998	141109	146107	111196
8	76-77	235887	5375	18088	1294	2852	261495	162763	98732	69140	5605	162763	168368	117905
9	77-78	257472	5737	20305	1452	2863	287829	203808	84021	54559	6432	203808	210240	136519
10	78-79	271182	6126	26909	1435	3000	307652	232254	75398	46002	6762	232254	239016	145830
11	79-80	293035	8982	27883	1414	3180	334493	269370	65123	36813	8330	269370	277700	156981

* Excluding capital expenditures (these costs will be taken into account under "Indirect Public Costs").

Sources: Cols. 1 and 4, lines 1 and 2: Public Account of Ontario, Ministry of Education; Cols. 1 and 4, lines 3-11, col. 2 and col. 5: Public Accounts of Ontario, Ministry of Colleges and Universities; col. 3, lines 3-11: Ontario Ministry of Colleges and Universities, Statistical Summaries; cols. 7 and 11: Secretary of State, Annual Reports (1969-80); col. 10: Public Accounts of Canada, Secretary of State and Department of Finance; col. 3, lines 1 and 2: Statistics Canada, Catalogue No. 81-220; Data on enrolment, Advanced Statistics of Education, Statistics Canada, Catalogue No. 81-220 and Ontario Ministry of Education, Annual Reports (for 1969-71). Bank of Canada Review CPI (excluding food) was used in calculation of cols. 9 and 13. (See Notes to this table for further details.)

Notes to Table III-1

Data Sources:

Since the responsibility of the affairs of the Ontario Community Colleges (or Ontario Colleges of Applied Arts and Technology) was transferred to the Ontario Ministry of Colleges and Universities from Ontario Ministry of Education in 1971, the data for basic operating grants and program administration for 1969-70 and 1970-71 were collected from the reports of the Ministry of Education in the Public Accounts of Ontario. Data for basic operating grants, program administration costs, Ontario Student Assistance Program (OSAP) and Ministry administration expenses for the rest of the period were calculated from the reports of the Ministry of Colleges and Universities in the Public Accounts of Ontario. Federal government transfer payments for Ontario for post-secondary education as a whole was reported by the Secretary of States, Annual Reports. Costs of Loan, financed by the federal government, to students in post-secondary education as a whole to all provinces was obtained from Public Accounts of Canada, Department of Finance and Secretary of States. Enrolment figures used for the appropriation of Ontario Student Assistant Program and Cost of Loan to federal government for Community Colleges are collected from Ontario Ministry of Colleges and Universities, Statistical Summary, and Statistics Canada, Advanced Statistics of Education, Catalogue No. 81-220.

Functions and Calculations:

1. Program administration costs: This program deals essentially with the funding and policy development concerning Colleges of Applied Arts and Technology (CAAT). However, since the breakdown of administration expenses between post-secondary education in Community Colleges, (CAAT) and other programs (such as Adult and Apprentice Training, Training in Industry and Ontario Career Action Program) was not available, total program administration costs was apportioned between post-secondary and other programs according to the share of the rest of the government expenditure between them.
2. Ontario Student Assistance Program (OSAP): This item, which includes cost of loans and grants to students, was calculated by multiplying the total Ontario student assistance to post-secondary education by a factor of proportionality which was determined by the proportion of full-time undergraduate enrolment in Ontario Community Colleges out of total full time undergraduate enrolment in post-secondary education in Ontario (see Appendix A, Table A-1, Column 8). Administration costs of OSAP was calculated similarly and added to OSAP. (OSAP for 1969-70 and 1970-71 was taken directly from Statistics Canada, Survey of Educational Finance, Catalogue No. 81-208.)
3. Ministry administration expenses: Since the breakdown of this cost for community colleges was not available, this item of the expenditure was apportioned between community colleges and the rest of the post-secondary education according to the ratio of total operating grants received by Ontario Community Colleges to total operating grants received by Ontario post-secondary education system.

Notes to Table III-1 (cont'd.)

4. Municipal taxation: Since 1971, provincial government of Ontario decided to compensate local governments (municipalities) for the property tax exemption of community colleges. Hence this cost can be considered a direct public cost.

5. Conditional federal government transfer: In general, the provincial governments are responsible for the allocation of conditional federal transfers for post-secondary education between community colleges and other post-secondary institutions (mainly universities). However, since the breakdown of such transfers between community colleges and other post-secondary institutions is not available, the proportion of federal government transfer which is used to support community colleges is assumed to be the same as the proportion of total operating grants for post-secondary education which goes to the community colleges. This item of expenditure is, however, the contribution of federal government which comes from its general revenue. Thus, in order to calculate the actual contribution of both federal and provincial governments to Ontario Community Colleges, the conditional federal transfer to the latter institutions are netted out of the provincial expenditures and added to the federal contribution.

6. Costs of loans (to federal government): This is the net costs of Canada Student Loans due to additional interest payments, default, etc., which is granted and paid by the federal government to lending institutions. Since the data sources (i.e., reports from Secretary of States and Department of Finance in the Public Accounts of Canada) do not provide the disaggregated data for the costs of loans, the following assumption is used to estimate a portion of the costs of Canada student loans which can be attributed to community colleges in Ontario. It is assumed that this cost is proportional to the ratio of full-time undergraduate enrolment in Ontario Community Colleges to full-time undergraduate enrolment in post-secondary education in Canada (see Appendix A, Table A-1, Column 7).

7. Since government expenditures on post-secondary education is mostly on non-food items, we have used CPI (excluding food) in order to convert the current dollars into 1971 dollars.

TABLE III-2
Fixed Assets of Ontario Community Colleges
1969-1980
(thousands of dollars)

No.	1 Year	2 CPI (excluding food) 1971=100	3 Fixed Assets as at March 31 of year t (Current Dollar)	4 Adjustment factor for inflation (CPI _{t-1} /CPI _t)	5 Less: Capital Grants	6 Fixed Assets as at March 31 of year t-1 (Current Dollar)	7 Fixed Assets as at March 31 of year t (Constant Dollar) 1971 prices
1	1969-70	93.1	133,466				143,358
2	1970-71	95.1	148,312	93.1/96.7	(9,325)	133,466	153,373
3	1971-72	100.00	218,523	96.7/100.0	(63,000)	148,312	218,523
4	1972-73	103.7	282,805	100.0/103.7	(54,191)	218,523	272,715
5	1973-74	109.0	325,907	103.7/109.0	(27,255)	282,805	298,997
6	1974-75	118.6	368,913	109.0/118.6	(13,145)	325,907	311,056
7	1975-76	130.5	432,846	118.6/130.5	(24,463)	368,913	331,683
8	1976-77	142.8	494,584	130.5/142.8	(19,137)	432,846	346,347
9	1977-78	154.0	546,958	142.8/154.0	(12,595)	494,584	355,168
10	1978-79	163.9	595,709	154.0/163.9	(12,769)	546,958	363,459
11	1979-80	176.9	657,650	163.9/176.9	(13,612)	595,709	371,763

Sources: Col. 2, Bank of Canada Review; col. 3, line 8, Ontario Ministry of Colleges and Universities, Financial Services, unpublished printout; col. 3, the rest of the lines calculated according to the following formula:

$$\text{Line (t-1)} = (\text{line t (of col. 3)}) \times \text{times adjustment factor for the same year, t, minus (capital grants for the same year, t)};$$

col. 4, calculated from col. 2; col. 5 Ontario Ministry of Colleges and Universities, statistical summary (except for 1970-71 which was collected from Statistics Canada, Catalogue No. 81-208); col. 6 equals col. 3 times col. 4 minus col. 5.

Note: An ideal price index for the conversion of the value of the fixed assets in current dollars into 1971 prices would have been the price index for capital stocks. The use of CPI (excluding food) would overestimate the results by a small amount.

TABLE III-3

Indirect Costs of Depreciation Allowances and
Imputed Interest for Ontario Community Colleges
1969-1980

(thousands of dollars)

	1	2	3	4	5	6
	Depreciation Allowances				Imputed Interest (1971 prices) at 85%	Total Indirect Costs (1971 prices) (4 + 5)
	Building	Equipment	Total Depreciation	Total Depreciation 1971 prices		
1969-70	1,762	4,057	5,819	6,250	12185	18435
70-71	1,958	4,509	6,467	6,688	13037	19725
71-72	2,885	6,643	9,528	9,528	18574	28102
72-73	3,733	8,597	12,330	11,890	23181	35071
73-74	4,302	9,908	14,210	13,037	25415	38452
74-75	4,870	11,215	16,085	13,562	26440	40002
75-76	5,714	13,159	18,873	14,462	28193	42655
76-77	6,829	15,035	21,864	15,311	29439	44750
77-78	7,220	16,628	23,848	15,486	30189	45675
78-79	7,863	18,110	25,973	15,847	30894	46741
79-80	8,681	19,993	28,674	16,209	31600	47809

Sources and Notes: Calculated from Table III-2, using the following formula for calculation of depreciation allowances:

Depreciation Allowances for building = Fixed Assets x (building share = .66) x
(building depreciation = .02) .

Depreciation Allowances for equipment = Fixed Assets x (equipment share = .304) x
(equipment depreciation = .10)

* There have been several studies concerning the social discount rate for Canada. None of them has provided a firm and rigorous proof in support of its argument for the choice of a particular rate to be used as an "appropriate", social discount rate. The recent debate in Canadian Public Policy (summer 1981) represents a clear picture of controversies surrounding the magnitude of the social discount rate for Canada. One thing, however, is clear and that is the fact that the debate over the magnitude of social discount rate for Canada has entered a stage of what might be called "fine tuning". Glenn Jenkins, whose work in the early seventies had a major impact on the Treasury Board's choice of discount rate, considers the median rate of 10 percent used by the Treasury Board as an appropriate measure of social discount rate. On the other hand, the empirical work by David Burgess indicates that such a rate should be roughly 7 percent.⁵ This is not the place to resolve the debate between Jenkins and Burgess. Therefore, in this study, we use the social discount rate of 8.5 percent which is the average of the rates suggested by Jenkins and Burgess.

Imputed interest is the foregone interest on the value of fixed assets of Ontario Community Colleges which is calculated by using the appropriate social rate of discount (assumed in this study to be 8.5 percent). Table III-3 shows the results of our calculations for imputed interest and depreciation allowances for Ontario Community Colleges from 1969-70 to 1970-80. It should be noted, however, that the use of Jenkins' 10 percent or Burgess' 7 percent discount rates would not alter the magnitudes of indirect costs significantly.

TOTAL PUBLIC COSTS

Calculation of total public costs of investment in post-secondary education in Ontario Community Colleges simply requires to combine direct federal and provincial subsidies and indirect costs of depreciation allowances and imputed interest on capital assets of these institutions. The results are shown in Table III-4.

As our calculations in Table III-4 indicate, federal contributions to Ontario Community Colleges have been increasing in real terms up to 1980 (the last year for which we could calculate the government's contribution), while the provincial subsidy to the same institutions has started to decline since 1976-77. Nevertheless, the overall government contribution (both federal and provincial) to Ontario post-secondary education in community colleges has been growing, although at a decreasing rate.

However, since such government contribution is a policy variable which could be changed at any moment in time and, in particular, our observation period is very short, we cannot determine any specific trend regarding the government subsidization of Ontario Community College system in the future. Therefore, and for the purpose of this study, we raise the following question:

What would be the income redistributional impact of financing Ontario Community Colleges if, on the average, the present system of public financing of such institutions were to continue?

In this case we take the average of federal and provincial government expenditures on Ontario Community Colleges over the period for which the data were calculated; that is, from 1969-70 to 1979-80, and assume that such average expenditures will remain unchanged throughout the working lifetime of the tax paying generation under consideration in this study. Figure 1 on page 30 provides a better understanding of the question under consideration and the format of the analysis to be followed.

TABEL III-4

Total Public Costs of Financing Post-Secondary
Education in Ontario Community Colleges
1969-1980

(thousands of 1971 dollars)

No. -	Year	Provincial Expenditures			Federal Expenditures	Total Public Costs
		Direct Costs	Indirect Costs	Total		
1	1969-70	22,197	18,435	40,632	43,875	84,507
2	1970-71	24,182	19,725	43,909	56,473	100,382
3	1971-72	24,785	28,102	52,887	76,647	129,534
4	1972-73	34,920	35,071	69,991	78,939	148,930
5	1973-74	47,899	38,452	86,351	89,381	175,669
6	1974-75	64,960	40,001	104,961	99,896	204,857
7	1975-76	66,986	42,655	109,641	111,196	220,837
8	1976-77	69,140	44,750	113,890	117,905	231,795
9	1977-78	54,559	45,675	100,234	136,519	236,753
10	1978-79	46,002	46,741	92,743	145,830	238,573
11	1979-80	36,813	47,809	84,622	156,981	241,603
12	Average	44,768	37,038	81,806	101,234	183,040

Sources: Based on Tables III-1 and III-3.

DISTRIBUTION OF TOTAL PUBLIC COSTS BY FAMILY INCOME GROUPS.

So far as the distribution of the total public costs for the users of the system (i.e., Case 1) is concerned, only that portion of the total public costs which is borne by these people (the users) should be taken into account as a relevant measure of the public costs attributable to them.

To estimate such costs, we first calculate the total public costs which is incurred by all people (i.e., both users and non-users) from different family income groups within a given age-cohort and then apply the appropriate share to determine that portion of the public costs which is borne only by the users of the system from these income groups. The details of the estimation procedure for the calculation of the ratio of the users out of total tax paying population are discussed in Appendix B.

In general, the actual measure of the total public costs which is incurred by different family income groups within a given age-cohort is the present values of the annual public costs that are borne by these income groups over their lifetime. From the cross-tabulation of the public costs by family income group and age of the head, we can calculate these present values. To construct such a cross-tabulation, two steps should be followed. First, we should allocate the total public costs which are borne over the lifetime of all families in a given age-cohort among different income groups according to the average lifetime tax share of these income groups.⁶ This is based on the "equiproportional assumption"; meaning that the percentage of the public costs incurred by a particular income group is the same as the percentage of average lifetime taxes paid by that income group. The estimation procedure

for the calculation of such a tax share is discussed in Appendix C. The second step is to calculate the present value of such costs. This could be done by first, determining the distribution of tax payments of families by age over their lifetime; secondly, allocating the public costs according to this distribution and thirdly, applying an appropriate discount rate to yearly public costs incurred by each family income group at each age to estimate the present values of the public costs. In so doing, we have chosen the average real market interest rate of 2.2 percent as a discount rate.⁷ The details of the allocation of the public costs by income group and age of head (of the family) are shown in Appendix D.

CALCULATION OF THE PRESENT VALUES

Normally to calculate the present value of the total public costs we should add up the discounted values of the public costs incurred by all families in each and every year of their tax paying period of their lifetime (e.g., from the age of 19 to 65 for a high school graduate who starts working at the age of 19). In the case of this study, however, there are two additional limitations which call for further adjustments. First, our data regarding the students participation in Ontario Community Colleges are based on 1975 Post-Secondary Survey of Students (PSSS) and secondly, Community Colleges in Ontario started their operation in 1967. These two constraints, together with the assumption that people have started to incur the extra tax costs of financing Ontario Community Colleges from 1967, imply that the parents of the students who were surveyed in 1975 did not actually incur such public costs until they reached, on the average, the age of 37.⁸ Thus we should calculate the present value of the public costs which is incurred by such parents for the period of only 28 years (assuming that they pay taxes up to the age of 65: $65 - 37 = 28$). Taxes paid by people after the age of 65 are spread over their working life time according to their tax share by age and income. The

potential bias is a minor overestimation of the tax costs which, relative to the rest of the costs, is negligible. Figure 1 on page 30 is helpful in clarifying the above adjustment procedure.

Table III-5 shows the results of these calculations. Line 3 of this table shows total public costs borne by all people (users and non-users) from different income groups and line 4 represents that portion of the public costs which is incurred only by the users of post-secondary education in Ontario Community Colleges. From this table it can be seen that only a small fraction of total public costs is incurred by the users of the system. In other words, most of the public funds used to support post-secondary education in Ontario Community Colleges are provided by those people who do not use such a system and, consequently, do not receive any direct benefit from post-secondary education in Community Colleges in Ontario.

TABLE III-5

Public Costs of Financing Post-Secondary Education (in present values) in Ontario Community Colleges Incurred by the Cohort of Parents whose Children Attended School in 1975

(thousands of 1971 dollars)

No.	Source	Income Group										
			< 2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7,000-9,999	10,000-14,999	15,000 & over	
1	Federal Government		240	293	482	674	1,261	2,833	11,832	16,327	17,048	50,042
2	Provincial Government		343	424	564	668	1,258	2,520	9,861	12,892	11,832	39,304
3	Total (1 + 2)		583	717	1,046	1,342	2,519	5,353	21,693	29,219	28,880	89,346
4	The amount of public Costs incurred by the <u>Users</u>		3.5	10.8	4.2	34.9	37.8	107.1	802.6	1,811.6	3,205.7	6,018.2

Sources: Author's calculation is based on Table D-2 (lines 8 and 16) in Appendix D, and Table B-1 (line 4) in Appendix B.

Note: To calculate line 4, the average proportion of the users of the system out of total tax paying population (see line 4 of Table B-1 in Appendix B) is multiplied by the total public costs shown in line 3 above.

ALLOCATION OF THE PUBLIC COSTS BY PROGRAM

Since the calculated public costs by each income group is used to support mainly three different programs (1-year, 2-year and 3-year programs) in Community Colleges, we should allocate such costs among these programs according to the amount of resources which are used up to support them. This determines the share of public costs which should be attributed to each program. The relative size and extent of these programs could be used as an indication of the amount of resources which are used up to support them. The larger the size of the program, the higher would be the public costs which is associated with that program. However, due to data limitation, we used the following approach to calculate a proxy for the relative size of each program. Since in each year in addition to students in a 1-year program, there are students in process in the 2nd- and 3rd-year programs, we use the average share of students in each program over the period of 10 years (1970 to 1980) as a proxy for the size of each program. These shares are 27.9%, 52.4% and 19.7% for 1-year, 2-year and 3-year programs, respectively.⁹ Table III-6 shows the allocation of the public costs by income group and program. These results correspond to equation (6) in Chapter II.

TABLE III-6

Allocation of Public Costs (in present value)

by Income Group and Program

(thousands of 1971 dollars)

No.	Income Group Program	< 2000	2000- 2999	3000- 3999	4000- 4999	5000- 5999	6000- 6999	7000- 9999	10,000- 14,999	15,000 and over	Total
1	1-year	1.0	3.0	1.2	9.7	10.6	29.9	223.9	505.4	894.4	1,679.1
2	2-year	1.8	5.7	2.2	18.3	19.8	56.1	420.6	949.3	1679.8	3,153.5
3	3-year	0.7	2.1	0.8	6.9	7.4	21.1	158.1	356.9	631.5	1,185.6
4	Total	3.5	10.8	4.2	34.9	37.8	107.1	802.6	1811.6	3205.7	6,018.2

Source: Based on Table III-5.

PRIVATE COSTS

The private costs, such as tuition and other academic expenses, and foregone earnings, could be considered as either reduction from the benefits or as additional costs which must be incurred over and above the public costs for individuals to be able to benefit from the present system of post-secondary education. We consider such private expenses on the cost side. Therefore, the present value of such private costs for each program should be allocated among different family income groups according to the representative share of each income group in post-secondary education in Ontario Community Colleges.

Total private costs could be divided into two categories: (a) "Direct Private Costs", which is the direct expenditures by students and/or their families for tuition and fees and other academic expenses; and (b) "Indirect Private Costs", which is the foregone earnings of individuals while attending college.

DIRECT PRIVATE COSTS

For the calculation of direct private costs to be consistent with our calculation of public cost, we should use the average of these costs incurred during 1969-80 as an appropriate base for the calculation of the private costs. Unfortunately, due to data limitation we were not able to collect data for the whole period of 1969-80. The only source of information which provides an estimate of average direct private costs is the unpublished data from the Student Awards Section of Ontario Ministry of Colleges and Universities which has provided an approximation of tuition and fees and other academic expenses for Ontario Community Colleges since the 1978-79 academic year.¹⁰ Table III-7 shows the details.

TABLE III-7

Direct Private Costs Per Student

No.	Year	Tuition	Activities, Student Fee and Building Fees	Other Fees ¹	Total Current	Total ³ (in 1971 \$)
1	1978-79	305	49	271	625	381
2	1979-80	333	61	273	667	377
3	1980-81	400	55	280 ²	735	378
4	Average 1978-81	346	55	275	676	379

Source: unpublished data, Student Awards, Ontario Ministry of Colleges and Universities.

Notes:

¹These are program-related fees (including books and supplies) which vary according to the type of program and the college. These charges are as high as \$800 for some programs in some colleges.

²Author's estimation.

³Since these are expenditures on non-food items we used Bank of Canada's calculation of price index (excluding food).

Due to such data limitation, however, we assume that the average direct private costs in real terms (i.e., 1971 prices) for the period of 1969-80 has been the same as the average of such costs between 1978-81. This item can be seen from the last column of Table III-7, line 4 (i.e., the average real direct private costs of attending one year of Ontario Community Colleges is assumed to be \$379 per student in 1971 prices).

The appropriate measure of direct private costs, however, requires calculation of the present values of such costs as of the time when the schooling begins. These costs obviously would be different for different programs as

shown in Table III-9, column 1.

INDIRECT PRIVATE COSTS

The second major component of total private costs is real net foregone earnings. For each year of study in Ontario Community Colleges, students have to forego the income which they could have otherwise earned and this is assumed to be equivalent of the income of high school graduates. On the other hand, most of these students have some earnings during the period of study which should be deducted from their foregone earnings to arrive at "net" foregone earnings. The median income of a high school graduate at age 19, 20 and 21 was considered to be gross foregone earnings of investment in 1-year, 2-year and 3-year programs, respectively, in Ontario Community Colleges. Now, to calculate the "real net" foregone earnings we should first subtract the tax payments for each income level (foregone); secondly, deduct the after-tax earnings of students while attending school; and thirdly, calculate the present values of these real net foregone earnings by using an appropriate discount rate (which is 2.2%, as explained in footnote 7). The details of the calculation of students' incomes during school years are discussed in Appendix F. Table III-8 shows earnings and foregone earnings of students before and after tax for different years.

We now can calculate the present values of net real foregone earnings for different programs. The results are shown in column 2 of Table III-9. Column 3 of this table shows total private costs (direct and indirect) per student for different programs.

Before we calculate total private costs for all students we should make a further adjustment to take account of the difference which exists between the base year for which the present values of the public costs are calculated

TABLE III-8

Earnings and Foregone Earnings of Students in Ontario
Community Colleges by Year of Study
(in 1971 dollars)

Year	<u>Foregone Earnings</u>		<u>Earnings</u>		Net Real Foregone Earnings (2)-(4)
	Before Tax (1)	After Tax (2)	Before Tax (3)	After Tax (4)	
Year 1	3825	2632	1013	404	2228
Year 2	4150	2855	1099	439	2416
Year 3	4473	2988	1185	473	2515

Source: Columns 1 and 2 from Table I-2 (Appendix I)
Column 3 based on Table III-15;
Column 4 based on column 3 and the tax rate of (60.1%);*
Column 5 the difference between columns 2 and 4.

* This tax rate is a total effective tax rate (including all kinds of taxes at all levels of the government) applicable to individuals who are less than 25 years old and whose income is less than \$2,000 per annum. See line 22 of table J-2 in Appendix J. The details of calculation of such effective tax rates for all income levels and age groups are discussed in the same Appendix.

and the base year for which the present values of the private costs are calculated. While the present values of the public costs are calculated as of 1967 (the year in which Ontario Community Colleges started to operate) the present values of private costs are calculated as of the time when students started their post-secondary schooling. This latter base year is 1975 (the year in which the post-secondary student survey was undertaken). Consequently we should further discount the results of total private costs (presented in column 3 of Table III-9) by another 8 years (1975-1967=8) to make it compatible with our calculation of public costs. Column 4 of Table III-9 shows the results. Now to calculate total private costs for all students (as of 1967) we should simply multiply total number of "graduate equivalents" in each

TABLE III-9

Private Costs (in present values) of Investment in
Post-Secondary Education in Ontario Community
Colleges by Program

(1971 dollars)

	1	2	3	4	5
Program	Direct Private Costs Per Student	Indirect Private Costs Per Student	Total Private Costs Per Student (1 + 2)	Adjustment of Present Values for 8 Years	Total Private Costs for all Students (thousands of 1971 \$)
1-year	371	2180	2551	2143	28,159
2-year	733	4493	5226	4391	54,102
3-year	1088	6849	7937	6669	20,594

Sources and Notes: Col. 1 - based on Table III-7, using 2.2% discount rate for the calculation of the present values.
Col. 2 - based on Table III-8.
Col. 3 - Sum of Col. 1 and Col. 2.
Col. 4 - Discounted values of Col. 3 (at 2.2%) for another 8 years to match the base year for the calculation of public costs.
Col. 5 - Based on Col. 4 above and Table E-3 in Appendix E (showing the number of "graduate equivalents" in each program).

program by private costs per student in that program. The results are shown in column 5 of Table III-9.

DISTRIBUTION OF TOTAL PRIVATE COSTS BY FAMILY INCOME GROUPS

Since the proportion of students' population who attend community colleges varies across different family income groups, total private costs incurred by each family income group would also vary in accordance with students' representation in these income groups. As a result, to determine the distribution of total private costs by family income groups for different

programs we should allocate total private costs for all students in each program (shown in column 5 of Table III-9) according to the distribution of Ontario Community Colleges' student population by family income (i.e., α_j^F). The details of the calculation of this distributional measure are discussed in Appendix G. Table III-10 shows the results of such distribution by income group and program. These results correspond to equation (7) in Chapter II.

TABLE III-10
Distribution of Total Private Costs by Income
Group and Program: Ontario
Community Colleges
(thousands of 1971 dollars)

No.	Program	Income Group									Total
		< 2000 ^a	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	10,000-14,999	15,000 & over	
1	1-year	1548.7	281.6	281.6	760.3	760.3	1182.7	3576.2	7405.8	12221.0	28159
2	2-year	1082.0	378.7	378.7	865.6	865.6	1947.7	6600.4	16392.9	25373.8	54102
3	3-year	473.7	205.9	205.9	350.1	350.1	741.4	2265.3	6301.8	9741.0	20594
4	Total	3104.4	866.2	866.2	1976.0	1976.0	3871.8	12441.9	30100.5	47335.8	102855

Sources: Based on Tables III-9 and G-3 in Appendix G.

Note: Sums may not add to totals, due to rounding.

TOTAL COSTS

The sum of the public costs and private costs (in present values) which is incurred by the users of post-secondary education in Ontario Community Colleges from different family income groups for different programs represents the total costs borne by these groups. The results are presented in Table III-11. These results correspond to equation (1) in Chapter II.

TABLE III-11

Distribution of Total Costs (in present values) of Investment
in Post-Secondary Education in Ontario Community
Colleges by Family Income Group and Program

(thousands of 1971 dollars)

No.	Program	Income Group									Total
		< 2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	10,000-14,999	15,000 & over	
1	1-year	1550	285	283	770	771	1213	3800	7911	13115	29838
2	2-year	1084	384	381	884	885	2004	7021	17342	27054	57256
3	3-year	474	208	207	357	358	763	2423	6659	10373	21780
4	Total	3108	877	870	2011	2014	3979	13245	31912	50542	108873

Sources: Based on Tables III-6 and III-10.

From Table III-11, it is clear that the higher the income group (with the exception of income group of \$2000 or less) the greater would be the total costs of investment in post-secondary education in Ontario Community Colleges. The reason for this is two-fold. First, the proportion of public costs out of total costs which is incurred by the users of the system is very small. So, even if the tax structure was strongly progressive, it would not have much effect on the final distribution of total costs. Secondly, distribution of students population by income group is such that the proportion of students from higher income groups is much larger than the proportion of students from lower income groups (see Table G-3 in Appendix G). Consequently, it can be expected that higher income groups incur greater costs than the lower groups.

Footnotes to Chapter III

¹ Since contribution of local government to Ontario Community Colleges is either negligible or none, this item was excluded from our calculations.

² Note that not all of the Provincial Government contribution is shown in Table III-1. For example, payments on principal and interests on debentures or capital grants are excluded from this table. The reason is that such costs are related to the capital stock of community colleges, which will be taken into account separately under the "indirect public costs" of such institutions.

³ Raymond W. Goldsmith, "A Perpetual Inventory of National Wealth," in Studies in Income and Wealth, Vol. 14, New York, National Bureau of Economic Research, 1951.

⁴ Theodore W. Schultz, "Capital Formation by Education," Journal of Political Economy, No. 6, Dec. 1960.

⁵ See David F. Burgess, "The Social Discount Rate for Canada: Theory and Evidence"; Harry F. Campbell, "Shadow-Prices for the Economic Appraisal of Public Sector Expenditures"; and Glenn P. Jenkins, "The Public-Sector Discount Rate for Canada: Some Further Observations," Canadian Public Policy, Summer 1981. Also see; Canada, Treasury Board (1976), Benefit-Cost Analysis Guide (Ottawa: Ministry of Supply and Services).

⁶ Such costs equal the total public costs incurred by all age-cohorts in a given year. For the proof refer to Chapter II, footnote 19.

⁷ This rate is based on the average real rate of interest on long-term (15 years and over) bonds between 1960 to 1980 in Canada, extracted from Michael Parkin, Modern Macroeconomics (Scarborough, Prentice Hall of Canada Inc., 1982), pp. 28-29.

⁸This is based on the assumption that the parents of students who are attending colleges are most likely in the age group of 40 to 50; or 45 years old on the average. Thus if in 1975 the average age of the parents is 45, in 1967 their average age must have been 37: $45 - (1975-1967) = 37$.

⁹To allocate the public costs among different programs (i.e., 1-year, 2-year and 3-year programs) we use the following formula:

$$\beta^r = \frac{N^r \cdot r}{\sum_{r=1}^3 N^r \cdot r},$$

where N^r is the average number of "graduate equivalent" from an r-year program and r represents the length of the program. The "graduate equivalent" is defined as the total number of the graduates from a program plus the number of students who have dropped out of school but passed at least an equivalent number of courses for the program. This ratio is used as a proxy for the relative size of each program according to which the public costs should be allocated. Using the estimates for "graduate equivalent" produced in Table E-3, Appendix E, we get the following ratios:

$$\beta^1 = 27.9\%, \beta^2 = 52.4\%, \beta^3 = 19.7\%.$$

¹⁰It should be noted that these private expenditures vary among Ontario Community Colleges and individual programs within each college. However, since the collection of data for each college and for each individual program within each college was a daunting task and outside the scope of this study, we used the limited information available from the Ontario Ministry of Colleges and Universities.

DISTRIBUTION OF BENEFITS

It is a common belief that post-secondary education produces a wide variety of monetary and non-monetary benefits for both the recipients of higher education and for others. It is, however, very difficult and almost an impossible task to measure many of these non-monetary benefits, and there are even some economists who actually doubt the importance and relevance of such non-monetary benefits for the justification of the government financing of post-secondary education.¹ For these reasons we concentrate only on the estimation of monetary benefits of investment in post-secondary education in Ontario Community Colleges, and in the subsequent sections we present these estimates and the methods which were used in order to calculate them.

MONETARY BENEFITS

Monetary benefits are defined to be the net income differentials resulting from the apparent increase in labor productivity that post-secondary education brings. Such income differentials are the difference between the earnings of college graduates as compared with high school graduates. It is important to note that to calculate actual monetary benefits we have to make two adjustments. First, since it is the net (after tax) income differentials which reflects the net monetary benefits, the adjustments should be made to deduct the tax payments from gross income levels at different ages. Secondly, since extra income differentials expected 20 or 40 years from now are certainly not equivalent to the same amount today, and hence a simple addition of future incomes would reflect a wrong measure of income differentials, we should discount the future income differentials and consider the present value of such income differentials as an appropriate measure of the monetary benefits. In the subsequent sections we will discuss the methods which were used to calculate the present values of net (after tax) income differentials and their distribution by family income groups.

As we discussed in Chapter II, there has been a number of studies which have attempted to determine the interaction between schooling and ability on the basis of the hypothesis that a part of such income differentials must be attributed to the ability of individuals. The results are mostly inconclusive and depend critically on the assumption that all crucial determinants of ability are captured in the analysis.

In this study, however, we use two sets of calculations. First, we assume that all of these income differentials are attributable to schooling (i.e., $\mu = 1$ in equation (8) in Chapter II) and secondly, following the assumption used by Hansen and Weisbrod, we attribute 25% of such income differentials to ability, mortality, etc. (i.e., $\mu = .75$) in order to test the sensitivity of the results.²

The first step then is to calculate the age-earnings profiles of individuals for different education levels.

Age-Earnings Profiles

Due to the absence of actual data on the earnings of individuals by their age and education over their working lifetime, we ought to estimate such data using an appropriate estimation technique. In so doing we have to know two crucial measures: (a) starting salaries of individuals with different education levels; and (b) rate of growth of real income over one's working lifetime. Age-earnings profiles then could be estimated by applying the growth rate of income in the first year to the starting salaries to arrive at the income of the individuals at the beginning of the second year and similarly applying the growth rate of income in the second year to the

income of these individuals in the beginning of that year to arrive at the third year income, and so forth (i.e., using the same method for the calculation of individuals' incomes for the subsequent years).

(a) Starting Salaries

To calculate the starting salaries of high school graduates we employed the data from the individual file based on Public Use Sample Tapes (PUST), Census of Canada, 1971, produced by Statistics Canada.

From a sample of 21,405 individual cases, a subgroup of individuals with grade 12 diploma who were working for at least 35 hours each week for a period of 40 weeks or more during 1970 and were 19 years of age or younger were selected. The median annual income of this subgroup which was \$3,500 (in 1970) was chosen to represent the starting salary of a high school graduate (grade 12) immediately after graduation and in the beginning of the first working year.

As far as starting salaries of graduates from Ontario Community Colleges is concerned, the only source of data which could provide some relevant statistics was "Graduate Placement Report, Colleges of Applied Arts and Technology," which is published by the Ontario Ministry of Colleges and Universities. Since these data were available only for 1976-1980, the adjustment for inflation and secular growth was made to transform these starting salaries to 1971 base. The details of the calculation of starting salaries for graduates from community colleges in Ontario are discussed in Appendix H. The results of our calculation indicate that such starting salaries in real terms (i.e., 1971 prices) were \$4707, \$5479 and \$6380 for 1-year, 2-year and 3-year programs, respectively, in Ontario Community Colleges.

(b) Growth Rate of Real Income

In order to estimate the growth rate of real income of individuals with a high school degree and a degree from community colleges in Ontario, once again we utilized the information in the 1971 Census of Canada (PUST). Before we pursue our discussion, however, it is important to note that since the breakdown of data for income by schooling level for community colleges was not available, it was assumed that the growth rate of real income of a college graduate (in all programs) is similar to the growth rate of real income of an individual with three or four years of university education who has received his/her degree. Hence from a sample of 21405 individual cases two subgroups were selected which were alike in all characteristics (as specified by the census) except their education level; one subgroup with the schooling level of grade 12 (high school graduate) and the other with the schooling level of three or four years of university with a degree.³ The major common characteristics of these groups were as follows:

Sex	:	Male
Age	:	Between 18 and 65
Labor Force Status	:	Employed labor force
Weeks Worked During 1970	:	40 weeks or more
1970 Work Activity	:	Full time
Hours Usually Worked Each Week	:	35 hours or more
Major Source of Income	:	Wages and salaries

Note that we have chosen only males because of the strong observation that female participation in the labor-force throughout their lifetime is not as regular as male participation. For example, during the pregnancy periods they take leave of absence for an extended period without pay. This

obviously underestimates the average actual earnings of all individuals (both males and females) and hence slows down the rate of progression of income. Nevertheless, the attempt was made to calculate the growth rate of income by age for combined male and female individuals who were employed as full time in 1970. The results showed an insignificant difference between the two rates of progression of income. Various regression models were tested and the best fit turned out to be a log-linear function of the form:

$$y^* = a^* + bA^* + cA$$

where y^* = natural log of income

A^* = natural log of age

A = age.

The above log-linear function is the log of an exponential function of the form:

$$y = aA^b e^{cA}$$

In this case the growth rate of income ($\dot{y}_A$) would be:

$$\dot{y}_A = \frac{dy/y}{dA} = \frac{b}{A} + c.$$

Accordingly, the growth rate ($\dot{y}_A$) is itself a variable which depends on age (A).

The regression results for alternative cases and for different levels of education are presented in Table IV-1.⁴

Table IV-1

Regression Results

No.	Independent Variables	Dependent Variables			
		Male		Male and Female	
		x_1^*	y_1^*	x_2^*	y_2^*
		Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)
1	A^*	3.04 (8.48)	4.29 (3.85)	3.16 (9.28)	4.56 (5.23)
2	A	-0.065 (-6.49)	-0.095 (-3.26)	-0.070 (-7.24)	-0.104 (-4.55)
3	Constant	0.57 (0.62)	-2.50 (-0.86)	0.17 (0.20)	-3.21 (-1.41)
4	Statistics R^2	0.28	0.20	0.22	0.22
5	N	586	134	902	174
6	F	110.7	16.3	126.4	24.4
7	Growth Rates	$\dot{x}_{A1} = \frac{3.04}{A} - 0.065$	$\dot{y}_{A1} = \frac{4.29}{A} - 0.095$	$\dot{x}_{A2} = \frac{3.16}{A} - 0.07$	$\dot{y}_{A2} = \frac{4.56}{A} - 0.10$

Definition of the terms:

x_1^* = natural log of income of male graduates from high school (grade 12)

x_2^* = natural log of income of mixed male-female graduates from high school (grade 12)

y_1^* = natural log of income of male college graduates

y_2^* = natural log of income of mixed male-female college graduates

A^* = natural log of age

A = age (from 19 to 65)

$\dot{x}_A$ and $\dot{y}_A$ represent the rate of growth of income by age for individuals with a high school degree and college degree respectively.

Note that the difference between $\dot{x}_{A1}$ and $\dot{x}_{A2}$ is minimal and insignificant. Similarly the difference between $\dot{y}_{A1}$ and $\dot{y}_{A2}$ is negligible. Hence, for

reasons explained before, we decided to choose $\dot{x}_{A1} (= \dot{x}_t)$ and $\dot{y}_{A1} (= \dot{y}_t)$ to represent the growth rate of income for high school and community college graduates respectively.⁵ The actual growth rates are shown in Table I-1 of Appendix I.

Estimation of Age-Earnings Profiles

Now that we have calculated the starting salaries and the growth rates of income of individuals by different education levels, we should be able to estimate the income of individuals at any point in time on the basis of their age and education. This can be done by using the following formulas:

$$x_t = \prod_{t=1}^n x_0 (1 + \dot{x}_t)^t$$

and

$$y_t^r = \prod_{t=r+1}^n y_0^r (1 + \dot{y}_t)^t,$$

where x_t is the real income (before tax) of an individual, in constant 1971 dollars, with a high school degree (grade 12) at time t ; x_0 is the starting salary (or income in the first working year) of a high school graduate; y_t^r is the real income (before tax) of an individual, in constant 1971 dollars, with a college degree from an r year program at time t ; y_0^r is the starting salary (or income in the first working year) of a college graduate from an r year program. The detailed results of our calculation is presented in Table I-2 of Appendix I.

Note that our results confirm the theoretical underpinning of the life cycle path of earnings discussed by J. Mincer and G. S. Becker:⁶ first, the age-earnings profiles exhibit an inverted U-shaped pattern;⁷ secondly, earnings are higher the higher the level of schooling; and thirdly, earnings increase more rapidly with age at the higher level of schooling.⁸

The results so far represent the gross income of individuals before tax deductions. Since an appropriate analysis of monetary benefits of post-secondary education which is reflected in the income differentials of the individuals requires an after tax calculation of such differentials, we ought to have a measure of tax incidence (effective tax rates) by age and income to apply to age-earnings profiles of these individuals in order to calculate their net income after tax. The details of calculation of such tax rates are discussed in Appendix J. The earnings of individuals before and after tax at each age and for different education levels are presented in Table I-2 of Appendix I.

Calculation of Present Values and Income Differentials (Benefits)

Having calculated the real net (after tax) income of the individuals at each age by different schooling levels throughout their working lifetime, we are able to calculate the present values of lifetime earnings of these individuals by simply using a present value formula. In order to calculate such present values accurately, we should use the real market rate of interest for each year in the future to discount the future earnings of individuals. However, due to the absence of such estimates on future interest rates, we use the average real rate of interest on long-term (15 years and over) bonds between 1960 and 1980 in Canada (which is 2.2 per cent) as a proxy for the real interest rates in future years. The discounted values of individuals' income at each age and for different education levels as well as the sum of these discounted values (i.e., the present values) are presented in Table I-3 of Appendix I. Now to calculate the benefit (i.e., the income differentials) for different schooling levels we should simply subtract the present value of future income stream of a high school graduate from the present values of future income stream of college graduate from different programs. The results are shown in Table IV-2, line 1.

Table IV-2
The Present Values of Real Net (after tax) Income
Differentials per College Graduate by Program

	Added Income for a 1-year program	Added Income for a 2-year program	Added Income for a 3-year program
1. present values as of 1975	68,729	101,261	124,052
2. present values as of 1967	57,747	85,081	104,231
3. present values as of 1967 adjusted for ability, etc.	43,310	63,811	78,173

Sources: Based on Table I-3 (Appendix I).

- Notes:
1. Present values in line 1 are calculated as of age 19 (to 65), using a 2.2% discount rate.
 2. Line 2 is calculated by discounting line 1 at 2.2% for 8 years (1975 - 1967 = 8).
 3. Line 3 = line 2 times .75.

Before we pursue our calculation of benefits and their allocation by income groups we have to make a further adjustment in the present value of the benefits to make it consistent with the calculation of the present values of the costs. As we discussed earlier in Chapter III for the calculation of the present values of the private costs, a further discounting adjustment was needed to transform our estimates, which were based on 1975 post-secondary student survey, into 1967 base. For the same reason we should further discount our present value estimates of benefits (which is calculated as of 1975) for another 8 years (that is to calculate the present values of benefits as of 1967) so that the benefits and costs be comparable. Line 2 of Table IV-2 shows such present values as of 1967. These results correspond to equation (9) in Chapter II. Figure 1 in Chapter II is helpful in clarifying such year adjustments.

Now, using average number of "graduate equivalents" for different programs, we can estimate the net total benefits accrued to all individuals or their families as a result of investment in post-secondary education in community colleges. Table IV-3 shows the results.

Table IV-3

Benefits (in present values) of Investment in
Post-Secondary Education in Ontario Community
Colleges by Program

	<u>1-year</u>	<u>2-year</u>	<u>3-year</u>
1. Average "Graduate Equivalent":	13,140	12,321	3,088
2. Average benefits per Graduate:	57,747	85,081	104,231
3. Total benefits, All (1x2) (thousands of 1971 dollars):	758,796	1,048,283	321,865
4. Total benefits, All Adjusted for ability differences (thousands of 1971 dollars):	569,097	786,212	241,399

Sources: Based on Tables IV-2 and E-3 (Appendix E).

Note: Line 4 = line 3 times .75.

DISTRIBUTION OF MONETARY BENEFITS BY FAMILY INCOME GROUPS

Since the main objective of this study is to investigate the income redistributional impact of investment in post-secondary education in Ontario Community Colleges, we have to calculate the amount of monetary benefits received by different income groups. To achieve this goal we allocate the total monetary benefits for different programs among different income groups according to the representation share of students' population by these groups

(i.e., α_j^r , calculation of which is discussed in Appendix G). Table IV-4 presents the results. These results correspond to equation (8) in Chapter II.

Table IV-4

**Distribution of Benefits (in present values) of Investment
In Post-Secondary Education in Ontario Community Colleges
By Family Income Group and Program**
(thousands of 1971 dollars)

No.	Income Group Program	<2000	2000- 2999	3000- 3999	4000- 4999	5000- 5999	6000- 6999	7000- 9999	10000- 14999	15000 & Over	Total
1	Unadjusted: 1-year	41734	7588	7588	20387	20487	31689	96367	199563	333111	758796
2	2-year	20966	7338	7338	16773	16773	40883	127891	317630	491645	1048283
3	3-year	7403	3219	3219	5472	5472	11587	35405	98491	152242	321865
4	Total	70102	18145	18145	42732	42732	84340	259663	615684	976998	2128944
5	Adjusted (for ability, etc.) 1-year	31301	5691	5691	15365	15365	23902	72275	149673	249833	569097
6	2-year	15725	5504	5504	12580	12580	30662	95918	238222	368734	786212
7	3-year	5552	2414	2414	4104	4104	8690	26554	73868	114182	241399
8	Total	52577	13609	13609	32049	32049	63255	194747	461763	732749	1596708

Sources: Based on Tables IV-3 and G-3 (Appendix G).

From this table, it is evident that the higher the income group, the greater will be the monetary benefits received by the users (in aggregate) of the post-secondary education system in Ontario Community Colleges in that income group (with the exception of lowest income group; i.e., less than \$2000). This is, of course, due to the higher participation rates of students in post-secondary education from the higher income groups.

Footnotes to Chapter IV

¹See, for example, E. G. West, Education and the State, op. cit.; and M. Eriedman, "The Higher Schooling in America," The Public Interest, Spring 1968

²See Lee W. Hansen and Burton A. Weisbrod: Benefits, Costs, and Finance of Public Higher Education, op. cit.; pp. 18-19.

³Note that the procedure of calculating the growth rate of real income by age on the basis of the cross-section data (i.e., Census of 1971) ignores the effect of secular growth on real income. Thus, the implicit assumption here is that there is either no secular growth from the base year afterward or if there is such a growth rate, it has no effect on the income differentials among individuals with different education levels. In fact, secular growth is likely to increase the income differentials. This is so because it is expected that the demand for highly skilled and educated people would increase relatively more than the demand for less skilled labour as real growth and technological progress took place. Hence, the real income of the former group should grow more than the latter group. That is the secular growth would likely enhance an increase in the income differentials and hence the monetary benefits of post-secondary education in Ontario Community Colleges would be greater. Thus the assumption of zero secular growth would underestimate the benefits within the model of this study.

⁴An alternative regression model was in the form of a quadratic function such as:

$$Y = a + bA + A^2$$

The results were:

(i) For high school male graduates:

$$\begin{array}{l} X_1^* = -4848 + 615A - 5.9A^2 \\ \text{(t-values)} \quad (-8064) \quad (437) \quad (-8.2) \end{array} \quad R^2 = .22$$

(ii) For college male graduates:

$$\begin{array}{l} Y_1^* = -17904 + 1377A - 14A^2 \\ \text{(t-values)} \quad (-2.13) \quad (3.15) \quad (-2.60) \end{array} \quad R^2 = .16$$

⁵ Note that since the estimation of the growth rates of income is based on the cross-section data from 1971 Census of Canada, the inflation factor has been automatically swept away. Thus such growth rates represent the growth rate of the real income.

⁶ J. Mincer, "Investment in Human Capital and Personal Income Distribution," op. cit. and G. S. Becker, Human Capital, op. cit.

⁷ According to G. Becker, Human Capital, op. cit., due to growth in income, business cycles and occupation and life cycle changes, it is unlikely that the real income decreases over time. However, if we exclude the secular growth, as we have done, income of individuals would fall after it reaches the peak level around the age range of 45-50 years. In this sense our results do not contradict Becker's conclusion.

⁸ Note that due to our data limitation we assumed the same growth rate of real income for all programs (1-year, 2-year, and 3-year) in Community Colleges even though they actually represent different levels of schooling. However, since the starting salaries are different, the differences in the level of income at each age is quite observable. The higher the level of schooling, the higher the level of income. The above assumption, however, overestimates the incomes of the individuals in programs with shorter duration.

CHAPTER V

NET INCIDENCE: NET DISTRIBUTIONAL EFFECTS OF INVESTMENT IN POST-SECONDARY EDUCATION IN ONTARIO COMMUNITY COLLEGES

Two steps of the basic model of this study have been completed. In Chapter III the total costs of investment in post-secondary education in Ontario Community Colleges which is incurred by a given age-cohort of the parents (on behalf of their children) throughout their lifetime were calculated and the distribution of such costs by income group was presented. In Chapter IV, the benefits of such an investment over the lifetime of the recipients of post-secondary education in Ontario Community Colleges were calculated and assumed to be received by the same parents (families) of these students on their behalf. The distribution of such benefits by family income groups was also presented. On the basis of these estimates, the net incidence of investment in post-secondary education in Ontario Community Colleges can be calculated.

PRESENTATION OF THE RESULTS

The major findings of this study can be presented in two categories. One for the users of the system and the other for those who do not receive any direct benefit from the present system of post-secondary education in Ontario Community Colleges (i.e., non-users).

(1) The Users:

The major results in this category are presented in Tables V-1, V-2 and V-3. These results correspond to equations (10), (11) and (12) in Chapter II. Table V-1 shows the difference between the costs incurred and benefits received by the families of the users of the system from each income group. It is clear from this table that there is a net benefit to be received by the families of the users of the post-secondary

education system in Ontario Community Colleges from all income groups and for all three different programs. Rows 5 to 8 of this Table show the same difference when the adjustment is made to take account of the ability factor.

TABLE V-1
Distribution of Net Benefits (Benefits Minus Costs)
by Family Income Group and Program
(Thousands of 1971 dollars)

No.	Income Group	Less than 2,000	2,000-2,999	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000-9,999	10,000-14,999	15,000 and over	Total
	Program										
1	U n 1-year	40184	7303	7305	19717	19716	30656	92567	191652	319996	728958
2	d 2-year	19882	6954	6957	15889	15888	38879	120870	300288	464591	991027
3	j 3-year	6929	3011	3012	5115	5114	10824	32982	91832	141869	300085
4	u s t All	66994	17268	17275	40721	40718	80361	246418	583772	926456	2020071
5	d 1-year	29751	5406	5408	14595	14594	22689	68475	141762	236718	539259
6	j 2-year	14641	5120	5123	11696	11695	28658	88897	220880	341680	728956
7	u s t 3-year	5078	2206	2207	3747	3746	7927	24131	67209	103809	219619
8	d All	49469	12732	12739	30038	30035	59276	181502	429851	682207	1487835

Sources: Based on Tables III-11 and V-4.

Table V-2 presents the ratios of benefits to costs by income groups and for different programs.

Here, it should be noted that such a ratio is used in a different context than it usually appears. It does not denote anything about allocative efficiency in its present form. Rather, it measures the magnitude of benefits compared to costs. Although there is a positive return to investment in post-secondary education in Ontario Community Colleges for all income groups, there seems to exist a negative relation between such return (benefit-cost ratios) and the length of the program. That is, the longer the program, the lower is the net return to investment in it. Rows 5 to 8 of this Table presents similar results after the adjustment for ability is made.

TABLE V-2

Actual Ratio of Benefits to Costs by
Family Income Group and Program

No.	Income Group	Less than 2,000	2,000-2,999	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000-9,999	10,000-14,999	15,000 and over	Total
	Program										
1	U n 1-year	26.9	26.6	26.8	26.6	26.6	26.3	25.4	25.2	25.4	25.4
2	a d 2-year	19.3	19.1	19.3	19.0	19.0	20.4	18.2	18.3	18.2	18.3
3	j u 3-year	15.6	15.5	15.6	15.3	15.3	15.2	14.6	14.8	14.7	14.8
4	s c All	22.6	20.7	20.9	21.0	21.0	21.2	19.6	19.3	19.3	19.6
	e d										
5	A d 1-year	20.2	20.0	20.1	20.0	19.9	19.7	19.0	18.9	19.0	19.1
6	j u 2-year	14.5	14.3	14.4	14.2	14.2	15.3	13.7	13.74	13.6	13.7
7	s c 3-year	11.7	11.6	11.7	11.5	11.5	11.4	11.0	11.1	11.0	11.1
8	e d All	16.9	15.5	15.6	15.9	15.9	15.9	14.7	14.5	14.5	14.7

Sources: Based on Tables III-11 and IV-4.

From Table V-2, it is immediately apparent that there is no redistribution of income among the users in various income groups. All users are net beneficiaries. Note, however, that the ratios of benefits to costs are fairly high, implying a possible disequilibrium system. Three reasons could be accounted for such a case. First, we are dealing with a generation of parents who did not have to incur the cost of supporting Ontario Community Colleges from the beginning of their working lifetime because these colleges were created only in late 1960's. If these parents were to pay for such a system from the beginning of their working lives, the ratios would have been smaller. Secondly, while all the benefits are attributed to the users of the system, only a small fraction of public costs is incurred by them (see Table III-5).

Finally, the choice of interest rate in discounting future earnings could have lowered the present value of benefits relatively more than the present value of the costs because we had to discount the benefits for an extra 8 years to make it consistent with the base for which the present values of the public costs were calculated.

In any rate, although all income groups are net beneficiaries, it would be an interesting question to ask which income groups benefited more than others. To answer this question, we have to standardize the ratio of benefits to costs by assuming that overall effects for all income groups are neutral. Thus the ratio of benefits to costs for all income groups together should be set equal to unity. Now the ratio of benefits to costs for each income group can be compared to the ratio of totals (for all income groups). For those income groups in which the standardized ratios are greater than unity, the users of the system would benefit relatively more than those who belong to income groups with the standardized ratios of less than unity. Table V-3 presents the unadjusted results of standardized ratios of benefits to costs by income groups and program of study.

TABLE V-3

Standardized Ratios of Benefits to Costs by
Family Income Group and Program
(unadjusted).

No.	Income Group	Less than 2,000	2,000- 2,999	3,000- 3,999	4,000- 4,999	5,000- 5,999	6,000- 6,999	7,000- 9,999	10,000- 14,999	15,000 and over	Total
Program											
1	1-year	1.059	1.047	1.054	1.046	1.044	1.033	0.997	0.992	0.999	1.000
2	2-year	1.056	1.044	1.052	1.036	1.035	1.114	0.995	1.000	0.993	1.000
3	3-year	1.057	1.047	1.052	1.037	1.034	1.028	0.989	1.001	0.993	1.000
4	All	1.153	1.058	1.067	1.087	1.085	1.084	1.003	0.987	0.989	1.000

Source: Based on Table V-2.

The results are particularly interesting because, contrary to the general belief that the present system of financing post-secondary education has a regressive (pro-rich) pattern, our results indicate that not only all the users from various income groups benefit from such a system in Ontario Community Colleges, they all benefit by about the same amount. Here, a word of caution is needed for the interpretation of the results in Table V-3. The apparent ratios indicate there may be slightly less benefits to be received by the users of the system in the income groups of \$7,000-\$9,999 (what might be called middle income groups) and \$15,000 and over (what might be called highest income groups) than the users of the system in the income groups of less than \$7,000 (what might be called low middle and lower income groups). However, not only these ratios are very close to unity (indicating a uniform effect), there were roundings and approximations in our calculation of benefits and costs at different stages of computations. Therefore, in view of such approximation of data and analysis, the latter interpretation (i.e. lower income groups benefiting more than higher income groups) is not to be accorded much significance.

It should be noted that Table V-3 could also be considered to represent the standardized ratios when the benefits are adjusted for ability differences. The reason for this is due to the fact that such adjustment did not affect the relative position of different family income groups and consequently there was no change in the standardized ratios of benefits to costs. (There are minor differences in the third decimal point which are neglected).

(ii) Non-Users:

This group of people are those families (in the same age-cohort as those whose children participated and benefited from the present system of post-secondary education in Ontario Community Colleges) who either

do not have children or their children have chosen not to pursue their studies into post-secondary education in Ontario Community Colleges. Thus they do not receive any direct benefit from such a system. They are, however, taxpayers and a portion of their tax payments is used to finance such a post-secondary education system.

It is immediately clear that there are some people (users) who gain at the expense of others (non-users). This certainly implies that there is a redistribution of income from the non-users to the users of the system. This is, however, a fairly general and obvious conclusion. It would be interesting to analyse such a distributional problem within the same context as we employed earlier for the users of the system (i.e. the analysis of the redistributional problem by income groups). The problem that we are going to investigate now is to determine whether non-users subsidize users in their own income group or do they also subsidize users in other income groups. This is a relevant distributional question since 100 per cent of such public costs incurred by the non-users could be considered as 100 per cent of subsidies received by the users of the system. However, since the distribution of these costs by income group is different from the distribution of the subsidies by income groups, there would likely be a redistribution by income groups.

To clarify this point, consider a hypothetical case where we have two income groups, A and B. Assume that the amount of public costs incurred by the non-users of the system in group A exceeds the amount of subsidy received by the users of the system in this group, while the amount of public costs incurred by the non-users of the system in group B

falls short of the subsidy received by the users in this group. This means that the extra amount of public costs incurred by the non-users in group A is used to subsidize the users in group B. In other words, there is a redistribution of income from income group A to income group B.

In order to determine such a distributional pattern, we use the following procedure : first, we calculate the amount of public costs incurred by the non-users (the difference between line 3 and 4 of Table III-5 provides us with this result); secondly, we distribute such costs among different programs, applying the same approach as we used to allocate the public costs incurred by the users of the system among different programs. That is allocating such costs on the basis of 27.9%, 52.4% and 19.7% for 1-year, 2-year, and 3-year programs respectively.¹ Table V-4 shows the results of our calculation so far. It represents the distribution of costs by the non-users of the system according to family income groups and for different programs.

TABLE V-4

Distribution of Public Costs Incurred by the Non-users of the
System by Family Income Group and Program
(Thousands of 1971 dollars)

No.	Income Group	Less than 2,000	2,000- 2,999	3,000- 3,999	4,000- 4,999	5,000- 5,999	6,000- 6,999	7,000- 9,999	10,000- 14,999	15,000 and over	Total
1	1-year	162	197	291	365	692	1464	5828	7647	7163	23249
2	2-year	304	370	546	685	1300	2749	10947	14362	13453	43664
3	3-year	114	139	205	257	489	1033	4115	5399	5058	16146
4	Total	580	706	1042	1307	2481	5246	20890	27407	25674	83328

Source: Based on Table III-5.

The next step is to distribute the amount of subsidies received by the users according to the distribution of "graduate equivalents" by income groups (Table G-3 of Appendix G). The results are presented in Table V-5.

TABLE V-5

Distribution of Subsidies Received by the Users
of the System According to Family Income Group and Program
(Thousands of 1971 dollars)

No.	Income Group	Less than 2,000	2,000-2,999	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000-9,999	10,000-14,999	15,000 and over	Total
	Program										
1.	1-year	1279	233	233	628	628	976	2953	6114	10206	23249
2.	2-year	873	306	306	699	699	1703	5327	13230	20478	43664
3.	3-year	371	162	162	275	275	581	1776	4941	7637	16146
4.	Total	2523	701	701	1602	1602	3260	10056	24285	38321	83328

Source: Based on Tables V-4 and G-3 of Appendix G.

The final step is to compare costs incurred by the non-users in each income group with the subsidies received by the users in the same income group. This is done simply by subtracting costs from subsidies. Table V-6 shows the results of such a comparison.

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TABLE V-6

Distribution of Costs incurred by the Non-users
minus Subsidies received by the Users According
To Family Income Group and Program
(Thousands of 1971 dollars)

No.	Income Group	Less than 2,000	2,000- 2,999	3,000- 3,999	4,000- 4,999	5,000- 5,999	6,000 6,999	7,000- 9,999	10,000- 14,999	15,000 and over	Total
Program											
1.	1-year	1117	36	-58	263	-64	-488	-2875	-1533	3043	0000
2.	2-year	569	-64	-240	14	-601	-1046	-5620	-1132	7025	0000
3.	3-year	257	23	-43	18	-214	-452	-2339	-458	2579	0000
4.	Total	1943	-5	-341	295	-879	-1986	-10834	-3122	12640	0000

Source: Based on Tables V-4 and V-5.

Before discussing the results of table V-6, let us define income groups of \$0-\$2000 as lowest; \$2000-\$4000 as lower; \$4000-\$5000 as lower middle; \$5000-\$15000 as middle and upper middle; and \$15000 & over as highest income groups. From this table, it can be seen that non-users in the middle and upper middle income groups (\$5000-\$15000) as well as total of non-users in the lower income groups (\$2000-\$4000) incur more costs than is needed to subsidize the users in the same income groups. On the other hand, non-users in the lowest income group (less than \$2000) as well as lower middle (\$4000-\$5000) and highest (\$15000 and over) income groups incur less costs than is needed to subsidize the users in these groups. As a result it can be concluded that in general, the present system of financing post-secondary education in Ontario Community Colleges is such that, not only is there a redistribution of income from non-users to users of the system within each income group, there also is a redistribution of income from non-users in the middle and upper middle income groups as well as lower income groups to users of the system in lowest, lower middle and highest income groups.²

The question may be raised about whether the pattern of Table V-6 resulted mainly from the costs (taxes) side or the benefits side of our calculations. Generally speaking, the pattern has resulted from both sides and any attempt to separate out the contribution of one side from the other entails additional restrictive assumptions and thus should be treated cautiously. However, in order to have a better understanding of this problem, we used different hypothetical taxes and benefits patterns (one at the time) and compared them with the existing pattern of taxes and benefits. The details of this experiment are explained in Appendix K. From such experiments we can deduce that both costs (taxes) side and benefits side have significantly contributed to the creation of such a distributional pattern.

REVIEW OF PREVIOUS STUDIES

Before we start our review of other major studies and comparison of their results with ours, it should be noted that, apart from differences in the sources of data and reference groups, there are methodological differences among these studies. In particular the methodology adopted in this study can be distinguished from the others in three respects: first, a clear distinction is made in this study between the users and non-users of the post-secondary education system; second, the analysis is done within a lifecycle framework; and third, our reference group is chosen to be only Community Colleges in Ontario.

On the basis of these differences in the methodology and due to the fact that there are differences in provincial and state tax structures as well as state laws regarding financing of post-secondary education, in most cases the comparison of the results per se will not render a clear conclusion with regard to either the methodological differences or the choice of reference group. Ideally, to have a meaningful comparison we should reduce the number of differences which exist in different studies into one and then compare the results. Any change in the results could then be associated with that single difference. Such an ideal comparison is impossible in our case because of substantial differences which exist between this and other studies. What can be done, however, is to compare our results with the results of those studies which have more common characteristics with ours.

In so doing, we have restricted the comparison of our results with those which are confined to the province of Ontario. We also present a brief review of some of the other major studies regarding the redistributive impact of financing post-secondary education. Although these studies may not be fully comparable with ours, nevertheless they will certainly be helpful in broadening our knowledge of the literature in this regard.

There are only two major studies concerning the income redistributional impact of post-secondary education in Ontario. One is the study by Ozey Mehmet, sponsored by the Ontario Economic Council, undertaken in 1978 and the other is the study by Commission on Post-Secondary Education in Ontario undertaken by Systems Research Group in 1971.^{3,4}

Mehmet's study is an attempt to investigate the income redistributional effects of the present university education system in Ontario. The central assumptions of his study are: first, that universities are wealth creators, over and above other functions they perform, such as being repositories of knowledge or research centres; and second, the process of wealth creation in universities reflects a set of investment decision "jointly" made by parents and students. Therefore, investment in future human capital formation in universities can be evaluated, using the human capital theory, from the standpoint of groups of socio-economic classes (e.g. parents of students) rather than from that of the individual student. Mehmet's choice of reference group is the full time male graduate of bachelor degree programs completing their studies in the Ontario Universities in spring 1974. These graduates are traced back to specific parental income groups using father's income group as the basis for this classification (as revealed by 1978 post-secondary student survey undertaken by Statistics Canada).⁵ Likewise, the taxpayers costs of producing the class of 1974 male graduates are allocated among the same parental income groups, and finally the group benefits and costs are derived in terms of 1970 present values.

So far as the calculation of the benefits (which are additional lifetime earnings created by post-secondary education) and their attribution to the families (parents) of students are concerned, there are similarities, in principle, between our study and Mehmet's. There are some differences in the other areas between the two studies which invoke further attention. The first, and most important one, is related to the calculation of the costs. An appropriate analysis of redistributive impact of post-secondary education should take into account the costs incurred and benefits received throughout the lifetime of a generation. In the case of Mehmet's study, while the calculation of benefits are on a lifetime basis, the calculation of costs are based on the period of study in the university only. In other words, the calculation of costs do not represent the amount of costs which are inflicted upon a given cohort of parents (i.e., parents of class of 1974 male graduates) over their lifetime to support the university education system in Ontario. This problem, coupled with the fact that foregone earnings and other opportunity costs are omitted in the calculation of costs make the results seriously biased. The second problem is that the distribution of students by income group is based on father's income only, while the tax data is classified by family income. Such a classification of students by income groups could be very misleading since there are students who, even though their father's income is very low, their combined parental (family) income may put them in a high income bracket. There is yet another problem (which might be considered as a technical ambiguity or error!) in the calculation of the benefits. While the regression results on lifetime earnings indicate an annual rate of progression of salaries that vary with age, his calculation of the present values treats them as constants (see equation 1-5 of Mehmet's study)?

At any rate, Mehmet concludes that the existing pattern of university education in Ontario strongly favors the rich and subsidizes the middle income group (i.e., \$10,000 to \$15,000) at the expense of the lower income groups.⁶

In our view, however, given the problems discussed above, Mehmet's results, although interesting, are open to serious questions.

The second study to be reviewed in this section is the study by Commission on Post-Secondary Education in Ontario which uses a totally different methodology. The model is basically the continuation of the work by R.W. Judy, "The Income Redistributive Effects of Aid to Higher Education", but utilizes a more extensive data base than was available to Judy at the time of his study. The methodology consists of the following two major assumptions:

- (1) Costs and benefits are attributed to five income classes, defined on the basis of 1961 census data and assuming that the family unit appropriates both costs incurred and benefits received.
- (2) Costs are defined as the total direct and opportunity costs attributable to the families of the five selected income groups. Thus, total program costs, regardless of their immediate origin (e.g., a government fund), are attributed to their base origin in one of the five income groups meeting the costs. Benefits, on the other hand, are defined as public subsidies of the higher education programs apportioned according to the income class of individuals engaged in higher education programs.

Commission's study concludes that:

"In light of the available information, it can be concluded that expenditure on post-secondary education is regressive, though not extremely regressive."

The results of the Commission indicate that so far as universities are concerned, the system of public financing of universities in 1968-69 appears to be regressive. On one hand, some 60 percent of the benefits were

received by students whose families had income in excess of \$7,000 per year while about 46 percent of university educational costs fell upon families with incomes of \$7,000 or more. On the other hand, tax-payers with family income groups under \$7,000 contributed about 54 percent of the public subsidy to university education while students whose families had an annual income under \$7,000 received only about 40 percent of the benefits. Table V-7 displays the basic results of the study by the Commission.

TABLE V-7

Redistributive Impact of Public Expenditures on
Post-Secondary Education in Ontario, 1968-69
(percent of subsidy and benefits)

No.	Income Group Institution	Under 3,000	3,000- 4,999	5,000- 6,999	7,000- 9,999	10,000 and over
1	1. Universities: Costs:	9.03	19.16	25.55	21.21	25.04
2	Benefits:	9.36	12.35	18.25	24.41	35.63
3	Net Incidence:	+3.33	+6.81	-7.30	+3.20	+10.59
4	2. Community Colleges: Costs:	8.89	19.23	25.95	21.53	24.35
5	Benefits:	7.48	11.04	31.77	27.13	22.58
6	Net Incidence:	-1.41	-8.19	+5.82	+5.6	-1.77

Source: Based on Commission on Post-Secondary Education in Ontario;
Cost and Benefit of Post-Secondary Education in Ontario,
School Year 1968-69, Volume 1, op cit, pp. 82, 84, 85 and 89.

As far as the post secondary education in Ontario Community Colleges is concerned, the picture appears rather different from that of the universities. Students whose family income fell between \$5,000 and \$10,000 per annum were the chief beneficiaries of the system. Tax paying families under \$5,000 and over \$10,000 contributed proportionately more than was received by students whose family incomes fell into those categories.

The results obtained by the Commission are obviously in contrast with ours which invokes further discussion. First of all, the methodologies adopted in the two studies are totally different. While our analysis is merely based on the investment nature of post-secondary education in a life-

cycle framework, Commission's study looks at the net incidence of public financing of post-secondary education in a given year. Secondly, so far as Community Colleges are concerned, the Commission's results cannot be accorded much significance since the study is based on the 1968-69 school year which is only one year after Community Colleges in Ontario started to operate and hence being in the stage of infancy. As far as the universities are concerned, however, there seems to exist a distinct bias against a progressive redistribution in the way the costs and benefits are calculated. The reason for such a bias can be best explained by referring to two sections from the study:

"Share of Tax Burden--Each income group is still paying the same relative percentage of the tax burden as they were in 1961. This is a weak but necessary assumption."

"Socio-Economic Composition of Enrolment--the socio-economic composition of enrolment in post-secondary educational institutions were derived from two sets of data taken in 1968-69 and 1961. These data were rendered comparable by assuming that the relative differences between various programs remained unchanged in 1961 and 1968."

It seems that the Commission's study essentially uses a 1961 distributive series on the tax side and 1968-69 series on the benefit side. Since population in the higher income groups must have increased from 1961 to 1969, benefits imputed to them in 1969 are likely to be higher relative to the share of costs borne by these groups in 1961. We believe if the Commission were able to use 1969 distributive series to allocate the costs of post-secondary education in Ontario, they would have arrived at a less regressive result.

In any case, their results would have been different from ours. For, so far as the non-users of the system are concerned, our results indicated an interesting redistributive impact. That is a redistribution of income from lower, middle and upper middle income groups to lowest, lower middle and highest income groups (see Table V-6). In the case of users, our results did

not indicate that there is any significant redistributive impact (see Table V-3). This latter conclusion, however, is consistent with R.W. Judy's conclusion regarding the redistributive impact of financing post-secondary education in Canada as a whole. In Judy's words,

"the basic conclusion restated, is that no appreciable overall redistribution of wealth among income classes take place through the medium of public financial assistance programs to higher education institutions of Canada. The people who benefit are, or will be, heavily concentrated in higher income brackets--but so are the people who pay the taxes that create the revenue from which comes the aid to the universities."¹⁰

This concludes our review of the most relevant studies in terms of time and space. In the following section we briefly review some of the other major studies concerning financing of higher education.

OTHER MAJOR STUDIES

In this section we review and critically assess three of the most significant attempts which were made to analyse the distributive impact of public financing of higher education. The pioneering work in this area is the study by W. Lee Hansen and B.A. Weisbrod for the state of California.¹¹

They measured subsidies received by students at each type of higher education institution in California, distinguishing among junior colleges (J.C.), state colleges (S.C.) and the University of California (U.C.). These subsidies were defined as full cost less student charges. In other words the subsidy is the cost per student to the taxpayers of California, in each type of post-secondary institutions. Rather than attempt to distribute these subsidies over income classes, they examined the relationship between mean family income at each type of institution and subsidy received. They concluded that,

"access to subsidies is positively related to levels of family income, with the highest single-year subsidy going to University of California students (and their families) who already have the highest (median) family income (\$12,000)."¹²

By comparing the average state and local tax payments with subsidies, they found that both average tax payments and subsidies rise as we proceed from junior to state college and on to the university system. However, the increase in tax payments is slower than the subsidy increases and in view of the fact that the median income of families increases as one moves from junior college to the state college and university, Hansen and Weisbrod concluded that,

"the current method of financing public higher education leads to a redistribution of income from lower to higher income families".¹³

Their results are summarized in Table V-8.

TABLE V-8

Average Net Subsidy for the Higher Education System
By Type of Institution Attended, California
Hansen-Weisbrod Estimates
1965

	All Families	Families With- out Children in California Public Higher Education	Families with children in California Public Higher Education			
			Total	J.C.	S.C.	U.C.
	(1)	(2)	(3)	(4)	(5)	(6)
1. Average family income	8,000	7,900	9,560	8,800	10,000	12,000
2. Average higher education subsidy per year		0	880	720	1,400	1,700
3. Average total state and local taxes paid	620	650	740	680	770	910
4. Net transfer (Line 2 - Line 3)		-650	+140	+40	+630	+790

Source: Hansen and Weisbrod: The Distribution of Costs and Direct Benefits of Public Higher Education: The Case of California," Journal of Human Resources, Vol. 4, Spring 1969, p. 190.

The validity of the Hansen and Weisbrod conclusion has been criticized by Joseph Pechman.¹⁴ By taking the same data and allocating subsidies and taxes for higher education by income class rather than by type of institution

Pechman showed that the incidence of California's system of higher education is slightly progressive (i.e., the low-income families receive a positive net transfer). Table V-9 presents the results of the Pechman study.

TABLE V-9

Average Net Subsidy for the Higher Education System
by Income Classes, California
Pechman Estimates
1965

(1)	(2)	(3)	(4)
Adjusted Gross Income Class	Average Tax Payment Calculated by Hansen-Weisbrod	Average Higher Education Subsidy Cal- culated by Pechman	Net Subsidy
\$ 0-3,999	\$ 66	\$ 56	\$ -10
4,000-5,999	77	122	+45
6,000-7,999	88	129	+41
8,000-9,999	112	126	+14
10,000-11,999	142	179	+37
12,000-13,999	175	167	-8
14,000-19,999	229	229	0
20,000-24,999	348	271	-77
25,000 & over	974	291	-683

Source: J.A. Pechman: "The Distributional Effects of Public Higher Education in California," Journal of Human Resources, Vol. 5, Summer 1970, p. 366, Table 3.

The major reason for the different findings of these studies appears to rest on the emphasis that Hansen and Weisbrod place on differential subsidies at the various types of higher educational institutions. In their approach Hansen and Weisbrod overlook total subsidies to an income class. Clearly if many low-income students get a small subsidy, their total subsidy might be larger than the few high-income students going to state university and receiving a larger subsidy.

One of the major problems faced in both studies by Hansen-Weisbrod and Pechman is that neither of these studies included direct student aid from public funds. Since the allocation of such aid is largely a function of income, exclusion of such a subsidy could substantially add to the degree

of regressivity (or reduce the degree of progressivity) of the results.

The other problem in Hansen and Weisbrod's study, which has been subject to criticism, is the arbitrary selection of just some taxes in their calculation. For example they do not include the corporation income tax and estate tax.

In an interesting comment on the Pechman--Hansen-Weisbrod controversy, Hartman points out that it is a situation where both are right in different ways.¹⁵ In Hartman's view, the position can be summarized in terms of the following three propositions:

(1) the poor pay taxes but very few use the public education system.

Those who do gain by it,

(2) the middle groups are heavy users of the system and their taxes do not cover the costs.

(3) Very few rich people use the system; those who do, gain handsomely, the rest pay taxes but get no return.

He suggests that none of the investigators have really found a way to quantify these propositions. Essentially the point that he seems to be making is that in addition to the question of benefits to each income group, the distribution of benefits within the group has also to be considered, to get a full picture of the distributional effect.¹⁶

The second study to be reviewed in this section was done by Douglas M. Windham for Florida for 1967-68.¹⁷ His classification scheme is similar to Pechman's, but he uses two different tax incidence estimates as calculated by W.I. Gillespie and the Tax Foundation.¹⁸ Windham's study, however, differs from others by its inclusion of the federal portion of aid and taxes in Florida.

Using either the tax incidence calculated by Gillespie or the one estimated by Tax Foundation, Windham finds that subsidizing higher education in Florida creates a regressive distributional impact. That is the public financing of post-secondary education in Florida results in a net transfer

from those families with annual incomes of less than \$10,000 to those with incomes of above \$10,000. Table V-10 presents a summary of Windham's results.

TABLE V-10
Net Incidence of Public Higher Education
in Florida
Windham Study
1967-68

(1)	(2)	(3)	(4)	(5)	(6)
Income Class	Total Subsidies	Total Costs Gillespie Incidence	Net Incidence	Total Costs Tax Foundation Incidence	Net Incidence
\$ 0- 2,999	\$10,419,600	\$17,542,190	-\$7,122,590	\$14,259,360	-\$ 3,839,760
3,000- 4,999	20,296,320	33,196,480	-12,900,160	28,979,110	-8,682,790
5,000- 9,999	70,395,980	76,433,460	- 6,037,480	82,518,780	-12,122,800
10,000 +	64,278,490	38,158,950	+26,119,540	39,603,440	+24,675,050

Source: Windham, D.M.: Education, Equality and Income Redistribution, Lexington, Massachusetts, Heath, 1970, pp. 40-43.

Based on these results, Windham concluded that:

"It is clearly shown that for each income group below \$10,000 in family income, the net incidence of Florida public education is negative. These lower income groups are required to bear an excessive proportion of the costs of this program, costs which could have been used to create more certain and direct benefits for them."¹⁹

The major factors causing the pro-rich distribution of net transfers in Windham's study are the smaller amount of aid going to junior colleges (which attract more students from lower income groups), the regressive tax structure in Florida and a general under-representation (on the basis of the income distribution of population) of low-income students at both universities and junior colleges. It should be noted, however, that these important characteristics may differ between states and consequently the results obtained for one state may not necessarily apply to others. Put differently, these results cannot be generalized. This final conclusion can be best supported by the final study to be reviewed in this chapter.

A computational modification of the method used in the studies cited above

is adopted in a comparative study of higher education system in Hawaii, California and Florida by Joseph E. Hight and Richard Pollock.²⁰

To make comparisons between California, Florida and Hawaii, the authors propose to examine the percentage distribution of transfers and taxes. Since 100 percent of the costs is the total subsidy made available to the whole student body, it equals by definition 100 percent of the benefits distributed. So if an income group bears a fraction t_j of the costs and receives fraction s_j subsidies in the system, the measure of its net benefit is $(s_j - t_j)$.

To obtain the percentage distribution of costs by income group, Hight and Pollock adopted the "equiproportional approach", used also by Windham and Pechman, which implies that the fraction t_j of costs which is borne by income group j is the same as the fraction of all taxes which is borne by that income group. The percentage distribution of subsidies (benefits) among income groups is assumed to be the same as percentage distribution of students in these income groups. This latter assumption, however, bypasses the effect of direct aid to students.

By using the same data as employed by Hansen and Weisbrod for California and Windham for Florida, in addition to existing data on tax incidence and student distribution by income group in Hawaii, they calculated the difference between s_j and t_j as defined above. Their results are presented in Table V-11.

TABLE V-11

Net Incidence of Public Higher Education in
California, Florida and Hawaii, by Income Groups

Income Group	Percentage of Net Gain or Loss		
	California	Florida	Hawaii
0- 3,999	-1.9	-7.5	-2.3
4,000- 5,999	5.9	1.3	-1.1
6,000- 8,999	10.9	4.3	6.1
9,000-14,999	-1.3	4.3	4.0
15,000-19,999	-3.1	2.6	0.1
20,000 and above	-10.7	-5.2	-6.9

Source: Hight and Pollock, "Income Distribution
Effects of Higher Education Expenditures
in California, Florida, and Hawaii",
Journal of Human Resources, Vol. 8,
Summer 1973, p. 324.

Hight and Pollock concluded that although in all three states, the three lower income classes contribute higher percentages of the junior college students than do of the university students--and for the three higher classes the situation is reversed--the general pattern of net benefits to different income groups can be strikingly different in different states or systems. This implies that it is not possible to generalize on the basis of evidence from one state alone.

This concludes our review of major studies regarding income redistributive effects of public financing of post-secondary education. It should be noted, however, that there are several other studies in this regard, as cited in footnote 13 of Chapter I. In view of the similarities of the methodologies adopted in these studies with those reviewed earlier in this Chapter, we chose not to discuss their findings since it adds unnecessary length and complications to our analysis which is out of scope of this study.

A major criticism against all of these studies is that none of them has attempted to take account of additional lifetime earnings that higher education brings, in their calculation of benefits, nor have they tried to verify and estimate the amount of tax costs that are borne by families during their lifetime to support post-secondary education. In other words, none of the previous studies have attempted to investigate the long-run distributional effects of public financing of post-secondary education, although it seems that they were all aware of the problem and even suggested that the latter approach (i.e., the long-run analysis) is more appropriate. Admittedly, data limitations and computational difficulties have been major factors in creating such a deficiency in the previous methodologies. It was the major contribution of this thesis to take account of such long-run effects by using a life-cycle analysis.

SUMMARY AND CONCLUSION

The major goal of this dissertation was an investigation into the income redistributional impact of investment in post-secondary education in Ontario Community Colleges in a life-cycle framework. Such a framework emphasizes the investment nature of post-secondary education, in terms of additional lifetime earnings associated with higher education, and its long-run impacts.

The question of income redistributive effects arises because of the fact that, on the one hand, these higher education institutions are substantially financed by the government via public funds which, in turn, are made up of the proceeds from tax payments borne by different income groups. In each year, on the average, roughly 65 percent of the total costs of post-secondary education in Ontario Community Colleges is financed by the government and only 35 percent of such costs are incurred by the users of the system privately.²¹ On the other hand, the beneficiaries of the system from different income groups are not necessarily the same as the tax payers in these groups.

Therefore two categories of people could be distinguished. First, those who, via their tax payments contribute to the financing of post-secondary education and at the same time benefit from it by having their children attend these institutions (whom we earlier called users) and second, those who support the system via their tax payments but do not receive any direct benefit from it because either they do not have children or their children have chosen not to attend these institutions (whom we earlier called non-users).

For the first category (the users), our findings indicated that there is no significant redistribution of income associated with the post-secondary education in Ontario Community Colleges. The reason for this is mainly because only a small fraction of the population from different income groups are the users of the system and hence the share of the public costs (which is based on the distribution of the tax payments by income groups) incurred by this group (users) is fairly small. The major cost which is borne by this group of people is the private costs of tuition and fees, foregone earnings, etc., which can be allocated among different income groups according to the distribution of students in these groups. Consequently, the distribution of costs by income groups is essentially based on the distribution of student population in these groups. Similarly, benefits which are attributable to these students (or their families) are allocated among different income groups according to the students distribution by these groups. Therefore, since percentage distribution of benefits and costs among different income groups are almost the same, there would not be any significant redistributive effects (see Table V-3). However, the benefits of post-secondary education in Ontario Community Colleges by far exceeds its costs for the users of the system (see Table V-1).

So far as the second group of people (non-users) are concerned, the results are particularly interesting. It was shown that the present system of

post-secondary education in Ontario Community Colleges is such that not only is there a redistribution of income from non-users to the users in each income group, there also is a redistribution of income from non-users in the lower income groups (\$2000-\$4000) as well as non-users in the middle and upper middle income groups (\$5000-\$15000) to the users of the system in the lowest (less than \$2000), lower middle (\$4000-\$5000) and highest income groups.

The approach which was pursued in this study could also be considered as a way to quantify Hartman's propositions.²² While our results show that very few people from the lower income groups use the post-secondary education in Ontario Community Colleges (which is in accordance with Hartman's first proposition), it does not, however, indicate that middle income groups are heavy users of the system and their taxes do not cover the costs (second proposition). Rather, it seems that the middle income groups use the system moderately. Those who do not, pay taxes but get no return. However, non-users' tax payments is more than the amount which is needed to cover the costs for the users in the same groups. So far as Hartman's last proposition is concerned, contrary to his view, our results indicate that high income group of \$15000 and over (rich people) are heavy users of the system. Furthermore although those who pay taxes and do not use the system get no direct return (which is in accordance with his proposition), their taxes do not cover the costs which is needed for the users of the system in the same groups.

It is evident now that the public financing of post-secondary education in Ontario Community Colleges does not make the proper adjustment in the distribution of income within the conventional terms of traditional public finance. In other words, if the government's goal in subsidizing post-secondary education in Community Colleges in Ontario has been to redistribute income from rich to poor, it has certainly failed to achieve it.²³

Footnotes to Chapter V

¹See footnote 9 to chapter III for the details of allocation procedure.

²One explanation for the lower middle income group (\$4000-\$5000) gaining from such a system is due to the fact that a larger fraction of the tax paying population in this group relative to its immediate income groups are users of the post-secondary education system in Ontario Community Colleges. (see Table B-1 in Appendix B).

³Ozey Mehmet, Who Benefits from the Ontario University System, op.cit.

⁴Commission on Post-Secondary Education, Costs and Benefit Study of Post-Secondary Education in Ontario, School Year 1968-69, System Research Group, Queen's Printer, Toronto, 1972.

⁵Note that this source of data is also used in our study.

⁶For details, see O. Mehmet, op. cit., p. 35, Table 7.

⁷R.W. Judy, "Income Redistributive Effects of Aid to Higher Education" in L.H. Officer and L.B. Smith, eds., Canadian Economic Problems and Policies (Toronto: McGraw-Hill, 1970).

⁸Commission on Post-Secondary Education in Ontario; op. cit., Vol. 1, p. 81.

⁹Ibid, p. 29

¹⁰R.W. Judy, op. cit., p. 314

¹¹W. Lee Hansen and Burton A. Weisbrod, Benefits, Costs, and Finance of Public Higher Education, op. cit., and, "The Distribution of Costs and Direct Benefits of Public Higher Education: The Case of California", Journal of Human Resources, Vol. 4, Spring 1969.

¹²Hansen and Weisbrod, "The Distribution of Costs and Direct Benefits of Public Higher Education", op. cit., p. 184

¹³Ibid, p. 191

¹⁴Joseph A. Pechman, "The Distributional Effects of Public Higher Education in California", Journal of Human Resources, Vol. 5, Summer 1970, pp. 361-70.

¹⁵R.W. Hartman, "A Comment on the Pechman--Hansen-Weisbrod Controversy", Journal of Human Resources, Vol. 5, Fall 1970, pp. 519-523.

¹⁶The separation of the analysis between the users and non-users may be considered as a solution to such a problem.

¹⁷Douglas M. Windham, Education, Equity and Income Distribution, pp. cit.

¹⁸W.I. Gillespie: "Effects of Public Expenditures on the Distribution of Income" in R.A. Musgrave, ed., Essays in Fiscal Federalism (Washington, D.C.: Brookings, 1965) pp. 122-86, and Tax Burdens and Benefits of Government Expenditures by Income Class, (New York: Tax Foundation Inc., 1967.)

¹⁹Douglas M. Windham, op. cit., p. 44

²⁰Joseph E. Hight and Richard Pollock, "Income Distributional Effects of Higher Education in California, Florida, and Hawaii", Journal of Human Resources, Vol. 8, Summer 1973, pp. 318-330.

²¹These ratios are based on the following data.

	Thousands of 1971 dollars
1) Total government subsidy, average 1969-80	183,040* (65%)
2) Total expenses incurred by the <u>users</u>	100,820** (35%)
3) Total	<u>283,860</u> (100%)

*From Table III-4 of the text.

**Calculated by multiplying average private costs per student per year (\$2,143) times total number of required enrolment in each year (47046) needed to generate an average number of graduate equivalent (shown in Table E-3 of Appendix E).

²²See page 94 of the text for these propositions.

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It should be noted, however, that there are two alternative explanations for such a redistributive outcome: 1 - modern public choice/pressure group theories argue that: "most government actions have the characteristics of giving rather intense benefits to a small group at a small cost to each member of a large group" - see G. Tullock, op. cit., 1981, p. 190. 2 - models which allow externalities in consumption of education of the Ontario Community Colleges could require non-users (as beneficiaries of these externalities) to pay for such benefits; and in this case the measured redistribution of Table V-6 may vanish. Since the underlying assumption of each of these explanations are outside the model used in our study, we leave any further analysis along these lines to other researchers.

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APPENDIXES

APPENDIX A

TABLE A-1

Full-Time Enrolment and Number of Graduates in
Post-Secondary Education in Ontario
(1969-80)

	1	2	3	4	5	6	7	8	
No.	Year	Full-Time Enrolment Canada T.P.S.*	Full-Time Undergrad- uate Enro- lment Univ	Full-Time Enrolment Ontario C.C.**	Part-Time Enrolment Ontario ² C.C.	Full-Time Equivalent Ontario ³ C.C.	Total No. of Graduates Ontario C.C.	Ratio 3/1 %	Ratio 3/2 %
1	1969-70	436,567	87,585	24,742	-	<u>28,849</u>	5,185	(5.7)	(28)
2	70-71	475,041	97,966	30,382	-	<u>35,426</u>	7,238	(6.4)	(31)
3	71-72	501,126	107,418	34,354	-	<u>40,031</u>	7,912	(6.9)	(32)
4	72-73	512,371	109,646	39,823	39,402	46,390	9,341	(7.8)	(36)
5	73-74	543,262	115,163	51,878	41,312	58,763	12,768	(9.5)	(45)
6	74-75	558,463	124,443	55,038	57,833	64,677	16,231	(9.9)	(44)
7	75-76	592,267	131,678	58,236	56,221	67,606	17,278	(9.8)	(44)
8	76-77	616,490	147,637	58,757	56,776	68,220	17,730	(9.5)	(40)
9	77-78	638,320	144,009	61,094	60,394	71,160	17,809	(9.6)	(42)
10	78-79	658,420	139,787	64,793	60,514	74,879	18,591	(9.8)	(46)
11	79-80	-	-	70,508 ¹	-	-	20,885	(9.8) ⁴	(46) ⁴

* Total Post-Secondary

** Community Colleges

Sources: Col. 1, Advanced Statistics of Education, Statistics Canada, Catalog No. 81-220; Cols. 2-4, Ontario Ministry of Colleges and Universities, Report of the Ministry (1969-72) and statistical summary (1972-79); Col. 6, Table E-1 in Appendix E.

Notes: 1. Unpublished data, Ministry of Colleges and Universities.

2. Part-Time enrolment is represented by post-secondary course registration.

3. Full-time equivalent is calculated on the basis of the assumption that every 6 part-time enrolment equals 1 full-time. This is because on average full-time students register in 6 courses each year. Underlined figures are author's estimates based on average growth rate of full-time enrolment in community colleges since 1972.

4. This ratio is assumed to be the same as 1978-79 ratio.

Table A-2
Distribution of Federal Tax Payments by Family Income Groups and Age of Head,*

Ontario, 1969
(millions of dollars)

No.	Kind of Tax	Income Age	<2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	15000 & Over	Total
1	Individual income tax, 50% of corporate	<25	0.5187	0.9282	1.6809	2.7534	5.296	6.934	29.570	43.59	47.89	139.05
2	Income tax, 50% of corporate	25-34	3.1388	5.6168	10.1716	16.6616	32.049	41.961	178.935	263.75	289.78	841.46
3	Income tax, 50% of corporate	35-44	4.0299	7.2114	13.0593	21.3918	41.147	53.873	229.735	338.63	372.05	1080.35
4	Income tax, 50% of corporate	45-54	3.4181	6.1166	11.0767	18.1442	34.901	45.695	194.857	287.22	315.57	916.33
5	Income tax, 50% of corporate	55-64	1.9817	3.5462	6.4219	10.5194	20.234	26.492	112.972	166.52	182.96	531.26
6	Income tax, 50% of corporate	65 & over	0.2128	0.3808	0.6896	1.1296	2.173	2.845	12.131	17.88	19.65	57.05
7	Income tax, 50% of corporate	Total	13.3000	23.8000	43.1000	70.5000	135.800	177.200	758.200	1117.60	1227.90	3565.50
8	General sales tax, 50% of Corporate Income	<25	4.9000	3.1542	5.7158	6.6155	9.525	12.625	31.938	24.838	4.883	134.87
9	General sales tax, 50% of Corporate Income	25-34	6.8600	8.8318	11.8712	14.7247	28.766	39.024	147.080	160.858	75.686	521.89
10	General sales tax, 50% of Corporate Income	35-44	7.5950	8.6215	12.3110	11.5237	24.236	34.815	136.994	160.858	161.138	526.78
11	General sales tax, 50% of Corporate Income	45-54	7.8400	7.1496	10.5522	12.8042	23.913	26.016	96.653	147.256	186.774	463.25
12	General sales tax, 50% of Corporate Income	55-64	8.0650	9.0421	8.5737	12.5907	13.895	19.512	57.992	83.386	89.114	302.97
13	General sales tax, 50% of Corporate Income	65 & over	3.9200	8.2009	5.2761	3.8413	4.524	4.208	7.144	6.505	6.104	75.76
14	General sales tax, 50% of Corporate Income	Total	39.2000	45.0000	54.3000	62.1000	136.200	136.200	477.800	583.700	523.700	2025.50
15	All Taxes	<25	5.4187	4.0824	7.3967	9.369	14.667	19.559	61.51	68.42	52.77	273.92
16	All Taxes	25-34	9.9988	14.4486	22.0428	31.386	60.809	80.985	326.01	424.61	365.47	1363.35
17	All Taxes	35-44	11.6249	15.8329	25.3703	32.916	65.383	88.688	366.73	499.49	533.19	1607.13
18	All Taxes	45-54	11.2581	13.2662	21.6289	30.948	58.814	71.711	291.51	434.48	502.34	1379.58
19	All Taxes	55-64	10.0667	12.5883	14.9956	23.110	34.129	46.004	170.96	249.91	272.07	834.23
20	All Taxes	65 & over	4.1328	8.5817	5.9657	4.971	6.697	7.053	19.28	24.39	25.75	132.79
21	All Taxes	Total	52.5000	68.8000	97.4000	132.700	240.500	314.000	1236.00	1701.30	1751.60	5591.00

Sources: Based on I. W. Gillespie (1980), Appendix A, Table A-5(c); and Table A-6 of this Appendix.

* See notes to Tables (A-2) to (A-6) for further details.

TABLE A-3
Distribution of Provincial Tax Payments by Family Income Groups and Age of Head,
Ontario, 1969
(millions of dollars)

No.	Kind of Tax	Income Age	<2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	15000 & Over	Total
1	Individual income tax, 50% of corporate income tax	<25	0.22620	0.32760	0.5265	0.7449	1.3416	1.8876	8.061	12.375	15.331	41.09
2	Individual income tax, 50% of corporate income tax	25-34	1.36880	1.98240	3.1860	4.5076	8.1184	11.4224	48.781	74.883	92.772	248.65
3	Individual income tax, 50% of corporate income tax	35-44	1.75740	2.54520	4.0905	5.7873	10.4232	14.6652	62.630	96.142	119.109	319.24
4	Individual income tax, 50% of corporate income tax	45-54	1.49060	2.15880	3.4695	4.9087	8.8408	12.4388	53.122	81.546	101.027	270.78
5	Individual income tax, 50% of corporate income tax	55-64	0.86420	1.25160	2.0115	2.8459	5.1256	7.2116	30.798	47.278	58.572	156.99
6	Individual income tax, 50% of corporate income tax	65 & over	0.09280	0.13440	0.2160	0.3056	0.5504	0.7744	3.307	5.077	6.290	16.86
7	Individual income tax, 50% of corporate income tax	Total	5.80000	8.40000	13.5000	19.1000	34.4000	48.4000	206.700	317.300	393.100	1053.60
8	General sales tax, 50% of corporate income tax	<25	5.5500	4.1285	7.0105	7.9045	11.895	15.888	38.388	29.425	4.757	154.21
9	General sales tax, 50% of corporate income tax	25-34	7.7700	11.5598	14.5603	17.5938	36.506	49.109	176.324	190.566	73.735	596.74
10	General sales tax, 50% of corporate income tax	35-44	8.6025	11.2846	15.0996	13.7691	30.764	43.813	164.233	190.566	156.984	602.33
11	General sales tax, 50% of corporate income tax	45-54	8.8800	9.3580	12.9425	15.2990	30.354	32.739	115.870	174.452	181.959	529.69
12	General sales tax, 50% of corporate income tax	55-64	9.1375	11.8351	10.5158	15.0440	17.638	24.554	69.522	98.786	86.817	346.42
13	General sales tax, 50% of corporate income tax	65 & over	4.4400	10.7341	6.4713	4.5897	5.743	5.296	8.565	7.707	5.946	86.60
14	General sales tax, 50% of corporate income tax	Total	44.4000	58.9000	66.6000	74.2000	132.900	171.400	572.800	691.500	510.200	2316.00
15	All taxes	<25	5.7762	4.4561	7.5370	8.6494	13.237	17.776	46.349	41.80	20.088	195.30
16	All taxes	25-34	9.1388	13.5422	17.7460	22.1014	44.625	60.531	225.105	265.45	166.507	845.39
17	All taxes	35-44	10.3599	13.8298	19.1900	19.5564	41.187	58.478	226.863	286.71	276.093	921.57
18	All taxes	45-54	10.3706	11.5168	16.4120	20.2077	39.194	45.178	168.992	256.00	282.986	800.47
19	All taxes	55-64	10.0217	13.0867	12.5270	17.8899	22.764	31.766	100.320	146.06	145.389	503.41
20	All taxes	65 & over	4.5328	10.8685	6.6870	4.8953	6.293	6.071	11.872	12.78	12.236	103.46
21	All taxes	Total	50.2000	67.3000	80.1000	93.3000	167.300	219.800	779.500	1008.80	903.300	3369.60

Sources: Based on I. W. Gillespie (1980), Appendix A, Table A-5(c); and Table A-6 of this Appendix.

* See notes to Tables (A-2) to (A-4) for further details.

Table A-4
Distribution of Total Tax Payments (at all levels of government) by Family Income Groups
and Age of Head, Ontario, 1969
(millions of dollars)

No.	Government Level	Income Age	<2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	15000 & Over	Total
1	Federal	<25	5,4187	4,0824	7,3967	9,369	14,667	19,559	61,51	68,42	52,77	273,92
2		25-34	9,9988	14,4486	22,0428	31,386	60,809	80,985	326,01	424,61	365,47	1363,35
3		35-44	11,6249	15,8329	25,3703	32,916	65,383	88,688	366,73	499,49	533,19	1607,13
4		45-54	11,2581	13,2662	21,6289	30,948	58,814	71,711	291,51	424,48	502,34	1379,58
5		55-64	10,0667	12,5883	14,9956	23,110	34,129	46,004	170,96	249,91	272,07	834,23
6		65 & over	4,1328	8,5817	5,9657	4,971	6,697	7,053	19,28	24,39	25,75	132,79
7		Total	52,5000	68,8000	97,4000	132,700	240,500	314,000	1236,00	1701,30	1751,60	5591,00
8	Provincial	<25	5,7762	4,4561	7,5370	8,6494	13,237	17,776	46,349	41,80	20,088	195,30
9		25-34	9,1388	13,5422	17,7460	22,1014	44,625	60,71	225,105	265,45	166,507	845,39
10		35-44	10,3599	13,8298	19,1900	19,5564	41,187	58,478	226,863	286,71	276,093	921,57
11		45-54	10,3706	11,5168	16,4120	20,2077	39,194	45,178	168,992	256,00	282,986	800,47
12		55-64	10,0217	13,0867	12,5270	17,8899	22,764	31,766	100,320	146,08	145,389	503,41
13		65 & over	4,5328	10,8685	6,6870	4,8953	6,293	6,071	11,872	12,78	12,236	103,46
14		Total	50,2000	67,3000	80,1000	93,3000	167,3000	219,800	779,500	1008,80	903,300	3369,60
15	Local	<25	1,5912	1,8096	1,8759	1,8564	2,9367	3,5178	12,983	15,467	13,003	54,82
16		25-34	9,6288	10,9504	11,3516	11,2336	17,7708	21,2872	78,564	93,598	78,682	331,74
17		35-44	12,3624	14,0592	14,5743	14,4228	22,8159	27,3306	100,869	120,170	101,020	425,93
18		45-54	10,4856	11,9248	12,3617	12,2332	19,3521	23,1814	85,555	101,926	85,684	361,26
19		55-64	6,0792	6,9136	7,1669	7,0924	11,2197	12,0098	49,602	59,093	49,677	209,45
20		65 & over	0,6528	0,7424	0,7696	0,7616	1,2048	1,0032	5,326	6,346	5,334	22,49
21		Total	40,8000	46,4000	48,1000	47,6000	75,3000	90,000	332,900	396,600	333,400	1405,70
22	ALL	ALL	143.5	182.6	225.6	273.6	483.1	624.0	2348.4	3106.7	2988.3	10366.3

Source: Based on Tables A-2, A-3 and A-6 of this Appendix and I. W. Gillespie (1980), Appendix A, Table A-5(c).

Note: Due to rounding, details may not add to totals.

TABLE A-5

Distribution of Total Tax Payments (at all Levels of Government) by Family Income Groups
and Age of Head, Ontario, 1969
(percentages)

No.	Government Level	Income Age	<2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	15000 & Over	Total
1	Federal	<25	2.0	1.5	2.7	3.4	5.4	7.1	22.5	25.0	19.3	100.0
2		25-34	0.7	1.1	1.6	2.3	4.5	5.9	23.9	31.1	26.8	100.0
3		35-44	0.7	1.0	1.6	2.0	4.1	5.5	22.8	31.1	33.2	100.0
4		45-54	0.8	1.0	1.6	2.2	4.3	5.2	21.1	31.5	36.4	100.0
5		55-64	1.2	1.5	1.8	2.8	6.1	5.5	20.5	30.0	32.6	100.0
6		65 & over	3.1	6.5	4.5	5.7	5.0	5.3	14.5	18.4	19.4	100.0
7		Total	0.9	1.2	1.7	2.4	4.3	5.6	22.1	30.4	31.3	100.0
8	Provincial	<25	3.0	2.3	3.9	4.4	6.8	9.1	23.7	21.4	10.3	100.0
9		25-34	1.1	1.6	2.1	2.6	5.3	7.2	26.6	31.4	19.7	100.0
10		35-44	1.1	1.5	2.1	2.1	4.5	6.3	24.6	31.1	30.0	100.0
11		45-54	1.3	1.4	2.1	2.5	4.9	5.6	21.1	32.0	35.4	100.0
12		55-64	2.0	2.6	2.5	3.6	6.5	6.3	19.9	29.0	28.9	100.0
13		65 & over	4.4	10.5	6.5	4.7	6.1	5.9	11.5	12.4	11.8	100.0
14		Total	1.5	2.0	2.4	2.8	5.0	6.5	23.1	29.9	26.8	100.0
15	Local	<25	2.9	3.3	3.4	3.4	5.4	6.4	23.7	28.2	23.7	100.0
16		25-34	2.9	3.3	3.4	3.4	5.4	6.4	23.7	28.2	23.7	100.0
17		35-44	2.9	3.3	3.4	3.4	5.4	6.4	23.7	28.2	23.7	100.0
18		45-54	2.9	3.3	3.4	3.4	5.4	6.4	23.7	28.2	23.7	100.0
19		55-64	2.9	3.3	3.4	3.4	5.4	6.4	23.7	28.2	23.7	100.0
20		65 & over	2.9	3.3	3.4	3.4	5.4	6.4	23.7	28.2	23.7	100.0
21		Total	2.9	3.3	3.4	3.4	5.4	6.4	23.7	28.2	23.7	100.0
22	ALL	ALL	1.4	1.8	2.2	2.6	4.7	6.0	22.7	30.0	28.8	100.0

Source: Based on Table A-4 of this Appendix.

Notes to Tables (A-2) to (A-5)

Distribution of Tax Payments by Age and Income Groups

The following assumptions are used to allocate various kinds of tax payments among different age groups within each income group.

1. Income tax, social security taxes, succession and estate taxes, business tax and property tax are distributed among different age groups according to the distribution of income tax payments among these groups which is calculated according to the following procedure:

- (i) Total income taxes paid by each age group is calculated for Canada (since data for provinces were not available), utilizing data provided by Statistics Canada, catalog no. 13-210, Table 7, p. 35. (Average income tax payments by family heads is multiplied by number of family heads in labor force for each age group.)

- (ii) The share of income tax paid by each age group is then calculated.

- (iii) It is assumed that the share of income taxes paid by different age groups in Ontario is the same for all income groups and equal to the income tax share for Canada (i.e., (ii) above). The result of such calculation is:

Age Group	Less than 25	25-34	35-44	45-54	55-64	65 and over	total
Income Tax Share	(3.9)*	(23.6)	(30.3)	(27.7)	(14.9)	(1.6)	(100.0)

* in percentages

2. General sales tax, selective excise taxes, customs import duties, medical hospital premium and other taxes (except those mentioned in 1 above and corporate income taxes) are distributed among different age groups according to the distribution of consumption by age groups, which, in turn, is assumed to be the same as the distribution of families by age group (Table A-6).
3. Fifty percent of the corporation income tax payments is allocated among different age groups according to the distribution of income tax payments among those groups and the other fifty percent is distributed according to the distribution of consumption (or families) by age group (Table A-6).

Table A-6
Distribution of Families by Age of Head and Family Income Groups
Canada, 1969
(Thousands)

No.	Income Age	< 2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	15000 & Over	Total
1	<25	20 (12.5)	15 (7.0)	26 (10.5)	31 (10.7)	29 (9.0)	33 (9.3)	76 (6.7)	42 (4.3)	4 (0.9)	205 (6.7)
2	25-34	28 (17.5)	42 (19.6)	54 (21.9)	69 (23.7)	89 (27.1)	102 (28.7)	350 (30.8)	272 (27.6)	62 (14.5)	1068 (25.8)
3	35-44	31 (19.4)	41 (19.2)	56 (22.7)	54 (18.6)	75 (23.1)	91 (25.6)	326 (28.7)	272 (27.6)	132 (30.8)	1078 (26.0)
4	45-54	32 (20.0)	34 (15.9)	48 (19.4)	60 (20.6)	74 (22.8)	68 (19.1)	230 (20.2)	249 (25.2)	153 (35.7)	948 (22.9)
5	55-64	33 (20.6)	43 (20.1)	39 (15.8)	59 (20.3)	43 (13.3)	51 (14.3)	138 (12.1)	141 (14.3)	73 (17.0)	620 (15.0)
6	65 & Over	16 (10.0)	39 (18.2)	24 (9.7)	18 (6.2)	14 (4.3)	11 (3.1)	17 (1.5)	11 (1.1)	5 (1.2)	155 (3.7)
7	Total	160 (100.0)	214 (100.0)	247 (100.0)	291 (100.0)	324 (100.0)	356 (100.0)	1137 (100.0)	987 (100.0)	429 (100.0)	4145 (100.0)

* Figures in brackets are column percentages.

Sources: Calculated on the basis of percentage distribution of families by income groups and age of head, Canada 1969, Statistics Canada, Catalog No. 13-546, Table 2; and number of family heads in labor force in Canada, Census 1971, Statistics Canada, Catalog No. 93-771 to 93-775, special series.

- Notes:
1. Since the distribution of families by income groups and age of head reported by Statistics Canada only shows the percentages across the income groups, we had to calculate the actual no. of families by age and income groups (by using the number of family heads in labor force) in order to be able to calculate the percentages across the age groups (i.e., column percentages shown above).
 2. The pattern of family distribution by age group in Canada has remained fairly steady over time since 1969. This can be seen from the estimate of family distribution by age group, Statistics Canada, Catalog No. 91-204. Thus, using 1971-Census for the family distribution by age as a proxy for 1969 estimate will not affect our conclusions.

Appendix B

Allocation of Total Public Costs Among Users and Non-Users of
Ontario Community Colleges

In order to calculate the share of the public costs incurred by the users of the system we utilize the information from the Public Use Sample Tapes (PUST) from Census of Canada, 1971 and 1975 Post-Secondary Student Survey (PSSS). The calculation procedure is as follows:

(i) Cross-tabulation of individuals by family income group and education level for all individuals aged 20 or more in the Province of Ontario is attained (two categories for education are specified: those with the schooling level of grade 13 or less and those who have post-secondary education regardless of whether they had completed their program or not).¹ See Table B-1, lines 1 and 2.

(ii) Now, in order to determine the tax share which is incurred only by the users of the post-secondary education in the Community College system we should find out what proportion of the total post-secondary students in Ontario are enrolled in Community Colleges. Actual data from the Ontario Ministry of Colleges and Universities indicate that, on the average, approximately 40% of the total post-secondary students attend Community Colleges in Ontario. (This measure is based on the average of column 8 in Table A-1 of Appendix A.)

It should be noted, however, that such a ratio may well be different for different income groups. Thus, the appropriate measure should be a ratio which applies to a particular income group. In order to calculate such measures, we utilize the sample data from the 1975 Post-Secondary Student Survey (PSSS). The result shows the proportion of students enrolled in

Community Colleges out of total enrolment in post-secondary education in Ontario by family income group (see Table B-2, lines 1 to 3). There seems, however, to exist a discrepancy regarding the proportion of enrolment in Community Colleges to total post-secondary student enrolment, between the sample data from PSSS and the actual data. While the actual data indicate that such a proportion is, on the average, about 40%; the data from PSSS indicate that this proportion is about 20%. To correct such a discrepancy, we assume that while the relative proportion of enrolment in Community Colleges to total post-secondary students by family income group remains the same as it is indicated by the PSSS, the actual proportion for each income group should be adjusted for such a discrepancy. Thus, we can adjust these proportions by applying the adjustment factor of 2 (since actual proportion of the total Community College students to total post-secondary students, regardless of their family income group, is approximately 40% and the same proportion from the sample survey is approximately 20%, the adjustment factor should be $40\%/20\% = 2$). The result is shown in line 4 of Table B-2 and line 3 of Table B-1.

Now, if we apply such shares to the proportion of population that attends post-secondary education (line 2 of Table B-1), we arrive at the actual proportion of the population, by family income groups, that are considered to be the users of the post-secondary education in Community Colleges in Ontario (see line 4 of Table B-1).

(iii) Now, we can apply such fractions (shown in line 4 of Table B-1) to the average lifetime public costs incurred by all members of each family income group to arrive at the share of the public costs incurred only by

TABLE B-1

Cross-Tabulation of Individuals by Family Income and Education
in Ontario (based on 1971 Census of Canada) and Share
of Total Public Costs Incurred by the Users of
Community Colleges in Ontario
(in percentages)

No.	Education Level \ Income Groups	less than 2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10,000-14,999	15,000 & Over
1	Grade 13 or less	94.8	93.1	98.0	88.0	93.1	94.8	91.8	88.0	72.0
2	Post-Secondary (Total)	5.2	6.9	2.0	12.0	6.9	5.2	8.2	12.0	28.0
3	Share of Community Colleges out of T.P.S.	12.2	21.6	21.6	21.4	21.4	37.6	45.2	52.0	39.8
4	Users' Share	0.6	1.5	0.4	2.6	1.5	2.0	3.7	6.2	11.1

Sources: Author's calculations, based on Public Use Sample Tapes (PUST), Census of Canada, 1971; and Table B-2.

- Notes: 1. Sum of lines 1 and 2 for each column equals 100%.
2. Line 4 equals line 3 times line 2 for each column.
3. One explanation for the low ratio of post-secondary education in the income group of \$3,000-\$3,999 is a high percentage of elderly people in this income group whose education level does not go beyond high school degree.

TABLE B-2

Proportion of Students Enrolled in Community Colleges Out of
Total Enrolment in Post-Secondary Education in
Ontario by Income Group

No.	Enrolment (Sample) \ Income Group	less than 2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10,000-14,999	15,000 & Over	Total
1	Total Post-Secondary (TPS)	494	111	111	205	205	207	633	1512	7474	10,857
2	Community Colleges (CC)	30	12	12	22	22	39	143	408	1488	2,188
3	Ratio of CC/TPS	(6.1)	(10.8)	(10.8)	(10.7)	(10.7)	(18.8)	(22.6)	(27.0)	(19.9)	(20.1)
4	Adjusted Ratio of CC/TPS	(12.2)	(21.6)	(21.6)	(21.4)	(21.4)	(37.6)	(45.2)	(52.0)	(39.8)	(40.2)

Sources: Author's calculations, based on 1975 Post-Secondary Student Survey (PSSS) and Table A-1 in Appendix A.

the users of the post-secondary education in Ontario Community Colleges. The results are shown in line 4 of Table III-5 of the text.

Note that the above procedure is based on the assumption that, on the average, the distribution of users versus non-users of the post-secondary education system in Ontario Community Colleges remains unchanged throughout the lifetime of the generation under consideration in this study.

Note to Appendix B:

1. A similar cross-tabulation for other age ranges, namely 18 years and over, 19 years and over, etc.; up to 30 years and over was calculated to test the sensitivity of the results with regard to those individuals who decide not to attend post-secondary education institutions until several years after their high school graduation. The results showed that for the age group of 20 years and over we get the highest participation rate of individuals in post-secondary education.

APPENDIX C

Average Lifetime Tax Shares

To calculate the average lifetime tax share of each income group the following procedure was adopted.

- (i) From the cross-section data provided by Gillespie's study and Statistics Canada for 1969, cross-tabulation of total tax payments by age and income groups was produced in the following way: Those kinds of taxes which change with variation in income level, such as income tax, social security taxes, succession and estate taxes, business taxes, property taxes and a portion of corporate income tax (50%), are distributed among different age groups according to the distribution of income tax payments among these groups. The rest of the tax payments are distributed among different age groups (within each income group) according to the distribution of family units, and hence consumption. The higher the number of families, the higher would be the consumption level.
- (ii) The average lifetime income of males from employment and for selected occupations is calculated from J. Podoluk's results (Incomes of Canadians, Statistics Canada, 1968) on age-earnings profiles for Canada in 1961, and the relevant age group that corresponds to such average income is determined. Podoluk's results for 1961 indicate that on the average the amount of income that individuals receive while they are in the age groups of 20-30 and 30-40 would correspond to their average lifetime income if they belong to low income groups (with average lifetime income of less than \$4,000 per year) and

high income groups (with the average lifetime income of more than \$6,000 per year) respectively (see Table C-1). However, due to secular growth and increases in real income between 1961 and 1969, real income was increased about 25% during this period.¹ Thus, we have to adjust the average lifetime incomes for different occupations so that we could apply these figures to 1969 tax structure. In this case the average lifetime income of higher income groups would increase from \$6,000-\$6,500 in 1961 to \$7,500-\$8,000 in 1969, and the average lifetime income of lower income groups increases from \$3,500-\$4,000 in 1961 to \$4,500-\$5,000 in 1969. As a result we choose an income level of \$6,000 (which is the mid-point between the income ranges of (\$4,500-\$5,000) and (\$7,500-\$8,000)) to be used as a dividing line such that the average lifetime income of higher income groups (i.e., \$6,000 and over) corresponds to the income range that people can earn in the age range of 30-40, while the average lifetime income of lower income groups (i.e., less than \$6,000) corresponds to the income range that people earn in the age group of 20-30.

- (iii) On the basis of these findings, it is assumed that the average lifetime tax payments for those individuals whose average lifetime income is less than \$6,000 (i.e., lower income groups) is the same as the annual taxes paid by the age group of 20-30. Similarly for those whose average lifetime income exceeds \$6,000 (i.e., higher income groups), the appropriate average lifetime tax payments is assumed to be the same as the annual taxes paid by

the age group of 30-40. Put differently, since for those whose average lifetime income is less than \$6,000, their average income in the age range of 20-30 is roughly the same as their lifetime average income, the annual taxes paid by this age group can be assumed to be the same as their average lifetime tax share. Similarly, since for those whose average lifetime income is greater than \$6,000, their average income in the age range of 30-40 is approximately the same as their lifetime average income, their average lifetime tax share could be assumed to be the same as their annual tax payments while they are in the age group of 30-40. Table C-2 shows the results.

It should be noted that although the above procedure does not seem to be very accurate, due to lack of sufficient data, it was the only way to estimate and relate the average lifetime income of individuals to their age. Consequently the results should be used with caution. Particularly, it should be mentioned that although the ideal income for a study of this kind is parental or family income (as we defined it on p.21) we had to use, because of data limitations, the average lifetime income of males as a basis for the determination of average lifetime tax share. This, however, would underestimate the average lifetime family income, which in turn, underestimates the income level which is used as a dividing line (i.e. \$6000).

TABLE C-1
Average Income of Males from Employment,
by Age and Selected Occupation, Year
Ended May 31, 1961

Age Occupation	Under 25	25- 34	35- 44	45- 54	55- 64	Lifetime Average	
1. Managerial Occupations (total)	3,631	5,973	7,203	7,562	7,449	6,363	} High Income Group
2. Professionals (total)	2,919	5,800	7,980	8,251	8,171	6,624	
3. Clerical	2,322	3,894	4,187	4,109	3,932	3,689	
4. Service Occupations (total)	1,998	3,712	4,128	3,620	2,952	3,282	} Low Income Group
5. Craftsmen, production process and related workers (total)	2,440	3,914	4,128	3,989	3,739	3,642	
6. Paper makers, still operators, chemical and related workers	3,121	4,589	4,661	4,675	4,649	4,339	
7. Mechanics and repairmen	2,540	4,022	4,187	3,991	3,766	3,701	
8. Labourers	1,480	2,634	2,781	2,652	2,561	2,422	

Source: J. Podoluk, Incomes of Canadians, 1968, Statistics Canada, CAl, B599, C544, Table 4.13, pp. 82-83

Note: The lifetime average income of individuals in higher income groups is roughly the same as the average income of these individuals between the age group of (25-34) and (35-44). Likewise the lifetime average income of lower income groups is roughly the same as their average income between the age groups of (less than 25) and (25-34).

TABLE C-2

Average Lifetime Tax Share by Income Groups for All Levels of the Government - Ontario
(millions of dollars) *

Income Groups less than 2000												
Tax Payments		2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	1500 & over	Total	
1	Age Group 20 - 30	7.71	9.27	14.72	20.38	37.74						
2	Age Group 30 - 40						84.84	346.38	462.10	449.33		
3	Total	7.71 (.5)	9.27 (.6)	14.72 (1.0)	20.38 (1.4)	37.74 (2.6)	84.84 (5.9)	346.38 (24.2)	462.10 (32.3)	449.33 (31.4)	1432.47 (100)	
4	Age Group 20 - 30	7.46	9.00	12.65	15.38	28.93						
5	Age Group 30 - 40						59.51	225.99	276.08	221.3		
6	Total	7.46 (.9)	9.00 (1.1)	12.65 (1.5)	15.38 (1.8)	28.93 (3.4)	59.51 (6.9)	225.99 (26.4)	276.08 (32.2)	221.3 (25.8)	856.28 (100)	
7	Age Group 20 - 30	5.60	6.38	6.62	6.55	10.35						
8	Age Group 30 - 40						24.31	89.72	106.89	89.85		
9	Total	5.60 (1.6)	6.38 (1.8)	6.62 (1.9)	6.55 (1.9)	10.35 (3.0)	24.31 (7.0)	89.72 (25.9)	106.89 (30.9)	89.85 (25.9)	346.26 (100)	

Sources: Author's calculations, based on Table A-4 in Appendix A.

- Notes: 1. Due to lack of sufficient data tax payments by age groups (20-30) and (30-40) are assumed to be equivalent to the average of tax payments by age groups (less than 25) and (25-34), and (25-34) and (35-44), respectively.
2. Figures in parentheses are percentages added to 100 percent across the rows.
3. Sums may not add to totals due to rounding.

Footnote to Appendix C

¹ Calculation of 25% increase in real income is based on the following indexes:

	1961	1969
Wages and salaries	100	150
CPI	100	125.5

Sources: Statistics Canada, Catalog No. CA1, B572, C002; and Bank of Canada Review.

APPENDIX D

Distribution of Public Costs by Age and Family Income Groups

Tables D-1 and D-2 show the details of distribution of total public costs by family income group and age of head.

TABLE D-1
Distribution of Total Public Costs by Family Income Group and Age of Head for Ontario Community Colleges
(thousands of 1971 dollars)

No.	Govt. Level	Age Group	Income Group	< 2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10,000-14,999	15,000 and Over	Total
1	Federal	less than 25		52 (10.3)	36 (5.9)	77 (7.6)	101 (7.1)	161 (6.1)	370 (6.2)	1225 (5.0)	1308 (4.0)	954 (3.0)	4960 (4.9)
2		25-34		96 (19.0)	127 (21.0)	229 (22.6)	336 (23.7)	666 (25.3)	1541 (25.8)	6468 (26.4)	8175 (25.0)	6643 (20.9)	24701 (24.4)
3		35-44		112 (22.2)	140 (23.0)	263 (26.0)	351 (24.8)	721 (27.4)	1684 (28.2)	7276 (29.7)	9614 (29.4)	9663 (30.4)	29054 (28.7)
4		45-54		108 (21.4)	117 (19.3)	225 (22.2)	330 (23.3)	642 (24.4)	1362 (22.8)	5782 (23.6)	8338 (25.5)	9123 (28.7)	25005 (24.7)
5		55-64		97 (19.2)	111 (18.3)	156 (15.4)	247 (17.4)	374 (14.2)	872 (14.6)	3381 (13.8)	4807 (14.7)	4927 (15.5)	15084 (14.9)
6		65 and over		35 (7.0)	76 (12.5)	62 (6.1)	52 (3.7)	74 (2.8)	131 (2.2)	392 (1.6)	458 (1.4)	477 (1.5)	2430 (2.4)
7		Total		506 (100.0)	607 (100.0)	1012 (100.0)	1417 (100.0)	2632 (100.0)	5973 (100.0)	24499 (100.0)	32699 (100.0)	31787 (100.0)	101234 (100.0)
8	Provincial	less than 25		85 (11.5)	59 (6.6)	115 (9.4)	137 (9.3)	220 (7.9)	457 (8.1)	1274 (5.9)	1080 (4.1)	464 (2.2)	4745 (5.8)
9		25-34		133 (18.1)	181 (20.1)	271 (22.1)	349 (23.7)	743 (26.7)	1552 (27.5)	6242 (28.9)	6928 (26.3)	3884 (18.4)	20533 (25.1)
10		35-44		152 (20.6)	185 (20.5)	294 (24.0)	309 (21.0)	684 (24.6)	1502 (26.6)	6285 (29.1)	7481 (28.4)	6458 (30.6)	22333 (27.3)
11		45-54		152 (20.7)	154 (17.1)	252 (20.5)	319 (21.7)	651 (23.4)	1163 (20.6)	4687 (21.7)	6691 (25.4)	6606 (31.3)	19470 (23.8)
12		55-64		147 (20.0)	176 (19.5)	191 (15.6)	283 (19.2)	378 (13.6)	819 (14.5)	2743 (12.7)	3819 (14.5)	3398 (16.1)	12189 (14.9)
13		65 and over		66 (9.0)	146 (16.2)	103 (8.4)	77 (5.2)	106 (3.8)	158 (2.8)	324 (1.5)	342 (1.3)	295 (1.4)	2536 (3.1)
14		Total		736 (100.0)	900 (100.0)	1227 (100.0)	1472 (100.0)	2781 (100.0)	5645 (100.0)	21597 (100.0)	26341 (100.0)	21106 (100.0)	81806 (100.0)

Sources: Author's calculation based on Tables A-4 (Appendix A) and C-2 (Appendix C).

Notes: (1) Figures in brackets are column percentages, (2) column percentages are based on Table A-4 in Appendix A, (3) lines 7 and 14 are based on Tables III-4 (total public costs) and C-2 (average lifetime tax share), (4) due to rounding, sums may not add to totals.

TABLE D-2
Distribution of Total Public Costs by Family Income Group and Age of Head for
Ontario Community Colleges

(Adjusted for tax costs incurred after the age of 65)
(thousands of 1971 dollars)

No.	Govt. Level	Age Group	Income Group	< 2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10,000-14,999	15,000 and over	Total
1	FEDERAL	less than 25		56	41	82	105	166	378	1245	1327	969	5082
2		25-34		104	145	244	349	683	1578	6578	8291	6744	25309
3		35-44		122	160	280	364	740	1728	7399	9751	9810	29769
4		45-54		118	134	240	343	661	1395	5880	8456	9262	25620
5		55-64		105	127	166	256	383	892	3439	4875	5002	15455
6		65 and over		-	-	-	-	-	-	-	-	-	-
7		Total		506	607	1012	1417	2632	5973	24499	32699	31787	101234
8		present values		240	293	482	674	1261	2833	11832	16327	17048	50042
9	PROVINCIAL	less than 25		93	70	126	145	229	470	1293	1094	474	4897
10		25-34		146	216	296	368	772	1595	6337	7019	3939	21190
11		35-44		167	221	321	326	711	1543	6381	7579	6550	23047
12		45-54		167	184	275	337	677	1196	4758	6779	6700	20093
13		55-64		161	210	209	298	393	843	2785	3869	3446	12579
14		65 and over		-	-	-	-	-	-	-	-	-	-
15		Total		736	900	1227	1472	2781	5645	21597	26341	21106	81806
16		present values		343	424	564	668	1258	2520	9861	12892	11832	39304

Source: Based on Table D-1.

Notes: 1. To adjust for the tax costs incurred after the age of 65, we have allocated the actual tax costs incurred by age group of 65 and over (shown in lines 6 and 14 of Table D-1) among other age groups proportionately. This would create a minor overestimation of public costs which, relative to the rest of the costs, is negligible.

2. Due to rounding, sums may not add to totals.

APPENDIX E

Calculation of "Graduate Equivalents"

Since some of the students who attend community colleges in Ontario drop out of school before completing their program, the adjustment should be made to take into account the costs incurred and possible benefits received by these students, as well as those who have completed the program for which they have registered. For this reason we estimate the average number of the "graduate equivalents" from each program in Ontario Community Colleges. The "graduate equivalent" is defined as the total number of the graduates from a program plus the number of students who have successfully passed at least an equivalent number of courses for that program, even though they have not received a degree (for example, a student who has registered in a 3-year program but drops out of school in his third year is considered to be equivalent of a graduate from a 2-year program).

The first step, therefore, is to calculate the average number of graduates from each program and then the adjustment for the dropouts should be made.

(1) Average Number of Graduates from Ontario Community Colleges:

While the breakdown of the graduates from community colleges in Ontario for one, two or three year programs was only available since 1976-77 from the Graduate Placement Report of Ontario Ministry of Colleges and Universities, the number of graduates for the years prior to 1976-77 (i.e., 1970-76) was reported only in aggregate by the Statistical Summary report of the Ministry. Thus, in order to calculate the average number of graduates from Ontario Community Colleges by program for the period of 1970-71 to 1979-80, first we assumed that the average ratios of graduates from one, two and three year programs to total number of graduates prior to 1976-77 has been the same as

this ratio for 1976-80. Then we apportioned the total number of graduates , in each year according to these ratios. The results of such calculations are shown in Table E-1.

(2) The Adjustment for the Dropout Students and Calculation of "Graduate Equivalents":

To take account of dropout students at different stages of their schooling and calculate the average number of "graduate equivalents" the following procedure is adopted:

- (i) First we have to calculate the required number of enrolment which is needed to produce a given number of graduates. This can be simply done by assuming that, on the average, total enrolment which is required in each year to produce a certain number of graduates equals the length of the program in which the students have registered times the average number of graduates from that program. For example to produce one graduate in a 3-year program we have to have 3 people enrolled in that program in each year (one student in the first year of the program, one in the second year and the third one in the last year of the program). Given such a relation between the number of graduates and the required enrolment, we can calculate total required enrolment for each program using the data for average number of graduates from Table E-1 (column 11) of this Appendix. The results are shown in Table E-2, lines 1 and 2.
- (ii) Actual enrolment by program is calculated by allocating average total full-time equivalent enrolment in Ontario Community Colleges

TABLE E-1

Total Number of Graduates from Ontario Community Colleges
(1970-1980)

<div>Year Program</div>	1	2	3	4	5	6	7	8	9	10	11
	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	Average 1970-1980
1 year	1013 (14)	1108 (14)	1308 (14)	1788 (14)	2272 (14)	2419 (14)	2472 (14)	2464 (14)	2727 (15)	3100 (15)	2067 (14)
2 year	4705 (65)	5143 (65)	6072 (65)	8299 (65)	10550 (65)	11231 (65)	11639 (66)	11636 (65)	11840 (64)	13114 (63)	9423 (65)
3 year	1520 (21)	1661 (21)	1961 (21)	2681 (21)	3409 (21)	3628 (21)	3619 (20)	3709 (21)	4024 (21)	4671 (22)	3088 (21)
Total	7,238 (100)	7,912 (100)	9,341 (100)	12,768 (100)	16,231 (100)	17,278 (100)	17,730 (100)	17,809 (100)	18,591 (100)	20,885 (100)	14,578 (100)

Sources: Cols. 1-6 (total), Statistical Summary, Ontario Ministry of Colleges and Universities (various years); cols. 7-10, Graduate Placement Report, Ontario Ministry of Colleges and Universities (various years); col. 11 = $\frac{1}{10} \Sigma(\text{cols. 1 to 10})$.

Note: Figures in parentheses are in percentages and add to 100% for each column.

TABLE E-2

Average Number of Dropouts from Ontario Community Colleges

No.	Program Students	1-year	2-year	3-year	Total
1	Average graduates	2067	9423	3088	14,578
2	Required enrolment	2067	18846	9264	30,177
3	Actual enrolment	2446 (4.4)	35195 (63.3)	17959 (32.3)	55,600 (100.0)
4	Dropouts (line 3-line 2)	379	16349	8695	25,423

- Notes: 1. Line 2 equals line 1 (for each program) times the length of the program (e.g., 9264 = 3088 x 3).
2. Figures in brackets are in percentages added to 100 percent across the row. Allocation of actual enrolment (line 3) is according to those percentages derived from 1975 sample of post-secondary student survey (PSSS).

Sources: Based on Table E-1 (for line 1); Table A-1 of Appendix A (for the average total actual enrolment) and 1975 post-secondary student survey (for the percentages in line 3).

TABLE E-3

Total Number of Graduate Equivalents

No.	Program Students	1-year	2-year	3-year
1	Graduates	2067	9423	3088
2	Adjustment for dropouts from: 2-year program	8175 ¹	-	-
3	3-year program	2898 ²	2898	-
4	Graduate equivalent	13140	12321	3088

- Notes: 1. $8175 = \frac{16349}{2}$, where 16349 equals total number of dropouts from a 2-year program.
2. $2898 = \frac{8695}{3}$, where 8695 equals total number of dropouts from a 3-year program.

Source: Based on Tables E-1 and E-2.

(average full-time equivalent enrolment is calculated from Table A-1, Appendix A) according to the proportion of students enrolled in 1, 2 and 3 year programs out of total enrolment. Line 3 of Table E-2 shows the results.

(iii) Now that we have calculated the actual enrolment as well as required enrolment by program we can estimate the number of dropouts from each program by simply subtracting the required number of enrolment from the actual enrolment. The result is shown in line 4 of Table E-2.

(iv) Although we have estimated the average number of dropouts from each program, we have yet to determine at what stage of their schooling, on the average, these students drop out of school. That is we should determine the proportion of students from a particular program (say a 3-year program) who drop out of school in the 1st, 2nd or 3rd year of their schooling. In the absence of sufficient data we make the following assumptions. Dropouts from a 1-year program obviously take place in the 1st year; for a 2-year program, half of the dropouts take place in the first year and the other half in the second year of the study; for a 3-year program, a third of the dropouts take place in the first year, a third in the second year and a third in the third year of the program.

(v) Those students who drop out of school in their first year are assumed not to receive any benefits or incur any costs as a result of post-secondary education system. (Since, however, some of these students receive some extra benefits, this assumption underestimates the results, although not appreciably.) Those who drop out in the second or third year are assumed to be equivalent to graduates from 1-year and 2-year programs respectively and hence are added to the number of graduates in those programs. Table E-3 shows the result.

Appendix F

Students' Income During School Years

Due to the lack of sufficient data regarding students' income while attending school, we utilized the data from the survey of post-secondary student population undertaken by Statistics Canada in 1968-69. (Similar data are provided in the Post-Secondary Student Survey (PSSS) undertaken in 1975 by Statistics Canada, but with broader income ranges. However, since the income ranges are narrower in the case of the 1969-70 survey, which, in turn, leads to more accurate predictions, we decided to utilize these data.) These data, which are shown in columns 1 and 2 of Table F-1, indicate the total number of post-secondary student population in 1968-69 by students' own income range. To estimate the average annual student's income during the school period, we take the mid-point of income within each income range (which implies a uniform distribution) and then calculate the weighted average of these mid-points (relative frequencies are used as weights). The result is shown in column 4 of Table F-1. The last line in this column represents an approximation of average annual student's income (that is, \$863.4). This latter figure is then adjusted for inflation on the basis of 1971 dollars and assumed to grow at the same rate as the income of individuals with a high school degree. That is, the growth rate of 9.29%, 8.5% and 7.79% for the first, second and third years, respectively (see Table I-1 in Appendix I. for the details of the growth rates).

The undiscounted results of such calculations (before tax deductions and on the basis of 1971 dollars) would be \$1,013, \$1,099 and \$1,185 for the first, second and third years of study, respectively. To take account of tax payments, we should use the proper tax rates applicable to these

TABLE F-1
Annual Student's Income During School Years
Ontario, 1968-69

1 Income Groups	2 Absolute Frequency	3 Relative Frequency	4 Individual Income (Mid-Range)	5 Average Individual Income (1971 dollars) ³
NO INCOME	21,584	(15.6)	0	
1-300	28,367	(20.4)	150	
301-600	30,815	(22.2)	450	
601-900	20,994	(15.1)	750	
901-1,200	13,574	(9.8)	1,050	
1,201-1,500	6,291	(4.5)	1,350	
1,501-1,800	3,050	(2.2)	1,650	
1,801-2,100	2,789	(2.0)	1,950	
2,101-2,400	1,126	(0.8)	2,250	
2,301-2,700	1,413	(1.0)	2,550	
2,701-3,000	790	(0.6)	2,850	
3,001-3,300	481	(0.3)	3,150	
3,301-3,600	743	(0.5)	3,450	
3,601-3,900	528	(0.4)	3,750	
3,901-4,200	568	(0.4)	4,050	
4,201-4,500	583	(0.4)	4,350	
4,501-4,800	705	(0.5)	4,650	
4,801-5,100	570	(0.4)	4,950	
5,101-5,400	347	(0.3)	5,250	
5,401-5,700	274	(0.2)	5,550	
5,701-6,000	591	(0.4)	5,850	
6,001-6,300	144	(0.1)	6,150	
6,301-6,600	274	(0.2)	6,450	
6,601-6,900	185	(0.1)	6,750	
6,901-7,200	222	(0.2)	7,050	
over 7,200	1,754	(1.3)	8,000 ¹	
Total	138,757	(100)		
Average			863.42	927

Source: Based on post-secondary student population survey, Statistics Canada, Catalogue No. 81-543, Table 13C.

Notes: 1: Author's estimate; 2: to calculate this average the relative frequencies are used as weights; 3: using CPI (excluding food) reported in the Bank of Canada Review; 4: Since we are concerned about the overall average income in real terms, such averaging for each individual income group is not calculated.

students. According to the 1975 Post-Secondary Survey (PSSS), more than 93 percent of students were from the age group of 24 or less, implying that the appropriate tax rates should be those which apply to this age group. These tax rates are taken from Table J-2 on effective tax rates by age and income groups presented in Appendix J.

Appendix C

Distribution of Ontario Community Colleges Student Population by Family Income (α_1^F)

In order to estimate the participation rate of students from different programs in Ontario Community Colleges by their family income groups we utilized the data from Canada-wide Post Secondary Student Survey (PSSS) undertaken by Statistics Canada in February 1975. Despite the possible data limitation such as high non-response, inaccuracy of replies and sampling problems, PSSS was the only source which could provide some information about the socio-economic background of the students attending community colleges in Ontario. For our purpose, however, the main problem was that students were not classified according to the combined parental (family) income groups. The classification was according to either the father's income range or the mother's income range independently.

To overcome this problem we used the following procedure:

1. A subgroup of students with the following characteristics were chosen:

Type of institution attended	: Community College
Province of institution attended	: Ontario
Registration status	: Full time
Qualification for which registered	: Certificate or Diploma
Admission requirement	: High School graduation
Length of program	: 1 year, 2 year or 3 year

2. Cross-tabulation of students with the above characteristics by mother's income range and father's income range was produced. The result indicated that about 70 percent of students in a 1-year program belong to the families that both mother and father earn income, and only 30 percent of students are from families in which only one of the parents earns income.¹ Corresponding rates for

both 2-year and 3-year programs was 64 percent (both parents earn income) and 36 percent (only one of the parents earn income). With regard to this fact, it is crucial to classify students by income classes that contain both mother's and father's incomes. Hence, it would be quite misleading to distribute students according to only father's (or mother's) income. For example, a student whose father's income is less than \$2,000 per year, while his mother's income is over \$15,000 per year, would have been considered to belong to lowest family income group (less than \$2,000), if only his father's income were to be taken into account, while we know that his family income (combined mother's and father's income) is over \$15,000 and hence this student actually belongs to the family income group of \$15,000 and over.

3. From the cross-tabulation of students by father's income and mother's income, various income groups resulted so that all students could be accommodated into these groups. For the expositional purposes, the result for a 2-year program is shown in Table G-1 below.

It is evident from the above table that we have an overlapping problem. To take account of this fact we first break down each income group into several sub-income groups so that these smaller income groups would not overlap (that is, an income range of \$1,000). For example, the income group of 6000-9999 is divided into the following four subgroups: 6000-6999; 7000-7999; 8000-8999 and 9000-9999. Secondly, we assume that the total number of students in each income group is uniformly distributed among the subgroups. For example, according to Table G-1, there are 97 students in income group 6000-9999 (only for those whose either mother or father earns income) which, if uniformly distributed by the above four sub-income groups, the number of students in each subgroup would be 24.25. Applying a similar procedure to all other income groups we can break down the number of students into smaller sub-income groups.

TABLE G-1

Distribution of Students in a 2-Year Program in Community Colleges in Ontario
by Family Income Groups (Combined Father's and Mother's Income)

		Absolute Frequency	Relative Frequency (%)
Either Mother or Father Earns Income	No income	8	(1.0)
	Less than 2,000	7	(0.9)
	2,000- 3,999	8	(1.0)
	4,000- 5,999	19	(2.4)
	6,000- 9,999	97	(12.3)
	10,000-14,999	148	(18.8)
Bpth. Mother and Father Earn Income	Less than 4,000	2	(0.3)
	2,000- 6,000	4	(0.5)
	4,000- 8,000	9	(1.1)
	6,000-10,000	3	(0.4)
	6,000-12,000	19	(2.4)
	8,000-12,000	7	(0.9)
	8,000-14,000	18	(2.3)
	10,000-16,000	56	(7.1)
	12,000-19,000	51	(6.5)
	Over 15,000	330	(42.0)
	TOTAL	786	(100.0)

Source: Based on 1975 Post-Secondary Student Survey, Statistics Canada.

Now we can add up all of the students in each group and hence estimate the distribution of students by each income group without having an overlapping problem. The result of such a breakdown procedure which is applied to Table G-1 above is presented in Table G-2. Note, however, that in order to have an estimate of actual graduates by income groups, instead of using the absolute frequencies shown in Table G-1, we first distributed the total number of graduates in a 2-year program in Ontario Community Colleges according to the relative frequencies, and then used the resultant absolute frequencies in the breakdown procedure.

The last line of Table G-2 shows the distribution of graduates from a 2-year program in Ontario Community Colleges by family (combined father's and mother's) income groups. A similar approach was used to calculate the distribution of students in 1-year and 3-year programs in Ontario Community Colleges. The final results for all programs are presented in Table G-3.

TABLE G-3

Distribution of Graduates from Ontario Community Colleges
by Program and Family Income Groups (α_1)^a
(based on 1974-75 survey of students)

Program	Income groups less than 2000	2000- 2999	3000- 3999	4000- 4999	5000- 5999	6000- 6999	7000- 7999	10000- 14999	15000 over	Total
1-year	114 (5.5)	21 (1.0)	21 (1.0)	56 (2.7)	56 (2.7)	87 (4.2)	262 (12.7)	544 (26.3)	908 (43.9)	2067 (100.0)
2-year	193 (2.0)	66 (.7)	66 (.7)	151 (1.6)	151 (1.6)	363 (3.9)	1151 (12.2)	2851 (30.3)	4419 (46.9)	9423 (100.0)
3-year	70 (2.3)	30 (1.0)	30 (1.0)	51 (1.7)	51 (1.7)	110 (3.6)	340 (11.0)	946 (30.6)	1460 (47.3)	3088 (100.0)

Sources: Author's calculation based on Table E-1, and 1975 Post-Secondary Student Survey by Education Branch of Statistics Canada.

Note: Figures in brackets are in percentages.

Footnote to Appendix G

¹ Since the sample size for students in 1-year programs in Ontario Community Colleges was very small, we decided to choose Canada-wide sample (except Newfoundland and Prince Edward Island) of students and assumed that the results would hold for Ontario as well.

APPENDIX H

Starting Salaries of Graduates from Ontario Community Colleges

The only source of data which could provide some statistics on the starting salaries of graduates from Ontario Community Colleges was "Graduate Placement Report, Colleges of Applied Arts and Technology," which is published by the Ontario Ministry of Colleges and Universities. This source, however, provides only a median range for the starting salaries of graduates in different programs in Ontario Community Colleges. Such data are shown in Table H-1.

TABLE H-1

Starting Salaries (median income range) of Graduates from Ontario Community Colleges by Program*

year	1-year	Program	
		2-year	3-year
1976-77	\$7,000-\$8,000	\$9,000-\$10,000	\$10,000-\$11,000
1977-78	8,000- 9,000	10,000-11,000	11,000-12,000
1978-79	9,000-10,000	10,000-11,000	12,000-13,000
1979-80	10,000-11,000	12,000-13,000	13,000-14,000

Source: "Graduate Placement Report, Colleges of Applied Arts and Technology," Ontario Ministry of Colleges and Universities.

* The period between 1976-80 is the only period for which the above data were available.

Since the above data only provide a range of median incomes, we take the mid-point of these ranges (presented in Table H-2) as an average median salary of graduates from Ontario Community Colleges.

TABLE H-2
Starting Salaries (average median income) of Graduates from
Ontario Community Colleges by Program

year	1-year	Program	3-year
		2-year	
1976-77	\$ 7,500	\$ 9,500	\$10,500
1977-78	8,500	10,500	11,500
1978-79	9,500	10,500	12,500
1979-80	10,500	12,500	13,500

Source: Based on Table H-1.

The average median salaries shown above should be adjusted for two factors. First, inflation and second, secular growth (affecting real starting salaries to grow over time). These adjustments are necessary since all other measures, including the starting salaries of high school graduates and costs are calculated in constant 1971 dollars. Columns 1-3 of Table H-3 show the starting salaries in constant 1971 dollars. To take account of the second fact, the overall growth rate of average weekly earnings since 1969 for industrial composite in constant 1971 dollars (that is 2.7% per year) was used in order to eliminate the effect of secular growth on starting salaries.^{1,2,3} Columns 4-6 of Table H-3 show the results. The average of resultant calculations for each program is considered to be the real starting salary of a college graduate in that program. See line 5 of Table H-3.

TABLE H-3
Real Starting Salaries of Graduates from
Ontario Community Colleges
(in 1971 dollars)

No.	program year	Adjusted only for inflation			Adjusted for both inflation and secular growth		
		¹ 1-year	² 2-year	³ 3-year	⁴ 1-year	⁵ 2-year	⁶ 3-year
1	1976-77	5252	6217	7353	4590	5422	6413
2	1977-78	5519	6818	7466	4683	5530	6335
3	1978-79	5796	6406	7627	4786	5289	6297
4	1979-80	5936	7066	7631	4769	5676	6475
5	Average	5626	6627	7519	4707	5479	6380

Sources: Based on Table H-2 according to the following formula.

Adjusted starting salary (for both inflation and secular growth at time t (i.e., Cols. 4, 5, and 6)

= Adjusted starting salaries (only for inflation--i.e., Cols., 1, 2, and 3) at time t+1 times (1 - .027).

Thus, all the figures in Cols. 1-3 above are traced back to 1971 according to the above formula and put in Cols. 4-6 in corresponding cells.

Notes to Appendix H

¹ Calculation of inflation rates and secular growth are based on CPI and average weekly earnings reported by the Bank of Canada Review.

² The adjustment for the secular growth is based on the assumption of zero growth rate of real output after 1969.

³ Due to data limitation on real growth of starting salaries of graduates from Ontario Community Colleges, we had to apply the overall real growth rate of average weekly earnings for industrial composite in Canada.

APPENDIX I: Age-Earnings Profiles

TABLE I-1
Growth Rate of Real Income by Age and Education Level

Working Age (Age - 18)	Growth Rate of Income for High School Graduates	Growth Rate of Income For all Age Graduates
1.	0.0928947	-0.126316
2.	0.0350000	0.115000
3.	0.0778571	0.104762
4.	0.0713636	0.095455
5.	0.0654348	0.086957
6.	0.0600000	0.079167
7.	0.0550000	0.072000
8.	0.0503846	0.065385
9.	0.0461111	0.059259
10.	0.0421429	0.053571
11.	0.0384483	0.048276
12.	0.0350000	0.043333
13.	0.0317742	0.038710
14.	0.0287500	0.034375
15.	0.0259091	0.030303
16.	0.0232353	0.026471
17.	0.0207143	0.022857
18.	0.0183333	0.019444
19.	0.0160811	0.016216
20.	0.0139474	0.013158
21.	0.0119231	0.010266
22.	0.0100000	0.007500
23.	0.0081707	0.004878
24.	0.0064286	0.002381
25.	0.0047674	0.000000
26.	0.0031818	-0.002273
27.	0.0016667	-0.004444
28.	0.0002174	-0.006522
29.	-0.0011702	-0.008511
30.	-0.0025000	-0.010417
31.	-0.0037750	-0.012245
32.	-0.0050000	-0.014000
33.	-0.0061765	-0.015686
34.	-0.0073077	-0.017308
35.	-0.0083962	-0.018868
36.	-0.0094444	-0.020370
37.	-0.0114286	-0.023214
38.	-0.0123684	-0.024561
39.	-0.0132759	-0.025862
40.	-0.0141525	-0.027119
41.	-0.0150000	-0.028333
42.	-0.0158197	-0.029508
43.	-0.0166129	-0.030645
44.	-0.0173810	-0.031746
45.	-0.0181250	-0.032812
46.	-0.0188462	-0.033846

Source: Based on 1971 Census of Canada (PUST).

TABLE I-2
Age-Earnings Profiles (before and after tax) by Education Level
(1971 dollars)

Working Age (Age - 18)	High School		1-year Program		2-year Program		3-year Program	
	Before Tax	After Tax	Before Tax	After Tax	Before Tax	After Tax	Before Tax	After Tax
1	3825.	2632.	0.	0.	0.	0.	0.	0.
2	4150.	2855.	5302.	3648.	0.	0.	0.	0.
3	4473.	2988.	5911.	4067.	6171.	4122.	0.	0.
4	4793.	3202.	6531.	4363.	6881.	4597.	7186.	4743.
5	5106.	3370.	7154.	4722.	7602.	5017.	8012.	5288.
6	5413.	3573.	7776.	5132.	8327.	5496.	8852.	5842.
7	5710.	3517.	8392.	5169.	9051.	5575.	9697.	5973.
8	5998.	3695.	8996.	5542.	9768.	6017.	10540.	6672.
9	6275.	3865.	9584.	5904.	10471.	6628.	11374.	7200.
10	6539.	4028.	10152.	6426.	11156.	7062.	12193.	7718.
11	6790.	4183.	10696.	6771.	11817.	7480.	12990.	8223.
12	7028.	4329.	11212.	7097.	12450.	7881.	13760.	8710.
13	7251.	4467.	11698.	7405.	13051.	8261.	14497.	9177.
14	7460.	4595.	12151.	7692.	13617.	8620.	15197.	9674.
15	7653.	4844.	12568.	7956.	14144.	8953.	15856.	10188.
16	7831.	4957.	12949.	8197.	14630.	9261.	16469.	10716.
17	7993.	4604.	13292.	7656.	15073.	9014.	17036.	11235.
18	8140.	4689.	13596.	7831.	15472.	9252.	17552.	11773.
19	8271.	4764.	13860.	7983.	15826.	9464.	18016.	12316.
20	8386.	4830.	14085.	8113.	16133.	9648.	18428.	12826.
21	8486.	4888.	14270.	8220.	16395.	9804.	18787.	13358.
22	8571.	4937.	14417.	8304.	16611.	9933.	19091.	13830.
23	8641.	4977.	14525.	8366.	16781.	10035.	19342.	14341.
24	8696.	5009.	14596.	8407.	16907.	10110.	19541.	14826.
25	8738.	5033.	14630.	8427.	16990.	10160.	19687.	15358.
26	8766.	5049.	14630.	8427.	17030.	10184.	19783.	15869.
27	8780.	5224.	14597.	8685.	17030.	11376.	19831.	16372.
28	8782.	5225.	14532.	8647.	16991.	11350.	19831.	16866.
29	8772.	5219.	14438.	8591.	16916.	11300.	19785.	17341.
30	8750.	5206.	14315.	8517.	16805.	11226.	19698.	17826.
31	8717.	5187.	14166.	8429.	16662.	11130.	19569.	18300.
32	8673.	5160.	13992.	8325.	16489.	11015.	19402.	18773.
33	8620.	5129.	13796.	8209.	16287.	10880.	19200.	19249.
34	8557.	5091.	13580.	8080.	16059.	10727.	18965.	19729.
35	8485.	5049.	13345.	7940.	15807.	10559.	18700.	20200.
36	8405.	5001.	13093.	7790.	15533.	10376.	18406.	20647.
37	8309.	4894.	12826.	7555.	15240.	9555.	18088.	21090.
38	8206.	4833.	12529.	7380.	14930.	8794.	17747.	21527.
39	8097.	4769.	12221.	7198.	14583.	8589.	17385.	21960.
40	7982.	4701.	11905.	7012.	14225.	8379.	16981.	22386.
41	7863.	4631.	11582.	6822.	13857.	8162.	16564.	22806.
42	7738.	4558.	11254.	6629.	13481.	7940.	16136.	23217.
43	7610.	3828.	10922.	6433.	13099.	7715.	15698.	23618.
44	7478.	3761.	10587.	6236.	12713.	7488.	15254.	24010.
45	7342.	3693.	10251.	6038.	12323.	7258.	14804.	24392.
46	7204.	3624.	9915.	4987.	11932.	7028.	14350.	24752.

- Sources and Notes: 1) Earnings before tax are calculated by applying the growth rate of real income (from Table I-1) to the starting salaries by education level (discussed in the text (p.69)). After tax earnings are calculated by applying appropriate tax rates (shown in Table J-2) to before tax earnings.
- 2) Students' earnings (as benefits) during school years are considered to be zero.

TABLE I-3

Discounted Values of After Tax Age-Earnings Profiles by Education Level
(1971 dollars)

Working Age (Age - 18)	High School	1-year Program	2-year Program	3-year Program
1	2575.	0.	0.	0.
2	2733.	3493.	0.	0.
3	2799.	3810.	3861.	0.
4	2935.	3999.	4214.	4348.
5	3023.	4235.	4500.	4743.
6	3136.	4504.	4823.	5127.
7	3020.	4439.	4787.	5129.
8	3105.	4657.	5056.	5606.
9	3178.	4854.	5449.	5919.
10	3240.	5169.	5681.	6209.
11	3293.	5330.	5888.	6472.
12	3334.	5466.	6070.	6708.
13	3366.	5580.	6225.	6916.
14	3388.	5672.	6356.	4774.
15	3495.	5740.	6460.	4874.
16	3500.	5787.	6538.	4953.
17	3180.	5289.	6227.	7038.
18	3169.	5293.	6253.	7094.
19	3151.	5280.	6259.	7125.
20	3126.	5250.	6243.	7131.
21	3095.	5205.	6208.	7114.
22	3059.	5145.	6154.	7073.
23	3017.	5072.	6083.	7012.
24	2971.	4987.	5997.	6932.
25	2921.	4891.	5897.	6833.
26	2867.	4786.	5784.	6718.
27	2903.	4826.	6321.	7361.
28	2841.	4702.	6171.	7203.
29	2777.	4571.	6012.	7031.
30	2710.	4434.	5844.	6850.
31	2642.	4293.	5669.	6659.
32	2572.	4149.	5490.	6460.
33	2501.	4003.	5306.	6255.
34	2429.	3856.	5119.	6045.
35	2357.	3707.	4930.	5832.
36	2285.	3559.	4740.	5617.
37	2198.	3377.	4271.	5070.
38	2114.	3228.	3846.	4867.
39	2041.	3081.	3676.	4665.
40	1969.	2936.	3509.	4459.
41	1898.	2795.	3344.	4256.
42	1827.	2658.	3183.	4056.
43	1502.	2524.	3027.	3861.
44	1444.	2394.	2874.	3671.
45	1397.	2268.	2726.	3275.
46	1332.	1833.	2583.	3106.
Total	124393.	193122.	225654.	248445.

Source: Based on Table I-2. Discounted at 2.2% rate of interest.

APPENDIX J

Effective Tax Rates:

Using Gillespie's data (1980) on the incidence of effective tax rates (all taxes) by income groups and total income of these groups in 1969, we have adopted the following procedure to estimate the cross-tabulation of effective tax rates by age and income groups.

If we denote the total tax payments by age and income groups (shown in Table A-4 of Appendix A) by T_j^i (where j and i represent income and age groups respectively), then:

$$T_j^i = t_j^i y_j^i, \quad (1)$$

where t_j^i = effective tax rate for the i^{th} age group in the j^{th} income bracket,
 y_j^i = total income of the i^{th} age group in the j^{th} income bracket.

On the other hand, total income of each income group (y_j) can be allocated among different age groups according to the distribution of families by age of head and income groups (see Table J-1). Therefore:

$$y_j^i = a_j^i y_j \quad (2)$$

where a_j^i = proportion of families in the i^{th} age group and the j^{th} income bracket.

Combining equations (1) and (2) and solving for t_j^i , we get:

$$t_j^i = \frac{T_j^i}{a_j^i y_j} \quad (3)$$

which is an approximation of effective tax rates by age and income groups.

Table J-2 presents the results.

In order to be able to apply such effective tax rates to age-earnings profiles of individuals we have to assume that such tax rates will remain undisturbed over the lifetime of the generation under consideration. This is a strong but necessary assumption.

Table J-1
Distribution of Income by Age of Head and Income Group
(millions of dollars)

Income Group Age Group	<2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	15000 & Over	Total
<25	21,275	22,647	46,326	82,869	98,87	123,17	355.62	329.90	68.62	1637.7
25 - 34	29,785	63,412	96,216	184,450	303.42	380.69	1637.71	2136.51	1063.57	6337.1
35 - 44	32,976	61,902	99,780	144,353	255.69	339.64	1525.40	2136.51	2264.37	6396.4
45 - 54	34,040	51,334	85,526	160,392	252.28	253.80	1076.21	1955.85	2624.61	5625.0
55 - 64	35,104	64,922	69,490	157,718	146.60	190.35	645.72	1107.53	1252.16	3678.8
65 & over	17,020	58,883	42,763	48,118	47.73	41.06	79.55	86.40	85.70	919.7
Total	170,200	323,100	440,100	777,900	1104.60	1328.70	5320.20	7752.70	7359.20	24594.7

Sources: Based on Table A-6 (Appendix A) and Gillespie's study (1980), Appendix A, Table A-4(d).

Table J-2
Effective Tax Rates by Age of Head and Income Group
Ontario, 1969

No.	Government Level	Income Age	<2000	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-9999	10000-14999	15000 & Over	Total
1	Federal	<25	0.254698	0.180262	0.159665	0.113057	0.148349	0.158801	0.172961	0.207408	0.769049	0.167263
2		25-34	0.335099	0.227852	0.229097	0.170161	0.200410	0.202729	0.199068	0.198741	0.343627	0.215139
3		35-44	0.352523	0.255772	0.254263	0.228022	0.255708	0.261124	0.240415	0.233788	0.235470	0.251256
4		45-54	0.330731	0.258430	0.252894	0.192955	0.233125	0.282553	0.270868	0.222143	0.191396	0.245257
5		55-64	0.286770	0.193899	0.215796	0.146528	0.232807	0.241685	0.264764	0.225645	0.217263	0.226765
6		65 & over	0.242820	0.145742	0.139507	0.103307	0.140311	0.171792	0.242308	0.282244	0.300216	0.144385
7		Total	0.208461	0.212937	0.221313	0.170587	0.217726	0.236320	0.232322	0.219446	0.238015	0.227325
8	Provincial	<25	0.271502	0.196763	0.162694	0.104375	0.133884	0.144325	0.130332	0.126705	0.8292755	0.119253
9		25-34	0.306826	0.213558	0.184439	0.119823	0.147071	0.149001	0.128451	0.124244	0.156555	0.123403
10		35-44	0.214162	0.223403	0.192333	0.135477	0.161079	0.172177	0.148723	0.134194	0.121929	0.140076
11		45-54	0.304659	0.224351	0.191896	0.125989	0.155258	0.178099	0.157025	0.130999	0.107820	0.142306
12		55-64	0.285488	0.201575	0.180272	0.113429	0.155779	0.166885	0.155361	0.131883	0.116101	0.113694
13		65 & over	0.266322	0.184579	0.156374	0.101736	0.131846	0.147873	0.242444	0.147956	0.142658	0.112493
14		Total	0.294947	0.208295	0.182004	0.119938	0.151457	0.165425	0.146517	0.130122	0.122744	0.137005
15	Local	<25	0.074792	0.079904	0.040493	0.022401	0.029703	0.029581	0.036509	0.046883	0.189501	0.033475
16		25-34	0.323777	0.172686	0.117980	0.60903	0.059567	0.055916	0.047972	0.043808	0.073979	0.052349
17		35-44	0.274888	0.227119	0.146064	0.099913	0.089231	0.080469	0.066126	0.056245	0.044613	0.066588
18		45-54	0.308038	0.232299	0.144538	0.076270	0.076707	0.091338	0.079496	0.052113	0.032646	0.064224
19		55-64	0.173178	0.106491	0.103136	0.044968	0.076533	0.070606	0.076816	0.033355	0.03967	0.056934
20		65 & over	0.038355	0.012608	0.017997	0.015827	0.025242	0.035152	0.066953	0.073445	0.062189	0.024454
21		Total	0.239718	0.143609	0.109293	0.061190	0.068169	0.067885	0.062572	0.051156	0.045304	0.047154
22	Total	<25	0.60099	0.456929	0.362832	0.239883	0.311936	0.331687	0.339803	0.380997	1.25131	0.319991
23		25-34	0.96580	0.614096	0.531516	0.350887	0.406048	0.427647	0.384491	0.366794	0.57416	0.400892
24		35-44	1.04157	0.706304	0.592650	0.463412	0.506019	0.513770	0.455265	0.424228	0.40201	0.461921
25		45-54	0.94343	0.715080	0.589238	0.395215	0.465190	0.550900	0.507390	0.405145	0.33186	0.451788
26		55-64	0.74544	0.501965	0.499204	0.304926	0.464620	0.479177	0.498941	0.410884	0.37303	0.423540
27		65 & over	0.54750	0.342929	0.313878	0.208771	0.297400	0.354817	0.458506	0.503646	0.50506	0.281333
28		Total	0.84313	0.564841	0.512610	0.351716	0.437353	0.469632	0.441412	0.400725	0.40606	0.421485

Sources: Based on Tables J-1 and A-4 (Appendix A).

Appendix K

In this Appendix we are using two experiments in order to determine whether the pattern of income redistribution from the non-users to the users, as presented in table V-6 of the text, resulted mainly from the costs side or the benefits side.

In the first experiment we hold the change in the benefits constant and compare it with the hypothetical distribution of taxes which is different from the existing distribution used in the text. The existing distributional pattern is based on tables III-5 and C-2, while the hypothetical distribution is proportional to income.¹ This experiment finances the same pattern of benefits with a proportional tax pattern, and it allows us to deduce the impact of different tax structure on the distributional pattern. Table K-1 shows the results.

TABLE K-1

Distribution of costs incurred by the non-users according to the hypothetical proportional tax system minus subsidies received by the users according to the existing distributional pattern of benefits by family income groups.

(Thousands of 1971 dollars)

No.	Income Group Program	Less than 2,000	2,000-2,999	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000-9,999	10,000-14,999	15,000 & over	Total
1	1-year	-1116	69	185	116	418	279	2069	1209	-3255	0000
2	2-year	-567	262	480	698	1266	655	4104	524	-7422	0000
3	3-year	-258	48	129	242	452	291	1711	145	-2809	0000
4	Total	-1940	382	799	1064	2148	1190	7943	1963	-13406	0000

Sources: Based on I.W. Gillespie (1980), Appendix A, table A-4(d) and Table V-5 of the text.

From Table K-1 and Table V-6 of the text, it can be seen that change in the tax structure totally changes the distributional pattern. However, this experiment alone is not sufficient in order to determine whether or not the tax structure has been mainly the cause of such a distributional pattern. Thus the second experiment should be undertaken which allows for a different distribution of benefits, while holding the existing distribution of costs (taxes) unchanged. In this case we assume the hypothetical distribution of benefits to be the same as distribution of income.² This experiment finances a different, proportional, pattern of benefits with the existing pattern of costs (taxes), and it allows us to deduce the impact of different distributional pattern of benefits on the overall distributional pattern. Table K-2 shows the result of this second experiment.

TABLE K-2

Distribution of costs incurred by the non-users according to the existing distributional pattern of average life-time tax share minus subsidies received by the users according to the hypothetical distributional pattern (proportional to income) by family income groups.

(thousands of 1971 dollars)

No.	Income Group Program	Less than 2,000	2,000-2,999	3,000-3,999	4,000-4,999	5,000-5,999	6,000-6,999	7,000-9,999	10,000-14,999	15,000 & over	Total
1	1-year	-1	-105	-127	-379	-354	209	806	324	212	0000
2	2-year	-2	-198	-240	-712	-665	391	1516	608	397	0000
3	3-year	-1	-71	-86	-260	-238	161	628	313	225	0000
4	Total	-3	-377	-458	-1359	-1269	796	2891	1159	759	0000

Sources: Based on I.W. Gillespie (1980), Appendix A, Table A-4(d) and Table V-4 of the text

Comparing Table K-2 and Table V-6 of the text, we can deduce that changes in the distribution of benefits alone would also change the overall distributional pattern significantly. As a result, we can claim that both costs (taxes) side and benefits side have contributed to the overall distributional pattern presented in table V-6.

Notes to Appendix R

- 1,2. To calculate such hypothetical patterns we used the distribution of broad income by income groups presented in I.W. Gillespie's study (1980), Table A-4(d).

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