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Economic Returns on Under-Graduate Fields of Study in Canadian Universities, 1961 to 1972
Le rendement économique des diverses disciplines dans les universités canadiennes de 1961 à 1972

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Résumé de l'article

Dans cet article, l'auteur tente d'évaluer le taux de rendement de 21 disciplines scolaires dans les universités canadiennes. Certaines études ont été faites sur le sujet dans le passé, mais elles avaient une portée générale. Ce que l'auteur cherche à cerner ici, c'est l'écart qui peut exister d'une discipline à une autre.

À cette fin, il a divisé son étude en trois parties. Dans une première partie, il évalue le rendement pécuniaire que peut rapporter au diplômé son travail dans une discipline donnée compte tenu des investissements qu'il a dû engager. Pour y arriver, il se place à trois moments différents: 1961, date du point de départ du mouvement d'investissements dans les études universitaires; 1969, date qui marque le sommet d'une expansion sans précédent dans la course au « haut savoir » ; 1972, finalement, début d'une période de régression économique susceptible d'influer sur les taux de rendement futurs.

Les données obtenues indiquent les taux de rendement qu'un diplômé d'une discipline donnée peut espérer réaliser au cours de sa carrière, s'il persévère dans la profession qu'il a choisie.

La deuxième partie, qui présente un modèle simple de détermination des salaires sur les marchés du travail au Canada, veut aider à évaluer les conséquences de l'offre et de la demande d'emploi sur la détermination des salaires des diplômés débutants entre 1961 et 1972, ce qui permet de voir s'il y a ou non « surproduction » de diplômés suivant les disciplines.

Dans la troisième partie, l'auteur fait ressortir les principales observations qu'il a faites ainsi que leurs implications pour l'avenir.

Relativement à la première partie de l'étude, l'auteur note d'abord que très peu d'études ont été faites sur le taux de rendement des études universitaires depuis 1960 et aucune en ce qui concerne une discipline déterminée. Si la formation universitaire constitue une forme d'investissement dans l'acquisition d'un diplôme on peut la comparer à l'investissement d'un capital dans une entreprise. Au départ d'un pareil calcul, il faut considérer un facteur risque qui réside dans la possibilité d'accéder au diplôme convoité. S'y ajoutent certaines hypothèses qui entrent en ligne de compte: l'entrée à l'université commence à 18 ans, le coût de la scolarité s'établit à la fin de chaque année d'étude: les gains obtenus après le diplôme sont calculés à la fin de chaque année.

L'auteur établit le coût des études universitaires de la façon suivante: les frais de scolarité, ce que le sujet aurait vraisemblablement gagné s'il était entré sur le marché du travail à la fin de son cours secondaire, les dépenses relatives à l'achat de livres, les bourses qu'il a pu obtenir et certaines dépenses incidentes qu'il est difficile d'apprécier. Au sujet des revenus qu'il a ainsi perdus, l'auteur signale spécialement leur importance: celles-ci équivalaient à 85 pour cent des dépenses en 1961 et elles étaient un peu moins élevées en 1972. D'où il résulte que la principale dépense qu'il faille attribuer à la formation universitaire consiste dans la perte de gains.

Quant au rendement des capitaux ainsi engagés, l'auteur l'a estimé à 14 pour cent en 1961. Il a grimpé jusqu'à 22 pour cent en 1972. À ce propos, quand l'on veut comparer les fluctuations entre les taux de rendement des différentes disciplines, il faut étudier attentivement le tableau no 1 ; ce tableau est ensuite analysé dans les pages suivantes de l'article. Les taux de rendement comparés à ceux qui existent aux États-Unis apparaissent relativement plus élevés.

L'auteur note aussi que, de 1961 à 1972, le coût de la formation universitaire s'est accrue en moyenne de 6.5 pour cent par année.

En ce qui touche le taux de départ des traitements des diplômés, le tableau 2 démontre que, de 1961 à 1969, toutes les disciplines ont connu des augmentations, non seulement en dollars courants, mais aussi en dollars constants. Dans toutes les disciplines, sauf trois, cette augmentation a été plus marquée que dans le cas des majorations de salaire en général. Depuis 1969, cependant, la situation s'est inversée. Pendant cette période (1969-1972), une seule discipline, celle du travailleur social, a connu des taux de salaire de départ qui dépassait l'augmentation des salaires en général.

De fait, sur les 21 disciplines, huit seulement ont connu des gains dans les taux de salaires réels. Les salaires réels ont diminué dans le cas des 13 autres, pour certaines d'une façon substantielle, mais en moyenne de 1 pour cent par année.

L'auteur attribue cet état de choses aux changements survenus dans l'économie d'abord, mais il ne peut s'empêcher de noter en même temps que pendant cette période le nombre des inscriptions a doublé dans les six universités qui ont fait le sujet de son étude, ce qui l'amène à penser que le déclin peut s'expliquer aussi par un accroissement de l'offre par rapport à la demande. L'auteur analyse ensuite la situation du marché du travail selon qu'il s'agit des disciplines professionnelles et des diplômes de formation générale.

De cette étude, il tire finalement trois conclusions. Premièrement, si les conditions économiques générales de la décennie 1960 avaient persisté, le marché aurait sans doute absorbé les diplômés. La deuxième conclusion à laquelle en arrive l'auteur, c'est qu'il s'est créé une espèce de marché de substitution en provenance des collèges d'enseignement professionnel. La troisième conclusion, c'est que, malgré un déclin depuis 1969, le taux de rendement, qui se situait en 1972 à 18 pour cent par rapport à 22 pour cent>en 1969, demeure encore très attrayant.

Economic Returns on Undergraduate Fields of Study in Canadian Universities: 1961 to 1972

Ozay Mehmet

This paper provides comparable estimates of private rates of return on a set of 21 undergraduate courses of study at Canadian Universities in 1961, 1969 and 1972, and then attempts to explain observed shifts in the college labour market using a simple multiple regression model.

This paper attempts to calculate the private rates of return on a set of 21 under-graduate̓ fields of study in Canadian universities. Such a study is useful because past rate-of-return studies have generally been aggregative, grouping all fields of study together. While the aggregative approach is meaningful for the question of *overall* level of investment of resources in university education, it nevertheless conceals important variations in yield rates for different fields of study. It is precisely these kinds of specific yield rates that are important for making *ex-ante* investment and enrollment decisions by individual students, their parents or governments.

The format of the paper is as follows: Part I calculates private (after-tax) rates of return on a set of 21 undergraduate fields of study, for which the necessary data could be obtained, at three important dates: 1961, 1969 and 1972. The first date represents the start of the Human Capital Revolution manifesting a general concensus of opinion about serious under-investment in Canadian university education; the second date marks the end of an unprecedented expansion of post-

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secondary education in Canada and a rising fear of over-investment; finally, 1972 is taken to represent a period of economic slow-down. The present rates of return are *ex-ante* or anticipated, computed at graduation dates. They reflect yield rates which a graduate of a given discipline can expect to realize during the course of his career up to retirement at age 65 assuming that he remains employed in the profession for which he was trained. The second part of the paper presents a simple multiple-regression model of salary determination in the Canadian labour market for university graduates. This model helps to evaluate the relative impact of the supply and demand determinants of the shifts which occurred in starting salaries offered to graduates by prospective employers during 1961-1972. Our results shed important light on the question of whether or not there was over-production of university-trained manpower in Canada during this period. Finally, Part III highlights the principal findings and policy implications of our results.

INTERNAL RATES OF RETURN

There has been surprizingly little empirical research to measure economic returns on Canadian university education since 1960[1]; and none at all so far as specific fields of study are concerned. Accordingly, we begin with an attempt to calculate internal rates of return on 21 undergraduate disciplines, or courses of study, listed in Table I. These disciplines represent some of the most important and popular investment opportunities available to potential Canadian university students in their enrollment and career decisions. While non-pecuniary, or consumption, considerations may play important roles in such decisions, here our con-

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[1]   D.A. DODGE and D.A.A. STAGER, « Economic Returns to Graduate Study in Science, Engineering and Business,» *Canadian Journal of Economics,* Vol. V, No. 2, May 1972, pp. 182-198, provide a cross-sectional study, based on the 1966 data, for the stated fields of graduate study. John F. CREAN, « Taux de rentabilité attendu et la demande d'éducation: quelques résultats empiriques,» *Relations Industrielles,* Vol. 27, No. 3, août 1972, pp. 382-402, presents estimates of the expected rates of return for students in the final years of secondary school by province and sex in Canada during 1960-61. As can be expected, his estimated returns are less than our estimates for undergraduates. Other related studies are presented in S. OSTRY, editor, *Canadian Higher Education in the Seventies,* Economic Council of Canada, May 1972, Ottawa. The Economic Council of Canada, which in its *Second Annual Review: Toward Sustained and Balanced Growth, 1965,* strongly advocated increased public investment in Canadian universities, based its recommendation on American data and findings of J.R. PODOLUK, *Earnings and Education,* DBS, Cat. No. 91-510, December 1965, which estimated an overall rate of return of 19.7%, for male Canadian university graduates in 1961.

cern is with the investment aspects. Naturally, this is by no means denying the presence or importance of non-pecuniary factors.

If university education is an investment process, the yield on investment expenditures incurred toward a degree or specialized knowledge is comparable to the yield realized on a physical capital good by a rational investor. This is the fundamental assumption of the human capital theory.[2] The private yield on investment in human capital formation is given by the internal rate of return, r, which, of course, is that discount rate which reduces to zero the present value of net additional life-time earnings (after tax) resulting from university education.

In the present study, we compute r at the date of graduation, t_0, just at the outset of the graduate's working career. Alternatively it could be computed at the date of commencement of his university program, but such a computation would have to be repeated later to capture changed economic conditions as at graduation date. For example, relative wages might be quite different. Additionally, we make the following simplifying assumptions: (1) all university programs begin at age 18; (2) all educational costs are paid in one payment at the end of each academic year; and (3) first-years' earnings, after graduation, as well as all subsequent yearly earnings are collected in one payment at the years' end. In this study, earning profiles ranging from the date of graduation up to the retirement age of 65 were constructed according to data from the 1961 and 1971 Census of Population, as explained below[2a].

The basic formula is:

$$(1) \quad \sum_{t=t_0+1}^{n} X_t (1 + r)^{-t} - \sum_{s=t_0-j}^{t_0} C_s (1 + r)_s = 0$$

where:

X's represent annual additional earnings of graduate relative to the annual earnings of employed High School graduates. These

[2] G. BECKER, *Human Capital, A Theoretical and Empirical Analysis*, NBER, 1964; G. BECKER, «Under-investment in College Education?» *American Economic Review*, Vol. 50, May 1960, pp. 346-54; T.W. SCHULTZ, «Investment in Human Capital,» *American Economic Review*, Mrach 1961, pp. 1-17. An early statement of the human capital theory is J.R. WALSH, «Capital Concept Applied to Man,» *Quarterly Journal of Economics*, February 1935.

[2a] A more detailed statement of statistical sources and methods is available, on request, from Professor Mehmet.

earnings are net of income tax payable to the federal and provincial governments. [3]

C's   are the yearly private costs of university education, including tuition fees, foregone earnings while at the university and foregone interest on funds used to meet academic costs. Living expenses are excluded since they would have to be incurred anyway.

t   is the graduation date, at which the internal rates of return, r, are computed, n is the retirement date, and j is the length of the university program, running for 3 years for general or pass courses, and 4 years for honours and professional courses. (i.e.: j = 1, 2, 3 or 4)

Earnings

These are calculated from the starting monthly salary offers of prospective employers in the Spring of the relevant years. The primary source of the earnings data is the publication *University* Career Outlook produced annually by the Canada Department of Manpower and Immigration (and in the earlier years by the Department of Labour), based on surveys of important employers across Canada. Intended for use primarily by CMC's and career counsellors, this source is the only available one containing annual time-series on starting salaries for university graduates.

In this study, the X's were calculated from a pair of earning/education profiles: one referring to university graduates in each of the 21 disciplines, each with a different growth path, and the other referring to employed High School graduates, all realizing uniform average earnings. The latter, in effect, represented the control group. Thus, the X's — i.e. the additional earnings due to university education — are extra life-time income that Canadian university graduates would realize as compared to High School graduates who obtained employment instead of proceeding to university. The data used in the calculation

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        [3]   Tax rates were computed from the following sources: For 1961: Department of National Revenue, *1963 Taxation Statistics,* Table 2, Queen's Printer and Controller of Stationary, Ottawa, 1963. For 1969: Department of National Revenue, Taxation Division, *Taxation Statistics, 1971 edition, Analyzing the Returns of Individuals for the 1969 Taxation Year and Miscellaneous Statistics,* Table 2, Ottawa, 1971. For 1972: Department of National Revenue, Taxation Division, *Taxation Statistics, 1974 edition, Analyzing the Returns of Individuals for the 1972 Taxation Year and Miscellaneous Statistics,* Table 2, Ottawa.

of these earnings/education profiles were taken from the 1961 and 1971 Censuses of Population.[4]

At this point, it is necessary to express a cautionary remark about the validity of X's as indicators of the economic value of university education. It may be observed that the X's are, in fact, more in the nature of quasi-rents associated with individual talents, I.Q. or other native traits rather than exclusively being the result of differences in educational attainments. Moreover, it may also be argued that, especially in the case of professional disciplines, observed earning differentials may actually reflect differences in the capability of professional associations to promote and maintain monopoly powers. These limitations, while obviously valid, apply with greater force to studies dealing with the question of whether or not additional investment in university education is socially justified (relative to some other public program) rather than in studies, such as the present one, concerned with the trend of economic returns on university education over time. Thus, in the earlier studies, where the focus of attention was the question of social under-investment, it was the common practice to attribute only a fraction of X's as being the proper consequence of university education.[5]

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[4]   The education/income profiles were constructed in two steps: (1) First year's income following university graduation (i.e., t_0+1) was calculated from *University Carrer Outlook* data over and above the employment income received by comparable groups of high-school graduates, as reported by the Census of Canada sources; (2) For subsequent years (i.e., t_0+2 up to the retirement age of 65) Census data were utilized. The 1961 education/income profiles were computed from the Census data as tabulated in J.R. PODOLUK, *Earnings and Education,* pp. 76-78, *op. cit.* The income figures are the average income from employment for the year ending May 31, 1961 in all occupations, realized by Canadian males with university degree or 4/5 years of high school education. The 1969 and 1972 profiles were computed from Statistics Canada, *1971 Census of Canada, Income of Individuals by Schooling, Age and Sex, for Canada and Provinces,* Catalogue No. 94-763, Vol. III, Part 6 (Bulletin 3.6-5), Table 10, July 1975, Ottawa. The income data in the latter source refers to average employment income received during the calendar year 1970 by Canadian males with university degree or grade 12/13 high school education. Since the Census sources present education/income profiles only according to multi-year intervals (10 in the case of 1961 and 5 in the case of 1971), annual growth (compound) rates were estimated by interpolation.

[5]   This was done in E.F. DENISON, *The Sources of Economic Growth in the United States and the Alternatives before Us,* Supplementary Paper No. 13, published by Committee for Economic Development, N.Y., 1962, who made an "explicit assumption that... three-fifths of the reported income differentials represent differences in income from work *due* to differences in education as distinguished from associated characteristics» p. 69. M. BLAUG, « An Economic Interpretation of the Private Demand for Education,» *Economica,* May 1966, p. 175, similarly assumed that «above one-third of the observed earnings differentials may be statistically due to differences in endowed ability, social class origins, and family environment.

Educational Costs

Yearly costs of university education, covering both foregone earnings and tuition fees, have been itemized for each academic year for the students graduating in the Spring of 1961, 1969, 1972 and 1974. These costs were calculated separately for Pass, Honour and Engineering students in order to take account of the differences in tuition costs. Tuition fees were calculated from the actual scales of fees in effect in the largest six Canadian universities.[6] Foregone earnings, are calculated from earnings of High School graduates who started work after graduation, using census data. Only 32 weeks were used in calculating foregone earnings in order to exclude summer earnings. Cost of books, bursaries and incidental expenses were excluded for lack data, as were living expenses which would have been incurred anyway.

One of the interesting points regarding Canadian university costs is the relative importance of tuition fees and foregone earnings. As can perhaps be expected. the foregone earnings are by far the largest component; they accounted for about 85% of total educational expenses in 1961, and a little higher in 1972. This, obviously, is a reflection of the inability of fees to rise as fast as other cost and wage factors in the Canadian economy, primarily as a result of political decisions.

One important policy implication of the relative significance of foregone earnings is the fact that accessibility of university education is primarily a function of loss of potential of earnings, and only secondarily of fees charged.[7] Thus, keeping fees deliberately down by governmental action, *per se,* would appear to be of relatively minor consequence. Students from high income family backgrounds are better able to withstand lost earnings for 3 or 4 years, while those from poorer income origins are less able to do so. In a system where student loans and grants based on some form of means test, setting fees at levels approximating user cost (i.e. average operating cost per student) might

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[6]   Tuition fees are from DBS, Cat. No. 81-520 (Occasional): *University Student Expenditures and Income,* 1960/1, Table 37, p. 38. Since no information for academic years prior to 1960/61 was available, the 1960/61 tuition fees were used. For 1969, 1971 and 1974, tuition fee data was obtained from Statistics Canada, Cat. No. 81-219 (Annual), *Tuition and Living Accommodation Costs at Canadian Universities,* on the basis of the average fees charged by the six largest Canadian Universities, Universities of Toronto, Montreal, McGill, Alberta, British Columbia and Sir George Williams.

[7]   For more supporting evidence on this, see J.F. CREAN, « Foregone Earnings and the Demand for Education: Some Empirical Evidence,» *Canadian Journal of Economics,* Vol. VI, No. 3, February 1973, pp. 23-42.

not be unduly burdensome[8] — assuming that time preference and fear of indebtedness are relatively equal among students of various socio-economic origins.

Internal Private Rates of Return

The internal rates of return, in private terms, for our set of 21 disciplines are presented in Table I for each of the three years. These results are for Canada as a whole; needless to say, it would be desirable to have a break-down by regional sub-markets, given the wide variation in labour market-conditions in the national economy. The major result which emerges is that the mean private rate of return improved during the period of relative economic expansion, 1961 — 1969, going up from 14% to 22%. During the period of relative economic decline, 1969 — 1972, it declined to 18%, which is still a very high yield rate.

Close study of Table I reveals some highly interesting trends in the economic return to Canadian undergraduate programs. First of all, looking at Unspecialised (pass or General) disciplines, it appears that their yield rates are relatively more susceptible to changing economic conditions than the more professional disciplines, such as engineering fields or honour courses. During the period of relative economic boom of 1961 — 1969, unspecialised disciplines registered some of the most impressive comparative gains, but conversely suffered heavily during the period of economic recession, 1969 — 1972, especially the Arts fields.

The severe decline in the economic return on Psychology over 1969 — 1972 (the sharpest single decline) is probably an indication of the rapid expansion of the so-called soft science disciplines.[9] These registered significant enrollment growths during the 1960's, especially of female students, who might be subject to sex discrimination in the labour market.

The engineering disciplines, as with most other professional studies, maintained relatively steady economic returns through the

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[8]   For an extensive discussion of this topic, see E.G. WEST, assisted by Michael MCKEE, *Student Loans: A Re-appraisal... with Special Reference to Ontario's and Canada's Changing Needs in Educational Finance,* Ontario Economic Council Working Paper No. 4/75, December 1975, Toronto, Ontario.

[9]   For a comparable American study, see L. FREEMAN, « Labor Market Adjustments in Psychology,» *American Psychologist,* Vol. 27, May 1972, pp. 384-93, which forecasts serious surplus of graduate psychologists in the late 1970-s and 1980's owing, among other factors, to a large increase in female enrollments in psychology programmes.

TABLE I

**Private Internal Rates of Return on Canadian
Undergraduate University Education in 1961, 1969, and 1972 By Discipline**

Discipline	1961	1969	1972
Arts			
Unspecialised (Gen. or Pass)	.13	.22	.16
Economics (Hons.)	.11	.20	.15
Psychology (Hons.)	.12	.18	.11
Science			
Unspecialised (Gen. or Pass)	.13	.25	.19
Biological Science (Hons.)	.12	.22	.14
Chemistry (Hons.)	.14	.22	.20
Geology (Hons.)	.17	.25	.20
Physics (Hons.)	.15	.22	.16
Math (Hons.)	.12	.22	.18
Engineering			
Chemical	.15	.22	.16
Civil	.15	.22	.18
Electrical	.15	.22	.18
Mechanical	.15	.22	.22
Metallurgical	.16	.21	.20
Mining	.19	.24	.22
Other			
Agriculture	.14	.20	.15
Forestry	.13	.23	.22
Social Work	.10	.15	.21
Library Science	.11	.21	.19
Pharmacy	.19	.28	.25
Commerce and Business Admin.	.15	.20	.16
Mean for Pass Degree	.130	.235	.175
Mean for Hons. Degree	.142	.221	.183
Mean for Engineering	.158	.225	.193
Mean for all disciplines (n=21)	.141	.223	.182

entire period, gaining significantly during the economic expansion of 1961 — 1969 and losing moderately during the recession since 1969.

There is only one discipline (viz. social work) which provided the exception to the general decline of the yield rates during 1969 — 1972. Its internal rate of return went continuously up from 10% in 1961 to 15% in 1969 and to an impressive 21% in 1972. Most likely this was due to continued growth of public welfare programs through to 1972.

Of our sample of 21 disciplines, Pharmacy and Mining Engineering had the highest rate of return in 1961 with an equal 19%. But while the yield rate for Mining Engineering rose to 24% by 1969, that of Phar-

macy was still in the leading position, with 25% in 1972, followed with 22% by Mining Engineering, Mechanical Engineering and Forestry.

The performance of Economics was below the average for honour disciplines. Its yield rate in 1961 was 11%, rose to 20% in 1969 and declined to 15% in 1972.

Other evidence on internal rates of return estimates are unfortunately not available except for 1961. Therefore, it is not possible to compare our results with other Canadian studies. The 1961 study by J. R. Podoluk[10], which was extensively utilized by the Economic Council of Canada in its 1965 Annual Review which called for large-scale expansion of educational expenditures, estimated an overall rate of return of 19.7% for male Canadian university graduates. Our mean estimate of 22% is reasonably consistent with Podoluk's.

In view of lack of Canadian data for later years, it may be instructive to compare our findings with those obtained in the U.S.A. In a recent study[11], Richard Freeman estimated the private internal rates of return on U.S. undergraduate college education for the years 1959, 1969, 1972 and 1974 as 11.0%, 11.5%, 10.5% and 8.5%, respectively. His figures indicate a rising economic return over 1959 — 1969 followed by a sharp decline which appears to have persisted during 1972 — 1974, presumably reflecting greater recession in the U.S.A. in those years. The fact that the American rates of return tend to be significantly less than the Canadian ones would suggest differences in the stocks of high-level manpower as well as dissimilar competitive forces in the college labour markets of the two countries.

In order to analyse the significance and implications of the internal rates of return presented in Table I, it is necessary to probe further into the changes in educational costs and starting salaries of graduates during 1961 — 1972. The period 1961 — 1969 was one of relative economic expansion. GNP in current prices grew at an annual rate of 12.5% (or 7.5% in constant prices). On the other hand, the period 1969 — 1972 was one of relative economic recession with an average annual growth of GNP of 9.9% in current prices (or 4.8% in constant prices).

During the period of relative economic expansion, educational costs at the university level increased by a little over 50%, with tuition fees rising by about 30% and the foregone earnings approximately by double that figure. On an annual average basis, the increase in total

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    [10] Op. cit.
    [11] R.B. FREEMAN, « Overinvestment in College Education, » Journal of Human Resources, Vol. X, No. 3, 1975, pp. 287-311.

education cost was about 6.5%. During the period of relative economic recession, education costs rose at an annual rate of about 5.5% with practically all of this increase owing to foregone earnings. The university fees stayed practically unchanged during 1969 — 1972.

Turning to the movement of starting salaries for graduates, we observe from Table II that during 1961-1969 all disciplines registered significant annual percentage increases, both in nominal money terms as well as in real earnings. If we compare these changes with the change in the earnings of the Canadian industrial composite[12], we notice that in only three disciplines (vis. Metallurgical Engineering, Mining engineering, and Commerce and Business Administration) were the annual percentage increases in starting salaries less than the increase in the wage-rate of the industrial composite. That is, the starting salaries of university graduates increased more rapidly than did the earnings of average industrial workers.

The picture during 1969 — 1972 was in sharp contrast to the earlier period. During this period, only one single discipline (viz. social work) had an annual increase in starting salaries that exceeded the increase in the weekly rate of the industrial composite. In fact, out of our sample of 21 disciplines, only eight registered any positive gain in real salaries; each of the remaining 13 disciplines suffered declining real salaries, in some cases, quite substantial, but generally of about 1% per annum. The period 1969 — 1972 was certainly one during which the earnings differentials between university-trained manpower and other manpower categories significantly narrowed down.

The sharp declines in the yield rates on Canadian undergraduate programs during 1969-1972 were closely related to fundamental changes in the economy at large. However, this was also a period of substantial growth in university enrollments and graduations. Thus, undergraduate enrollments more than doubled during 1961 — 1962 to 1971 — 1972 from 121,000 to 267,000, while bachelor graduations over the same period more than tripled rising from 23,000 to 73,000. These figures reflect substantial expansions in university and post-secondary education facilities in Canada during the 1960's. Therefore, it is necessary to determine the relative significance of supply and demand factors in the Canadian labour market for university manpower. This is the purpose of the next part of this paper.

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[12] Based on Statistics Canada, *Employment, Earnings and Hours,* Catalogue No. 72-001 (Annual) and Catalogue No. 72-002 (Monthly).

TABLE 2

Average Annual Changes in the Starting Salaries of
University Graduates, 1961-69 and 1969-72

Discipline	1961-69 Period of Relative Economic Expansion		1969-72 Period of Relative Economic Recession	
	Annual % Change in Salaries	Annual % Change Minus Change in CPI	Annual % Change in Salaries	Annual % Change Minus Change in CPI
	(1)	(2)	(3)	(4)
Arts				
Unspecialized (Gen. or Pass)	6.7	+3.5	2.5	−1.3
Economics (Hons.)	6.9	+3.7	2.6	−1.4
Psychology (Hons.)	6.1	+2.9	0.3	−3.5
Science				
Unspecialized (Gen. or Pass)	7.8	+4.6	3.3	−0.5
Biological Sciences (Hons.)	7.5	+4.3	0.7	−3.1
Chemistry (4 Hons.)	6.4	+3.2	5.7	+1.9
Geology (Hons.)	6.1	+2.9	3.0	−0.8
Physics (Hons.)	5.9	+2.7	2.7	−1.1
Math (Hons.)	7.8	+4.6	4.0	+0.2
Engineering				
Chemical (Hons.)	6.0	+2.8	1.3	−2.5
Civil (Hons.)	6.4	+3.2	3.3	−0.5
Electrical (Hons.)	6.5	+3.5	3.3	−0.5
Mechanical (Hons.)	6.0	+2.8	6.0	+2.2
Metallurgical (Hons.)	5.5	+2.3	5.3	+1.5
Mining (Hons.)	5.0	+1.8	4.0	+0.2
Other				
Agriculture (Hons.)	6.0	+2.8	3.0	−0.8
Forestry (Hons.)	7.0	+3.8	8.0	+4.2
Social Work (Hons.)	5.6	+2.4	12.0	+8.2
Library Science (Hons.)	7.4	+4.2	3.0	−0.8
Pharmacy (Hons.)	7.1	+3.9	4.0	+0.2
Comm. and Business Admin. (Hons.)	5.4	+2.2	3.0	−0.08
Changes in Weekly Wage-rate of the Industrial Composite, Canada (Unadjusted)	5.9	2.7	10.4	+6.6

Sources: Cols. (1) and (3) are from *University Career Outlook* data; Cols. (2) and (4) are
from *Canada Yearbook* for 1974, Statistics Canada, Table 21-15, p. 817.

SALARY DETERMINATION FOR CANADIAN UNIVERSITY GRADUATES,
1971 TO 1972

A multiple regression model was constructed in order to calculate
the coefficients of the supply and demand determinants of changes in
salary offers for the holders of Canadian bachelor degrees during the
period 1961 — 1972. In view of the fact that the market for graduates
of professional disciplines would be expected to be substantially dif-
ferent as compared to the market for graduates of relatively more
general disciplines, it was decided to construct two regression models,
one for engineers comprising all six specific disciplines in this field,
and a second one for the combined nine specific disciplines in arts and
sciences. The general format of the regression equation used is:

$$X_1 = a + b_2 X_2 + b_3 X_3 + b_4 X_4$$

where:

X_1 is the percentage annual change in starting salaries;

X_2 is the percentage annual change in GNP in current prices;

X_3 is the percentage annual change in the number of graduates
    joining the labour market.

For the arts and science graduates, an additional independent variable,
X_4, is employed and it is the percentage annual change in the number
of graduates of non-university post-secondary institutions. This was
done in order to test the existence and order of magnitude of substitu-
tion between university graduates with general degrees and graduates
of non-university post-secondary institutions. In addition, various tests
with time-lags were carried out to examine the type of adjustment pro-
cess in the Canadian college-trained manpower. Our results are sum-
marized in Table III, where the superscripts t, and t-1 of the independent
variables refer to current year and the past year respectively. The num-
bers in the brackets under the estimated regression coefficients are the
calculated t-values at the relevant degrees of freedom.

The Market for Graduate Engineers

Equations (1) and (2), presented in Table III, show that the most
important impact on percentage changes in salary offers to graduate
engineers originated from the demand side of the market, as reflected
by movements in the level of GNP in current prices. When current
period's regression is considered (i.e. eq. 1), we observe that a 1% rise
in the level of GNP causes a 0.92% rise in starting salary offers to
graduate engineers. But when the supply of engineering graduates one
year ago is substituted, as in X_3 in eq. 2, then there is a uniform pro-
portionate rise in salary offers and variations in GNP. On the supply

TABLE 3

**Salary Determination for Canadian University Graduates with
Bachelor Degrees. 1961-1972, by Discipline**

Equation No.	Constant	Annual % Change in GNP in Current Prices		Annual % Change in Graduation	R^2	D.W.+
Engineers						
1	-2.8	$+0.92\ X_2^t$ (5.3204) a		$-0.01\ X_3^t$ (0.2479)	0.78 (3.7580) a	1.40
2	-3.2	$+1.00\ X_2^t$ (8.7353) a		$-0.11\ X_3^{t-1}$ (5.2913) a	0.94 (7.2219) a	2.20
Arts and Science						
3	-14.2	$+2.27\ X_2^t$ (3.6112) a	$-0.07\ X_3^{t-1}$ (0.6317)		0.64 (2.5148) b	2.52
4	-4.8	$+2.25\ X_2^t$ (5.5063) a	$-0.09\ X_3^{t-1}$ (1.0972)	$-0.33\ X_4^t$ (3.3105) b	0.87 (3.6551) b	0.94

Number in brackets are t values. a = significant at 0.01; b = significant at 0.05

* LF = Labour Force

** NUPS = Non University Post Secondary Institutions.

+ At 1% level, the critical minimum and maximum values for the D-W test (at 10 degrees of freedom) are: 0.83 and 3.61 respectively, which indicate no significant auto-correlation in our regressions.

side, we observe that while the coefficients have the expected sign the magnitude is surprisingly small. In eq. 1, it is barely above zero. In eq. 2, it is 0.11, which while significant at 1% confidence level, is only one-tenth of the coefficient of X_2. In both equations, the coefficient of determination is quite high and there is no significant auto-correlation. Clearly, the dominant determinant of changes in starting salary offers for graduate engineers during 1961 — 1972 was on the demand side of the market, the change in supply playing relatively a small role, and even then it manifested itself rather slowly. This means that employers of graduate engineers determined salary offers first and foremost with reference to business prospects and overall economic conditions, and, to a much lesser degree, by taking into account last year's supply of graduates from the engineering schools. They apparently did not take expected supply into their calculations.

The type of salary determination in the Canadian market for graduate engineers appears to be substantially different relative to the U.S.A. market for college engineers, as reported by R. Freeman.[13] He found significant correlation between current period's supply of college engineers and variations in salary offers. The simple correlation coefficients fell sharply when lagged regressions were employed. This clearly indicates that the American market for college engineers is much more sensitive to supply changes, and may suggest that it is also more competitively organized, than the Canadian counterpart.

The Market for B.A.-B.Sc. Graduates

A major difference between the engineers' market and the one for B.A.-B.Sc. graduates during the period under review is the fact that in the latter there were significant withdrawals (e.g. entrants into the graduate school, teachers' training colleges, female graduates becoming housewives) from the number of graduates. As a result, it is necessary to refine the gross graduation numbers by excluding withdrawals in an attempt at estimating the graduates joining the labour force. These adjustments to the gross graduation numbers could only be performed indirectly as the Canadian education statistics do not have actual numbers of students entering graduate school; only yearly enrollments in graduate schools are available.[14] Similarly, only enrollments in tea-

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[13]   *The Market for College-Trained Manpower,* Harvard University Press, Cambridge 1971, Chapter 4.

[14]   Source: Table 35, p. 151, *Education in Canada, A Statistical Review, 1960/1 to 1970/1,* Statistics Canada, Catalogue No. 81-229 (Occasional). The figure for 1971/2 was taken from Table 1, *Service Bulletin,* Statistics Canada, Vol. I, No. 8, October 1972.

cher's training colleges are published.[15] Indirect estimates of annual in-
takes were computed as the difference between enrollments at year
t minus enrollments at year t-1. Even after these adjustments were
done, no satisfactory regression between current year's graduate job-
seekers and current year's salary offers (relative to the last years')
could be obtained. However, bearing in mind the slowness of the salary
determination in the market for graduate engineers, it was decided to
run a regression with a one-year lag. The result is eq. 3, showing the
expected negative sign for the coefficient of X_3 together with a positi-
ve and far more impactful GNP coefficient. As with the engineering
market, this result indicates that the market for Canadian B.A.-B.Sc.
graduates during 1961 — 1972 was substantially influenced by demand
factors, as reflected by GNP.

In order to test for existence of substitution between B.A.-B.Sc.
graduates and alternative types of manpower, it was decided to include
a fourth independent variable, X_4, which refers to the graduates of non-
university post-secondary institutions.[16] The regression results shown
in eq. 4, showed a suprisingly high and significant degree of negative
relationship between X_4 and X_1. Thus, a 1% increase in the supply of
graduates of non-university post-secondary institutions lead to a 0.33%
decrease in the starting salaries offered to B.A.-B.Sc. graduates. Clearly
this suggests important substitution of the relatively cheaper manpower
category for the more general university graduate. It will also be noticed
that the coefficient of determination rises from 0.64 in eq. 3 to 0.87 in
eq. 4. An attempt to test for the existence of substitution between
B.A.-B.Sc. graduates and newly arriving qualified immigrants did not
reveal the expected inverse relationship presumably because the flow
of immigrants into Canada tends to be highly pro-cyclical.

IMPLICATIONS OF FINDINGS

There are three principal implications emerging from the present
empirical analysis. The first is that demand factors, or more specifically
changes in the level of Canadian GNP, were far more important than
increased supply of university graduates entering the employment
market, in explaining the dramatic shifts in the Canadian college labour

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[15]   Source: *Education in Canada, op. cit.,* Table 39, pp. 156-7. Figures for 1971/2
are taken from *Canada Yearbook 1974,* p. 294.

[16]   Data taken from Table 2 of *Preliminary Statistics of Education,* Statistics
Canada, Catalogue No. 81-201 (Annual). As there is no figure for 1968, it was estimated
by interpolation.

market during 1961 — 1972. Thus, if the economic expansion of the 1960's has persisted into the 1970's it is virtually certain, according to our results, that the additional university graduates would have been absorbed in employment with little difficulty. In this sense, the popular editorial argument of « over-production » in the Canadian universities since 1969 must be regarded as a deficiency of aggregate demand linked to the overall economic recession of the early 1970's.

Secondly, our results indicate that a further reason for the relative decline in the yield rate on a number of university courses of study since 1969 was the emergence of significant substitution possibilities for the employers of University graduates. There was, during this period, increased supply of alternative manpower from junior or community colleges; the existence of this type of manpower substitution, especially for the more general university graduates, could be explained either in terms of differences in renumeration rates or the preference of employers for the more vocational-oriented junior college graduates. Emerging at a time of overall economic slow-down, this manpower substitution during 1969 — 1972 must have contributed to an increasingly tight college labour market, adding to the general public fear of an « over-production » of manpower in the Canadian universities.

The third principal implication of our results is that, despite a significant general decline in the yield rates on our sample of 21 university courses of study during 1969 — 1972, the economic returns (in private terms) remain at attractively high levels. The 1972 average yield rate was an impressive 18%. Therefore, investment in a Canadian university (undergraduate) degree was, even in the recession year of 1972, a rational and highly profitable decision for a private human capital investor, both relative to alternative investment opportunities (such as in long-term government securities or bonds) and in comparison with the average yield rate of 14% in 1961. Consequently, our results suggest that, in private terms, there was no over-investment in Canadian universities during 1961 — 1972.[17]

Finally, it must be noted that the implications of the present paper for university planning and policy-making are limited by the nature of its underlying methodology and the type of statistical data utilized. For

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[17] It must, however, be realized that this result is strictly applicable to *employed* graduates, and does not take into account the fact that some graduates may experience a duration of unemployment or loss of income, which would reduce their realized rate of return. This matter is of especial importance in studies aimed at computing the *social* rate of return on higher education, since unemployed university graduates represent social waste.

policy evaluation purposes, one needs to calculate *social* rates of return. The latter would be less than private rates of return if the cost of public support of university education exceeded the social benefits generated by universities. This is an empirical issue requiring the identification and measurement of social (or estimal) benefits and costs of university education — a virtually impossible task[18]. It is for this reason that no attempt was made in this study to estimate the social rates of return of Canadian university education in order to determine whether or not there was public over-investment during 1961-1972. While this question cannot be settled on the basis of the present findings, nevertheless our analysis throws some light on a related policy problem. This is the fact that the market for university-trained manpower has its own adjustment process, manifesting a timelag associate with the educational gestation period, and that, moreover, the level of manpower utilization in the college market is predominantly determined by the dynamic factors working in the Canadian economy at large. For these reasons, any attempt by policy-makers to attempt to 'manipulate' the scale of university education through massive budgetary interventions, whether expansionary or contractionary, may not have the desired effect. Certainly, reliance on simplistic manpower forecasting methods in university planning and policy formulation is hardly consistent with a rational approach in a dynamic economy.

Le rendement économique des diverses disciplines dans les universités canadiennes de 1961 à 1972

Dans cet article, l'auteur tente d'évaluer le taux de rendement de 21 disciplines scolaires dans les universités canadiennes.

Certaines études ont été faites sur le sujet dans le passé, mais elles avaient une portée générale. Ce que l'auteur cherche à cerner ici, c'est l'écart qui peut exister d'une discipline à une autre.

À cette fin, il a divisé son étude en trois parties. Dans une première partie, il évalue le rendement pécuniaire que peut rapporter au diplômé son travail dans une discipline donnée compte tenu des investissements qu'il a dû engager. Pour y arriver, il se place à trois moments différents: 1961, date du point de départ du mouvement d'investissements dans les études universitaires; 1969, date qui marque le sommet d'une expansion sans précédent dans la course au « haut savoir »; 1972, finalement, début d'une période de régression économique susceptible d'influer sur les taux de rendement futurs.

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[18] See the West study cited, especially Chapters 3 and 4.

Les données obtenues indiquent les taux de rendement qu'un diplômé d'une discipline donnée peut espérer réaliser au cours de sa carrière, s'il persévère dans la profession qu'il a choisie.

La deuxième partie, qui présente un modèle simple de détermination des salaires sur les marchés du travail au Canada, veut aider à évaluer les conséquences de l'offre et de la demande d'emploi sur la détermination des salaires des diplômés débutants entre 1961 et 1972, ce qui permet de voir s'il y a ou non «surproduction» de diplômés suivant les disciplines.

Dans la troisième partie, l'auteur fait ressortir les principales observations qu'il a faites ainsi que leurs implications pour l'avenir.

Relativement à la première partie de l'étude, l'auteur note d'abord que très peu d'études ont été faites sur le taux de rendement des études universitaires depuis 1960 et aucune en ce qui concerne une discipline déterminée. Si la formation universitaire constitue une forme d'investissement dans l'acquisition d'un diplôme on peut la comparer à l'investissement d'un capital dans une entreprise. Au départ d'un pareil calcul, il faut considérer un facteur risque qui réside dans la possibilité d'accéder au diplôme convoité. S'y ajoutent certaines hypothèses qui entrent en ligne de compte: l'entrée à l'université commence à 18 ans, le coût de la scolarité s'établit à la fin de chaque année d'étude: les gains obtenus après le diplôme sont calculés à la fin de chaque année.

L'auteur établit le coût des études universitaires de la façon suivante: les frais de scolarité, ce que le sujet aurait vraisemblablement gagné s'il était entré sur le marché du travail à la fin de son cours secondaire, les dépenses relatives à l'achat de livres, les bourses qu'il a pu obtenir et certaines dépenses incidentes qu'il est difficile d'apprécier. Au sujet des revenus qu'il a ainsi perdus, l'auteur signale spécialement leur importance: celles-ci équivalaient à 85 pour cent des dépenses en 1961 et elles étaient un peu moins élevées en 1972. D'où il résulte que la principale dépense qu'il faille attribuer à la formation universitaire consiste dans la perte de gains.

Quant au rendement des capitaux ainsi engagés, l'auteur l'a estimé à 14 pour cent en 1961. Il a grimpé jusqu'à 22 pour cent en 1972. À ce propos, quand l'on veut comparer les fluctuations entre les taux de rendement des différentes disciplines, il faut étudier attentivement le tableau no 1; ce tableau est ensuite analysé dans les pages suivantes de l'article. Les taux de rendement comparés à ceux qui existent aux États-Unis apparaissent relativement plus élevés.

L'auteur note aussi que, de 1961 à 1972, le coût de la formation universitaire s'est accrue en moyenne de 6.5 pour cent par année.

En ce qui touche le taux de départ des traitements des diplômés, le tableau 2 démontre que, de 1961 à 1969, toutes les disciplines ont connu des augmentations, non seulement en dollars courants, mais aussi en dollars constants. Dans toutes les disciplines, sauf trois, cette augmentation a étéplus marquée que dans le cas des majorations de salaire en général. Depuis 1969, cependant, la situation s'est inversée. Pendant cette période (1969-1972), une seule discipline, celle du travailleur social, a connu des taux de salaire de départ qui dépassait l'augmentation des salaires en général.

De fait, sur les 21 disciplines, huit seulement ont connu des gains dans les taux de salaires réels. Les salaires réels ont diminué dans le cas des 13 autres, pour certaines d'une façon substantielle, mais en moyenne de 1 pour cent par année.

L'auteur attribue cet état de choses aux changements survenus dans l'économie d'abord, mais il ne peut s'empêcher de noter en même temps que pendant cette pério-

de le nombre des inscriptions a doublé dans les six universités qui ont fait le sujet de son étude, ce qui l'amène à penser que le déclin peut s'expliquer aussi par un accroissement de l'offre par rapport à la demande. L'auteur analyse ensuite la situation du marché du travail selon qu'il s'agit des disciplines professionnelles et des diplômes de formation générale.

De cette étude, il tire finalement trois conclusions. Premièrement, si les conditions économiques générales de la décennie 1960 avaient persisté, le marché aurait sans doute absorbé les diplômés. La deuxième conclusion à laquelle en arrive l'auteur, c'est qu'il s'est créé une espèce de marché de substitution en provenance des collèges d'enseignement professionnel. La troisième conclusion, c'est que, malgré un déclin depuis 1969, le taux de rendement, qui se situait en 1972 à 18 pour cent par rapport à 22 pour cent en 1969, demeure encore très attrayant.