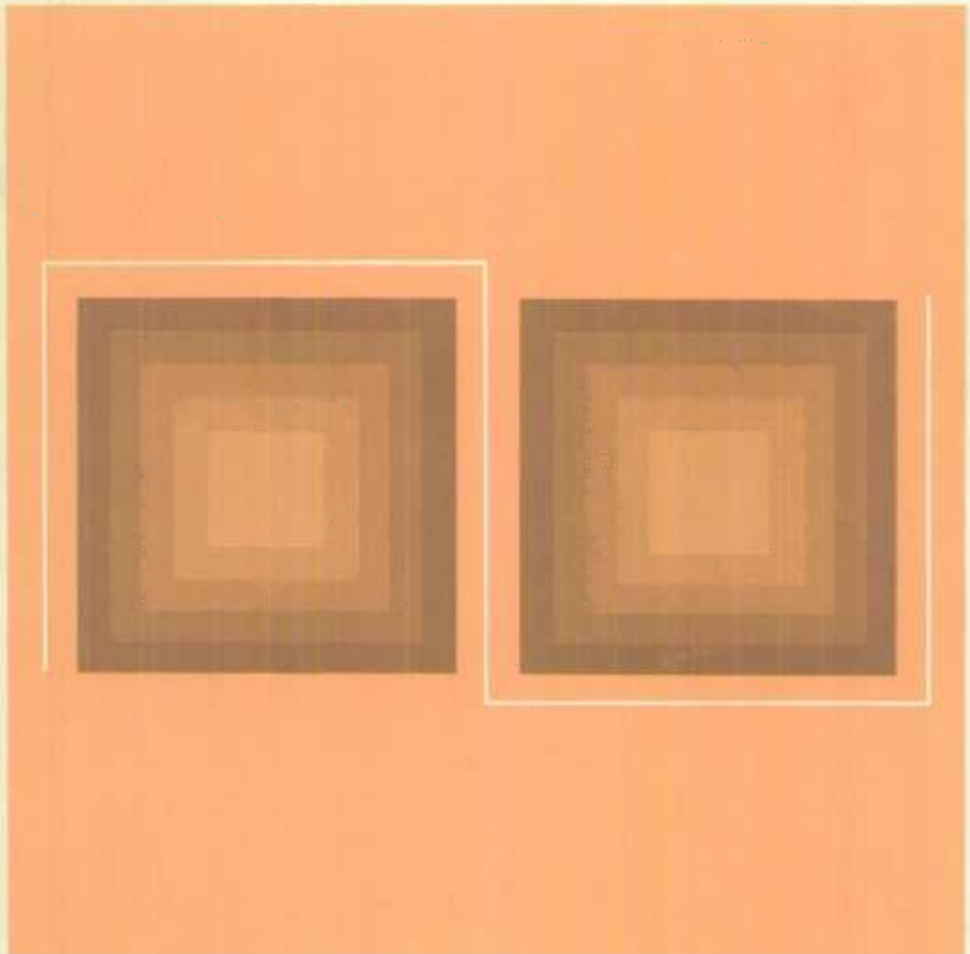
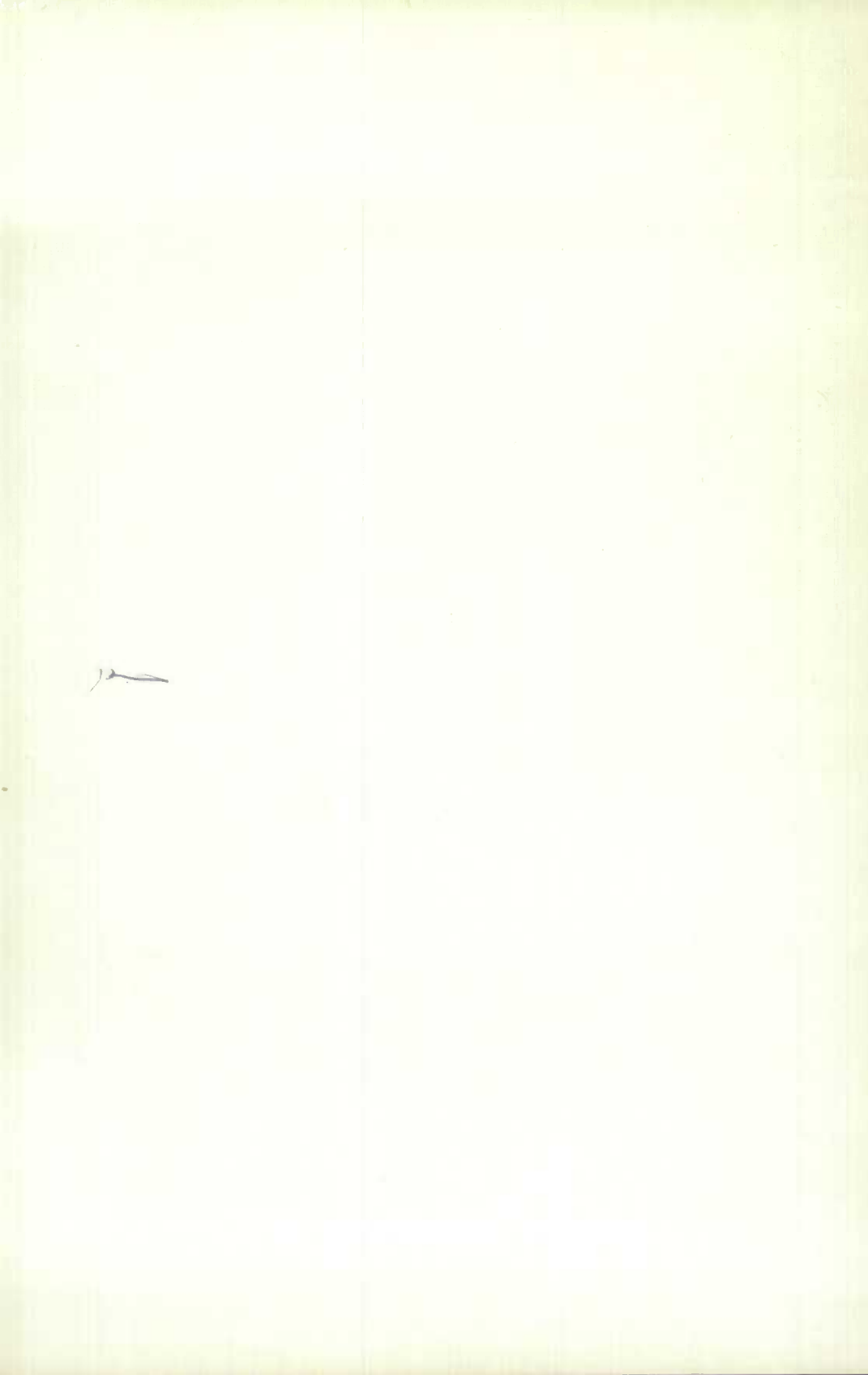


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# Economic returns to education in Canada





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# ECONOMIC RETURNS TO EDUCATION IN CANADA

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## FOREWORD

Statistics Canada supports, carries out, and publishes studies which contribute to the public knowledge and understanding of socio-economic issues.

This study is concerned with the economic returns to education in Canada and was undertaken by Professor R.A. Holmes of the Department of Economics and Commerce, Simon Fraser University while he was under a research contract with Statistics Canada, in 1970-71.

Although the study has been supported and published by Statistics Canada, responsibility for the analyses and conclusions is that of the author.

SYLVIA OSTRY,  
*Chief Statistician of Canada.*



## PREFACE

Regular measurement of the economic returns to education is important, not only because a large amount of public money is involved, but also because the returns are changing as rapidly as changes in the amount and kind of education acquired by the Canadian working force. This study represents only a beginning on a part of the information required by policy-makers to ensure continuously optimal allocation of public money to the various levels and kinds of education in Canada. However, it is a beginning that has required much assistance for which the author is very grateful. The late Mr. Paul Conway and Miss Ruth Simonton of the Current Economic Analysis Division ran all the regressions. Since the author did not have direct access to the basic data, this study could not have been carried out without their assistance. Constructive comments have also been received from others at Statistics Canada, particularly Dr. Nicholas Skoulas, as well as from colleagues in the Department of Economics and Commerce at Simon Fraser University. In addition to the support received from Statistics Canada, financial assistance was provided by The Canada Council.

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## INTRODUCTION

The purpose of this study is to utilize the micro-economic data of the Survey of Consumer Finances<sup>1</sup> to measure the social economic returns to education in Canada more accurately than has been previously done. Most studies have estimated the returns to education from average incomes by education class without adjusting for the effects on income of other relevant characteristics such as occupation, age or region. This can introduce error since these other variables may be related to education, and if adjustment is not explicitly made, their effects on income may be incorrectly attributed to education. Moreover, if these other relevant variables are simply included along with education as independent variables in a regression model, multicollinearity problems are likely to prevent reliable estimation of their separate effects on income. These various sources of error are avoided in this study by employing micro-economic data in regression analyses carried out within education classes and including as independent variables, characteristics other than education which are related to income. This approach enables us to derive, by education class, average age-income profiles whose differences reflect both direct and indirect effects of education on income, but which are adjusted for the influence on income of relevant independent variables other than education.

Table 1 shows the distribution by sex and education level of the sample data analyzed for 1967. Altogether, 50,076 persons are included in the study, 23,065 being male and 27,011 female. Some differences exist in the education levels attained by males and females. A larger proportion of males obtain both very low and very high levels of education. Some 43% of males as compared to 37% of

<sup>1</sup> The Survey of Consumer Finances is conducted by the Consumer Income and Expenditure Division of Statistics Canada and is based on the same sample as the Labour Force Survey.

**TABLE 1. Distribution of Respondents to the 1967 Survey of  
Consumer Finances by Sex and Education**

Education level	Male		Female	
	Number	Per cent	Number	Per cent
No education . . . . .	366	1.6	346	1.3
Some elementary . . . . .	4,966	21.5	4,851	18.0
Elementary . . . . .	4,530	19.6	4,807	17.8
Some high school . . . . .	7,035	30.5	8,571	31.7
High school . . . . .	3,743	16.2	6,402	23.7
Some university . . . . .	1,136	4.9	1,318	4.9
University . . . . .	1,289	5.6	716	2.7
<b>Totals . . . . .</b>	<b>23,065</b>	<b>100.0</b>	<b>27,011</b>	<b>100.0</b>

females have only elementary school education or lower, while 6% of males but only 3% of females obtain one or more university degrees. A larger percentage of females, on the other hand, have high school education (24% vs. 16%). Perhaps the most disconcerting information provided by Table 1 is the large number of people in the sample in 1967 with very limited education. The fact that about 40% of the sample had no high school education is not comforting information in a period of rapid technological change requiring many persons to adapt to new job situations and to retrain themselves for alternative kinds of employment.<sup>2</sup>

Table 2 shows the numbers and percentages of the 1967 sample who did not work in the survey year. This table clearly reveals that the proportion of both males and females who did not work is highly and negatively correlated with education level. With males, the proportion who did not work declines from 59% with no education to 5% with one or more university degrees. The corresponding decline for females is from 90% to 42%. With both groups, the proportion who did not work is substantially higher for education levels below some high school than for higher levels of education, and for any given level of education the proportion who did not work is substantially higher for females than for males.

<sup>2</sup> This estimate may be somewhat biased as the sample overrepresents the Atlantic and Prairie regions and underrepresents Quebec and Ontario.

**TABLE 2. Work Status by Sex and Education Level for Respondents to the 1967 Survey of Consumer Finances**

Sex and education level	Worked <sup>1</sup>		Did not work		Total
	Number	Per cent	Number	Per cent	Number
<b>Male:</b>					
No education . . . . .	150	41	216	59	366
Some elementary . . . . .	3,574	72	1,392	28	4,966
Elementary . . . . .	3,806	84	724	16	4,530
Some high school . . . . .	6,387	91	648	9	7,035
High school . . . . .	3,481	93	262	7	3,743
Some university . . . . .	1,031	91	105	9	1,136
University . . . . .	1,223	95	66	5	1,289
<b>Totals . . . . .</b>	<b>19,652</b>	<b>85</b>	<b>3,413</b>	<b>15</b>	<b>23,065</b>
<b>Female:</b>					
No education . . . . .	36	10	310	90	346
Some elementary . . . . .	1,003	21	3,848	79	4,851
Elementary . . . . .	1,357	28	3,450	72	4,807
Some high school . . . . .	3,577	42	4,994	58	8,571
High school . . . . .	3,215	50	3,187	50	6,402
Some university . . . . .	764	58	554	42	1,318
University . . . . .	415	58	301	42	716
<b>Totals . . . . .</b>	<b>10,367</b>	<b>38</b>	<b>16,644</b>	<b>62</b>	<b>27,011</b>

<sup>1</sup> Part-time or full-time work.

### THE MODEL

Our regression model is fitted separately for males and females in each of 7 education classes (no education, some elementary, elementary, some high school, high school, some university, and university). Thus, we obtain 14 regression equations with earnings as the dependent variable and in which we employ the following independent variables:

- (1) age;
- (2) weeks worked;
- (3) region (Ontario, Atlantic, Quebec, Prairies, British Columbia);
- (4) residence (metropolitan, other city, urban, rural);
- (5) immigration status (unknown, landed before 1945, landed 1946-64, landed 1965 or later, born in Canada);
- (6) class of worker (paid worker, self-employed non-farm, self-employed farm, unpaid family worker);
- (7) marital status (married, single, other);
- (8) occupation (service and recreation, professional and technical, clerical, sales, managerial, transportation and communication, farmers and farm workers, loggers and fishermen, miners, craftsmen and related labourers);
- (9) nature of work (full time, part time).

These variables are transformed in our model to obtain constant terms which are equal to the overall average earnings for the given education-sex class, and dummy variable coefficients which are earnings differentials from the overall average. In addition, persons who did not work must be excluded from the regression because this category is included in more than one of the sets of dummy variables. The "did not work" group is a separate category in class of worker, occupation, and nature of work so that to have included this group of people would have produced perfectly collinear independent variables in the model. Consequently, the "did not work" group is excluded from the regressions and the influence of this group on the analysis is considered following discussion of the regression results.

Our regression equation for each sex-education class in 1967 is given by:

$$(1) Y_i = \beta_1 + \beta_2 a_i + \beta_3 (a_i^*)^2 + \beta_4 w_i + \sum_{j=1}^k \sum_{r=1}^s \beta_{rj} X_{rji} + u_i$$

where:

$Y_i$  = earnings of the  $i^{\text{th}}$  individual

$a_i$  = age of the  $i^{\text{th}}$  individual

$a_i = (A_i - \bar{A})$  = deviation of the  $i^{\text{th}}$  individual's age from the mean age

$(a_i^*)^2 = (A_i^2 - \bar{A}_i^2)$  Note that  $\bar{A}_i^2$  is the mean of the  $A_i^2$  not the square of

$\bar{A}$  (i.e.  $(a_i^*)^2 \neq a_i^2$ )

$W_i$  = weeks worked by the  $i^{\text{th}}$  individual

$w_i = (W_i - \bar{W})$  = deviation of weeks worked by the  $i^{\text{th}}$  individual from the mean

$X_{rji}$  = value of the  $r^{\text{th}}$  dummy variable (one or zero) in the  $j^{\text{th}}$  set of dummy variables for the  $i^{\text{th}}$  individual

$s_j$  = number of dummy variables in the  $j^{\text{th}}$  set of dummy variables ( $s_1 = 5, s_2 = 4, s_3 = 5, s_4 = 4, s_5 = 3, s_6 = 11, s_7 = 2$ )

$n$  = number of observations in the given sex-education class (ranges from 36 to 6,387 - see Table 1)

$k = 7$  (number of sets of dummy variables)

$u_i$  = disturbance term.

Our dependent variable "earnings" includes wages and salaries before deductions and net income (i.e., gross income less operating expenses) from non-farm and farm self-employment. The dependent variable in each of the 14 education-sex classes is taken to be a quadratic function of age, a linear function of weeks worked, and step functions of the dummy variables reflecting the various other characteristics previously described (region, residence, immigration status, class of worker, marital status, occupation, and nature of work).

The regressions are run by excluding one dummy variable from each set (to avoid singularity of the  $X'X$  matrix) and subsequently reintroducing the excluded dummies so that the weighted average of the coefficients for each set of dummy variables is equal to zero. The weights are the number of observations on each of the dummy variables in the set, and the adjustments made are offset in the equation by appropriate adjustments to the constant terms. In addition, the age and weeks worked variables are taken as deviations from their means. These transformations of both the dummy and the other variables provide ease of interpretation. The transformations imply that:

$$(2) \sum_{r=1}^{s_j} P_{rj} \beta_{rj} = 0 \text{ for all } j \text{ where:}$$

$P_{rj}$  = the proportion of observations on the  $r^{\text{th}}$  dummy variable in the  $j^{\text{th}}$  set

$$(3) \sum_{i=1}^n a_i = \sum_{i=1}^n (a_i^*)^2 = \sum_{i=1}^n w_i = 0$$

As a result, a regression coefficient  $\beta_{rj}$  in equation (1) will be the earnings differential for the  $r^{\text{th}}$  dummy variable in the  $j^{\text{th}}$  set of dummy variables from the overall average earnings for the given education-sex class,<sup>3</sup> and the constant term

<sup>3</sup> Morgan, James N., *A Note on the Interpretation of Multiple Regression Using Dummy Variables*. (University of Michigan, 1964.)

in each regression will be equal to the overall mean income of the group analyzed.<sup>4</sup>

Our primary interest, however, is in average age-earnings profiles which are obtained from the regression equations by substituting average weeks worked  $\bar{W}$  for  $W_j$ . This yields a new constant term  $\beta_1' = \beta_1 - \beta_2 \bar{A} - \beta_3 \bar{A}^2$  and average age-earnings profiles:

$$(4) \hat{Y}_k = \hat{\beta}_1' + \hat{\beta}_2 k + \hat{\beta}_3 k^2$$

where:

$\hat{Y}_k$  = estimated average income for age  $k$

$\hat{\beta}$  = least squares regression coefficients

$k = j, j+1, \dots, 64$

$j = 16$  for education levels from no education to some high school

= 17 for high school education

= 19 for some university education

= 21 for university education.

Since the effect of average weeks worked has been incorporated in our constant terms, the differences in our age-income profiles reflect both direct and indirect effects of education on income. By direct effects we mean higher rates of pay per week which tend to accompany higher levels of education, and by indirect effects we mean the expectation of higher numbers of weeks worked per year which also tends to vary directly with education level. Table 3 shows the

<sup>4</sup> Sweeney, Robert E., and Ulveling E.F., "A Transformation for Simplifying the Interpretation of Coefficients of Binary Variables in Regression Analysis" *The American Statistician*, (December 1972), pp. 30-32.

**TABLE 3. Average Weeks Worked by Sex and Education Level, 1967**  
(Including Those who did not Work in 1967)

Education level	Average weeks worked	
	Male	Female
No education . . . . .	16.4	4.4
Some elementary . . . . .	31.5	8.3
Elementary . . . . .	40.4	11.2
Some high school . . . . .	43.5	16.6
High school . . . . .	45.8	21.4
Some university . . . . .	44.5	25.3
University . . . . .	48.0	25.8

importance of these indirect effects. Average weeks worked varied in 1967 from 16 to 48 weeks for males and from 4 to 26 weeks for females as their education levels increased from none through university. Obviously, the effect of education, particularly through high school, on expected weeks worked is an extremely important part of the economic returns to education.

### EMPIRICAL RESULTS

Table 4 shows part-time workers as a percentage of all who worked in 1967 to be much larger for females than for males. Consequently, greater variation in earnings is found among females in the sample, and since this variation is closely associated with the "weeks worked" or "worked part time" variables, the  $\bar{R}^2$  values turn out to be higher for females than for males. Tables 5 and 6 show  $\bar{R}^2$  values for males up to .44 but for females up to .59. Had it been possible to include those who did not work in 1967 in the regressions, this would have further increased the amount of "explainable" variation in earnings which would have yielded higher  $\bar{R}^2$  values in all groups and even more pronounced differences between the male and female regressions.

**TABLE 4. Percentage of Full-time and Part-time Work by Education Level and Sex, 1967**

Education level	Male		Female	
	Full time	Part time	Full time	Part time
No education . . . . .	87	13	81	19
Some elementary . . . . .	93	7	67	33
Elementary . . . . .	96	4	69	31
Some high school . . . . .	92	8	68	32
High school . . . . .	97	3	81	19
Some university . . . . .	95	5	80	20
University . . . . .	98	2	85	15

Source: Appendix Tables 1 and 2.



TABLE 5. Adjusted Regression Coefficients for Males by Level of Education, 1967  
(Excludes Those who did not Work, Military, and Students in School)

Independent variable	No education	Some elementary	Elementary	Some high school	High school	Some university	University
Age . . . . .	178.198	127.341 <sup>1</sup>	162.075 <sup>1</sup>	262.061 <sup>1</sup>	298.532 <sup>1</sup>	476.376 <sup>1</sup>	903.688 <sup>1</sup>
(Age) <sup>2</sup> . . . . .	- 2.33379 <sup>2</sup>	- 1.49783 <sup>1</sup>	- 1.88249 <sup>1</sup>	- 2.97978 <sup>1</sup>	- 3.19585 <sup>1</sup>	- 4.96878 <sup>1</sup>	- 9.22094 <sup>1</sup>
Weeks worked . . . . .	31.8530 <sup>2</sup>	60.7248 <sup>1</sup>	64.7648 <sup>1</sup>	60.2884 <sup>1</sup>	76.8499 <sup>1</sup>	78.2811 <sup>1</sup>	137.092 <sup>1</sup>
Region:							
Ontario . . . . .	- 580.518	563.502	388.599	400.694	381.591	129.060	1,063.98
Atlantic . . . . .	- 55.5356	- 455.089 <sup>1</sup>	- 631.222 <sup>1</sup>	- 953.370 <sup>1</sup>	- 458.698 <sup>1</sup>	- 478.623	- 652.835 <sup>1</sup>
Quebec . . . . .	187.078	24,1658 <sup>1</sup>	- 388.627 <sup>1</sup>	- 255.117 <sup>1</sup>	63,2021 <sup>2</sup>	280.399	- 384.728 <sup>1</sup>
Prairies . . . . .	7,75146	261.302 <sup>2</sup>	174.642	117,417 <sup>1</sup>	- 248,112 <sup>1</sup>	- 98.5874	771.360 <sup>1</sup>
British Columbia . . . . .	1,021.96	812.817	494,323	727,829 <sup>1</sup>	76,9175	91,8373	- 188,736 <sup>2</sup>
Residence:							
Metropolitan . . . . .	- 408.445	403.525	335.045	167.985	210.079	203.314	534.395
Other city . . . . .	453.179	133,226 <sup>2</sup>	- 47,6409	269,560	- 315,909 <sup>1</sup>	288,122	- 841,570
Urban . . . . .	- 429.069	- 116,515 <sup>1</sup>	- 165,421 <sup>1</sup>	- 230,549 <sup>1</sup>	- 348,701 <sup>1</sup>	- 107,339	- 1,969,72 <sup>1</sup>
Rural . . . . .	135.094	- 333,719 <sup>1</sup>	- 428,443 <sup>1</sup>	- 386,239 <sup>1</sup>	- 619,665 <sup>1</sup>	- 1,293,39 <sup>1</sup>	- 2,312,39 <sup>1</sup>
Immigration status:							
Unknown . . . . .	- 258.125	- 44,4082	- 96,3777	33,5005	- 76,6500	- 210,627	- 2,51619
Landed before 1945 . . . . .	1,087.69	562,271 <sup>1</sup>	6,56384	- 19,3768	600,269 <sup>2</sup>	652,677	3,559,26 <sup>1</sup>
Landed 1946-64 . . . . .	147.093	- 101,597	- 186,452	- 249,506 <sup>2</sup>	- 91,9772	313,860	- 1,119,08
Landed 1965 or later . . . . .	982,927	- 916,763 <sup>1</sup>	- 1,038,84 <sup>2</sup>	- 1,077,28 <sup>1</sup>	- 821,201 <sup>2</sup>	88,0469	- 2,950,40 <sup>1</sup>
Born in Canada . . . . .	- 30,9527	- 3,82875	89,3348	20,6239	51,2442	18,6556	257,501
Class of worker:							
Paid worker . . . . .	120.105	122,985	169,823	99,2645	117,095	- 27,4964	- 559,484
Self-employed, non-farm . . . . .	- 815,521	- 573,493 <sup>1</sup>	- 1,115,61 <sup>1</sup>	- 656,710 <sup>1</sup>	- 1,030,64 <sup>1</sup>	1,730,66 <sup>1</sup>	4,179,38 <sup>1</sup>
Landed 1946-64 . . . . .	- 24,9307	- 307,180 <sup>2</sup>	- 271,095	- 610,175 <sup>1</sup>	- 1,434,56 <sup>1</sup>	- 2,656,67	3,029,81
Unpaid family worker . . . . .	-	- 1,000,60 <sup>1</sup>	- 1,285,72 <sup>1</sup>	- 499,185 <sup>2</sup>	- 1,377,52 <sup>2</sup>	- 1,783,55	-
Marital status:							
Married . . . . .	162,404	177,166	131,027	261,767	238,912	129,012	267,861
Single . . . . .	- 962,001	- 685,961 <sup>1</sup>	- 723,904 <sup>1</sup>	- 743,067 <sup>1</sup>	- 725,683 <sup>1</sup>	- 374,392	- 1,599,76 <sup>1</sup>
Other . . . . .	- 105,098	- 57,8405	88,6845	- 509,189 <sup>1</sup>	- 810,340 <sup>1</sup>	- 943,652	- 2,464,39
Occupation:							
Service and recreation . . . . .	1,871.46	- 712,262	- 887,700	- 701,056	- 1,087,83	- 1,224,74	- 1,154,95
Professional and technical . . . . .	-	1,370,28 <sup>1</sup>	587,237 <sup>1</sup>	942,923 <sup>1</sup>	112,198 <sup>1</sup>	- 142,110 <sup>2</sup>	14,661 <sup>1</sup>
Clerical . . . . .	329,422	- 83,2986	- 265,663 <sup>2</sup>	- 445,863 <sup>2</sup>	- 927,566	- 918,212	- 2,679,54
Sales . . . . .	-	238,776 <sup>1</sup>	- 545,694	- 209,299 <sup>1</sup>	142,383 <sup>1</sup>	- 493,680	- 1,901,35
Managerial . . . . .	864,236	989,360 <sup>1</sup>	2,157,27 <sup>1</sup>	1,643,13 <sup>1</sup>	1,619,45 <sup>1</sup>	- 1,586,58 <sup>1</sup>	1,566,57
Transport and communications . . . . .	- 56,8645	197,128 <sup>1</sup>	- 34,9514 <sup>1</sup>	- 132,853 <sup>1</sup>	- 444,107 <sup>2</sup>	- 213,572	14,1377
Farmers and farm workers . . . . .	- 964,694 <sup>2</sup>	- 1,143,34 <sup>2</sup>	- 1,069,88	- 842,689	- 584,682	337,301	- 7,313,09
Loggers and fishermen . . . . .	- 699,074 <sup>2</sup>	238,381 <sup>1</sup>	1,056,72 <sup>1</sup>	82,6223 <sup>1</sup>	- 871,711	- 1,585,08	-
Miners . . . . .	1,041,00	505,472 <sup>1</sup>	1,342,34 <sup>1</sup>	552,493 <sup>1</sup>	344,421 <sup>2</sup>	- 1,732,58	-
Craftsmen, production process, related . . . . .	584,523	401,915 <sup>1</sup>	276,206 <sup>1</sup>	61,8877 <sup>1</sup>	- 309,514 <sup>1</sup>	- 647,573	- 1,471,93
Labourers . . . . .	- 726,202 <sup>1</sup>	- 187,592 <sup>1</sup>	- 456,314 <sup>2</sup>	- 525,465	- 528,960	- 411,406	- 1,519,23
Nature of work:							
Full time . . . . .	129,104	60,5583	41,1857	110,073	41,0779	123,014	44,9987
Part time . . . . .	- 839,176	- 784,893 <sup>1</sup>	- 897,455 <sup>1</sup>	- 1,263,05 <sup>1</sup>	- 1,480,12 <sup>1</sup>	- 2,465,30 <sup>1</sup>	- 2,706,67 <sup>2</sup>
Constant . . . . .	2,680,39 <sup>1</sup>	3,475,88 <sup>1</sup>	4,522,13 <sup>1</sup>	4,863,03 <sup>1</sup>	6,071,51 <sup>1</sup>	6,657,22 <sup>1</sup>	10,729,1 <sup>1</sup>
R <sup>2</sup> . . . . .	.079	.38 <sup>1</sup>	.24 <sup>1</sup>	.44 <sup>1</sup>	.32 <sup>1</sup>	.33 <sup>1</sup>	.25 <sup>1</sup>

<sup>1</sup> Indicates significance at the .01 level in a one-tail test.

<sup>2</sup> Indicates significance at the .05 level in a one-tail test.

Source: Statistics Canada, Survey of Consumer Finances, 1968.

TABLE 6. Adjusted Regression Coefficients for Females by Level of Education, 1967  
(Excludes Those who did not Work, Military, and Students in School)

Independent variable	No education	Some elementary	Elementary	Some high school	High school	Some university	University
Age	-128.800	41.4650 <sup>1</sup>	59.6277 <sup>1</sup>	87.9895 <sup>1</sup>	150.263 <sup>1</sup>	210.015 <sup>1</sup>	259.051 <sup>1</sup>
(Age) <sup>2</sup>	1.66290	-4.37459 <sup>1</sup>	-.660003 <sup>1</sup>	-1.01143 <sup>1</sup>	-1.63008 <sup>1</sup>	-2.27018 <sup>1</sup>	-2.44868 <sup>1</sup>
Weeks worked	37.0750 <sup>1</sup>	30.5511 <sup>1</sup>	36.7970 <sup>1</sup>	41.4182 <sup>1</sup>	52.9963 <sup>1</sup>	67.4677 <sup>1</sup>	85.6348 <sup>1</sup>
Region:							
Ontario	77.8715	248.779	194.790	113.709	234.788	133.812	378.393
Atlantic	-914.090	-216.427 <sup>1</sup>	-342.706 <sup>1</sup>	-312.895 <sup>1</sup>	-296.767 <sup>1</sup>	-509.748 <sup>1</sup>	-320.333 <sup>2</sup>
Quebec	342.827	94.6887 <sup>2</sup>	-34.7559 <sup>1</sup>	-46.0790 <sup>1</sup>	27.8850 <sup>1</sup>	276.337	-479.861 <sup>1</sup>
Prairies	110.396	-64.2681 <sup>1</sup>	-6.74088 <sup>1</sup>	67.0757	-65.8795 <sup>1</sup>	-87.3611	43.9285
British Columbia	389.993	-28.9534 <sup>2</sup>	119.498	62.3645	-5.11392 <sup>1</sup>	396.635	212.526
Residence:							
Metropolitan	-153.553	96.9158	90.5978	106.203	117.672	146.654	117.417
Other city	-941.255	88.0570	-59.1143 <sup>2</sup>	-56.2402 <sup>2</sup>	-420.587 <sup>1</sup>	-419.146 <sup>1</sup>	-101.509
Urban	261.973	-124.793 <sup>1</sup>	-73.2619 <sup>2</sup>	-154.691 <sup>1</sup>	-101.071 <sup>1</sup>	-157.173 <sup>2</sup>	-150.713
Rural	860.255	-167.969 <sup>1</sup>	-142.878 <sup>1</sup>	-256.141 <sup>1</sup>	-158.434 <sup>1</sup>	-119.638	-631.213 <sup>2</sup>
Immigration status:							
Unknown	-226.707	-4.36929	5.60081	2.16073	106.178	-73.5855	263.592
Landed before 1945	-845.624	91.0564	298.461 <sup>1</sup>	43.3845	61.2319	21.6765	-998.923
Landed 1946-64	253.728	-66.8745	-59.9483	60.4040	-164.917 <sup>1</sup>	-356.005	-673.510 <sup>2</sup>
Landed 1965 or later	83.9297	-216.222	-223.527	-589.566 <sup>1</sup>	-168.951	-1,154.66 <sup>1</sup>	-920.697 <sup>2</sup>
Born in Canada	856.151	17.1473	-13.0362	-4.10928	-27.7359 <sup>1</sup>	106.601	43.0181
Class of worker:							
Paid worker	379.375	202.583	208.711	114.974	104.886	110.873	54.4296
Self-employed, non-farm	-1,518.04 <sup>1</sup>	-763.250 <sup>1</sup>	-663.942 <sup>1</sup>	-724.782 <sup>1</sup>	-1,201.79 <sup>1</sup>	-1,783.21 <sup>1</sup>	-1,781.03
Self-employed, farm	-	-1,389.47 <sup>1</sup>	-746.580 <sup>1</sup>	-875.960	-3,274.39 <sup>1</sup>	-3,259.20 <sup>2</sup>	-
Unpaid family worker	-378.307	-1,129.79 <sup>1</sup>	-1,549.16 <sup>1</sup>	-1,372.96 <sup>1</sup>	-2,164.40 <sup>1</sup>	-3,086.12 <sup>1</sup>	-2,380.58 <sup>2</sup>
Marital status:							
Married	300.891	-8.75029	-44.9039	-90.8370	-100.281	-63.4169	-198.943
Single	-792.307	-68.9070	80.8689	104.612 <sup>1</sup>	146.985 <sup>1</sup>	46.0041	538.169 <sup>1</sup>
Other	-643.168	131.134	128.820 <sup>2</sup>	361.146 <sup>1</sup>	134.531 <sup>1</sup>	353.955 <sup>2</sup>	-1,263.48 <sup>1</sup>
Occupation:							
Service and recreation	-196.481	-211.012	-263.907	-368.287	-643.683	-1,021.08	-933.092
Professional and technical	-	2,241.51 <sup>1</sup>	742.781 <sup>1</sup>	417.756 <sup>1</sup>	449.153 <sup>1</sup>	347.672 <sup>1</sup>	284.066 <sup>2</sup>
Clerical	-	242.999 <sup>1</sup>	302.905 <sup>1</sup>	318.512 <sup>1</sup>	-18,8320 <sup>1</sup>	-584.411	-2,180.99 <sup>2</sup>
Sales	142.367	-73.3753	-267.952 <sup>1</sup>	-295.488	552.225	961.564	-2,272.41
Managerial	1,748.75	56.7286	213.484 <sup>1</sup>	475.913 <sup>1</sup>	510.005 <sup>1</sup>	372.885 <sup>1</sup>	133.451
Transport and communication	-	218.098	383,290 <sup>1</sup>	321.765 <sup>1</sup>	94,2566 <sup>1</sup>	-248.418	-1,940.20
Farmers and farm workers	-134.198	202.415 <sup>1</sup>	268.216 <sup>1</sup>	-9,03467 <sup>1</sup>	330.177 <sup>1</sup>	615.075 <sup>2</sup>	-1,891.48
Loggers and fishermen	-	594.693	-	-871.444	-174.721	-	-
Miners	-	-	-	-372.796	-	-	-
Craftsmen, production process, related	-49.8690	229.065 <sup>1</sup>	269.383 <sup>1</sup>	21,9287 <sup>1</sup>	-559.500	-1,281.91	-2,237.04
Labourers	497.194	-254.195	421.438 <sup>1</sup>	-166.123	-472.095	-	-
Nature of work:							
Full time	36.9878	203.016	221.414	319.647	240.866	349.338	445.748
Part time	-153.235	-419.690 <sup>1</sup>	-493.963 <sup>1</sup>	-672.869 <sup>1</sup>	-1,010.16 <sup>1</sup>	-1,383.74 <sup>1</sup>	-2,449.65 <sup>1</sup>
Constant	1,153.58 <sup>1</sup>	1,302.49 <sup>1</sup>	1,515.82 <sup>1</sup>	1,848.54 <sup>1</sup>	2,638.54 <sup>1</sup>	3,387.30 <sup>1</sup>	4,799.27 <sup>1</sup>
R <sup>2</sup>	.56	.52 <sup>1</sup>	.57 <sup>1</sup>	.53 <sup>1</sup>	.53 <sup>1</sup>	.59 <sup>1</sup>	.57 <sup>1</sup>

<sup>1</sup> Indicates significance at the .01 level in a one-tail test.

<sup>2</sup> Indicates significance at the .05 level in a one-tail test.

Source: Statistics Canada, Survey of Consumer Finances, 1968.

### Differentials from Age-earnings Profiles

Before considering the age-earnings profiles in which we are primarily interested, it is worthwhile to examine in Tables 5 and 6 the earnings differentials from the overall averages for the various characteristics represented by dummy variables in the regressions.<sup>5</sup> Regionally, the differentials reflect in large part the wealth of the regions, with large positive differentials occurring in Ontario and British Columbia and negative differentials in the Atlantic. The premium on university education is particularly high for males in Ontario (+ \$1,050). With males on the Prairies, the differentials tend to be positive for lower but negative for higher levels of education, while in Quebec no consistent pattern emerges, although fairly large negative differentials exist there for both males and females with university degrees.

Metropolitan areas generally provide males with positive differentials the largest being + \$550 for males with university degrees. This differential for male university graduates decreases to - \$850 in other cities, to - \$2,000 in urban areas and to - \$2,300 in rural areas. No doubt this trend reflects changes in the mix of the type of degree by place of residence as well as a larger proportion of persons with post-graduate degrees in larger centres, but it is noteworthy that the differentials are all negative or close to zero in both urban and rural areas for all levels of education.

The importance of time for integration of immigrants into the Canadian social and cultural stream is shown by the coefficients for immigration status. Male immigrants landing before 1945 with high school or higher education show positive differentials (+ \$3,550 for those with university degrees) while the differentials for immigrants landing since 1965 are generally negative (- \$2,950 for males and - \$900 for females with university degrees).

Some interesting results are obtained with respect to class of worker. Because of the close correlation between self-employed farm workers with the farmers and farm workers occupation groups, the regression coefficients for the two classes must be taken in conjunction and turn out to be large and negative at all education levels. Paid workers, because they constitute the vast majority of the sample (Appendix Tables 1 and 2) are generally close to the means for any given education level. The exception is males with university degrees (- \$550).

More interesting are the large negative differentials to self-employed non-farm workers for all education levels with females (- \$650 to - \$1,800), and for males with education levels up to high school (- \$600 to - \$1,100). In the case of both males and females with education through high school, the negative differentials probably reflect the price they are willing to pay for independence

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<sup>5</sup> The tests of significance with the dummy variables are on their differences from the first one in each group as shown in Tables 5 and 6.

and their need in self-employment to enter risky fields. Similarly, females with some university or university education include, relative to males, a small proportion with professional or post-graduate degrees, so that self-employment again may force them into relatively risky fields. In contrast, large positive differentials are enjoyed by self-employed males who have some university (+ \$1,750) and particularly by males with university degrees (+ \$4,200). This, of course, is due to the relatively large incomes of doctors, lawyers, architects, accountants and other self-employed professionals.

The effect of marital status on earnings differs between the sexes. Married males but single females generally earn positive differentials, while married females along with single males earn less than the averages for their education levels. These results probably reflect the fact that married women are unlikely to be in the labour force when they have young children. As a result, when they do enter the labour force, they have less on-the-job training than single females of their age, and the value of their formal education will have depreciated. Married males do not suffer those same disadvantages, but rather their greater financial obligations may lead them to place more emphasis than single males on financial return as a criterion in job selection.

The occupation variables are of course closely related to education. One finds in our 1967 sample, no one in the professional and technical field with no education, and no one with a university degree working as a logger, a miner, or a fisherman. The differentials for the service and recreation field are generally negative while the professional and technical differentials are generally positive but a decreasing function of the education level. The clerical differentials are generally negative for males and for females with high levels of education, but positive for females with education levels up to high school. The sales differential is generally negative and it is very large at high levels of education (- \$1,900 for males and - \$2,300 for females with university degrees). The managerial class is the only occupational group to enjoy large positive differentials for both males and females at all levels of education (+ \$1,000 to + \$2,150 for males and + \$50 to + \$500 for females). Transportation and communication, miners and craftsmen are alike in that they tend to provide positive differentials at low levels of education but negative differentials at high levels of education. Except for females with low levels of education (none and elementary), the differentials for labourers are negative at all education levels.

### **Statistical Significance of the Regression Coefficients**

We shall usually ignore the "no education" groups because of the relatively small samples involved and because the validity of some of the data for these groups is suspect. As a result, the empirical results are generally not statistically significant with the "no education" categories and even where they are, they cannot be taken too seriously because of the questionable quality of the data for these categories.

With levels of education from some elementary through university, the scaled variables (age, age squared, and weeks worked) are highly significant in all regressions. Table 7 shows the Student t values obtained for these three variables in each of the 12 regressions. All of them are significant well beyond the .01 level.

**TABLE 7. Student t Values for Scaled Variables, Male and Female Regressions by Level of Education, 1967**

Scaled variables	Some elementary	Elementary	Some high school	High school	Some university	University
<b>Male:</b>						
Age . . . . .	8.29	7.08	16.96	9.95	6.94	7.79
(Age) <sup>2</sup> . . . . .	- 8.74	- 7.39	- 16.40	- 8.97	- 6.20	- 7.07
Weeks worked . . . .	20.70	12.47	19.48	12.24	5.60	4.69
<b>Female:</b>						
Age . . . . .	3.24	5.25	9.32	12.51	7.52	4.89
(Age) <sup>2</sup> . . . . .	- 2.91	- 4.89	- 8.43	- 10.68	- 6.61	- 3.83
Weeks worked . . . .	16.86	23.85	34.15	33.30	18.01	11.72

Tables 8 and 9 show F tests of significance on the sets of dummy variables. The F values are based on the ratio of the regression sum of squares (attributable to the group) to the error sum of squares each divided by the appropriate degrees of freedom. The class of worker and occupation dummies are highly significant in all 12 regressions. Nature of work is highly significant in 11 of 12 regressions and is not significant with male university graduates because only 20 of 1,203 observations on that group fall in the "part-time worker" category (Appendix Table 1). The region and residence dummies are also highly significant in 11 of 12 regressions. Marital status is highly significant in 8 of 12 regressions and on the borderline in one other case (females with elementary level education). The weakest of the dummy variables is immigration status which is still significant at the .05 level in 6 of the 12 regressions and nearly significant in another 3. Moreover, with males having some elementary and university level education, immigration is highly significant, reflecting the relatively great disadvantage with which recent immigrants having these levels of education compete with their Canadian counterparts for jobs.

**TABLE 8. F Values for Sets of Dummy Variables, Male Regressions  
by Level of Education, 1967**

Dummy variable set	Some elementary	Elementary	Some high school	High school	Some university	University
Region:						
F . . . . .	24.99	16.31	72.69	7.12	0.91	3.56
F <sub>.05</sub> . . . . .	2.37	2.37	2.37	2.37	2.38	2.38
Residence:						
F . . . . .	20.81	10.85	16.89	9.24	4.34	7.36
F <sub>.05</sub> . . . . .	2.60	2.60	2.60	2.60	2.61	2.61
Immigration status:						
F . . . . .	5.06	2.01	3.09	2.40	0.57	5.53
F <sub>.05</sub> . . . . .	2.37	2.37	2.37	2.37	2.38	2.38
Class of worker:						
F . . . . .	11.42	15.92	12.55	9.65	4.14	26.18
F <sub>.05</sub> . . . . .	2.60	2.60	2.60	2.60	2.61	2.61
Marital status:						
F . . . . .	29.95	13.45	52.55	18.78	1.36	5.25
F <sub>.05</sub> . . . . .	2.99	2.99	2.99	2.99	3.00	3.00
Occupation:						
F . . . . .	13.96	17.21	35.37	21.88	4.86	2.85
F <sub>.05</sub> . . . . .	1.83	1.83	1.83	1.83	1.84	1.84
Nature of work:						
F . . . . .	32.64	13.10	101.71	18.17	16.94	2.74
F <sub>.05</sub> . . . . .	3.84	3.84	3.84	3.84	3.85	3.85

**TABLE 9. F Values for Sets of Dummy Variables, Female Regressions  
by Level of Education, 1967**

Dummy variable set	Some elementary	Elementary	Some high school	High school	Some university	University
Region:						
F . . . . .	6.91	11.09	13.54	13.07	7.14	2.75
F <sub>.05</sub> . . . . .	2.38	2.38	2.37	2.38	2.38	2.39
Residence:						
F . . . . .	4.61	3.95	15.08	17.95	3.62	1.47
F <sub>.05</sub> . . . . .	2.61	2.61	2.60	2.61	2.61	2.62
Immigration status:						
F . . . . .	0.56	2.31	2.17	2.74	3.02	2.37
F <sub>.05</sub> . . . . .	2.38	2.38	2.37	2.38	2.38	2.39
Class of worker:						
F . . . . .	43.72	83.26	78.54	85.23	16.34	3.98
F <sub>.05</sub> . . . . .	2.61	2.61	2.60	2.61	2.61	3.02
Marital status:						
F . . . . .	1.53	2.98	19.86	9.72	1.75	10.04
F <sub>.05</sub> . . . . .	3.00	3.00	2.99	3.00	3.01	3.02
Occupation:						
F . . . . .	9.09	14.47	24.74	24.60	11.47	7.21
F <sub>.05</sub> . . . . .	1.89	1.95	1.83	1.89	2.02	2.03
Nature of work:						
F . . . . .	85.83	137.16	468.38	345.14	120.07	82.74
F <sub>.05</sub> . . . . .	3.85	3.85	3.84	3.85	3.85	3.86

### Average Age-earnings Profiles

Our average age-earnings profiles are obtained for each education-sex class from the equation

$$\hat{Y}_k = \hat{\beta}_1' + \hat{\beta}_2 k + \hat{\beta}_3 k^2 \quad (\text{see page 13})$$

The constant incorporates the average weeks worked variable for the particular regression and the remaining attribute variables are ignored since their weighted mean values are all zero. The results are shown graphically in Charts 1 and 2 and numerically in Appendix Tables 3 and 4.

Chart 1 shows that for males, earnings tend to increase with the level of education. Only in the case of some university and some high school education are average earnings ever lower than for the next lowest education group, and in those cases it occurs only at a few very young ages. In general, higher levels of education are closely associated with higher average earnings and the difference is particularly large, for both males and females, between those with some university education and those with one or more university degrees. In all cases shown in Charts 1 and 2, average earnings at first increase with age and eventually decline at older age levels. Moreover, the higher the education level the sharper the rise in average earnings and the older the age at which average earnings tend to peak. For example with university education, average earnings for males rise from \$5,700 to \$12,914 by age 49, while with some elementary education the rise is from \$2,748 to only \$3,800 by age 43.

The most pronounced difference in the average age-earnings profiles of females (Chart 2) is the lower level of average earnings at all age levels due in part to the smaller number of weeks worked by females and to the larger proportion of females who work part time at all education levels. (See Tables 3 and 4 pages 13 and 14). The differences may also be due in part to discrimination against females in the Canadian labour market.

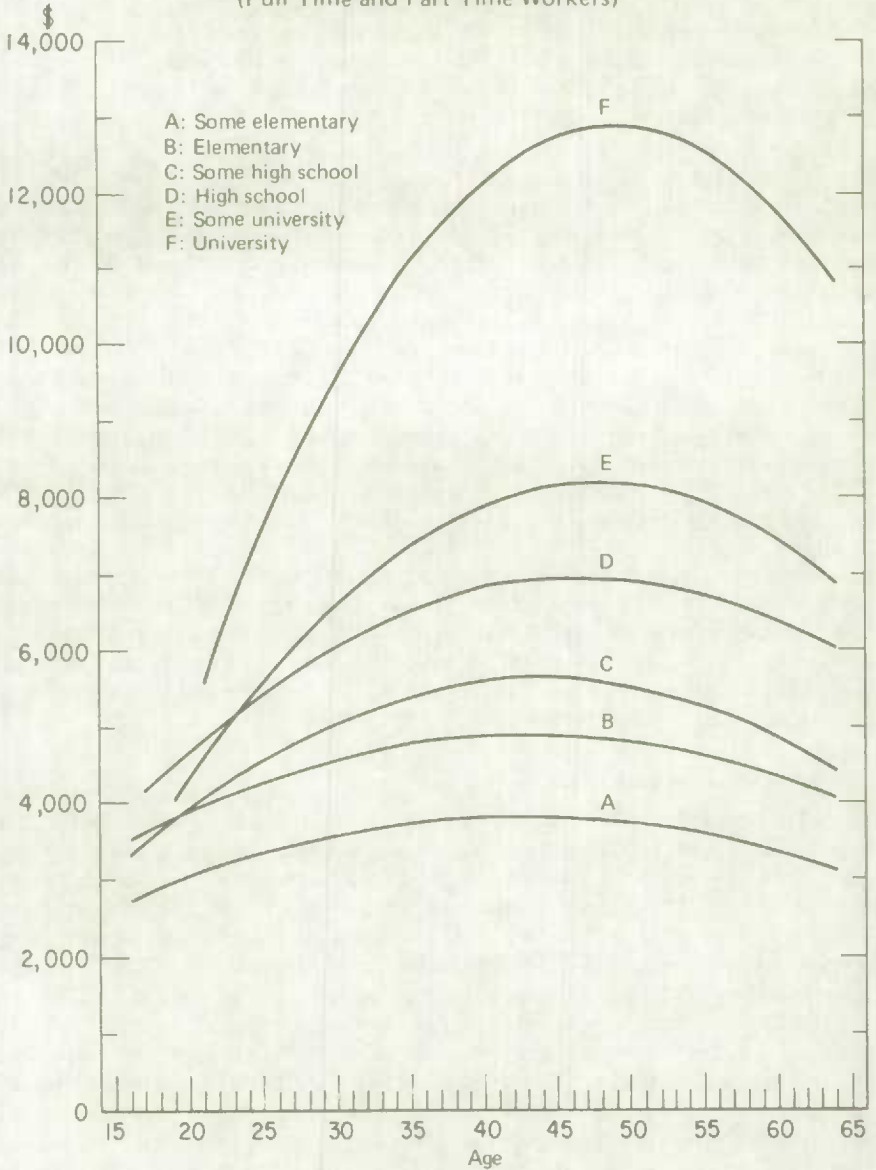
### Estimated Lifetime Earnings

The estimation of lifetime earnings from average age-earnings profiles depends critically on the growth and discount rates used. For example, our estimates of the expected lifetime earnings of male university graduates vary from \$217,000 to \$611,000 at 4% discount rates for growth rates varying from zero to 5.0%, and from \$241,000 to \$899,000 at a 2.5% growth rate for discount rates varying from zero to 6.0%. Undoubtedly the shape and upward shifts of the age-earnings profiles in future years will vary with education level in response to the effects on labour demand of changes in technology and consumers' tastes, as well as to changes in the many different kinds of labour supplies. Additional studies of this kind will in subsequent years indicate trends, but in the absence of such information, we employ here, an arbitrarily estimated real growth rate in all age-earnings profiles of 2.5% annually. This estimate is, of course, net of both the growth in earnings within age-income profiles at a given time and the upward shifts which simply offset the effects of inflation.

Chart - 1

### Average Age - Earnings Profiles for Canadian Males by Education Level, 1967

(Full Time and Part Time Workers)

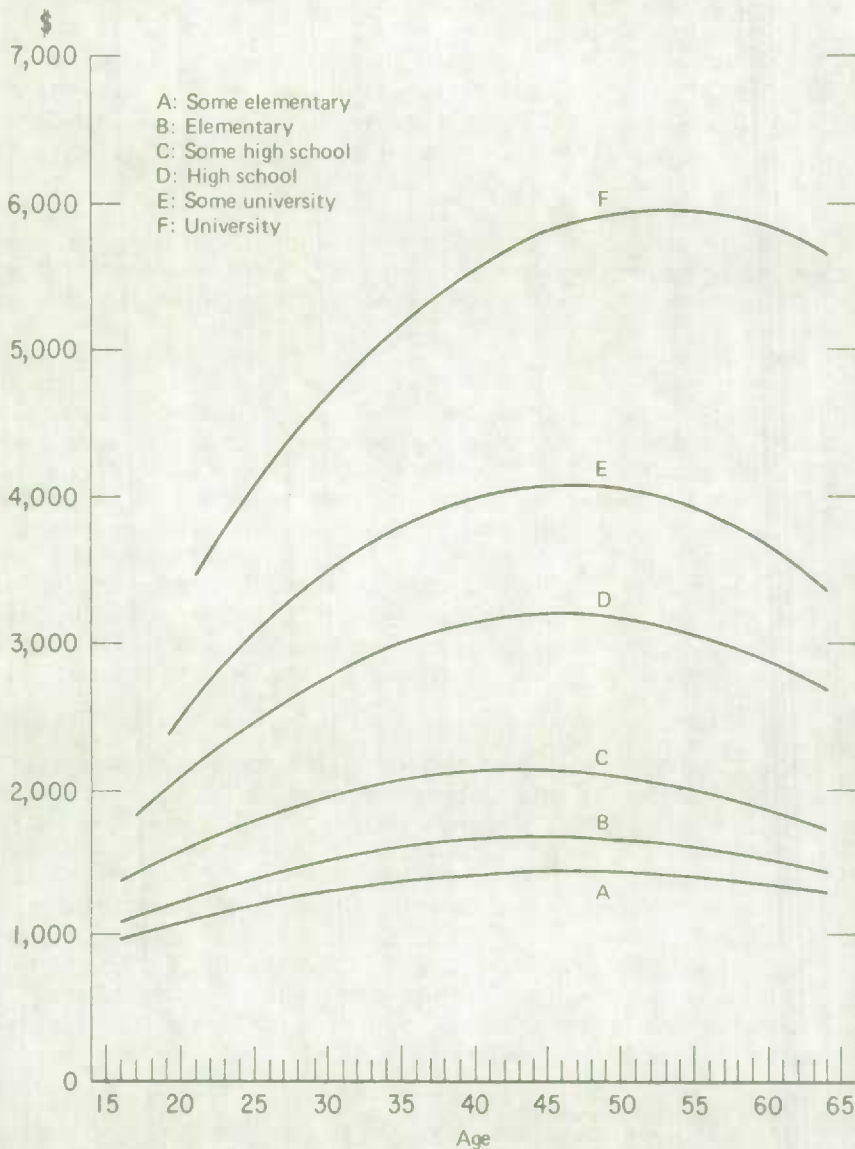


Source: Statistics Canada, Survey of Consumer Finances, 1968.



Chart - 2

### Average Age - Earnings Profiles for Canadian Females by Education Level, 1967 (Full Time and Part Time Workers)



Source: Statistics Canada, Survey of Consumer Finances, 1968.

Choice of the appropriate discount rate is equally important. In some studies the problem is avoided by calculating internal rates of return but these estimates are very sensitive to net earnings during the school period and shortly after, and this information cannot be reliably estimated. In this study therefore, we choose to face the difficult question of selecting an appropriate discount rate for determining expected lifetime earnings.

Becker<sup>6</sup> argues that the appropriate rate of discount is the return on private investment which he estimates to average between 9% and 10%. There is widespread acceptance of the idea that the private rate of return should be employed as the opportunity costs of funds in public investment, but this is not the position taken here.

Becker's argument on the appropriate rate of discount would be correct only if private investors in maximizing their private return made socially optimal decisions. However, there are several reasons for expecting the rate on private investment to be higher than the socially optimal rate for investment in education:

1. Investment increases the productivity of labour and other factors which, while socially desirable, is a cost rather than a benefit to the private investor who calculates his return net of the returns to other factors. Consequently, private investment may stop short of the level that would be optimal to society at large and the private investor may require a higher private return on investment than is socially optimal.<sup>7</sup> This is particularly true if the investment is labour-using rather than labour-saving but even in the latter case, additional investment would still raise the productivity and earning power of that part of the labour force employed after additional investment. Thus, the socially optimal rate of return on investment (public and private) is lower than the observed private rate on private investment.
2. The distribution of income which determines influence in the market may be an undesirable way of determining public investment. If the weights of the ballot box are a more desirable distribution of influence as far as public investment is concerned, then different rates of return should be demanded from public than from private investment.<sup>8</sup> Whether these rates should be higher or lower will depend on the distribution of the costs and benefits of the investment, but in the case of education which should provide a major form of upward mobility for disadvantaged groups, a much lower rate of return may be acceptable, at least to the disadvantaged groups who take advantage of educational opportunities and who cannot in any case capture the higher rates of return enjoyed by the private investor.

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<sup>6</sup> Becker, G.S., *Human Capital* (New York, 1964).

<sup>7</sup> Feldstein, M.S., "The Social Time Preference Discount Rate in Cost Benefit Analysis". *The Economic Journal* (June 1964), pp. 360-79.

<sup>8</sup> Feldstein, *op. cit.*

3. Denison<sup>9</sup> has pointed out that the great bulk of expenditures on education comes from what would have been consumption expenditures rather than from the savings-investment stream. This is particularly true of the foregone earnings of students which is the largest single component of the costs of higher education, and to a large extent it is also probably true of the property and other taxes used to finance all levels of education. Consequently, investment in education would make a net contribution to economic growth even if the rate of return were only a small fraction of that on other investment.
4. Although pure time preference would influence the individual to favour current to future consumption thereby reducing savings and increasing the rate of return on private investment, this factor is much less powerful from the point of view of a society concerned with the interests of succeeding as well as present generations.<sup>10</sup> One might well conclude that the effect of pure time preference on private rates of return should be greatly reduced if not eliminated in determining the socially optimal rate on public investment in education.

On the basis of the foregoing analysis our judgement of the appropriate real discount rate for public investment in education is 4%. This corresponds to an 8% monetary rate if inflation accounts for 4 percentage points, or, in our model, if the estimated 2.5% real rate of growth in age income profiles converts to a monetary rate of about 6.4%. Consideration of other factors which bear on this problem, in particular, fringe benefits and non-monetary returns to various kinds of employment and the correlation between ability and education have not led us to alter this judgement. One must recognize of course, that fringe benefits and non-monetary advantages in the form of psychic income, subsidized travel, long vacations, generous expense accounts, and attractive disability and pension plans are likely to be greater with higher levels of education.<sup>11</sup>

On the other hand, the correlation between ability and education have led some to argue that the apparent returns to education are in part returns to ability and motivation. Becker,<sup>12</sup> for example, reduced his estimate of the gain from a college education by 20% and Denison<sup>13</sup> concluded that only 3/5 of observed income differentials represented differences due to education as distinguished from associated characteristics. However, more recent work by Griliches<sup>14</sup> and by Griliches and Mason<sup>15</sup> suggest that Becker and Denison make too much of the

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<sup>9</sup> Denison, E.F., *The Sources of Economic Growth in the United States*, (New York, 1962), p. 78.

<sup>10</sup> Feldstein, *op. cit.*

<sup>11</sup> Bowen, W.G., *Economic Aspects of Education Three Essays*, (Princeton University, 1964).

<sup>12</sup> Becker, *op. cit.*

<sup>13</sup> Denison, *op. cit.*

<sup>14</sup> Griliches, Z., "Notes on the Role of Education in Production Functions and Growth Accounting", in Hansen, W.L., ed., *Education, Income and Human Capital*. Studies in Income and Wealth, Vol. 35, (New York, 1970).

<sup>15</sup> Griliches, Z., Mason, W.M., "Education, Income, and Ability". *The Journal of Political Economy*, 80, (May/June 1972), S74-S103.

effect of the correlation between ability and education on the estimated returns to education. The most important part of their argument is that causation runs both ways between ability and education, and that if ability measures are taken prior to the schooling considered, then the available evidence suggests that the ability variable may add to the explanation of the income variable but does not appreciably affect the schooling coefficient.<sup>16</sup> Therefore, there would appear to be little bias in a schooling coefficient which does not take ability into account. We conclude that any overestimate of the economic returns to education due to correlation between ability and education is at least offset by the more attractive fringe benefits and non-monetary returns that tend to accompany employment with higher levels of education, and as a result we retain our previous judgement of 4% as the appropriate real discount rate for public investment in education.

Table 10 shows lifetime earnings adjusted for our 2.5% growth rate and 4% discount rate, by sex and education level. These estimates are obtained from

$$(5) \hat{Y}_k = \hat{\beta}_1' + \hat{\beta}_2 k + \hat{\beta}_3 k^2$$

by first adjusting average earnings in each year for our discount and growth rates and then summing adjusted earnings over estimated working life.<sup>17</sup> That is, we obtain

$$(6) A\hat{Y}_k = \hat{Y}_k \left( \frac{1.025}{1.04} \right)^{k-j} \text{ and}$$

$$(7) ALE = \sum_{k=j}^{64} A\hat{Y}_k \quad \text{where}$$

$A\hat{Y}_k$  = adjusted average earnings for age  $k$

ALE = adjusted lifetime earnings

$k = j, j + 1, \dots, 64$

$j = 16$  for education levels from no education to some high school

= 17 for high school education

= 19 for some university education

= 21 for university education.

The estimates of Table 10 exclude the effects of education on the number who did not work in 1967, and Table 2 page 10 shows a very strong positive correlation between education level and the proportion not working. With males the proportion who did not work declines from 59% to 5% as the education level increases from none to university and the corresponding decline with females is

<sup>16</sup> *Ibid*, S90.

<sup>17</sup> No adjustments have been made for mortality rates since these are not available by education level.

from 90% to 42%. If one adjusts for this effect of education by multiplying the entries of Table 10 by the proportion who worked for each education-sex class, the results obtained are shown in Table 11.

**TABLE 10. Adjusted Lifetime Earnings by Sex and Education, 1967**  
(Full-time and Part-time Workers)

Education level	Male	Female
	dollars	
No education . . . . .	106,664	36,469
Some elementary . . . . .	122,348	45,092
Elementary . . . . .	157,597	52,450
Some high school . . . . .	173,464	66,873
High school . . . . .	212,545	96,759
Some university . . . . .	234,524	120,357
University . . . . .	351,635	169,327

**TABLE 11. Adjusted Lifetime Earnings by Sex and Education, 1967**  
(Full-time Workers, Part-time Workers and Those who did not Work)

Education level	Male	Female
	dollars	
No education . . . . .	43,732	3,647
Some elementary . . . . .	88,091	9,469
Elementary . . . . .	132,381	14,686
Some high school . . . . .	157,852	28,087
High school . . . . .	197,667	48,380
Some university . . . . .	213,417	69,807
University . . . . .	334,053	98,210

The increments to lifetime earnings resulting from additional education are by far the largest with university education (an increment over high school education of \$136,000 for males and \$50,000 for females). Completion of high school adds \$65,000 over elementary school and \$40,000 over some high school for males and corresponding increments of \$34,000 and \$20,000 for females. Some university adds an increment over high school of \$25,000 for males and \$21,000 for females, while the difference in average lifetime earnings between some high school and elementary school education is \$16,000 for males and \$13,000 for females.

These estimates are imperfect indicators of the social value of additional education. The problems are particularly serious with females since so many females fall in the "did not work" or "worked part-time" groups. (See Tables 2 and 4, pages 10 and 14.) Our estimates take no account of the social value of housewives services which, if known, would tend to offset the lower average

earnings of females due to the temporary attachment of so many to the labour force. In addition, the salary structures of both males and females may be determined by influence, ignorance, or tradition as well as by the social value of the individual's work. Undoubtedly some individuals are grossly overpaid. On the other hand, the work of many involves significant external economies so that their earnings will be less than the social value of their product. Unfortunately, quantitative estimates cannot be made of either the overestimate or the underestimates involved in taking earnings as a measure of social value, and our judgement leads us to conclude, at least in the case of males, that we can do no better than to assume a cancellation of errors.

With this in mind, we next consider the rates of return implicit in our estimates of male lifetime earnings. Our cost estimates, including foregone earnings, are \$7,700 for a high school education and \$32,300 for a 4-year university education.<sup>18</sup> Based on our estimated lifetime earnings (at a zero discount rate and 2.5% growth rate) of \$337,900 for high school education and \$899,300 for university education, these cost estimates imply real annual rates of return of over 8% for high school education and just under 8% for university education.<sup>19</sup>

We conclude therefore, that the social return to education at both the high school and university levels is about double that which we have argued would justify the expenditure. This conclusion, important though it is, leaves many other important economic questions unanswered. These include the efficiency of resource allocation within educational institutions, the effects on the distribution of income of public expenditure on each of the various levels and types of education, discrimination against females, and variations in rates of return by field of education and overtime. None of this should be taken to mean that economic considerations are the only, or even the most important factors in the evaluation

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<sup>18</sup> With high school education a direct cost of \$740 per student per year (1969-70) has been obtained for Ontario. This cost includes both school board expenditures (instruction, administration, plant operation and maintenance, transportation, capital expenditures, debt charges and other expenses) and Department of Education expenditures (supervision and inspection, curriculum, registrar examinations, audio-visual education and superannuation). To this we have added estimated foregone annual earnings of \$2,950 (with elementary education and after allowance for unemployment) for a 16-year old, and \$2,500 in total earnings for younger ages. This yields a total cost for 3 years of secondary education (junior matriculation) of \$7,700 ( $3 \times 740 + 2,950 + 2,500$ ).

With university education, Slater (*Economics of Universities and Colleges, 1970*, Canadian Economics Association) has estimated direct costs (1969-70) of an arts and science undergraduate at more than \$4,000 per year. To this we add foregone earnings (with high school education, and after allowance for unemployment) of \$16,300 to obtain a total cost for 4 years of university education of \$32,000 ( $4 \times 4,000 + 16,300$ ).

<sup>19</sup> With high school, the ratio of lifetime earnings to costs is 43.9 and assuming 48 years of gainful employment beyond high school the implied rate is 8% (i.e.  $(1.082)^{48} = 43.9$ ). With university the ratio of lifetime earnings to cost is 27.8 and assuming 44 years of gainful employment beyond university, the implied rate is just under 8% (i.e.  $(1.08)^{44} = 29.6$ ).

of educational programs. Priorities in the expenditure of public funds may very properly be assigned primarily on non-economic grounds, but economic considerations remain important, particularly now that the financing of our educational system takes such a large share of the taxpayers' dollar. Our finding of an 8% real annual rate of return for both high school and university education in 1967 is reassuring, but there is no reason to assume that these rates have remained unchanged since that time. Additional and continuing work is needed on the range, and on changes in, these rates of return.<sup>20</sup>

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<sup>20</sup> In future, attempts will be made to obtain greater detail on education level. University education needs to be broken down by bachelors, masters and doctors degrees and additional information on technical education is also needed. In addition, study of particular occupations such as medical doctors, public school teachers, university professors, engineers and civil servants would be very useful.

APPENDIX

TABLE 1. Distribution of 1967 Labour Force Survey of Males by Level of Schooling and other Characteristics  
(Excludes Those who did not Work, Military, and Students in School)

Characteristic	No education	Some elementary	Elementary	Some high school	High school	Some university	University
<b>Region:</b>							
Ontario . . . . .	13	530	1,143	1,922	973	266	402
Atlantic . . . . .	74	1,309	714	1,232	554	181	164
Quebec . . . . .	34	1,008	780	1,123	756	204	284
Prairies . . . . .	24	577	839	1,384	791	209	242
British Columbia . . . . .	5	150	330	726	407	171	131
<b>Residence:</b>							
Metropolitan . . . . .	29	1,320	1,834	3,635	2,382	724	940
Other city . . . . .	16	259	291	505	277	86	78
Urban . . . . .	17	454	453	778	356	96	109
Rural . . . . .	88	1,541	1,228	1,469	466	125	96
<b>Immigration status:</b>							
Unknown . . . . .	44	959	1,016	1,757	973	304	340
Landed before 1945 . . . . .	10	193	258	241	106	36	35
Landed 1946-64 . . . . .	8	206	324	365	320	88	118
Landed 1965 or later . . . . .	2	40	36	42	76	24	56
Born in Canada . . . . .	86	2,176	2,172	3,982	2,006	579	674
<b>Class of worker:</b>							
Paid worker . . . . .	113	2,869	3,029	5,493	3,159	942	1,074
Self-employed, non-farm . . . . .	16	280	296	398	225	59	130
Self-employed, farm . . . . .	21	336	428	327	77	26	19
Unpaid family workers . . . . .	-	89	53	169	20	4	-
<b>Marital status:</b>							
Married . . . . .	123	2,729	3,140	4,698	2,624	786	1,055
Single . . . . .	20	723	579	1,581	798	228	152
Other . . . . .	7	122	87	108	59	17	16
<b>Occupation:</b>							
Service and recreation . . . . .	16	298	327	542	196	46	13
Professional and technical . . . . .	-	17	33	188	480	325	888
Clerical . . . . .	2	70	158	433	479	110	30
Sales . . . . .	-	59	133	469	310	89	42
Managerial . . . . .	3	129	226	645	653	224	199
Transport and communication . . . . .	9	316	343	600	179	30	5
Farmers and farm workers . . . . .	28	512	552	587	114	32	14
Loggers and fishermen . . . . .	29	275	106	107	26	2	-
Miners . . . . .	3	92	60	87	23	3	-
Craftsmen, production process, related . . . . .	42	1,362	1,584	2,359	925	144	30
Labourers . . . . .	18	444	284	370	96	26	2
<b>Nature of work:</b>							
Full time . . . . .	130	3,318	3,639	5,875	3,387	982	1,203
Part time . . . . .	20	256	167	512	94	49	20
<b>Totals . . . . .</b>	<b>150</b>	<b>3,574</b>	<b>3,806</b>	<b>6,387</b>	<b>3,481</b>	<b>1,031</b>	<b>1,223</b>

Source: Statistics Canada, Survey of Consumer Finances, 1968.



TABLE 2. Distribution of 1967 Labour Force Survey of Females by Level of Schooling and Other Characteristics

(Excludes Those who did not Work, Military, and Students in School)

Characteristic	No education	Some elementary	Elementary	Some high school	High school	Some university	University
<b>Region:</b>							
Ontario . . . . .	9	179	413	1,178	838	183	130
Atlantic . . . . .	7	273	239	603	567	168	58
Quebec . . . . .	9	301	292	564	721	97	91
Prairies . . . . .	6	190	299	824	708	188	94
British Columbia . . . . .	5	60	114	408	381	128	42
<b>Residence:</b>							
Metropolitan . . . . .	27	524	726	2,233	2,117	458	296
Other city . . . . .	1	96	134	314	358	91	39
Urban . . . . .	3	118	189	437	326	88	41
Rural . . . . .	5	265	308	593	414	127	39
<b>Immigration status:</b>							
Unknown . . . . .	13	295	373	994	889	205	114
Landed before 1945 . . . . .	6	41	75	102	91	19	7
Landed 1946-64 . . . . .	7	93	130	209	213	60	31
Landed 1965 or later . . . . .	3	26	31	31	62	12	14
Born in Canada . . . . .	7	548	748	2,241	1,960	468	249
<b>Class of worker:</b>							
Paid worker . . . . .	27	835	1,153	3,236	3,034	729	404
Self-employed, non-farm . . . . .	6	62	77	146	81	21	7
Self-employed, farm . . . . .	-	8	9	3	4	1	-
Unpaid family worker . . . . .	3	98	118	192	96	13	4
<b>Marital status:</b>							
Married . . . . .	25	690	940	2,286	1,900	476	237
Single . . . . .	3	175	240	1,008	1,094	233	151
Other . . . . .	8	138	177	283	221	55	27
<b>Occupation:</b>							
Service and recreation . . . . .	14	480	579	1,026	309	37	11
Professional and technical . . . . .	-	5	12	123	733	475	352
Clerical . . . . .	-	53	149	1,184	1,627	174	31
Sales . . . . .	3	51	132	456	207	29	5
Managerial . . . . .	1	25	39	123	118	27	10
Transportation and communication . . . . .	-	6	20	81	68	5	1
Farmers and farm workers . . . . .	2	90	103	145	36	8	3
Loggers and fishermen . . . . .	-	3	-	1	1	-	-
Miners . . . . .	-	-	-	1	-	-	-
Craftsmen, production process, related . . . . .	13	273	300	397	102	9	2
Labourers . . . . .	3	17	23	40	14	-	-
<b>Nature of work:</b>							
Full time . . . . .	29	676	937	2,425	2,596	610	351
Part time . . . . .	7	327	420	1,152	619	154	64
<b>Totals . . . . .</b>	<b>36</b>	<b>1,003</b>	<b>1,357</b>	<b>3,577</b>	<b>3,215</b>	<b>764</b>	<b>415</b>

Source: Statistics Canada, Survey of Consumer Finances, 1968.

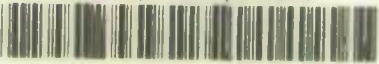
**TABLE 3. Average Age-earnings Profiles for Canadian Males by Education Level**  
(Full-time and Part-time Workers)

Age	No education	Some elementary	Elementary	Some high school	High school	Some university	University
16 . . . . .	2,331	2,748	3,519	3,302	-	-	-
20 . . . . .	2,707	3,042	3,897	3,921	4,682	4,318	-
25 . . . . .	3,073	3,341	4,283	4,561	5,456	5,583	7,602
30 . . . . .	3,323	3,566	4,576	5,052	6,070	6,598	9,584
35 . . . . .	3,455	3,716	4,775	5,394	6,524	7,365	11,106
40 . . . . .	3,471	3,791	4,879	5,587	6,818	7,884	12,167
45 . . . . .	3,370	3,791	4,889	5,631	6,952	8,154	12,766
50 . . . . .	3,152	3,717	4,806	5,526	6,927	8,176	12,905
55 . . . . .	2,818	3,567	4,628	5,271	6,742	7,949	12,582
60 . . . . .	2,367	3,342	4,356	4,868	6,397	7,474	11,799
64 . . . . .	1,922	3,109	4,070	4,439	6,006	6,915	10,840

**TABLE 4. Average Age-earnings Profiles for Canadian Females by Education Level**  
(Full-time and Part-time Workers)

Age	No education	Some elementary	Elementary	Some high school	High school	Some university	University
16 . . . . .	1,563	977	1,095	1,368	-	-	-
20 . . . . .	1,287	1,080	1,239	1,574	2,089	2,509	-
25 . . . . .	1,018	1,189	1,388	1,786	2,474	3,048	4,049
30 . . . . .	831	1,276	1,505	1,948	2,777	3,474	4,670
35 . . . . .	727	1,341	1,589	2,059	2,998	3,786	5,170
40 . . . . .	707	1,385	1,639	2,120	3,138	3,985	5,547
45 . . . . .	770	1,406	1,657	2,130	3,197	4,070	5,801
50 . . . . .	916	1,406	1,642	2,090	3,174	4,042	5,934
55 . . . . .	1,145	1,383	1,593	1,999	3,069	3,900	5,943
60 . . . . .	1,457	1,339	1,512	1,857	2,883	3,645	5,831
64 . . . . .	1,766	1,288	1,423	1,707	2,676	3,359	5,652

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