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NAVIGATION BUTTONS

Male-female earnings gap among recent university graduates

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The earnings gap that exists between men and women is not news. In the past, traditional family roles dictated the division of labour within the household: for most women, a paid working career ended at marriage or the birth of a first child. So women did not accumulate the skills and experience necessary to climb the salary ladder. Women's salaries were further hampered by their lower level of post-secondary education, particularly in fields that led to high-paying occupations. For these and other reasons including the possibility of discrimination, a wide gulf existed between the salaries of working men and women.

But recent decades have witnessed dramatic change in the role of women in the Canadian labour market. More and more women in the younger cohorts have entered and remained in the full-time work force. As a result, women's share of the full-time work force rose from 27% in 1967 to almost 39% in 1988.

Gains in the educational attainment of women have been equally dramatic. While only a quarter of undergraduate university degrees went to women in the early 1960s, women received more than half the undergraduate degrees in the late 1980s. Women still lag behind at the postgraduate level, but are catching up rapidly. The female share of master's degrees rose from 19% in 1961 to 45% in 1989. Women accounted for less than one-tenth of earned doctorates in 1961, but nearly one-third by 1989.

Despite the increasing shares of women among university graduates and full-time workers, their earnings still lag well behind those of men. The earnings gap has narrowed in recent years, but it remains substantial. In 1987, women working full-time for the full year earned, on average, one-third less than their male counterparts.

That such a large gap persists can be partially explained by differences in the male and female work forces. Among the older age groups, men generally have advantages in experience and educational credentials. Among the less educated groups in the work force, the predominantly male, blue-collar workers are paid higher wages than the mainly female, "pink-collar" workers. In such muddy waters it is very difficult to compare the earnings of men and women on an equal footing.

VIEW Chart A **Women in the work force**

Sources: *Labour Force Survey, University Student Information System, and Survey of Consumer Finances*

What could one learn by following a single recent cohort of labour market entrants whose main earnings-related characteristics were known? Would such a study reveal that men and women with the same qualifications had similar earnings? The National Graduates Survey (NGS) of 1984 and the Follow-up of 1982 Graduates Survey (FOG) in 1987 yield a unique perspective on the recent status of the earnings gap between men and women. The target population for these surveys includes the 1982 graduates of all universities in Canada. (1) Focusing on this group of men and women, this study examines two issues:

- Given recent increases in female labour force participation and educational attainment, does an earnings gap still exist for men and women with equal qualifications? And if so, why?
- How does the earnings ratio change over time within a particular cohort of graduates?

The earnings gap is first examined by field and level of study. Although these variables offer some insights, many other factors could contribute to different earnings for men and women. Accordingly, a multivariate model is then presented to simultaneously account for many of the factors that can affect an individual's earnings. A decomposition technique is applied to separate the earnings gap into two components:

- the explained component, that is, the part of the earnings gap attributable to differences in the labour market-related characteristics of men and women; and
- the residual component, that is, the proportion of the gap due to differences in the way men and women are rewarded for those characteristics.

Female university graduates earn less

Among 1982 university graduates, women employed full-time in 1984 earned an average of $24,000 - 88% of the male average of $27,000. By 1987, the ratio of female to male earnings had dropped to 82%, with earnings for women averaging $31,000 compared to $38,000 for men. (2)

The earnings gap was smaller for the university graduates than for their peers in the work force at large. Among full-time, full-year workers the same age as the graduates, women's 1984 earnings averaged $18,000 and men's averaged $25,000 - a ratio of 70%. (3) The corresponding ratio for 1987 was 71%. Thus, for this cohort, a university education was a factor in reducing but not eliminating the earnings

difference.

VIEW ▶ Chart B **Male-female earnings gap, full-time, full-year workers**

Sources: *National Graduates Survey, Follow-up of 1982 Graduates Survey, and Survey of Consumer Finances*

***** *Comparable to 1982 university graduates. (See note 3.)*

Earnings gap narrows slightly within field of study

What could account for the persistent earnings gap? The divergent fields of study followed by men and women are an obvious starting point (Table 1). Since many fields tend to be dominated by one sex, a tendency for men to gravitate to high-reward fields of study would contribute to an earnings gap. A simple method to check for this effect is to compare the earnings ratios within each field of study to the overall ratio (Table 2). The effect of divergent fields of study seemed relatively weak in 1984; the within-field earnings ratio averaged 89%, just one percentage point greater than the overall ratio. However, the spread had widened to three percentage points by 1987, when the within-field ratios averaged 85%, compared with the 82% overall ratio.

VIEW ▶ Table 1 **Field of study distribution of 1982 university graduates employed full-time*, 1987**

Source: *Follow-up of 1982 Graduates Survey*

***** *Sample comprises graduates employed full-time at the time of the interview.*

VIEW ▶ Table 2 **Female to male earnings ratios of 1982 university graduates by field of study***

Sources: *National Graduates Survey and Follow-up of 1982 Graduates Survey*

***** *Sample for each year comprises graduates employed full-time at the time of the interview.*

Even though the earnings gap was generally smaller within fields of study, women graduates of virtually all programs still earned less than men. In fact, in only one field - political science - did female graduates earn at least as much as men in 1984. But the earnings pendulum had swung back in favour of men by 1987.

Earnings ratio varies by degree level

The earnings ratio did not follow a consistent pattern by degree level. The earnings gap was largest among master's graduates, with ratios of 85% in 1984 and 81% in 1987. This compared with 90% and 83% for those with an undergraduate degree. (4) The gap is virtually nonexistent at the doctorate level: women with a Ph.D. earned 1% more than men in 1984 and 1% less in 1987.

Degree level obviously has an effect on earnings - postgraduate degrees generally lead to higher salaries. University graduates with doctorates who worked full-time in 1984 earned 45% more than those with undergraduate degrees (36% more in 1987). Master's level graduates occupied the middle ground. Since more men received postgraduate degrees, one would expect their earnings to be somewhat higher.

Combining the effects of field of study and degree level should then narrow the earnings gap. And this is indeed the case. In a simple average across ten major fields of study and three degree levels, female university graduates earned 94% of the salaries of their male counterparts in 1984 and 92% in 1987 (Table 3). Of course this average, which gives equal weight to the earnings ratios for each degree level, is biased by Ph.D. holders, who make up only a small proportion (1%) of the graduate population. Furthermore, broad field of study comparisons are plagued by other problems. For example, the medical and health sciences category compares a male population consisting mostly of medical doctors to a female population of mainly nursing graduates.

VIEW ▶ Table 3 **Female to male earnings ratios of 1982 university graduates, by field of study and level of degree***

Sources: *National Graduates Survey and Follow-up of 1982 Graduates Survey*

*** Sample for each year comprises graduates employed full-time at the time of the interview.*

VIEW ▶ Chart C **Male-female earnings gap, 1982 university graduates**

Sources: *National Graduates Survey and Follow-up of 1982 Graduates Survey*

Although further cross-classifications or more detailed categories might create more comparable groups, small sample sizes severely limit the range of such analyses. To simultaneously account for the many characteristics relevant to an individual's earnings, a multivariate model must be used.

A multivariate model of the earnings gap

In the previous section, the earnings gap between male and female graduates was categorized by only one or two variables at a time. A multivariate approach allows the effects of a number of variables to be studied simultaneously. In this section, a technique known as decomposition is used to analyze the sex differential in earnings.

The decomposition technique is based on a human capital model of earnings. An individual's earnings are assumed to be a function of his or her earnings-related characteristics (such as education, skill, experience and family background) and the rewards for each of these characteristics as determined by the labour market. The average level of each characteristic possessed by men and women is easily determined from the NGS and FOG data base. The returns to the characteristics are estimated by fitting linear regression equations for the male and female subpopulations. The decomposition technique is then used to determine how much of the percentage difference in mean earnings is due to the differing characteristics of men and women (the explained component) and what portion is due to unequal rewards for those characteristics (the residual component). (For details of the technique, see *Decomposition methodology*.)

The characteristics in the model include age, language, province, inter-provincial mobility, parents' postsecondary education, marital status, presence of children, work experience prior to studies, detailed field of study, degree level and public sector employment. (For a list of the categories for each characteristic, see Wannell, 1989.)

Note that the industry and occupation of employment are not included in the model. These characteristics are earnings-related, but the differences observed in men and women may be partly due to demand-side discrimination. (See *Discrimination and alternative explanations*.) For example, it is possible that barriers to women exist in some high-paying industries or occupations. If these variables were included in the model, the component of the earnings gap explained by differences in supply-side characteristics of men and women could be inflated by the potential effects of discrimination. On the other hand, employment sector (public or private) is included in the model since the implementation of employment equity programs and related initiatives may prevent significant barriers in the public sector. In other words, somewhat different rules may apply in the public and private sector labour markets.

The equations were estimated for earnings in 1984 and 1987. The population was limited to graduates with valid earnings data in 1984 and 1987 who were working full-time at each of the five time points covered in the surveys. (5) Thus, the subpopulations of women and men have a history of strong and generally equal attachment to the labour force.

Slightly higher earnings potential for male graduates

The differing earnings-related characteristics of men and women accounted for relatively little of the earnings gap in 1984 and 1987. The explained component represented one-third of the percentage difference in earnings in each year (Table 4). Whereas male graduates earned 15% more than female graduates in 1984, and 22% more in 1987, the model estimates that if men and women received equal returns to their characteristics the earnings gap would have been only 5% and 7%, respectively. So male graduates, on average, had slightly "better" earnings-related characteristics than women. But what were the important characteristics?

VIEW ▶ Table 4 **Decomposition of the male to female earnings ratio among 1982 university graduates***

Sources: *National Graduates Survey and Follow-up of 1982 Graduates Survey*

* *Sample for both years comprises graduates employed full-time at five time points: January 1983, October 1983, June 1984, January 1986 and March 1987.*

Field and level of study count

The explained component of the earnings gap was distributed across six main categories of explanatory variables (Table 5). The different fields of study followed by men and women were the most important category, comprising 133% of the net difference in 1984 and 84% in 1987. (6) The higher percentage of men with master's degrees was also a major factor in 1984, but less so in 1987.

VIEW ▶ Table 5 **The "explained" component of the male to female earnings gap among 1982 university graduates***

* *The sample for both years comprises 1982 university graduates employed full-time at five time points: January 1983, October 1983, June 1984, January 1986 and March 1987.*

Some factors favoured women

Some factors worked in the opposite direction, diminishing the explained component. The women in the

population were, on average, slightly older than the men and had more previous full-time work experience. The greater previous experience of women had the effect of decreasing the explained component by 9% in 1984 and 6% in 1987. Similarly, a much higher percentage of women worked in the public sector in both years. However, public sector employment was a strong equalizing factor in 1984, but worked to widen the explained component in 1987. In effect, the higher starting earnings in the public sector (favouring women) were soon eclipsed by faster earnings growth in the private sector (favouring men).

Residual earnings difference remains a puzzle

Although the model provides some interesting insights into the explained component of the earnings gap, it offers little in the way of explanation for the much larger residual component (Table 4). The size of the residual component is mainly due to much larger estimated age and sex coefficients for men than for women. But there is no clear reason why men should receive higher returns for age (particularly when employment experience is included as a control) or simply for being male. The non-specific nature of these variables leaves the residual difference in earnings open to a wide range of interpretations (several of which are discussed in *Discrimination and alternative explanations*).

Summary

This study focuses on the differences in earnings between men and women of a very select group - 1982 university graduates who were employed full-time. With their identical educational backgrounds, and their similar age profiles and labour market experience, one would expect these individuals to have little or no earnings differential.

However, the data indicate that a sizable earnings gap exists between recent male and female university graduates and that the gap grows over time. Women's earnings averaged 88% of men's earnings in 1984, and by 1987 the ratio had fallen to 82%.

Although the earnings gap in this young, well-educated cohort is smaller than that found in the work force as a whole, female graduates earn less than their male counterparts in most fields and levels of study. Ph.D. holders are the exception to the rule - the average earnings of women and men with Ph.D's are equivalent, although the ratio varies considerably by field of study.

The decomposition model estimates that differences in the education and background of the 1982 university graduates explain only about one-third of the gap between female and male earnings. In other words, the model estimated that if men and women were rewarded equally for their education and other characteristics, men would have earned 5% more than women in 1984 and 7% more in 1987. But male graduates actually earned 15% more in 1984 and 22% more in 1987.

The results of this study raise as many questions as they answer. If the variables in the model do not

adequately explain the remaining two-thirds of the earnings gap, then what does? What accounts for the growth in the earnings gap for this cohort? Is the gap shrinking for more recent graduating classes? Why is the earnings gap so much larger in less educated segments of the population? While the answers to these questions remain elusive, the increasingly important role of women in the work force merits their pursuit.

A brief note on the data

The National Graduates Survey (NGS), 1984, and the Follow-up of 1982 Graduates Survey (FOG), 1987, captured extensive demographic, educational and labour market information about the 1982 graduates of universities, community colleges and vocational and trade programs. Included in each survey was a question asking the respondent to estimate their yearly earnings (to the nearest thousand dollars) based on the job held at the time of the interview.

The analysis in this report is limited to university graduates working full-time. This restriction ensures that more or less equal amounts of labour are being compared. It also follows that the earnings figures approximate full-time, full-year earnings (because respondents are estimating their yearly earnings based on the current, full-time job). The descriptive comparisons of 1984 earnings include all graduates working full-time in June 1984. A similar restriction applies to the comparison of 1987 earnings, yielding the following maximum sample sizes:

	1984	**1987**
Men	5,141	4,986
Women	4,032	3,689
Total	9,173	8,675

Since missing values in the data set were not imputed, the exact sample size for each comparison is somewhat smaller.

A much more restrictive definition was used in the multivariate analyses: only those employed full-time at each of five separate time points were included. The resultant maximum sample is 5,971 individuals (3,582 males and 2,389 females). The working samples are substantially smaller due to missing values among the many variables included in the analysis.

More detailed information on the surveys is available from the Special Surveys Group, Statistics Canada at (613) 951-4577. An overview of the results of the 1984 survey can be found in Clark, Laing and Rechnitzer, 1986.

Decomposition methodology

The "non-discriminatory" decomposition technique is a variant of a methodology that dates back to the 1950s and has appeared in economic, sociological and demographic literature (Cotton, 1988 and Gunderson, 1989).

Consider the following earnings equation:

$$ln\ W = Xb + u$$

where *ln W* is a vector of the natural log of yearly earnings for *k* individuals; *X* is a *(kj)* matrix of *k* observed data values for *j* characteristics, *b* is a vector of *j* coefficients measuring returns to those explanatory variables and *u* is the error term. (The natural log of earnings is used so that the estimated coefficients approximate the proportionate effect on earnings of changes in the explanatory variables.) Using ordinary least squares (OLS), the earnings equation is estimated separately for men and women. The superscripts *m* and *f* identify the male and female estimated regression functions:

$$\widehat{ln\ W}^f = \hat{X}^f \hat{b}^f$$
$$\widehat{ln\ W}^m = \hat{X}^m \hat{b}^m$$

One property of OLS estimators is that the product of the coefficients and sample means of the associated characteristics sum to the mean of the dependent variable, so that

$$\overline{ln\ W^f} = \overline{X^f}\hat{b}^f$$
$$\overline{ln\ W^m} = \overline{X^m}\hat{b}^m$$

The decomposition technique centres on the premise that the difference in mean earnings between women and men is a simple function of differences in the observed explanatory variable means and the estimated returns to these characteristics. Therefore, if men and women were to receive the same returns to their characteristics, the difference in earnings would be solely attributable to differing characteristics.

Cotton proposes that in the absence of differential rewards, the returns to attributes would fall somewhere between the respective returns for men and women. He suggests that "non-discriminatory" coefficients be estimated as the weighted average of the male and female coefficients. Therefore,

$$\hat{b}^* = p^m \hat{b}^m + p^f \hat{b}^f$$

where $\hat{b}^*$ is the vector of non-discriminatory coefficients and p^m and p^f are the proportions of the total population that are male and female.

From the estimated regression functions, the difference in mean log earnings between men and women is decomposed into three terms:

$$\overline{ln\ W^m} - \overline{ln\ W^f} = (\overline{X^m} - \overline{X^f})\,\hat{b}^* + \overline{X^m}(\hat{b}^m - \hat{b}^*) + \overline{X^f}(\hat{b}^* - \hat{b}^f)$$

The first term represents the explained component of the earnings gap attributable to differing characteristics. The residual component, which is the proportion of the gap due to differing returns to characteristics, consists of a premium for the higher-paid group (the second term) and a penalty for the lower-paid group (the third term).

In the logarithmic form, the components are additive - the components sum to the difference in average log earnings - and symmetric (that is, if the male mean is subtracted from the female mean, the proportions remain the same and only the sign is reversed).

The differences of the logs can also be transformed back to earnings ratios (Table 4), such that:

$$exp(\overline{ln\ W^m})/exp(\overline{ln\ W^f}) = Z_1 Z_2 Z_3$$

where $exp(\overline{ln\ W^m})$ and $exp(\overline{ln\ W^f})$ are the male and female geometric mean earnings, and

$$Z_1 = exp\,[(\overline{X^m} - \overline{X^f})\,\hat{b}^*]$$

$$Z_2 = exp\,[\overline{X^m}(\hat{b}^m - \hat{b}^*)]$$

$$Z_3 = exp\,[\overline{X^f}(\hat{b}^* - \hat{b}^f)]$$

Note that in this form the components are multiplicative: the ratio of the male to female mean is the product of the exponential transform of the components.

It is important to remember that the decomposition results are estimates subject to both specification error and measurement error. The results can be affected by unmeasured human capital characteristics or labour market decisions that are unrelated to income (such as individual preferences to work in a particular place or with certain people). Accordingly, decomposition cannot provide direct evidence of wage discrimination. On the other hand, it can suggest which characteristics might be differentially rewarded.

Discrimination and alternative explanations

How does one account for the residual differences in the earnings of male and female graduates? Are these differences evidence of discrimination, or are there alternative factors? Here, we consider three general classes of explanations for the residual difference: incomplete measurement of the dependent variable (income), omission of explanatory variables, and discrimination by employers.

Incomplete measurement of income

Earnings, as measured by the NGS and FOG, is just one component of the total income from any job. Total income, in its broadest sense, also includes both monetary and non-monetary benefits. Monetary benefits include such things as company contributions to pension plans, dental plans and supplemental medical plans. Non-monetary benefits are less easily defined or measured: for example, job satisfaction, geographic preferences, challenge or opportunities for advancement.

Unfortunately, the NGS and FOG contain no information on the monetary benefits received by respondents. Although it is unlikely that the distribution of such benefits would be so balanced in the favour of women as to significantly narrow the earnings gap the different types of jobs held by men and women could allow for some small differences. If, for example, benefits were greater in the public sector

than the private sector, the gap, as measured by earnings alone, might be slightly overestimated.

On the other hand, benefits tend to be correlated with earnings - workers with higher earnings generally receive greater benefits. Since men earn, on average, more than women, they may also receive greater benefits. Of course, without specific estimates of employment benefits, it is impossible to tell which factors would predominate in this population.

The issue of non-monetary rewards is closely linked to the notion of individual preferences. The income gap, in this line of argument, may be narrowed if women receive greater non-monetary returns, such as satisfaction, from their jobs. The NGS and FOG offer only inconclusive evidence in this area. Both surveys asked respondents to rate their overall satisfaction with their jobs and, more specifically, with their salaries. Men and women were equally satisfied with their jobs, indicating that women are probably not receiving greater non-monetary rewards than men. The salary satisfaction question did, however, show that slightly more women than men (22% compared with 19%) were dissatisfied with their salaries.

Omitted explanatory variables

The regression models that fed into the decomposition calculations accounted for 29% to 43% of the total variation in earnings of the graduates. Although such measures compare favourably with most earnings models based on data at the respondent level, the fit of the model to the data might have been improved by including other earnings-related variables. But, to contribute to the explained proportion of the earnings gap, either men or women would need to have appreciably more of this unobserved characteristic. This requirement appears to rule out many possibilities.

Inherent ability, for example, is often cited as a possible source of unexplained variance in earnings models. Regardless of the problems of defining or measuring such a concept, it doesn't seem a very reasonable proposition that such a characteristic should be unequally distributed between men and women. This is particularly true if very specific education controls are already in the model.

On the other hand, occupation is one earnings-related characteristic in which men and women differ significantly. Male graduates tend to enter higher-paying occupations than female graduates, even within a given field of study (Wannell, 1989). Occupation (or industry) could have been included among the control variables. In fact, when the 1987 decomposition calculations were repeated for a model containing 15 occupation and 12 industry dummy variables, the explained component of the earnings gap rose from 35% to 47%. Clearly, men and women with similar qualifications are getting different types of jobs. However, as noted earlier, the matching of male and female graduates to first jobs could involve discriminatory processes as well as individual preferences. The identification and separation of these demand- and supply-side factors is discussed below.

Demand-side discrimination

Sex discrimination by employers can be classified into two basic forms: hiring and advancement

selection based on sex; and differential pay for the same work. Each form of discrimination presents its own problems to researchers. The existence of hiring and advancement selection has stronger theoretical underpinnings and seems to fit NGS and FOG data. However, employer selection is so functionally and theoretically similar to self-selection (individual preferences) that it is virtually impossible to distinguish the two. On the other hand, unequal pay for the same work does not have strong theoretical support, is probably identifiable only with a case study format and may be difficult to isolate from selection effects.

At the risk of oversimplification, most theoretical discussions of hiring and advancement selection boil down to "statistical discrimination". (For a longer, more general discussion of statistical discrimination, see Thurow, 1975.) To summarize this argument, women are more likely to interrupt their working careers for marriage and child care than men. Employers prefer "career-track" employees, who do not have short or frequently interrupted careers. Since employers cannot readily determine at the time of hiring which women will have short or interrupted careers, according to this hypothesis hiring or advancing a man is a better bet - particularly in jobs that require significant on-the-job training and career development, all other considerations being equal. Although this type of discrimination has traditionally been illustrated by the shunting of women to "pink-collar ghettos" such as clerical work, it is not necessarily that categorical. Enough leeway exists within most highly qualified occupations for some stratification by sex to occur. But at this level the distinction between discrimination and self-selection is not always clear.

Human capital theory suggests that women who plan to have short or interrupted careers would favour jobs that have relatively short periods of on-the-job training and offer little penalty for time spent out of the labour force. Trade-offs may exist within most occupations whereby some jobs can be exited and re-entered relatively easily, but with some pay or benefit penalties. The self-selection of different occupational streams reinforces the earnings gap, but is not normally labelled discrimination.

Of course the distinction between discrimination and self-selection is blurred by other factors such as childhood instruction in male and female roles and the expectation of discrimination in some occupations. All of which makes it very difficult to clearly identify hiring and advancement discrimination.

The issue of earnings differentials for essentially the same duties is even more difficult to assess. In addition to the problems with theoretical arguments, this phenomenon simply cannot be measured with normal survey microdata. There are two main reasons for this. The first involves sampling ratios. Surveys typically sample only a small proportion of the population, therefore making it highly unlikely that men and women with similar qualifications doing similar jobs at the same firm could be identified. Even though the NGS and FOG provide many controls for qualification and experience and have a very low sampling ratio, the jobs held by the graduates represent a minute fraction of all jobs in the labour market. Even if a few matches could be found (from which no statistical inferences could be drawn), the second problem, occupation coding, would come into play.

Canadian microdata sources - the NGS and FOG included - at best contain occupational information coded at the Standard Occupation Classification four-digit level (***Standard Occupational Classification***

1980, Statistics Canada Cat. 12-565E). This means that the entire range of jobs in Canada is summarized into less than 500 categories. Obviously, jobs within categories cannot be entirely homogenous at this level. If homogenous jobs cannot be identified, then unequal pay for the same job cannot be measured.

Furthermore, job titles may be a source of discrimination. It is possible that essentially similar job duties may be given different titles or descriptions for men and women (Bielby and Baron, 1986). Focused case studies may provide some insights, but create different problems.

Notes

Note 1
The graduates of community colleges and vocational and trade programs were also surveyed but are not included in this report for two reasons. First, the entrance requirements vary greatly, thus the graduates are a much less homogenous group with respect to age, years of education and academic skills. Second, trade and vocational (and, to a lesser extent, community college) programs are so stratified by sex that comparisons between men and women are subject to high sampling variability (due to small numbers in the minority group). A longer version of this paper includes analyses of the earnings gap among community college graduates and is available, on request, from the author.

Note 2
One might expect a drop in the female to male earnings ratio between 1984 and 1987 if women worked less than men - for example, as a result of higher part-time employment rates and periods spent on maternity leave. However, the corresponding ratios for the sample consisting of those employed full-time at each of five separate time points were 86% in 1984 and 81 % in 1987. It is thus unlikely that the increase in the earnings gap between men and women is an artifact of a less experienced female work force in 1987.

Note 3
The earnings ratio for full-time, full-year workers the same age as the 1982 graduates is based on a hypothetical work force with the same age distribution as the 1982 graduates. Age-weighted average earnings are calculated by multiplying the average earnings for a particular age group (from ***Earnings of Men and Women***, Statistics Canada Cat. 13-217) by the proportion of graduates in that age group and summing across age groups. Age-weighting the full-time, full-year work force tends to narrow the earnings gap because wages of men and women are closer together in the younger age groups, which contain the majority of graduates.

Note 4
First professional degrees are included in the undergraduate degree category. The master's level includes

graduate level certificates and diplomas.

Note 5
These time points are January 1983, October 1983, June 1984, January 1986 and March 1987. This restriction may create a sample selection bias. For example, those with lower wage-related characteristics or less than adequate returns to their characteristics will be less likely to enter the full-time labour market.

If this affects women more than men, it results in an upward bias on the observed earnings for women and, therefore, a downward bias on the earnings gap.

Note 6
Since some variables can have the opposite effect to the overall trend (that is, they favour women), the absolute sum of differences can easily exceed the net sum of differences. The subtotal of 133% for fields of study in 1984 indicates that net of field of study, women had "better" wage-generating characteristics than men (for example, higher average age and more public sector employment).

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Source

Perspectives on Labour and Income, Summer 1990, Vol. 2, No. 2 (Statistics Canada, Catalogue 75-001E). This is the second of six articles in the issue.

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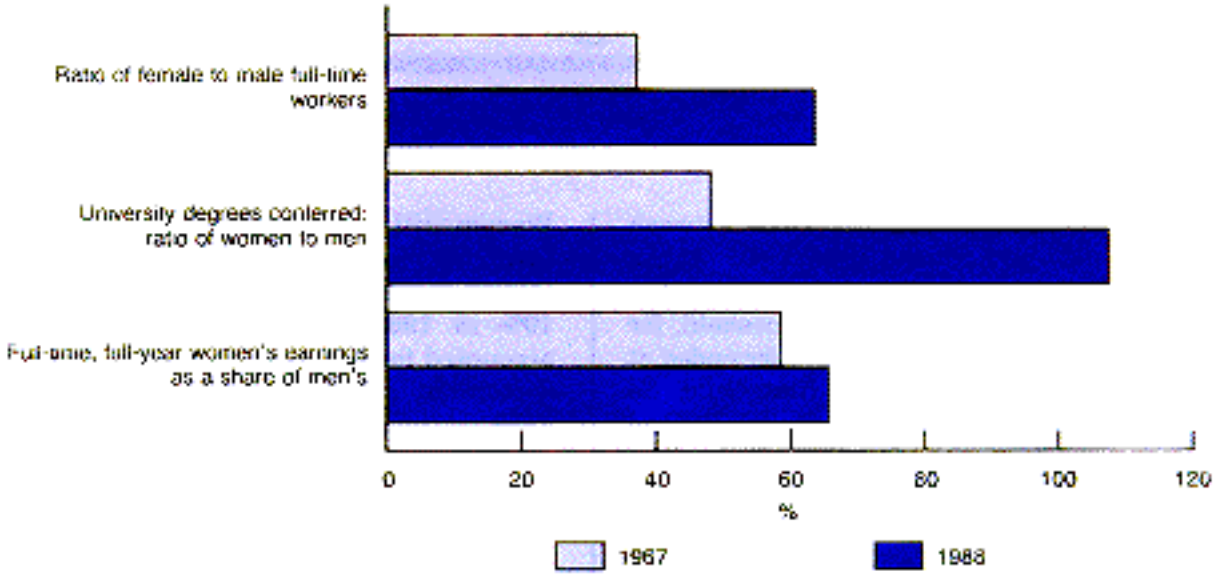
Women in the work force

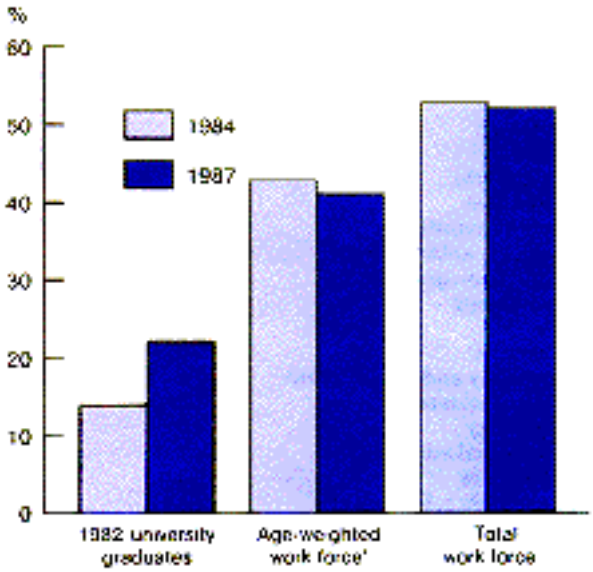
Despite the increasing proportions of women among full-time workers and new university graduates their earnings still lag behind those of men.



Sources: Labour Force Survey, University Student Information System, and Survey of Consumer Finances

Male-female earnings gap, full-time, full-year workers

The earnings gap was smaller for 1982 university graduates than for their peers in the work force.



Sources: National Graduates Survey, Follow-up of 1982 Graduates Survey, and Survey of Consumer Finances
** Comparable to 1982 university graduates. (See note 3.)*

Table 1

Field of study distribution of 1982 university graduates employed full-time*, 1987

Field of study	Men	Women
	%	
Total	**100.0**	**100.0**
Education	15.7	27.7
Fine arts	1.5	2.3
Applied arts	--	1.4
Journalism	--	--
Other humanities	7.8	13.7
Sociology, anthropology and demography	1.7	4.1
Criminology	--	--
Law	3.4	2.6
Economics	5.3	1.7
Geography and environment	4.1	2.2
Political science	2.3	1.9
Psychology	2.3	6.4
Other social sciences	22.0	14.9
Agriculture	1.5	--
Biochemistry, biology and zoology	2.4	2.1
Home economics	--	1.3
Veterinary medicine	--	--
Architecture	0.9	--
Engineering	14.1	1.4
Forestry	0.9	--
Landscape architecture	--	--
Dentistry	0.9	--
Medicine	2.7	1.8
Nursing	--	4.8
Optometry	--	--
Pharmacy	--	1.2

Public health	--	--
Computer sciences	3.4	1.2
Mathematics	2.3	1.3
Chemistry, geology and metallurgy	1.8	3.2
Meteorology	--	--
Physics	--	--
Source: Follow-up of 1982 Graduates Survey		
** Sample comprises graduates employed full-time at the time of the interview.*		

Table 2

Female to male earnings ratios of 1982 university graduates by field of study*

Field of study	Female to male earnings ratio	
	1984	1987
	%	
All fields	**88**	**82**
Education	87	86
Fine arts	96	89
Applied arts	--	--
Journalism	--	--
Other humanities	98	94
Sociology, anthropology and demography	99	97
Criminology	--	--
Law	88	95
Economics	88	75
Geography and environment	83	82
Political science	104	86
Psychology	83	82
Other social sciences	90	86
Agriculture	--	--
Biochemistry, biology and zoology	90	95
Home economics	--	--
Veterinary medicine	--	--
Architecture	--	--
Engineering	89	89
Forestry	--	--
Landscape architecture	--	--
Dentistry	--	--
Medicine	81	87
Nursing	--	--
Optometry	--	--

Pharmacy	--	--
Public health	--	--
Computer sciences	95	91
Mathematics	97	93
Chemistry, geology and metallurgy	90	84
Meteorology	--	--
Physics	--	--
Unweighted average of field of study ratios	89	85
Sources: National Graduates Survey and Follow-up of 1982 Graduates Survey		
** Sample for each year comprises graduates employed full-time at the time of the interview.*		

Table 3

Female to male earnings ratios of 1982 university graduates, by field of study and level of degree*

Field of study	Level of degree	Female to male earnings ratio	
		1984	1987
		%	%
All fields	**All levels**	**88**	**82**
	Undergraduate	90	83
	Master	85	81
	Doctorate	101	99
Education	Undergraduate	92	89
	Master	83	86
	Doctorate	91	88
Fine arts and humanities	Undergraduate	99	91
	Master	95	95
	Doctorate	102	94
Commerce, economics and law	Undergraduate	87	87
	Master	87	89
	Doctorate	--	--
Other social sciences	Undergraduate	94	90
	Master	89	84
	Doctorate	93	91
Agriculture and biological sciences	Undergraduate	91	80
	Master	89	84
	Doctorate	87	89
Engineering	Undergraduate	91	89
	Master	80	--
	Doctorate	--	--
Medical and health sciences	Undergraduate	65	54
	Master	77	50
	Doctorate	158	118
Mathematics and physical sciences	Undergraduate	95	93

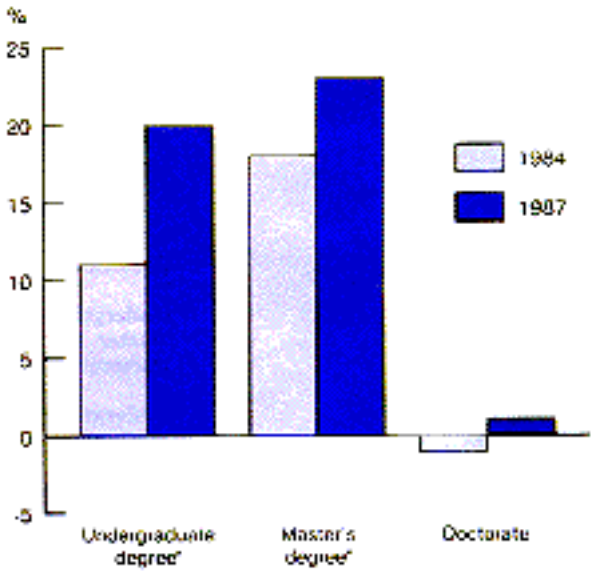
	Master	83	89
	Doctorate	94	94
Unweighted average of field of study/level of degree ratios		94	92

Sources: National Graduates Survey and Follow-up of 1982 Graduates Survey

** Sample for each year comprises graduates employed full-time at the time of the interview.*

Male-female earnings gap, 1982 university graduates

Only at the Ph.D. level did women and men have similar earnings.



Source: National Graduates Survey and Follow-up of 1982 Graduates Survey
* See note 4.

Table 4

Decomposition of the male to female earnings ratio among 1982 university graduates*

	1984	1987
Explained component (differing characteristics)	1.05	1.07
Residual component (differing returns to characteristics)		
Male premium	1.04	1.07
Female penalty	1.05	1.06
Male to female earnings ratio† (product of three components)	1.15	1.22
(Female to male earnings ratio†)	0.87	0.82

Sources: National Graduates Survey and Follow-up of 1982 Graduates Survey

** Sample for both years comprises graduates employed full-time at five time points: January 1983, October 1983, June 1984, January 1986 and March 1987.*

† Ratio of geometric mean earnings.

Table 5

The "explained" component of the male to female earnings gap among 1982 university graduates*

	Composition of explained component of earnings gap	
	1984	1987
	%	
Total†	**100**	**100**
Demography/family	-11	3
Field of study	133	84
Level of degree	26	9
Previous employment experience	-9	-6
Region	1	-
Public sector employment	-40	10

** The sample for both years comprises 1982 university graduates employed full-time at five time points: January 1983, October 1983, June 1984, January 1986 and March 1987.*

† The total is the explained component of the difference in mean log of earnings between men and women.