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EVALUATING THE LABOUR MARKET EXPERIENCE
OF CANADIAN MALE AND FEMALE
1986 UNIVERSITY GRADUATES

A thesis presented to
the School of Graduate Studies
of the University of Ottawa
in partial fulfillment
of the requirement
of the degree of Master of Arts in Economics.

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ABSTRACT

EVALUATING THE LABOUR MARKET EXPERIENCE OF CANADIAN MALE AND FEMALE 1986 UNIVERSITY GRADUATES. Gordon R. Bulmer. University of Ottawa, Ottawa, Ontario.

A major issue in labour economics concerns the differences in earnings between males and females. This thesis evaluates the male-female wage gap of the 1986 university graduates using *The Follow-Up of 1986 Graduates* (NGS). The wage differential among graduates with bachelor degrees widens over the period 1986-1991. The increase in wage discrimination is the result of a change in the skill sets of males and females. However, wage discrimination decreases among graduates with master's degrees. The main reason for the decrease is the improved returns, relative to males, that females earn for their human capital characteristics.

The results are obtained using Oaxaca's (1973), Cotton's (1988) and Wellington's (1993) decomposition methodologies. Wellington's (1993) two-period decomposition takes advantage of the panel nature of the data and has been employed only once previously on Canadian data. This thesis shows that the analysis of wage differentials is sensitive to the parameters of the model and the underlying populations.

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CHAPTER 1

INTRODUCTION

A major issue in labour economics and among society during the past several decades concerns the differences in wage earnings between males and females. These differences in earnings have declined somewhat in recent years but the decline has been painstakingly slow. The chronic wage gap puzzles theorists who find it difficult to explain in a competitive environment. Among empiricists the difficulty lies in explaining the contribution of discrimination to the wage differential.

In Canada, most research on this issue has been based on census data. However, the census does not obtain information on prior work experience and only began collecting detailed information on field of study in 1986. Theorists and empiricists agree that detailed information on prior work experience, education and family status variables are crucial to advancing an understanding of the existence of wage differentials. In Canada, one survey that does contain these variables is the National Graduates Survey (NGS) conducted by Statistics Canada for Employment and Immigration Canada (now Human Resource Development Canada). The surveys are conducted on samples of the entire national post-secondary graduate population. *The Follow-Up of 1986 Graduates* is the third panel survey of the series. It offers a unique opportunity to document the labour market experience of the 1986 graduates over the period 1986 to 1991. Using the NGS, the impact of wage discrimination on the graduates can be determined also. For example, analyses of the two earlier surveys, based on the 1978 and 1982

graduates, found evidence of gender discrimination in wages and reported that the wage differential widened for the graduate sample population over the period 1982-1987.

This thesis evaluates the extent and characteristics of the male-female wage gap of the 1986 university graduates using *The Follow-Up of 1986 Graduates* (NGS). The evidence from this thesis shows that wage discrimination among graduates with bachelor degrees widen slightly over the period 1986-1991. However, among graduates with master degrees, the wage discrimination decreased after graduation. The preceding result suggests that the labour market may reward graduates differently depending not only on gender but on the level of attained degree.

Previously, it had been assumed that an individual who increased his or her level of education could expect an increased financial reward from the labour market. The argument is based on the idea that graduates who are capable and willing to pursue an advanced degree may be endowed with substantially different characteristics than those who do not continue their education. Furthermore, in a competitive labour market such as the late 1980's and early 1990's, employers may place a premium on the attributes held by graduates with master degrees. However, the popular press has provided anecdotal evidence that employers may in fact prefer graduates with a bachelor's degree over more advanced degrees. Apparently, these employers have indicated a preference for hiring, at a lower cost, graduates with a bachelor's degree and then providing the new recruit with company-specific training. This thesis provides evidence contradicting the view that the financial returns to having an advanced degree may have been overstated.

In addition, this thesis addresses the issue of whether graduates with an advanced degree did significantly better than graduates with bachelor degrees as the economy dipped into the 1990-1992 recession. By considering MA and BA graduates separately, the analysis also provides additional insight on whether the effect on earnings of discrimination based on endowed characteristics differ by degree level. For example, the thesis finds that the labour market seems to treat female graduates with a bachelor's degree differently than female graduates with a master's degree, particularly when their family status characteristics are considered.

Another significant concern relates to the importance of education. This paper provides a deeper exploration of the relationship between gender, degree level and field of study. Perhaps not surprisingly, the rewards for advanced training are gender-specific. For females, it seems that the acquisition of any advanced degree is more important than the actual area of specialization, i.e., the field of study.

A number of different decomposition methodologies have been developed to study the issue of gender wage discrimination. This paper shows the results obtained from using several of the more prevalent decomposition procedures. Among these are the decomposition techniques as developed by Oaxaca (1973), Cotton (1988) and Wellington's (1993) two-period decomposition that takes advantage of the panel nature of the data. The panel aspect of the National Graduates Survey stems from the data being obtained at two time points, 1988 and 1991.

The next chapter reviews the economic literature on wage discrimination. Due to the enormous volume of literature in this area, the review focuses primarily on (i) recent Canadian research that studies similar demographic groups, (ii) the measurement of discrimination and (iii) the more prevalent decomposition methodologies. Chapter three details the methodology employed in the current analysis while the results of the study are presented in Chapter four. The summary and conclusions are in Chapter five. The more technical information is relegated to the two appendices that follow the bibliography.

CHAPTER 2

CRITICAL REVIEW OF EXISTING LITERATURE

Research into wage discrimination in the labour market has generated a considerable amount of literature during the last twenty years. Much of the knowledge gained in Canada has been from employing census data. However, census data have several drawbacks. For instance, the data usually do not provide sufficient detail on variables that are crucial in exploring an issue as complex as wage discrimination. Among the key variables often lacking is detailed information on field of study and prior work experience - two variables that have repeatedly been shown to have a significant impact on earnings. The Canadian National Graduate Survey (NGS) overcomes the Census shortcomings by providing greater degrees of information on these factors and others that have a significant influence on earnings for one demographic group, i.e., post-secondary graduates. In addition, the panel nature of NGS provides an opportunity to explore how significant life events such as marriage, attaining an advanced degree and children affect the wage gap.

This chapter begins by reviewing the more prevalent theories that attempt to explain the existence of the wage differential. Second, the usual method of measuring discrimination is described along with some of the concerns associated with the methodology. Third, the evidence on wage discrimination is presented with a focus on the existence and extent of wage inequities among similar demographic groups such as university graduates. The results of research that employs Canadian data are highlighted to allow for a comparison with the results

gleaned from this thesis. The chapter concludes with a short summary.

Historically, females have earned less than males in the aggregate sense. It is this difference in aggregate incomes that first generated interest among economists and later led to the development of the human capital theory and the economics of discrimination (Becker, 1971, Oaxaca, 1973, Blinder, 1973). Recent Canadian evidence for the period 1970-1990 based on workers employed full-year and full-time shows that "the raw, i.e., unadjusted difference between male and female earnings at the mean declined modestly over the period. The female/male earnings ratio rises from 0.60 in 1970 to 0.64 in 1980 to 0.67 in 1990" (Baker, Benjamin, Desaulniers and Grant, 1995)¹. Gunderson and Riddell, (p. 454, 1988) speculate that "this unadjusted ratio may reflect wage discrimination, the segregation of females into low-wage firms, occupations and industries, and differences in productivity-related factors such as education, training experience, absenteeism and turnover. Differences in these productivity-related factors may reflect unconstrained choices and they may reflect pre-labour market discrimination, perhaps in educational institutions or in the household." They suggest that discrimination may occur for many reasons. For instance, gender discrimination may arise, (1) since males may prefer working with or buying from other males, (2) for reasons of job security, i.e., to protect themselves from low-wage female competition, (3) or because employers may judge individual females based on the average performance of all females, (4) or because females may underestimate their own capacity in the labour market, (5) or because employers

¹ In a comparison of the male/female differential, based on data from the 1981 Census of Canada, Miller (1987) found that among workers employed full-time, women earn on average 70 percent of the male rate of pay.

who consistently underestimate the productivity of females (Gunderson and Riddell, 1988).

With respect to the latter point, Folbre (1994) states that “major reasons why employers typically pay women less than men include the belief that women *should* specialize in caring for families, and/or the suspicion that (whether they should or not) women *will* devote more time and energy to this task than men, detracting from their performance in paid work (emphasis the author’s).”

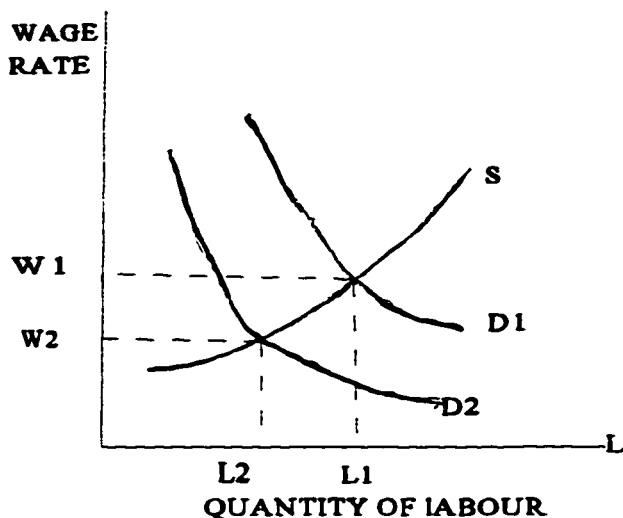
The essence of the preceding argument, in economic terms, is that society will demand less work from females. When this is coupled with an increasing supply of females willing and able to work, the result is lower wages relative to males.

Theories of Wage Discrimination

Demand Theories of Discrimination:

Early explanations put forward to explain wage discrimination focused on the demand side of the labour market (Tzannatos, 1990). These early neoclassical models assumed full employment and a lack of wage rigidities. Figure 1 depicts a simple model of this type. In the demand schedule for a particular type of labour (e.g., machinist), prejudice by employers results in a shift in the demand curve for the members of the discriminated group, e.g., women. Hence the demand for labour of the discriminated group shifts from D1 to D2. The shift reduces the discriminated group’s wages and the quantity of labour employed.

Figure 1:



The actions of the firm can be more closely viewed as they relate to its profit-maximizing behaviour² (see Figure 2). Assume that a discriminating firm maximizes utility which depends on profits and the percentage of males in its workforce, i.e.,

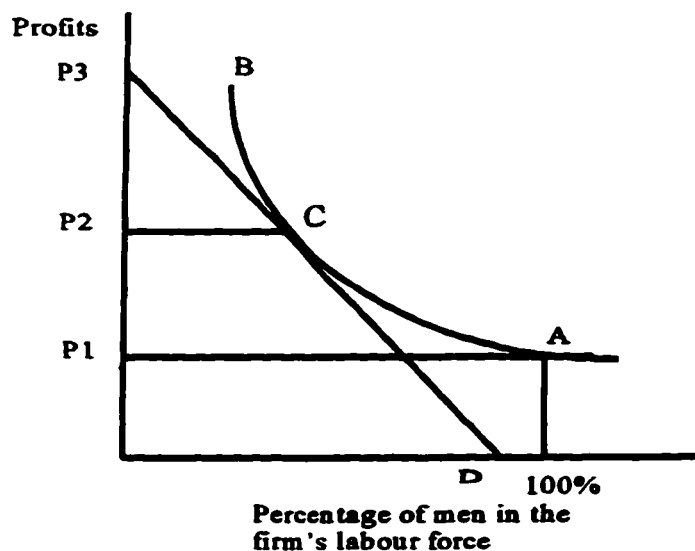
$$\max U = f(\text{profits, percentage of males in its workforce})$$

where U stands for the employers objective utility function. The model assumes first that males and females are perfect substitutes in the workforce and are paid equal wages. Second, it assumes the production function is “smooth” (i.e., no discontinuities) and (c) competition exists in both the product and labour market. Monetary profits are depicted on the vertical axis and the gender composition of the firm’s workforce is on the horizontal axis. The firm’s indifference

²The following explanation is derived from Arrow (1973) as described by Gunderson and Riddell (1988) and Tzannatos (1990).

curve is shown by the line AB. The more a firm dislikes females the steeper the indifference curve becomes. Assuming that males and females are perfect substitutes in production and are paid equal wages, then the firm's profit level is given by a horizontal line such as AP1. If the firm was non-discriminating, i.e., sex-blind, AB would have been horizontal and the equilibrium position would be indeterminate under the assumptions of the model. In other words, the equilibrium position would depend on factors such as chance and not on the parameters of the model.

Figure 2:



However, as AB is drawn, the discriminating employer would prefer to hire only males. The

reason given by the model is that the employer incurs a psychic cost from employing females. Hence the net cost to the employer is the prevailing wage rate plus the psychic cost i.e., $w(1 + d)$ where “d” ($d > 0$) is the disutility to the employer caused by having females in the workforce. In the literature “d” is usually referred to as the discrimination coefficient. With the assumption of equal wages for males and females, the discriminating employer’s equilibrium is at point A, where 100% of the workforce is male. Here the discriminating employer’s utility is maximized since it is the only point where monetary and net costs coincide.

If female wage rates are below the male wage rates, and one maintains the assumption that males and females are perfect substitutes in production, then the higher the percentage of males, the lower will be the level of profits. This relationship is shown by the new profit curve DP3. With female wages assumed to be less than males, the employer’s equilibrium occurs at point C and the employer would forego profits equal to P3P2.

The model yields the following predictions:

- (1) the larger the discrimination coefficient, “d”, the more convex will be the indifference curves and the larger the percentage of males that the firm will hire
- (2) the larger the wage differential between the sexes, the more expensive it will be for employers to discriminate against females and the percentage of females employed by the firm will be increased

(3) the less substitutable males and females are as factors of production, the more females will be employed since small deviations from the firm's preferred level of optimal sex-mix will lead to a sharp decline in profits.

The model is consistent with the neo-classical view that assumes full employment. However, according to neoclassical theory, the discriminating employer will cease to exist since nondiscriminating employers are more efficient and hence will survive in the long run. The discrimination model captured in figure 2 indicates that both wage and employment differentials would continue in the short run.

In a critical review of this model, Bergmann (1989) states that its predictions rest on three further assumptions that may or may not be true in a given time or place: "(1) that there are large numbers of people who are willing and able to openly violate social customs, which they themselves support and enjoy, for purposes of making money, (2) that violating customs does not entail costs that cancel out the advantage of cheap wages, and (3) that competition is intense enough to . . . (eliminate discriminatory firms)."

Other demand side considerations such as occupations and work content have been identified as possible explanations for differences in wages also (Chauvin and Ash, 1994, Gerhart 1990, Blau and Ferber, 1987). For example, if females have a taste for lower wage occupations and freely choose them, then perhaps a large portion of the wage differential can be explained. However, it is possible that females do not have such preferences and enter low wage

occupations as a result of past discrimination developed either at school or in the home. These issues will be explored in greater detail later in the review.

Supply Theories of Discrimination:

In addition to the demand-side theories, researchers have considered supply-side explanations. There are two aspects to labour supply, the quantity of labour supplied and the quality of labour supplied. The quantity aspect is concerned with the decision to participate in the paid labour market. Examples of issues that impact on the labour force participation decision are the wage rate, access to child-care, hours of work and technology. The quality aspect deals with human capital characteristics that affect productivity such as education, child and elder-care responsibilities, health status, intermittent attachment to the paid labour market etcetera. For simplicity the quantity and quality aspects affecting labour supply are dealt with separately. However, in practical terms the two issues are interwoven, particularly in their effect on the decision by women to enter and/or remain in the paid labour market.

Quality of Labour Supplied:

An early concept to explain the disparity in men's and women's wages were that men were paid more because they were more productive (Tzannatos, 1990). These productivity related differences between the genders could be acquired characteristics such as education and experience or innate characteristics such as perseverance or strength (Gunderson and Riddell, 1988). The innate differences have either been discounted by science (as in intelligence) or overcome by technology (as in strength). The focus is then on the acquired characteristics that

improve productivity. Human Capital Theory was developed as economists explored this issue. The theory postulates that an individual's decision to invest in her/his human capital can be explained by examining the costs and benefits attached to investing in their human resources. Examples on the cost side are the costs of tuition and opportunity costs such as income foregone while in school. On the benefit side, are the (hopefully) improved earnings associated with the improvements in productivity one can offer the employer (p. 364, Gunderson and Riddell, 1988). With perfect information, an individual will invest in their human capital development only if the marginal benefit exceeds the marginal cost.

However, women in general invest less in developing their human capital than men (Bergmann, 1989). Groneau (1988) suggests that the "wage differentials between men and women are often attributed to differences in on-the-job training, the lower investment of women being explained by their plans to interrupt their careers for family reasons." Similarly, Hersch (p. 747, 1991) states that "women may expect discontinuous labour market participation and fewer total years in the labour market than men. Thus, women will have less incentive than men to undertake human capital investments." However, it is equally plausible that women invest less in their human capital because they expect poorer returns than what males would receive for a similar investment. Supporting this argument are studies that have found that the quit rates for similarly paid men and women are similar (Bergmann, 1989). The fact that women are able to perceive these differences in pay has been established by Hampton and Haywood (1993).

As female participation rates increased during the past century there should have been a commensurate increase in the market skills of women. In turn, this should have led to a narrowing of the wage gap. Economists have been puzzled since this has not been the case (Smith and Ward, 1989, O'Neil, 1985). Smith and Ward (1989) suggest that the explanation can be found by analyzing the compositions of the working and not-in-the-labour-market female populations. They claim that new entrants and reentrants into the labour market have predominantly been women with little labour market experience and poorer than average education. They argue that as the female labour force continues to upgrade their education and work experience, the wage gap will narrow to possibly 80% by the year 2000 (Smith and Ward, 1989).

Quantity of Labour Supplied:

Early explanations that focused on the quantity aspects of labour supply as they impact on wage differentials were developed as economists attempted to explain the dramatic increase in female labour force participation rates that became evident at the beginning of this century (Wright, 1991). Table 1 illustrates that an increase in female participation rates occurred in Canada during the same period as it occurred in the United States. Wright (1991) cites studies conducted by Mincer (1962) and Smith and Ward (1984) that explain the increase in female labour force participation rates as "a consistent supply response (substitution effect) to the long-term rise in real wages available to women. (They conclude) that movement along a stable but elastic supply function can account for a large fraction of the change in (American) women's labour force participation between 1900 and 1980."

**Table 1: Female Labour Force Participation Rates by Age, Canada,
Census Years 1901-1991**

Year	14-19	20-24	25-34	35-64	65+	All Ages
1901	n.a.	n.a.	n.a.	n.a.	n.a.	16
1911	n.a.	n.a.	n.a.	n.a.	n.a.	19
1921	30	40	20	12	7	20
1931	27	47	24	13	6	22
1941	27	47	28	15	6	23
1951	34	49	25	20	5	24
1961	32	51	29	30	6	29
1971	37	63	45	42	8	40
1981	45	77	66	53	6	52
1991	n.a.	n.a.	n.a.	n.a.	n.a.	60

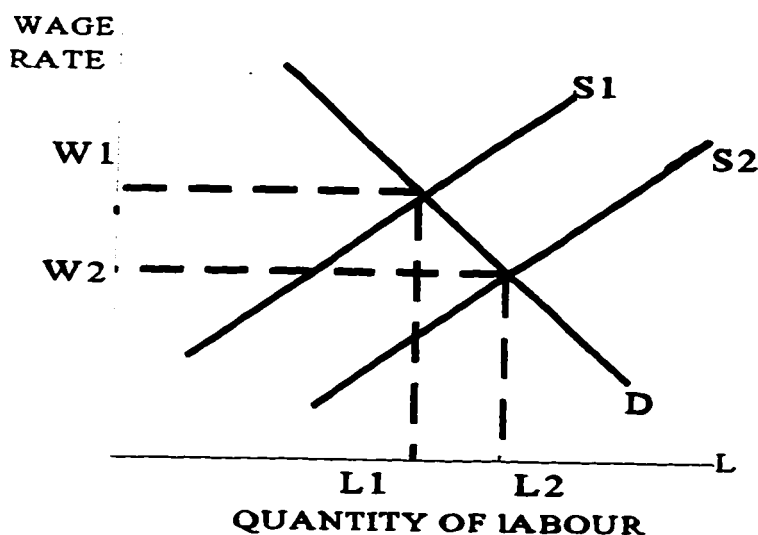
Abridged from Table 5.2, Gunderson and Riddell, 1988
 "The Daily" Census Canada, 1992

Hence, the increasing real wages of females caused an increase in their paid labour force participation rates. Figure 3 depicts one possibility as to why the increasing participation rates of females may have lead to a constraint on their earnings.

The model assumes a neoclassical world of full employment. The male labour market is ignored. Female wages are at W_1 and the quantity of female labour demanded, L_1 , are determined by the intersection of initial female labour supply, S_1 , and the demand by firms for female labour D . As female participation rates rise, (i.e., supply increases to S_2 and demand is held constant) a surplus of female labour develops, depressing the wage rate W_2 . Hence, the increasing labour force participation rates of females may in part have caused a reduction in

their wage rate. Furthermore, if females are over-represented in certain occupations, then the oversupply of female labour will depress female wages in these occupations *ceteris paribus*. This is the essence of the crowding hypothesis (Tzannatos, 1990, Gunderson and Riddell, 1988).

Figure 3:



Becker (1965) suggests that the issue of labour supply must be looked at in the context of the household or family unit. His “household production theory” employs the household as the unit that determines how much male and female labour is provided to the market. The family/household divides labour output based on specialization of its members. It follows that since women have a larger involvement in reproduction and child-rearing, they will be less involved in the paid labour market. Hence the sexual division of labour is “a simple outcome of rational choice and economic efficiency” (Folbre, 1994).

In economic terms, the labour supply of an individual is determined by the intersection of their reservation wage function (the compensation required for an individual to offer one more unit of time) and offered wage function (the wage an employer is prepared to pay for one more unit of time). “Within this theoretical context, factors that act to raise the reservation wage or lower the offered wage tend to decrease an individual’s labour supply. In the literature on female labour supply and earnings, economists have argued that family responsibilities, and particularly children will affect both the reservation and offered wage rates of women and that the impacts on their labour supply will be predominantly negative” (p.305, Nakamura and Nakamura, 1994). In the 20th century, changes in technology and declining fertility levels have created a decline in the traditional amount of housework done by women and as a result, they are able to commit a larger fraction of their time to labour force participation. One important result of these changes has been the reduction of time that young mothers withdraw from the labour force. Shapiro and Mott (1994), using the American National Longitudinal Survey of Labor Market Experience, found those American mothers who returned to work within 6 months of the birth of their first child had accumulated more than three and a half more years of work experience (by 1987) *ceteris paribus*, than did mothers who did not return to work within the 6-month period. This translated into a 19% wage premium for those women who had chosen an early return to work over those who had not.

However, the household production theory still does not answer the question of why women tend to be concentrated in low-paying sectors. Some have argued that women tend to concentrate in the low-paying sectors since these industries offer more flexible work

arrangements and the penalties for exiting and reentering this particular labour market may be lower (Duncan, Prus and Sandy, 1993, Fuchs 1989). Still this argument fails to address why there is such a wage disparity between men and women in the same occupations. Becker (1985) proposes that most household activities are borne by women and are more “effort intensive.” Hence, women are less able to work as hard as men in the workplace. Thus, “married women spend less effort on each hour of market work than married men working the same number of hours. The result is that married women have lower hourly earnings than married men with the same market capital, and they economize on the effort expended on market work by seeking fewer demanding jobs.” Becker’s (1985) theory is criticized by Bergman (1989). She states that “it seems unlikely that women operating slicing and cutting machines make \$192 and males operating such devices make \$303 because the men, being less tired, do a better job of slicing and cutting. Anybody who operates such a machine had better do it right, regardless of sex . . . it also seems unlikely that the quality of men’s hotel clerking justifies a wage 46% higher than women’s” (p.48, Bergmann, 1989).

In summary, human capital theory seems to be able to explain a woman’s decision to work, but it does not necessarily explain her occupational choice (Duncan et al., 1993). However, other elements of the theory, such as the positive financial effect of more education and prior work experience, appears to withstand empirical evaluation. The results that support human capital theory will be presented later when considering the evidence on the wage gap.

Heterodox Theories:

Human capital theory and modern neoclassical economics are based largely on the belief that individuals or individual firms determine market economic outcomes. Some alternative theories that attempt to explain the wage gap emphasize the political and/or sociological frameworks. For example, Marxists and some feminists see wage differentials as being rooted in the behaviour of empowered groups or classes. Proponents of these theories argue that empowered groups (or classes) will use economic means including the market system to maintain dominion over disempowered groups (or classes) (Folbre 1994).

Another theory that has gained some degree of support among economists is the dual or segmented labour market theory. The dual labour market theory proposes that there are two separate and distinct labour markets. The primary market provides secure employment at high wages and is typically unionized and monopolistic. The secondary market provides insecure or temporary employment in a labour market that is predominantly non-unionized and highly competitive. Males are typically employed in the primary market and females in the secondary market. Entry by females into the male dominated primary market is deterred by union activities or other barriers such as licensing requirements, pre-employment discriminatory tests etcetera. High turnover rates and absenteeism of females in the secondary market is seen as a consequence of working in a low-wage and undesirable environment.

These models have found support among some economists who argue that the labour market is imperfect and thus there is a necessity for government intervention (Bergman 1989).

There is more than a little truth to these arguments as evidenced by the fact that despite an awareness of the problem for the past 100 years, and despite the enactment of wage equality legislation by governments in most industrial societies, the wage gap still exists. According to most estimates, the narrowing of the wage gap has been painstaking slow. The methodology on which these findings are based is reviewed next.

Measurement of Discrimination

Human capital theory and the economics of discrimination attempt to explain the observed pattern of differences in the average wages of distinct societal groups. The methodology employed most often in studying discrimination was developed (in economics) by Oaxaca (1973) and Blinder (1973). It is based on the ordinary least squares regression methodology (OLS). In the wage discrimination methodology, regression analysis deals with the relationship between the dependant variable (usually the log of earnings) on one or more explanatory variables (e.g., gender, language, etc.). It attempts to "predict the mean or average value of the former in terms of the known or fixed . . . values of the latter" (p. 14, Gujarati 1988). An important feature of this technique is that "wage discrimination" is really a residual. Therefore, one cannot attribute all of the estimated residual to discrimination since it is probable that some of the difference includes the effects of unknown factors.

O.L.S. Methodology

Following Oaxaca (1973), the wage rate for each gender can be represented by,

$$(1) \ln W^j = X^j b^j + e^j \quad j = \text{male, female}$$

where

$\ln W^j$ = natural log of earnings

X^j = vector of variables reflecting, productivity, personal characteristics and labour market structure

b^j = vector of regression coefficients to be estimated

e^j = stochastic error term

Separate earnings equations are estimated for males and females. Subtracting the female from the male earnings equations, evaluated at the mean of the explanatory variables, yields

$$(2) \overline{\ln W^m} - \overline{\ln W^f} = \overline{X^m} b^m - \overline{X^f} b^f$$

Subtracting and adding $b^f \overline{X^m}$ from the right-hand side and collecting terms yields

$$(3) \overline{\ln W^m} - \overline{\ln W^f} = \overline{(X^m - X^f)} b^m + \overline{X^f} (b^m - b^f)$$

(returns for (differing returns for the same
different endowments) endowments i.e., discrimination)

In words, the female earnings equations are subtracted from the male earnings equations (at the mean of the explanatory variables) and the resulting differential is decomposed into two parts. One part is considered the returns to endowments and the other is termed the wage "gap."

"That is the average male-female earnings differential can be decomposed into two parts: a portion attributable to differences in endowments of wage-generating characteristics (some of which may reflect pre-labour market discrimination), and

a portion attributable to different wage payments for the same characteristics (i.e., discrimination)" (p.454, Gunderson and Riddell, 1988).

Before considering some of the concerns expressed with Oaxaca's technique, a brief digression follows on how the procedure can be applied in the special case employing panel data.

Panel Data and Oaxaca's Procedure

In the case of panel data, information is available on two or more time points.

Considering only the case of two time points, Oaxaca's decomposition can be modified in a number of ways. Example 1 is from Wellington (1993).

Example 1:

$$(4a) \overline{(\ln W^{ma} - \ln W^{mc})} - \overline{(\ln W^{fa} - \ln W^{fc})} = \\ \overline{[(X^{ma} - X^{mc})b^{ma} - (X^{fa} - X^{fc})b^{fa}]} + [\overline{X^{mc}}(b^{ma} - b^{mc}) - \overline{X^{fc}}(b^{fa} - b^{fc})]$$

where "a" and "c" denote the specific time points and where all other variables have the same meaning as before

The first expression on the right-hand side of the equation shows the changes to the wage gap due to changes in the means evaluated at their year "a" coefficients. It answers the question, "If the returns to the independent variables were constant at their year "a" levels, what portion of the wage gap can be accounted for by changes in the means?" (p. 393, Wellington, 1993). The second expression shows the portion of the wage gap that can be explained by changes in the coefficients over the period, evaluated at the year "c" means. The immediate question that arises is which time point should be the "a" or "c". This is an example of the familiar indexing problem. Since there are no compelling arguments that favour either choice, the matter is an arbitrary decision.

Alternatively Wellington (1993) reports that Smith and Welch (1989) employ:

Example 2:

$$\begin{aligned}
 (4b) \quad & (\overline{\ln W^{ma}} - \overline{\ln W^{mc}}) - (\overline{\ln W^{fa}} - \overline{\ln W^{fc}}) = \\
 & [(\overline{X^{ma}} - \overline{X^{mc}}) - (\overline{X^{fa}} - \overline{X^{fc}})] \overline{b^{ma}} \\
 & + \overline{X^{fc}} [(\overline{b^{ma}} - \overline{b^{mc}}) - (\overline{b^{fa}} - \overline{b^{fc}})] \\
 & + [(\overline{X^{mc}} - \overline{X^{fc}}) (\overline{b^{ma}} - \overline{b^{mc}})] \\
 & + [(\overline{X^{fa}} - \overline{X^{fc}}) (\overline{b^{ma}} - \overline{b^{fc}})]
 \end{aligned}$$

where all terms have the same meaning as before

The first expression on the right-hand side yields the portion of the wage gap due to changes over time using the year “a” returns for that characteristic. The second expression gives the effect of changes in the coefficients evaluated at the women’s means in year “c”. The last two expression have no clear meaning. In this thesis, Wellington’s decomposition i.e., equation (4a) will be employed since all terms offer a clear interpretation.

Concerns with Oaxaca’s Procedure:

The indexing problem also surfaces in the simpler Oaxaca decomposition. This follows since by subtracting the females earnings equation from the males, it is assumed implicitly that “in the absence of discrimination the male wage would prevail, since in estimating the wage differential that would then exist, the coefficients of the male wage structure are used to weight the differences in characteristics” (Neumark, 1988). However, if the males’ earnings equation is subtracted from the females, the converse is assumed. Since two different results will occur, the question then becomes which is the correct method? Gyimah-Brempong, Fichtenbaum and

Willis (1992) show that using the standard decomposition technique is likely to result in a, "biased estimate of wage discrimination against females . . . (and) the direction of the bias is dependent upon whether one uses the male wage structure or the female wage structure as the basis for decomposition. The implication is that decomposition of (the) wage differential should be based on a wage structure that will prevail in the absence of discrimination" (p. 803, Gyimah-Brempong et al., 1992).

Other than the indexing problem, most concerns with the procedure are statistical in nature. For example there is continuing concern with the omitted variables problem. This arises since in the decomposition procedure, the wage gap is a residual. Hence, any omission of a pertinent variable may lead to an over or under-estimation of wage discrimination. At present, there is no solution for this difficulty, except to recognize its existence.

Another problem with the procedure is that there are both supply-side and demand-side effects that influence the coefficients developed within the analysis. In other words, as a result of past discrimination on a supply-side characteristic such as education, the decomposition of the coefficients may under-or-overstate the differences. For example, females may not enter into the engineering discipline, if they believe that they will endure wage or other forms of discrimination. Again, one can only recognize the existence of the problem and weigh the results from the analysis accordingly. In other words, these are only statistical techniques, they do not identify "discrimination."

Cotton's Decomposition Procedure:

Cotton (1988) attempts to deal with the indexing problem arguing "that in the absence of differential rewards, the return to endowments would fall somewhere between those for the currently advantaged and disadvantaged." Briefly, the argument is as follows. Suppose males are in higher demand because of discrimination and so command premium wages while females are in low demand and so they receive low wages. Elimination of discrimination increases the demand for female labour while it decreases the demand for male labour, *ceteris paribus*. These changes will continue until the male and female wage structures converge to a new equilibrium discrimination free wage that is lower than the male wage rate but higher than the female wage³. In this vein, Cotton developed an estimate of where the non-discriminatory wage would fall.

Cotton proposes that the 'nondiscriminatory' coefficients be estimated as the weighted average of the male and female coefficients. Thus

$$(5) \ b^* = p^m b^m + p^f b^f$$

where b^* = vector of nondiscriminatory coefficients

p^m and p^f are the shares of the total sample population that are male and female respectively and

b^m and b^f have the same meaning as before

Incorporating Cotton's modification one arrives at the following decomposition:

$$(6) \ \ln W^m - \ln W^f = (\overline{X^m} - \overline{X^f})b^* + \overline{X^m}(b^m - b^*) + \overline{X^f}(b^* - b^f)$$

³Neumark (p. 294, 1988) cautions against accepting the two results as forming the range within which the true result lies. He concludes that "there is some arbitrariness in using decompositions of wage differentials to estimate wage discrimination . . . (and) the choice of the theoretical model remains an open question."

Considering the right-hand expression only, the first term represents the component of the earnings gap attributable to differing endowments (human capital and background characteristics). The second and third terms divide the residual earnings differential into male treatment advantage (higher than expected return to endowments) and female treatment disadvantage (lower than expected return to endowments). Note that the sum of the second and third expressions constitute the measure of wage discrimination.

In addition to the assumption that the discrimination-free wage would be higher than the discriminated group's wages and lower than the preferred group's wages, Cotton's claims his decomposition relies on the following three assumptions:

- (1) "In the absence of discrimination, the prevailing wage structure will be some function of the forces that currently determine the (male) and (female) wages" (Cotton, 1988).
- (2) The discrimination-free wage will be closer to the preferred groups wages, i.e., the male wage.
- (3) Total output and total wages would not change, however there would be a redistribution of wage income and jobs.

Cotton's (1988) approach is adopted by a number of authors (Wannell, 1989, Gyimah-Brempong et al., 1992, Christofides et al., 1994). The present study will employ Cotton's procedure, since it is the most prevalent methodology cited in the recent literature. For comparison purposes and as a test of the robustness of Cotton's procedure, the results from the simpler Oaxaca technique will be presented also.

Sample Selection Bias

In addition to the indexing problem, there is another major concern with the standard methodology. This is the problem of sample selection bias. The mean of the wage rate generated by regressions based on employed individuals is conditional on being included in the sample - the participation effect. Thus the true mean may not equal the derived results, i.e., they are distorted by an omitted variable, which is the mean of the error term conditional on sample selection. In practice, failing to incorporate non-participation effects, i.e., sample selection effects, have been found to bias the resulting OLS estimates upwards (Choudhury, 1993). In other words, the problem is simply that "restricting the sample to workers who are paid employees could significantly underestimate the degree of wage discrimination directed at more representative groups of women and visible minorities" (p. 43, Christofides et al. 1994).

Heckman (1979) proposes a solution for solving the sample selection problem. "The procedure involves estimating the probability of being in the select sample. Information from these probabilities is used to construct an artificial variable - the inverse of Mill's ratio. This ratio is then used to correct the estimated relationship that is based on the select sample, to get a relationship corrected for selectivity bias" (p.138, Gunderson and Riddell, 1988).

Heckman's procedure is thus a two-step estimation method. The artificial variable is first determined by probit analysis and then the second step is to include the new variable in the OLS estimation. However, recent evidence has shown that the technique may be flawed. "First the model is conditional on normality of the disturbance terms . . . and some evidence exists that indicates a lack of robustness to normality. Second, the method provides a qualitative solution

to least squares regression bias (nonconsistency) rather than a quantitative one in the sense that it is not usually known just how much bias is removed from the estimated treatment effects . . . " (p. 73, Basilevsky and Hum, 1984). Dolton and Makepeace (1987) identify additional concerns with Heckman's procedure such as the importance of the underlying structural form error and the variables to be included in the model.

Furthermore, Heckman's procedure corrects only for one particular form of sample selection, inclusion/non-inclusion in the paid labour market. However, there are a number of other sample-selection problems that can arise. For example, consider an individual gifted in both engineering (on average a high-paying field) and music (on average, a low-paying endeavour). Suppose the individual chooses to pursue, i.e., self-selects, a career in music as opposed to engineering. It is reasonable to expect that her/his lifetime earnings will be less than if they had selected engineering. In practical terms it is exceedingly difficult to employ Heckman's technique to compensate for all forms of sample selection.

As a result of these concerns, much of the more recent research does not attempt to correct for sample selection bias. This thesis also does not use Heckman's procedure to allow for ease of comparison with these earlier papers.

Evidence on the Male/Female Earnings Differential in Canada:

The majority of studies in Canada have been based on data prior to 1980. Gunderson (1989) provides a comprehensive review of this literature. Miller (1987) conducted an analysis of the gender differential based on the 1981 census. Christofides and Swidinsky (1992) report on the gender wage differential using data drawn from the 1989 *Labour Market Activity Survey*. Generally, the previous studies have shown a modest reduction in the differential. However these estimates are all based on point-in-time surveys. More recent estimates have been developed by Grenier and Joseph (1993) and Baker et al. (1995) who create “synthetic” cohorts from successive censuses.

Grenier and Joseph (1993) evaluate the “cohort” effects by employing samples from the 1971, 1981 and 1986 Canadian censuses. They find that the overall wage differential has decreased over the period 1970-1985. Furthermore their evidence suggests that the reduction is largely the result of younger generations of women doing better relative to men. Baker et al., (1995) employ the same Canadian censuses plus the individual files of the 1986 and 1991 *Survey of Consumer Finances*. They also find a reduction in the wage differential. Their analysis shows that the change is due to decreases in the differences in returns to characteristics across males and females. Their results are supportive of Grenier and Joseph (1993) since they also find that changes in the differential over the period favour younger females.

In addition to the information determined from cross-sectional evaluations based on point-in-time estimates, several recent Canadian studies have employed the National Graduates

Survey data. These are Finnie (1993), Wannell (1989), and Wannell and Caron (1994a,b). These papers are concerned mainly with documenting the existence of the earnings differential among male and female post-secondary graduates from Canadian universities. The results found from these studies are used as a basis of comparison for this paper.

Wannell (1989) and Finnie (1993) use the earlier survey, *"Follow-Up of 1982 Graduates"* as their source of data. Finnie's report studies the "education experiences and early labour market outcomes of Canadian university graduates at the bachelors level, with a focus on the comparison of science versus non-science graduates and men versus women" (p.1, Finnie 1993). Wannell's (1989) paper reviews the school-to-labour market transition of university, college and trade/vocational graduates and focuses on the gender earnings differential. Drawing on the 1982, 1986 and 1990 NGS, Wannell and Caron (1994a) compare the earnings of men and women from the graduating classes of 1982, 1986, and 1990. In a subsequent paper based solely on the 1990 graduates, the authors evaluate the earnings of visible minorities, Aboriginal peoples and persons with disabilities (Wannell and Caron, 1994b).

The aforementioned papers all employ regression analysis to examine some aspect of the earnings differential of Canadian university graduates. Wannell (p.2, 1989) in his analysis of the graduating class of 1982 shows that "men earn more than women in virtually every subgroup of graduates (Ph.D. holders being the notable exception); the earnings gap tended to widen over time within this cohort; and, differences in the wage-generating characteristics of men and women accounted for, at best, a third of the earnings gap." Using the same database (NGS-

1982), Finnie (p. 2, 1993) also finds that "the gender earnings gap was relatively uniform across all education groups in 1984 - around 10% when part-time workers are included. The gap then increased everywhere by 1987 . . . "

In a later paper, Wannell and Caron (1994b) report that overall, the gender earnings gap decreases over time but not across cohorts. After analyzing the results of the 1982, 1986 and 1990 *National Graduates Surveys* they find that "the new data demonstrate that the gender earnings gap has been shrinking among recent university graduates." Faced with similar American evidence, one researcher stated that, "the possibility that the male/female gap is narrowing due to women's productivity characteristics becoming more similar to men's is not surprising. The surprising aspect is that it has taken so long for it to make a noticeable difference" (p. 385, Wellington, 1993). Among the reasons that Wellington (1993) suggests might account for a decline in the gap are:

- (i) changes in the returns to the explanatory variables, such as a change in the relative magnitudes of the coefficients that favour women (such as education becoming relatively more important)
- (ii) women becoming more committed to the workforce and increasing their investment in on-the-job training
- (iii) the labour market experience of the entire female working population has increased because of increased labour market participation.

Wannell and Caron (1994a) have an alternate explanation. They state that if hours are controlled for, "the university earnings model estimates that women are rewarded about the

same in the labour market" . . . (in fact for the 1990 and later graduates) "**controlling for differences in characteristics, female graduates earned more than men**" (emphasis the authors), (p. 3,20, Wannell and Caron, 1994a).

In addition to the "hours worked" variable, the following variables have been employed in earnings models: age, age squared, gender, minority status (and foreign-born), language, union status, industry, occupation, prior work experience, marital status, children, field of study, education, work time lost to illness, region (location), full-time/part-time, firm size, disability, tenure and others. In addition, combinations of these variables have been used, e.g., married with/without child. The more prevalent variables included in discrimination analysis and the results of their inclusion are discussed next, beginning with the dependent variable "earnings."

Earnings and the Natural Log of Earnings- The Dependent Variable

By convention, earnings or the log of earnings is employed as the dependent variable. In many cases the log of earnings is employed since it makes the interpretation of the results easier. This is because the coefficients of the variables in the linear form give the relative change in the log of earnings for a unit change in the explanatory variable (Gujarati, 1988, Finnie, 1993). Two caveats are required however. First, in the case of continuous variables, e.g., age, the relationship holds only for small changes at the margin (Finnie 1993). Second, in the case of dichotomous variables, a simple adjustment of the value of the coefficients is required⁴

⁴ The procedure is to take the antilog of the estimated dummy coefficient to base e, and subtract 1 from it e.g., if the obtained coefficient is 0.2799, its antilog is 1.3229. Take 1 from this value and one is left with 0.3229 or 32.29% which is different from 27.99%, the original coefficient (example is taken from p.461, Gujarati,

(Gujarati, 1988). Failure to include the necessary modification to dichotomous variables has been shown to distort the results although the distortion is relatively minor (Halvorsen and Palmquist, 1980).

The Effect of Industry/Occupation:

A review of earnings models conducted by Blau and Ferber (1987) concluded that the models that incorporate occupation variables show that the variable adds considerably to their explanatory power. A notable Canadian exception is Finnie (1993) who found in his analysis of Canadian university graduates that industry and occupations contributed little to the model. Some researchers have expressed concerns about the appropriateness of including occupation variables in the models. As Blau and Ferber (p. 317, 1987) explain,

“if it is believed that individuals freely choose occupations according to their talents, tastes, and plans for labour force participation, differences in rewards for different types of work are appropriately included in the ‘explained’ part of the earnings gap. If on the other hand, occupational differences are caused by labour market discrimination and the adverse feedback effects it generates, occupational variables should be excluded. In the not implausible case that both discrimination and choice play a role, neither procedure will be unbiased . . . it is likely that specifications which exclude occupations (and other similar variables) yield an upper-bound estimate of discrimination and those which include such variables yield a lower bound.”

As an example of this form of market discrimination consider that women may choose not to enter into a career in engineering to the same degree as men if they perceive that the financial returns to investing in engineering are less than the financial returns men will receive. As noted earlier, workers have been found to accurately perceive gender wage discrimination and react accordingly (Hampton and Heywood, 1993).

There is another difficulty with using occupation variables in analytical work. Most research that incorporates occupational classification is done at the 3 or 2 digit Census level but "evidence suggests that the actual work content of jobs varies widely within 3-digit occupation (codes)" (Gerhart, 1990, Fuchs 1989). A full exploration of this avenue of research has been hampered by the lack of data available at the level of the firm. Using firm level data for one firm, Gerhart (1990), determined that most of the differences in wages seems to occur at the time of hiring. Gerhart (p. 418, 1990) argues that "the greater female disadvantage in starting salary than in subsequent salary growth may stem from the smaller amount of job-relevant information available on applicants than on current employees."

A closely related issue involving occupations is the differences in earnings between those employed in the public and private sectors. Previous Canadian research finds that the male-female earnings gap is smaller in the public sector than in the private sector (Gunderson, 1989, Gunderson and Riddell, 1988). Wannell (p.27, 1989), employing panel data on Canadian university students that graduated in 1982, shows that "public sector employment yielded positive returns in 1984 but negative returns in 1987 -- largely due to a high premium accruing to

men in the private sector in 1987. Therefore, the higher percentage of women in the public sector was an equalizing variable in 1984, but helped to widen the earnings gap in 1987." After reviewing the evidence for the 1986 and 1990 graduating classes, Wannell and Caron (p.20, 1994a) conclude that recent female graduates received consistently higher returns to working in the public sector. They speculate that these higher returns to females are a possible consequence of Canadian employment equity legislation. Thus in recent studies of Canadian university graduates, variables indicating participation in the public or private sector achieve statistical significance more often than the more detailed occupation or industry code variables.

The Effect of Minority Status

The results with respect to visible minority status from earlier studies are ambiguous. In a study that employs the 1981 Census of Canada, the evidence is that "for men, the earnings gap ranges from 2% for South Asians to 21% for Blacks. For women, the earnings differential was approximately 4% for both South-East and South Asian women" (Howland and Sakellariou, 1993). Using the 1989 Canadian *Labour Market Activity Survey*, Christofides and Swidinsky (1994) also find that minorities (and white females) are at a disadvantage in the Canadian labour market. Specifically, the average wage offer⁵ for minority females is "45.8 per cent lower than for white males, and 9.4 percent lower than for white females. Approximately 70 per cent of the offered wage gap between white males-minority females is not explained by productivity differences . . . " (p. 45, Christofides et al., 1994).

⁵ Offered wage rates are different from the earnings variable which is the actual wage rate. The offered wage rate is found by incorporating selectivity bias corrections into the analysis. The results of using this procedure is that the differentials tend to be larger and the components that can be explained by differences in productivity characteristics are smaller (Christofides et al., 1994).

However, evidence from research that employs the *National Graduates Surveys* indicates that the earnings of visible minority groups are in line with national averages. Wannell and Caron (p. 53, 1994b) report that for a sample of Canadian university graduates "the earnings of visible minority graduates did not differ greatly from the earnings of other graduates . . . (however) the relative earnings of visible minority graduates fell with each step up in degree level⁶." In an attempt to add insight and clarify the ambiguities associated with visible minority status, this thesis will address this issue. Also considered are the impact on earnings of visible minority graduates while controlling for level of attained degree.

The Effect of Language

There is evidence that earnings are affected by an individual's language (Grenier 1987). Tainer (1986) finds that English proficiency is a significant factor in the determination of earnings of foreign-born men in the United States. Specifically "language proficiency improves earnings of all foreign-born men" (Tainer, 1986). Gunderson (p. 484, 1979) using the 1971 Census reports that "those who speak only French earn considerably less (9.5% for males and 5.9% for females) than those who speak only English even after controlling for the effects of other wage -determining variables."

Among bilingual workers, "it would appear that bilingualism in 1980 (Quebecers) still had a high pay-off for the Francophones but not for the Anglophone" (Grenier 1987). Wannell (1989) shows that the earnings of Allophone Canadian university graduates are not significantly

⁶ The authors caution that visible minorities continue to have lower participation rates and higher unemployment rates perhaps indicating the effect of hiring discrimination based on employers' and customers' preferences.

affected by their language two years after graduation (i.e., in 1984). However, five years after graduation, the effect of being allophone on males is negative and on females positive - but again the results do not achieve significance (Appendix I.4, I.5, Wannell, 1989). Also he finds similar inconclusive results occur when considering the effects of language on the earnings of Francophones (Wannell, 1989).

The Effects of Marital Status and Children

Gunderson (p. 52, 1989) reports that "being married has a differential effect on the earnings of men versus women. The gap is widest between married men and married women, suggesting that household responsibilities may have an important effect on the earnings gap." In addition, employers may perceive that married women are more likely to interrupt their careers and therefore prefer men or unmarried women - a preference denoted by higher income rewards. In addition, marriage may induce increased stability and productivity in males (or at least employers may think that this is the case) (Dolton et al., 1986). There is also another explanation for these results. As Wannell and Caron (p. 28, 1994a) explain "labour supply decisions within the family context may favour a pattern of earnings maximization for men while women might place more importance on the ability to exit and reenter a job. Such a pattern of decisions would be more limited to women who (are) married and/or have children." In consideration of these concerns previous researchers often base their estimates on a comparison of single men and single women (Dolton et al., 1986).

With respect to the presence of children, Fuchs (p. 33, 1989) explains that females' wages are depressed in three ways:

“First, many women leave the labour market during pregnancy, at childbirth, or when the children are young. These child related interruptions are damaging to subsequent earnings because three out of four births occur to women before the age of 30 - the same time that men are gaining the training and experience that leads to higher earnings in life. Second, even when mothers stay in the labour force, responsibility for children frequently constrains their choice of job . . .

Third, women who have disproportionate responsibility for child care and housework often have to make sacrifices in their market work . . . (i.e.,) be absent from work.”

In the Canadian context, Wannell (1989) shows that the variables for married and/or children are statistically significant and positive on males who graduated in 1982. In the case of females, marriage has a weak positive effect and as expected *a priori* children have a negative effect on earnings. Similarly Finnie (p. 5, 1993) finds "about two-fifths of the 1987 gender earnings gap are related to the marriage and children variables, suggesting that a major factor in these male-female earnings differences (are) the different aspects of family responsibilities on men's and women's earnings. A good portion of these effects (are) related to differences in job attachment (i.e., experience, part-time versus full-time)." Finnie's analysis also found marriage and children are associated with more experience and higher rates of full-time work for men (Finnie 1993).

The Effects of Prior Work Experience and Age

The length and continuity of previous labour market experience are positively correlated with earnings (Dolton and Makepeace, 1986, Gunderson 1989). Canadian evidence presented by Wannell (1989) and Wannell and Caron (1994a) document the strong positive effects of previous labour market attachment. Gunderson (1989) suggests that "as women become more attached to the labour force and accumulate both general labour market experience and company-specific experience and seniority, the gap should diminish." This in fact may have occurred in the graduating class of 1986. Sunter (1992) reports that in the 1980-1982 recession, young women in high school were more likely to be employed than their male counterparts. If these working women elected to continue with post-secondary education, then they may, as Gunderson suggests, have acquired an advantage in the labour market over males upon graduation in 1986.

Age has generally been used as a proxy for labour market experience. In addition, the square of age has been included in earnings models since the increase in earnings appears to rise at a decreasing rate with the number of years in the work force. Usually, experience is defined as age less years of schooling less five. Note that in studying earnings inequalities among graduates, it is expected that this variable would seldom achieve significance since the majority of graduates are in the age group 24-34⁷. This thesis employs the variables, age, the square of age and work experience acquired prior to graduation. The respondents were asked to indicate whether they had acquired less than one year prior of work experience before graduation, from

⁷ The present analysis restricts the sample to individuals aged 20-40 upon graduation.

one to three years, more than three years or no prior work experience. One necessary caveat is that variables that attempt to capture the quantity of work experience seldom provide insight on the quality aspect of previous work experience.

Disability⁸

Approximately seven percent of the total Canadian population and six and a half percent of the 1991 workforce are classified as activity-limited by the Employment Equity Data Program (Wannell and Caron, 1994b). However, there has been very little research that has attempted to capture the effect of possible discrimination against the disabled. In part, this stems from the lack of data sets that include this variable. Two Canadian sources that do include activity-limiting or disability variables are the *1989 Labour Market Activity Survey* (LMAS) and the later series of the *National Graduates Surveys* (NGS). In the United States, the 1984 *Survey of Income and Program Participation* also included information on disabilities and earnings. Using this source Baldwin and Johnson (1993) show that disabled Americans earn 11.5 % less than their non-disabled colleagues.

⁸The Follow-Up of 1986 Graduates Survey asks "Are you limited in the kind or amount of activity you can do because of a long-term physical condition, mental condition or health problem, that is, one that has lasted or is expected to last six months or more.

- at home?
- at school?
- at work?
- in any other activities, such as transportation to or from work or leisure time activities?

Evidence from the LMAS shows that disability is a factor in explaining wage differences in Canada also (Table 2, Christofides et al., 1994). In Christofides et al., study, disability that limits work has a negative sign (and is significant at the 5% level) for white males, white females and minority males. With respect to graduate students, the only research available indicates that "activity-limited university graduates earn about seven percent less than others in their class. (However) the earnings model does not generate any strong evidence of earnings discrimination towards activity-limited graduates" (p. 56, Wannell and Caron, 1994b). Furthermore there is no evidence on whether disability effects can be overcome by the level of degree, i.e., does attainment of a master's degree ameliorate the effects of disability, more so than attainment of a bachelor's degree? This issue is addressed in the present thesis.

The Effects of Field of Study (training):

Education is included as a control variable in virtually all earnings models since its positive effects on earnings is recognized in the earliest work employing human capital theory⁹. For instance, Paglin and Rufolo (1990) in Gyimah-Brempong et al., (1992), state that the male-female wage differential can be accounted for by the difference in mathematical and scientific aptitudes of the sexes. Furthermore, they state that studies that do not account for the differences in college majors may overstate the extent of discrimination (Gyimah-Brempong et al., 1992). Finnie reports that the mean earnings of Canadian female graduates were lower than males even after controlling for field of study and occupation; however, "the gap was smaller

⁹Vaillancourt and Henriques (1986) employing Canadian data drawn from the 1981 Survey of Consumer Finance show that university training yields positive financial returns for graduates and for society. Their results show "that university schooling has a private rate of return of 7 to 14 percent and a public rate of return of 6 to 10 percent."

among the engineering and math/science graduates . . . but (women) lagged behind all the same - just not as much as elsewhere" (p. 4, Finnie 1993).

Some researchers have argued that since many young women expect to be mothers, they are less likely to invest in wage-enhancing human capital while in school and in their first job after graduation. "In the past this has been reflected in the choice of major, in uncertainty about pursuing graduate school training, and in reluctance to experience the rigours characteristic of apprenticeships in medicine, law, business et cetera" (Fuchs, 1989). Similarly Gunderson (p. 52, 1989) states that in the past, "while women have (obtained) similar levels of education to men, the type of education women acquire(d) is often not as oriented towards gaining skills that are rewarded in the labour market. In recent years, however, this has been changing, and this should help reduce the gap in the future."

Supporting Gunderson's (1989) assertion that women's investment in their human capital is increasing, Wannell and Caron (1994a) found that women earned 51% of all Canadian university degrees in 1982 and the share of degrees awarded to women had increased to 55% by 1990. In addition, they report that the share of female representation increased at each degree levels. Hughes (1990) also notes that during 1971-86 period, American men and women became better educated overall, but "women in particular made great strides."

Although certain disciplines continue to be favoured by one gender, there is an erosion of single-sex dominated fields of study (Wannell and Caron 1994a). For instance, Wannell and

Caron (1994a) conclude that the mix of men and women is relatively equal in some of the fields that lead to high-paying jobs: law, medicine, optometry, and dentistry. However, many high-paying fields such as engineering continue to be dominated by males. For example, Finnie (1993) reports that among the graduating class of 1982, Canadian female science graduates opted for agriculture and biological sciences, which among science categories provide one of the lowest financial rewards. Nevertheless, most researchers have concluded that female graduates with post-secondary education have improved their relative position somewhat (Gyimah-Brempong et al., 1992).¹⁰

The Effects of Location:

Most earnings models incorporate the location of an individual during their earnings period. Two variables, region (or province in Canada) and urban/rural are selected usually. Christofides et al. (1994), using data from the 1989 *Labour Market Activity Survey*, finds that earnings across all groups are lower in all regions of the country outside of Ontario. Similarly, Wannell (1989) shows that graduates from Atlantic Canada, Quebec, British Columbia and the Territories report lower earnings than the (reference) province of Ontario two years after graduation, i.e., in 1984. In the same year, graduates from Manitoba, Saskatchewan and Alberta fared somewhat better than Ontario. However by 1987, the graduates from all provinces report lower earnings than the Ontario graduates. One possible explanation for this may be that the effects of the 1980-1982 recession tended to linger in regions outside of Ontario longer than in

¹⁰It is interesting to note that some of the earliest evidence of earnings inequalities or wage discrimination resulted from an examination of college and university faculty salaries. (see Hoffman, 1976).

Ontario itself. Furthermore by 1987, Ontario was further advanced into the economic recovery than the rest of Canada.

Intra cohort Changes

Few data sets are available that allow for analysis of how the earnings of a cohort changes over time. In one American study, Wellington (1993) found that wage discrimination among white Americans had decreased over time. The data for the study was drawn from the *Panel Study of Income Dynamics* that included information for the period 1976-85. Wellington reports that most of the decrease can be attributed to an increase in women's stock of human capital, especially the average work history variable. However, the sample population is not as homogeneous as what is available from the Canadian National Graduates Survey.

As noted previously, there have been a number of Canadian studies that have made use of the National Graduates Survey. Among the advantages of the survey are that it deals with a sample population possessing similar characteristics in terms of age and training. Most research has shown that the wage gap has increased over time for each cohorts. For example, Finnie (1993) reports that the wage gap among the university graduating class of 1982 widened from 14% in 1984 to 24% in 1987. This widening in the gap seems to reflect household responsibilities since almost 40% of the wage gap apparent in 1987 was related to the marriage and children variables (Finnie 1993). Wannell and Caron (1994b), using samples of three cohorts drawn from the 1982, 1986, and 1990 graduates surveys, found that the overall gap seemed to expand during the period 1984 to 1988 and shrink during the period 1988 to 1992.

After controlling for hours worked, they claim that the gap had disappeared completely by 1992 (Wannell and Caron, 1994b). Their model indicates that prior to 1988, the effects of having dependent children produced a negative effect on earnings for females. However, after 1988 the presence of dependent children had a positive impact on earnings of females.

The ambiguities that appear when employing panel data may reflect the effects of different impacts on each cohort as it advances through time. Each cohort has had to contend with a rapidly changing labour market. For example, in addition to the two economic recessions that have occurred in Canada during the period 1980 to 1992, there has been a shift in the labour market towards part-time versus full-time employment. High-paying manufacturing employment (that typically favoured males) has seen a sharp decline. Most job growth has been in the service sector - a sector that in the past attracted females. In addition, government sector employment, including health and education, has been reduced in recent years as have the financial returns to a job in that industry. Computerization has increased the flexibility of work and of the work place. Most of these issues are not captured in the income models and even panel data will only offer hints of the impact of a rapidly evolving labour market.

Summary

There is ample evidence that the gender earnings differential exists. Part of the gap appears to be a function of the differing levels of human capital held by males and females. Another portion is the differing returns that males and females receive for the same characteristics. After considering the results using the more common control variables such as,

field of study, minority status, language, marital status, presence of children, prior work experience, industry and disability, the following conclusions are possible:

- (1) Field of study selected has a strong relationship with future financial returns. In general, science or technical disciplines offer a financial advantage.
- (2) The Canadian labour market seems to treat the disabled and visible minority groups in a similar fashion. Being a member of a visible minority group or disabled has a negative effect on earnings in studies that look at the earnings of all Canadians. However, studies that deal only with graduates report that being disabled or a member of a visible minority group has no impact on earnings.
- (3) Language other than that of the majority has a negative effect on earnings.
- (4) The presence of dependent children has a negative effect on female graduates and a positive effect on male graduates.
- (5) Being married has a strong positive effect on male graduates and a weak positive (or neutral effect on female graduates. With respect to female graduates, being married seldom achieves statistical significance in the published literature.
- (6) Prior work experience is beneficial for either gender. However, the results from Canadian studies indicate that the returns are not uniform, i.e., males receive higher rewards than females for a given level of prior work experience. This may reflect that the variables usually only provide information on the quantity as opposed to the quality aspects of prior work experience.
- (7) In the Canadian context, public sector employment has a significant positive effect on

earnings for females, possibly as a consequence of affirmative action programs.

- (8) There is little comparative information whether characteristics impact differently on graduates with differing degree levels.
- (9) Estimates on whether the wage gap widens or narrows over time for different cohorts are mixed. In part, this may be caused by the rapid changes occurring in the labour market.

These results will be compared with those obtained from the current study that employs the *Follow-Up to 1986 Graduates Survey*. The OLS methodology is adopted for this analysis since it is the most prevalent in the literature. For similar reasons, Cotton's (1988) methodology is employed for decomposing the differential. In addition, this thesis shows for comparison purposes, the results of using the more simpler Oaxaca (1973) decomposition. This paper also takes advantage of the panel nature of the data by incorporating the two-period decomposition method developed by Wellington (1993). The two-period decomposition methodology has not been employed previously in the analysis of the NGS. Furthermore it has been used only once in an evaluation of Canadian census data. The next chapter provides additional details on the methodology used in the current analysis.

CHAPTER 3

METHODOLOGY

The sample population was obtained from the raw data set of the 1986 National Graduates Survey. Considerable work was required to make the data useful. However, this was preferable to waiting for the public use sample tapes to become available from Statistics Canada. (The public use sample tapes are now available). Although the tapes included information on the respondent's place of residence i.e., region, it was not available at the time the sample was obtained for this paper. This limitation should not be severe since graduates are one of the most mobile subgroups of the population. Nevertheless, this variable would have been included if available.

As noted in the introduction, the intention of this paper is to create a sub-sample from the 1986 National Graduates Survey that is as homogeneous as possible in terms of human capital characteristics such as age and educational attainment. The original survey population includes approximately 15,000 university graduates. However, this study is restricted to individuals;

- (i) employed **full-time** and reporting positive earnings in **either** of the survey periods
- (ii) between twenty to forty years of age at the time of graduation
- (iii) who did not increase their level of formal education after graduation

Also excluded are foreign students with visa status working in Canada. These restrictions reduced the sample size to approximately 7300 bachelor graduates and approximately 3500 graduates with a master degrees.

The following explanatory variables are employed to identify their effects on earnings; age, the square of age, field of study, marital status, presence of children, language, disabled, i.e., activity-limited, public/private sector employment, and prior work experience. Age and the square of age are continuous variables and the remainder are dummy variables. The log of annual earnings serves as the dependant variable¹.

Sample Weights

Statistics Canada provides sample weighting factors for the data so that researchers may extend the results from cross-tabulations to the entire postsecondary student population. The sample weights are not employed in the analysis because the weights are not truly representative of the sub-samples chosen for the present analysis. For example, they are not applicable when the analysis is restricted to those not missing any of the relevant information (Finnie, 1993). In a similar analysis, Finnie (p. 4, 1993) also did not report results using weights but found that the results on "certain (weighted) cross-tabulations and regressions . . . were similar to those obtained with the unweighted samples." Nevertheless, the results of the present thesis should not be considered as representative of the entire university graduate population of the class of 1986.

1

The respondents were asked "If you had to work your usual hours at that job for 12 months, approximately what would be your gross earnings?"

Selection of Variables

The sample is divided with respect to two variables, "gender," since gender wage differentials are the focus of this analysis, and "degree," since it is the intention of this paper to determine if the coefficients are substantially different between graduates with either a bachelor's or master's degree.

Sex

Gender is considered a significant factor in discrimination. The raw data set contained several instances where gender was not specified and hence these individuals were dropped from the analysis. As the literature suggests, (see Chapter 2) it is expected that females earn less than males, *ceteris paribus*.

Degree

The analysis is based on samples segregated by degree, i.e., either completed bachelor's or master's level of study. Individuals who went on to complete their masters' or doctorate degree after graduation in 1986 are excluded from the analysis. Again, this is implemented to make the subject groups homogeneous in terms of educational attainment. It should be noted that it is the premise of this thesis that individuals who elect to continue their education beyond the bachelor's level may possess characteristics that are different from those who do not continue their education. In other words, some degree of sample selection may be taking place. Furthermore, the labour market may offer differential rewards for these differing characteristics. By controlling for level of degree, it is expected that these differing rewards may be easily

recognized. In this regard, this thesis deviates from the methodology employed by previous researchers. For example, Wannell (1989) and Wannell and Caron (1994a,b) determine the effects of exogenous variables on earnings by including the level of degree attained within a single regression. In a comparison of the results for bachelor and master level graduates, the effect on earnings of extra schooling is expected to be positive.

Age and Age squared

In the current analysis "age" and "age squared" are the only continuous variables. They are included to act as a proxy for labour market experience. In human capital theory, it is expected that older individuals possess, on average, more labour market experience since on average, they have participated in the labour market for a longer period of time. In addition, earnings seem to rise at a decreasing rate with age, hence the inclusion of the "age-squared" variable. As indicated previously, this study restricts the sample to graduates aged 20-40 inclusive. This is done to remove a significant number of outliers and to make the sample group as homogeneous as possible. This is different from the approach adopted by Wannell (1989), Wannell and Caron (1994a,b) and Finnie (1993) who do not place any age restrictions on their samples.

Prior work experience

In the *Follow-Up to 1986 Graduates Survey*, graduates are asked how much prior full-time work experience they had upon graduation. From their answers four categories are created: three years or more, from one to less than three years, less than one year and no experience. The

"no prior work experience" serves as the reference category. It is expected *a priori* that the variable will be highly significant in the regression analysis since previous research has found this to be the case. Most researchers include it within their studies if it is available because of its importance. There are two concerns with this variable. First, prior work experience only indicates the quantity and not the quality of previous work experience. Even with respect to the quantity aspect the variable is somewhat deficient. This follows since it is only a summary measure of prior work experience, i.e., it does not provide insight into the continuity of the previous employment. For example, an individual may work at several jobs in a one year period while another individual works continuously for one employer over the same period. It is possible that the labour market may offer differing rewards based on this information.

Second, in the last survey point, i.e. 1991, the graduates have been out of school for five years. The prior work experience variables do not provide information on experience gained during this period of time. To compensate for this deficiency, all three variables, age, age-squared and prior work experience are employed in the current analysis. It is expected that the variables age and age squared will not be as important as the variable prior work experience in explaining earnings during the analysis based on the first survey period in 1988. However, it is possible that the age and age squared variable may have a stronger impact on the earnings of graduates in the second survey period compared to the variables prior work experience since the influence of work experience gained prior to graduation has diminished.

Marital Status

Respondents are asked in the two time periods for their marital status. The responses are coded into married (or living common-law) and not married (i.e., divorced, separated, widow/widower or single). Only a few individuals chose not to state their marital status. In this case, they are coded as unmarried. The literature suggests that the results of marital status are dependent on the gender of the respondent. The principal difference in the effect of marital status on gender is the level of significance that appears in the regressions. Regardless of gender, being married usually has a positive effect on earnings. However, in males it is usually highly significant while it often does not achieve significance for females. Some earlier studies incorporate greater detail in the marital status variable. However, to maintain significant sizes in the sub-samples, this is not done in the present analysis.

Presence of children

As in the case of marital status, respondents are asked in each of the two time periods if they had any dependent children. The National Graduates Survey provides details on the age of all dependent children. However, only the presence of children is used in this analysis (i.e., has dependent child = 1). Although it may have proved interesting to study the effects of differing numbers of dependents, it is felt that this procedure would have placed an unnecessary restriction on the analysis. This follows since the greater the number of variables, the larger the possibility of "empty cells" in the cross-tabulation analysis. Previous research indicates that the presence of children has a positive effect on male earnings and a negative impact on female earnings.

Field of study

It is expected that field of study has a major impact on the earnings of individuals. The inclusion of this variable allows for the analysis to control for the effects of different areas of specialization. Previous research shows that individuals who majored in the sciences earn considerably more than their non-science counterparts. Greater detail is provided by the nine fields of study that are incorporated in this analysis². The following nine fields are used;

- education and recreation,
- fine arts and humanities,
- commerce, law and economics,
- engineering and architecture
- health sciences
- mathematics and physical sciences
- other social sciences (omitted category)
- and general/unknown field of study.

In general, "fields of study" follow those employed in the University Student Information System with the exception of Economics which is included in the Commerce and Law fields. Previous Canadian studies employ either greater detail (Wannell, 1989) or less detail (Finnie, 1993) in the fields of study categories.

²For a more detailed explanation of fields of study the reader is referred to Appendix I.

Industry

To maintain significant sample sizes, the only industry variable used is a dichotomous dummy variable that explores the relation between public and private sector employment. From the answers provided, the NGS codes the industrial classification of the graduate's employer using the Standard Industrial Classification Code (three digits). Thus any respondent whose employer fell within industrial codes 811 to 869 is coded as employed in the public sector ($\text{Emp_pub} = 1$). Wannell (1989) employs a similar variable in his study of the 1982 university graduates and found that the variable had a significant effect on the earnings of females. The performance of this variable may indicate the success (or failure) of recent government initiatives in the field of employment equity.

Minority status

Due to small sample size, minority status is represented by a dichotomous variable, "1" for visible minorities, otherwise "0". Actual group status is assigned based on where the respondents claimed they were born (or where their ancestors were born). Individuals whose parents or ancestors came from Asia, Africa, the Middle East, Latin America, South America, the Caribbean, North American Indians, Métis, Inuit and the Pacific Islands are designated as "visible minorities."

Finnie (1993), Wannell (1989) and Wannell and Caron (1994a) do not include variables for visible minorities in their studies. Wannell and Caron (1994b) include two variables to represent visible minorities, one for aboriginal peoples and the other for all other visible

minorities. It is expected that visible minorities would be at a disadvantage in the paid labour market and that this disadvantage would be reflected in lower earnings.

Language

Three language variables are constructed, English (reference variable), French and Other Language. The responses to the questions "what language did you first speak in childhood?" determines which language category is applicable. If the respondents indicate more than one language, then the language code applied is the one expected to provide the best financial returns, e.g., if "French" and "English" are indicated by the respondent, then the individual is classified as "English,"; if "French" and "Other Language" are selected, the respondent is classified as "French." This rule is adopted since it is expected that in the job market, the order of preference of employers in Canada would be for English first, followed by French and finally by Other Language.

Wannell (1989) and Wannell and Caron (1994a) also incorporate the same three categories for language in their analyses. In the present analysis, the *a priori* expectation is that respondents whose mother-tongue is "French" or (especially) "Other Language" would be at a disadvantage in a society where the English language is predominant.

Disability

Disability is coded as a dichotomous variable. The NGS asks respondents a series of questions relating to whether the individual is limited at work by any physical, mental or health conditions. From their answers to these questions, the NGS creates a derived variable. If the

respondent answered in the positive for any question, they are classified as disabled. Wannell and Caron (1994b) use the variable in their analysis and go so far as to construct a crude index of activity-limiting severity. In this thesis, disabled individuals are coded "1" during the regression analysis.

This concludes the discussion on the variables employed in this analysis. Table 2 summarizes the variables used and those selected as the omitted category (where applicable). Following the table are two sections that discuss the analysis that is used in the current study.

Table 2: Variables List

- 1) Age (restricted to those aged 20-40 years upon graduation in 1986)
- 2) Age squared
- 3) Sex
- 4) Marital status married = 1 otherwise = 0
- 5) Language
 - a) English (omitted variable)
 - b) French
 - c) other language
- 6) Child88 - had care and custody of child in 1988, dependent child = 1, no child = 0
- 7) Child91 - had care and custody of child in 1991, dependent child = 1, no child = 0
- 8) Degree - level of attained degree upon graduation in 1986, i.e., master's or bachelor's
- 9) Llearn88 - self-estimation of total earned income in 1988
- 10) Llearn91 - self-estimation of total earned income in 1991
- 11) Prior work experience (on graduation)
 - a) priorwvx = none (omitted variable)
 - b) priorwk1 = less than 1 yr
 - c) priorwk2 = 1 to < 3 years
 - d) priorwk3 = 3 or more years
- 12) Minority status - member of a visible minority = 1, else = 0.
- 13) Disabled i.e., activity-limited = 1, else = 0.
- 14) Field of study
 - a) education
 - b) fine arts, humanities
 - c) commerce, law, economics
 - d) other social sciences (an omitted category)
 - e) agriculture and biological sciences
 - f) engineering
 - g) medical and health sciences
 - h) mathematics and physical sciences
 - i) other discipline (a residual category)

For further description of the "field of study" variables see Appendix I.

Descriptive Analysis

To familiarize the reader with the sample, several descriptive tables are presented in the next chapter. These are (a) major field of study by gender and degree obtained and (b) mean earnings by field of study, degree obtained and gender. Also included are the ratios of earnings of the graduates, by gender, field of study and degree. In addition, the sample means, by degree obtained and gender for the years 1988 and 1991 are shown in Appendix II.

Methodology

The existence of the wage gap is determined using Ordinary Least Squares (OLS) and Cotton's (1988) decomposition technique. The results from using Oaxaca's decomposition technique are also presented for comparison purposes. The dependent variable in all decompositions is the log of earnings. Separate regressions are performed for the two periods (1988 and 1991), for males and females and by level of degree attained on graduation. The study also takes advantage of the panel nature of the data by conducting a two-period decomposition as developed by Wellington (1993) (see Chapter 2). The only other application of the two-period decomposition that uses Canadian data is Baker et al (1995) in an analysis of primarily Census data.

Summary

The intent of this paper is to create a sub-sample of homogeneous Canadian university students. The sample is homogeneous in the sense that the graduates selected;

- (a) have completed but did not go on to the next level of degree (during the five years covered by the survey)
- (b) are all Canadian citizens
- (c) are employed full-time in either reference period and report positive earnings
- (d) are of a similar age, i.e., between 20–40 years of age upon graduation

A number of differences exist between this paper and previous research. For instance, the earlier research does not employ the same classification of fields of study as the present one. Finnie (1993) in his regressions classified the graduates into either science or non-science fields. He also omitted graduates with master's degrees from the analysis³. Wannell (1989) and Wannell and Caron (1994a,b) report field of study at a much greater level of detail than the current analysis. However these authors chose not to control explicitly for the degree obtained but instead permit it to appear as a variable in a single regression. This approach overlooks the possibility that those who continue on to advanced degrees may have attributes which differ considerably from those individuals who complete their studies at the bachelor's level.

³As in the present analysis, Finnie restricts his sample to those graduates who had not continued their studies to the next higher level after graduating. Thus, those individuals who completed a master's degree after graduating with a bachelor's degree in 1982 are excluded from the analysis. Another similarity is that Finnie restricts his sample to graduates employed full-time during the two detailed timepoints that are associated with the 1982 NGS (1984 and 1987 are the two and five year survey time points that correspond to the 1982 NGS).

In addition, neither Wannell (1989) nor Finnie (1993) restrict their sample to Canadian graduates only. Hence their results may be somewhat distorted by the inclusion of foreign students. Finally, neither of the above authors nor Wannell and Caron (1994a,b) place any age restriction on their respective samples. This may have the effect of masking the effects of age on younger graduates since many graduates obtaining degrees in the 1980s are older individuals.

Finally, this thesis presents the results using Oaxaca's and Cotton's decomposition technique simultaneously. Although it does not appear to have been done by Canadian researchers, it allows the reader to see at a glance the effects of employing the two techniques. Also presented are the results gained from employing a two-period decomposition procedure. This may yield additional insight on the school-to-labour-market transition of Canadian university graduates during the period 1986 to 1991.

CHAPTER 4

RESULTS

The frequency and cross-tabulations are presented first in order to give the reader some perspective on the sample population. (Detailed descriptions of the sample means are provided in Appendix II). Subsequently, the results from the econometric analyses are highlighted and the wage decomposition results using Oaxaca's (1973) procedure are presented. The results of the slightly more complex decomposition procedure as developed by Cotton (1988) are given subsequently. Also presented are the results of the two-period decomposition procedure that takes advantage of the panel nature of the data. The chapter concludes with a short summary.

The survey's base population is the set of graduates from Canadian post-secondary education institutions. Of this population, 40,814 completed the survey. This study employs a sub-sample that restricts itself to those individuals (approximately 15,000) who completed the requirements for degrees at either the bachelor's or master's level in the calendar year 1986. Also excluded from the sample are individuals that held visa status, or who have increased their level of education after their 1986 graduation. In an attempt to create homogeneous groups (in terms of educational attainment and age) the analysis is limited to individuals between 20 and 40 years of age at the time of graduation. In addition, this study is confined to graduates employed full-time in either of the reference periods, i.e., May 1988 or March 1991. These further restrictions yield the following sample sizes:

Table 3: Sample Sizes

Education Level	Bachelor's	Master's
Males	3,437	2,021
Females	3,836	1,568
Total	7,273	3,589

Field of Study and Gender:

Tables 4 and 5 show the percentage of male and female graduates in each of the nine fields of study by level of degree. As is evident in Table 4, males graduating with a bachelor's degree favour the Math and Physical Sciences and the Engineering fields and the Commerce, Law and Economics category. Engineering is over 88% males while Health Sciences is

Table 4: Major Field of Study by Gender, BA Graduates

Field of Study	Males (%)	Females (%)
Education	30	70
Fine Arts and Humanities	39	61
Commerce, Law, Economics	60	40
Other Social Sciences	33	67
Agricultural and Biological Sciences	43	57
Engineering	88	12
Health Sciences	18	82
Math and Physical Sciences	69	31
Other	46	54

82% females. Also, female graduates dominate in the Education, Fine Arts and Other Social Sciences categories.

In general, the same pattern that appears for the bachelor graduates also exists with the master's level graduates (Table 5). Almost 90% of graduates with master's degrees in engineering are male. However, the female dominance in Health Sciences falls to less than

Table 5: Major Field of Study by Gender, MA Graduates

Field of Study	Males (%)	Females (%)
Education	43	57
Fine Arts and Humanities	39	61
Commerce, Law, Economics	72	28
Other Social Sciences	47	53
Agricultural and Biological Sciences	51	49
Engineering	89	11
Health Sciences	27	73
Math and Physical Sciences	78	22
Other Discipline	57	43

73%. Note that the discrepancies apparent by gender in the other fields of study narrows at the master's level. However, there are three notable exceptions. First, the dominance of males in the Commerce, Law and Economics, categories increases from 60% to 72%. A similar situation exists in the Math and Physical Sciences category, where the percentage of males increases from 69% to 78%. In the other exception, the dominance of females at the undergraduate level in the

Agricultural and Biological Science category no longer exists at the master's level.

Earnings by Field of Study, Gender, and Degree Level

Tables 6 and 7 present the average annual earnings (current dollars) of the graduates employed full-time in the survey periods 1988 and 1991 respectively. Table 6 shows the

Table 6: Mean Earnings by Field of Study and Gender, Graduates with Bachelor Degrees, 1988,1991

Field of Study	Males Earnings (\$) (natural log)		Female Earnings (\$) (natural log)	
	1988	1991	1988	1991
Education	25,816 (3.251)	34,779 (3.549)	24,191 (3.186)	31,406 (3.447)
Fine Arts & Humanities	22,513 (3.115)	29,844 (3.396)	20,186 (3.005)	26,523 (3.278)
Commerce, Law, Economics	25,381 (3.234)	37,003 (3.611)	23,336 (3.150)	34,124 (3.530)
Other Social Sciences	24,191 (3.186)	33,549 (3.513)	21,541 (3.070)	30,175 (3.407)
Agricultural & Biological Sciences	23,784 (3.169)	35,481 (3.569)	21,392 (3.063)	29,430 (3.382)
Engineering	29,459 (3.383)	41,721 (3.731)	28,022 (3.333)	39,056 (3.665)
Health Sciences	39,488 (3.676)	57,628 (4.054)	29,636 (3.389)	38,092 (3.640)
Math & Physical Sciences	27,779 (3.325)	39,173 (3.668)	25,662 (3.245)	36,379 (3.594)
Other Discipline	24,730 (3.208)	34,709 (3.547)	21,911 (3.087)	30,478 (3.417)
All disciplines	26,364 (3.272)	37,114 (3.614)	23,524 (3.158)	31,976 (3.465)

earnings experience of graduates with bachelor degrees. As expected *a priori*, males consistently earn more than females for a given field of study. In 1988, average earnings for males with a bachelor's degree range from \$22,381 for Fine Arts and Humanities graduates to \$39,488 for Health Science graduates. Male Health Science graduates earn almost \$10,000 more than the second highest male income earners, which are graduates from the Engineering disciplines. The same pattern holds during the 1991 survey period. However, the wage difference between Health Science graduates and Engineering graduates increases to approximately \$16,000. The smallest increase for males across the two survey periods occurs in the Fine Arts and Humanities category - an increase of approximately \$7,000. As with the case of males, female undergraduates in 1988 in the Health Sciences discipline earn on average, more than any other category (Table 6). Again, females with a degree in Fine Arts and Humanities earn less than all other categories. The range of average earnings for females is approximately \$10,000 in 1988.

However, the 1991 female earnings pattern is different from males in several respects. In 1991, female graduates with an Engineering degree earn more than their female contemporaries with a Health Sciences degree. In addition, the range of earnings between categories of degree holders with respect to their chosen fields is approximately \$13,000. Thus the dramatic increase in post-graduate earnings apparent for males is not as evident among females in this sample of graduates with bachelor degrees.

Table 7: Mean Earnings by Field of Study and Gender, Graduates with Master's Degrees, 1988,1991

Field of Study	Males Earnings (\$) (natural log)		Female Earnings (\$) (natural log)	
	1988	1991	1988	1991
Education	43,250 (3.767)	51,367 (3.939)	38,706 (3.656)	46,852 (3.847)
Fine Arts & Humanities	24,928 (3.216)	35,802 (3.578)	27,058 (3.298)	35,023 (3.556)
Commerce, Law, Economics	41,940 (3.736)	57,858 (4.058)	35,446 (3.568)	49,849 (3.909)
Other Social Sciences	32,720 (3.488)	41,846 (3.734)	31,881 (3.462)	41,637 (3.729)
Agricultural & Biological Sciences	28,247 (3.341)	37,487 (3.624)	27,413 (3.311)	37,151 (3.615)
Engineering	36,489 (3.597)	48,667 (3.885)	33,348 (3.507)	42,564 (3.751)
Health Sciences	41,182 (3.718)	52,300 (3.957)	33,348 (3.507)	43,728 (3.778)
Math & Physical Sciences	34,022 (3.527)	43,423 (3.771)	31,913 (3.463)	38,283 (3.645)
Other Discipline	36,343 (3.593)	46,386 (3.837)	31,375 (3.446)	38,900 (3.661)
All Disciplines	36,671 (3.602)	47,656 (3.864)	32,852 (3.492)	42,140 (3.741)

Table 7 shows the earnings experiences of male and female master's graduates during the two survey periods. Once again, males earn more than females with respect to any field of study. However the differences, although substantial in most cases, are not as severe as those affecting graduates with bachelor degrees.

Highest income earners in 1988 are males with a master's degree in education. The substantial rewards earned by males in this female-dominated discipline may reflect discrimination also. For example males may be earning more as a result of being promoted over females into higher paid positions. Females with a degree in education also earn more than

females with any other degree. The lowest average incomes accrue to males in 1988 with a degree in Fine Arts or Humanities. Females with the same degree also earn the least amount of income among their peers. Curiously, they earn more than males with a similar degree however.

In 1991, highest incomes by field of study are for male and female graduates with master's degrees in Commerce, Law or Economics. In 1991, lowest income earners for either gender are also holders of degrees in Fine Arts and Humanities. However, males edge out females slightly.

Table 8 shows the ratio of earnings of the female graduates to male graduates. In 1988, the ratio for bachelor graduates of female aggregate earnings to male aggregate earnings is .89, i.e., females graduates with bachelor degrees earn 89% of what males males with bachelor degrees earn. In 1991, the ratio of female to male earnings falls to .86. Wannell (1989) in his analysis of the graduating class of 1982 reports a similar decline; from a ratio of .90 in 1984 to .83 in 1987. At the bachelor level, females earn less than males regardless of field of study.

Table 8: Ratio* of Earnings, by Degree, 1988 & 1991

Discipline	Bachelor Graduates		Master Graduates	
	Ratio 1988	Ratio 1991	Ratio 1988	Ratio 1991
Education	0.94	0.90	0.89	0.91
Humanities	0.90	0.89	1.09	0.98
Commerce, Law, Economics	0.92	0.92	0.85	0.86
Other Social Sciences	0.89	0.90	0.97	1.00
Agricultural & Biological Sciences	0.90	0.83	0.97	0.99
Engineering	0.95	0.94	0.91	0.87
Health Sciences	0.75	0.66	0.81	0.84
Mathematics & Physical Sciences	0.92	0.93	0.94	0.88
Other Disciplines	0.89	0.88	0.86	0.84
All Disciplines	0.89	0.86	0.90	0.88

* ratio = female earnings / male earnings

However, the earnings of female graduates with master's degrees exceed the earnings of males with similar degrees in the humanities category in 1988. In addition, they are equal in the

“other social science” category in 1991. However, the overall ratio of female to male earnings declines over the two periods although slightly less than is the case for graduates with bachelor degrees. Nevertheless, the ratios are still an improvement on what previous research has found when analysing wage differences in the censal population, i.e., a 60% to 70% wage differential among full-time workers. Regression analysis is employed to further understand these differences in earnings.

Regression Results for Graduates with Bachelor's Degrees

The results of regressing the independent variables on the dependent variable (log of earnings) are in Tables 9 through 12¹. Separate regressions are performed for females and males, controlling for the degree level. The regressions performed well with respect to their F-statistics. As usual with studies of this type, the adjusted R^2 values are relatively poor. This indicates that the explanatory variables cannot explain a significant part of the independent variable i.e., the natural log of earnings.

Tables 9 and 10 show the results of regressing the explanatory variables against the natural log of earnings in each of the two survey periods for the bachelor graduates. During the 1988 survey (Tables 9), the effects of prior work experience longer than three years (PRWRK3), and the disciplines of Engineering, Health Sciences, Mathematics, and Commerce, Law and Economics are positive and significant for male and female graduates at the 1% level of significance.

Females also benefited if they chose Education (1% degree of significance). Also for females, public sector employment has a positive and highly significant coefficient. For males,

¹For a description of the omitted categories, refer to Chapter 3 and Table 2.

Table 9: Regression Results, B.A. Graduates, by Gender, 1988

	Males				Females			
	B	SEB	t	mean + X	B	SEB	t	mean + X
AGE	-0.029	0.0213	-1.337	24.339	0.020	0.0175	1.164	24.275
SQAGE	0.001	0.0000	1.962***	605.184	0.000	0.0000	-0.121	608.754
PRWRK1	-0.002	0.0289	-0.084	0.061	0.034	0.0260	1.312	0.063
PRWRK2	0.028	0.0227	1.247	0.116	0.000	0.0231	0.015	0.095
PRWRK3	0.075	0.0287	2.621*	0.139	0.081	0.0265	3.048*	0.155
VIS_MIN	-0.077	0.0273	-2.809*	0.081	-0.009	0.0256	-0.337	0.07
DISABLED	-0.014	0.0592	-0.233	0.013	-0.104	0.0471	-2.218**	0.017
FRENCH	-0.037	0.0190	-1.921***	0.158	-0.036	0.0179	-2.031**	0.144
OTH_LANG	-0.015	0.0253	-0.605	0.097	-0.004	0.0227	-0.196	0.091
CHILD	0.009	0.0252	0.361	0.129	-0.005	0.0246	-0.185	0.125
MSTATUS	0.063	0.0164	3.850*	0.344	0.021	0.0136	1.576	0.366
EMP_PUB	0.003	0.0165	0.157	0.33	0.111	0.0148	7.466*	0.601
EDUCATE	0.033	0.0321	1.028	0.107	0.062	0.0217	2.843*	0.192
HUMANE	-0.082	0.0357	-2.306**	0.065	-0.055	0.0257	-2.123**	0.093
COMLAWEC	0.082	0.0298	2.738*	0.169	0.160	0.0248	6.445*	0.115
AGRI_BIO	0.009	0.0361	0.239	0.063	0.034	0.0268	1.251	0.082
ENGINE	0.226	0.0288	7.827*	0.227	0.346	0.0401	8.624*	0.029
HEALTH	0.511	0.0516	9.901*	0.022	0.286	0.0237	12.085*	0.133
MATH	0.178	0.0309	5.769*	0.131	0.239	0.0306	7.818*	0.059
OTH_DISC	0.037	0.0301	1.243	0.139	0.022	0.0225	0.958	0.149
Constant	3.392	0.2927	11.590*	1	2.512	0.2424	10.362*	1
ln of earnings	3.272				3.158			
adjusted R2	0.131				0.219			
F-statistic	20.017*				37.283*			
Sample Size	2772				2748			

*sig. at 1%, ** sig. at 5%, *** sig. at 10%.

being married is the only other variable which is both highly significant and positive. Marriage is positive for females but does not achieve significance in the regression. The presence of children has the expected results, positive for males and negative for females, although in neither case does the variable achieve statistical significance.

Disability has a negative effect on earnings, regardless of gender, although it only achieves significance in the case of females. Christofides and Swidinsky (1994) in an analysis of the 1989 *Canadian Labour Market Activity Survey*, report similar results. The effect of being a francophone also had a negative impact on the earnings of male bachelor graduates in 1988 (sig. at 10%) and female (sig. At 5%). In addition, the earnings of males are negatively influenced by visible minority status (sig. at 1%).

Table 10 show the results for the graduates with bachelor degrees employed full-time in 1991. Regardless of gender, positive and highly significant results occur in the choice of field of study. Commerce, Law and Economics, Engineering, Health, and Mathematics all have a strong positive effect on earnings. As in the case of females in 1988, public sector employment also has a strong positive effect on the earnings of females in 1991.

Language other than English has a strong negative effect on the earnings of males in 1991, although it does not appear to be a significant factor for females. Again, as expected, having a child has a negative effect on females earnings (10% level of significance) and a positive effect on males earnings (5% level of significance). Being married has similar effects in 1991 as in 1988 on the bachelor graduates, positive for both genders, but achieving significance only for males. The results of prior work experience longer than three years is again highly significant for males and females.

in 1991 as in 1988 on the bachelor graduates, positive for both genders, but achieving significance only for males. The results of prior work experience longer than three years is again highly significant for males and females.

Table 10: Regression Results, B.A. Graduates, by Gender, 1991

	Males				Females			
	B	SEB	t	mean = X	B	SEB	t	mean = X
AGE	-0.044	0.020	-2.243**	24.269	-0.031	0.019	-1.680***	24.336
SQAGE	0.001	0.000	2.407*	601.787	0.001	0.000	2.155**	613.578
PRWRK1	-0.029	0.027	-1.096	0.062	-0.014	0.028	-0.500	0.063
PRWRK2	0.011	0.022	0.514	0.111	0.033	0.026	1.270	0.087
PRWRK3	0.062	0.026	2.334*	0.135	0.089	0.029	3.073*	0.151
VIS_MIN	-0.002	0.026	-0.062	0.079	-0.018	0.028	-0.646	0.072
DISABLED	-0.031	0.053	-0.586	0.014	-0.041	0.061	-0.668	0.012
FRENCH	-0.051	0.018	-2.812*	0.151	0.000	0.020	-0.013	0.140
OTH_LANG	-0.070	0.023	-3.026*	0.101	0.034	0.025	1.371	0.090
CHILD	0.038	0.017	2.186**	0.259	-0.036	0.019	-1.921***	0.235
MSTATUS	0.098	0.015	6.695*	0.543	0.009	0.014	0.592	0.572
EMP_PUB	-0.011	0.015	-0.751	0.366	0.097	0.016	6.025*	0.649
EDUCATE	0.023	0.030	0.761	0.106	0.000	0.023	0.008	0.213
HUMANE	-0.110	0.032	-3.416*	0.072	-0.049	0.028	-1.764***	0.097
COMLAWEC	0.115	0.028	4.178*	0.167	0.173	0.028	6.251*	0.107
AGRI_BIO	0.075	0.033	2.265**	0.065	-0.014	0.029	-0.467	0.085
ENGINE	0.229	0.027	8.460*	0.213	0.319	0.049	6.552*	0.022
HEALTH	0.547	0.045	12.252*	0.027	0.203	0.027	7.512*	0.111
MATH	0.180	0.029	6.190*	0.123	0.233	0.035	6.610*	0.051
OTH_DISC	0.035	0.028	1.275	0.145	0.002	0.024	0.096	0.168
Constant	4.019	0.269	14.917*	1.000	3.676	0.260	14.162*	1.000
ln of earnings	3.614				3.465			
adjusted R ²	0.150				0.101			
F-statistic	25.222*				16.123*			
Sample Size	2963				2901			

*sig at 1%, ** sig. at 5%, *** sig. at 10%.

Regression Results for Graduates with Master's Degrees

Tables 11 and 12 show the regression results for graduates with masters degrees. For master level graduates in 1988, (Table 11), prior work experience greater than three years is an asset, regardless of gender (1% level of significance). As in the case with the bachelor graduates, field of study has a significant effect on earnings. For example, a degree in Commerce, Law, Economics, and Education or Engineering is positive and achieves a 1% significance level. Note that for male graduates, having a child or being married has a strong positive effect on earnings while for females the variables are positive also but fail to achieve any level of significance. With respect to females this poses an interesting question. Why is the effect of children positive for females with a master's degree while it is negative for females with bachelor degrees? The answer may be that the labour market treats female graduates with master's degree more like males, believing that their attachment to the labour market is stronger since the female master's graduate has climbed an additional rung in the education ladder.

Table 12 shows the results for graduates with master's degrees in the 1991 survey period, i.e., five years after graduation. The importance of prior work experience for all graduates is evident again since it is highly significant and positive for prior work experience between one to three years (PRWRK2) and prior work experience greater than three years (PRWRK3). Note that field of study achieves importance for females in 1991 in three cases only: positive and highly significant in the Commerce, Law and Economics category and negative and highly significant in both the Humanities and Other Discipline categories. Field of study continues to play an important role in the earnings of male post-graduates (Table 12), achieving significance in virtually every field of study. Finnie (1993) in an analysis of the graduating class of 1982 (bachelor graduates only) reported that the earnings of graduates are negatively affected by specializing in agricultural or biological sciences. These findings are supported in the present analysis of the 1986 graduates in the case of master level graduates only.

Table 11: Regression Results, M.A. Graduates, by Gender, 1988

	Males				Females			
	B	SEB	t	mean = X	B	SEB	t	mean = X
AGE	-0.021	0.024	-0.877	29.646	-0.008	0.028	-0.304	30.014
SQAGE	0.001	0.000	1.363	901.051	0.000	0.000	0.736	925.986
PRWRK1	-0.003	0.033	-0.088	0.063	-0.011	0.040	-0.268	0.065
PRWRK2	0.079	0.025	3.195*	0.153	0.018	0.031	0.579	0.140
PRWRK3	0.207	0.026	7.835*	0.452	0.163	0.030	5.362*	0.487
VIS_MIN	0.012	0.031	0.383	0.077	-0.108	0.049	-2.231**	0.039
DISABLED	-0.025	0.063	-0.394	0.015	-0.113	0.073	-1.541	0.016
FRENCH	-0.021	0.019	-1.105	0.220	0.008	0.023	0.352	0.222
OTH. LANG	-0.052	0.027	-1.913***	0.111	-0.020	0.035	-0.570	0.081
CHILD	0.070	0.020	3.428*	0.371	0.000	0.024	0.016	0.291
MSTATUS	0.038	0.019	2.068**	0.613	0.017	0.020	0.827	0.516
EMP_PUB	-0.015	0.019	-0.832	0.484	0.046	0.025	1.880***	0.738
EDUCATE	0.106	0.031	3.384*	0.135	0.073	0.031	2.380*	0.218
HUMANE	-0.276	0.036	-7.661*	0.069	-0.134	0.032	-4.132*	0.143
COMLAWEC	0.239	0.028	8.517*	0.249	0.132	0.036	3.646*	0.123
AGRI_BIO	-0.093	0.044	-2.110**	0.038	-0.089	0.044	-2.039**	0.059
ENGINE	0.160	0.029	5.470*	0.180	0.131	0.060	2.191**	0.029
HEALTH	0.249	0.046	5.356*	0.033	0.045	0.034	1.344	0.124
MATH	0.114	0.034	3.308*	0.082	0.104	0.056	1.862***	0.033
OTH. DISC	0.071	0.034	2.101**	0.088	-0.055	0.039	-1.402	0.082
Constant	3.521	0.369	9.545*	1.000	3.315	0.424	7.811*	1.000
ln of earnings	3.602				3.492			
adjusted R ²	0.352				0.232			
F-statistic	40.12*				17.23*			
Sample Size	2021				1162			

*sig at 1%, ** sig. at 5%, *** sig. at 10%.

Table 12: Regression Results, M.A. Graduates, by Gender, 1991

	Males				Females			
	B	SEB	t	mean = X	B	SEB	t	mean = X
AGE	-0.025	0.024	-1.019	29.569	-0.060	0.027	-2.217**	30.079
SQAGE	0.000	0.000	1.231	896.735	0.001	0.000	2.298**	930.724
PRWRK1	0.027	0.035	0.769	0.057	0.045	0.039	1.164	0.066
PRWRK2	0.073	0.025	2.974*	0.157	0.080	0.031	2.551*	0.127
PRWRK3	0.175	0.027	6.564*	0.427	0.214	0.029	7.293*	0.466
VIS_MIN	0.009	0.032	0.289	0.080	-0.037	0.043	-0.853	0.051
DISABLED	-0.067	0.066	-1.018	0.014	-0.144	0.075	-1.931***	0.015
FRENCH	-0.033	0.019	-1.694***	0.229	-0.035	0.023	-1.477	0.217
OTH. LANG	-0.073	0.028	-2.610*	0.110	-0.074	0.033	-2.224**	0.093
CHILD	0.053	0.020	2.718*	0.495	0.013	0.021	0.601	0.407
MSTATUS	0.072	0.021	3.514*	0.719	0.017	0.020	0.827	0.617
EMP_PUB	-0.063	0.019	-3.395*	0.514	0.025	0.024	1.048	0.753
EDUCATE	0.082	0.032	2.562*	0.133	0.031	0.031	1.004	0.197
HUMANE	-0.163	0.035	-4.646*	0.078	-0.134	0.031	-4.322*	0.161
COMLAWEC	0.272	0.029	9.493*	0.231	0.167	0.035	4.748*	0.129
AGRI_BIO	-0.086	0.042	-2.052**	0.046	-0.059	0.045	-1.309	0.053
ENGINE	0.148	0.030	4.953*	0.169	0.077	0.060	1.299	0.028
HEALTH	0.256	0.049	5.256*	0.031	0.051	0.033	1.536	0.124
MATH	0.064	0.033	1.923***	0.094	0.011	0.056	0.198	0.032
OTIL DISC	0.057	0.034	1.676***	0.088	-0.100	0.038	-2.663*	0.087
Constant	3.952	0.372	10.635*	1.000	4.499	0.411	10.946*	1.000
ln of earnings	3.864				3.741			
adjusted R ²	0.266				0.195			
F-statistic	29.770*				13.89*			
Sample Size	1741				1160			

*sig at 1%, ** sig. at 5%, *** sig. at 10%

The diminishing importance of public sector employment for females identified by Wannell (1989) is also substantiated in the current analysis. Public sector employment, significant in 1988 for females, is no longer significant for female graduates with master's degrees five years after graduation. For males, the negative consequences of public sector employment increases across the panel period. This may reflect that the earnings of males working in the public sector do not increase at the same pace as the earnings of males in the private sector.

As is the case in 1988, being married or having children has a positive and highly significant effect on male earnings and a positive but statistically insignificant effect on female incomes. Regardless of gender and particularly in 1991, language other than english has a negative impact on earned income, particularly for males.

Decomposition of Earnings, Oaxaca's Procedure²:

After having generated the separate regressions for males and females, Oaxaca's technique calls for the female earnings equations to be subtracted from the male earnings equations (at the mean of the explanatory variables)³. Subsequently, the resulting differential is decomposed into two parts. One part is considered the returns to endowments and the other is the treatment differential i.e., the differential awards that males and females receive for the same characteristics. Mathematically we have:

$$(1) \overline{\ln W^m} - \overline{\ln W^f} = \underbrace{(\overline{X^m} - \overline{X^f}) b^m}_{\text{(returns to endowments)}} + \underbrace{\overline{X^f} (b^m - b^f)}_{\text{(treatment differential)}}$$

where $\ln W^j$ = natural log of earnings
 X^j = vector of variables reflecting, productivity, personal characteristics and labour market structure
 b^j = vector of regression coefficients
 j = males, females

²The details of the decomposition procedure have been shown in Chapter 2.

³Recall that this procedure assumes that in the absence of labour market discrimination, the male wage would prevail, i.e., the male wage is the non-discriminatory wage.

Tables 13 and 14 show the results after applying Oaxaca's decomposition under the assumption that in the absence of discrimination the male wage will prevail. Table 13 shows that in 1988, female graduates with a bachelor's degree earn a small premium (3.83%) with respect to their returns to endowments. In other words, female graduates with bachelor degrees have superior wage generating characteristics such as their age and prior work experience of more than three years.

Table 13: Results from Oaxaca's Procedure, Bachelor Graduates, 1988 & 1991

Variable	1988			1991		
	returns to endowments	treatment differential	total	returns to endowments	treatment differential	total
AGE	-0.0018	-1.1862	-1.1880	0.0030	-0.3101	-0.3071
SQAGE	-0.0026	0.4720	0.4693	-0.0099	0.0935	0.0836
PRWRK1	0.0000	-0.0023	-0.0023	0.0000	-0.0010	-0.0009
PRWRK2	0.0006	0.0027	0.0033	0.0003	-0.0019	-0.0016
PRWRK3	-0.0012	-0.0009	-0.0021	-0.0010	-0.0042	-0.0052
VISMIN	-0.0008	-0.0048	-0.0056	-0.0000	0.0012	0.0012
DISABLED	0.0001	0.0015	0.0016	-0.0001	0.0001	0.0000
FRENCH	-0.0005	-0.0000	-0.0005	-0.0006	-0.0071	-0.0077
OTH. LANG	-0.0001	-0.0010	-0.0011	-0.0008	-0.0094	-0.0102
CHILD	0.0000	0.0017	0.0017	0.0009	0.0174	0.0183
MSTATUS	-0.0014	0.0152	0.0138	-0.0028	0.0511	0.0483
EMP_PUB	-0.0007	-0.0650	-0.0657	0.0032	-0.0702	-0.0670
EDUCATE	-0.0028	-0.0055	-0.0083	-0.0024	0.0048	0.0024
HUMANE	0.0023	-0.0026	-0.0003	0.0028	-0.0060	-0.0032
COMLAWEC	0.0044	-0.0090	-0.0046	0.0069	-0.0061	0.0008
AGRIBIO	-0.0002	-0.0020	-0.0022	-0.0015	0.0076	0.0061
ENGINE	0.0447	-0.0035	0.0412	0.0437	-0.0020	0.0417
HEALTH	-0.0567	0.0299	-0.0268	-0.0460	0.0382	-0.0078
MATH	0.0128	-0.0036	0.0092	0.0130	-0.0027	0.0103
OTHER DISC.	-0.0004	0.0024	0.0020	-0.0008	0.0055	0.0047
Constant	0.0000	0.8800	0.8800	0.0000	0.3423	0.3423
sums	-0.0044	0.1190	0.1146	0.0079	0.1411	0.1489
percent*	-3.83	103.83	100.00	5.28	94.72	100.00

* Percent is percent of endowments or wage gap as a percentage of all explained
c.g. $(\text{endowments}) / (\text{endowments} + \text{treatment differential}) * 100$

The remuneration females receive in 1988 for the experience characteristics (i.e., the treatment differential) such as age, prior work experience and employment in the public sector also reduce the overall gap. However, family status and the returns for field of study increase the overall wage differential. The largest factor affecting the wage gap is the constant term. Recall that this term captures the effects of factors not included in the analysis such as pre-labour market discrimination.

In 1991, slightly more than 5% of the wage gap is explained by the returns to endowments. Again, the work history variables favour females. However, males have superior education characteristics particularly with respect to their endowments in Commerce/Law/Economics, Engineering and Mathematics.

With respect to the treatment differential, the constant term is again significant. The compensation females receive for work experience and public sector employment reduces the wage gap as it did in 1988. Similarly family status, notably being married, and the rewards for their educational endowments increases the gap. In either year, disability or language other than english have a minimal effect in explaining the gap.

Table 14 shows the results of the Oaxaca decomposition for graduates with master's degrees. In 1988, almost one-half of the total wage gap is explained by the superior skill set of males with the most dominant characteristic being the field of study categories. As in the case of the bachelor graduates, females exhibit better experience characteristics (PRWRK3 and SQAGE) which reduces the skills gap slightly.

In 1991, the superior wage generating characteristics of males with masters degrees are evident again. The superior skill sets of males again accounts for almost half (44.2%) of the total wage gap. With respect to the treatment differential, the largest negative influences (for females) are the constant term and work experience characteristics.

Table 14: Results from Oaxaca's Procedure, Master's Graduates, 1988 & 1991

Variable	1988			1991		
	returns to endowments	treatment differential	total	returns to endowments	treatment differential	total
AGE	0.0078	-0.3799	-0.3721	0.0126	1.0565	1.0691
SQAGE	-0.0129	0.1814	0.1685	-0.0160	-0.4681	-0.4841
PRWRK1	0.0000	0.0005	0.0005	-0.0002	-0.0012	-0.0015
PRWRK2	0.0010	0.0086	0.0096	0.0022	-0.0009	0.0013
PRWRK3	-0.0072	0.0215	0.0143	-0.0068	-0.0179	-0.0247
VISMIN	0.0004	0.0047	0.0051	0.0003	0.0023	0.0026
DISABLED	0.0000	0.0014	0.0014	0.0001	0.0012	0.0012
FRENCH	0.0000	-0.0065	-0.0065	-0.0004	0.0004	0.0000
OTH. LANG	-0.0016	-0.0026	-0.0041	-0.0012	0.0001	-0.0012
CHILD	0.0056	0.0203	0.0259	0.0047	0.0165	0.0212
MSTATUS	0.0037	0.0112	0.0150	0.0074	0.0345	0.0418
EMP_PUB	0.0039	-0.0455	-0.0416	0.0151	-0.0666	-0.0516
EDUCATE	-0.0088	0.0072	-0.0016	-0.0052	0.0100	0.0047
HUMANE	0.0204	-0.0202	0.0002	0.0135	-0.0046	0.0089
COMLAWEC	0.0301	0.0132	0.0433	0.0278	0.0136	0.0413
AGRIBIO	0.0020	-0.0003	0.0017	0.0006	-0.0014	-0.0008
ENGINE	0.0242	0.0008	0.0250	0.0209	0.0020	0.0229
HEALTH	-0.0226	0.0253	0.0026	-0.0239	0.0255	0.0016
MATH	0.0056	0.0003	0.0059	0.0040	0.0017	0.0057
OTHER DISC.	0.0004	0.0103	0.0107	0.0001	0.0137	0.0138
Constant	0.0000	0.2059	0.2059	0.0000	-0.5473	-0.5473
sums	0.0521	0.0576	0.1097	0.0553	0.0698	0.1251
percent	47.5	52.5	100.0	44.2	55.8	100.0

* Percent is percent of endowments or wage gap as a percentage of all explained
 e.g. (endowments)/ (endowments+ treatment differential) * 100

Decomposition of Earnings, Cotton's Procedure:

Recall from Chapter 2, that Cotton (1988) proposes that the 'non-discriminatory' wage would fall between what males and females currently earn in a discriminating market. He proposes that the non-discriminatory coefficients be estimated as the weighted average of the male and female coefficients. Mathematically, the decomposition can be expressed as⁴:

$$(2) \overline{\ln W^m} - \overline{\ln W^f} = (\overline{X^m} - \overline{X^f}) b^* + \overline{X^m} (b^m - b^*) + \overline{X^f} (b^* - b^f)$$

(returns to endowments) (male treatment advantage) (female treatment disadvantage)

where b^* is the vector of coefficients representing the weighted sum of male and female coefficients
and all other variables have the same meaning as before

The first term (right-hand side) is the component of the earnings gap attributable to differing endowments. The second and third term divide the residual earnings differential into male treatment advantage (higher than expected return to endowments) and female treatment disadvantage (lower than expected return to endowments). The sum of the second and third term is the unexplained component that is usually considered as "discrimination." Tables 15 and 16 show the results after applying Cotton's decomposition procedure.

⁴ For additional detail on Cotton's procedure, refer to Chapter 2.

Table 15: Results from Cotton's Procedure, Bachelor Graduates, 1988 & 1991

Variables	1988				1991			
	returns to endow. (a)	male treat. adv. (b)	female treat. disadv. (c)	total treat. (d) (b + c = d)	returns to endow. (e)	male treat. adv. (f)	female treat. disadv. (g)	total treat. (h) (f + g = h)
AGE	-0.0002	-0.6268	-0.5611	-1.1878	0.0025	-0.1630	-0.1467	-0.3096
SQAGE	-0.0012	0.2473	0.2232	0.4705	-0.0090	0.0483	0.0442	0.0925
PRWRK1	0.0000	-0.0012	-0.0011	-0.0023	0.0014	-0.0005	-0.0005	-0.0010
PRWRK2	0.0003	0.0017	0.0013	0.0030	0.0005	-0.0013	-0.0009	-0.0022
PRWRK3	-0.0013	-0.0004	-0.0004	-0.0008	-0.0012	-0.0020	-0.0020	-0.0039
VIS_MIN	-0.0004	-0.0029	-0.0022	-0.0051	-0.0001	0.0007	0.0006	0.0012
DISABLED	0.0002	0.0006	0.0007	0.0013	-0.0001	0.0001	0.0001	0.0001
FRENCH	-0.0005	0.0000	0.0000	-0.0000	-0.0003	-0.0041	-0.0034	-0.0074
OTH_LANG	-0.0001	-0.0006	-0.0005	-0.0010	-0.0002	-0.0056	-0.0045	-0.0100
CHILD	0.0000	0.0009	0.0008	0.0017	0.0000	0.0101	0.0082	0.0184
MSTATUS	-0.0009	0.0075	0.0072	0.0147	-0.0015	0.0256	0.0242	0.0497
EMP_PUB	-0.0161	-0.0188	-0.0307	-0.0495	-0.0129	-0.0209	-0.0332	-0.0541
EDUCATE	-0.0041	-0.0016	-0.0026	-0.0042	-0.0012	0.0013	0.0023	0.0035
HUMANE	0.0019	-0.0009	-0.0012	-0.0022	0.0019	-0.0023	-0.0028	-0.0052
COMLAWEC	0.0066	-0.0070	-0.0043	-0.0113	0.0087	-0.0050	-0.0029	-0.0079
AGRI_BIO	-0.0004	-0.0008	-0.0010	-0.0018	-0.0006	0.0031	0.0036	0.0066
ENGINE	0.0572	-0.0143	-0.0016	-0.0160	0.0527	-0.0101	-0.0009	-0.0110
HEALTH	-0.0436	0.0026	0.0142	0.0168	-0.0307	0.0049	0.0181	0.0230
MATH	0.0151	-0.0042	-0.0017	-0.0059	0.0150	-0.0034	-0.0013	-0.0047
OTH_DISC	-0.0003	0.0012	0.0011	0.0023	-0.0004	0.0025	0.0026	0.0051
Constant	0.0000	0.4638	0.4162	0.8800	0.0000	0.1804	0.1619	0.3423
sums	0.0123	0.0460	0.0563	0.1023	0.0234	0.0588	0.0667	0.1255
percent	10.73	40.14	49.12	89.26	15.72	39.49	44.80	84.29

sumstotal (1988) = 0.0123 (endowments) + 0.0460 (male advantage) + 0.0563 (female disadvantage) = 0.1146
 percent total (1988) = 10.73 (endowments) + 40.14 (male advantage) + 49.12 (female disadvantage) = 100.00
 sumstotal (1991) = 0.0234 (endowments) + 0.0588 (male advantage) + 0.0667 (female disadvantage) = 0.1489
 percent total (1991) = 15.72 (endowments) + 39.49 (male advantage) + 44.80 (female disadvantage) = 100.00

Table 15 shows the results for bachelor graduates after using Cotton's decomposition procedure. Between 1988 and 1991, the portion of the wage differential explained by the returns to endowments component increases from approximately 11 percent to almost 16 percent. In 1988, approximately 11 percent of the wage gap is explained by the males skills advantage i.e., the returns to endowments, column "a". Eighty-nine percent of the wage gap is explained by the sum of male treatment advantage and female treatment disadvantage. The fields of study skill set has the largest positive influence on the earnings of males (column a). This is offset by the superior wage generating characteristics held by females such as the experience variables especially, age, sqage and prior work experience greater than three years. The presence of children has a neutral effect while being married also reduces the endowed characteristics differential.

In terms of the total treatment effect, column "d", females grads in 1988 receive superior rewards for their work experience, fields of study, and public sector employment. This is offset by the family variables, (marriage and children) and the constant term. Visible minority status and the other language category also reduced the treatment differential, i.e., favoured females, but the effect is minimal.

In 1991, female graduates with bachelor degrees show superior wage generating characteristics such as work experience and family status variables. Again this is more than offset by the returns males receive for their skill differential in the fields of study categories (column e). Females are not compensated fairly for their skill sets as column "h" shows. Females receive less than adequate compensation for their family status variables and for the fields of study. However, the majority of the adverse effect is from the constant term (i.e., 0.3423). As indicated previously, this term includes the effects of pre-labour market discrimination and variables not included in the analysis.

Table 16: Results from Cotton's Procedure, Master's Graduates, 1988 & 1991

Variables	1988				1991			
	returns to endow. (a)	male treat. adv. (b)	female treat. disadv. (c)	total treat. (d) (b+c=d)	returns to endow. (e)	male treat. adv. (f)	female treat. disadv. (g)	total treat. (h) (f+g=h)
AGE	0.0057	-0.1640	-0.2139	-0.3779	0.0204	0.4539	0.5948	1.0487
SQAGE	-0.0107	0.0771	0.1021	0.1792	-0.0235	-0.1971	-0.2635	-0.4606
PRWRK1	0.0003	0.0002	0.0003	0.0005	-0.0003	-0.0005	-0.0007	-0.0012
PRWRK2	0.0007	0.0041	0.0048	0.0089	0.0023	-0.0005	-0.0005	-0.0010
PRWRK3	-0.0066	0.0087	0.0121	0.0208	-0.0075	-0.0072	-0.0101	-0.0172
VIS_MIN	-0.0015	0.0040	0.0026	0.0067	-0.0003	0.0016	0.0013	0.0029
DISABLED	0.0001	0.0006	0.0008	0.0014	0.0001	0.0005	0.0006	0.0011
FRENCH	0.0003	-0.0028	-0.0037	-0.0065	-0.0004	0.0002	0.0002	0.0004
OTH_LANG	-0.0011	-0.0015	-0.0015	-0.0030	-0.0013	0.0000	0.0000	0.0001
CHILD	0.0032	0.0113	0.0114	0.0227	0.0031	0.0088	0.0093	0.0181
MSTATUS	0.0028	0.0058	0.0063	0.0122	0.0049	0.0176	0.0194	0.0370
EMP_PUB	-0.0029	-0.0130	-0.0256	-0.0387	0.0058	-0.0199	-0.0375	-0.0574
EDUCATE	-0.0076	0.0020	0.0041	0.0060	-0.0038	0.0029	0.0056	0.0085
HUMANE	0.0158	-0.0043	-0.0114	-0.0157	0.0125	-0.0010	-0.0026	-0.0035
COMLAWEC	0.0242	0.0117	0.0074	0.0191	0.0231	0.0106	0.0076	0.0183
AGRI_BIO	0.0019	-0.0001	-0.0001	-0.0002	0.0005	-0.0005	-0.0008	-0.0014
ENGINE	0.0222	0.0023	0.0005	0.0028	0.0165	0.0052	0.0011	0.0064
HEALTH	-0.0145	0.0029	0.0142	0.0172	-0.0155	0.0028	0.0143	0.0171
MATH	0.0054	0.0003	0.0002	0.0005	0.0025	0.0022	0.0010	0.0031
OTH_DISC	0.0001	0.0048	0.0058	0.0106	0.0000	0.0061	0.0077	0.0138
Constant	0.0000	0.0900	0.1159	0.2059	0.0000	-0.2392	-0.3081	-0.5473
sums	0.0371	0.0402	0.0324	0.0726	0.0392	0.0466	0.0393	0.0859
percent	33.79	36.64	29.57	66.21	31.37	37.22	31.41	68.63

sum total (1988) = 0.0371 (endowments) + 0.0402 (male advantage) + 0.0324 (female disadvantage) = 0.1097

percent total (1988) = 33.79 (endowments) + 36.64 (male advantage) + 29.57 (female disadvantage) = 100.00

sum total (1991) = 0.0392 (endowments) + 0.0466 (male advantage) + 0.0393 (female disadvantage) = 0.1251

percent total (1991) = 31.37 (endowments) + 37.22 (male advantage) + 31.41 (female disadvantage) = 100.00

Table 16 shows the results for graduates with master's degrees in 1988 and 1991. Unlike the bachelor graduates, the percent of the wage differential explained by the returns to endowments decreases between 1988 and 1991, from almost 34 percent to approximately 31 percent. In 1988, the skills advantage held by males in the fields of study category is offset by the superior work history characteristics held by females. In addition, the presence of children and being married favours males (column a). Males receive higher rewards than females for the family status variables and fields of study (column d). Although the effects are small, non-English females receive additional rewards. The inverse is true in the case of disability or being a member of a visible minority.

In 1991, the returns to endowments are similar to the situation in 1988. Males have superior characteristics in terms of field of study and marital status. And again, females possess preferred work history characteristics. The majority of the wage differential can be explained by the different rewards that females and males receive as compensation for their field of study. The total treatment differential for fields of study sums to 0.0623, almost 75 percent of the total treatment sum of 0.0858. A brief comparison of the results of the two decomposition techniques are reviewed next.

Comparison of Oaxaca's and Cotton's Decomposition Technique

Oaxaca's procedure is based on the assumption that in a discrimination-free environment, the male wage would prevail. Cotton's decomposition method is based on the argument that in a discrimination-free environment, wages would fall between what the discriminated group currently receives and what the preferred group now receives. Both techniques show that the discrimination-related wage gap decreases over time for bachelor graduates. Cotton's technique shows a reduction from 89% in 1988 to 84% in 1991 while Oaxaca's decomposition technique indicates a reduction from 104% to 95%.

The two techniques show similar results results (i.e., Oaxaca's "unexplained gap" and Cotton's "treatment effects") for graduates with master's degrees. Oaxaca's technique produces an increase from 52.5% to almost 56% while Cotton's decomposition yields an increase from 66.2% to almost 69%. Either technique shows similar effects for the returns to endowments although the magnitude of the change varies somewhat.

Table 17: Comparison of Results from Oaxaca's and Cotton's Decomposition*

Degree & Survey Year	Returns to Endowments (%)		Oaxaca's Unexplained Gap(%) (discrimin- ation)	Cotton's Treatment Effects (discrimination)		
	Oaxaca	Cotton		Male Treatment Adv. (%)	Female Treatment Disadv(%)	Total Treatment Effect
B.A., 1988	-3.8	10.7	103.8	40.1	49.1	89.2
B.A., 1991	5.3	15.7	94.7	39.5	44.8	84.3
M.A., 1988	47.5	33.8	52.5	36.6	29.6	66.2
M.A., 1991	44.2	31.4	55.8	37.2	31.4	68.6

* Percent totals may not sum to 100 due to rounding

The results show the decomposition methodologies are sensitive to the model parameters and the population. For example, wage discrimination affecting bachelor graduates as measured by Oaxaca's technique is more than that measured by Cotton's. However, the converse is true for graduates with master's degrees. The preceding highlights the lack of robustness of the models to the population under analysis. Although not evident from this study, decomposition analysis is also known to be sensitive to the year the data was collected and in the case of panel data, the status of the economy during the period (Grenier and Joseph 1993, Wellington 1993, Baker et al. 1995)

Two-period Decomposition Model

The two-period decomposition model is an extension of the single-period Oaxaca procedure made possible by the availability of data on two or more time points. The model as developed by Wellington (1993)⁵ and incorporating the 1988 and 1991 survey points has the following form:

$$\begin{aligned}
 (+) \quad & \overline{(\ln W^{m91} - \ln W^{m88})} - \overline{(\ln W^{t91} - \ln W^{t88})} = \\
 & \overline{[(X^{m91} - X^{m88})b^{m91} - (X^{t91} - X^{t88})b^{t91}]} + [\overline{X^{m88}}(b^{m91} - b^{m88}) - \overline{X^{t88}}(b^{t91} - b^{t88})] \\
 & \text{(changes in means} \qquad \qquad \qquad \text{(changes in coefficients} \\
 & \text{derived from using} \qquad \qquad \qquad \text{evaluated at year 1988 means)} \\
 & \text{year 1991 coefficients)}
 \end{aligned}$$

Table 18 shows the results of the two-period decomposition for bachelor and master graduates respectively. Table 18 shows that for bachelor graduates, approximately 2.8 percentage points of the total wage change is due to a change in the means, i.e., a change in the relative amounts of skills/endowments of males and females. The largest influences effecting the change in means is in the family status variables, child(ren) at 0.0089 and marital status at 0.0177 for a total of 0.0266 (i.e., 2.7%). Wage discrimination increased during the period 1988 to 1991, by 0.0061, i.e. 0.6 percent (column b). Thus the change in the coefficients, i.e., the treatment effect is minimal for the bachelor graduates.

⁵A more detailed exposition of the model is in Chapter 2.

Table 18: Two-Period Decomposition, All Graduates, (1988 & 1991)

Variable	Bachelor Graduates			Master Graduates		
	change in endow. (a)	change in treat. (b)	sum of changes (c)	change in endow. (d)	change in treat. (e)	sum of changes (f)
AGE	0.0050	0.8759	0.8809	-0.0020	-1.6793	-1.6813
SQAGE	-0.0062	-0.3796	-0.3857	0.0047	0.0249	0.0297
PRWRK1	-0.0000	0.0014	0.0014	-0.0001	0.0055	0.0054
PRWRK2	0.0002	-0.0051	-0.0049	-0.0007	0.0078	0.0070
PRWRK3	0.0001	-0.0032	-0.0031	-0.0089	0.0104	0.0015
VISMIN	0.0000	0.0067	0.0068	-0.0004	0.0025	0.0021
DISABLED	-0.0002	-0.0013	-0.0015	0.0002	-0.0011	-0.0009
FRENCH	0.0004	-0.0075	-0.0072	-0.0001	-0.0122	-0.0123
OTH. LANG.	-0.0002	-0.0089	-0.0091	-0.0008	-0.0067	-0.0075
CHILD	0.0089	0.0077	0.0166	0.0081	-0.0025	0.0056
MSTATUS	0.0177	0.0167	0.0344	0.0093	0.0208	0.0302
EMP_PUB	-0.0051	0.0038	-0.0013	-0.0015	-0.0387	-0.0402
EDUCATE	-0.0000	0.0107	0.0107	-0.0008	-0.0124	-0.0132
HUMANE	-0.0006	-0.0024	-0.0030	-0.0039	0.0078	0.0039
COMLAWEC	0.0011	0.0043	0.0054	-0.0039	0.0125	0.0086
AGRIBIO	0.0002	0.0081	0.0083	-0.0003	0.0020	0.0017
ENGINEERING	-0.0010	0.0015	0.0005	-0.0017	-0.0037	-0.0054
HEALTH	0.0072	0.0118	0.0190	-0.0005	0.0010	0.0005
MATH	0.0004	0.0006	0.0011	0.0008	-0.0072	-0.0064
OTH. DISC.	0.0002	0.0026	0.0028	-0.0005	-0.0049	-0.0054
Constant	0.0000	-0.5377	-0.5377	0.0000	1.6150	1.6150
Totals	0.0282	0.0061	0.0343	-0.0031	-0.0585	-0.0616

For graduates with master's degrees wage discrimination decreases across the survey period by 6 percent (column e). In this case, the change in the total wage differential results from changes in the reward structure. Specifically, the improving degree of compensation that females receive from increasing returns or rewards to their experience characteristic, age (column f).

Hence, for the cohort representing graduates with master's degrees the wage gap narrows over the period 1988 to 1991 as a result of changes to the wage structure, i.e., females receive improved compensation compared to males for the same level of human capital. However, for the bachelor graduate cohort, the amount of wage discrimination increases as a consequence of the deterioration of the females skill set relative to males. Thus Baker et al., (1995) results that show a decrease in the wage gap over the period 1985-1990 is supported in this thesis only in the case of master's graduates..

Summary

The descriptive statistics show that males continue to earn higher wages than females regardless of degree level. Male bachelor graduates earn approximately \$2800 more than females two years after graduation and more than \$5100 five years after graduation. Similarly, male graduates with a master's degree earn \$3800 more than females in 1988 and approximately \$5500 more than females in 1991.

The regression results show that the field of study chosen by the graduates is a major factor in explaining the differences in earnings. For bachelor graduates of either gender and male master graduates, Engineering, Mathematics, Health and Commerce/Law/Economics provide the strongest explanation for financial returns. However, for female master graduates, the field of study is not as important. This is evident since in the case of female post-graduates, the discipline category fails to achieve any degree of significance.

The effects of the family status variables is mixed for the graduates. At the bachelor level, being married is significant in explaining the earnings of male graduates. The presence of children variable achieves significance in 1991 only, positive for males and negative for females. For the master's cohort, the family variables are important for males in either survey year. Unlike the female bachelor graduates, the earnings of female master graduates is positively

related to the variable “child” although as noted previously, the variable does not achieve statistical significance.

Among the remaining variables, public sector employment yields positive returns for females at either degree level. Disability has a negative impact although it achieves significance only for female master graduates in 1991 and female bachelor grads in 1988. Membership in a visible minority group also has a negative influence on earnings but is significant for female graduates with master’s degrees in 1988 only. Also as expected, non-English speaking graduates are at a disadvantage in the labour market. The disadvantage increases over time regardless of the degree obtained. More than three years of prior work experience also contributes to higher earnings for all graduates, as expected. Other experience variables such as age and age squared achieve significance in many of the regressions.

The decomposition techniques reveal that the analysis of wage differentials is sensitive to the methodology and the population. With respect to graduates with master’s degrees, Oaxaca’s and Cotton’s technique both show an increase in the unexplained portion of the wage differential. However, Wellington’s two-period decomposition shows a 6 percent decrease in wage discrimination for graduates with master’s degrees over the reference period.

For graduates with bachelor’s degrees, the two-period decomposition model shows a small decrease in wage discrimination (approximately 0.6 percent). In addition, Wellington’s procedure shows that the largest influence in the reduction of the total wage differential for the bachelor graduates is the positive effect of the change in endowments. Both results are consistent with those obtained from Oaxaca’s and Cotton’s techniques.

CHAPTER 5

CONCLUSIONS

Significant differences are found when evaluating the labour market experiences of Canadian male and female 1986 graduates with either a bachelor's or master's degree. However, the results are sensitive to the choice of decomposition method and population. Employing Cotton's decomposition technique, the unexplained portion of the wage gap decreases from 89% in 1988 to 84% in 1991, for bachelor graduates. For graduates with master's degree, the gap increases slightly from 66% in 1988, to almost 69% in 1991. Hence a larger portion of the wage gap can be explained for graduates with master's degrees than for graduates with bachelor's degrees.

More important are the differences that appear to be dependent on the level of attained degree. With respect to the graduates with bachelor degrees, the decrease in the wage gap is caused by an increase in the stock of the human capital of females relative to males. However, the increase in the wage gap of the graduates with master's degrees is caused by females receiving less compensation for their human capital relative to males. One possible explanation for these degree specific effects may be the difficult labour market of 1986 to 1991. Although the graduates entered a relatively robust labour market in 1986, by 1991 the economy was in a severe recession. It is possible that as a result of the fiercely competitive nature of the recession economy, employers may have reduced costs by favouring graduates with bachelor's degrees over graduates with master's degrees and among bachelor level graduates, females over males. One indication of this is the results from the public employment variable. The regression results

show that public sector employment favoured females in 1988 but less so in 1991.

Field of study is also important in explaining the differences in male/female earnings. However, it is not as important for female graduates with master's degrees as it is for females with bachelor degrees. Thus for females, it seems that the level of degree attained is more important than the actual area of specialization. It is possible that the labour market views females with master's degrees as "like" males in terms of the characteristics employers view as desirable (e.g., committed, career-oriented etc.). This result is supported by the fact that the earnings of females with a master's degree are positively related (although not statistically significant) to having a dependent child as is the case for males while the earnings of females with a bachelor's degree are negatively affected by having a dependent child.

This study also supports the previously established importance of prior work experience (or its proxies - age or age squared) in reducing gender differentials. The evidence is clearly apparent at either degree level. This result appears in the analysis even though the sample is restricted to individuals age 20-40 inclusive. However, future research should focus on the quality as well as the quantity aspect of prior work experience. Unfortunately, this aspect is not recovered in the National Graduates Survey.

Other differences in degree level treatment surface in the effect of the different levels of degree on the language variables. Non-English speaking graduates are at a disadvantage in the labour market and this disadvantage increases over time. Furthermore, increases in the level of

attained degree does not significantly assist in improving their earnings. Again, this result may be a consequence of the poor labour market of the early 1990's.

These results suggests that there is room for a broader policy remedy. In passing the Employment Equity Act in 1986 the federal government moved towards eliminating discrimination in the workplace. One clear consequence of the Act is apparent in the effect of the public sector employment variable. Public sector employment has the effect of narrowing the earnings differential. However, this effect diminishes over time. Some authors have suggested that this may be because males in the private sector earn higher rewards as they progress through their careers. An alternate explanation may be that females in the public service reach the infamous "glass ceiling," i.e., the point in their career where further advancement is halted by discrimination that limits their access to senior positions and the financial returns that accrue to higher management. Hence one implication of this paper is that governments should review their promotional practices in order to accelerate the promotion of females and minority groups into higher paying positions.

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Appendix I

Fields of Study

In general, "Field of Study", follows the University Student Information System (USIS)

1) Education

USIS Codes: 10000 - 14100

Includes school librarians, guidance and counselling, physical education, kinesiology, recreation and others

2) Fine Arts & Humanities

USIS Codes: 20000 - 21499, 30000 - 32700

Includes music, performing arts, industrial design, languages, theology, translation and interpretation and others

3) Commerce, Law and Economics

USIS Codes: 412XX, 427XX, 433XX

Includes, Commerce, Business Administration, Economics, Law and Jurisprudence

4) Other Social Sciences

USIS Codes: 40000 - 45700 except those listed above

Includes archaeology, demography, sociology, political science, social work, secretarial studies, military studies and others

5) Agriculture and Biological Sciences

USIS Codes: 50000 - 52500

Includes biophysics, zoology, toxicology, biochemistry

6) Engineering

USIS Codes: 60000 - 62200

Includes architecture, all engineering, forestry, landscape architecture etc.

7) Health Sciences

USIS Codes: 70000 - 79900

Includes anatomy, medical technology, dentistry, etc.

8) Mathematics and Physical Sciences

USIS Codes: 80000 - 83099

Includes computer sciences, geology, oceanography, etc.

9) Other Discipline

USIS

Codes

00000 General Arts and Sciences

00001 Interdisciplinary Studies

00002 General Arts

00008 General Sciences

99998 Not Applicable/None

99999 Not reported

APPENDIX II

The tabulations for the sample populations in 1988 and 1991 are shown in Tables II a,b,c,d. Tables IIa,b show the characteristics for the sample of bachelor graduates selected for this thesis. Recall that the total sample of bachelor graduates is composed of those graduates employed in either of the reference years, i.e., 1988 or 1991. Table IIa show the characteristics of the sub-sample of graduates employed full-time in 1988 as compared to the total sample of all graduates with bachelor degrees employed full-time in either reference period. Similarly, table IIb illustrates the characteristics of the sub-sample of bachelor graduates employed full-time in 1991 compared to the total sample of bachelor graduates employed full-time in either reference period.

Tables IIc,d show the values for the graduates with master's degrees in either of the reference years. Note that the regressions are based on the sub-samples of the graduates while the cross-tabulations that appear in the beginning of Chapter 4 show the values of the total sample with respect to the level of attained degree.

TABLE IIA: SAMPLE TABULATIONS, BACHELOR GRADUATES, 1988

VARIABLE	FEMALE			MALE			TOTAL		
	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL
SAMPLE	2772	72	3836	2748	80	3437	5520	76	7273
LN EARN	3.07			3.27					
NOWRKEXP	1903	71	2677	1890	78	2410	3793	75	5087
WRKEXP<1	176	74	237	166	77	215	342	76	452
WRKEXP<3	261	74	353	309	84	367	570	79	720
WRKEXP>3	432	76	569	383	86	445	815	80	1014
VIS. MIN	196	72	272	225	78	289	421	75	561
DISABLED	49	79	62	34	74	46	83	77	108
ENGLISH	2119	73	2917	2041	80	2565	4160	76	5482
FRENCH	390	72	542	422	83	508	812	78	1050
OTH. LANG	259	73	356	280	80	351	539	76	707
CHILD	347	60	578	347	86	405	694	71	983
MARRIED	1018	71	1440	945	87	1083	1963	78	2523
SINGLE	1754	73	2396	1803	77	2354	3557	75	4750
EMP. PUB	1648			874			2522		
EDUCAT'N	542	68	795	293	84	349	835	73	1144
HUMAN	264	61	434	177	65	273	441	62	707
COMLAWEC	321	88	367	472	85	553	793	86	920
OTH. SOC	418	73	575	209	72	290	627	72	865
AGRIBIO.	224	65	346	170	65	262	394	66	608
ENGINE.	79	87	91	616	90	681	695	90	772
HEALTH	353	85	417	64	70	92	417	82	509
MATH/SC.	161	88	183	358	887	405	519	88	588
OTH. DISC.	410	65	628	389	74	532	799	699	1160

TABLE IIB: SAMPLE TABULATIONS, BACHELOR GRADUATES, 1991

VARIABLE	FEMALE			MALE			TOTAL		
	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL
SAMPLE	2901	76	3836	2963	869	3437	5864	81	7273
LN.EARN.	3.46			3.61					
NOWRKEXP	2025	76	2677	2062	86	2410	4087	80	5087
WRKEXP<1	185	78	237	182	85	215	367	81	452
WRKEXP<3	256	73	353	321	87	367	577	80	720
WRKEXP>3	435	76	569	398	898	445	833	828	1014
VIS.MIN	212	78	272	245	858	289	457	82	561
DISABLED	36	58	62	41	898	46	77	71	108
ENGLISH	2221	76	2917	2204	86	2565	4425	81	5482
FRENCH	394	73	542	437	868	508	831	79	1050
OTH.LANG	269	76	356	309	88	351	578	82	707
CHILD	676	61	1109	768	92	835	1444	74	1944
MARRIED	1661	73	2278	1617	91	1768	3278	81	4046
SINGLE	1240	80	1558	1346	81	1669	2586	80	3227
EMPPUB	1851			1058					
EDUCAT'N	607	76	795	310	89	349	917	80	1144
HUMAN	286	66	434	210	77	273	496	70	707
COMLAWEC	310	84	367	506	92	553	816	89	920
OTIL.SOC.	425	74	575	239	82	290	664	77	865
AGRI.BIO.	247	71	346	190	73	262	437	72	608
ENGINE.	67	74	91	634	93	681	701	91	772
HEALTH	320	77	417	83	90	92	403	79	509
MATH/SC.	149	81	183	358	88	405	507	86	588
OTH.DISC	490	78	628	433	81	532	923	80	1160

TABLE IIC: SAMPLE TABULATIONS, MASTER GRADUATES, 1988

VARIABLE	FEMALE			MALE			TOTAL		
	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL
SAMPLE	1162	74	1568	1642	81	2021	2804	78	3589
LN.EARN.	3.49			3.60					
NOWRKEXP	358	65	549	545	70	779	903	68	1328
WRKEXP<1	75	63	120	103	84	123	178	74	242
WRKEXP<3	169	73	231	252	80	314	421	77	545
WRKEXP>3	560	84	668	742	92	805	1302	88	1473
VIS.MIN	43	57	78	127	81	157	170	72	235
DISABLED	17	63	27	25	74	34	42	69	61
ENGLISH	811	77	1057	1109	83	1330	1920	80	2387
FRENCH	255	72	353	351	79	447	606	76	800
OTH.LANG	94	61	153	177	76	233	271	70	386
CHILD	337	70	484	604	89	680	941	81	1164
MARRIED	608	60	1012	999	86	1163	1607	79	2023
SINGLE	554	78	708	643	75	858	1197	76	1566
EMPPUB	841			767					
EDUCAT'N	250	84	299	213	94	226	463	88	525
HUMAN	170	62	276	115	65	178	285	63	454
COMLAWEC	153	89	172	417	94	444	570	93	616
OTH.SOC.	215	73	296	197	75	264	412	74	560
AGRI.BIO.	64	60	106	67	61	110	131	61	216
ENGINE.	35	88	40	299	88	339	334	88	379
HEALTH	144	80	181	52	76	68	196	79	249
MATH/SC.	39	68	57	140	69	203	179	69	260
OTH.DISC	92	65	141	142	75	189	234	71	330

TABLE IID: SAMPLE TABULATIONS, MASTER GRADUATES, 1991

VARIABLE	FEMALE			MALE			TOTAL		
	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL	EMPLOY	%	TOTAL
SAMPLE	1160	74	1568	1741	86	2021	2901	81	3589
LN.EARN.	3.74			3.86					
NOWRKEXP	388	71	549	619	79	779	1007	76	1328
WRKEXP<1	75	63	120	99	80	123	174	72	242
WRKEXP<3	151	65	231	272	87	314	423	78	545
WRKEXP>3	546	82	668	751	93	805	1297	88	1473
VIS.MIN	56	72	78	142	90	157	198	84	235
DISABLED	19	70	27	29	85	34	48	79	61
ENGLISH	796	75	1057	1152	87	1330	2126	89	2387
FRENCH	250	71	353	382	85	447	632	79	800
OTH.LANG	111	73	153	197	85	233	308	80	386
CHILD	464	67	690	859	91	939	1323	81	1164
MARRIED	717	71	1012	1253	90	1396	1970	82	2023
SINGLE	443	80	556	488	78	625	931	79	1566
EMPPUB	848			860			1708		
EDUCAT'N	236	79	299	222	98	226	458	87	525
HUMAN	187	68	276	131	74	178	318	70	454
COMLAWEC	152	88	172	418	94	444	570	93	616
OTIL.SOC.	212	72	296	218	83	264	430	77	560
AGRIBIO.	61	58	106	77	70	110	148	69	216
ENGINE.	35	88	40	305	90	339	340	90	379
HEALTH	141	78	181	57	84	68	198	80	249
MATH/SC.	38	67	57	161	79	203	199	77	260
OTIL.DISC	98	70	141	152	80	189	250	76	330