

THE DYNAMICS OF GENDER-WAGE DIFFERENTIALS AND DISCRIMINATION IN CANADA

by

Troy Joseph

489559

Major Paper presented to the

Department of Economics of the University of Ottawa

in partial fulfilment of the requirements of the M.A. Degree

Supervisor: Dr. Gilles Grenier

ECO 7997

Ottawa, Ontario

January, 1992

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THE DYNAMICS OF GENDER-WAGE DIFFERENTIALS AND DISCRIMINATION IN CANADA

Introduction:

In 1989, the average annual wage for female full-time full-year workers in Canada was \$27 091, well below the average male wage of \$35 073 (Statistics Canada, 1990). Part of the average gender-wage gap may be attributed to male advantages in average endowments of education, experience, or other productivity-generating characteristics. In addition, some of this gap may be attributable to forms of discriminatory treatment of women in the labour market. For instance, women may be paid less than comparably skilled males or perhaps they are concentrated in industries that are lower-paying than the industries in which males predominate, all other influences held constant. Likely, a combination of many factors is responsible for the existence of the earnings gap between men and women.

Also noteworthy is the observation that the gross earnings differential between the genders has been diminishing in recent years, falling from 40% in 1970 to 34% in 1985 (Statistics Canada, 1990). The dissipating magnitude of the wage gap may be due to a narrowing of the differential in the labour market value of female compared to male labour services, or possibly a general reduction in the discriminatory influences against women in the labour market.

Male-female wage differentials should be of some concern to economic analysis. Pure wage discrimination would act to impede the efficient allocation of resources in the economy (Miller, 1987). When society's rewards and punishments, financial and otherwise, are distributed among its members in a manner not consonant with their relative contributions to output, then it is bound to be the case that more than the efficient amount of resources will be allocated to some relatively unproductive members of the non-discriminated group while too few resources will be allocated to some relatively productive members of the discriminated group. Thus effective discrimination would act to keep aggregate real output below its potential. On the other hand, elimination of wage differentials stemming from differences in productivity would also obstruct efficiency. Therefore, the root causes of the male-female wage differential should be of interest with regards to maximization of the economy's output and how public policy can best further this goal.

But besides the concerns economic efficiency, there are the more obvious concerns of justice and equity in the treatment of women in the labour market. Discrimination, would be expected to impose some hardship on women. Effective gender-wage discrimination would deprive women of full compensation for their societal contributions. Possible negative repercussions of discrimination on the welfare of women include lower personal earnings, a lower standard of living and lower social status than would have prevailed in the absence of discrimination, and lower also relative to their male peers.

This paper begins with a brief review of some theoretical explanations put forth to rationalize the existence of the gender-wage gap. Secondly, a brief synopsis of previous studies measuring the earnings gap in the 1970's and 1980's is presented. In the third section, measurements are made of the degree of influence of various

factors that are proposed to contribute to the gap in earnings between males and females, including forms of discrimination, using the most recent available Canadian Census data from 1986. The fourth section attempts to examine the dynamics of the composition of the male-female wage differential. Measurements are made at three points in time: 1970, 1980 and 1985. Specifically, this study tries to detect whether wage discrimination directed toward women has been increasing or decreasing in the Canadian labour market over this fifteen-year period by applying consistent methods of measuring discrimination to three different censuses. Lastly, this paper explores the extent to which discrimination differs among the different generations of Canadian working women using an as yet unexplored analysis to detect generation effects on women's earnings.

I. THEORETICAL EXPLANATIONS OF THE GENDER-WAGE GAP

In testing for discrimination, it is essential to have a theoretical framework from which measurable expressions for discrimination can be derived. Economic theory has provided a multitude of explanations to account for the lower earnings of females relative to males. From these theories, several distinct conceptions of discrimination have emerged, and hence numerous methods can be used to test for various types of discrimination. The theories presented in this section will prove useful as they form the basis for the measures of discrimination employed in the subsequent analytical sections.

A commonly used definition of gender-wage discrimination is the lower payment of female workers relative to equally qualified male workers. Many explanations have been proposed for such discrimination. Male workers may foster discrimination due to a distaste for working with females or the threat that low-wage female workers pose to their more stable and higher-paying jobs. In order to ensure a greater degree of job security, males may encourage employers, governments and unions to keep women out of positions of great responsibility and authority. Obviously, employers have an incentive to discriminate in their payment of female employees by paying them less than equally productive males. Plainly, such discriminatory behaviour would act to reduce labour costs and hence increase profits for the firm.

DEMAND THEORIES

Demand theories of discrimination postulate that male and female labour markets are distinct. The demand for male labour is stronger relative to the demand for female labour. Consequently, in demand theories of discrimination, the equilibrium level of employment and wages of females are reduced relative to males.

Gender-wage discrimination may arise partially due to employers' underestimation of the productive capabilities of women. This underestimation may be fostered by negatively biased reports on the performance of female workers submitted by the supervisors and fellow employees of female workers, especially male workers.

Some employers may use statistical judgement in estimating the productivity of female workers. Since precise information regarding a given worker's productivity would be prohibitively costly to acquire, an employer may simply estimate the productivity of a given female worker to be equal to the average productivity of all his female employees (Aigner and Cain, 1972). As a result, the productivity of half such an employer's female workers will be underestimated. To the extent that employers consistently underestimate the marginal revenue products of females, their demand for female labour will be lower than for males.

Gary Becker (1971) proposed that employers, white co-workers and customers require some premium to deal with blacks in the workplace. Extending Becker's analysis to the discriminatory treatment of women in the labour market, employers would not consider the wage rate of a female to be the full cost of employing her, rather they would behave as though some higher wage, $W_f(1 + d_f)$ were the net imputed cost of hiring a female worker. Similarly, Arrow (1973) explains that employers' demand for female relative to male labour is reduced since the utility of a firm's managers increases less by hiring a female than an equally productive male. Likewise, males that work alongside females do not consider their actual take-home wages to be reflective of their compensation for working in the presence of females, but only some fraction of that wage, $W_m(1 - d_m)$. Analogously, consumers act as though goods or services purchased from females were more costly than their actual prices, namely $p_c(1 + d_c)$ is the consumer's perceived price of a good or service sold by females. It is these perceived extra costs of dealing with females in the labour market that give rise to lower demand for female labour. Within this framework, we would not expect females to earn wages corresponding to their productivity, but only some fraction of such a wage due to a reluctance to deal with females in the work place.

"Dual Labour Market" theory describes the nature of the separate male and female labour markets. Men are proposed to dominate a "primary" or "core" labour market characterized by a high degree of unionization, monopolistic market power, and expanding markets (Doeringer and Piore, 1971). The prosperous environment surrounding the core market ensures that its predominantly male employees are provided with high wages and stable employment. Males may act to minimize the number of women entering the core labour market to retain their superior employment positions, or they may have biased judgements of females' potential abilities in the core labour market. Juxtaposed to the core market is the "secondary" or "peripheral" labour market characterized by a low degree of unionization, highly competitive markets and markets which are on the decline. The unstable nature of these markets ensures that the predominantly female employees in this sector suffer from unstable employment at low wages. Women may be concentrated in the peripheral labour market due to greater household responsibilities than men, or women may have a stronger tendency to move to the places of their husbands' employment than vice versa. The low wages and unpleasant working conditions of women working in the peripheral labour market may in fact be a contributing factor to high absenteeism and turnover rates. In turn, wages in the secondary labour market may be further depleted.

SUPPLY THEORIES

In the framework of supply theories of discrimination, forces exist that exert upward pressure on the supply of female labour in the female labour market. Even though women may be paid wages equal to their marginal revenue products, their wages are depressed relative to males since males do not suffer from excess labour supply as do females.

Bergmann's "crowding hypothesis" (1971) suggests that females are crowded into "female-type" occupations as a result of a discriminatory socioeconomic environment. The resulting oversupply of females in these occupations acts to drive down their marginal productivity and thus reduce their wages relative to males who do not suffer from excess supply.

According to Zellner (1972), the labour market consists of a discriminatory "masculine" sector in which males are preferred to females, and a non-discriminatory "feminine" sector. Since females are in low demand in the masculine sector, the few females that do find employment in that sector must accept low wages while the remaining females are crowded into the feminine sector. As a consequence of the excess supply of females in the feminine sector, wages are driven down. Thus women's wages turn out to be low in both sectors.

Part of the explanation for the lower earnings of females may stem from women's own underestimation of their labour market worth. When seeking employment, women may reduce their asking wages below what a strictly productivity-determined wage would command. Perhaps erroneous female estimation of their labour market capabilities stems from the sociological environment surrounding the labour market in which the dominant positions in society are held primarily by males. (The influence of the sociological environment on the reservation wages of females of different generations will be explored in Section V.) As a result of females' underestimation of fair rates for their labour services, more females would be willing to work at any given wage than if women valued their labour services by their marginal revenue products. Consequently, females would suffer from excess supply in the labour market.

THEORIES OF THE PERSISTENCE OF THE WAGE DIFFERENTIAL

Standard neoclassical economic theory would predict that the payment of female workers below their marginal revenue products should be unsustainable in competitive markets since non-discriminating firms could bid away female workers from discriminating firms, thereby making huge profits that would drive discriminating firms out of business. Thus we might expect discrimination to dissipate over time. However, despite the predictions of competitive theory, the male-female wage differential has not disappeared. The following are some of the proposed non-competitive factors that may explain this persistence in the face of competitive forces.

It is possible that some component of gender-wage discrimination is due to the persistence of historical employment practices that are sluggish in disappearing (systemic discrimination). For example, word-of-mouth

recruiting practises may act to maintain the existing balance of men and women in a firm's work force. Perhaps in the past, many firms' occupations required some degree of physical strength or height (e.g. construction, farming) although this is less likely to be the case in the present day. If firms are paying higher-than-competitive wages, the resultant scarce number of job positions may be rationed on the basis of former job requirements, that is, to the physically strongest job applicants, predominantly men, even though such jobs may not require a great deal of strength in the present day.

Kenneth J. Arrow (1973) contends that discriminating firms may in fact realize that profits could be bolstered by replacing males with less-expensive but equally qualified female workers. But realistically, a firm is unable to instantaneously replace its male employees by an all-female work-force except at substantial cost. To spread the costs over time, the firm slowly replaces its male workers with females as the male workers leave the firm over the natural course of employment relationships (e.g. as older workers retire or workers quit the firm). Therefore, it may take an extended period before females are hired in the same proportion as males by presently discriminating firms.

PRODUCTIVITY DIFFERENCES

In addition to discriminatory forces that would act to drive women's wages below their marginal revenue products, the wages of males and females may differ due to differences in productivity and thus discrepancies in the labour market worth of men and women. Wage differentials due to productivity differences would occur even if males and females with identical skills were paid equally. Measures of workers' productivity-related characteristics include acquired attributes such as education, training, mobility and labour market experience. In some occupations, measures of productivity-related skills may require measuring other more innate characteristics such as strength, perseverance or dexterity. However, in the present day, we would not expect performance of a worker to be greatly different due to inherent characteristics of the employee. In a modern labour market, physical strength, for which there may exist some difference between genders, should not be a significant contributor to wage differentials, since inborn physical strength is required of only a few occupations.

It may be economically rational for females (or firms) to be reluctant to invest in female human capital formation. Women's labour market careers tend to be more brief and disrupted relative to males, largely due to greater family responsibilities than men (Mincer and Ofek, 1982). As a result, women and their employers can expect to have a shorter period from which the benefits of human capital training will be realized (the costs of human capital formation will be recovered). In addition, female labour market experience may generally be discontinuous compared to males. Such disrupted labour market careers may accelerate the depreciation of women's human capital skills.

The decision of females to engage in human capital formation may be based on economically sound decision-

making, but these decisions may themselves be influenced by forms of discrimination that lead women to acquire less human capital skills. It may be the case that females receive discriminatory returns to the acquisition of human capital (i.e. lower expected wages after graduation than males). Discrimination in the acquisition of human capital could also take the form of reduced access to borrowed funds to finance the cost of human capital formation, or investment in human capital may be discouraged within the family unit and through peer pressure. The before-mentioned observed tendency for females to have increased family responsibilities may be attributable more to discriminatory influences that take place outside the labour market than to females' own choosing. All these factors may cause females to accumulate less labour-market-oriented human capital than males and thus increase productivity differentials between men and women.

Higher rates of absenteeism for females than males may be largely due to the greater family responsibilities of females, especially those related to the care of children (Boulet and Lavallée, 1984). Within the family unit, the decision for the female, rather than the male, to miss a day of work to stay home to care for the children when required may consistently be the economically "rational" decision since it is the female who would forgo the lesser earnings rather than the male. In 1987, four out of five wives from double-income families made less than their husbands (Statistics Canada, 1990). Thus low female wages work to keep female wages low in a somewhat circular course of causality.

To summarize the theories put forth to rationalize the existence of the wage gap between males and females, some theories propose that men and women are unequally rewarded for productivity-related characteristics, while other theories contend that men and women may be paid equally according to their skills, but due to various discriminatory influences (e.g. crowding, occupational segregation), females are paid wages that are, on average, below male wages. Different types of tests must be carried out to measure these different forms of discrimination. In addition, the theories present reasons to expect the wage differential and discrimination to decrease over time, although there may exist forces which keep the gap from being fully eradicated.

Complications in Applying Theories of Discrimination Empirically:

Deriving an empirical measure of discrimination that would satisfy all theories of discrimination would be inordinately demanding. Moreover, there is no single data source that provides information sufficient to measure all aspects of discrimination. Differences in the earnings of females resulting from lower returns to women for the acquisition of productivity-related characteristics would unequivocally constitute labour market discrimination. However, it is less evident how to classify differences in earnings that stem from women's lower acquisition of productivity-related characteristics. Differences in skills may result from non-discriminatory influences, such as differences in the preferences of men and women for acquiring earnings-enhancing skills. However, by some theories, it may be discrimination that takes place before entering the labour market, such as family and peer

pressure or lower expected returns to education, that induces women to acquire lower productivity-related skills relative to males. Hence women's lower empirically measured level of earnings-enhancing characteristics may be partially attributable to discriminatory influences and partially to non-discriminatory influences. But although differences in the measured endowments of productivity-related characteristics may be somewhat due to discrimination that take place outside the labour market, empirical studies typically do not attempt to measure such influences when computing estimates of discrimination. Therefore, we should exercise caution in interpreting the measures of discrimination found in the studies referred to later in the paper since the measures of discrimination may not reflect all discriminatory forces leading to lower earnings of females relative to males.

Some theories suggest that females, even if they had the same measured human capital skills as males (in terms of education, experience, etc.), would nonetheless have lower productivity than males due to factors such as higher rates of absenteeism and turnover. The factors that bring about the lower productivity of females relative to males with the same skills may themselves be due to discrimination that takes place outside the labour market. However, it would be exceedingly difficult to accurately measure the discriminatory influences that act to bring about lower productivity of females compared to males with identical measured skills.¹ Hence they are often (implicitly) ignored in the empirical studies by attributing differences in earnings between men and women with identical productivity-related skills entirely to discrimination.

II. PREVIOUS STUDIES MEASURING THE MALE-FEMALE EARNINGS DIFFERENTIAL AND DISCRIMINATION

In order to determine the magnitudes of the various factors that are proposed to influence female wages, efforts have been made to econometrically separate the observed gross earnings differential into components attributable to inequalities in productivity-related characteristics and a component ascribable to pure wage discrimination. Unfortunately, none of the established methods is able to measure precisely and with certainty the contribution of each factor to the earnings differential. The previous studies are not directly comparable due to different sources of data, different methodologies, and emphasis on different aspects of discrimination.

At least five Canadian studies undertaken in the 1970's and 1980's had estimated differences in earnings via the human capital approach of measuring the average male-female wage gap and decomposed the gap using the framework established by Blinder (1973) and Oaxaca (1973). Table 1 provides a summary of the broad estimates of the wage differential and discrimination reported in these studies using the results of their least restrictive samples of the Canadian population. In the framework of the human capital approach, part of the earnings gap between the genders is attributed to differences in wage-related characteristics while the residual is ascribed to employers' discrimination in the payment of their female employees (the human capital approach and decomposition technique is discussed in detail later). These studies analyzed the wage-determination process

for broad sections of the Canadian working population. Differences in productivity-related skills, job characteristics and other influences on wages were controlled for via multivariate regression techniques. Separate regressions were run for males and females. Four of the previous studies used 1971 Canadian Census data, while Paul W. Miller's paper used 1981 data.

Despite some discrepancies in the modelling of wage determination, geographical focus and the sample of workers chosen, these previous studies generated similar general conclusions. All five studies concluded that the male advantage in the area of average characteristics accounted for a substantial portion of the gender-wage gap. The portion of the gross wage gap induced by differences in average characteristics was estimated between 25% and 56%. Thus 44% to 75% of the gender-wage gap was left to be attributed to discrimination. All studies regressed the natural logarithm of annual earnings of Canadian-born workers on variables controlling for education, hours and weeks, marital status, occupation and industry, province and residence in a metropolitan area unless otherwise indicated. The exact definitions of these variables and model specifications differed somewhat among studies.

TABLE 1
SUMMARY OF PREVIOUS CANADIAN STUDIES MEASURING
MALE-FEMALE WAGE DIFFERENTIALS AND DISCRIMINATION

Study & Year of Publication	Year of Data	Geographic Region Analyzed	Distinguishing Characteristics	Male-Female Wage Gap	Percentage of Gap Attributed to Average Characteristics	Percentage of Gap Attributed to Discrimination
Holmes (1976)	1970	Canada	Present value of potential lifetime earnings (in absolute dollars) - dummy variable to indicate immigrants - continuous weeks variable - no hours variable	41%	25%	75%
Gunderson (1979)	1970	Canada	Full-time, full-year workers - weeks not controlled for	51%	37%	63%
Robb (1978)	1970	Ontario	Persons working more than 30 30 hours/week and 40 weeks/year - no language variables	53%	41%	59%
Shapiro & Stelcner (1981)	1970	Québec	Full-time, full year workers - language variables indicate ability to communicate in official languages & mother tongue - wages measured in absolute (not log) of dollars	\$2767 (Gross)	56%	44%
Miller (1987)	1980	Canada	Full-time, full year workers - hourly wages - number of children variable included	42%	28%	72%

On average, these studies found a percentage wage gap of about 47% while discrimination accounted for about 63% of this gap. A general characteristic of the studies is that the greater the number of regressors that were included in the specification of the regression model for wage determination, the lower was the unexplained wage gap. However, since exhaustive cross-sectional data about labour market participants is difficult to obtain, these measures of the wage gap serve only as rough estimates and vary from study to study.

Previous studies have also found an interesting tendency in the momentum of the earnings gap in recent years. Miller, using 1981 data, found a male-female wage gap of 42%, 28% of which was attributed to differences in average characteristics (Miller, 1987). A comparable earlier study (although it used a slightly differently specified wage-determination model) by Gunderson, which used 1971 data, revealed an earnings gap of 51% of which 37% could be accounted for by productivity-related characteristics. Using these observations, Miller made the following general conclusions about Canadian wages in the 1970's and early 1980's:

1. The gender-wage gap narrowed over the 1970's and early 1980's.
2. The fraction of the gap explained by differences in average characteristics declined over this period.

However, since these studies differed in their sources of data and model specification, inferences as to the movement of the wage gap and discrimination over time can only cautiously be made by comparisons among studies. Section IV of this paper will attempt to fit a *consistent* empirical model of wage determination to the Canadian labour market at three points in time spanning fifteen years, thereby allowing more meaningful comparisons to be made.

III. MEASUREMENT OF THE WAGE GAP

As mentioned earlier, an intention of this paper is to estimate human capital functions for males and females using Canadian cross-sectional employment data, as did the five preceding studies, but using the most recent available data. A new measure of the male-female earnings gap shall ensue. The following cross-section results include data from Statistics Canada's Canadian Census taken in 1986, the most current Census data available. In the next section of the paper, the 1986 findings are compared to the results from the 1971 and 1981 Censuses. What follows next is an outline of the methodology used to measure the wage differential and discrimination.

ECONOMETRIC METHODOLOGY

The econometric techniques adopted in this paper follow many of the conventions used in preceding studies. As in earlier works, an effort is made to measure the gross wage differential between males and females, and then decompose the differential into components due to differences in average characteristics and discrimination. The methodology used to achieve this goal is discussed in the next section.

The Human Capital Earnings Function:

Employing the methodology established by Mincer (1974), the following relationship between wages and observed worker characteristics could be proposed. Equations of this sort are often referred to as human capital earnings functions:

$$\ln w_i = X_i \cdot \beta + \epsilon_i$$

Where, w_i : wage
 X_i : vector of characteristics for individual i
(proxies for productivity)
 β : vector of coefficients
 ϵ_i : error term

Such a log-linear regression may be used to estimate the influence of each productivity-related worker characteristic on earnings. An advantage of using the natural logarithm of wages as the dependent variable is that the resulting parameter estimates for the influence of worker characteristics will be in percentage form.

THE WORKER CHARACTERISTIC VARIABLES

Education:

We would expect years of education to enhance a worker's productivity and thus his or her wages. Therefore, an education variable was included to approximate years of education. The continuous education variable was defined as the highest grade of elementary schooling achieved up to Grade 13, which could be augmented up to six years for each year of university or college completed. As a further indicator of education, dummy variables were defined for the highest certificate or degree obtained by the individual. These variables indicated whether the worker had no degree or certificate, a trade or university certificate or diploma, or a university degree. The reference group for degree and certificate categories was individuals who had no degree or certificate or whose highest achieved educational certification was a high school diploma.

Experience:

We would generally expect a worker's productivity and thus wages to improve over time as he or she becomes more familiar and skilled at the tasks involved in an occupation or industry, and as the worker's seniority advances, although maybe not as fast in his or her senior years. Thus it would be appropriate to include a variable indicating years of experience to isolate the effects of an employee's improving performance and seniority over time. Based on Mincer's theory (1974), an experience squared variable was included to isolate the expected decreasing rate of increase of the experience-wage profile (there would be a negative parameter estimate if experience were statistically associated with increasing earnings at a decreasing rate).

Unfortunately, the available Census data provide no exact measure of experience. Hence the study resorts to an imperfect proxy for experience based on existing data. A common proxy for labour market experience used in other studies and adopted in this study is the following linear combination of age and education:

$$\text{EXPERIENCE} = \text{AGE} - \text{YEARS OF EDUCATION} - 6$$

Such a measure aims to capture how many years the typical worker has been out of school. Implicit in such a proxy for experience is the assumption that absorption into the labour market was relatively instantaneous and that experience was fairly continuous over the worker's lifetime (or at least uniformly disrupted for all workers, male and female).

Region:

Indicator variables were included for regions. The classifications were: the Maritimes, Québec, Ontario, Alberta, Manitoba and Saskatchewan, and B.C. with the reference region being Ontario. In the previous studies, all three Prairie provinces were normally included in one category. However, this study includes Alberta as a separate region in light of its larger per capita income relative to Manitoba and Saskatchewan.²

Language Variables:

Language variables were included in the vector of characteristics in the hope of isolating the impact of language on earnings due to both productivity-related effects and any systematic discrimination effects. Language indicator variables showed whether a worker spoke English only (the reference group), French only, or was bilingual with French as the native tongue or bilingual with English as the native tongue or bilingual with another language as the native tongue.³ The number of Canadian-born persons who reported speaking neither language was negligible and thus they were not considered in this study.⁴

Occupation & Industry:

Some of the regressions included work type variables to observe the influence of working in different occupations and industries on earnings. The reference group for the occupation categories was clerical workers while the reference industry was government.

Some of the theories of discrimination presented in Section I suggest that the concentration of women in low-paying or "crowded" industries and occupations is a factor contributing to the wage gap between men and women. According to a Statistics Canada's Women and the Labour Force (1990), most women are concentrated in a few low-wage occupations with weak prospects for advancement. 58.1% of working women are concentrated in clerical, sales and service jobs, an increase from the 1970 level of 55%. The study also observes that, in 1989, the average wage of women in the service industry was \$13 418 compared to \$24 151 for men in the same industry. Some of the discriminatory forces that lead women to accept positions in low-paying industries and occupations may operate before women enter the labour market, for instance peer pressure or females' underestimation of their labour market capabilities.

We may want to examine the effects of removing the occupation and industry variables from the vector of worker characteristics since, by some theories, the segregation of women into low-paying occupations and industries, even though they may be as qualified as males in higher-paying industries in terms of skills such as education and experience, is itself a form of discrimination. By excluding occupation and industry variables, the resulting measure of discrimination should provide more accurate inferences as to the influence of occupational segregation on the earnings of females. For this reason, regressions models are tested with and without occupation and industry variables to get measures of different conceptions of discrimination. We might expect to find a higher level of discrimination when testing the models without occupation and industry variables since additional discriminatory effects should be encompassed in such measures.

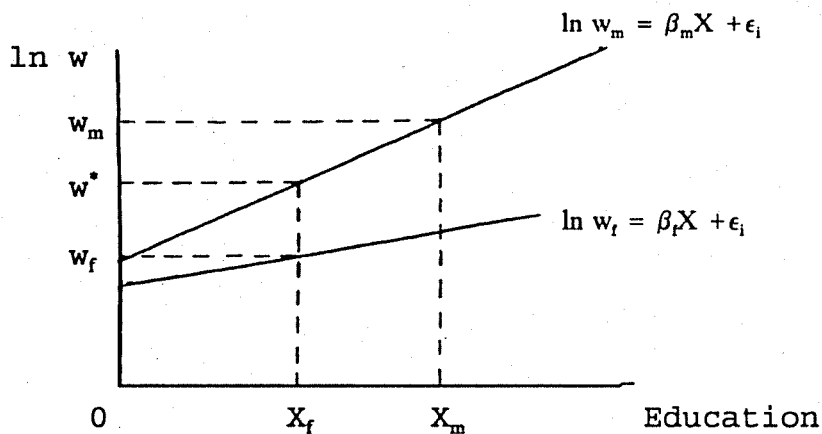
Other Dummy Variables:

Other variables considered to be influential in determining earnings were included in the vector of worker characteristics. The following marital status indicator variables were included: 1) divorced or separated, 2) widowed, 3) never married (single), and 4) married (the reference group). Indicator variables were also included to control for the effects of hours and weeks worked on earnings (the 1985 cross section results used continuous variables to control for number and weeks worked, and later dummy variables were used so that the results could be compared with the previous Censuses). The reference group for hours was persons working 40 to 44 hours per week while the reference group for weeks was persons working 49 to 52 weeks per year. In the 1985 cross section results only, an indicator variable was included to isolate the effects on earnings of living in one of the nine largest census metropolitan areas (CMA status).

THE HYPOTHESIS OF UNEQUAL RETURNS TO WORK-RELATED CHARACTERISTICS

In some of the theories of discrimination reviewed in Section I, it was proposed that males are more highly compensated than females for work-related characteristics. As an example, suppose that males in fact receive a higher return to education than females. We could test this hypothesis by estimating two separate regression equations that show the differential returns to education for males and females. If males truly received higher returns to education, then we should find a male regression equation that has a greater slope than the female regression equation.

Figure 1



If such differential returns to education exist, then the female with the average level of education, were she paid according to the male regression, would receive some higher wage, call it $\ln w^*$. Then, the difference between $\ln w^*$ and $\ln w_f$ would provide a measure of discrimination found in returns to education. Notice ($w_m - w^*$) is due to differences in endowments of work-related characteristics. Such conceptions of discrimination are implicit in the econometric methodology next described.

DECOMPOSING THE WAGE DIFFERENTIAL BETWEEN GENDERS:

Recall that some of the theories of discrimination propose that work-related characteristics have differential impacts on earnings for males and females. If males and females were in fact unequally compensated for productivity-related characteristics, then the vector of coefficients, β , would differ between the genders. Following the methodology of Oaxaca (1973) and Blinder (1973), we can decompose the gender-wage gap by first grouping observations of male and female labour market participants into separate data sets. Then two separate regressions could be run with separate vectors of coefficients computed for males and females, call them β_m and β_f .

$$\begin{aligned} \text{Males: } \ln w_{mi} &= X_{mi}\beta_m + \epsilon_{mi} \\ \text{Females: } \ln w_{fi} &= X_{fi}\beta_f + \epsilon_{fi} \end{aligned}$$

Assessments of the differential compensation to work-related characteristics between genders could be made by comparing the values of the coefficients found for the variables when the regressions were run separately for males and females.

The semi-logarithmic wage differential between the two groups can be expressed as follows:

$$\ln \text{ wage differential} = \ln w_m - \ln w_f$$

We could take the mean of these two equations. Since the expected value of the error terms, ϵ_{mi} and ϵ_{fi} , are assumed to be zero, they drop out when their means are considered.

$$\begin{aligned} \overline{\ln w_m} &= \overline{X_m}\beta_m \\ \overline{\ln w_f} &= \overline{X_f}\beta_f \end{aligned}$$

By substituting the values of $\ln w_m$ and $\ln w_f$ into the expression for the logarithmic wage differential, we get:

$$\overline{\ln w_m} - \overline{\ln w_f} = \overline{X_m}\beta_m - \overline{X_f}\beta_f$$

We can add the following term, which sums to zero, to the right side of the equation without altering this equality.

$$\overline{\ln w_m} - \overline{\ln w_f} = \overline{X_m}\beta_m - \overline{X_f}\beta_f + (\overline{X_f}\beta_m - \overline{X_f}\beta_m)$$

Rearranging, we get:

$$\overline{\ln w_m} - \overline{\ln w_f} = \overline{X_f}(\beta_m - \beta_f) + (\overline{X_m} - \overline{X_f})\beta_m$$

The left hand side of this equation provides an approximate measure of the percentage wage differential between males and females. The second term on the right hand side of this equation approximates the

component of the percentage wage differential attributable to differences in average characteristics between the genders. The first term on the right hand side yields the share of the wage gap due to differences in the estimated coefficients of the β_m and β_f vectors. This first term may be interpreted as the percentage of the wage differential due to discrimination, in the sense that this component of the earnings differential is unrelated to productivity differences. Thus we have derived a convenient, econometrically testable expression that separates the effects of differences in average characteristics and unequal returns to productivity-generating characteristics on the earnings of males and females.

Notice this equation employs the definition of wage discrimination as the occurrence of male-female wage differentials that exceed productivity differentials in given occupations. Such an equation implicitly assumes that male and female labour are perfect substitutes. It also assumes women have the same preferences for employment as men. Although this is the most commonly-used definition of labour market discrimination, there are other competing definitions.

AN ALTERNATE APPROACH:

It could also be argued that males and females are rewarded more or less equally for their productivity-related characteristics, but women receive lower wages because of discriminatory influences or less advantageous labour market conditions in the female labour market. As a distinct and somewhat simpler alternative to the decomposition method of measuring discrimination, we could run a regression using observations of both men and women interacted with a dummy variable to indicate female workers.

$$\ln w_i = X_i \cdot \beta + d \cdot FEMALE_i + \epsilon_i$$

Where, w_i : wage

X_i : vector of characteristics for individual i
(proxies for productivity)

β_i : vector of coefficients

$FEMALE_i$: a dummy variable, equal to 1 for females, 0 for males

ϵ_i : error term

The estimated parameter on the dummy variable for females should yield a crude measure of the difference in earnings we would expect between men and women with comparable average characteristics. Implicit in such a measure of discrimination is the assumption that men and women are rewarded equally for productivity-generating characteristics (i.e. $\beta_m = \beta_f$) but that women's salaries are reduced by some discriminatory premium relative to equally qualified males.

THE SAMPLING PROCEDURE

This study uses data obtained from the Statistics Canada's Census of Canada: Public Use Microdata File on Individuals accessed via machine-readable magnetic tape. The tapes contain responses given by 500 000 individuals (about 2% of the Canadian population or a 1/50 sample) to questions relating to personal demographic, social and economic characteristics. The 1971 tape contained fewer observations corresponding roughly to a 1% sample of the population. About 10% of the observations (20% in 1971) were chosen randomly for inclusion in the sample sets. Data sets of this size should be sufficiently large so as to make meaningful inferences as to the process of wage determination in the Canadian labour market. Of the observations chosen, only those that satisfied the well-defined requirements of the sample sets were kept. As a result of these procedures, the data sets used in the subsequent analysis mimic a 1 in 500 random sample from the Canadian population for each given Census.

The first step in choosing the sample was to define the population from which observations were drawn. In order to minimize mismeasurements of gender discrimination, some categories of workers were excluded from the sample sets. Individuals reporting no wage income, the foreign-born, the self-employed, and those not between the ages of 15 and 64 were excluded from the samples.

Individuals who reported zero wages or zero weeks worked in the year preceding the census were not considered for sample inclusion. This study explores the discriminatory payment of workers who are already participants in the labour force, although this has been known to underestimate discrimination somewhat (the possible effects of using a biased sample selection rule are discussed in Section VI). Age restrictions were placed on the various data sets. Only workers between the ages of 15 to 65 that met the previous requirements were included in the sample. The lower bound of the age limit was chosen to be 15 since noteworthy labour force participation rarely occurs before this age. Elderly persons working beyond age 65, the traditional retirement age, were excluded since employment contracts are often renegotiated after workers reach this age on different terms in light of elderly workers changed labour market abilities.

In an effort to prevent discrimination based on country of origin from entering the measurement of male-female discrimination, all foreign-born persons were excluded from the sample. Previous studies have detected the presence of discriminatory pay practices in employers' payment of immigrants in the Canadian labour market (for instance Borjas, 1985 or Bloom and Gunderson, 1989).

Individuals who claimed that some portion of their income was earned (or lost) through self-employment were excluded from the sample sets since the process underlying the determination of their wages is likely to differ than for workers whose income is derived entirely from wage earnings. We would suspect that individuals would be unlikely to practice discriminatory behaviour if given the opportunity to compensate themselves, although they may experience other forms of discrimination, (for instance, discriminatory behaviour on the part of their customers). We generally would not expect self-employed persons to base compensation of themselves

on criteria very closely related to their own productivity-related employment traits. Furthermore, an individual that derives some of his or her income from self-employment may have somewhat distorted performance at his or her wage-paying job. It is hoped that the remaining wage-earning workers are paid in a fashion more closely based on productivity-related criteria, at least net of the influence of gender discrimination.

THE EMPIRICAL FINDINGS FOR 1985

What follows is a general interpretation of the results obtained by fitting the described human capital functions, separately for males and females, to the 1985 cross sectional data using ordinary least squares regression techniques. The parameter estimates resulting from the regressions are presented in Table 1a of the appendix. The wage gap is decomposed using the $\beta_m(\bar{X}_m - \bar{X}_f)$ definition of the amount of the gap attributable to differences in endowments and the $\bar{X}_f(\beta_m - \beta_f)$ definition of the amount attributable to discrimination. Table 2 shows the contribution of each set of variables in the vector of characteristics to male-female earnings gap worker. A positive entry signifies a male advantage in the given productivity-enhancing characteristic (which would act to contribute to the wage differential) while a negative coefficient indicates a female advantage (which would act to decrease the wage differential).

TABLE 2
CONTRIBUTION OF CHARACTERISTICS TO WAGE GAP

Characteristic	<u>WITH OCCUPATION AND INDUSTRY VARIABLES</u>		
	Attributable to Endowments: $\beta_m(\bar{X}_m - \bar{X}_f)$	Attributable to Discrimination: $\bar{X}_f(\beta_m - \beta_f)$	Percentage Due to Endowments & Discrimination: $\beta_m\bar{X}_m - \beta_f\bar{X}_f$
Constant	0	.22222	.22222
Education	-.01107	.17192	.16085
Experience	.03868	.18144	.22012
Marital Status	.01105	-.09133	-.08028
CMA Status	-.00168	.02499	.02331
Language	.00069	-.00607	-.00538
Province	.00016	-.01592	-.01576
Occupation	.01457	.08157	.09614
Industry	.09792	.00450	.10242
Hours	.13669	-.02834	.10835
Weeks	.18160	-.22916	-.04757
Total	.46858	.31591	.78449
% of Gap	59.73%	40.27%	100%
Discrimination Measured by Female Dummy		31.41%	

Characteristic	<u>WITHOUT OCCUPATION AND INDUSTRY VARIABLES</u>		
	Attributable to Endowments: $\beta_m(\bar{X}_m - \bar{X}_f)$	Attributable to Discrimination: $\bar{X}_f(\beta_m - \beta_f)$	Percentage Due to Endowments & Discrimination: $\beta_m\bar{X}_m - \beta_f\bar{X}_f$
Constant	0	.65408	.65408
Education	-.01150	-.04842	-.05992
Experience	.04173	.15613	.19786
Marital Status	.01242	-.09586	-.08344
CMA Status	-.00140	.04956	.04816
Language	.00077	-.01147	-.01124
Province	.00023	-.02412	-.02389
Hours	.14924	-.03484	.11440
Weeks	.18545	-.23776	-.05231
Total	.37693	.40728	.78420
% Of Gap	48.07%	51.93%	100%
Discrimination Measured by Female Dummy		36.94%	

Average Characteristics:

The analysis finds that a sizable portion of the average gender-wage gap (48% to 60%) can be attributed to the male endowment advantage in average wage-determining skills. In general, the 1986 Census data reveals that males have greater experience and a more favourable occupational and industrial distribution. So the basic result found in numerous previous studies is once again affirmed; a sizable portion of the wage gap is attributed to males' advantage over females in average endowments of wage-related characteristics. The mean endowments of many characteristics that enhance earnings, such as experience, or possession of a university degree, is found to be greater for males than females.

Unexplained Discrimination:

The discriminatory component of the wage gap attributable to the constant term of the regressions is substantial. This component of the gap is interpreted as "unexplained discrimination" in that it does not vary with the skills and characteristics included in the vector of worker characteristics. However, the measurement of unexplained discrimination is highly contingent on the choice of reference groups for the dummy variable categories since the combined influence on earnings of all reference group characteristics are encompassed in this single term. The large contribution of the constant to the discriminatory portion of the wage gap seems to indicate that discriminatory payment of female employees largely takes the form of lower base wages (unrelated to skills) more so than through low returns to women's productivity-related characteristics.

Occupational Distribution:

The concentration of men and women in different industries and occupations is found to be a significant factor in explaining earnings differences between them. Females are found to be less dominant in occupations and industries that are high-paying, such as management or science. Instead, they appear concentrated in occupations such as services or primary occupations, where wages appear to be relatively lower. Removing occupation and industry variables from the regressions to include the effects of the separation of equally skilled males and females into different industries yielded estimates of discrimination that were, on average, 9% higher. Thus there is evidence that differences in the occupational and industrial distribution between the genders acts to reduce the earnings of women relative to men.

Comparisons of the contribution of the constant terms found in the regressions with and without occupation and industry variables seems to further indicate that the influence of occupational segregation favours males. This is evident from the increase in the contribution of the constant term to the discriminatory wage gap when occupation and industry variables were omitted from the regressions. In fact, with these variables omitted, the contribution of unexplained discrimination to the wage gap seems greater than the net contribution of all discriminatory influences.⁵ The net contribution of differences between genders in the returns to all productivity-related characteristics other than unexplained discrimination seemed to be in favour of women. In particular, returns to education seemed to dramatically favour of women. But the combined effects of more favourable returns to women's productivity-related characteristics only partially outweighed the impact of the increase in

unexplained discrimination. We can conclude that for males and females with identical human capital endowments, the males would be expected to earn a sizable wage premium relative to the females. Furthermore, the higher average wages received by men than identically qualified women seems to take place largely due to the segregation of the men into higher-paying occupations and industries.

Marital Status:

The parameter estimates presented in Table 1a of the appendix indicate that for a male, being married is associated with 30.6% higher earnings than being single. But the substantial increase in earnings associated with being married is not found for females; being single is associated with only a 5.7% decrease in earnings. Since the reference group for the marital status indicator variables was married individuals, the male advantage in returns to being married is largely reflected by the constant term. From Table 2, we see that differences between the genders in average marital status characteristics (other than married) are also found to have a more favourable impact on the earnings of males. That is, the contribution of average marital status characteristics to the wage gap is positive. However, due to differences in the distributions of men and women among the marital status categories, the amount of the gender-wage gap attributable to returns to the marital status dummies included in the vector of worker characteristics is found to be negative. In other words, differences in the returns and distribution among marital status categories (other than being married) seem to have a more favourable impact on the earnings of women, although this advantage is overshadowed by the male advantage in the average endowment and returns associated with being married.

Perhaps the earnings advantage of males stemming from marital status is attributable to the greater family responsibilities of females which may interfere with their labour market performance. In a similar vein, labour market experience is found to be more highly rewarded among male workers than female workers. As postulated by the theory in Section I, married women may have higher absenteeism and turnover rates than men, since females are observed to spend a disproportionate amount of time on household tasks, especially those associated with the bearing and raising of children. Employers may use marital status as an indicator of stability and reliability of an employee working in opposite directions for both males and females (Polachek, 1975).

Female Advantages:

Although the overall endowment advantage is in favour of males, it is noteworthy that females have some average endowment advantages. For instance, females have a slightly higher mean level of years of education than males (12.08 years for females versus 11.87 for males) and receive notably higher returns to university education. The observed female advantage weakens the arguments that discrimination is fostered through the educational system (including access to education) or returns to education. Women also have a substantial earnings advantage in occupations in the fields of health and sciences. However, only in a select few characteristics do females appear to be more highly rewarded (i.e. have a higher coefficient than males). None of the coefficients on the work-related characteristics variables reveals females to have a significant earnings advantage over males.

Summary of the 1985 Cross Section Findings

In conclusion, the discrepancy between male and female earnings can be largely attributed to differences in endowments of productivity-related characteristics such as differences in experience or weeks and hours worked. However, a portion of the gap in earnings, estimated between 31% to 52%, can be ascribed to discriminatory returns to women for productivity-enhancing employment traits.

IV. DYNAMICS OF THE DIFFERENTIAL AND DISCRIMINATION

This section will attempt to generate consistent measures of the gender-wage gap and its composition for 1970, 1980 and 1985. The model has to be somewhat modified since the census data is not identical for these three years. Dummy variables were used to control for weeks and hours worked and the variable controlling for CMA status had to be discarded since it was not included in the 1971 Census data.⁶ Again, a second model is tested by pooling males and females for a given year and including a dummy variable to indicate females, for which the estimated parameter should provide a broad measure of discrimination assuming males and females are rewarded equally for productivity-related characteristics. The parameter estimates from the regressions are presented in Table 2a of the appendix while the decomposition of the gap is presented in Table 3.

TABLE 3
DECOMPOSITION OF THE GENDER-WAGE GAP: 1970, 1980 AND 1985

	1970	1980	1985
Measured Wage Gap	55.9%	48.2%	54.4%
Percentage Attributed to Endowments	37.1%	45.1%	49.6%
Percentage Attributed to Discrimination	62.9%	54.9%	50.4%
Discrimination Measured Using Dummy for Females	45.5%	39.8%	41.2%

From the table, we see that the wage gap appears to have narrowed over the 1970's from 55.9% in 1970 to 48.2% in 1980. This finding is in accordance with Miller's observation that the wage gap dissipated over the 1970's. However, the more striking finding is that the gap appears to have *risen* to 54.4% in the first five years of the 1980's almost reattaining its 1970 level. The gains in earnings of females relative to males experienced over the 1970's appeared to be predominantly lost over the early 1980's. It might be noted that the early 1980's were a period of economic recession in Canada. The average increase in real personal disposable income per

capita averaged 4.6% per year over the 1970's but then dropped to an average of 1.6% per year for the first five years of the 1980's (Department of Finance, 1991). Perhaps women experienced a disproportionately high share of the observed deceleration in the growth rate of personal income over the early 1980's.

Discrimination, as measured by the unexplained residual in the regressions, seems to have followed a more steadily decreasing path over this period falling from 63% of the earnings gap in 1970 to 50% in 1985. Measuring discrimination by interacting an indicator variable for females in the regression yields a 5% decrease in the fraction of the gap explained by discrimination from 1970 to 1980 and a marginal increase in measured discrimination from 1980 to 1985.

The fraction of the wage gap attributable to differences in average characteristics appears to have steadily increased over this fifteen-year period from 37.1% in 1970 to 45.1% in 1980 and 49.6% in 1986. This finding is at odds with Miller's conclusion that the portion of the wage explained by differences in average characteristics has decreased over the 1970's. Miller arrived at this conclusion after comparing his results from the 1981 Census to Gunderson's findings from the 1971 Census. However, Miller and Gunderson used differently specified models of wage-determination.⁷ In addition, their choice of Census tapes differed; Gunderson used the Individual File of the Public Use Sample Tapes while Miller used the Household/Family File of the Public Use Census Tapes. This study finds that comparisons of like models of wage-determination shows the portion of the wage-gap attributable to differences in average characteristics has increased over the 1970's and continued to increase in the first half of the 1980's.

V. Generation Effects

Building on the finding in the previous section that the measured gender-wage gap appears to have generally followed a decreasing trend over the period from 1970 to 1985, it would be interesting to determine the extent to which discrimination differs among the different generations of Canadian working women. To some degree, the reduction in discrimination over time, may be indicative of a changing socioeconomic environment surrounding the labour force and society at large. Changing attitudes toward women's participation in the economy may be partially responsible for the reduction in discrimination's impact on the earnings of women. Moreover, if the socioeconomic environment has acted to reduce gender-wage discrimination facing women over time, there may be some reason to expect discrimination to be lowest among the more recent female entrants in the labour market as a result of higher reservation wages of younger workers or as a consequence of imperfect labour mobility. This section attempts to estimate and interpret differences in discrimination across generations of working women.⁸

Perhaps employers were able to pay lower wages to females in earlier time periods, since the socioeconomic climate was more conducive to gender-wage discrimination, as compared to more recent times in which women demand wages that are less discriminatory. Older generations of women were raised in time periods when female labour force participation was low and their position in the labour market relatively weak compared to men's. The generally subdued position of females in the labour market prevailing in earlier times may have resulted in earlier generations of women developing low reservation wages, which allowed employers to pay them strongly discriminatory wages. Perhaps, even in the present, employers are still able to pay older women who were raised in this more discriminatory social environment, wages that are lower than those they must pay newer generations of working women, all other things equal. In more recent times, the labour market position of women has been strengthened. In 1986, 55.4% of women were employed or looking for work, compared to 39.9% in 1971 or 24.1% in 1951 (Statistics Canada, 1988). Furthermore, there is some evidence that younger female labour force participants are more highly skilled than the previous generations.⁹ For instance, the percentage of women attaining managerial positions was found to double from 15.4% in 1970 to 31.5% in 1985 (Statistics Canada, 1990). In addition, younger women may be more dedicated to pursuing continuous labour market experience than were previous generations of female workers. Thus females who entered the labour market in more recent years, when women's position in the labour market was relatively stronger than in the past, may be less willing to accept wages below the level their productivity would command. For this reason, we might expect older female workers to receive wages that are more discriminatory than younger females who are demanding wages comparable to equally qualified males.

Recall that the segregation of men and women into separate occupations and industries was found to account for part of the difference in earnings between males and females. In the past, the socioeconomic environment may have worked to restrict women's access to high-paying occupations and industries, more so than in the present. As a result, more older women may have accepted jobs in low-paying occupations and industries than the more recent generations of working women. Although it may have been possible for older women to transfer to higher-paying positions as employment opportunities became less restrictive, labour market mobility is a somewhat impeded process. Mobility among jobs is not completely costless. An individual's career choice is often a decision that can only be reversed at some expense. After spending numerous years at a given job, a career change may be associated with a lower starting salary and may entail considerable psychic costs, especially for older workers. Consequently, many older women may continue working in low-paying occupations and industries they entered in earlier times. In addition, employers in traditionally male-dominated professions may generally choose to rectify their prejudicial hiring and payment practices by hiring a greater number of younger more adaptive female workers rather than recruiting older workers from low-paying industries. For these reasons, we may expect discrimination to be greater for older generations of working women than for the younger generations.

The Model to Measure Generation Effects

In the proposed framework to study generation effects, a standard human capital function is interacted with a dummy variable that indicates female workers. Male observations from a given census are pooled with observations of a *single generation* of females from the same census. Generations were defined by the decade in which women were born: from 1910 to 1919, the 1920's, the 1930's, the 1940's, the 1950's and the 1960's. The estimated parameter for the generation dummies obtained in the regressions should approximate discrimination directed toward the given generation of women in the corresponding census year.

$$\ln w_i = X_i \cdot \beta + FEMALE_i + \epsilon_i$$

where $FEMALE_i$ indicates women of a single generation

If, as proposed, discrimination is strongest among older women, we would expect to find coefficients for the generation dummies that are more negative for older cohorts of working women. Said differently, the coefficients of the cohort dummies would be less negative for more recent generations of women. Again, regressions are run with and without occupation and industry dummy variables. The indicator variables found for the different generations of women are presented in Table 4.

TABLE 4

**PARAMETER ESTIMATES OF GENERATION INDICATOR VARIABLES FROM
REGRESSIONS USING POOLED MALE AND FEMALE DATA**

GENERATION	With Occupation and Industry Variables			Without Occupation and Industry Variables		
	1970	1980	1985	1970	1980	1985
Born 1910-1919	-.52596140	-	-	-.59026088	-	-
Born 1920-1929	-.66223614	-.48610654	-.49586814	-.72659498	-.55684378	-.60557306
Born 1930-1939	-.59026333	-.57892466	-.58452427	-.64052090	-.63783261	-.67736374
Born 1940-1949	-.26142633	-.47159107	-.55409942	-.28473065	-.51757530	-.63073690
Born 1950-1959	-	-.25999560	-.35124258	-	-.28357812	-.40261215
Born 1960-1969	-	-	-.25318308	-	-	-.30529293
All Women	-.45462232	-.39774486	-.41252766	-.46887081	-.41750904	-.46949326

Note: All estimated parameters were significant at the .001-level.

RESULTS:

Focusing on women born since the 1930's, the results seem to weakly support the hypothesis that discrimination is strongest for women born further back in time. However, there seems to be no well-defined strictly increasing relationship between discrimination in the present and the number of years since a woman's birth. There is much variation in the earnings of the different generations of women over time, particularly those born in the 1920's and the 1940's. On the other hand, discrimination directed toward women born in the 1930's seems very statistically well-defined over time. Generalizations regarding the earnings of women of different generations must be made cautiously.

Labour market discrimination is generally found to be smallest among the newest participants in the labour force. Notice in comparing discrimination among different generations of women that those born in the 1950's and 1960's always have estimated discrimination coefficients that show less than the average discrimination for all women, while women born from 1910 to 1919, in the 1920's, in the 1930's and in the 1940's always have coefficients that show stronger than average discrimination (with one exception).

As in the previous section, measuring discrimination by an indicator variable showed a general decrease in discrimination from 1970 to 1980, but discrimination seemed to increase over the subsequent five years. The increases in discrimination were especially pronounced for the generations of women born in the 1940's and 1950's. Women born in the 1940's appear to have experienced a sizable increase in labour market discrimination in each successive census.

A shortcoming of this study's analysis of generation effects is the inability of the experience variable to isolate the extent to which labour market experience is disrupted; it is implicitly assumed that males and females who are the same age and have the same level of education have identical experience profiles. However, we would generally expect older working women to have spent more time out of the labour force than their male counterparts due to differential family responsibilities between the genders, particularly with regard to the bearing and rearing of children, or in the aftermath of divorce and separation situation. Since periods of withdrawal from the labour force are associated with a more rapid depreciation of human capital skills than continuous labour force participation, the lower observed earnings of older generations of females relative to younger generations, all other things equal, may partially reflect the (non-discriminatory) decrease in earnings associated with returning to the labour market after an extended absence. If experience were truly mismeasured, and perhaps the more strongly negative estimated discrimination coefficients for older workers provide some indication of an experience mismeasurement, then the method of approximating experience employed in this study would result in an overestimation of discrimination for older generations of female workers. Moreover, this result generalizes to the measures of discrimination made in the previous sections of this study and in the previous studies reviewed. The overestimation of wage discrimination directed toward older women would lead to an inflated estimate of the discriminatory wage gap between all women and men due to the measurement error in approximating experience.

VI. ACKNOWLEDGED SHORTCOMINGS OF THE MODELS USED IN THE ANALYSIS

Sample Selection Bias:

One of the most striking observations found when creating data sets for this study was that the sample sizes were usually smaller for women than for men. Fewer females than males were included in the samples used in this study largely because a higher percentage of women were deleted from the 1/500 sample of the population since they reported zero wages. But what of the females who were excluded from the analysis since their reported earnings were zero? Perhaps some of these women would be willing to work at non-discriminatory wages but chose not to participate in the labour force in the absence of such a wage offer.

In light of the findings of Gronau (1974), it must be acknowledged that a bias may be introduced by exclusively examining wages of employed persons. According to Gronau, male-female wage discrimination should be defined as the existence of "different wage offer distributions of males and females exceeding productivity differences". Gronau reasons that we should try to measure empirically the *wage-offer* differential. Using Gronau's definition of discrimination, it is unavoidable that econometric techniques based only on *observed* male-female wage data, such as the previous analysis, will understate the wage-offer differential. Others have attempted to correct for this bias by adopting the method of distinguishing between observed-wage and wage-offer functions developed by Heckman (1979) and further refined by Reimers (1983) via the probit model.

In Miller's 1987 paper, a probit model was estimated to determine the probability of an individual being included in the sample. The variables included in the probit analysis were province, size of place, marital status, number and age structure of children, years married, education, possession of a trade certificate or university degree, age and age squared, language, French-ethnic origin, family income and spouse's education. Miller found the differential in wage offers to be 48%, markedly higher than the 30% gap he found for observed wages. 35% to 40% of the wage-offer gap was accounted for by the variables chosen, a considerably lower proportion than was explained of the observed-wage gap. Alternatively stated, the unexplained residual, which was Miller's proxy for discrimination, was significantly larger when offered wages were used rather than observed wages.

However, Miller acknowledges that his measures of the gap in offered wages were highly sensitive to the choice of variables included in the probit model for estimating the probability for sample inclusion. Since estimates of the gap in offered wages found via the probit model are so strongly contingent on the choice of variables used in the probit model specification, the resilience of the resulting selectivity corrected estimates of discrimination found via the probit technique is somewhat suspect (Hirsch and Addison, 1986).

Other Sample Selection Biases:

This study used 1986 Census data focusing only on observations for native-born wage and salary earners aged 15 to 64 who derive no income from self-employment. It must be acknowledged that such precautions may introduce a bias. We no longer have a simple random sample; not just any Canadian worker can potentially enter the sample. The exclusion of some categories of workers was carried out in order to create a relatively homogeneous sample of workers in which the confounding influences of forms of discrimination other than gender-wage discrimination would not distort the measures of gender-wage discrimination. The benefits gained by being better able to isolate gender-wage discrimination was felt to outweigh the sacrifices associated with employing a non-random sample of the working population.

Omitted Variable Bias:

One shortcoming of the previous econometric models is the implicit assumption that the X_i vector adequately and exhaustively measures each worker's productivity. Mismeasurements would result if the X_i vector does not supply an exhaustive account of all variables that influence worker productivity. Unfortunately, some characteristics that were found to influence earnings in other studies were not included in the vector of worker characteristics since they were unavailable using only the Census data. One such excluded variable, discussed below, was the presence of children.

Children:

Solomon Polachek (1975) determined that the number and age structure of children and the number of years married were significant determinants of earnings for both males and females, but would be of opposite sign for each gender. We may expect females to have higher absenteeism and turnover than males since females more often have greater household responsibilities, including caring for children (Boulet and Lavallée, 1984). Unfortunately, the Census tapes contained data indicating the presence of children for females only, so comparable regressions using a presence of children variable could not be run.¹⁰

Miller's 1987 study, which used the Household/Family File of the Public Use Samples containing information on the number and age of children, determined that for females, having a child was associated with a decrease in earnings while for males, having a child was associated with an increase in earnings. Miller estimated that differences in the average number of children and unequal rewards to parenthood were able to account for 35% to 44% of the gap in observed wages between men and women. These results seemed to indicate that parenthood is associated with a decrease in labour market productivity for women, likely attributable to greater family responsibilities, and an enhancement in the labour market performance for males.

Differential Productivity-Enhancement of Skills:

Gunderson (1979) points out that the practise of labelling all differences in earnings that are not due to differences in characteristics as discrimination ignores the possibility that women's human capital skills may be associated with lower productivity enhancement than males' characteristics. Recall that the following approximation for experience was used:

$$\text{YEARS OF LABOUR MARKET EXPERIENCE} = \text{AGE} - \text{YEARS OF EDUCATION} - 6$$

As discussed in the section on generation effects, this may provide an adequate proxy for the work experience of males, but likely overstates the work experience of females. Females' experience may be less productivity-improving than males' experience. Similarly, the education women attain may, in general, be less labour-market oriented. However, Gunderson acknowledges that differences in the extent to which male and female characteristics are oriented toward the labour market would likely explain only a small fraction of the gap.

Feedback Effects:

In addition, the previous techniques disregard the root causes of differences in characteristics. For instance, gender discrimination that may occur in the acquisition of educational skills (sometimes called feedback effects) are ignored. Such discrimination stemming from differences in opportunities would seem like a difference due to different average characteristics rather than discrimination in the analysis.

Differential Preferences:

The previous techniques may also mismeasure discrimination in that the unexplained difference in earnings may partially reflect voluntary choices of different occupations among males and females. For whatever reason, females may prefer some occupations even though they are financially less rewarding. Similarly, even though women may be qualified to work in certain occupations and industries, and may be better paid to do so, they may voluntarily abstain from such employment due to their employment preferences. Voluntary occupational choices due to different preferences of men and women would show up as discrimination in the study.

Anti-Competitive Implications:

The persistence of wage differentials that exceed productivity differentials would be incompatible with profit-maximizing behaviour of employers. It seems somewhat suspect that employers in competitive markets could maintain such sizeable discrimination components in the wage determination process of their female employees. In other aspects of profit-maximizing behaviour, employers have proven remarkably adaptive to competitive pressures with the passage of time. Perhaps the large measured male-female wage differential merely indicates that this sort of methodology leads to overstatements of the amount of sex discrimination practised by employers since significant discrimination would be unsustainable in competitive markets over time.

SUMMARY

Empirical testing of 1986 Canadian Census data revealed that the average earnings gap between male and female workers was 54%. Male-female differences in productivity-related characteristics were able to account for three-fifths of the difference in observed wages. Of these productivity-related characteristics, the most important factors were weeks and hours, occupation and experience.

By applying consistent measures of discrimination to the 1971, 1981 and 1986 Censuses, we find that the male-female earnings differential decreased considerably over the decade of the 1970's, falling from 56% to 48%. But most of the women's gains in earnings relative to males that took place over the 1970's appeared to have been lost in the recessionary years of the early 1980's. A more promising trend was found with regards to measured discrimination. Using the decomposition technique, the component of the gender gap that could be explained by productivity-related factors was observed to increase steadily over this fifteen-year period from 37% to 50%. So over the 1970's and the first half of the 1980's, Census data reveal a decrease in the size of the unexplained wage gap, which is the study's proxy for discrimination.

Further interesting results were found as to the future direction of the gap. There is some evidence that employers are less able to discriminate against newer generations of Canadian female workers.

Appendix

TABLE 1A
PARAMETER ESTIMATES FROM REGRESSIONS FOR MALES AND FEMALES, 1986

Variable	Males		Females		Without Occupation & Industry Variables	
	Mean	β_m	Mean	β_f	β_m	β_f
<u>Dependent Variable:</u>						
Ln Wages	9.7360		8.9518			
Constant:	1.0000	6.6612	1.0000	6.4390	6.5268	5.8727
<u>Education & Experience:</u>						
(No Degree/Certificate)						
Education (years)	11.8742	.0587	12.0818	.0436	.0617	.0639
University Degree	.1283	.1125	.1048	.2401	.1440	.2869
Trade Certificate	.2703	.0857	.2884	.0758	.1151	.1389
Experience	17.1976	.0588	15.5201	.0412	.0639	.0497
Experience Squared	461.9591	-.0009	398.2577	-.0007	-.0010	-.0009
<u>Marital Status:</u>						
(Married)						
Single	.2973	-.3058	.3058	-.0574	-.3431	-.0786
Divorced/Separated	.0484	-.0891	.0781	.0170*	-.1048	-.0108*
Widowed	.0004	-.3691	.0200	-.0080*	-.3976	-.0159*
<u>Language:</u>						
(English Only)						
French Only	.1361	.0390*	.1420	.0509*	.0299*	.0562*
Bilingual -						
English Native Lang.	.0518	-.0257*	.0662	-.0423*	-.0378*	-.0372*
French Native Lang.	.1448	.0260*	.1256	.0512*	.0180*	.0610*
Other Native Lang.	.0188	-.0448*	.0199	.0726*	-.0523*	.0630*
<u>Region:</u>						
(Ontario)						
Maritimes	.0930	-.0414*	.0922	.0348*	-.0555**	.0529*
Québec	.2747	.0258*	.2631	.0347*	.0233*	.0549*
Manitoba/Sask.	.0762	-.0350	.0825	.0105*	-.0473**	-.0009*
Alberta	.0968	.0939	.1009	.0996	.0811	.0770
B.C.	.1022	.0716	.1015	.0935	.0474*	.0712
<u>Metropolitan Residence:</u>						
(CMA region)						
Non-CMA	.5218	-.0944	.5039	-.1440	-.0787	-.1770
<u>Occupation:</u>						
(Clerical)						
Manager	.1402	.2481	.0758	.2411		
Science	.0514	.2660	.0139	.3846		
Social Science	.0128	.0789*	.0277	.0417*		
Teaching	.0316	.3351	.0651	.1696		
Health	.0122	.2372	.0908	.2750		
Art & Literature	.0154	.0105*	.0139	-.0893*		
Sales	.0955	.0408*	.0987	-.1548		
Service	.0965	-.0195*	.1594	-.2865		
Primary	.0673	.0020*	.0249	-.1387**		
Processing	.1870	.1278	.0517	.0234*		
Construction	.0772	-.0865	.0166	-.1278**		
Transportation	.1169	.0428*	.0497	.1073*		
Other Occupation	.0742	.0659*	.0234	-.1300*		
<u>Industry:</u>						
(Government)						
Primary	.0504	-.0109*	.0170	-.2242*		
Manufacturing	.2252	.0077*	.1076	-.0305*		
Construction	.0871	.1511	.0032	-.0886		
Transportation	.0655	.0537*	.0073	-.2395		
Trades	.1824	-.2140	.1797	-.3111		
Finance	.0433	-.0301*	.0817	-.0666*		
Services	.1894	-.2929	.4659	-.2358		
Weeks:	44.3408	.0338	26.2425	.0102*	.0345	.0406
Hours:	41.3105	.0091	38.9619	.0396*	.0099	.0112
R-Squared	.5990		.5921		.5793	
Sample Size	8446		8494		8446	

Reference groups in parentheses
 *Not significant at the .05-level
 **Not significant at the .10-level

TABLE 2A

PARAMETER ESTIMATES FROM REGRESSIONS FOR MALES AND FEMALES

Variable	1971		1981		1986	
	Males	Females	Males	Females	Males	Females
AVGERAGE LN WAGE (Dependent Variable)	8.3854	7.5707	9.4769	8.8181	9.7360	8.9518
	β_m	β_f	β_m	β_f	β_m	β_f
Constant	7.8184	7.7992	8.642	8.3682	8.7525	8.6404
EDUCATION & EXPERIENCE:						
(No Degree/Certificate)						
Education (years)	.0508	.0313	.0421	.0547	.0583	.0445
University Degree	.1750	.3019	.1497	.1420	.1021	.2640
Trade Certificate	.0799	.0687	.0863	.0990	.0760	.0711
Experience	.0485	.0269	.0457	.0253	.0579	.0447
Experience ²	-.0008	-.0004	-.0007	-.0004	-.0009	-.0008
MARITAL STATUS:						
(Married)						
Single	-.3283	-.0204*	-.3005	-.0823	-.3108	-.0161*
Divorced/Separated	-.1041	.0737*	-.1014	.0004*	-.0818	.0438*
Widowed	-.0912	-.0139*	.0095*	.0731*	-.3101	-.0324*
LANGUAGE:						
(English Only)						
French Only	.0159*	-.0471*	.0130*	.0194*	.0185*	-.0124*
Bilingual -						
English Native Lang	.0312*	-.0478*	-.0313*	.0841	.0164*	-.0322*
French Native Lang	.0617	.0377*	-.0076*	.0562*	.0261*	.0315*
Other Native Lang	.3474	-.0758*	-.2474	.0386*	-.0039*	.0569*
REGION:						
(Ontario)						
Maritimes	-.2256	-.2234	-.0850	.0421*	-.0995	-.0601**
Québec	-.0973	.0537**	.0461*	.1129	.0106*	.0365*
Manitoba/Sack.	-.1293	-.1255	.0114*	.0100*	-.0160*	.0127*
Alberta	-.0330*	-.1157	.1758	.1509	.1129	.1017
B.C	.0557	-.0008*	.1314	.1467	.0612	.0856
OCCUPATION:						
(Clerical)						
Manager	.3540	.1934	.2452	.2126	.2802	.2543
Science	.2315	.1001*	.1757	.0694*	.2439	.3292
Social Science	.1346*	-.2117	-.0917*	-.1001*	.0599*	.0535*
Teaching	.3858	.4667	.2095	.2510	.3461	.1871
Health	.3055	.2808	.1376**	.2072	.2477	.2966
Art & Literature	.1180*	.3523	-.0683*	-.1689	.0389*	-.0749*
Sales	.1148	-.1373	.0853	-.0772	.0725	-.1299
Service	.0492*	-.2635	-.0767	-.3082	.0112*	-.2769
Primary	.0496*	-.0050*	.2650	-.1206*	.0184*	-.0863*
Processing	.0707	-.1662	.0802	-.0607*	.1123	.0203*
Construction	.0453**	.0017*	.1103	.0035*	-.0763**	-.0589**
Transportation	.0421*	.0589*	.1842	.1077*	.0619**	.1578
Other Occupations	.0475*	-.1993	.0006*	-.1705	.0587*	-.1254
INDUSTRY:						
(Government)						
Primary	-.1396	-.6082	-.0786*	-.4334	-.0177*	-.2097
Manufacturing	.0037*	-.0003*	.1510	.0711**	.0131*	.0154*
Construction	.1238	-.0481*	.0666*	.1292*	.1135	-.1913*
Transportation	.0544	.1226*	.0754*	-.1469*	.0736**	-.1885**
Trades	-.1469	-.1282	.1184	-.0808*	-.1890	-.2468
Finance	-.0280*	.0219*	-.0849	-.1456	-.0094*	-.0306*
Services	-.2353	-.1274	.0707	-.0422*	-.2627	-.1952

TABLE 2A

(continued)

PARAMETER ESTIMATES FROM REGRESSIONS FOR MALES AND FEMALES

Variable	1971		1981		1986	
	Males	Females	Males	Females	Males	Females
	β_m	β_f	β_m	β_f	β_m	β_f
WEEKS WORKED DUMMIES:						
(Weeks 49 to 52)						
Weeks 1 to 13	-1.6827	-1.9287	-1.6818	-1.8343	-1.6131	-2.0330
Weeks 14 to 26	-.9249	-.9608	-.8162	-.9768	-.8044	-1.0892
Weeks 27 to 39	-.4411	-.4799	-.3872	-.4694	-.4883	-.6271
Weeks 40 to 48	-.0780	-.1759	-.1163	-.2369	-.1986	-.3173
HOURS WORKED DUMMIES:						
(Hours 40 to 44)						
Hours 1 to 19	-.7360	-.8207	-.6726	-.6813	-.7278	-.5360
Hours 20 to 29	-.3008	-.3474	-.3797	-.4316	-.4273	-.2598
Hours 30 to 34	-.1658	-.0960	-.1658	-.1130	-.1502	-.0066*
Hours 35 to 39	.0061*	.0256*	.0362**	.0519	-.0012	.1676
Hours 45 to 49	-.0053*	-.0375*	.0161*	-.0590*	.0470**	.1717
R-Squared	.6713	.7005	.5546	.6059	.5985	.5898
Sample Size	8007	4836	8360	5932	8446	8494

Note:

*Not significant at the .05-level

**Not significant at the .10-level

Reference groups in parentheses

FOOTNOTES

1. Gunderson's 1975 study attempts to measure differences in productivity between males and females by comparing workers in incentive-pay occupations. Gunderson contends that in occupations where earnings are contingent on the worker's performance, earnings will be a reasonable approximation of marginal productivity. He estimates the marginal physical product of female workers to be 88% that of males, although this measure may partially reflect the crowding of women in female-type occupations.

2. In 1985, per capita income in Alberta was 146.7% of the Canadian average while Manitoba's was 87.5% and Saskatchewan's 91.2% (Department of Finance, 1991). Not surprisingly, by isolating Alberta from the other two Prairie provinces, the regressions using 1985 data yielded parameter estimates for Alberta that were positive and significantly different from zero while the estimates for Manitoba and Saskatchewan were negative but not significantly different from Ontario's (the reference group). In contrast, the regressions later in the paper which used 1970 data found parameter estimates for Alberta that were positive and not significantly different than Ontario's (at that time, Alberta's per capita income was 107% of the Canadian average) while the estimates for Manitoba and Saskatchewan were negative and significant (per capita income was 90.4 and 77.9% respectively). In summary, there seems persuasive reasons to include Alberta and the other two Prairie provinces separately in the regressions in light of their different relative income positions, even though they varied considerably over the fifteen year time span of the study.

3. The same indicator variables for language were used in the previous studies by Miller (1987) and Gunderson (1979).

4. In fact, some samples found no workers in this category.

5. Since some characteristics have negative contributions to the discriminatory component of the wage gap (i.e. they lower the wage gap), it is possible for a single characteristic to exceed the net contribution of discrimination to the wage gap.

6. After excluding the CMA status variable and using dummies to control for hours and weeks, although the average wage gap for 1985 remained the same, the percentage of gap attributable to average characteristics by the decomposition technique declined from 60% to 50% while the percentage attributable to discrimination increased from 40% to 50% when occupation and industry variables were included in the regression model.

7. The following are some variables the were not common to the studies by both Miller and Gunderson. In Gunderson's model of wage-determination, a variable was included in the vector of worker characteristics defined as education multiplied by experience. All degree and certificate categories were represented by a dummy

variable indicating whether the worker was "trained". Dummy variables indicated whether a worker lived in a rural area, a town or a city. In Miller's model, dummy variables were included to indicate French ethnic origin, the possession of a university degree or trade certificate and whether the worker resided in one of the nine largest cities.

8. In examining the generation effects on women's earnings, a technique referred to as "cohort analysis" was influential. Similar techniques have been used in other studies to analyze the determinants of immigrants' earnings. For instance, Borjas, 1985 or Bloom and Gunderson, 1989.

9. This tendency can be seen by examining the change in women's average endowment of skills found when running the regressions used in the Section IV.

10. Experimentation with the female regressions showed that the presence of children has a negative impact on the earnings of women, with stronger negative effects the younger are the children. However, the inclusion of children variables altered the coefficients on the marital status indicator variables. By including the presence of children as an explanatory variable in the regressions, being married seemed to have a less negative impact on earnings of women. So the negative influence of parenthood on women's wages seems to be partially incorporated in the marital status indicator variables.

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