

DECOMPOSING THE GENDER WAGE GAP

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Abstract

The gender wage gap persists as an important and controversial topic in various socio-economic agendas and appears as a topic of research in scholarly research regularly. The conventional approach to conducting a gender wage gap assessment is measuring the difference in average earnings between men and women that remains after controlling for various explanatory variables suggested by theory and empirical labor studies. The list of explanatory factors used in particular papers varies depending on the specificity of the population sample, availability of data, research focus and other aspects. Specifically, variation in occupational distribution between men and women in most cases in the literature has been limited to 20-40 fairly broad occupational groups. The inclusion of occupation as an explanatory variable is a controversial approach as it may lead to an undervaluation of the influence of labor market gender segregation tendencies, or, on the opposite, to over-justification of gender-pay differentials. This thesis provides an overview of conventional techniques used for gender wage gap estimations, discusses the importance and appropriateness of occupation as an explanatory variable, and contrasts gender wage gap estimations with and without these controls in the context of the Canadian labor market. Furthermore the thesis tests whether very detailed occupation controls is advantageous compared with a more limited set of broad occupational groups in terms of examination of the wage gap, and suggests evidence for justification of occupational gender segregation that is often perceived as discrimination.

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Introduction

The gender wage gap was and remains an important issue in the media, political agenda sphere, and in academic research in Canada. In many cases the existence of a gap was put forward as evidence of gender discrimination against women in the workplace.

A number of studies demonstrate the persistence of the gender wage gap in Canada that is not accounted for by human capital and other observable factors, suggesting various uncontrolled factors to be contributors to the magnitude of the gap, including discrimination. In some papers, the difference in average earnings between men and women that remains after controlling for various explanatory variables is due to other factors than discrimination, for example, concentration of women in a small number of lower-paying jobs, and that women may be more likely than men to make accommodations to balance paid and unpaid work. (Cool, 2010). There are also papers that assess the gender wage gap controlling for various factors that influence work productivity, occupational specifics, and human capital and attribute remaining earnings difference to discrimination against women in the labor market. (Drolet, 1999) (Akbari, 2004)., (Goldberg Dey & Hill, 2007), (Council of Economic Advisers (U.S.), 2015). As one of the researchers proposed: “The simple fact that a significant proportion of gender pay gaps remains unexplained suggests the possibility that discriminatory practices are at play” (Vincent, 2013). The papers also mention that it is difficult to document the existence of prejudice and gender stereotypes in the workplace, let alone to statistically assess the effect of such practices on salary discrepancies. Discrimination in hiring or in promotions, for instance, may be one of the contributors of the remaining wage difference, but unfortunately can be very difficult to assess with available data sets.

Nonetheless, one specific kind of discrimination, the “equal pay for equal work” principle violation is more amenable to testing with detailed enough data. The issue of unequal pay for equal work rarely has been addressed explicitly in previous work; its relevance however, is either supported or omitted in discussion. Legal norms requiring equal pay for equal work are recognized in some papers however as having failed to narrow the wage gap. (Cool, 2010), (Fortin & Huberman, 2002). Papers mentioned above examined the wage gap as a difference between average earnings of males and average earnings of females, and analyzed contributors to the discrepancy. Controls traditionally used in quantitative assessment - human capital controls and industry controls - tend to account for a large proportion of the observed pay gap, leaving the remaining gap to represent the difference in wages between males and females in similar occupations and with very similar performance potentials. However, it is far from sufficient to reflect the restriction of work of equal value since analyses typically lack additional controls for jobs differences.

A wide spectrum of wage gap interpretations can lead to policy recommendations that are not firmly based on empirical evidence. For example in New Brunswick “Critics say the widening pay gap is a sign the New Brunswick government should legislate pay equity in the private sector.” (Perron, 2009) Even though the “equal pay for equal work” principle was proclaimed and came into force December 1st, 1985 in the New Brunswick [Employment Standards Act, the question remains as to whether there is any evidence that this principle fails to hold in the Canadian workplace](#). A more transparent and clear understanding of what underpins the wage gap could also assist in the debate about public policy proposals to address the wage gap by providing more accurate measureable

indicator of pay equity, which, for example, was one of the goals of [New Brunswick's Five Year Wage Gap Action Plan \(2005-2010\)](#).

One of the possible explanation of the wage gap that remains after controlling for standard explanatory factors used in much of the earlier research is insufficient specificity and level of disaggregation in occupational controls that lead to an inaccurate comparison of earnings of men and women engaged in 'equal work'. Examination of the wage gap with control over differences in detailed job positions within industries is required. In research mentioned above, control for differences in jobs was based on broad industry controls, leaving the diversity of positions within industries unaddressed. There are also papers that assess the gender wage gap within a set of specific occupations, but unfortunately without controls for important human capital factors (Hegewisch & Ellis, 2015), (Baxter, 2015). One paper based on Norwegian labor force data set uses estimates of gender wage gap in 122 five-digit occupations with a rich collection of human capital variables but omits hours of work for employees working on shifts schedule, difference in employers, and sources of non-wage compensation such as tips and commissions. (Ruijter, 2003)

There is considerable debate over the inclusion of industry and occupation as explanatory variables since occupational segregation is a mechanism whereby wage discrimination may occur and their inclusion may undervalue the importance of labor market constraints on wages or alternatively, may over-justify gender-pay differentials. However, excluding occupation and industry may neglect the importance of background or individual decisions with respect to wage outcomes. (Drolet, 2002a) It can be argued that the relevance of industry, occupation and organization variables as wage

determinants depends on the researcher's goals. Estimation of the wage gap on more general levels of jobs differentiation avoids interpretation of sex-segregation on lower levels, and can potentially lead to overestimation of the gender wage gap by interpreting jobs gender segregation fully as discriminatory practice. Gender segregation in occupations is an important but different topic, nevertheless, omitting valuable explanatory factors leaves more variation for the dependent variable, as a result, leaving bigger unexplained wage gap opened to interpretations and suggestions.

We will use data on the Canadian labor market to contrast results of the gender wage gap estimation with and without inclusion of occupations in the list of explanatory variables. We start with outlining frequently used approaches in wage gap studies. In the first chapter we will overview common theoretical background and empirical studies that are used to justify selection of explanatory factors in wage gap estimations with a focus on person-specific factors that affect earnings.

1. Theoretical framework of wage discrimination

This section is dedicated to an overview of theoretical and empirical approaches used to explain the choice of explanatory variables and econometric techniques used in the literature for assessing the wage gap.

1.1 Wage determinants and wage discrimination

This subchapter provides an overview of theoretical underpinning of a person's wage formation and determinants of wage discrepancies between men and women.

1.1.1 Human Capital

Economics formulation of the idea that training increases productivity was initially presented in “Human Capital” (Becker, 1964). It reflected interest in labor as more than a number of man-hours worked, and of education as a determinant of capacity as well as demand. The book is an attempt to construct a general micro-theory of the quality of labor which relies heavily on the neo-classical proposition that remuneration is determined by marginal productivity.

Becker defines human capital of an individual as an accumulation of productive resources he realizes during his life. These resources, consist of level of education, training in business or professional experience. Deciding to continue their studies, to practice medicine, to form a company or to acquire new experiences is a decision whether to make a new investment likely to increase the stock of productive resources, that is to say, their human capital. The expected return of this investment consists of income flows in the future. This investment is expected to be profitable since the individual hopes that incurred costs will be lower than wages or discounted future earnings flows. Yet the level of human capital investment varies from one employee to another. Women, who are more likely to give preference to family life, tend to invest less in terms of years of experience and professional training and accumulate less productive resources. According to Becker, these different levels of investment in human capital between men and women have consequences for the disparities in productivity, which obviously lead to wage gaps. The salary difference is always the result of different intertemporal investment choices made in the past by employees.

(Mincer, 1958) developed the first model to measure the impact of human capital on wage determination. This model explains why individuals from different educational levels receive different wages over time. The model assumes that all individuals are identical ex ante; that is to say they have a priori the same skills and opportunities. Accordingly, it is the professional experiences and skills acquired by individuals that differentiate them and determine their possible professional occupations. Therefore, those in positions requiring long years of investment in school education and experience receive a substantial compensation. The magnitude of this difference compensating would be determined by equating the present value of future earnings and the various costs invested in education.

A second model developed by the author (Mincer, 1974) focused on the dynamics of wages lifecycle. The model seeks to establish that disparities in human capital investments between men and women explain the difference in observed wages. Thus, as the education gap between men and women becomes weak, the wage gap is clearly reduced. A significant number of studies (Goldberg Dey & Hill, 2007) (Vincent, 2013) (Cool, 2010) explain the wage gap between men and women by estimating the equation proposed by the model but are unable to explain the phenomenon of gender wage gap fully. The question may arise then: what is the source of differences in salary between men and women exist?

1.1.2 Determinants of wages

Typically, the following determinants of wages could be found in the theoretical and empirical literature: education, work experience, job tenure, marital status of the

employee, occupational categories and sectors, size of firm, and union membership. Each will be discussed in turn.

Education

According to human capital theory, there would be a positive relationship between the number of years of study and obtained salary. The theory suggests there is an opportunity cost to acquire education, because the decision of the individual to invest in its human capital depends on future earnings (expected salary) and acquisition costs of that education (time and effort required for this acquisition). But when the anticipated salary is certainly greater than the total costs relating to the acquisition of this new formation, the individual will be tempted to invest more in this aspect of its human capital.

Professional experience

The number of years of professional experience greatly influences the salary. As for education, the human capital theory states that the more an individual years of experience acquires, the more productive they would be, thus probably they will be offered a higher compensation. The stock of experience accumulated during his career, promoting productivity which, in turn, normally favors an increase in salary. The stock of experience consists of two elements: the experience accumulated in the company where the employee works (assessed by seniority), and possibly the experience in other companies. Relevance of work experience as a form of human capital was mentioned in previous subchapter.

Duration in employment or seniority

Incentives theory employed in (Lazear, Why Is There Mandatory Retirement?, 1979) have resulted in the concept of deferred compensation, which is likely to emerge if the worker-firm relationship is expected to be long-term and direct monitoring of worker productivity in the short-term is either costly or not possible. In a deferred compensation contract, workers are underpaid during the early part of their career (that is, pay is less than marginal revenue product) and overpaid during the later part of their career. This

structure of compensation encourages higher effort because future pay within the firm always exceeds future pay elsewhere. An important issue concerning deferred compensation is that firms have an incentive to renege on late-career overpayment, as older workers are paid more than their marginal product. Deferred compensation makes seniority a wage determinant separate from tenure.

Marital status

Marital status can have a significant impact on earnings. In fact, married men often have a marriage premium unlike single men. (de Singly, 1982) notes that they occupy more senior positions than singles and are often asked to positions of responsibility, which would justify a positive impact of marriage on men's pay. By cons, he stressed that the marital and professional lives interact differently for men or women. According to him, marriage is rather synonymous with constraints, declining availability and productivity for women. Indeed, he observes that married women acquire fewer years of experience than single women in the labor market as a result of job disruptions due to family obligations. Thus, married women invest less in human capital and consequently, receive lower wages.

The professional categories and industries

The industry to which a company belongs can have a decisive influence on the level of remuneration of its employees. The profitability of the industry and its dynamics compared to other sectors of the economy can have direct impact on relative level of wages within the industry. Moreover, the level of pay of an employee varies, in general, according to its occupational category within the company. Several studies, including those of (Fortin & Huberman, 2002), (Korkeamaki & Kyyra, 2005) show that the gender differential can be explained by horizontal segregation. Certain groups of individuals, may have tendencies to get segregated into certain industries or certain professional

sectors. (Drolet, 2002a), (Bayard, Hellerstein, & Neumark, 2003) show that women are more concentrated in lower-paid occupations.

The size of the firm

Large companies usually pay their employees better than smaller companies. The theory supported by Oi and Idison (1999) is explained by the fact that higher wages are the result of higher productivity of the business itself or business sector. The larger companies would give more importance to observable characteristics such as experience and education, compared to smaller companies. A model (Garen, 1985) was suggested where firms are allowed to choose how imperfect their information is, which influences the wage offered to workers. The hypothesis is that the cost of acquiring information about personnel rises with firm size; thus large firms face numerous information problems that small firms do not. The model shows how these greater information costs manifest themselves in wage data. The empirical analysis in the paper supports the hypothesis.

Labor-market signaling

In the job market, potential employees seek to sell their labor to employers for most favourable wage. Generally, employers are willing to pay higher wages to workers with better productivity. While the individual may know their own level of ability, the hiring firm is not (usually) able to observe such an intangible trait. Education credentials can be used as a signal to the firm, indicating a certain level of ability that the individual may possess. (Spence, 1973) reported that even if education did not contribute anything to an employee's productivity, it could still have value to both the employer and employee.

The informational value of the credential comes from the fact that the employer believes the credential is positively correlated with having greater ability and difficult for low ability employees to obtain. Thus the credential enables the employer to reliably distinguish low productivity workers from high productivity workers.

Similar implications concerning the importance of potential employees' attainments for hiring firms are drawn in (Weiss, 1995) about human capital factors in general. The concept of signalling is used in the paper to show that firms derive inferences about unobserved characteristics of workers basing on their credentials. Even though in most cases the wage is determined by the actual productivity of an employee, not the one that was perceived before hiring, there are numerous factors to support the influence of presumed productivity on one's wage. In most job markets the employer is not sure of the productive capabilities of an individual at the time the employee is hired, however, nor will this information necessarily become available to the employer immediately after hiring. The job may take time to learn. Often specific training is required. And there may be a contract period within which no contract renegotiation is allowed.

In summary it can be said that concept of signaling provides another justification for using human capital credentials as wages determinants since employers value the credentials even if they do not correspond to actual productivity of employee.

1.1.3 Theories of occupational segregation by sex

Compensations in different industries and occupations within industries may differ greatly for a number of reasons. These wage differentials are mostly the result of differences in worker ability and the workers' effort in performing the job. There are also

wage differentials across occupations, because of differences in the demand and supply of laborers for particular job or occupation. These differences arise primarily because of differences in the amount of education or training required and in the desirability of the job itself. Educational and training requirements on positions, what is often referred to as human capital, have major influences on offered wages; in depth discussion of this aspect is presented below. Some jobs may also pay more because they are less desirable. They may be hazardous, dirty, and employment may be sporadic or seasonal. Status or power, or the lack thereof, may also be a compensating differential. For any given type of job, wages are usually higher in one locality than in others. Much of this difference is because of differences in the cost-of-living. Labor market information imperfections are another factor. There is a presumption that people will migrate to higher paying jobs from lower paying jobs of the same type and with the same requirements. However, this can only happen if people know about the jobs and if there are no significant barriers to mobility. Some factors affect males and females on differently leading to occupational gender segregation.

The segmentation of occupations on the basis of workers' sex is an important labor market phenomenon that can have a significant impact on the gender wage gap. The principal explanations for the existence and persistence of occupational segregation by sex is reviewed below.

Researchers usually distinguish between labor supply and labor demand factors when explaining occupational segregation by sex. Factors related to labor supply generally focus on why women prefer certain types of occupation - for example, women may "prefer" those with flexible hours in order to allow time for child care. Explanations

related to labor demand focus on why employers generally prefer to hire women or men for particular occupations and why women and men have different opportunities for promotion and career development within firms.

Theories explaining the existence of occupational segregation by sex can be classified into three broad categories: neo-classical and human capital theories; institutional and labor market segmentation theories; and non-economic and feminist or gender theories. Although these sets of theories overlap, this classification nonetheless provides a useful basis for discussion.

1.1.3.1 The neo-classical, human capital model

Neo-classical economics assumes that workers and employers are rational and that labor markets function efficiently. According to this theory, workers seek out the best-paying jobs after taking into consideration their own personal endowments (e.g. education and experience), constraints (e.g. young child to take care of), and preferences (e.g. a pleasant work environment). Employers try to maximize profits by maximizing productivity and minimizing costs to the extent possible. But because of competition and efficient labor markets, employers pay workers their marginal product.

On the labor supply side, neo-classical/human capital theories stress the lower levels of female human capital in terms both of what women bring to the labor market (e.g. less education and less relevant fields of study), as well as what they acquire after joining the labor market (e.g. less experience than men owing to intermittent or truncated labor market participation because of marriage and/or household/child-care responsibilities). According to these theories, women receive lower pay than men because of their lower productivity. This implies, all else being equal, that women should

be reasonably well represented in a wide range of occupations in the formal sector (and at least in proportion to female-male educational levels). When this is not the case, it probably implies the presence of discrimination.

Many of the factors influencing women's and men's preferences for particular occupations also influence employers' preferences for male or female workers. According to (Anker, 1997), women are often considered to be higher-cost workers (even when the same wage rate applies) because of a number of supposedly higher, indirect labor costs associated with women workers. For example, women are often said to have higher rates of absenteeism and are often said to be late to work more (probably in part because of family responsibilities which cause women to miss work in order to care for family members). Women are also often said to have higher labor market separation rates, which can be an important indirect cost for employers, who have to find and train new workers. Labor laws and regulations sometimes directly affect the demand for women workers. Protective legislation sometimes prohibits women from working in certain occupations and/or under certain conditions.

1.1.3.2 Institutional and labor market segmentation theories

Institutional and labor market segmentation theories also rely on well established economic thought and neo-classical logic. Their starting-point is the assumption that institutions, such as unions and large enterprises, play an important role in determining who is hired, fired and promoted, and how much they are paid. Institutional theories also begin with the assumption that labor markets are segmented in certain ways. And while each labor market segment may function according to neo-classical theory, it is difficult for workers to pass from one segment to another. The best-known is the dual labor

market theory which distinguishes between a "primary" and a "secondary" sectors (Doeringer & Piore, 1971). Jobs in the primary sector are relatively good in terms of pay, job security, opportunities for advancement and working conditions. Secondary sector jobs tend to be relatively less attractive with regard to pay, chances for promotion and working conditions, and may provide little protection or job security. It is a relatively short step to adapt the concept of dual labor markets to occupational segregation by sex. With one labor market segment comprised of "female" occupations and another of "male" occupations, this segmentation implies relatively low wage rates in "female" occupations because many women workers are "overcrowded" into a small number of "female" occupations (Bergmann, 1974).

Another economic theory related to labor market segmentation is Statistical Discrimination theory. This is based on the assumption that there are differences, on average, in the productivity, skills, experience, etc., of distinct groups of workers (such as men and women), and high search and information costs associated with recruitment and promotion decisions. In such circumstances, it is argued, it is rational for employers to discriminate against groups of workers (such as women) when differences, on average between the abilities of persons from different groups (e.g. women and men) cost less to sustain than the decision-making costs associated with identifying suitable individual workers of either sex.

1.1.3.3 Feminist/gender theories

Feminist or gender theories are mainly concerned with non-labor market variables which economists take as given. A basic premise of gender theories is that women's disadvantaged position in the labor market is caused by, and is a reflection of, patriarchy

and women's subordinate position in society and the family. In all societies, household work and child care are seen as women's chief responsibility, while being the breadwinner is perceived as men's main responsibility. The fact that these societal norms and perceptions bear little relation to the daily lives of many women, men and families does not detract from their influence on people's behavior and their contribution to gender based discrimination against women.

This division of responsibilities and the patriarchal ordering of society are instrumental in determining why women usually accumulate less human capital compared with men before entering the labor market - that is, why girls receive less education than boys, and are less likely to pursue fields of study of greater relevance to the labor market. Overall, women are perceived as having a lesser need for labor market skills. These same influences are also instrumental in explaining why women acquire less labor market experience, on average, because many of them withdraw from the labor force early, and many others withdraw from the labor force temporarily.

1.1.3.4 Occupational segregation and gender pay gap

Studies relating occupational segregation by sex to female-male pay differentials are also greatly affected by the level of disaggregation of the occupational data analyzed. When very aggregated data are used, occupational segregation's effect is underestimated, mainly because most occupational segregation by sex remains unobserved. As occupational data become more disaggregated, the observed level of sex segregation increases, and the portion of the female-male pay differential explained by occupational segregation tends to increase.

After a fairly high level of detail in the occupational classification is reached, however, further disaggregation of the occupational data probably reduces the proportion of the female-male pay differential observed to be attributable to occupational segregation by sex. At the extreme of detailed job descriptions within establishments, there is usually very little difference in pay for men and women, since anti-discrimination laws make it illegal to pay different wages for the identical job within an enterprise.

Currently, there is no universally agreed upon view on the inclusion of industry and occupation as explanatory variables since occupational segregation is a mechanism whereby wage discrimination may occur and their inclusion may undervalue the importance of labor market constraints on wages or alternatively, may over-justify gender-pay differentials. However, excluding occupation and industry may neglect the importance of background or individual decisions with respect to wage outcomes.

It seems that using explanatory disaggregated occupational variables in gender wage differential assessments accounts for a significant portion of it. A study from the United States (Treiman & Hartmann, 1981) illustrates this: the percentage of the female-male earnings gap explained by occupational segregation by sex rose from about 10 per cent when 12 occupational categories were used, to 20 per cent when 222 occupations were used, and to at least 30 per cent when 479 occupations were used. Similarly, a study by (Kidd & Shannon, 1996) found that the percentage of the female-male wage gap explained rose from 12 to 18 and 27 per cent as the number of occupations classified increased from 9, to 17 and 36 using the same (Oaxaca R. , 1973) approach used by (Treiman & Hartmann, 1981). However, it is not clear whether the effect of disaggregated occupational variables can be attributed to discriminatory practices as it is

difficult to distinguish between a voluntary choice of women to allocate more (than men) time and effort for child care and other housework, and imposed gender role that forces women to do so. One way to start tackling this issue is to investigate dependency between formal child care service costs and supply of women in the labor force. The magnitude of an increase of women participation in labor force after introduction of children daycare subsidies could illustrate what proportion of women population are out of labor force because their family cannot afford formal daycare service and not due to preference in favor of personal daily child care. In a policy research report published by the World Bank (Lokshin, 2000) studying the contemporary Russian labor market, author estimated the effect of child care partial subsidies on women's decision about participation in labor force, and via simulation showed that if formal child care were fully subsidized (the price was zero) this would result in an 11.9 percent increase in the rate of mothers' labor force participation.

The assumption that women prefer to dedicate more effort to housekeeping leaves no room for discrimination in neo-classical understanding of occupational segregation. Effort is not observed and therefore not accounted by human capital and at the same time the assumption clearly says that women provide less labor supply on the labor market. The assumption also justifies favoring men on the demand side and institutional segmentation of labor market. On the other hand, if women allocate more time to housework involuntarily, then the portion of gender wage differential absorbed by occupation variables can be considered as contributed by discrimination. While formal barriers to female occupational attainment have been significantly reduced, most men and women continue to understand their roles and aptitudes in highly gendered terms, based

in large part on deeply institutionalized, widely shared notions of “natural” male and female qualities. (Charles, 2003) There are approaches to study the question whether the gender roles are natural and deliberately accepted or artificially created by society and imposed upon them. With appropriate longitudinal data at hand one can construct natural experiments tracing effects of various exogenous shocks on women’ labor market or factor out some of unobserved aspects. This topic, however, lays beyond the scope of this paper. In the context of this subchapter it is important to emphasize that disaggregated occupational variables have explanatory meaning for gender pay gap.

1.1.3 Theory of discrimination

(Cain, 1987) Outlines the definition for economic discrimination. It can be best expressed with proposed models:

- Model (I) short-term: $Y_i = X_i' * B + A * Z_i + e_i$

Y_i - the outcome of the process, such as the income, earnings, or wage of the i^{th} person. X_i - vector of productivity characteristics that are presumed exogenous.

Z_i is a binary dummy for being a member of favored group.

- Model (II) long-run: $Y_i = C * Z_i + e_i$

Considers all X characteristics to be endogenous, and any difference in X across groups attributed to the process of discrimination under study. $C > 0$ would be the evidence of discrimination.

The author’s quantitative assessment have shown that the difference in market earnings between men and women for the most part can be rationalized by economic theories of the gains from specialization and investment in human capital, combined with an assumption of voluntary choices by women to specialize in the home sector.

The hypothesis of discrimination suggests that the wage gap may be partially explained by belonging to a particular group (called minority in the chapter), not only by productivity of individuals. According to Cain's theory, employers tend to prefer a class of employees to another for specific positions. The discriminatory preference can be a subject of gender, race or other innate characteristics. Becker developed the concept of taste for discrimination (taste of employers, employees and even consumers) which is conceptually equivalent to preference.

(Arrow, 1971) explains the persistence of wage discrimination by an informational imperfection. Indeed, it is difficult to observe the quality and commitment to the work of a candidate for hiring. Accordingly, an applicant will be a priori classified according to the average productivity of the group to which it belongs. Their statistical classification used in a group of employees may be different from that of another employee of the same productivity but statistically classified in another group. Thus once a group proves itself to be more productive, any member of the group may be considered as more favorable in view of an employer. The work of Arrow on statistical discrimination has shown that prejudice is a determining factor in the hiring and employee compensation process.

Studies however show that the line between discriminatory practices and training preferences of individuals is difficult to trace. ((US) Council of Economic Advisers , 2015)

1.2 Quantitative assessment techniques

As it was shown in the literature, the gender pay gap has been attributed to a number of factors including human capital endowments and career interruptions of women,

discrimination by employers, job characteristics, occupational self-selection and labor market institutions. The difference in pay that is unexplained is generally assumed to be the outcome of gender discrimination by employers. This subchapter presents measuring techniques used to evaluate the gender wage gap itself as well as its components.

1.2.1 Mincer earnings function

Probably the most basic econometric model that is used for wage and its derivatives assessments is the Mincer earnings function (Mincer, 1974). It is a single-equation model that explains earnings as a function of schooling and experience. The equation has been examined on many datasets, it is one of the most widely used models in empirical labour economics. Typically, the logarithm of earnings is modelled as the sum of years of education and a quadratic function of "years of potential experience".

$$\ln(y) = \ln(y_0) + r * S + \beta_1 * X + \beta_2 * X^2$$

Where y is earnings S is years of schooling and r is rate of return on schooling; X is years of potential labor market experience.

Adding more human capital independent variables and a group affiliation dummy variable leads to the (Cain, 1987) discrimination model described in a previous subchapter.

In more advanced form (Mincer, 1995) the Mincerian equation relates the wage with individual demographics and job definitions:

$$\ln(w_i) = \alpha + \sum_{j=1}^k \beta_j X_i + \sum_{s=1}^m \gamma_s Z_i + \varepsilon_i$$

where w_i is the wage for individual i and X_i are their personal and demographic characteristics. Z_i represents dummy variables for occupations of each individual. This

technique lacks the possibility for the male-female wage differential to be posed in two parts: the explained portion of the differential (explained by the different characteristics of men and women) and the unexplained differential.

1.2.2 Blinder-Oaxaca decomposition

An often used methodology to study labor-market outcomes by groups (sex, race, and so on) is to decompose mean differences in earnings. It divides the wage differentials in log wages based on linear regression models in a counterfactual manner. The procedure is known in the literature as the Blinder– Oaxaca decomposition (Blinder, 1973) (Oaxaca R. , 1973) and divides earnings between two groups into a part that is “explained” by group differences in productivity characteristics, such as education or work experience, and a residual part that cannot be accounted for by such differences in wage determinants. This “unexplained” part is often used as a measure for discrimination.

If wage is determined by a linear model $W_g = X'_g\beta_g + \varepsilon_g$ where g the group identifier, the gender is whether male (m) or female (f), then the difference of the mean outcome is:

$$R = E(W_f) - E(W_m) = E(X'_f)\beta_f - E(X'_m)\beta_m$$

To identify the contribution of group differences in predictors to the overall outcome the difference equation can be rearranged into decomposition prominent in the discrimination literature that results from the concept that there is a non-discriminatory coefficient vector that should be used to determine the contribution of the differences in the predictors. Let β^* be such a non-discriminatory coefficient vector. The outcome difference can then be written as

$$R = \{E(X_f) - E(X_m)\}'\beta^* + \{E(X_f)'(\beta_f - \beta^*) + E(X_m)'(\beta^* - \beta_m)\}$$

This twofold decomposition represents $R = Q + U$ is comprised of two parts:

$Q = \{E(X_f) - E(X_m)\}'\beta^*$ is the part of the wage gap that is explained by group differences in the predictors (the “quantity effect”), and the second component

$U = E(X_f)'(\beta_f - \beta^*) + E(X_m)'(\beta^* - \beta_m)$ is the unexplained part. The latter is usually attributed to discrimination, but it is important to recognize that it also captures all the potential effects of differences in unobserved variables.

Several suggestions for estimation of the unknown non-discriminatory coefficients vector β^* have been made in the literature. For example, there may be reason to assume that discrimination is directed toward only one of the groups (Oaxaca R. , 1973). If, for instance, wage discrimination is directed only against women and there is no (positive) discrimination of men, then we can use $\widehat{\beta}_m$ as an estimate for β^* :

$$\widehat{R} = \{\overline{X}_f - \overline{X}_m\}'\widehat{\beta}_m + \overline{X}_f'(\beta_f - \beta_m)$$

Often, however, there is no specific reason to assume that the coefficients of one or the other group are non-discriminating. Moreover, (Cotton, 1988) have argued that such oversimplified assumption abstracts from the central reality of wage and other forms of economic discrimination: not only is the group discriminated against undervalued, but the preferred group is overvalued, and the undervaluation of the one subsidizes the overvaluation of the other.. In the case of the gender pay gap, typically propositions (Reimers C. W., 1983) (Cotton, 1988) (Neumark, 1988) (Oaxaca & Ransom, 1994) suggest to weight the coefficients by the group sizes, n_m and n_f ; that is:

$$\widehat{\beta}^* = \frac{n_m}{n_m + n_f}\widehat{\beta}_m + \frac{n_f}{n_m + n_f}\widehat{\beta}_f$$

Furthermore, based on theoretical derivations, (Neumark, 1988) advocates the use of the coefficients from a pooled regression over both groups as an estimate for β^* .

Some researchers also shown that the decomposition of the gender wages gap is subject to selection bias. (Schafgans & Stelcnery, 2006) show that when labor market participation decisions of couples are not independent, the sample selection corrections used in the literature have been incomplete. The authors derive the appropriate sample selection corrections, based on a reduced form model for the joint participation decisions of both spouses. They note that taking account of these issues might influence the outcome of the decomposition analysis and affect the evidence of discrimination.

In labor-market research, it is common to include a correction for sample-selection bias in the wage equations based on the procedure by (Heckman, 1979). Wages are observed only for people who are participating in the labor force, and this might be a selective group. The most straightforward approach to account for selection bias in the decomposition is to deduct the selection effects from the overall differential and then apply the standard decomposition formulas to this adjusted differential (Reimers C. W., 1983)

2. Empirical findings on wage discrimination in Canada

Almost all Canadian national scale wage gap research uses (Oaxaca R. , 1973) decomposition techniques for quantitative analyses. Results differ with various datasets, preference of explanatory variables and tweaks to the Oaxaca model. This chapter summarizes research on the Canadian wage gap and establishes the basis for the quantitative assessment presented in next chapter.

In (Baker & Drolet, 2010) the authors have illustrated the difference between wage gap estimation using wages and employment income. The notion of wages refers to the theories of the labor market which state that the individual must obtain a salary equal to its marginal productivity. Unlike wages, labor income accounts for hours worked. Thus, the ratio based on earned income tends to overestimate the wage gap between men and women, as women spend less time at work than men. These authors found in 2006 a ratio of wages between men and women 72% when the ratio is based on labor income while this ratio is 85% for annual wage gap. The use of salary rather than working income to measure more accurately the effects of legislation on pay equity, because these laws are designed to provide equal pay for jobs of equal value. The authors used 19 industries and 11 occupations controls variables which accounted for about 5% of the gap.

The authors also use a dynamic Oaxaca decomposition to account for differences in observable characteristics. With this decomposition technique, the wage gap decreased by 10.2% between 1981 and 2008 and the part not explained by observable characteristics decreased by 4.2% during this period. The authors note that the 60% reduction in the log of the wage gap is due to changes in characteristics and that the wage gap is mainly due to a better education for women, and the fact they occupy more high-paying position. The authors show that the earnings-based ratios range from 0.53 to almost 0.65, while the wage-based ratios range from just under 0.74 to over 0.84. In many years, the difference is almost 20 percentage points.

The authors stressed the importance of using the wage income rather than work income because working income tends to overestimate discrimination between men and women by not accounting for the hours worked.

Selectivity bias issue is addressed in (Miller, 1987). The hypothesis of (Miller, 1987) is that wage inequality in Canada between men and women is overestimated in the works of (Robb, 1978) and (Shapiro & Stelcner, 1981). As traditional measures of discrimination, they have relied upon analyses of observed wage distributions which constitute only part of the wage-offer function. (Gronau, 1974) suggests that such measures will tend to understate the wage-offer differentials between males and females.

The author used (Oaxaca R. , 1973) technique, incorporating the Heckman selection bias technique (Heckman, 1979), to analyze the wage gap between men and women. After correcting selection bias in the equation, the results indicate that the observed wage gap between women and men is 30%, which is significantly lower than 48% suggested in previous research.

By considering that full-time workers and excluding family characteristics — as in (Gunderson, 1979), Miller concludes from the Canadian census data of 1981, that on average women earn 30% less, and only 28% of the wage gap is explained by the individual characteristics. However, when the decomposition technique is used with the family related variables, his results indicate that the components related to characteristics determine 55% of the wage gap between men and women. Furthermore, the author has shown that the characteristics associated with the family, such as the number of preschool children negatively influences women's number of years of experience.

The same selection bias issue was addressed in (Baker, Benjamin, Cegep, & Grant, 1995) where the authors used data from the 1971, 1981, and 1986 Canadian censuses, and the individual files of the 1986 and 1991 Survey of Consumer Finance in the analyses. Conventional determinants of earnings were used together with a proxy for potential work experience. The proxy is a derived variable based on age and education. The authors designed a dynamic model based on Oaxaca decomposition which revealed that most of the gender gap fall is due to decreases in the difference in returns to characteristics across males and females.

Similar finding are presented in (Gunderson, 1998): in 1990, female annual earnings were 61% of male earnings, while the ratio of weekly earnings was slightly higher, 63.3%. As a main factor explaining the discrepancy the author named the fact that women tend to work fewer weeks per year than men do. According to the author there is substantial variation in earnings across different occupations, reflecting different skill levels, usually with a similar pattern for females and males. There are variations in those patterns: notably, the low proportions of females who enter non-traditional occupations appear to fare poorly in improving their earnings relative to males in those jobs. The predominance of females in low-paying jobs and of males in high-paying jobs highlights the potential scope for pay equity policies, which allow comparisons across different occupations, and equal employment opportunity policies, which facilitate the advance of women into higher paying jobs, in contrast with conventional equal pay policies, which do not allow comparisons across occupations.

The same occupational segregation is also mentioned in (Drolet, 2002b), where the author updates the results of previous work on the wage gap between men and women

in Canada using a wider range of variables. She considered the highest education degree achieved, field of study, the level of job responsibility and professional experience. The author notes that the databases used by some Canadian studies had not enough information to explain the wage gap. The methodological approach of Drolet was inspired by (Oaxaca, 1973), with data from the Survey of Labor and Income Dynamics 1997 survey. 14 industries controls were used in the research. The study shows that women earn an average hourly rate 82% - 89% of men. Furthermore, using the measurement of Oaxaca in 1973, it shows that the unexplained (residual) of the wage gap is 50.7% of the total gap. The contribution of industry to gender-pay differentials falls from 33.8% when worker characteristics are considered, to 19.7% when both worker and workplace attributes are considered.

Slightly different approach based on Oaxaca decomposition was taken in (Reilly and Wirjanto, 1999). The authors used the 1979 cross-section of the General Segmentation Survey from the Maritime Provinces of Canada. The major focus of the General Segmentation Survey was inter-establishment variation in instability in employment and labor market segmentation. The study assessed the role of government policies and pay equity programs intended to mitigate the wage discrimination of women on the labor market. To conduct the research, the authors adopted Arrow's model of heterogeneous employer discrimination. In this model, employer satisfaction depends only on the male-female ratio and the fact that the profitability of the company is maintained in the presence of the discrimination against women. Pay equity, correspondingly, is achieved by redistribution of a portion of the income from men to

women. The amount of income distributed to men increases with the increases of discrimination within the firm.

To empirically assess segregation between men and women, the authors used the Oaxaca decomposition. According to the authors, the gender ratio within a company is a relevant variable for understanding the phenomenon of discrimination. Their results show that a government employment equity policy to increase the proportion of women in companies reduced the wage gap between men and women by 20%. Moreover, they show that the proportion of women in institutions explains 26% of the wage gap.

Institutional segregation was addressed in (Vincent, 2013). The author uses Canadian microdata to examine the remaining discrepancy in earnings of men and women working full-time. Four main hypotheses were put forth to explain the fact that, still today, women are paid less than men:

1. Women are overrepresented in occupations that are at the lower end of the pay scale.
2. Women place a greater value on non-pecuniary aspects of a job.
3. Women's greater family responsibilities lead them to opt for jobs that offer a better work-life balance.
4. Gender stereotypes in many workplace organizational practices tend to better value men's patterns of employment.

Several findings stand out. Less than a third of this gap is explained by the differences in the productive characteristics of women and men, such as the level of education reached, the occupation or trade practiced, the experience accumulated, the number of hours worked, or the sector in which they work.

These differences in the productive characteristics of women and men explain an increasingly smaller portion of the wage gap as the pay gaps diminish over time. So much

so that the greater portion of the gap measured nowadays cannot be explained by these differences.

The hypothesis stating that women are more interested than men in non-pecuniary aspects of a job finds some empirical support, but the importance of this factor in explaining the wage gap is relatively small compared to educational and occupational choices.

While it is difficult to document the existence of prejudice and gender stereotypes, according to author, there are indications suggesting that, in some workplaces, such as traditionally male-dominated sectors or sectors where non-standard jobs tend to be concentrated, discriminatory practices toward women exist.

In the next chapter we will follow suggestions given in the aforementioned papers. In order to avoid difficulties described in (Drolet, 2002a), (Drolet, 2002b) and to minimize bias from unobserved variables we use the Labour Force Survey master data that includes a rich variety of human capital variables. We use wages over work income as suggested in (Baker & Drolet, 2010) and we also address occupational segregation issue with detailed occupational variables (Gunderson, 1979), (Reilly & Wirjanto, 1999). The Oaxaca model is estimated with automatic adjustment for selection (Miller, 1987), (Baker, Benjamin, Cegep, & Grant, 1995). It should be borne in mind that in (Drolet, 2002b) and (Baker & Drolet, 2010) broad occupational and industry controls accounted for about 5% of the wage gap to contrast the portion of the gap that is attributable to set of very detailed occupational controls.

3. Analysis of the gender wage gap in Canada

3.1 Data description

In order to estimate the gender wage gap in Canada we use the Labour Force Survey (LFS) Masterfile data from 2015. Access to confidential data was gained through the New Brunswick Research Data Center. The dataset provides measures of the current state of the Canadian labor market on monthly basis. The survey is comprised of various person-level labor-related questions and includes data particularly useful for gender wage gap analysis. Specifically, personal information about respondents such as sex, age, education, and job tenure that can be used for human capital evaluation; hourly and weekly wage rates as representation of returns to human capital; and also other factors that can affect the returns such as occupation, firm size, usual hours of work, and location. Weekly and hourly wages are calculated in conjunction with usual paid work hours per week. Respondents are asked to report their wage before taxes and other deductions. Values are represented in cents. Observations with tips or commissions are excluded.

The LFS is a monthly household survey of a sample of individuals who are representative of the civilian, non-institutionalized population 15 years of age or older. The sample size counts approximately 56,000 households. LFS follows a rotating panel sample design where each respondent is surveyed up to six consecutive months. Therefore all observations available within year 2015 should not be treated as a simple cross sectional dataset since the assumption of independent observations is unlikely to hold.

To form cross-sectional data and maintain observation independence assumption we included only the first observation for each respondent.

We used hourly wages over weekly wages to represent wages as it reflects the specific return to human capital without being directly affected by the employment participation decision.

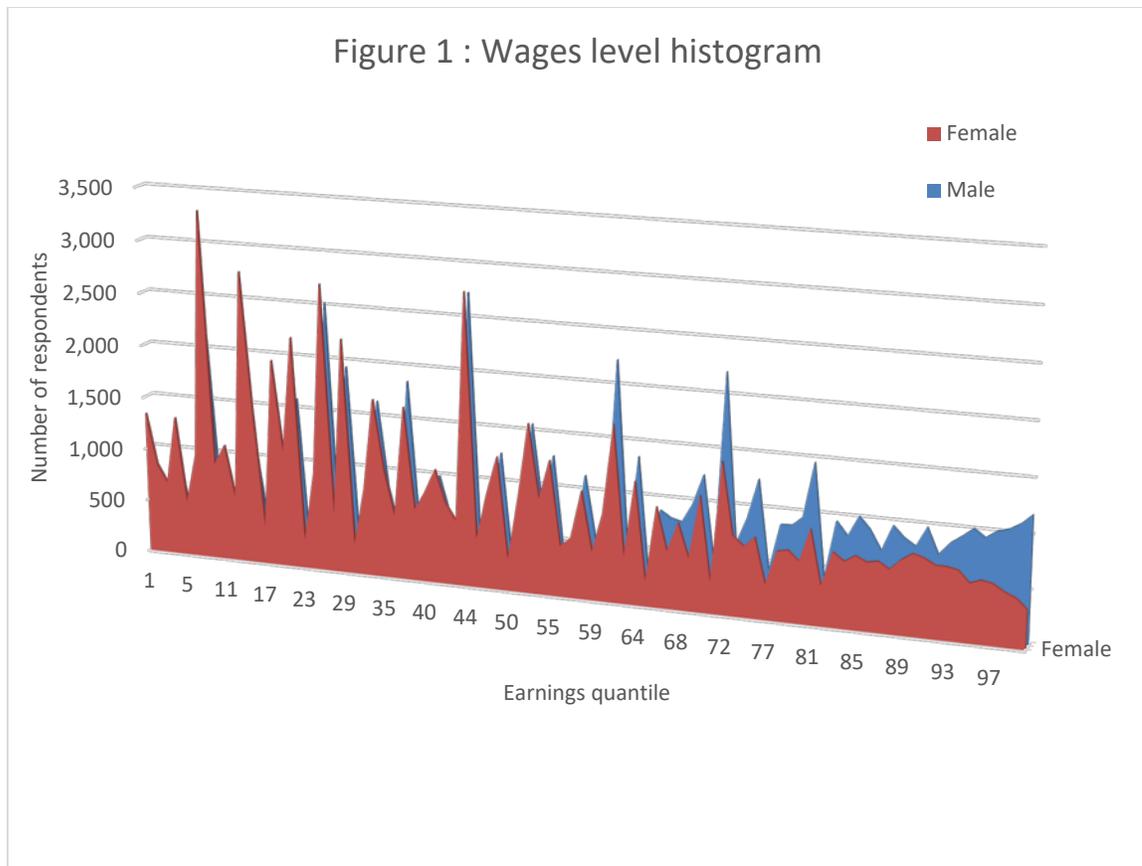
Some of data had to be transformed from absolute values to quantiles due to privacy reasons. Unfortunately, Enterprises ID is not available in the dataset, which would have allowed clustering of individuals by enterprise. The only information available on enterprise of employment is firm size aggregated into 3 groups.

We used STATA 13 software package for statistical computations.

3.2 Descriptive statistics of cross-sectional data

The working dataset from the LFS 2015 was obtained by dropping observations with missing information on wages as well as observations on respondents who entered the 2015 LFS sample prior to the start of 2015. The cross-sectional data had almost one-third of observations on individuals joining the sample beginning in January and about 6% joining each month after that.

The resulting cross-sectional dataset is comprised of 372,198 observations total, of whom 49,14% are males and 50,86% are females. Figure 1 illustrates the distribution of wages of both men and women where the horizontal axis denotes hourly wages and vertical axis is the frequency. Wages have been transformed into 100 quantiles where 1 is lowest level of wages and 100 is the highest.



The graph clearly shows that there are more males in high level wages quantiles and more females in quantiles with low wages which means that men on average have higher wages. Now we proceed with more detailed analysis of the wage difference.

3.3 Decomposing the wage gap

One way to get an insight into how different factors contribute to the Canadian wage gap is to perform a quantitative analysis using Mincer and Blinder-Oaxaca models described in chapter 1. Application of the Mincer model with various regressors can shed some light on how much of the difference in wages can be explained with different variables and how much of the difference remains after accounting for all available variables.

Another conventional way to evaluate contributors of explained part of the wage gap is to

use Blinder-Oaxaca decomposition to see how different the gap would be if one group had the same value of a variable as the comparison group.

3.3.1 Mincer model application

To investigate how the role of full/part-time status factors into wage determination we estimate some models using weekly wages rather than hourly wages. Wages are transformed with natural logarithm as we are interested in percentage difference. We start with the simplest model without any independent variables other than gender to see the difference of average weekly wages of two groups. The female coefficient has a value of -0.33 which means that females' wages are about 33% lower than that of males. The adjusted R-squared of this regression was only 0.0473 so that a lot of variation remains unexplained (Table A.1). We then include a part-time dummy variable which takes the value 1 if a respondent usually works less than 30 hours per week on their main (or only) job, and 0 otherwise. Including a part-time variable in the regression immediately shifts the adjusted R-squared to 0.4872 and brings the wage gap down to 15% (Table A.2). This implies that more than half of difference in weekly wages is attributable to the fact that women compared with men are more likely to take part-time jobs which are paid less than full time jobs (Hirsch, 2004).

A similar simple regression with hourly wages shows that females' hourly wages are about 15% less than males' wages, a figure very close to the estimated gap in weekly wages after controlling for part time status. (Table A.3). Interestingly, a set of human capital and job characteristics (excluding job classification) variables explain less than 1% of the gap. Explanatory variables include: number of paid overtime hours, number of unpaid overtime hours, age (in squared form), marital status, whether the job is

permanent, union status, firm size, usual hours of work, education, tenure, and province (Table A.4). Motivation for the inclusion of these variables was described in chapter 1. Nevertheless, the Adjusted R-squared of the regression is 0.4277 and, all variables are statistically highly significant. A possible reason for new variables to have such small impact on the gender dummy coefficient is small difference of their values between genders. The extent to which discrepancies in human capital between men and women explains the remaining gap will be seen in the Blinder-Oaxaca model evaluation.

In order to account for differences in occupations we use a set of 502 mutually exclusive dummy variables from the National Occupational Classification, which provides a systematic classification structure to identify and categorize the entire range of occupational activity in Canada. The basic principle of classification of the NOC-S is based on the kind of work performed. Occupations are, therefore, identified and grouped primarily in terms of the work usually performed, this being determined by the tasks, duties, and responsibilities of the occupation.

The inclusion of occupational dummy variables not only drives the adjusted R-square value up to 0.6046, but also explains about 4.5% of the gap (Table A.5). This implies that occupational segregation takes place in Canada and males are more likely to have employment in better paid occupations. The extent to which the wage gap is attributable to the full set of NOC occupational binary dummies is very close to results in (Drolet, 2002b) and (Baker & Drolet, 2010). Such similarity suggests that broad occupational and industry controls pick up the occupational segregation sufficiently. We will address the occupational segregation issue in subchapter 3.4 in more detail.

Since the dependent variable is the log of hourly wages, estimated coefficients represent the percentage change in hourly wages of a person from a small change in the continuous variables or (approximately) the discrete change if a binary variable takes the value one compared to zero.

It is important to emphasize limits of the firm size variable in this estimation. Since it takes one of only three values, it does not pick up rich variety of enterprises in Canada. Therefore, results of the estimation are not to be considered as test of ‘same pay for work of same value’ principle since many potentially important enterprise-level characteristics remain unobserved.

3.3.2 Blinder-Oaxaca model application

A Blinder-Oaxaca decomposition is performed with observations divided into groups based on gender. The set of independent variables is the same as with the Mincer model but in the first regression the occupation classification variables are excluded. The Blinder-Oaxaca decomposition is performed with correction for a selection bias correction available in Stata. We use both hourly and weekly wages to contrast results with those from the Mincer model.

In the case of weekly earnings, the decomposition output reports the difference in mean predictions by groups to be 0.3146 which means that the estimated gender wage gap is about 32% (Table A.6). The explained part is 0.1855 and the unexplained component is 0.1291. The explained part is almost completely attributable of usual hours of work variable, which is estimated to account for 0.1720 in the explained part.

As was similarly found with the Mincer model, the estimated earnings gap based on hourly earnings is 0.1418 (Table A.7), indicating that females’ hourly earnings are

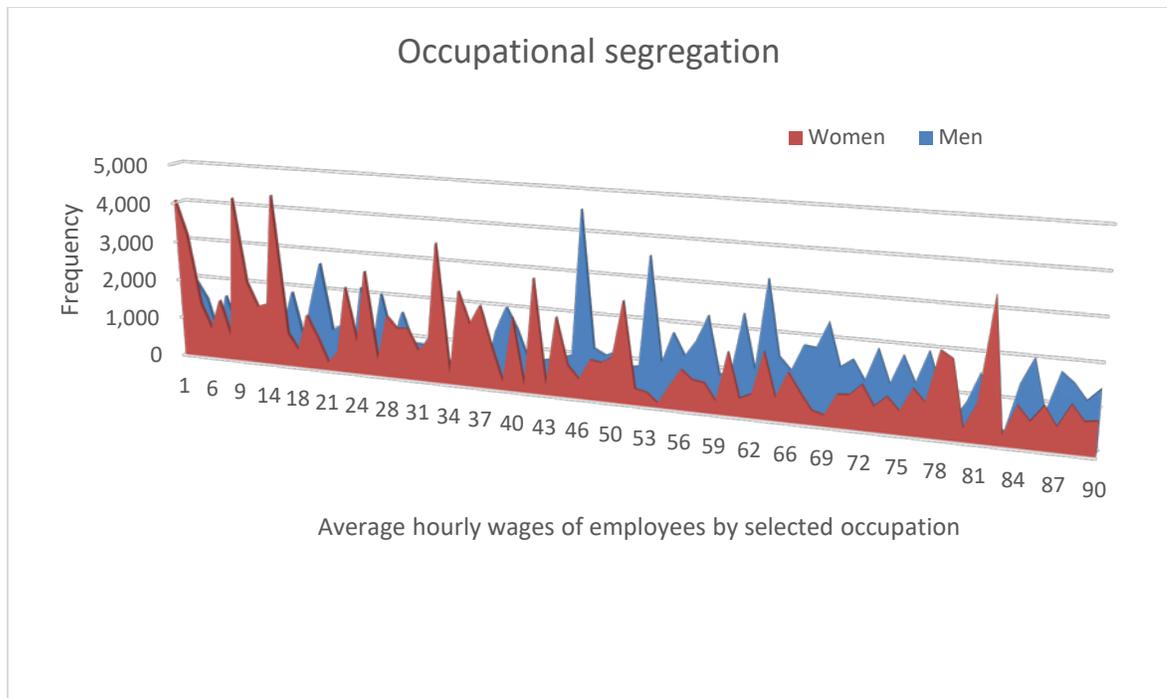
14% less than males'. The explained part has a magnitude of 0.004, implying that available set of factors (occupational classification is not included) does not explain the gap.

The remaining gap estimations are very close between Mincer and Blinder-Oaxaca models, which suggests that that Mincer model is not affected by selection bias.

The magnitude of the explained part is around 2.85% of the remaining gap, meaning that difference in human capital between men and women explains less than three percent of the remaining gap. This supports the suggestion that human capital variables have only a small effect on the wage gap due to small differences of human capital between genders.

3.5 Occupational segregation

As it was shown in subchapter 3.3.1 men are more likely to occupy jobs with better compensation and a significant portion of the wage gap can be attributed to variations in occupations. One way to illustrate which group is larger in numbers in well paid occupations (on basis of average earnings in the occupation) is to build a histograms for both genders with occupations on the horizontal axis sorted from left to right from low paid to well paid occupations, and contrast the numbers of group members in each occupation. The graph below shows that there are more men on jobs with higher level of earnings and more women in occupations with lower compensations.



The frequency of men in occupations exceeds that of women in two thirds of the quantiles. The unequal number of dominated quantiles is explained by the fact that there are more men in labor force (Table A.6), and that the women’s quantiles are less balanced. That is, the proportion of women in women-dominated quantiles is substantially higher than the proportion of men in male-dominated quantiles.

The reasons of such segregation, however, remain unclear and requires further research. Question relating to the kind of motives employers have to prefer men for better paid jobs and whether the motives have an economic rationale or are based on sociological phenomena are of paramount interest. Recent research (Isaac, Lee, & Carnes, 2009) indicates that gender bias is the difference in ratings or perceptions of men and women with identical qualifications, and show negative bias against women being evaluated for positions traditionally or predominantly held by men. Investigations of

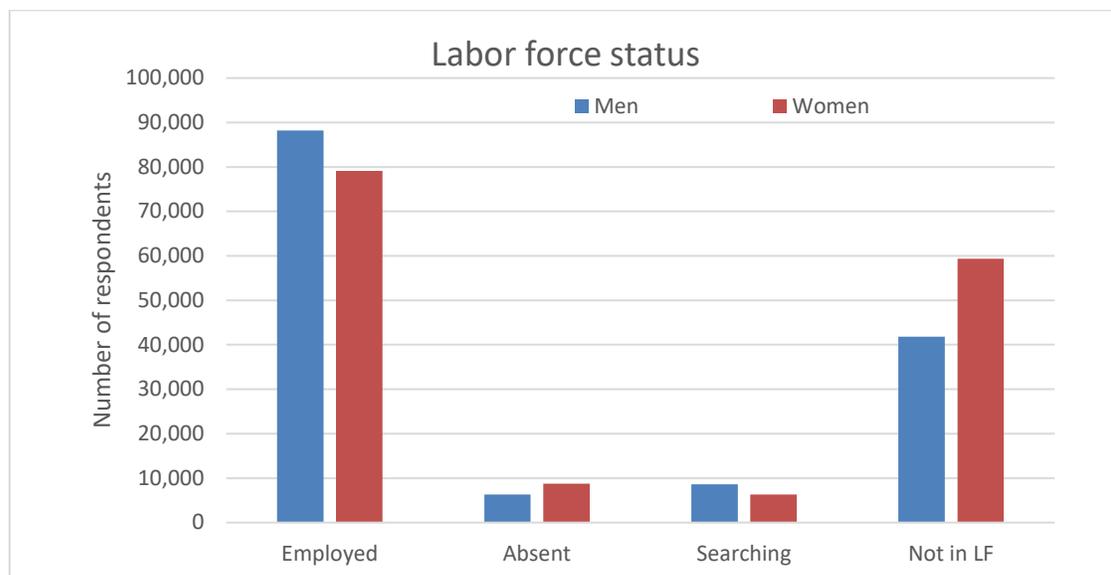
employers preferences and their evaluation from an economic rationale standpoint is a potentially fruitful direction of future study.

3.6 Indirect labor costs

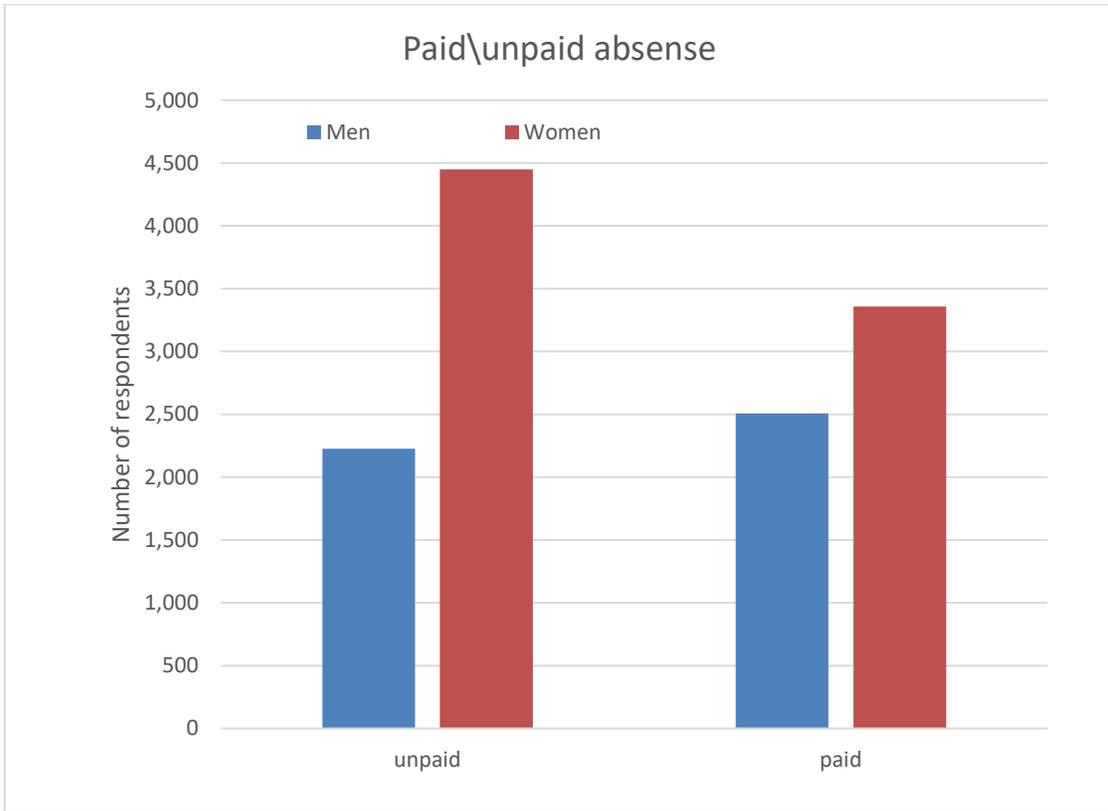
As it was mentioned in chapter 1, some preferences of employers have an indirect effect on employers' labor costs, for example, high absenteeism and labor separation rates within a population group would discourage an employer to hire the group's members due to high risks of need for replacement.

We use descriptive statistics on cross-section data to depict labor force participation and work absence ratios within female and male groups. We also take advantage of longitudinal data to see how likely are members of both groups to change labor force membership status, employment status and occupation.

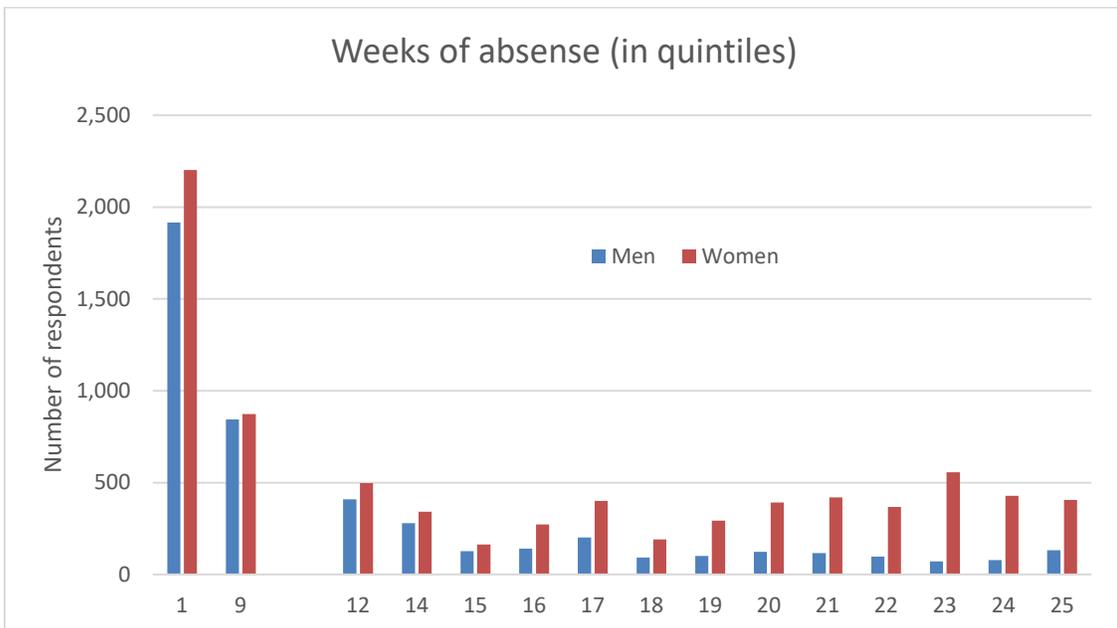
According to LFS 2015, males are more likely to have employed status or be unemployed and be searching for job, while employed females are substantially more likely to have an absence from work.



Full labor force participation results are provided in appendix A, (Table A.8) : labor force status. Women are more likely to have both paid and unpaid absence (Table A.9).



Women are also highly more likely to have longer absence.



The tendency of women to take more leaves of absence and associated employers' costs may be one of factors that influence employers' decisions to prefer men in certain more highly paid occupations, and correspondingly allowing more career advancement for men than women.

4. Conclusions

We outlined various theoretical frameworks for gender wage gap studies, reviewed some of the previous research dedicated to the subject of the gender wage gap in Canada, and analyzed the subject with available labor market data. Previous research has used similar approaches to estimating the determinants of the gender wage gap and has reported similar results, however the complexity of gender gap and gender wages discrimination phenomena means continued interest in and study of the phenomenon. In our analysis we used conventional Mincer and Blinder-Oaxaca models for the gap assessment and decomposition. We also used descriptive statistics to investigate the nature of occupational segregation.

Results of the empirical analysis were consistent in both models estimated, with men estimated to earn about 31% more based on weekly earnings though more than half of the difference is attributable to differences in the usual number of work. With hourly earnings, the earnings gap is estimated to be about 14% after controlling for other factors. Decomposition techniques showed that human capital factors do not explain the wage gap completely.

We provided some evidence of occupational gender segregation, with descriptive statistics showing that Canadian employers may have incentives to prefer men, as women are more likely to cause more indirect labor costs. Employers' indirect costs and search

for other motives not exhaustible by human capital factors may also be constructive direction of further research.

Occupational segregation has proven to be an important factor in the Canadian gender wage gap context. About 5 percentage points of the 14% gap is attributable to occupational variation. However very detailed occupational controls have not proven to be advantageous over traditionally used set of broad occupations and industry controls. It is important to keep in mind that jobs of same occupation class in different firms can noticeably vary and, correspondingly, can be paid very differently. The fact that firm variety is almost completely unobserved leaves results of quantitative analysis open to interpretation. It may be that the marked variation in earnings even after controlling for a large set of occupational differences arises from the characteristics of the firms themselves. Further disaggregating the gender wage gap with controls for enterprise-level factors (as well as how men and women may be differentially sorted according to such factors) is an interesting avenue for future research.

Bibliography

- (US) Council of Economic Advisers . (2015). *Gender pay gap: recent trends and explanations*. [Washington, D.C.]: Council of Economic Advisers (U.S.).
- Akbari, A. H. (2004, 10 01). The gender wage gap in New Brunswick. *Halifax, N.S. : GPI Atlantic, 2004*, p. 92.
- Anker, R. (1997, Autumn). Theories of occupational segregation by sex: An overview. *International Labour Review*, pp. 315-339.
- Arrow, K. (1971). *The theory of discrimination*. Princeton University.
- Backman, J. (1959). *Wage determination; an analysis of wage criteria*. Princeton, N.J., Van Nostrand.
- Baker, M., & Drolet, M. (2010, December). A New View of the Male-Female Pay Gap. *Canadian Public Policy*, pp. 429-464.
- Baker, M., Benjamin, D., Cegep, A. D., & Grant, M. (1995, August). The Distribution of the Male/Female Earnings Differential, 1970-1990. *The Canadian Journal of Economics*, pp. 479-501.
- Baxter, E. (2015). *How the Gender Wage Gap Differs by Occupation*. Center of American Progress.
- Bayard, K., Hellerstein, J., & Neumark, D. (2003). New evidence on sex segregation and sex differences in wages from matched employee-employer data. *Journal of Labor Economics*, pp. 887–922.
- Becker, G. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition*. NEW YORK: NATIONAL BUREAU OF ECONOMIC RESEARCH.
- Bergmann, B. (1974). Occupational segregation, wages and profits when employers discriminate by wage or sex. *Eastern Economic Journal*, 2-3.
- Biblarz, T. J., Bengtson, V. L., & Bucur, A. (1996, Feb.). Social Mobility Across Three Generations. *Journal of Marriage and Family*, pp. 188-200.
- Blau, F. D., Gielen, A. C., & Zimmermann, K. F. (2012). *Gender, Inequality, and Wages*. Oxford Scholarship Online.

- Blinder, A. S. (1973). Wage Discrimination: Reduced Form and Structural Estimates. *The Journal of Human Resources*, 436-455.
- Brunswick, L. A. (1982). *Employment Standards Act*. Legislative Assembly of New Brunswick.
- Brunswick, P. o. (n.d.). *Facing the Economic Imperative. New Brunswick's Five Year Wage Gap Action Plan 2005-2010*. Fredericton NB E3B 5H1: Province of New Brunswick.
- Cain, G. (1987). The economic analysis of labor market discrimination: A survey. In O. A. Layard, *Handbook of Labor Economics* (pp. 693-785). North Holland.
- Charles, M. (2003, December). Deciphering Sex Segregation: Vertical and Horizontal Inequalities in Ten National Labor Markets. *Acta Sociologica*, pp. 267-287.
- Cool, J. (2010). Wage gap between women and men. *Background paper (Canada. Parliamentary Information and Research Service : Online)*, no. 2010-30-E.
- Cotton, J. (1988). On the Decomposition of Wage Differentials. *Review of Economics and Statistics*, pp. 236-243.
- de Singly. (1982). Mariage, dot scolaire et position sociale. *Économie et statistique*, pp. 7-20.
- Deaton, A. (1997). *The analysis of household surveys : a microeconomic approach to development policy*. The World Bank.
- Doeringer, P., & Piore, M. (1971). *International labour markets and manpower analysis*. Lexington: Manpower Administration (DOL), Washington, D.C.
- Drolet, M. (1999, December 20). The persistent gap: New Evidence on the Canadian Gender Wage Gap. *Income Research Paper Series*.
- Drolet, M. (2002). *The "who, what, when and where" of gender pay differentials*. Ottawa: Statistics Canada.
- Drolet, M. (2002a). *Can the Workplace Explain Canadian Gender Pay Differentials?* Guelph, Ont: Canadian Public Policy.
- Drolet, M. (2002b, March). New Evidence on Gender Pay Differentials: Does Measurement Matter? *Canadian Public Policy*, pp. 1-16.
- Drolet, M., & Mumford, K. (2012). The Gender Pay Gap for Private-Sector Employees in Canada and Britain. *British Journal of Industrial Relations*, pp. 529-553.

- Fortin, N., & Huberman, M. (2002). *Occupational Gender Segregation and Women's Wages in Canada: An Historical Perspective*. Toronto: University of Toronto Press on behalf of Canadian Public Policy.
- Fuller, S., & Stephens, L. (2004). *Women's Employment in BC: Effects of Government Downsizing and Employment Policy Changes 2001-2004*. Canadian Centre Policy Alternatives.
- Garen, J. E. (1985). Worker heterogeneity, job screening, and firm size. *Journal of political Economy*, pp. 715-739.
- Goldberg Dey, J., & Hill, C. (2007). *Behind the Pay Gap*. Washington, DC: American Association of University Women Educational Foundation.
- Gunderson, M. (1979, August). Decomposition of the Male/Female Earnings Differential: Canada 1970. *Canadian Journal of Economics*, pp. 479-485.
- Gunderson, M. (1998). *Women and the Canadian labour market : transitions towards the future*. Statistics Canada.
- Heckman, J. J. (1979, January). Sample Selection Bias as a Specification Error. *Econometrica*, pp. 153-161.
- Heckman, J. J. (1979, January). Sample Selection Bias as a Specification Error. *Econometrica*, pp. 153-161.
- Hegewisch, A., & Ellis, E. (2015). *The Gender Wage Gap by Occupation 2014 and by Race and Ethnicity*. Washington, DC: Institute for Women's Policy Research.
- Hirsch, B. T. (2004). *Why Do Part-Time Workers Earn Less? The Role of Worker and Job Skills*. Bonn, Germany: Trinity University and IZA Bonn.
- Isaac, C., Lee, B., & Carnes, M. (2009, October). Interventions That Affect Gender Bias in Hiring: A Systematic Review. *Academic Medicine*, pp. 1441-1446.
- Kidd, M. P., & Shannon, M. (1996). Does the level of occupational segregation affect estimates of the gender wage gap? *Industrial and Labor Relations Review*, 317-329.
- Kirkaldy, H. S. (1960, Jun). Review. *The Economic Journal*, pp. 384-386.
- Korkeamaki, O., & Kyyra, T. (2005). THE GENDER WAGE GAP AND SEX SEGREGATION IN FINLAND. *Finnish Economic Papers*, pp. 57-71.

- Kunze, A. (2008). Gender wage gap studies: consistency and decomposition. *Empirical Economics*, 63–76.
- Lazear, E. P. (1979). Why Is There Mandatory Retirement? *Journal of Political Economy*, 1261-1284.
- Lazear, E. P., & Moore, R. L. (1984). Incentives, Productivity, and Labor Contracts. *The Quarterly Journal of Economics*, v99 n2.
- Lim, U., Choi, Y. S., & Lee, H. (2015). Occupational skills and the gender wage gap in Seoul, Korea: a multilevel approach. *Ann Reg Sci*, 335–356.
- Lokshin, M. M. (2000, April). *Effects of Child Care Prices on Women's Labor Force Participation in Russia*. The World Bank.
- Miller, P. W. (1987, May). Gender Differences in Observed and Offered Wages in Canada. *The Canadian Journal of Economics*, pp. 225-244.
- Mincer, J. (1958). Investment in Human Capital and Personal Income Distribution. *Journal of Political Economy*, 281-302.
- Mincer, J. (1974). *Schooling, experience, and earnings*. New York: National Bureau of Economic Research.
- Mincer, J. (1995). Labor Force Participation of Married Women: A Study of Labor Supply. In U.-N. B. Research, *Aspects of Labor Economics* (pp. 63-105). Princeton University Press.
- Neumark, D. (1988). Employers' Discriminatory Behavior and the Estimation of Wage Discrimination. *Journal of Human Resources*, pp. 279-295.
- Oaxaca, R. (1973, October). Male–female wage differentials in urban labor markets. *International Economic Review*, pp. 693-709.
- Oaxaca, R. L., & Ransom, M. R. (1994). On discrimination and the decomposition of wage differentials. *Journal of Econometrics*, pp. 5-21.
- Perron, J. (2009, August 18). *N.B. wage gap between men, women widens*. Retrieved from CBC News: <http://www.cbc.ca/news/canada/new-brunswick/n-b-wage-gap-between-men-women-widens-1.838234>
- Pyatt, G. (1966). Review. *The Economic Journal*, 635-638.

- Reilly, K. T., & Wirjanto, T. S. (1999, August). Does More Mean Less? The Male/Female Wage Gap and the Proportion of Females at the Establishment Level. *The Canadian Journal of Economics*, pp. 906-929.
- Reiman, C. (2001). *The Gender Wage Gap in Australia*. University of Canberra.
- Reimers, C. W. (1983). Labor market discrimination against Hispanic and black men. *Review of Economics and Statistics*, pp. 570-579.
- Reimers, C. W. (1983). Labor Market Discrimination Against Hispanic and Black Men. *Review of Economics and Statistics*, pp. 570-579.
- Robb, R. (1978). Earnings Differential between Males and Females in Ontario. *Canadian Journal of Economics*, pp. 350-359.
- Ruijter, J. M. (2003). *Size and Causes of the Occupational Gender Wage-gap in the Netherlands*. European Sociological Review.
- Schafgans, M. M., & Stelcner, M. (2006). *Selectivity and the gender wage gap decomposition in the presence of a joint decision process*. London School of Economics and Political Science.
- Shapiro, D. M., & Stelcner, M. (1981, May). Male-Female Earnings Differentials and the Role of Language in Canada, Ontario, and Quebec. *The Canadian Journal of Economics*, pp. 341-348.
- Snijders, T. A., & Bosker, R. J. (1999). *Multilevel Analysis: An introduction to basic and advanced multilevel modeling*. Sage Publishers.
- Spence, M. (1973, August). Job Market Signaling. *The Quarterly Journal of Economics*, pp. 355-374.
- Treiman, D. J., & Hartmann, H. I. (1981). *Women, Work, and Wages: Equal Pay for Jobs of Equal Value*. Washington, DC: National Academy Press.
- Up, L., Ye Seul, C., & Heonyoung, L. (2015). Occupational skills and the gender wage gap in Seoul, Korea: a multilevel approach. *Ann Reg Sci*, 335-356.
- Vincent, C. (2013, September). Why Do Women Earn Less Than Men? A Synthesis of Findings from Canadian Microdata. *CRDCN Synthesis Series*.
- Weiss, A. (1995). Human Capital vs. Signalling Explanations of Wages. *The Journal of Economic Perspectives*, pp. 133-154.

Appendix A

Table A.1 (Mincer model with weakly wages, no explanatory variables):

Number of observations = 154927 Adjusted R-squared = 0.0473

<i>Variable</i>	Coefficient	t
<i>female</i>	-0.3290896	-87.66
<i>_ constant</i>	11.35101	4270.09

Table A.2 (Mincer model with hourly wages, no explanatory variables but “part time”):

Number of observations = 154927 Adjusted R-squared = 0.4872

<i>Variable</i>	Coef.	t
<i>female</i>	-.14855	-53.09
<i>part time</i>	-1.320622	-364.59
<i>_ constant</i>	11.50149	5769.82

Table A.3 (Mincer model with hourly wages, no explanatory variables):

Number of observations = 154927 Adjusted R-squared = 0.0243

<i>Variable</i>	Coefficient	t
<i>female</i>	-.1523533	-62.14
<i>constant</i>	7.763399	4471.88

Table A.4 (Mincer model with hourly wages, no occupational variables):

Number of observations = 132050 Adjusted R-squared = 0.4277

<i>Variable</i>	Coefficient	t
<i>female</i>	-.1458417	-67.86
<i>paid overtime</i>	.0069184	27.14
<i>unpaid overtime</i>	.0156698	52.80
<i>age</i>	.0356974	70.29
<i>age squared</i>	-.0003928	-66.28
<i>married</i>	.0407347	17.74
<i>part time</i>	-.1427556	-31.78
<i>permanent job</i>	.0242699	7.76
<i>unionized</i>	.1304002	54.23
<i>firm size (set of dummies)</i>		
2	.0371939	10.89
3	.0677087	18.84
4	.0899848	39.95
<i>usual hours at work per week</i>	.001072	6.68
<i>level of education (set of dummies)</i>		
1	.0294563	3.18
2	.0448069	4.73
3	.0854918	10.32
4	.1196521	13.37
5	.2228855	26.22

6	.2303648	27.76
7	.3024586	30.11
8	.3941013	46.70
9	.5067893	56.78
<i>tenure</i>	.0007823	69.76
<i>constant</i>	6.56452	479.98
<i>province (set of dummies)</i>	F(9, 132017) =	764.257

Table A.5 (Mincer model with hourly wages, full set of explanatory variables):

Number of observations = 132050 Adjusted R-squared = 0.6046

<i>Variables</i>	<i>Coefficient</i>	<i>t</i>
<i>female</i>	-.0915532	-41.85
<i>paid overtime</i>	.004509	20.77
<i>unpaid overtime</i>	.0085155	32.44
<i>age</i>	.0280342	64.90
<i>age squared</i>	-.0002991	-59.49
<i>married</i>	.0203798	10.60
<i>province (set of dummies)</i>		
<i>part time</i>	-.0740547	-19.25
<i>permanent job</i>	.0399334	14.76
<i>unionized</i>	.1158153	51.02
<i>firm size (set of dummies)</i>		
2	.0392595	13.52
3	.067546	21.79
4	.0955622	36.61
<i>usual hours at work per week</i>	-.0007901	-5.65
<i>level of education (set of dummies)</i>		
1	.0189252	2.45
2	.0263985	3.33
3	.041743	6.00
4	.0452372	6.01
5	.0903697	12.57
6	.0746349	10.59
7	.0901275	10.59
8	.1104404	15.18
9	.1600156	20.39
<i>tenure</i>	.0004928	51.56
<i>constant</i>	6.880246	545.75
<i>NOC (set of dummies)</i>		

Table A.6 (Oaxaca decomposition, weakly earnings):

Number of observations = 132050

<i>Variables</i>	<i>Coefficient</i>	<i>z</i>
<i>men group prediction</i>	11.3555	4148.16
<i>women group prediction</i>	11.0409	3731.19
<i>difference</i>	.3145992	78.04
<i>explained</i>	.1854974	51.25

<i>unexplained</i>	.1291018	50.82
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Table A.7 (Oaxaca decomposition, hourly earnings):

Number of observations = 132050

<i>Variables</i>	<i>Coefficient</i>	<i>z</i>
<i>men group prediction</i>	7.765459	4140.75
<i>women group prediction</i>	7.623661	4114.21
<i>difference</i>	.1417972	53.78
<i>explained</i>	-.0040445	-2.14
<i>unexplained</i>	.1458417	66.74

Table A.8 (Labor force status):

<i>Labor force status</i>	1	2	3	4	5	6	7	.	Total
<i>men</i>	88,209	6,316	853	7,381	339	41,827	4,858	33,107	182,890
<i>women</i>	79,145	8,763	254	5,746	310	59,335	4,726	31,029	189,308
<i>Total</i>	167,354	15,079	1,107	13,127	649	101,162	9,584	64,136	372,198

Detailed labor force status.

- 1 Employed, at work
- 2 Employed, absent from work
- 3 Unemployed, temporary layoff
- 4 Unemployed, job searcher
- 5 Unemployed, future start
- 6 Not in the labor force, able to work
- 7 Not in the labor force, permanently unable to work

Table A.9 (absence from work) :

<i>absence</i>	unpaid	paid	Total
<i>men</i>	2,226	2,508	4,734
<i>women</i>	4,449	3,357	7,806
<i>Total</i>	6,675	5,865	12,540

Curriculum Vitae

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