Union and Non-Union Wage Differential in Canada during the 1990's

by

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Major Paper presented to the

Department of Economics of the University of Ottawa

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

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ECO 7997

Ottawa, Ontario
December 2000

Abstract.

This paper treats the estimation of the structure of wages in union and nonunion sectors. The impact of unionization on earnings in Canada is analyzed using 1995 Survey of Work Arrangements micro data set. Using the conventional OLS procedure, the study finds a 12 percent wage differential between union and non-union worker. The results also indicate that there was no big change in the wage differential between 1980s and 1990s.

1. Introduction

Economists and other social scientists, labour unionists, and business people have debated the social and economic effects of unionism. Despite the extensive debate, however, there is no definitive answer to the question of what effects unions have on labour market outcomes. According to one perspective, the trade union is viewed as a monopoly organization, which can raise wages in the labour market above competitive levels. Assuming that the labour market is competitive, these wage increases have harmful economic effects, reducing employment and distorting the distribution of income. It plays an obstructionist role in our economy. According to another view, some people believe unions have beneficial economic and social effects. Trade unions, acting as collective bargaining organizations, can reduce relative wage differentials, earnings inequality, and induce higher productivity.

In 1920, Canada union membership was only the 9.4 percent on labour force. Recent statistics (1994) on union membership show that union membership accounts for about 33 percentage of the labour force (Akyeampong 1997). The possible reasons for the increase in union membership are that the demand for union representation has increased as a result of raising the net benefit to workers of union representation. Furthermore, the legislative changes have encouraged union growth. We can imagine that when their membership expands, unions will play major roles in determining the wages and working conditions of both organized and unorganized workers in Canada. Unions may also seek to influence government policy. For example, they have been involved in various forms of consultation with governments and, in some cases, representatives of the business community. What effects do their activity have on union workers, and on other workers? Do unions increase or decrease the overall level of income inequality? Together these questions form the main objective of this paper.

There are many robust empirical results that indicate that unionized workers tend to earn more than non-unionized workers do when all other factors are held constant. Also, some studies suggest that unions tend to reduce the overall dispersion of wages in the economy.[1] Of course, the overall effect of unions on wages will depend both on the effect of unions on the wages of different types of workers and on the types of workers tend to be unionized. In Canada, there is a developed empirical

literature indicating that unions provide their members with a significant wage premium. Early studies using aggregate data tend to show a positive wage differential of about 10 to 23 percent (MacDonald and Evans 1983; MacDonald 1983). Studies using micro data report a wage premium that was between 10 to 27 percent.[2] It was approximately 15 percent at the beginning of the 1970s, and then increased in the mid-1970s, peaking around 25 percent at the end of that period. It increased during the 1980s. (See Appendix C.) However, the Canadian estimates of the union and non-union wage differentials are currently quite dated. An updating of this research is unwarranted.

The main purpose of this paper is to extend existing research concerning the impact of unionism on relative wages in Canada during the 1990s. The plan of this paper is as follows. Section 2 briefly describes the details about the two opposing views of unionism and its economic effects. Section 3 covers the theoretical background for the union wage effect. Section 4 proposes a general OLS method approach to estimate the union and non-union wage equations and resulting wage gap decompositions. Section 5 surveys the early empirical work on the union and non-union wage differential in U.S. and Canada. The data from the 1995 work arrangement survey and results are presented in Section 6 and 7. Finally, I conclude in section 8.

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[1] See, example, Freeman (1980), who find that about 20% of the increase in male wage inequality in the United States between the 1970s and 1987 could be attributed to the decrease in unionization over that period.

[2] Grant, Swidinsky and Vanderkamp 1987; Robinson and Tomes 1984; Simpson 1985; Kumar and Stengos 1985, 1986; Green 1991; Swidinsky and Kupfeschmidt 1991; Lemieux 1993; Doiron and Riddell 1994.

2. Background

2.1 Two perspectives on Unionism

There has been a widespread discussion about the effects of unions on the labour market. At a very general level, there are two broad perspectives of unionism, each of which leads to a different view of the institution. According to one view, unions function as monopoly organizations, and have power to raise wages. According to the competing perspective, unions can be seen as a collective voice associated with representation of workers within enterprises (see Appendix B).

Many economists view unions largely as monopolies in the labour market and believe that its primary economic impact is to raise members' wages above competitive levels. The analysis of unions as monopolies focuses on the magnitude of the union markup of wages and traces the ways in which this markup causes firms to lower employment and output, thereby harming economic efficiency and altering the distribution of income.

The basic tenet of neoclassical economics is that the free exit and entry of workers on the labour market produces a Pareto-optimum situation. As long as the exit-entry market mechanism is viewed as the only efficient adjustment mechanism, institutions such as trade unions must necessarily be viewed as obstacles to the optimal operation of the labour market. For example, wage increases above the competitive level may induce firms to raise product prices. In particular, in response to wage increases, firms will try to reduce their production costs, creating increases in the capital-to-labour ratio, which means using more capital per worker, while the level

of satisfaction is held constant. In economic term, this is a substitution effect. In addition, the average cost of production may rise with output especially in small firms due to increasing wage. This is known as diseconomies of scale. Consequently, increasing labour wages force firms to operate ineffectively. In this case, some workers will lose their jobs, or their job opportunities will be reduced. In other words, high quality workers will find it easier to get jobs, and lower quality workers will encounter more difficulties finding a job. When unemployment rates rise, government would need to spend more money to take care the unemployed. Society also suffers welfare losses from unionism. Further losses result from strikes, inefficient work rules, decreases in managerial discretion, and a standardized compensation structure that does not provide optimal work incentives.

On the other hand, unions can be treated as the members' bargaining agent, providing a collective voice for worker preferences. The union collective bargaining voice (or so-called institutional-response), combined with firms' responses to unionism, helps to improve productivity and the functioning of internal labour markets. There are several reasons why collective bargaining voice may be more effective than individual bargaining.

First, without a collective organization, the incentive for the individual to take into account the effects of workers actions on others is likely to be too small to encourage action, because individuals may not believe that top managers will listen or accept their personal opinion. Second, without a union, workers who are not prepared to exit or who have low outside opportunities will be unlikely to reveal their true

preferences to their bosses, such as the safety of working condition. Their hesitation is due to their fear of possible retribution, such as layoff and a diminished chance of promotion. Unionism can protect workers simply by creating an efficient and open communication environment. Third, collective voice organization provides workers with a means of communicating with management. Safety conditions, lighting, heating, the speed of the production line, the pension plan, and other policies could be viewed as public goods—a non-exclusive and non-rivalrous good. With respect to public goods at the workplace, the union can add up members' preferences in much the same manner as a government can add up voters' preferences. In short, unionism allows workers to communicate collectively to management. Collective rather than individual bargaining with an employer is necessary for effective exchange of ideas at the workplace. In summary, unions can improve morale, reduce labour turnover, reduce training costs, and pressure management to be more efficient in its operations.

Since unions have both monopoly and collective-voice functions, the key question for understanding unionism in Canada relates to the relative importance of these two perspectives. Do unions function as a primarily monopolistic institution, or are they an institution that is the collective voice that induces socially and economically beneficial effects? To answer this question, researchers have studied a variety of data that makes distinctions between union and nonunion establishments and between union and nonunion workers. The vast majority of the studies focus on the differences in wage outcomes between the union and non-union firms.

2.2 Union membership in the labour market

Table 2.2.1 provides several measures of the quantitative significance of unions in the Canadian labour market. In some periods union density (union membership as a percentage of non-agricultural paid employment) declined in absolute terms, such as between 1921 and 1936, 1956 and 64, and 1992 and 98. However, there is an evident substantial upward trend in all these measures. Union membership as a proportion of the labour force increased from about 9.4 percent in 1921 to about 25.6 percent in 1998. Over the same period, union membership as a proportion of nonagricultural paid workers has increased from 16 percent to 32.5 percent. Union membership levels in Canada have increased fairly steadily over the past 70 years, surpassing 4 million members in 1990. Union membership in Canada grew by 20.1 percent, and non-agricultural paid employment increased by 37.0 percent between the years 1978 and 1998. The causes of union growth have long been a subject of scholarly research and discussion.

Furthermore, according to Statistics Canada 1998 report, approximately 76 percent of public sector employees belong to a union, compared to about 24 percent of private sector employees.[3] Public sector employees account for approximately 18 percent of the labour force but represent over 40 percent of the total trade union membership in Canada. There are more male union members than female union members, although the number of women in unions is growing, and the number of

[3] Source: Adapted from Statistics Canada. (1999, January). Labour Force Update: An Overview of the 1998 Labour Market Ottawa: Statistics Canada p.35 (Catalogue no. 71-005-XPB).

men is declining. In the 1960s, about 80 percent of union members in Canada were men. In the 1990s, that percentage had fallen to about 55 percent. One possible reason for decline in the percentage of male membership is the shift in employment from goods-producing industries, which are heavily unionized, to the service sector of the economy, which is less unionized.

Table 2.2.2 shows the extent of union organization in several countries in 1990. The union density in Canada (36 percent) is higher than that in Japan (25 percent), U.S.A (16 percent), France (10 percent), Germany (32 percent), Netherlands (26), Portugal (32 percent), Spain (11 percent), and Switzerland (27 percent). But it is lower than the union density in Australia (40 percent) and many other European countries. It is interesting that the gap between coverage and membership is much greater in European countries.[4] In North America the gap is small; however, U.S. union coverage and membership are less than half those of Canada at about 16 and 15 percent. The industrial relations systems in European countries and Japan are quite different from North American countries (Canada and United States have similar industrial relations systems). In the North American/British/Australian model, the union has sole representation rights for a group of workers, which is not the case in many European countries. This may be a main reason that explains why developing levels of unionization are different between European countries and North American countries. Of course, other factors, such as workers' behavior and legislative developments, should play important role, too

Table 2.2.1 Union Membership in Canada, 1921-1998

Year	Total (in thousands)	Percent of Labour Force	Percent of Non-Agricultural Paid Workers
1921	313	9.4%	16.0%
1926	275	7.5	12.0
1931	311	7.5	15.3
1936	323	7.2	16.2
1941	462	10.3	18.0
1946	832	17.2	2.9
1951	1,029	19.7	28.4
1956	1,352	23.4	33.3
1960	1,459	22.8	32.3
1962	1,423	21.5	30.2
1964	1,493	21.3	29.4
1966	1,736	23.2	30.7
1968	2,010	25.3	33.1
1970	2,173	27.2	33.6
1972	2,388	27.6	33.9
1974	2,732	29.5	35.2
1976	3,042	30.5	36.9
1978	3,278	31.2	38.4
1980	3,397	29.2	35.7
1982	3,617	29.3	35.7
1984	3,651	29	37.2
1986	3,730	28.4	36.0
1988	3,841	28.2	34.8
1990	4,031	28.5	34.5
1992	4,089	28.4	35.7
1994	4,078	27.8	35.6
1996	4,033	27.0	33.9
1998	3,938	25.6	32.5

Source:
Labour Canada, *Directory of Labour Organizations in Canada*, Catalogue L2-2-1922 (Ottawa: Minister of Supply and Services, 1992), various issues, Table 1 (1970-1992).
Labour Canada, *Directory of Labour Organizations in Canada*, Table 1 (1980-98).

[4] Coverage: Workers report no union affiliation but their jobs are covered by a union

Table 2.2.2 Union membership, OECD countries, 1990

Country	Membership (percent of employed)	Coverage (percent of employed)
Australia	40	80
Austria	46	98
Belgium	51	90
Canada	36	38
Finland	72	95
France	10	92
Germany	32	90
Japan	25	23
Netherlands	26	71
New Zealand	45	67
Norway	56	75
Portugal	32	79
Spain	11	68
Sweden	83	83
Switzerland	27	53
United Kingdom	39	47
Union States	16	18

Source OECD (1994 chart 5.1). Coverage rates in France, Germany, Japan, and Portugal refer to 1985, 1992, 1989, and 1991, respectively.

3. Union Wage Effects: Theory

Economists have devoted considerable attention to understanding the impact of unions on labor market outcomes, in particular to the estimation and interpretation of union-non-union wage differentials. One of the harshest criticisms of trade unions is the claim that unions increase income inequality in the labour market. According to the monopoly model, some workers are displaced from unionized firm as a result of union wage gains, which expands the supply of labour to nonunion firms. Reduced wages in non-union labour sector can be expected. Therefore, trade unions not only affect union wages; its effects also reach the non-union sector.

The collective-voice perspective, however, suggests very different effects on income inequalities than the monopoly view does. According to this view, union decisions are based on a political process. And given that the majority of union members might have earnings below the mean wage in any workplace, unions can be expected to seek to reduce wage inequality within that bargaining unit. In other words, unions help workers who earn below-standard wages to reach average wage level so as to improve their living standard and bring all members toward the same wage level. Also, collective bargaining reduces managerial discretion in the wage-setting process, and this should also reduce differences among similarly situated workers.

Union effects on union and non-union wages

Collective bargaining will enable unions to raise wages relative to a competitive, non-union labour market equilibrium, thus creating a wage differential between union and comparable non-union workers. According to the two-sector model, the magnitude of the union and non-union differential depends on: (1) the wage elasticity of labour demand in each sector, (2) the power of the union to raise wages in the organized sector, and (3) the elasticity of labour supply in the union sector.

The basic theory of the union wage impact can be illustrated with a two-sector model, as shown in Figure 3.1.1 (One is the union sector; the other is the non-union sector). This framework is also call Spillover Effects of Unions on Wages and Employment. In sector B (non-union worker) the labour market is competitive; therefore, equilibrium wage in the absence of collective bargaining is W_0. We assume that workers in union sector (sector A) could increase the wage to W_u, and Employment in sector A will decrease to E_U^1. The labour quantity ($E_U^0 - E_U^1$) in sector A will be forced to leave job market and try to search jobs in Sector B; in particular, increasing labour supply from S_N to $S_N^{'}$ (as show in Figure 3.1.1 a = $E_U^0 - E_U^1$). In the competitive labour market, when the labour supply increases, the new equilibrium wage is decreased to W_N and the total number of unemployed

workers should be equal to the distance (a-b). $\hat{d} = \frac{W_U - W_N}{W_N}$ is what we so call Union and Non-union wage differential in economy.

As a result, the observed union relative wage advantage ($\hat{d} = \frac{W_U - W_N}{W_N}$) will tend to be greater than the true absolute effect of the union on its members' real wage. This true absolute effect ($\hat{d}_t$) is defined as $\hat{d}_t = \frac{W_U - W_0}{W_0}$ and is not observed. The union relative wage advantage ($\hat{d}$) is greater than true absolute effect ($\hat{d}_t$) because W_N is lower than W_0.

Another possible impact of unionism is the so-called threat effects. When the union wage increases, it tends to depress the wage of unorganized workers along the lines of the two-sector model shown just above. The non-union firms might be tempted to raise the wages of non-union labour in order to discourage their own employees from unionizing.[5]

Obviously, the increase in the wage in the union sector will force some union worker out of job and try to find a job in non-union sector. Therefore, supply of workers curve in non-union sector will shift to S_N^1. In response to the threat of union entry, non-union employers are assumed to increase their wages to W_N^* (lies between W_0 and W_U^1). Because wages increase in non-union section, employment will

[5] Non-union wage increases resulting from the threat of union entry are shown in Figure 3.1.2.

decrease to E_N^* from E_N^0. Now union relative wage advantage $\hat{d}_2 = \frac{W_U - W_N^*}{W_N^*}$ is smaller than the absolute effect of unions $\hat{d}_1 = \frac{W_U - W_0}{W_0}$. In other words, when wages in union sector are raised due to the threat effect, the Union and Non-union wage differential will decrease. This result is in the opposite direction of Spillover effects.

In addition, when the wage increases in the union sector, labour that is forced out of job in the union sector may not move to non-union sector and search for jobs. Workers' rejection of lower-paying non-union jobs would be a possible reason that workers want to wait for union job. In such a case, we call the phenomenon 'Wait Unemployment' (Figure 3.1.3). Wait unemployment in the union sector will reduce the spillover of displaced workers to the non-union sector. The magnitude of the non-union supply shift of non-union labour to the right should be less than in spillover effects (Supply curve shift from S_N to $S_N^{"}$ in non-union sector). Of course, if enough non-union workers decide to search for union jobs, the labour supply curve in the non-union sector could even shift to the left. In this case, it would resemble the Threat Effect.

Finally, assuming unionism raises product prices, the demand effects may result from a shift of demand away from more costly products produced in the union sector to the non-union sector. As long as labour supply to the non-union sector is not perfectly elastic, these demand effects will put upward pressure on wages in the non-union sector.

Figure 3.1.1
Spillover Effects of Unions on Wages and Employment.

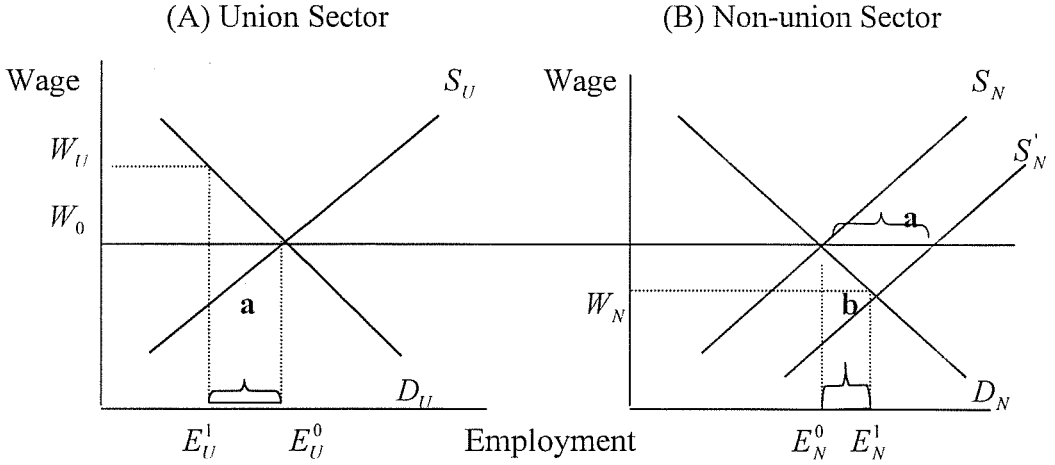


Figure 3.1.2
Union Wage impact with a threat effect

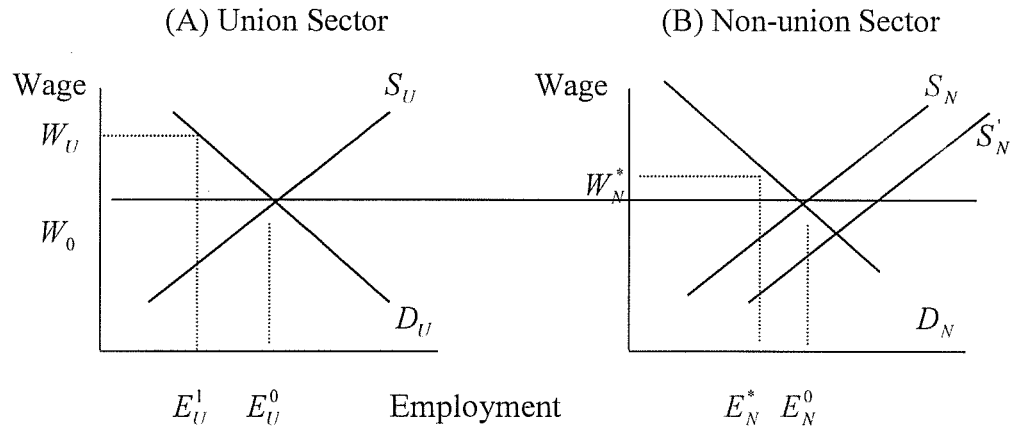
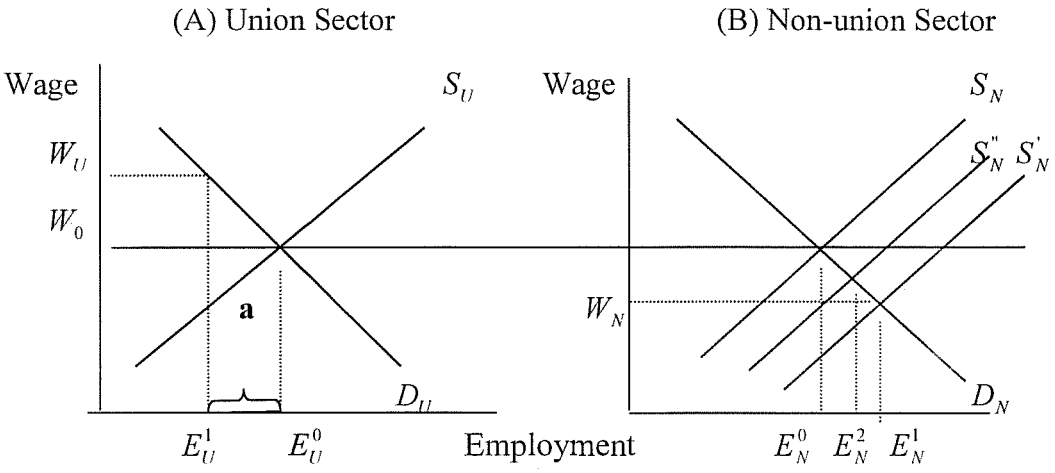


Figure 3.1.3
Union wage impact with wait unemployment



4. Econometric Specification and estimate problem

4.1 Measurement of the differential

The impact of unionization on wages has received more attention from economists than other aspect of union behavior. This is because it is easier to analyze than some of the other issues, such as their impact on productivity or profitability. Most of the empirical research has been directed at measuring the union-non-union wage differential in terms of the percentage difference in wages between union and otherwise comparable non-union workers.

What is the average observed union/non-union relative wage differential? According to most of the literature, we compare the average wage of union versus non-union workers. The proportionate difference in wages would be given by:

$$\hat{d} = \frac{\overline{W}_u - \overline{W}_n}{\overline{W}_n} \qquad (1)$$

where $\overline{W}_u$ is average union member worker wage, and $\overline{W}_n$ is average non-union labour wage. This is the raw differential.

In practice, most studies estimate equation (1) as a semi-logarithmic wage equation in which the dependent variable is the natural logarithm of the wage, and the right-hand side variables include education, age, and other wage determinants. Equation (1) can be decomposed as follows:

$$\hat{d} = e^{D} - 1 \qquad (2),$$

where $D = \ln\overline{W}_u - \ln\overline{W}_n$ is estimated by the substitution of the characteristics of the

individual or group into the estimates of (1) and (2).[6] For the percentage differential should be multiplied by one hundred (Benjamin D., Gunderson M. and Riddell W. 1998).

4.2 Econometric Specification: Aggregate cross-section estimation and Micro cross-section estimation.

Aggregate Cross-section estimation

Before the end of 1960s, all estimates of union wage effects were based on aggregate or grouped data. Data were typically aggregated by industry. When data are available on average wages only for all workers, how might the researcher estimate union wage effects? Suppose the log of the geometric mean wage in industry k is a weighted average of the logs of the geometric means of union and nonunion wage, we can write:

$$\overline{\ln W}_k = P_k \overline{LnW}_{uk} + (1 - P_k)\overline{LnW}_{nk} \qquad (3)$$

where P_k is the proportion unionized in industry k. The relative wage differential ($\hat{d}_k$) can be expressed as follows:

$$\hat{d}_k = (W_{uk} - W_{nk})/W_{nk} = (W_{uk}/W_{nk}) - 1 \quad \text{or} \quad 1 + \hat{d}_k = W_{uk}/W_{nk}. \qquad (4)$$

Taking logs of equation (4) and then taking means yields:

$$\overline{LnW}_{uk} = \overline{LnW}_{nk} + Ln(1 + \hat{d}_k). \qquad (5)$$

[6] Although this method of estimating wage differentials is standard in the literature (Parsley, 1980; Halvorsen and Palmquist, 1980), Kennedy (1981) shows that this estimator is biased. The bias is expected to be small if D is large relative to its variance.

Substituting for $\overline{LnW}_{nk}$ in equation (5), canceling terms, and assuming $\hat{d}$ does not vary by group or with P, yields:

$$\overline{LnW}_{k} = \overline{LnW}_{nk} + P_{k} Ln(1+\hat{d}) \qquad (6)$$

The next step is to model the determinants of wages. In order to put such an equation into a form that can be estimated, the procedure is to postulate a vector C of j observable worker and industry characteristics that determine non-union wages. That is:

$$\overline{LnW}_{nk} = f(C_{kj}). \qquad (7)$$

Then the wage equation can be estimated in the following form:

$$\overline{LnW}_{k} = f(C_{kj}) + P_{k} Ln(1+\hat{d}) + s \qquad (8)$$

where s is the error term. Also, an estimate of $\hat{d}$ is obtained from the regression coefficient D on P_k by $\hat{d} = e^{D} - 1$ (this is similar that I mention in equation (1) and (2) above). Equation (8) is what we so call aggregate cross-section equation.[7]

A large number of studies have obtained estimates of union wage effects from such an equation. Yet this approach is replete with problems. First, theoretically it is required to use of the mean of the log wage to estimate wage equation, however, virtually all studies in fact use the log of the arithmetic mean. Hirsch (1986) estimates such an equation and finds that estimated union wage effects are in fact quite sensitive to the choice of the dependent variable. Moreover, Estimation using ordinary least squares (OLS) is dependent on unionism and all variables in $\hat{d}$ being exogenous.

Obviously, this assumption is violated since union membership is not exogenous. Unfortunately, previous studies found that aggregate estimates obtained using two stage least square and three stage least squares are highly erratic and very sensitive to specification of the wage and union equations (Lewis 1986).[8] Furthermore, OLS estimates of D are also likely to be biased and inconsistent if D is correlated with P or any variable in C_j. Each of these cases is likely. A fundamental problem of the aggregate cross-section estimation is that the entire wage structures within the union and nonunion sectors are different. Therefore, it is necessary to separate estimation of wage equations by union status. However, of course, this is impossible with available grouped data.

Micro Cross-section estimation

Fortunately, recently we have rich micro data (including separate observations on union and non-union workers) to make our estimation procedures more powerful. According to the simple vision of this approach, one might estimate a micro cross section equation as follows:

$$\ln W_i = \sum_{j=0}^{k} \beta_j X_{ij} + \alpha U_i + e_i \qquad (9)$$

[7] See Lewis 1986 for more detail.

[8] Two-stage least squares regression (2SLS) is a method of extending regression to cover models which violate ordinary least squares (OLS) regression's assumption, specifically models where the researcher must assume that the disturbance term of the dependent variable is correlated with the cause(s) of the independent variable(s).

Where $\ln W_i$ is the natural log of the wage of individual *i*, X_j is a vector of *k* earnings determining characteristics (and when $X_0 = 1$, so that β_0 is constant). U_i is a dummy variable; if individual *i* is a union member, U_i is equal to 1 and 0 otherwise. α is the coefficient on U_i and it is interpreted as an estimate of the average log differential D as we mention before in equation (2). e_i is an error term.

The estimation has some major problems, however. For example this functional form does not allow the structure of earnings to differ between union and non-union workers. Second, the union status is treated as exogenous, leading to the possibility of simultaneity bias.[9] A preferable approach which allows for differences in the earnings structure among union and non-union workers, is the separate estimation of union and non-union wage equations:

$$\ln W_{ui} = \sum_{j=0}^{k} \beta_{uj} X_{uij} + e_{ui} \qquad (10)$$

$$\ln W_{ni} = \sum_{j=0}^{k} \beta_{nj} X_{nij} + e_{ni} \qquad (11)$$

Then the average logarithmic union and non-union wage differential is estimated as:

$$\overline{d} = \overline{\ln W_u} - \overline{\ln W_n} = \sum_{j=0}^{k} (\hat{\beta}_{uj} - \hat{\beta}_{nj}) \overline{X_j} \qquad (12)$$

where $\overline{X}_j$ can represent either union means, non-union means, or all worker means. This version basically holds the characteristics fixed. The equation (12) also can be expressed as follows:

[9] See the measurement problem section to get more detail about this bias.

$$\overline{d} = \sum_{j=0}^{k} (\hat{\beta}_{uj} - \hat{\beta}_{nj})[p\overline{X}_{uj} + (1-p)\overline{X}_{nj}] \qquad (13)$$

where p is the fraction of union workers in entire samples. This version allows different mean characteristics.

4.3 Measurement Issues

There are several problems involved in measuring the union and non-union wage differentials. Generally, the problems can be separated into two main types. One is the data measurement problem. The other shortcoming is inherent within the model.

Data problem

Until the late 1960s, there was no large survey of workers containing the required information on wages, and wage-explanatory control variables that also classified the workers by their union status (See Appendix A). Data were typically aggregated by industry, which obvious by means a lack of separated data on union and non-union wages. Union wage effects are likely to differ according to demographic traits, such as age, sex, race, as well as vary according to industry characteristics. In other words, the wage structures are different between union and non-union workers. This inherent data problem will bias our estimation, which always generates an empirical challenge.

Moreover, in order to measure the pure union-non-union wage differential, the most important task is to control for other wage determining factors, which will help in separating cause and effect. For example, when we want to compare wage differences between union and non-union sectors, it is important to control for other wage-determining factors such as experience, skill, motivation and training. If we omit these variables, it is likely to impart a bias in wage gap estimates, and therefore not reflect a pure union impact on wage. Unfortunately, in empirical studies some factors that affect labour quality, such as motivation, and reliability may not be observed by researchers. Therefore, there are no available complete data that enable researchers to fully control those factors.

Finally, Lewis (1986) argues that omitted-variable or selectivity bias is not the only source of error in wage gap estimates. There are also three types of imperfections in the data other than failure to observe unobservable that would cause estimate error:

1. **The omission of fringe benefits in the dependent wage variable**. In the most commonly used household survey, the wage measures that exclude employer expenditures for fringe benefits that are not paid directly to workers. However, fringe benefits should be considered as part of the wage, or at least not ignored in the analysis.
2. **The use of an annual or weekly wage instead of an hourly wage**. If unionism produces a union and non-union differential or gap in hours worked, wage gaps

estimated from annual or weekly earnings will differ from those estimated from hourly wage.

3. **Misclassifications of workers by union status.** Lewis found that even a small fraction of misclassified workers (e.g. union workers mis-reported as non-union workers or vice versa) might lead to a large bias in wage gap estimates obtained by panel methods. Overlooking this seemingly minor factor could bias our estimate significantly.

Issues with specification

The more recent micro data for which the unit of observation is the individual enables analysts to compare the wages of union and nonunion workers who have similar demographic characteristics and work in the same industry, occupation and area. The more recent micro data for which the unit of observation is the firm enables analysts to compare the wages of union and non-union establishments in the same industry and geographical area. In addition to these cross sectional data sets, more recent data on workers before and after unionization (panel data) is also available. These data permits researchers to observe what happens to the wage of an individual upon becoming a union member or upon giving up membership.

Although we have rich data that enable us to estimate wage differences more accurately, the more recent estimation models still have their limits. The problem with the cross sectional studies is that the comparison of different persons may lead one to misinterpret wage differences as differences due to trade unionism, when they

are actually due to differences in the unobserved skills and abilities of workers. For example, because employers pay more per hour of labour in the union sector than in the non-union sector, they have a stronger incentive to hire better workers. If the measures of worker skill and ability in the data are inadequate, then the typical cross sectional estimate will overstate the union wage effect for workers comparable in all observable respects other than unionism.

Some economists use longitudinal data to estimate union wage effect. This technique is called a before and after comparisons estimation. The primary advantage of longitudinal data is that they allow the researcher to control for unmeasured person specific quality differences. Longitudinal data provide observations on the same individuals over time. With longitudinal data, person-specific characteristics that are conventionally unobservable to the research (e.g., reliability and motivation) can be taken into account if these characteristics are constant for each individual over time. When a first difference is taken, the unobserved effect disappears. Thus, longitudinal wage change models do not suffer from the sort of selectivity or omitted variable bias that occurs on Micro Data Cross Section studies.

Nevertheless, a longitudinal data have their own difficulties. By limiting analysis to individuals who change union status, the resulting data leads one to infer union effects from a small sample of persons, some of whom may have changed jobs for particular reasons that make them inaccurate representatives of the average worker.

Besides, to the extent that workers voluntarily change jobs in order to improve their earnings, the before-after comparisons are likely to understate the union wage effect, because workers going from union jobs to non-union jobs are likely to require as large an improvement in wages as those going in the other direction. Such an effect is called an asymmetry. Because wages are higher under unionism, few persons will voluntarily give up jobs in the union sector, but those who do will, according to this line of reasoning, enjoy wage gains comparable to those of persons moving from non-union to union jobs, even though unions raise wages. This consideration further reveals how such data understates the gain that would be obtained by an average worker.

It is for these reasons that neither cross section nor before-after studies of the impact of unions on wages are perfect. The most that one can hope for is that the two types of analyses yield roughly consistent pictures of what unions do to wages.

Measurement problem solution

Generally, economists use cross-section micro data with a variety of least squares techniques to estimate the union and non-union relative wage differential, because using micro estimation model is better than aggregated cross section estimation. However, this approach has two main problems that are associated with the unobserved characteristics. First, changes in the economic and social environment will modify the costs and benefits of union status for individual workers. In other words, person-specific qualities change over time. When we try to compare each

year's union effect on wage, it may not pertain to other years. Second, there is the selectivity bias problem. Union status is the outcome of decisions made by individual workers. The omission from the estimated earnings equations of unobserved variables which are related to wages such as motivation and work ethic will not bias the estimates of the union wage impact if these unobserved factors do not also influence the decisions relating to union status. For instance, if higher quality workers prefer to join workers with similar capability, then the higher wage in union sector should be caused by the high quality of workers and not by the union. These important control variables are often omitted from estimating equations.

To address this problem, many economists try to use a different method to estimate union and non-union relative wage differential. The most popular adjusting selection bias method is Heckman-Lee two steps procedure (Heckman 1979).

Correction for selectivity bias involves the creation of an omitted variable based on an estimated selection rule. The union-non-union wage differential D and union status U may be viewed as the simultaneous outcomes of a market process and, their reduced form equations may be represented as

$$D = Y\gamma_d + \xi_d \quad (14) \quad \text{and} \quad U = Y\gamma_u + \xi_u \quad (15)$$

where Y is a matrix of characteristics including those contained in X_u and X_n, and other factors which influence demand and supply behaviour. The first stage of the selectivity bias correction involves consistent estimation of the union status equation (15) by probit regression. The calculated values $\hat{U} = Y\hat{\gamma}_u$ of U from this first stage are

then used as a proxy for omitted variables λ_w and λ_n from equations (10) and (11), respectively, where

$$\lambda_w = -f(\hat{U}) / F(\hat{U}) \quad (16) \quad \text{and} \quad \lambda_n = f(\hat{U}) / [1 - F(\hat{U})] \qquad (17)$$

These variables are called inverse Mills ratios. F is the cumulative distribution of a standard normal random variable, and f is its density function. The second stage applies ordinary least squares estimates to the corrected equations.

$$\ln W_w = \sum_{j=0}^{m} \alpha_{wj} X_{wj} + \eta \lambda_w + \mu_w \qquad (18)$$

$$\ln W_n = \sum_{j=0}^{m} \alpha_{nj} X_{nj} + \eta \lambda_n + \mu_n \qquad (19)$$

However, many econometricians and applied researchers have come to feel that indiscriminate use of these techniques should be avoided. H. Gregg Lewis (1986), for example, in an influential survey of the effect of union on wages, summarized his review of estimates computed using some type of selectivity bias corrections this way:

> I admire the ingenuity that has gone into development of simultaneous equations econometrics to deal with this problem. Yet in the present context the techniques are not working. I know little more about the magnitude of the selectivity bias in OLS wage gap estimates after completing the survey in this chapter than if I had ignored the ... estimates reported here.[10]

[10] H. Gregg lewis, *Union Relative Wage Effects: A Survey*, University of Chicago Press, 1986, p.59.

A problem with the Heckman-Lee procedure is that the results can be sensitive to changes in model specification or sample. In fact, it is hard to find instruments (right hand side variables on equation 14 and 15) to identify the union status equation which are omitted from the wage determination equation.[11] Lewis noted that estimates using these techniques seemed to exhibit much greater variability across studies than estimates produced by using generally simpler techniques.

Economists are still interested in researching the wage differential between union and non-union workers. Recently, most economists have suggested the use of cross section micro data with ordinary least squares to estimate the union and non-union relative wage differential. It is because wage gap estimates based on OLS regressions seem to be more stable and realistic than those that are connected for selectivity bias. Therefore, in this paper I will use ordinary least squares without adjusting selective bias to estimate wage differential.

5. Early Empirical Result in U.S. and Canada

Much of the early work on union wage gains was summarized in 1986 in an influential book by H. Gregg Lewis, then at the University of Chicago in the United States. He reviewed almost 200 empirical studies of the union impact on wages. The early work found a union wage effect of 10 to 20 percent on average, with

[11] The instrumental variable, which are also commonly referred to as instruments, is a proxy variable for the lagged regression but with the property that it is uncorrelated with the error term

considerable variation over time and among different groups of workers. In Canada, the union and non-union wage differential is about 10 to 25 percent (Benjamin, Gunderson and Riddell 1998). The union impact appeared to decline during inflationary periods, and to rise during recessions. It was high for workers such as airline pilots, coal miners, and skilled construction workers, and low for workers such as unskilled labourers and employees in competitive industries. Data availability imposed important limitations on these early studies. The union and non-union wage differential often had to be inferred from the average wage and the extent of unionization within an industry. Freeman and Medoff's (1984) empirical estimates show that the results for unionized workers in both the manufacturing and non-manufacturing sectors are a much narrower distribution. In contrast, the results for nonunion workers show a much more dispersed pattern of earnings. However, unionized establishments have lower wage dispersion among their workers, and this lower dispersion can be explained statistically by a difference in pay practices. Unionized workplaces are more likely to pay a standard hourly wage rate and less likely to use merit pay, bonuses, performance review, and other incentive mechanisms.

Variation in the Union Wage Impact across different separateling variables

The estimate of the difference between the hourly wages of comparable union and non-union workers could be shown by selecting groups. The hourly wage as well

as the differential vary considerably across labour markets, industries, occupations and demographic groups.

Considering the factor of age, the union wage effect is generally the largest for the youngest workers, who are the lowest paid (all other factors held constant). The smallest union wage effect is for the prime aged members, who are the highest-paid. This result implies that unions not only raise the age-earnings profile, but also flattens it and makes it less concave. Also, wage equations estimated with a quadratic for experience (or age) term suggest a U-shaped relationship between the wage differential and experience. The result for Canada is similar with that from the U.S (Benjamin, Gunderson and Riddell 1998; Freeman and Medoff 1984; and Lewis 1985).

Considering the tenure variable, there is a similar pattern, with the union and non-union wage differential being the largest for those with the lowest level of seniority, who are again the lowest-paid (all other factors held fixed). The union wage effect is larger for the less experienced worker. When tenure increases, the wage differential decreases. The result is the same as the case for the age variable. In Canada, the evidence was confirmed by several studies such as Kumar and Stengos (1986), and Swidinsky and Kupferschmidt (1991).

Taking into consideration the factor of race, the union wage effect in the U.S. is larger in non-whites sector than in whites sector. However, this result is not accepted by every economist. Mellow (1983) argued that if black people do realize a larger wage advantage in the union sector, they would prefer to join unions, but the

fact is that most black people stay in non-union sector. He found that black union members are of relatively higher quality when it compared to non-union black workers and would earn higher wages than non-union black workers, all other factors held fixed. This would be another possible reason to explain why union wage effect is larger for non-whites. Note that this is an illustration of the selectivity problem. The pure union effect would be less under this scenario. In this area, most studies came from U.S. In Canada, only a few people, such as Lemieux (1993), researched the wage differential by race.

Considering the sex variable, the research shows a divergent pattern. Despite uniformly higher wages received by men, unions raised male wages somewhat more than female wages in 1979. As with blacks, however, analyses in other years show a diverse pattern of union effects on male and female wages, suggesting that unions raise wages of the two groups by roughly the same percentage, although in 1979 they benefited men more than women (Freeman and Medoff 1984). U.S. studies generally find that union and non-union gender wage differential are approximately equal.

However, in Canada there is evidence of a larger union and non-union wage differential for females. Recently, the most well-known study in this area is by Doiron and Riddel (1994). They used three Canadian micro data sets during the period 1981 to 1988.[12] Unionization has two offsetting effects on the average earnings of Canadian males and females. Females benefit less overall from

[12] The 1981 Survey of Work History (SWH), the 1984 Survey of Union Membership (SUM), and the 1988 Labour Market Activity Survey (LMAS).

unionization because they are less likely to be covered by a collective agreement. However, unions raise female wages more than those of males do. These two effects tend to offset each other. Also, male-female unionization gap narrowed considerably during the 1980s (from 12 percentage points in 1981 to 9 percentage points in 1988), and the drop in the gender unionization gap prevented an increase of 7 percent in the overall union-non-union wage differential between men and women.

Considering the skill level variable, highly skilled workers typically gain less from unionization than their semi-skilled and unskilled counterparts. The wage differential declines as skill level increases. Unionism tends to standardize wages, and hence skilled workers generally benefit less from joining union than do less skilled workers. There is a negative relationship between skill level and the union and non-union wage differential. For example, in Canada low skilled workers and semi-skilled workers receive a union/non-union wage differential of 28.9 percent and 17.9 percent, respectively. Highly skilled workers gain only 12.4 percent (Simpson 1985). Research by Kumar and Stengos (1986) and Robinson and Tomes (1984) also confirm this result.

Taking into account the worker's occupation, Hamermesh (1971), Oaxaca (1993), Bloch and Kushin (1978), Duncan and Leigh (1980), and others present evidence on union wage differentials by occupation. Bloch and Kuskin, using May 1973 CPS data, estimate an overall log differential of 0.11. They find the largest differentials for labourers and transport equipment operators (0.39 and 0.32

respectively), differentials of 0.16 to 0.19 for craftsmen, non-transport operators, and service workers, and differentials close to zero for non-production occupations.

Unions win much larger gains for blue-collar than for white-collar workers. In Freeman and Medoff (1984) the estimated gain for blue-collar workers is 19 percent on average, whereas the gain for white-collar workers is an only 4 percent, on average. They also found that union wage policies contribute to the equalization of wage by decreasing the difference between covered blue-collar workers and uncovered white-collar workers. Antos (1983) found a wage differential of 0.01 and a compensation (wages plus fringes) differential of 0.07 among white-collar workers, compared to differentials of about 0.15 among blue-collar workers. In short, the literature to date indicates that the union wage differential by occupation is significantly larger among blue-collar workers than among white-collar workers (see Appendix A).

Across industries, union and non-union wage differentials are largest in construction, and tend to be smaller in manufacturing than in non-manufacturing. In manufacturing, although white-collar workers earn an average of 49 percent more than blue-collar workers overall, their estimates indicate that this premium is only 32 percent in unionized enterprises. In the non-manufacturing sector, where white-collar workers average 31 percent more in earnings than blue-collar workers, the estimated differential is only 19 percent in firms which are unionized. Among blue-collar workers, gains are greatest for transport operators and labourers and lowest for service workers and operatives outside of transportation. These results were expected since

blue-collar workers are likely to be less skilled than white-collar workers. In Canada, there seems to be no detailed research in this area.

The union and non-union wage differential has also been found to differ across geographical regions. Unions have large effects in the relatively unorganized South and West, since wage levels are relatively lower, all other factors held fixed. The effects are more modest in the Northeast and the Central area in U.S. (Freeman and Medoff 1984). In Canada, the wage differential varies across the five Canadian regions, ranging from the highest on Prairies to the lowest in Ontario and western provinces.[13] The high differential on the Prairies is not surprising, considering that it is a region where agricultural and service industries are over-represented. The union and nonunion wage differential tends to be higher in rural communities and in the agricultural and service industries. Some of these regional effects are probably entangled with sector effect (Renaud 1997).

The union and the non-union wage differential do differ with firm size or establishment size. A large literature has found higher wages in larger firms or plants (Mellow, 1983; Kwoka, 1983) within the manufacturing sector, even after accounting for measured worker quality differences, and several studies find the effects of size to be larger in non-union firms than in union firms. Freeman and Medoff (1984) report that average firm size in an individual's industry of employment positively affects wages for union and non-union workers. However, the coefficient in their non-union wages equation is 80 percent larger than that in the union equation, so firm size effect

greater for non-unionized workers. Bloch and Kusin (1978), using a similar framework, find a positive effect of size on wages in the non-union sector, but no significant effect in the union sector. Mellow (1983) finds that the union/non-union wage differential is much larger in small firms, and that flatter union earnings profiles with respect to schooling and experience are restricted to workers in larger firms. In Canada, Benjamin, Gunderson, and Riddell (1998) attribute this negative relationship between union and non-union wage differentials and firm size to the union threat effect. This outcome may reflect several forces. The most important reason is that because of the economies of scale in large firms, union organization becomes cheaper and leads unorganized firms to match union wages in order to avoid the unionization of their workforce. The wage differential declines as firm size increases, confirming that workers employed by small firms gain more from unionization than those working in large firms.

Finally, considering the factor of industry sector, there is also a substantial variation in the union wage effect. Freeman and Medoff (1984) used the Current Population Survey to estimate the union wage effect in sixty-two industries, and found very small effects of less than 5 percent in thirteen of the industries surveyed and large effects of 15 to 35 percent in twenty-four of the industries. Freeman and Medoff (1984) found that in the United States, the union wage impact tends to be smaller in the public than in the private sector. Canadian evidence generally supports the conclusion that the union wage impact is smaller in the public sector. Larger union

[13] Western provinces include Alberta and British Colombia.

and non-union wage differentials are found in the private sector compared to the public sector. Robinson and Tomes (1984) find a value of 27 percent in the public sector compared to a value of 34 percent in the private sector. Also, Simpson (1986) concludes that union and non-union wage differentials are significantly lower in the public than in the private sector for each skill group. One possible reason for the above finding is that public sector unions have weaker power than do private sector unions, such as bargaining and strike rights.

6. Data and Variables

The empirical analysis presented in this paper is based mainly on micro cross-sectional data drawn from the November 1995 Survey of Work Arrangements (SWA), sponsored by Human Resources Development Canada and conducted twice by Statistics Canada.[14] The 1995 SWA is based on a sample of approximately 29,000 households. Like the Labour Force Survey, the SWA collected information on the labour market activities and demographic characteristics of the working-age population.[15] It covered additional information of interest, such as place of work, job permanency, multiple job-holding, work-time preferences, and union status. For each

[14]To my knowledge, the Survey of Work Arrangement 1995 is among the newest micro data sets which includes union status and collective agreement coverage in Canada.

[15] The LFS is the main source of information on vital labour market data in Canada. It covers 52,000 households across Canada. The LFS provides a wide range of information on employment, unemployment, and labour force participation. The information is available by demographic characteristics such as age, sex, level of education, and family situation. Information is also available by industry, occupation, job tenure, and class of worker. Major redesign of the survey occurred in 1997. The most

individual in the sample, the SWA person file contains information on the rich variety of work arrangements among Canadian workers, such as job characteristics, work patterns, and earnings in 1995.[16] It updates and expands upon the 1991 SWA, and is integrated with the Labour Force Survey.[17] These data sets are primarily focussed on a comparison of work arrangements for paid employees (the self-employed were covered only in the 1995 survey) between 1991 and 1995.

The analysis focuses on paid workers. The initial total SWA sample includes 42,324 cases. In order to estimate the empirical model properly, we restrict data cases. First, 16,455 individuals were eliminated because either they were unemployed or out of the labour market during the survey period. Of the remaining 25,869 individuals, an additional 10,694 were excluded, because either they did not report their union status or coverage and wage rate, or because they were self-employed and had more than one job.[18] These restrictions reduced the working sample to 15,175 observations. Obviously, these restrictions may affect our results. However, there is nothing we can do unless data are improved.

The SWA includes a measure of job tenure (experience on the current job). This availability of information on job tenure is an important advantage, as many studies of union and non-union wage differential have no information on labour force

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recent changes provide a number of improvements the the data, including wages and union status, and more detailed information on job status and hours worked.

[16] For details about the sampling techniques, refer to 1995 Survey of Work Arrangements User Guide.

[17] The 1995 survey gathered information not collected by the previous 1991 survey on : firm size, employee benefits, unpaid overtime, and preference for fewer or more hours of work.

[18] Canadian labor legislation requires that all individuals in the bargaining unit receive the wage and working conditions stipulated in the collective agreement, whatever these individuals are union members or

experience. Usually, they use age and years of education to calculate a proxy for tenure. The earnings measure used is hourly earnings. The hourly wage rate is calculated by dividing the usual earnings per week by the usual number of weekly working hours.

Table 6 provides the means of the dependent variable and selected explanatory variables used in the OLS wage regressions. As we can see, the greatest differences between union and non-union workers are in the values for tenure (a greater proportion of non-union workers have under five years, and a greater proportion of union member workers have over five years), the proportion of unionized workers who are in the public sector (substantially higher for the public sector), and age distribution (a greater proportion of union members are over thirty-five and a greater proportion of non-union members are under thirty-five years old). These variables are used to estimate equations (10) and (11). The wage equations (10) and (11) include the following exogenous variables: gender, tenure, public, age, education, marital status, firm size, industry; occupation, main job type (full-time or part-time worker), and region. These are the regressor elements of X.

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not. Therefore for measuring the impact of unionization on earnings, collective agreement coverage can be see as union members.

Table 6. Variable constructed from the WAS and their sample means

Label	Variable Definition	Full sample	Union Sample	Non-union Sample
Union	Respondent is a union members	0.42	---	---
Wage	Average hourly wage	13.075	16.715	10.951
Lnw	Log of the hourly wage rate	2.5707	2.8163	2.3934
Male	Respondent is male	0.5	0.53	0.47
T112m	Respondent's tenure with employer between 1 to 12 months	0.24	0.11	0.33
T15y	Respondent's tenure with employer between 1 to 5 years	0.26	0.19	0.31
T610y	Respondent's tenure with employer between 6 to 10 years	0.20	0.22	0.18
T1120y	Respondent's tenure with employer between 11 to 20 years	0.19	0.29	0.13
T20up	Respondent's tenure with employer over 20 years	0.11	0.19	0.054
Public	Public-sector worker	0.22	0.43	0.073
Private	Private sector worker	0.78	0.57	0.927
Age2024	Respondent is between 20 to 24 years old	0.097	0.045	0.14
Age2534	Respondent is between 25 to 34 years old	0.27	0.26	0.29
Age3544	Respondent is between 35 to 44 years old	0.31	0.37	0.27
Age4554	Respondent is between 45 to 54 years old	0.19	0.24	0.15

Age5564	Respondent is between 55 to 64 years old	0.063	0.071	0.056
Married	Respondent is Married	0.69	0.76	0.63
Ehs	Respondent has a high school diploma	0.21	0.19	0.23
Ep2nd	Respondent has a some post-second	0.09	0.068	0.1
Ep2ndc	Respondent has a postsecondary college	0.33	0.37	0.3
Eud	University degree	0.16	0.2	0.13
Atlantic	Atlantic province include Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick	0.19	0.17	0.2
Quebec	Respond region is Quebec	0.19	0.23	0.17
Ontario	Respondent is living in Ontario	0.32	0.31	0.33
Prairie	Respondent is living in a Prairie province	0.13	0.14	0.12
West	Respondent is living in Alberta or British Columbia	0.17	0.15	0.18
Fulltime	Full time worker	0.8	0.88	0.75
Parttime	Part time worker	0.2	0.12	0.25
F19d	Reference group is 19 or less at all locations	0.22	0.045	0.35
F2099	20 to 99 persons employed at all locations	0.16	0.12	0.19
F100500	100 to 500 persons employed at all locations	0.18	0.24	0.14
F500up	Over 500 persons employed at all locations	0.41	0.57	0.29

The geometric mean of wages for the full sample is (the mean log wage) $2.57. The mean wage for union sector is higher than the mean wage for the full sample, but the mean wage for non-union sector is lower than the mean wage for the full sample. Table 6 also provides the union densities -- 42 percent are covered by collective bargaining agreements and union membership.

7. Empirical Results

Union and non-union differentials were computed using equations (10), (11), (12) and (13) without any adjustment modeled for selectivity bias for entire samples. The estimation includes fifty- eight independent variables reflecting individual, human capital, industry and workplace attributes (13 industry and 21 occupation groups variables). Table 7.1 provides the main results of interest, which concern the determinants of union and non-union wages. In both cases, the R^2 is substantial for cross-section regressions, indicating that an important part of the variation of wages is explained by the variables in the analysis. The adjusted R^2 of union section is 0.485 and non-union adjusted R^2 is 0.596. Obviously, the coefficient of determination adjusted R^2 on union sector is lower than that of the non-union equation. Some explanatory variables have less predictive power for the wage in union sector than in the non-union sector. The highest adjusted R^2 (0.63) is found for the entire sample, for which union status is included as an independent dummy variable. The union

variable has a positive relationship with wage (11 percent effect on the wage). A union/non-union hourly wage rate differential of 12.1 percent is obtained, which is almost same in last 1980s report by Canadian studies. They are within the 10 to 20 percent range found by aggregated studies, and the 10 to 25 percent range reported by using individual micro data.

Table 7.1 Estimates of union and non-union wage equations unadjusted

Variables	All Sample	Union	Non-Union
Differential	---	0.121	
Lnw	2.5707	2.8163	2.3934
Male	0.177 (0.006)*	0.154 (0.009)	0.187 (0.008)
Age:			
A2024	0.026 (0.014)	0.121 (0.035)	-0.004 (0.016)
A2534	0.18 (0.013)	0.273 (0.033)	0.134 (0.016)
A3544	0.233 (0.013)	0.311 (0.033)	0.2 (0.016)
A4554	0.241 (0.014)	0.326 (0.033)	0.2 (0.018)
A5565	0.183 (0.016)	0.273 (0.035)	0.13 (0.021)
A6569	0.042 (0.044)	0.197 (0.076)	-0.066 (0.056)
Married	0.072 (0.006)	0.053 (0.008)	0.08 (0.009)
Edu:			
Ehs	0.088 (0.008)	0.09 (0.012)	0.088 (0.011)
Ep2nd	0.109 (0.01)	0.098 (0.016)	0.113 (0.014)
Ep2ndc	0.172 (0.008)	0.164 (0.011)	0.176 (0.011)
Eud	0.33 (0.011)	0.297 (0.015)	0.363 (0.014)
Fulltime	0.045 (0.007)	0.003 (0.011)	0.061 (0.01)
Public	0.049 (0.01)	0.04 (0.01)	0.092 (0.019)
Exp:			
T15	0.055 (0.007)	0.023 (0.013)	0.062 (0.009)
T610	0.152 (0.008)	0.128 (0.013)	0.156 (0.011)
T1120	0.222 (0.009)	0.183 (0.013)	0.247 (0.013)
T20up	0.287 (0.011)	0.228 (0.014)	0.379 (0.018)
Region:			
Atlantic	-0.136 (0.008)	-0.128 (0.011)	-0.132 (0.012)
Ontario	0.078 (0.007)	0.054 (0.009)	0.1 (0.01)
Prairie	-0.055 (0.009)	-0.07 (0.012)	-0.036 (0.013)
West	0.08 (0.008)	0.061 (0.011)	0.095 (0.012)
Firm size:			
F20b	-0.024 (0.016)	-0.077 (0.028)	0.0001 (0.021)

F2099	0.024 (0.016)	0.008 (0.025)	0.031 (0.021)
F100500	0.074 (0.016)	0.051 (0.024)	0.08 (0.022)
F500up	0.111 (0.016)	0.094 (0.024)	0.116 (0.021)
Union	0.113 (0.007)	---	---
Constant	1.886 (0.033)	2.092 (0.05)	1.837 (0.052)
F	437.642	101.920	224.375
R^2	0.632	0.485	0.599
Adjusted R^2	0.63	0.48	0.596
Observations	15127	6344	8783

Equations include controls for 13 industry and 21 occupation groups.
All samples: treat union as the dummy variable
* are standard errors.

Results for the Control Variables

The estimates for the coefficients of the control variables are generally consistent with previous empirical findings. Also, the sign patterns of the estimated coefficients are generally as expected. Being male has a significant and positive effect on the hourly wage, ranging from a 15.4 percent in the union sector to a larger 18.7 percent in the non-union sector. These results confirm Doiron and Riddell's (1994) findings and are consistent with the view that unions tend to reduce wage discrimination against women.

The relationship between age and wages is also consistent with previous findings. The estimated age coefficients follow the expected inverted U profile. Wages increase with age until about age 54, at which point they start to decline in both sectors. The relationship between age and wages has stronger effect in the unionized sector.

Married workers earn significantly more in both sectors compared to single workers (5.3 percent more in the unionized sector and 8 percent in the non-unionized sector). These results are similar to the findings of Christofides and Swidinsky (1994) and Kumar and Stengos (1986) during 1980s in Canada. In fact, age is already included as a regressor in the regression, so this effect for being married is in addition to the age effect.

There is no surprise that the public sector has positive effect on labour wages, and is much stronger in non-union sector (4 percent effect on the wage in union sector and 9 percent in non-union sector). Many previous studies, such as Simpson (1985)

and Robinson and Tomes (1984), found that the public sector wage premium is lower for unionized workers than for non-unionized workers.

Education is positively related to hourly wage rate in both sectors, but the relationships are much stronger in the non-unionized sector. These estimates reveal progressively higher wage rates with more advanced levels of education. These results confirms previous findings that unions diminish the impact of market forces on wages by providing their members with a flat union premium that declines with productivity-related characteristics.

The Table 7.1 also shows there is 0.3 percent effect for full-time work on wages in union sector and 6 percent in non-union sector. This result is similar to Lemieux (1993) and Kumar and Stengos (1986), both of which report a positive relationship between full time job status and the labour wage.

There is a positive relationship between tenure and the hourly wage rate. Wages increase with tenure in both union and non-union sector. However, the relationship is stronger in the non-unionized sector. This result is similar to those reported by Green (1991), Swidinsky and Kupferschmidt (1991), and Robinson and Tomes (1984).

Finally, there is positive relationship between firm size and wages in both the union and non-union sector. As firm size increases, wages increase. Generally, in the non-union sector it has a stronger effect on wages than in the union sector. In addition, the regional wage pattern is consistent with that found in other studies, with the higher wage regions being Ontario and the Western provinces, followed by

Quebec and the Prairies, and the Atlantic provinces. The same applies for firm size, where the positive relationship between wages and firm size is much stronger in the non-union sector.

7.2 Union effect for selected groups in the labour market

There is an alternative method for calculating the union/non-union wage differential. The union and non-union wage differential is a global mean for all workers in the sample. In the previous regressions, the differential is estimated by the coefficient of the union status variable, holding all other factors constant and using the global sample. Equations of the form (10) and (11) are estimated for the entire sample. It is also feasible to estimate differentials by separating the sample according to the characteristic of interest. We can take the average values of the regressors of selected groups for each variable and insert them into the equations. The differential is estimated using fitted values of wages rather than the estimated coefficient of a variable for union status. The estimated equations for the union workers and the non-union workers are used separately.

To begin with, we take the estimated equations for the union and non-union samples, and take the mean value of the exogenous variables and insert them into equations. Secondly, we solve these equations and take the fitted valves for $\ln \hat{W}_{Ui}$. Finally, we take the means. It gives fitted or adjusted means of union versus non-union workers for selected groups in the labour force. In this paper, I select 4

groups—gender, age, industry, and firm size, which can be divided into 12 sub-samples.[19] In this situation, equations (10) and (11) are estimated for the 12 sub-samples. Sub-sample estimates of equations (10) and (11) are relegated to the appendix and differentials by 4 groups--gender, age, industry, and firm size are presented in the Table 7.2.1.

[19] 12 sub-samples are male, female, age between 20-24 years old, age between 25-34 years old, age between 35-44 years old, age between 45-54 years old, the public sector, the private sector, firm that employ less than 19 people, firm that employ between 20-99 people, firm that employ between 100-500 people, and firm that employ above 500 people.

Table 7.2.1 Union and Non-union Wage Differentials for Selected Categories of Workers in Canada

Variable		Differentials (%)
Gender		
	Males	8.44
	Females	10.34
Age		
	20-24 Years	13.86
	25-34 Years	13.07
	35-44 Years	11.97
	45-54 Years	3.88
Industry		
	Public administration	2.96
	Non-public administration	23.15
Firm size		
	Less than 20 persons	18.97
	20 to 99 persons	16.5
	100 to 500 persons	12.78
	Over 500 persons	3.99

See Appendix E to G for more details.

The estimates generally agree with our expectations. Canadian female workers receive a substantially larger union wage differential than their male counterparts. The unionized female hourly wage rate is 10.34 percent larger than non-unionized female rate, while the unionized male hourly wage rate is only 8.44 percent larger than the non-unionized male rate. These results verify previous Doiron and Riddell (1994) findings such as those of Christofides and Swidinsky (1994), Doiron and Riddell (1994), Lemieux (1993), and Kumar and Stengos (1986). However, the percentage of the unions raise wage of the two groups are closer each other.

The union and non-union wage differential varies across age groups, with the largest gains accruing to younger workers, especially between ages 20 to 24. For the first 25 years (from age 20 to 44), workers benefit from a union and non-union wage differential of about 12 to 14 percent. Over the age of 45, this differential declines to about 4 percent and remains at this level. Larger union wage effects for young workers imply that unions not only raise but also flatten and make less concave the age-earnings profile. This is exactly the pattern reported in previous cross-sectional studies. However, if fringe benefits are included in the compensation measure, the union-non-union differential may do not vary as much by age.

Significant differences exist in union and non-union differentials across industries. The largest gains accrue to workers outside public administration. Workers in public administration gain on average about 3 percent from joining a union, whereas workers outside this sector gain on average about 23 percent. However, this is of little consequence, since only 19 percent of public sector workers

in the sample are non-unionized compared with 69 percent of private workers. This is consistent with the results reported by Simpson (1985) and Robinson and Tomes (1984), which both reported a larger union and non-union wage differential in the private sector compared to the public sector.

The wage differential declines as firm size increases, confirming that workers employed by small firms gain more from unionization than those working in large firms. Workers in firms that employ 19 or fewer persons at all locations receive a 19 percent union wage premium, while those in firms that employ 20 to 99 persons or 100 to 500 persons gain 17 percent and 13 percent respectively from unionization. Workers in larger firms (over 500 persons) benefit least from unionization, receiving a 4 percent union wage premium. These findings are nothing special. It is same as we describe in section 5 (page 35).

8. Conclusions

Unions tend to reduce wage differentials among workers that differ according to factors such as skill, education, age, experience, and seniority. Unions attempt to standardize the wages of similar workers across establishments, especially those in the same industry or region. However, if we compare union and non-union sector, indeed there exits an earning gap. The average wage of union sector is greater than non-union sector, holding other factors constant.

The empirical results from the 1995 Survey of Work Arrangements micro data indicate a Canadian union and non-union wage differential of approximately 12 percent. This is at the lower end of the spectrum of Canadian studies (10 to 25 percent) during 1980s. It may suggest that the differential may be declining over time as a result of greater competitive pressures in labour markets in recent years. Therefore, it appears as though there is no increase wage differential between union and non-union sector during the 1990s. Also, union/non-union differentials are found to vary across the Canadian labour market. Higher union and non-union differentials were associated with the following types of worker: females, younger workers, workers in small firms, and workers who are not in public sector. These results are similar to these found in previous studies.

In addition, most of the findings within the Canadian literature are robust in demonstrating empirically that unions provide their members with a substantial wage premium. However, we have concentrated on the union impact on the hourly wage rate, omitting other important components of compensation, such as benefits. Further research in this area may yield higher quality estimates and a better understanding of the role of unions play in our society.

Appendix

Appendix A
Estimates of the Impact of Unionism on Relative Wage

Setting in U.S.	Relative Wage Different Between Unionism and Non-unionism section
Blue vs. white collar worker in union sector (manufacture) 1	White-collar worker earn an average of 32 percent more than blue-collar worker
Blue vs. white collar worker in Non-union sector (manufacture) 2	White-collar worker earn an average of 49 percent more than blue-collar worker
Blue vs. white collar worker in union sector (non-manufacture) 3	White-collar worker earn an average of 19 percent more than blue-collar worker
Blue vs. white collar worker in Non-union sector (non-manufacture) 4	White-collar worker earn an average of 31 percent more than blue-collar worker
1. 2. 3. 4. From C. Brown and J. Medoff, "Trade Unions in the Production Process."	

Appendix B. Two views of Trade Unionism

	Union Effects on Economic Efficiency	Union Effects on Distribution of Income	Social Nature of Union Organization
Monopoly View	Unions raise wages above competitive levels, which leads to too little labor relative to capital in unionized firms.	Unions increase income inequality by raising the wages of highly skilled worker.	Unions discriminate in rationing positions
	Union work rules decrease productivity.	Unions create horizontal inequities by creating differentials among comparable workers.	Unions fight for their own interests in the political arena.
	Unions lower society's output through frequent strikes.		Union monopoly power breeds corrupt and non-democratic elements.
Collective Voice view	Unions have some positive effects on productivity—by reducing quit rates, by inducing management to alter methods of production and adopt more efficient policies, and by improving morale and cooperation among workers.	Unions' standard rate policies reduce inequality among organized workers in a given company or a given industry.	Unions are political institutions that represent the will of their members.

	Unions collect information about the preferences of all workers, which leads the firm to choose a "better" mix of employee compensation and a "better" set of personnel policies.	Union rules limit the scope for arbitrary actions concerning the promotion, layoff, recall, etc., of individuals.	Unions represent the political interests of lower income and disadvantaged persons.
	Unions improve the communication between workers and management, leading to better decision-making.	Unionism fundamentally alters the distribution of power between marginal (typically junior) and inframarginal (generally senior) employees, causing union firms to select different compensation packages and personnel practices than nonunion firms.	

Source: Richard B. and James Medoff. (1984). "What Do Unions Do?"

Appendix C. Summary of Canadian Literature: Estimates of the Union-Nonunion Wage differential in Canada

Author	Time Period	Estimated Differential (%)	Characteristics of Sample; Other Comments
1. Kumar (1972)	1966	17-23	Unskilled workers in manufacturing; aggregate data
2. Starr (1973)	1966	10-15	Unskilled male workers in Ontario manufacturing; disaggregate data (base wage at plant level)
3. Grant and Vanderkamp (1980)	1971	15	Individual data; annual earnings; union member includes membership in professional associations
4. MacDonald and Evans (1983)	1971-76	16	Aggregate industry data; 30 manufacturing industries
5. MacDonald (1983)	1971-79	20	Aggregate industry data; 30 manufacturing industries
6. Grant, Swidinsky and Vanderkamp (1987)	1969-71	12-14 (1969) 13-16 (1970)	Individual longitudinal data, annual earnings; union membership includes professional associations
7. Robinson and Tomes (1984) and Robinson (1989)	1979	24	Individual data on hourly paid workers
8. Simpson (1985)	1974	11	Micro-data on wage rates for narrowly defined occupations
9. Kumar and Stengos (1985)	1978	10	Union and nonunion earnings data by industry
10. Kumar and Stengos (1986)	1981	12	Individual data; hourly earnings, representative sample
11. Green (1991)	1986	15	Individual data on males; hourly earnings
12. Swidinsky and Kupfeschmidt (1991)	1986	15	Individual data on job changers

13. Lemieux (1993)	1986-87	20(males, cross section) 27(females, cross section) 16(males, longitudinal) 17(females, longitudinal)	Individual longitudinal data on males and female
14. Doiron and Riddell (1994)	1984	15 (males) 24 (females)	Individual data on males and females
15. White (1994)	1989	18-20 (all worker) 9-10 (professionals)	Individual data; samples of all workers, and professionals and managers

Source: Benjamin D., Gunderson M. and Riddell W. (1998) Table 16.1

Note: Recently, there is no estimates of the union/nonunion wage differential during the 1990s article can be found.

Appendix D.

1995 Average Hourly Wage by Job Type and Unionization

	Unionized*	Non-unionized	Combined
Permanent	$18.02	$13.42	$15.28
Non-Permanent	$17.18	$10.16	$12.33
Type of Non-Permanent Job			
Seasonal Job	$16.41	$10.08	$11.91
Temporary, Term or Contract (Non-Seasonal)	$18.05	$12.16	$14.39
On-Call or Casual Job	$15.57	$7.79	$9.51
Work Done Through a Temporary Help Agency	**	$9.58	$10.33

*Unionized here means either a union member or covered by a union contract or collective agreement.

**Denotes insufficient cell size for publication.

Source: HRDC calculations based on the 1995 Survey of Work Arrangements, Statistics Canada.
Flexible Work Arrangements Evidence from the 1991 and 1995 Survey of Work Arrangements R-97-10E, Table 24.

Appendix E. Geometric Mean of Wage for Select Group.

Variable		Union		Non-union	
		Average hourly pay	Log wage	Average hourly pay	Log wage
Gender	Males	18.9835	2.944	14.1614	2.651
	Females	16.5395	2.806	11.1063	2.408
Age	Under19 Years	8.4497	2.134	6.7906	1.916
	20-24 Years	12.2994	2.51	8.7328	2.167
	25-34 Years	16.7085	2.816	12.7499	2.546
	35-44 Years	18.5037	2.918	14.7472	2.694
	45-54 Years	19.555	2.973	15.2628	2.725
	55-64 Years	17.8091	2.879	13.2967	2.588
	65-69 Years	13.1783	2.579	12.178	2.5
Edu	Under High school degree	14.8475	2.698	9.4052	2.241
	Graduated From High school	16.0859	2.778	11.4552	2.438
	Some Post-Second	16.0477	2.776	10.977	2.396
	Post Secondary College	18.2204	2.903	13.5158	2.604
	University Degree	21.8694	3.085	19.4284	2.967
Job type	Full time job	18.1485	2.899	13.7273	2.619
	Part time job	15.6157	2.748	9.0946	2.208
Industry	Public administration	19.2352	2.951	16.891	2.827
	Non-public administration	16.7877	2.821	12.2122	2.502
Firm size	Less than 20 persons	14.8282	2.697	10.7407	2.374
	20 to 99 persons	16.0965	2.779	11.828	2.47
	100 to 500	17.4332	2.876	13.6363	2.613

	persons Over 500 persons	18.646	2.926	14.9357	2.704
Region	Atlantic	16.1954	2.785	10.3672	2.339
	Quebec	17.7158	2.874	12.2188	2.503
	Ontario	18.9218	2.94	13.9253	2.634
	Prairies	16.6978	2.815	11.5574	2.447
	West	18.6954	2.928	13.4032	2.595

Appendix F. Estimates of union and non-union wage differential wage equations on Sex Group (also including 13 industry and 21 occupation groups variables)

	Male		Female	
Variables	Union	Non-union	Union	Non-Union
Differential		0.0844		0.1034
logw	2.944	2.651	2.806	2.408
Age:				
A2024	0.135 (0.045)	-0.023 (0.022)	0.084 (0.055)	0.001 (0.023)
A2534	0.286 (0.043)	0.116 (0.023)	0.217 (0.052)	0.127 (0.022)
A3544	0.339 (0.043)	0.022 (0.024)	0.248 (0.052)	0.167 (0.022)
A4554	0.374 (0.044)	0.243 (0.026)	0.243 (0.053)	0.143 (0.024)
A5565	0.327 (0.046)	0.147 (0.03)	0.178 (0.055)	0.093 (0.029)
A6569	0.037 (0.125)	0.015 (0.073)	0.2 (0.097)	-0.145 (0.085)
Married	0.05 (0.012)	0.127 (0.013)	0.045 (0.011)	0.029 (0.012)
Edu:				
Ehs	0.08 (0.015)	0.075 (0.015)	0.073 (0.019)	0.09 (0.015)
Ep2nd	0.081 (0.02)	0.115 (0.019)	0.085 (0.025)	0.096 (0.019)
Ep2ndc	0.155 (0.014)	0.176 (0.014)	0.134 (0.019)	0.153 (0.015)
Eud	0.227 (0.021)	0.333 (0.02)	0.32 (0.022)	0.374 (0.021)
Fulltime	0.09 (0.026)	0.15 (0.018)	-0.012 (0.013)	0.00 (0.012)
Public	0.036 (0.016)	0.081 (0.03)	0.046 (0.013)	0.1 (0.024)
Exp:				
T15	0.017 (0.017)	0.051 (0.013)	0.033 (0.018)	0.071 (0.012)
T610	0.114 (0.018)	0.144 (0.016)	0.135 (0.018)	0.166 (0.015)
T1120	0.162 (0.017)	0.199 (0.017)	0.19 (0.018)	0.279 (0.018)
T20up	0.201 (0.035)	0.308 (0.023)	0.229 (0.021)	0.407 (0.027)
Region:				
Atlantic	-0.098 (0.015)	-0.138 (0.016)	-0.162 (0.016)	-0.126 (0.016)
Ontario	0.064 (0.012)	0.082 (0.014)	0.042 (0.014)	0.114 (0.015)
Prairie	-0.026 (0.016)	-0.036 (0.018)	-0.113 (0.016)	-0.042 (0.018)
West	0.093 (0.016)	0.093 (0.016)	0.023 (0.016)	0.088 (0.017)
Firm Size:				

F20b	-0.078 (0.035)	-0.034 (0.028)	-0.103 (0.046)	0.019 (0.03)
F2099	-0.011 (0.032)	0.008 (0.029)	0.011 (0.041)	0.05 (0.031)
F100500	0.049 (0.031)	0.087 (0.03)	0.044 (0.039)	0.066 (0.031)
F500up	0.089 (0.03)	0.137 (0.028)	0.084 (0.039)	0.101 (0.03)
Constant	2.157 (0.062)	1.996 (0.069)	2.153 (0.107)	1.802 (0.077)
Adjusted R^2	0.45	0.635	0.503	0.537
Observations	3361	4155	2983	4628

Appendix G. Estimates of union and non-union wage equations on industry select group (also including 13 industry and 21 occupation groups variables)

	Public sector		Private Sector	
Variables	Union	Non-union	Union	Non-Union
Differential	0.0296		0.2315	
logw	2.957	2.827	2.821	2.502
Age:				
A2024	0.257 (0.132)	0.06 (0.088)	0.094 (0.037)	-0.009 (0.016)
A2534	0.375 (0.129)	0.23 (0.081)	0.25 (0.035)	0.128 (0.016)
A3544	0.42 (0.129)	0.314 (0.079)	0.284 (0.036)	0.19 (0.017)
A4554	0.419 (0.129)	0.314 (0.082)	0.313 (0.036)	0.193 (0.018)
A5565	0.382 (0.131)	0.158 (0.094)	0.245 (0.039)	0.134 (0.021)
A6569	0.234 (0.198)	0.015 (0.147)	0.297 (0.125)	-0.144 (0.063)
Married	0.053 (0.012)	0.07 (0.039)	0.051 (0.011)	0.082 (0.009)
Edu:				
Ehs	0.116 (0.022)	0.156 (0.057)	0.077 (0.014)	0.082 (0.011)
Ep2nd	0.143 (0.028)	0.15 (0.067)	0.073 (0.019)	0.108 (0.014)
Ep2ndc	0.178 (0.021)	0.141 (0.052)	0.152 (0.013)	0.176 (0.011)
Eud	0.343 (0.023)	0.417 (0.059)	0.252 (0.021)	0.35 (0.015)
Fulltime	-0.021 (0.079)	0.141 (0.04)	0.016 (0.015)	0.055 (0.01)
Male	0.127 (0.012)	0.088 (0.036)	0.175 (0.012)	0.193 (0.09)
Exp:				
T15	0.005 (0.02)	0.089 (0.042)	0.042 (0.016)	0.06 (0.009)
T610	0.107 (0.019)	0.141 (0.046)	0.149 (0.017)	0.156 (0.011)
T1120	0.153 (0.019)	0.204 (0.051)	0.208 (0.017)	0.251 (0.013)
T20up	0.202 (0.021)	0.35 (0.058)	0.25 (0.019)	0.38 (0.019)
Region:				
Atlantic	-0.206 (0.016)	-0.151 (0.049)	-0.08 (0.015)	-0.132 (0.012)
Ontario	-0.01 (0.015)	0.021 (0.049)	0.085 (0.012)	0.105 (0.011)
Prairie	-0.014 (0.017)	-0.099 (0.054)	-0.036 (0.016)	-0.033 (0.013)
West	-0.05 (0.017)	-0.019 (0.054)	0.13 (0.015)	0.102 (0.012)
Firm Size:				

F20b	-0.078 (0.049)	0.016 (0.085)	-0.082 (0.035)	-0.006 (0.021)
F2099	0.049 (0.041)	0.127 (0.086)	-0.011 (0.032)	0.022 (0.022)
F100500	0.083 (0.039)	0.242 (0.84)	0.031 (0.031)	0.066 (0.023)
F500up	0.1 (0.039)	0.307 (0.082)	0.088 (0.03)	0.096 (0.022)
Constant	2.068 (0.143)	1.642 (0.181)	1.976 (0.275)	2.22 (0.232)
Adjusted R^2	0.418	0.583	0.501	0.591
Observations	2713	637	3631	8146

References

Abowd J., and T. Lemieux (1993). "The Effects of International Competition on Collective Bargaining Qutcomes: A Comparison of the United States and Canada." *Quarterly Journal of Economics*, Vol. 98, 983-1014.

Akyeampong, E. (1997). "A statistical portrait of the union movement. " *Perspectives on Labour and Income*, 45-54.

Antos, Joseph R. (1983). "Union Effects on White-Collar Campensation." *Industrial and Labour Relations Review* 36(3), April, 461-79.

Benjamin D., Gunderson M. and Riddell W. (1998). *Labour Market Economics.* 4th ed. Toronto: McGraw-Hill Ryerson.

Bloch, Farrell E. and Mark S. Kuskin (1978). "Wage Determination in the Union and Nonunion Sector." *Industrial and Labour Relations Review* 31(2), January, 183-92.

Brown, C., and J. Medoff (1978). "Trade unions in the production process." *Journal of Political Economy* 86, 355-78.

Bruce, Christopher j. (1995). *Economics of Employment and Earnings.* Scarborough: Nelson Canada.

Christofides, L. N., and R. Swidinsky. (1994). "Wage Determination by Gender and Visible Minority Status: Evidence from the 1989 LMAS." *Canadian Public Policy*, Vol. 20, 24-51.

Clark, Kim. (1980). "Unionization and productivity: a case study." *Industrial and Labor Relations Review* 33, 613-39.

Clark, Kim. (1980). "Unionization and firm performance: the impact on profits, growth, and productivity." *American Economic Review* 74, 893-919.

Doiron, D.J. and W.C. Riddell. (1994). "The impact of Unionization on Male-Female Earnings Differences in Canada." *Journal of Human Resources* 29, 504-534.

Drost. H. and H. Richard Hird (2000). *An Introduction to the Canadian Labour Market.* Scarborough: Nelson, a division of Thomson Learning.

Duncan, Gregory M. and Duane E. Leigh (1980). "Wage Determination in the Union and Nonunion Sector: A Sample Selectivity Approach." *Industrial and Labour Relations Review* 34(1), October, 24-34.

Freeman, Richard B. (1980). "Unionism and the Dispersion of Wages." *Industrial Labour Relations Review*. 34(1), October, 3-23.

Freeman, Richard B. and James Medoff. (1984). *What Do Unions Do?* New York: Basic Books.

Grant, E. Kenneth, Robert Swidinsky and John Vanderkamp. (1987). "Canadian Union-Nonunion Wage Differentials." *Industrial and Labor Relations Review*, Vol. 41, No. 1. October. 93-107.

Green, D. A. (1991). "A Comparison of Estimation Approaches for the Union-Nonunion Wage Differential." *UBC Department of Economics. Working Paper* 91-13.

Halvorsen, Robert and Raymond Palmquist (1980). "The Interpretation of Dummy Variables in Semilogarithmic Equations." *American Economic Review* 70 (3), June, 474-5.

Hamermesh, Daniel S. (1971). "White-Collar Unions, Blue-Collar Unions, and Wages in Manufacturing." *Industrial and Labour Relations Review* 24(2), January, 159-70.

Heckman, j. (1979). "Sample Selection Bias as a Specification Error." *Econometrica* 47, 153-61.

Hirsch, Barry T. and John T. Addison. (1986). "*The Economic Analysis of Unions: New Approaches and Evidence.*" Winchester: Allen & Unwin Inc.

Kennedy, Peter E. (1981). "Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations." *American Economic Review* 71(4), September, 801.

Kuhn, Peter. (1998). "Unions and the Economy: What We Know; What We Should Know." *Canadian Journal of Economics,* November, 31, 1033-1056.

Kumar, P., and T. Stengos. (1985). "Measuring the Union Relative Wage

Impact: A Methodological Note." *Canadian Journal of Economics*, Vol. 18, 182-189.

Kumar, P., and T. Stengos. (1986). "Interpreting the Wage Gap Estimate from Selectivity Correction Techniques Using Micro-Data." *Economics Letters*, Vol. 20, 191-195.

Kwoka, John E., Jr (1983). "Monopoly, Plant, and Union Effects on Worker Wages." *Industrial and Labour Relations Review* 36(2), Jan., 251-7.

Lee, L. F. (1978). "Unionism and Wage Rates: A Simultaneous Equations Model with `Qualitative and Limited Dependant Variables." *International Economic Review*, Vol. 19, 415-433.

Lemieux, T. (1993). "Unions and Wage Inequality in Canada and in the United States." Small Differences that Matter. D. Card and R. B. Freeman, eds. Chicago: University of Chicago Press, 69-107.

Lewis, H. G. (1986). "Union Relative Wage Effects: A Survey". Chicago: The University of Chicago Press.

MacDonald, G. M. (1983). "The Size and Structure of Union-Non-Union Wage Differential in Canadian Industry: Corroboration, Refinement, and Extension." *Canadian Journal of Economics*, Vol. 16, 480-485.

MacDonald, G. M., and J. C. Evans. (1981). "The Size and Structure of Union-Non-Union Wage Differentials in Canadian Industry." *Canadian Journal of Economics*, Vol. 14, 216-231.

Mellow, Wesley (1983). "Employer Size, Unionism, and Wages." In Joseph D. Reid, Jr(ed.), *New Approaches to Labour Unions* (Greenwich, CT: JAI Press), 253-82.

Oaxaca, Ronald L. (1973). "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review* 14(3), 693-709.

Oaxaca, Ronald L. (1975). "Estimation of Union/Nonunion Wage Differentials With in Occupational-Regional Subgroups." *Journal of Human Resources* 10(4), Fall, 529-36.

Parsley, C. J. (1980). "Labour Union Effects on Wage Gains: A Survey of Recent Literature." *Journal of Economic Literature* 18(1), March, 1-31.

Renaud, S. (1997). "Union and Wages in Canada: A Review of the Literature."

Proceedings of the 33rd Annual Conference of the Canadian Industrial Relations Association. St. Catharines: CIRA, 211-225.

Robinson, C., and N. Tomes. (1984). "Union Wage Differentials in the Public and Private Sectors: A Simultaneous Equation Specification." *Journal of Labour Economics*, Vol. 2, 106-127.

Simpson, W. (1985). "The impact of Unions on the Structure of Canadian Wages: An Empirical Analysis with Micro Data." *Canadian Journal of Economics,* Vol. 18, No. 1 February, 164-81

Statistics Canada 1998. *Survey of Work Arrangements 1995*. Ottawa.

Swidinsky, R., and M. Kupferschmidt. (1991). "Longitudinal Estimates of the Union Effects on Wage, Wage Dispersion and Pension Fringe Benefits." *Industrial Relations*, Vol. 46, 819-838.