The Effects of Unions on Wages:
With a focus on the Canadian Health Care Industry

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Abstract

Using Canadian Labour Force Survey data, this paper examines the union – non-union wage differential for the years 1997, 2002 and 2007. In particular, this is the first paper to look at the impact of unions on the wages of health care workers in Canada. I find that there is a 10% wage premium to being unionized in the health care sector. Accounting for heterogeneous returns to unionization and for self-selection does not alter this finding. Finally, I find that wage inequality arising from gender and education differences is reduced in the health care industry as a result of unionization.

1. Introduction

The public health care system in Canada will soon come under tremendous pressure as the early baby-boom generation approaches the age of retirement. A growing number of Canadians will begin demanding more health services, which will put strain on the current operational and financial capabilities of an already sluggish and costly system. In order to balance budgets while at the same time sustaining reasonable wait times for medical treatments, provincial governments will have to look for new sources of funding as well as reduce costs. Labour costs represent a major component of the total cost of health care, and as such, warrants further inspection. I will examine the earnings of health care workers, in particular, by focusing on the impact of unions on the determination of wages in the Canadian health care industry.

Many health care workers in Canada belong to labour unions and earn higher wages than non-unionized workers. For example, a unionized housekeeper at a hospital can earn between $18.00 and $20.00 per hour of work compared to a non-unionized housekeeper at a hotel or shopping centre, who typically earn closer to minimum wage. Although the dynamics of working in a health care facility are different from working in a hotel or mall, the higher wage is, at least partly, reflective of union status. This paper is the first empirical study to look at the direct effect of unions on the wages of health care workers in Canada. I contribute to the body of literature by using LFS data to provide an estimated union-wage effect for the Canadian health care industry.[1]

[1] Fang and Verma (2002) looked at union wage premiums for health care and education workers together.

I find that the majority of health care workers in Canada are unionized and that there is a positive union effect on real wages. Similar to workers in other industries, unionized health care workers earn 10% higher wages compared to non-unionized health care workers. Accounting for heterogeneous returns to unionization and self-selection does not alter this result.

Another key finding is that gender wage inequality is much lower in the health care industry compared to all other industries together. I find that the real wages of female health care workers is around 4% lower than those of male health care workers. In all other industries together, female workers earn substantially less (24%). Furthermore, I find that the vast majority of health care workers are female and that unionized female health care workers actually earn slightly higher wages than unionized male health care workers.

Finally, I find that wage inequality, along education lines, is lower for unionized health care workers compared to non-unionized health care workers. That is, workers with lower levels of education earn higher real wages than the same non-unionized workers, while those who are unionized and possess higher levels of education earn slightly lower real wages compared to the same non-unionized workers.

The remaining sections of this paper are divided as follows: Section 2 includes a literature review of unions as well as a small sub-section on the Canadian health care system. In Section 3, I describe the data set as well as present summary statistics. In

Section 4, I describe my empirical strategy and discuss my results. Finally, Section 5 concludes.

2. Literature review

2.1 The role of unions

The main function of unions is to improve the well being of their members by means of collective bargaining. Collective agreements (i.e. employment contracts) which are reached between the employer and the union detail many areas of the employment relationship from wages and benefits to promotions and layoffs.

One important and consistent feature of unions is their ability to influence compensation. Freeman (1984), Card (1996), Renaud (1998) and Kuhn et al. (1998) all found that unions were successful in increasing the wages of their members relative to non-unionized workers. In addition to their influence on wages, unions are also often able to obtain and improve benefits such as: pension plans, medical insurance plans and dental plans. Renaud (1998) observed that the impact of unions on benefits appears to be much higher than on wages.

Another important feature of unions is their ability to regulate and improve the working conditions of their members. Depending on the specific interests of a particular union, collective agreements may include rules and procedures governing the hours of work, allocation of overtime, statutory holidays, issuance of vacation, safety, rest periods and the supply of uniforms and equipment to workers, to name a few.

Collective agreements also provide detailed hiring, firing and layoff procedures. Unionized employees are therefore protected from unjustified termination. Layoff procedures almost always incorporate worker seniority, which ranks workers based on the total amount of hours[2] they have accumulated within the unionized establishment. Workers with higher seniority are rewarded with more stable employment and stable income.

Unions provide a "voice" for members to express their opinions and concerns to management (Freeman and Medoff, 1984). Unions convey complaints, grievances and demands to employers with the intention of correcting and improving the relationship between the employer and employees. In non-unionized work environments, it may be difficult for employees to communicate with management. Given unfavourable working conditions, workers are then faced with the choice of "exiting" the job or having their concerns ignored. If unionized workers are successful in transmitting their collective voice to management, the likelihood of a worker choosing to exit a unionized job will be reduced. Turnover forces employers to hire and train new workers, thus a decrease in turnover will lead to a reduction in labour costs.[3]

Unions also engage in social and political affairs including promoting the expansion of union representation in Canada, promoting favourable federal labour legislation and providing financial and other support[4] to favourable political parties (for example, the

[2] Total hours usually does not include overtime.
[3] Costs associated with turnover include: paying staff to conduct interviews, paying trainers to provide training, and paying wages to new employees while they are being trained.
[4] Examples of other support include: dialogue and consultations.

New Democratic Party (NDP) of Canada). By influencing public policy, unions may be able to gain advantage in their bargaining positions with employers or might be able to improve the working conditions of Canadians in general.

Although unions provide many beneficial services to their members, there are some disadvantages to their association. Unions may have a detrimental impact on productivity. Robinson (1989) argues that unions reduce productivity by limiting the powers of employers. For example, unions may limit the ability of management to use incentives to reward good performance because for lower performing workers, it may be seen as discrimination. Also, in a unionized workplace, promotions are often seniority-based which might result in the allocation of jobs to less qualified workers. Freeman and Medoff (1984), on the other hand, argue that unions improve productivity because they facilitate the circulation of information among workers, which helps to motivate them - an extension of the exit-voice theory.

Less debated is the effect of unions on profitability and investment. Many Canadian and American studies suggest that union firms are less profitable compared to non-union firms and that unions negatively affect the profitability of firms (e.g. Maki and Meredith (1986)). There also appears to be a similar relationship between unions and investment (e.g. Odgers and Betts (1997)).

Finally, unions lower wage inequality within the unionized sector. The majority of Canadian studies (Riddell et al., 2003) find that wage dispersion is reduced when there is

a union present. Meng (1990), for example, found that the standard deviation of hourly wages was 24% lower in the unionized manufacturing sector compared to the non-union sector, and 16% lower in the unionized non-manufacturing sector.

2.2 Union density and union coverage

Union density and collective agreement coverage represent two separate measures of unionization (though closely related) and both measures of unionization differ from country to country. Union density is defined as the proportion of wage-earners who are unionized. Collective agreement coverage is defined as the proportion of wage-earners who are covered by collective agreements. The difference between the two groups is that, while both have their terms of employment covered under a collective agreement, the latter group are not members of a union.

In 1990, 36% of Canada's paid workers were union members. In comparison, 83% of paid workers in Sweden were union members, while only 10% of paid workers in France belonged to a union. The percentage of paid workers covered under a collective agreement in Canada in 1990 was 38%, only slightly higher than the percentage of union members. During the same year, 83% of paid workers in Sweden were covered under a collective agreement while 92% of paid workers in France were covered (Kuhn, 1998).

The high levels of collective agreement coverage of non-unionized workers in many European countries is a result of centralized bargaining at the industry and, in some cases, entire economy-wide level. In Canada, as well as in the United States, most bargaining

takes place between individual employers and unions and do not extend to non-unionized workers. For this reason, Benjamin et al. (2002) remark that Canada, compared to most other OECD (Organization for Economic Co-operation and Development) countries, had very low collective agreement coverage in 1994, surpassing only New Zealand, Japan and the United States.

Most OECD countries, with the exception of the Scandinavian countries, experienced a decline in union density (i.e. union membership) between 1980 and 1994. During this period, both Canada and the United States experienced declines in union density, although by 1994, Canada had more than double the union density of the United States.[5]

The decline in union density in Canada has often been associated with changes in industrial compositions and a decline in traditional jobs. However, a more basic explanation is that the economic and labour market conditions in Canada have weakened union power, intimidated workers and created a hostile environment towards unions. Harsh monetary policies, trade liberalization and weakened labour market and social programs have contributed by aggravating these conditions (Godard, 2003). In addition, limitations to Canada's labour policy model have limited the ability of unions to grow in Canada.

The extent of unionization in Canada varies a great deal by industry. Public sector employees are typically more likely to be in a union than private sector employees.

[5] In 1994, Canada had 34% of paid workers belonging to a union compared to 16% in the United States (Benjamin et al., 2002).

Industries such as public administration, education, utilities and health care exhibit extensive unionization whereas industries such as trade, finance and business services exhibit low levels of unionization (Benjamin et al., 2002).[6]

Finally, most Canadian studies, for example Riddell and Riddell (1998), Kuhn and Sweetman (1998) and Macdonald and Evans (1981), incorporate collective agreement coverage as the preferred measure of union status because individuals who are covered but not members of a union still have their wages and working conditions determined by collective bargaining. In this sense, the covered, non-union group is thus a part of the "union-sector". I will follow the same approach in this paper.

2.3 Empirical evidence: union effects

There is a large volume of literature that examines the effects of unions on economic variables, such as: wages, benefits and job satisfaction. The vast majority of studies concern the effects unions have on the compensation of their members relative to the compensation of non-unionized workers.

2.3.1 Wages

The majority of studies measure the impact of union membership on wages by comparing unionized and non-unionized workers' wages (Macdonald et al., 1981; Simpson, 1985; and Card, 1996). Running Ordinary Least Squares (OLS) regressions on the dependent variable 'wage' is one method for estimating the union effect, while holding other

[6] I also find that the public sector has a high rate of unionization compared to the private sector and that the rate of unionization varies by industry - specifically those mentioned.

observable characteristics constant. In order to account for a possible selection bias, the Heckman procedure[7] is often incorporated in the regressions. Virtually all studies find a positive differential between wages of unionized employees and non-unionized employees, which can, at least partly, be credited to the presence of unions.

Kuhn (1998) performed a review of literature involving the wage effects of unions. He observed that the average wage differential between unionized employees (in the United States or in Canada) and "observationally equivalent" non-unionized employees, is approximately 15%. That is, most studies determine that workers who are members of a union earn around 15% higher wages than similar workers who are not members of a union. Kuhn points out that, although most studies produce similar results, the 15% differential cannot be fully attributed to the presence of a union.

Kuhn identifies two other factors that could influence the difference in wages. (1) Within the standard supply and demand model, there is a "spill-over effect." This effect is the result of wages being higher in the unionized sector, which leads to a reduction in employment in that sector. As a result, there is in an inflow of workers to the non-unionized sector, which increases the available supply of workers to that sector, decreasing the non-union sector wage. (2) The threat of unionization may lead employers in the non-unionized sector to offer wages closer to those in the unionized sector.

Simpson (1985) used micro-data from the Labour Canada Wages Survey, and the Heckman procedure to correct for selectivity bias and found an overall wage differential

[7] Developed by James Heckman (1979).

of 18.6% in Canada. Simpson also found that higher public sector wages were strictly due to union coverage. In his paper, Simpson points out that union status is not random. Characteristics of individuals and jobs as well as the structure of the wage differential between unionized and non-unionized sectors influence the decision of individuals to become a member of a union. This is referred to as the sample selection bias. Simple OLS regression cannot allow one to conclude that the wage differential is a pure result of union membership and not at least partly influenced by other factors.

In analyzing the impact of unions on wages it may be misleading to compare wages of all unionized workers with all non-unionized workers in one country. Several approaches have been taken to estimate the union effect using subgroups of the labour force. For example, Card (1996) used a large panel data set derived from the U.S. Current Population Survey to estimate the effects of unions on wage structures for five different skill groups.[8] Card found that the positive effect of unions on wages is greater the less skilled the workers are.

In some research the wage differential is calculated for a specific industry. For example, Macdonald et al. (1981) used data from 30 Canadian manufacturing industries from 1971-1976, and found a 15.8% wage differential between unionized and non-unionized manufacturing workers. Similarly, this paper will analyze data from the health care industry.

[8] Skill groups were created using an index of predicted wages of respondents.

In addition to analysis by industry, some researchers calculate the effects of unions on the wages of different occupations. Cleveland et al. (2003) analyzed survey data for Canadian childcare workers[9] from 1991 and determined a 15% impact of unions on wages. They also noted that fringe benefits arising from union membership were competitive with those of other occupations.

The estimated union-non-union wage differential varies greatly between occupations and industries (Benjamin et al., 2002). There is a greater differential between blue-collar workers than between white-collar workers and non-manufacturing industries have a higher wage differential than manufacturing industries. Several Canadian empirical studies have found that semiskilled and unskilled workers gain more from unionization than skilled workers (Simpson, 1985; Robinson and Tomes, 1984; and Renaud, 1998), although Benjamin et al. (2002) remarks that craft unions generally exhibit large earnings differentials.

With respect to the health care industry, there is no Canadian empirical evidence indicating the effects of unions on the wages of Canadian health care workers.

2.3.2 Benefits

A slightly different approach to determining the impact of unions on compensation was taken by Renaud (1998). Renaud used micro-data from the Canadian General Social Survey (CGSS), the Heckman procedure and included a variable to represent benefits in

[9] The survey was conducted as part of the *Caring for a living* (1992) project supported by the Canadian Day Care Advocacy Association and the Canadian Child Day Care Federation.

his analysis. To measure benefits, Renaud utilized a variable in the CGSS that asked respondents to indicate if their employer provided them with a pension plan, a medical insurance plan, or a dental plan. Renaud then added the average employer cost of each individual employee benefit by industry to the reported annual income of each worker in that industry who declared receiving a particular benefit. Renaud found that the impact of unions in 1989 was to increase total compensation by 12.4%, compared to a 10.6% increase on wages alone. He identified a remarkable 45.5% increase in benefits arising from union membership. Finally, Renaud points out that there is a lack of empirical studies that focus on all aspects of compensation, rather than wages solely.

2.3.3 Job satisfaction

Analysis of the impact of unions on wages and total compensation is one way to measure the effects of unions on their members. Another measure commonly analyzed is the effects of unions on job satisfaction. Most of the research on job satisfaction suggests that unionized workers are commonly less satisfied with their jobs than non-unionized workers (Hersch and Stone, 1990; Kochan and Helfman, 1981; and Meng, 1990).

Bender et al. (1998) used data from the Social Change and Economic Life Initiative Survey (U.K.) to analyze the relationship between union membership and job satisfaction. The authors found that unionized workers were relatively dissatisfied with their jobs compared to non-unionized workers and that this differential was not significantly related to union membership. They concluded that the union workers' job

dissatisfaction was more a result of poor industrial relations or from unions forming where satisfaction is low anyway.

Finally, Bryson et al. (2004) used data from the 1998 British Workplace Employee Relations Survey and found that unionized workers did appear to be less satisfied with their jobs than non-unionized workers. In analyzing the effects of unions on job satisfaction, the authors found that, after controlling for individual and establishment heterogeneity, the difference in job satisfaction between unionized and non-unionized workers disappeared. They concluded that the relationship between job satisfaction of unionized and non-unionized individuals is characterized by a selection effect rather than a causal effect.

2.4 The Canadian health care system

Health care in Canada is a publicly insured service and the provincial governments are responsible for the administration and delivery of health care. Under the Canada Health Act (1984) provinces must follow several criteria and conditions in order to receive full federal cash contributions under the Canada Health Transfer (CHT). The "five principles" that provinces are evaluated for include: public administration, comprehensiveness, universality, portability and accessibility.

The first principle, public administration, implies that health insurance plans must be administered and operated by a public authority, on a non-profit basis. For this reason, many health care workers in Canada are employed directly through the province in which

they work or by an organization contracted by the province. Each province must provide health insurance to every citizen of that province. For example, the Ontario Health Insurance Plan (OHIP) provides health insurance to each citizen of Ontario.

The CHT is not the sole source of provincial health funding – provinces must also contribute through tax revenues, municipalities provide contributions and many hospitals and other organizations organize lotteries to raise funds (for example, the Ottawa Hospital and CHEO lottery). Health spending represents the largest component of provincial government spending and has been rising significantly since the 1990s (Landon et al., 2006). To meet the growing cost of health care, some provinces have started to look for other areas of funding, for example, Ontario re-introduced tax premiums[10] for health care in 2004. As expenditures on health care rise, provinces will have to find other ways to generate funds or look for possible ways to lower costs. As such, the costs associated with labour will most definitely be an area of interest to policy makers.

The Canadian health care system incorporates many different types of professionals such as physicians, nurses, laboratory workers, social workers, physiotherapists, as well as a variety of hospital occupations including logistical support staff, engineers, cooks, housekeepers, medical records workers, security guards and orderlies, to name a few.

Although not all health care workers are unionized, many belong to unions and associations. Examples of unions and associations representing health care workers in Canada include the Canadian Union of Public Employees (CUPE), Ontario Public

[10] Premiums are based on income.

Service Employees Union (OPSEU), Canadian Health Care Workers (CHCW), Hospital Employees' Union (HEW), Ontario Medical Association (OMA) and Registered Nurses' Association of Ontario (RNAO).

The following section will describe the data source and provide summary statistics for the selected sample of data.

3. Data Description

3.1 LFS data

The data used in this paper is from the Labour Force Survey (LFS). The LFS - established after the Second World War - is a monthly survey conducted by Statistics Canada that collects information on the labour market activities of the working-age population.[11] The LFS samples approximately 50,000 households per month. The size of the LFS will be useful in producing a large sample of health care workers, the key group of interest in this paper.

The LFS asks questions related to personal characteristics of the working-age population including: gender, age, marital status and educational attainment; as well as questions related to the employment characteristics of the working-age population including: industry, occupation, job tenure and usual hours worked. Data from the LFS is used to produce official statistics on employment (i.e. self-employment, full-time employment and part-time employment) and unemployment, both at the provincial and national levels.

[11] The working-age population is defined as Canadians aged 15 and older.

The LFS questionnaire was revised in 1997 in order to provide monthly statistics concerning wages, union status, number of employees at a workplace, and classification (temporary or permanent) of employment, among others. The variables for union status and wages will be fundamental in analyzing the effects of unions on compensation, and as such, the empirical analysis is limited to the post-1997 period.

With respect to union status, the LFS asks respondents (who are considered employees only) if they are either: in a union, not in a union but covered under a collective agreement or not in a union and not covered under a collective agreement. In this paper, all respondents who are covered by a collective agreement are considered "unionized".[12] The LFS questionnaire asks workers to report their usual hourly wage including tips, commissions and bonuses, before taxes and other reductions.[13] The public use files[14] do not record the hourly wage of the self-employed. As such, they are excluded from the sample.

This paper is primarily concerned with the effects of unions on the wages of health care workers; therefore, health care workers need to be separated from workers in other industries. The LFS arranges industries based on the North American Industry Classification System (NAICS). I grouped the LFS industries into 13 separate categories,

[12] Note: I followed the same approach in defining "unionized workers" as Riddell and Riddell (1998), Kuhn and Sweetman (1998) and Macdonald and Evans (1981). See section 2.2 for a complete explanation.
[13] The wage variable is measured in dollars ($).
[14] Public use files include variables that are aggregated (or collapsed), whereas master files include all raw data. For example, the LFS public use files have the variable representing 'age' grouped into 12, five-year brackets, whereas the master files include each age group individually.

where one category represents health care and social assistance workers.[15] Since the sample in this paper was generated using the LFS public use files, health care and social assistance workers could not be separated. As a robustness check, I will also try regressions where I exclude several occupations that are typically associated with social assistance (for example, child care).

I used the April and October surveys for 1997, 2002 and 2007 to create the sample. April was selected as the first month because Canadian personal income taxes must be submitted before the end of April; therefore, respondents are generally more knowledgeable and precise when answering questions regarding wages and income. October was selected as the second month because the LFS retains respondents for a six-month period and October falls exactly six months after the April survey. This technique ensures a more random sample. I chose the three survey years in order to produce a large sample and I selected five-year intervals between survey years in order to verify whether there were any major changes in the rate of unionization over time.

Weights were used to ensure that the empirical analysis is representative of the population of interest. The LFS includes weights to account for the fact that not all individuals have the same probability of being drawn. For example, the LFS over-samples from smaller provinces like Prince Edward Island. Given that the LFS weights sum up to the population size, the weights in 2007 will add to a larger number than those

[15] I used the Riddell & Riddell (2004) industry groupings but separated the community services industry into two groups; one of which represents health care and social assistance workers. See Appendix 1 for concordance between the LFS and the Riddell industry groupings.

in 1997 simply due to an increase in population. I, therefore, re-normalized the weights so that they sum up to 1 in each survey.

In order to analyze the effects of unions on wages, the sample includes participants who were employed only, i.e. the unemployed and those who were not in the labour force were dropped.[16]

Following Bender and Sloane (1998) and Kuhn and Sweetman (1998), the sample is restricted to respondents aged 20-60 years old. Participants aged 60 years and over were excluded from the sample to abstract from the issues of changes in retirement age over the survey years.

In summary, the sample was created using surveys from April and October of 1997, 2002 and 2007, and, is restricted to individuals who are employed (excluding self-employed) and aged 20-60 years old. The pooled sample is very large and consists of 269,496 respondents. The following section provides summary statistics.

3.2 Summary statistics

3.2.1 Union and non-union statistics

Among the restricted sample, 98,624 workers are covered by unions and 170,872 are not. Mean statistics for the unionized and non-unionized sub-groups of all industries together are presented in Table 1.

[16] Employed individuals include both employed and at work, and also those that are employed but absent from work.

Table 1. Summary Statistics: Means and standard deviations in brackets

Explanatory Variables	All industries	
	Union	Non-Union
1. *Gender*		
Female	0.482 (0.499)	0.491 (0.499)
2. *Age*		
20-29 years	0.164 (0.370)	0.291 (0.454)
30-39 years	0.271 (0.444)	0.288 (0.452)
40-49 years	0.336 (0.472)	0.262 (0.440)
50-59 years	0.227 (0.419)	0.157 (0.364)
3. *Education attainment*		
Did not finish high school	0.107 (0.309)	0.122 (0.327)
High school graduate	0.256 (0.436)	0.318 (0.465)
College graduate	0.391 (0.488)	0.350 (0.477)
University undergraduate degree	0.170 (0.376)	0.149 (0.356)
University graduate degree	0.074 (0.262)	0.058 (0.234)
4. *Work related*		
Sector-public	0.533 (0.498)	0.086 (0.281)
Status-part time	0.126 (0.332)	0.156 (0.362)
Wage-hourly ($)	20.848 (8.279)	17.141 (9.992)
Tenure (avg months)	119.478 (86.927)	67.662 (72.150)
Employees/firm (under 20)	0.145 (0.353)	0.414 (0.492)
Employees/firm (20-100)	0.324 (0.468)	0.321 (0.467)
Employees/firm (100-500)	0.299 (0.457)	0.177 (0.382)
Employees/firm (500+)	0.230 (0.421)	0.085 (0.279)
N	98,624	170,872

[a] Sample restricted to employed individuals 20-60 years of age.
[b] All means are weighted.

Table 1 shows that older individuals are more prevalent in unionized jobs while younger individuals are more prevalent in non-unionized jobs. For example, Canadians between the ages of 40 and 59 years old account for 56% of unionized workers but only 42% of non-unionized workers.[17] One of the roles of unions is to increase job security and, because unions typically apply seniority rules, older union members should benefit the greatest, which could explain why unionized workers tend to be older.

[17] In comparison, Canadians between the ages of 20 and 39 years old account for 44% of unionized workers and 58% of non-unionized workers

Table 1 indicates that average educational attainment levels are relatively similar for both unionized and non-unionized workers. However, the lower levels of education (high school or less) are slightly more common in the non-unionized sector while higher levels of educational attainment (college and university) are slightly more common in the unionized sector. Unionized individuals appear to be much more commonly employed in the public sector. Approximately 53% of unionized workers included in the sample work in the public sector; whereas only 8.5% of non-unionized workers are public sector employees.[18] This finding is in line with Benjamin (2002) who remarked that public sector employees are typically more likely to be in a union than private sector employees.

As shown in Table 1, the average job tenure[19] of a unionized worker is almost twice the average tenure of a non-unionized worker (an average of 120 months in the unionized sector compared to 68 months in the non-unionized sector). In addition, it appears as though establishments with higher numbers of employees are more common in the unionized sector while establishments with smaller numbers of employees are more common in the non-unionized sector.

Finally, Table 1 shows that the average hourly wage of unionized workers is higher than the average hourly wage of non-unionized workers – as one would expect. The mean

[18] A t-test was used to determine whether the mean difference between public sector employment and union status was statistically different from zero. The t-statistic was such that one must reject the null hypothesis that the means are equal at the 1% level.

[19] The LFS measures the variable job tenure in months and it is top-coded at 240 months. The variable is top-coded in order to guard the anonymity of respondents. I found that approximately 13% of the sample is top-coded.

hourly union wage is $20.84, while in the non-union sector it is $17.14.[20] The $3.70 differential represents a 21.5% mark-up.

3.2.2 Health care industry statistics

The health care (and social assistance) industry produces a large sub-sample of 34,481 respondents, or approximately 12.5% of the total sample. Included in the sub-sample are 20,605 unionized workers and 13,876 non-unionized workers. The mean variable statistics for unionized and non-unionized health care workers are presented in Table 2, along with those of all other industries together, for comparison.

Table 2 shows that approximately 84% of all health care and social services industry workers – unionized and non-unionized - are female. In all other industries together, the percentage of workers who are female is much lower at approximately 43% of workers.[21] The high rate of female health care workers could stem from the fact that many health care occupations for example nurses, are traditionally held by women and this tendency could persist today.

Table 2 indicates that unionized health care workers attain higher levels of education. For example, nearly 80% of unionized health care workers have at least a college degree or certificate. One puzzling characteristic is that the percentage of unionized health care

[20] A t-test was used to determine whether the mean difference between hourly wages and union status was statistically different from zero. The t-statistic was such that one must reject the null hypothesis that the means are equal at the 1% level.

[21] A t-test was used to determine whether the mean difference between gender and health care industry status was statistically different from zero. The t-statistic was such that one must reject the null hypothesis that the means are equal at the 1% level.

workers with a college degree or certificate is very high relative to the other groups while the percentage of unionized health care workers that attain the highest levels of education (i.e. university graduate degrees) is slightly lower than that of all other groups.[22]

Table 2. Summary Statistics: Means and standard deviations in brackets

Explanatory Variables	Health care and social services		All other industries	
	Union	Non-union	Union	Non-union
1. *Gender*				
Female	0.837 (0.369)	0.853 (0.353)	0.400 (0.489)	0.461 (0.498)
2. *Age*				
20-29 years	0.157 (0.364)	0.232 (0.422)	0.165 (0.371)	0.296 (0.456)
30-39 years	0.275 (0.446)	0.281 (0.449)	0.270 (0.444)	0.288 (0.453)
40-49 years	0.333 (0.471)	0.289 (0.453)	0.337 (0.472)	0.260 (0.439)
50-59 years	0.233 (0.422)	0.196 (0.397)	0.226 (0.418)	0.154 (0.360)
3. *Education attainment*				
Did not finish high school	0.052 (0.222)	0.069 (0.255)	0.120 (0.324)	0.126 (0.332)
High school graduate	0.154 (0.361)	0.209 (0.406)	0.279 (0.448)	0.327 (0.469)
College graduate	0.571 (0.494)	0.470 (0.499)	0.349 (0.476)	0.341 (0.474)
University undergraduate degree	0.169 (0.375)	0.166 (0.372)	0.171 (0.376)	0.148 (0.355)
University graduate degree	0.052 (0.222)	0.083 (0.276)	0.079 (0.270)	0.056 (0.230)
4. *Work related*				
Sector-public	0.760 (0.426)	0.283 (0.450)	0.480 (0.499)	0.070 (0.256)
Status-part time	0.239 (0.426)	0.265 (0.441)	0.100 (0.300)	0.147 (0.354)
Wage-hourly ($)	20.305 (7.444)	17.232 (9.087)	20.973 (8.455)	17.133 (10.062)
Tenure (avg months)	118.198 (84.284)	72.012 (72.224)	119.772 (87.523)	67.310 (72.133)
Employees/firm (under 20)	0.115 (0.319)	0.533 (0.498)	0.152 (0.359)	0.405 (0.490)
Employees/firm (20-100)	0.246 (0.431)	0.241 (0.427)	0.341 (0.474)	0.328 (0.469)
Employees/firm (100-500)	0.301 (0.458)	0.126 (0.332)	0.298 (0.457)	0.181 (0.385)
Employees/firm (500+)	0.335 (0.472)	0.098 (0.298)	0.206 (0.404)	0.084 (0.278)
N	20,605	13,876	78,019	156,996

[a] Sample restricted to employed individuals 20-60 years of age.
[b] All means are weighted.

[22] The high rate of college graduates among unionized (and even non-unionized) health care workers could be a result of Provincial accreditation requirements. For example, in Quebec, many health care professions (including nurses) require a CEGEP degree which is classified as a college degree in the LFS.

As shown in Table 2, the percentage of unionized health care workers working in the public sector is very high. That is, 76% of unionized health care workers are public employees, compared to only 28% of non-unionized health care workers. In addition, the average job tenure of unionized health care workers is much higher than the average job tenure of non-unionized health care workers (118 months in the unionized health care sector compared to 72 in the non-unionized health care sector). Establishments with higher numbers of workers employed are much more common in the unionized health care sector compared to all other groups. For example, an average of 64% of unionized health care workers work in establishments with over 100 employees while 77% of non-unionized health care workers work in establishments with under 100 employees.

Finally, Table 2 shows that the average hourly wage of unionized health care workers ($20.30) is higher than that of non-unionized health care workers ($17.23), as expected. In comparison, the average hourly wage of unionized health care workers is slightly lower than that of unionized workers in all other industries ($20.97). At the same time, the average hourly wage of non-unionized health care workers is slightly higher than that of non-unionized, non-health care workers ($17.13).[23] The smaller differential in mean wages between unionized and non-unionized workers in the health care industry could be a result of spillover in the sense that non-unionized health care workers benefit more from the outcome of collective bargaining in the unionized health care sector.

[23] A t-test was used to determine whether the mean difference between hourly wages and health care industry status was statistically different from zero. The t-statistic was such that one must reject the null hypothesis that the means are equal at the 1% level.

3.2.3 Occupations in the health care industry

The LFS uses the National Occupational Classification for Statistics (NOC-S) to categorize occupations into 25 groups. Table 3 describes the health care and social assistance industry by occupations for both the unionized and non-unionized groups of workers.[24]

Table 3. Summary Statistics: Means and standard deviations in brackets

Occupation[25]	Health care and social assistance industry	
	Union	Non-union
Management	0.011 (0.105)	0.069 (0.254)
Business and finances	0.002 (0.052)	0.010 (0.103)
Administration	0.033 (0.180)	0.098 (0.297)
Clerical	0.070 (0.255)	0.110 (0.313)
Natural sciences	0.008 (0.091)	0.013 (0.114)
Health care professionals, nursing	0.300 (0.458)	0.112 (0.316)
Health care related, technical, assisting	0.297 (0.456)	0.223 (0.416)
Social sciences, gov't services, religion	0.135 (0.341)	0.227 (0.419)
Teaching	0.001 (0.038)	0.003 (0.059)
Art, recreation, culture, sport	0.004 (0.070)	0.007 (0.083)
Wholesale, insurance, real estate	0.000 (0.009)	0.000 (0.028
Retail sales	0.000 (0.025)	0.001 (0.032)
Food services	0.014 (0.120)	0.019 (0.138)
Protective services	0.003 (0.057)	0.002 (0.047)
Child care and home care	0.022 (0.148)	0.047 (0.213)
Other sales and services	0.083 (0.276)	0.037 (0.190)
Trades	0.008 (0.089)	0.005 (0.074)
Transportation and equipment	0.000 (0.029)	0.002 (0.051)
Primary industry related	0.000 (0.017)	0.000 (0.024)
Operational and assembly	0.000 (0.016)	0.002 (0.050
General labour	0.000 (0.005)	0.002 (0.054)

[a] Sample restricted to employed individuals 20-60 years of age.
[b] All means are weighted.

[24] A t-test was used to determine whether the mean difference between union status and health care industry status was statistically different from zero. The t-statistic was such that one must reject the null hypothesis that the means are equal at the 1% level.
[25] Note: management occupations were placed into one occupational group while all trades occupations were grouped together.

Table 3 shows that the two largest unionized occupational sub-groups of the health care and social assistance industry are health care professionals and nurses, and technical, assisting and other related health care professions, each with 30% of the sample group. Other common occupations in the unionized health care sector include food services, social sciences and government services, sciences and clerical. The two largest non-unionized occupational sub-groups of the health care and social assistance industry are social sciences (23%) and technical, assisting and other related health care professions (22%). Among the non-unionized health care workers, health care professionals and nurses make up only 11% of the total, a much lower proportion than in the unionized sector.

3.2.4 Rate of unionization

The rate of unionization[26] varies between industries. Typically, industries with a large number of public employees have higher rates of unionization. The mean rate of unionization for each industry is presented in Table 4.

Table 4 indicates that approximately one in three individuals included in the sample is unionized. Health care and social assistance, components of the community services industry, have a relatively high rate of unionization of 56%.[27] Other industries with high rates of unionization include public administration and other community services[28] while industries with lower rates of unionization include general business, finance, wholesale

[26] Note: the rate of unionization includes both union members and non-union members who are covered under a collective agreement.
[27] See Appendix 3 for the unionization rate of health care workers for each province.
[28] Note: Education occupations are included in the 'other community services' industry and retain a 73% rate of unionization.

trade and retail trade. Table 4 also shows that health care and social services is a relatively large industry in Canada, in fact, one of the two largest groups of workers.

Table 4 Summary Statistics: Means and standard deviations in brackets
Years 1997. 2002, 2007

Industry	Rate of unionization	N
Primary	0.343 (0.474)	14,064
Manufacturing		
Durables	0.342 (0.474)	22,853
Nondurables	0.326 (0.468)	18,904
Construction	0.343 (0.475)	13,564
Transportation	0.442 (0.496)	13,578
Wholesale trade	0.109 (0.312)	8,875
Retail trade	0.152 (0.359)	30,717
Finance	0.107 (0.310)	14,711
Community services		
Health care and social assistance	0.564 (0.495)	34,481
Other services	0.584 (0.492)	34,535
Personal services	0.077 (0.267)	25,900
Business services and miscellaneous	0.138 (0.345)	17,806
Public administration	0.735 (0.440)	19,508

[a] Sample restricted to employed individuals 20-60 years of age.
[b] All means are weighted.

Finally, over the survey years, most industries experienced a slight decline in the rate of unionization, as expected; however, others experienced slight increases (see Appendix 2). In general, there were no major changes in the rate of unionization for any industry. The rate of unionization in the health care and social assistance industry went essentially unchanged over the survey years.

The following section will develop models that will estimate the effects of unions on the wages of health care workers in Canada.

4. Empirical analysis

4.1 OLS

In order to examine the effects of unionization on the real wage of health care workers in Canada I start with the following econometric model:

$$\ln(realwage)_{it} = \beta_0 + \beta_1 union_{it} + X_{it}\gamma + Z_{it}\phi + \varepsilon_{it} \quad (1)$$

Where *ln(realwage)* is the log of the hourly real wage[29] (in dollars) for individual *i*, in period *t*. *Union* is a dummy variable, which is equal to 1 if the participant is unionized and 0 otherwise. X is a vector of individual characteristics which include: female, age groups[30], educational attainment levels, provinces of residence[31] and years of survey. Z is a vector of employment characteristics which include: public sector status, job tenure, part-time employment status and employees per establishment. All of the variables in the vectors X and Z are binary (or dummy variables). For example, the variable female is equal to 1 if the participant is female and 0 otherwise. ε represents the error term which contains unobserved factors (e.g. unobserved characteristics of respondents) that affect the wage.

I estimate four different specifications of Model (1). Specification (1) only includes the union dummy and the individual characteristics dummy variables. Specification (2)

[29] Nominal hourly wages were adjusted for CPI using the following formula: realwage=wage/(CPI/100). The CPI index is from the Bank of Canada website and the monthly CPI figures were as follows: April 2007: 111.6, October 2007: 111.6; April 2002: 99.5, October 2002: 101.2; April 1997: 90.2, October 1997: 90.6.

[30] Note: age groups were used as a proxy for experience.

[31] Provinces were grouped in the following way: Atlantic Provinces (NB, Nfld., PEI, NS), Western Provinces (Man, Sask, Alta), Quebec, and BC. (Note: Ontario was the omitted variable).

includes all variables in Specification (1), plus the public sector status dummy. Specification (3) consists of Specification (2), as well as job tenure[32] dummies and the part-time status dummy. Finally, Specification (4) includes all of the variables in Specification (3), as well as employees per establishment dummies.[33]

Model (1) was estimated using OLS for the health care industry exclusively as well as for all other industries together. The results for health care workers are presented in Table 5 and the results for all other industries together in Table 6.

4.1.1 Results for the health care industry

Table 5 shows that for all four specifications of Model (1) there is a positive (and economically significant) union effect. Holding all other variables constant, the union premium ranges from a high of 21% in Specification (1) to a low of 6.5% in Specification (4). As variables are added to the model, the effect of unions on real wages shrinks.

Table 5 displays many consistencies among the estimated variable coefficients. For example, the effect of being a female health care worker lowers the real wage by 1-4% across specifications. Also, higher age groups earn higher real wages. That is, the greater the work experience of individuals, the higher the relative wage, although in some specifications, the effect tapers off for the oldest respondents.

[32] Job tenures were grouped as follows: 101-200 months and 201-240 months. (Note: under 100 months was the omitted variable).
[33] Employees per establishment were grouped as follows: 20-99 employees, 100-500 employees and 501+ employees. (Note: under 20 employees was the omitted variable).

Table 5. OLS regression model - Health care industry - Sample 20-59 year old workers

Explanatory variables	Dependent variable = log real wage			
	(1)	(2)	(3)	(4)
Female	-0.042 (0.008)	-0.025 (0.008)	-0.019 (0.008)	-0.012 (0.008)
Union member	0.208 (0.006)	0.118 (0.006)	0.097 (0.006)	0.065 (0.006)
Age 30-39	0.155 (0.007)	0.151 (0.007)	0.113 (0.007)	0.112 (0.007)
Age 40-49	0.197 (0.007)	0.186 (0.007)	0.111 (0.008)	0.113 (0.007)
Age 50-59	0.196 (0.008)	0.186 (0.008)	0.094 (0.009)	0.097 (0.009)
Did not finish high school	-0.158 (0.011)	-0.146 (0.011)	-0.140 (0.011)	-0.140 (0.011)
College degree	0.205 (0.007)	0.197 (0.006)	0.193 (0.006)	0.191 (0.006)
University-undergraduate degree	0.385 (0.009)	0.358 (0.009)	0.360 (0.009)	0.356 (0.009)
University-graduate degree	0.511 (0.014)	0.471 (0.014)	0.479 (0.014)	0.468 (0.014)
Atlantic	-0.222 (0.007)	-0.235 (0.007)	-0.239 (0.006)	-0.229 (0.006)
Quebec	-0.107 (0.007)	-0.107 (0.007)	-0.111 (0.007)	-0.108 (0.007)
Western	-0.112 (0.007)	-0.123 (0.007)	-0.116 (0.007)	-0.107 (0.007)
B.C.	0.022 (0.008)	0.029 (0.008)	0.042 (0.008)	0.058 (0.008)
Year 2002	0.021 (0.006)	0.018 (0.006)	0.021 (0.006)	0.021 (0.006)
Year 2007	0.064 (0.006)	0.064 (0.006)	0.070 (0.006)	0.069 (0.006)
Public service		0.191 (0.006)	0.171 (0.006)	0.127 (0.006)
Job tenure: 101-200 months			0.126 (0.007)	0.120 (0.006)
Job tenure: 201+ months			0.169 (0.007)	0.157 (0.007)
Part-time employee			-0.045 (0.006)	-0.042 (0.006)
Employees: 20-99				0.061 (0.007)
Employees: 100-500				0.108 (0.007)
Employees: 500+				0.150 (0.008)
R-squared	0.29	0.33	0.35	0.36
N	34,481	34,481	34,481	34,481

[a] Standard errors are in brackets.

[b] The omitted variables include: males, non-unionized, aged 20-29, high school graduates, Ontario, 1997, working at current establishment for 1-100 months, full-time employees and working at establishment with under 20 employees.

[c] All estimated coefficients are significant at the 1% level (two-tailed test) except the coefficient for female in Specification (3) is significant at the 5% level and the estimated coefficient for female in Specification (4) is not significant.

Table 5 shows that there is a positive return to education. For example, individuals with college degrees, university undergraduate degrees and university graduate degrees earn up to 50% higher real wages than individuals who have high school degrees as the highest level of educational attainment. The real wage of individuals who did not finish high school is consistently lower across specifications.

As shown in Table 5, workers from the Atlantic Provinces, the Western provinces and Quebec earn consistently lower real wages compared to those in Ontario. Those in the Atlantic Provinces earn the lowest at around 22% lower real wages. In addition, workers from B.C. earn slightly higher real wages compared to workers from Ontario.[34]

Table 5 shows that a health care worker employed in the public sector earns 12-19% more than a health care worker in the private sector. In the three specifications that include public sector status, the estimated coefficient for public status is larger than the estimated coefficient for union status. This suggests that there is a greater return for being publicly employed than for being unionized, although both are always positive.

Finally, Table 5 indicates that longer employment tenures and establishments with larger numbers of employees correspond to higher real wages. In addition, full-time employees earn higher real wages compared to part-time employees.

[34] Note: I found that the estimated regression results are almost identical when using individual provincial dummies rather than regional dummies.

4.1.2 Comparison with results for all industries (except health care) together

Table 6 shows that the effects of being in a union, on the real wage of workers in all non-health care industries together, is very similar to the results found in the health care industry alone. In each specification, however, the union effect is slightly higher for the health care industry.

One major difference between Table 5 and Table 6 is that females in other industries earn significantly lower real wages compared to males. In the results for the health care industry, the effect of being female was a reduction in real wages by 1-4%, whereas, in all other industries together, the effect of being female is a reduction in real wages by 19-24%. A t-test confirms that the female coefficient is statistically different across the two sectors (health versus non-health industries) and this at the 1% level of significance. One possible explanation is that, because there is such a high ratio of females to males in the health care industry, the effect of being female is drowned out.

Table 6 shows that age effects are larger in all other industries together compared to the health care industry. This would suggest that experience is more rewarded in industries outside of health care. The estimated coefficients for educational attainment are relatively similar between industries; however, the effect (on real wages) of being a college graduate working in the health care industry is much higher than for a college graduate working in another industry. A t-test confirms that most of the education coefficients (except did not finish high school) are statistically different across the two sectors and this at the 5% level of significance.

Table 6. OLS regression model - All industries (excluding health care) - Sample 20-59 year old workers

Explanatory variables	Dependent variable = log real wage			
	(1)	(2)	(3)	(4)
Female	-0.229 (0.002)	-0.241 (0.002)	-0.198 (0.002)	-0.192 (0.002)
Union status	0.195 (0.002)	0.140 (0.003)	0.095 (0.003)	0.058 (0.003)
Age 30-39	0.257 (0.003)	0.255 (0.003)	0.193 (0.003)	0.190 (0.003)
Age 40-49	0.327 (0.003)	0.320 (0.003)	0.210 (0.003)	0.210 (0.003)
Age 50-59	0.339 (0.004)	0.328 (0.004)	0.195 (0.004)	0.197 (0.004)
Did not finish high school	-0.150 (0.003)	-0.140 (0.003)	-0.133 (0.003)	-0.123 (0.003)
College degree	0.127 (0.003)	0.122 (0.003)	0.120 (0.002)	0.118 (0.002)
University-undergraduate degree	0.351 (0.004)	0.325 (0.004)	0.325 (0.004)	0.312 (0.004)
University-graduate degree	0.458 (0.006)	0.418 (0.006)	0.425 (0.006)	0.404 (0.006)
Atlantic	-0.225 (0.003)	-0.234 (0.003)	-0.237 (0.003)	-0.214 (0.003)
Quebec	-0.093 (0.003)	-0.092 (0.003)	-0.090 (0.003)	-0.081 (0.003)
Western	-0.031 (0.003)	-0.037 (0.003)	-0.031 (0.003)	-0.016 (0.003)
B.C.	0.013 (0.004)	0.013 (0.004)	0.028 (0.003)	0.052 (0.003)
Year 2002	0.017 (0.003)	0.018 (0.003)	0.021 (0.003)	0.019 (0.003)
Year 2007	0.055 (0.003)	0.056 (0.003)	0.062 (0.003)	0.058 (0.003)
Public service		0.140 (0.003)	0.130 (0.003)	0.124 (0.003)
Job tenure: 101-200 months			0.158 (0.003)	0.146 (0.003)
Job tenure: 201+ months			0.247 (0.003)	0.225 (0.003)
Part-time employee			-0.220 (0.003)	-0.201 (0.003)
Employees: 20-99				0.076 (0.003)
Employees: 100-500				0.146 (0.003)
Employees: 500+				0.225 (0.004)
R-squared	0.32	0.33	0.39	0.41
N	235,015	235,015	235,015	235,015

[a] Standard errors are in brackets.
[b] The omitted variables include: males, non-unionized, aged 20-29, high school graduates, Ontario, 1997, working at current establishment for 1-100 months, full-time employees and working at establishment with under 20 employees.
[c] All estimated coefficients are significant at the 1% level (two-tailed test).

Table 6 indicates that the estimated coefficients for province are also relatively similar between industries; however, the negative effect (on real wages) of living in the western

provinces and working in health care is much larger compared to the effect on real wages for respondents working in other industries.

As shown in Table 6, the positive return for being employed in the public sector is lower for all other industries together compared to the health care industry alone. Finally, part-time employees in all other industries earn significantly less than their full-time counterparts and this effect is much greater than in the health care industry.

4.2 Alternative model

One problem with Model (1) is that it assumes that the union effect is the same for all workers (i.e. it is a level effect). For example, an individual who did not finish high school is assumed to receive the same premium from being unionized as an individual with a Masters degree. This assumption may not be appropriate if unions are indeed successful in reducing inequality. I enrich the Model (1) by allowing for the union effect to vary across observable characteristics. The new model is:

$$\begin{aligned} \ln(realwage)_{it}^{\ u} &= \beta_0^{\ u} + X_{it}\gamma^u + Z_{it}\phi^u + \varepsilon_{it}^{\ u} \\ \ln(realwage)_{it}^{\ nu} &= \beta_0^{\ nu} + X_{it}\gamma^{nu} + Z_{it}\phi^{nu} + \varepsilon_{it}^{\ nu} \end{aligned} \qquad (2)$$

Where the first equation represents unionized workers (as denoted by the superscript *u*) and the second equation represents non-unionized workers (as denoted by the superscript *nu)*. The vector X includes: female, age groups, educational attainment levels, provinces of residence and years of survey. The vector Z includes: public sector status, job tenure and part-time employment status. I am therefore using the same set of explanatory dummy variables as Specification (3) in Table 5 and 6. I also restrict my analysis to the

group of interest, workers in the health care industry. I estimated both equations in Model (2) using OLS. The results are presented in Table 7.

Table 7 shows that the age effects are greater in the non-unionized sector compared to the unionized sector. This implies that non-unionized workers receive greater rewards for experience.

Table 7. OLS regression - Health care industry - Specification (3) - Sample 20-59-year-old workers

Explanatory variables	Union	Non-union
Female	0.015 (0.008)	-0.074 (0.015)
Age 30-39	0.070 (0.008)	0.156 (0.012)
Age 40-49	0.076 (0.009)	0.145 (0.012)
Age 50-59	0.068 (0.010)	0.116 (0.014)
Did not finish high school	-0.112 (0.011)	-0.165 (0.018)
College degree	0.198 (0.007)	0.177 (0.011)
University-undergraduate degree	0.370 (0.010)	0.332 (0.015)
University- graduate degree	0.427 (0.019)	0.495 (0.020)
Atlantic	-0.174 (0.007)	-0.313 (0.011)
Quebec	-0.086 (0.008)	-0.137 (0.014)
Western	-0.118 (0.007)	-0.110 (0.011)
B.C.	0.056 (0.008)	0.032 (0.015)
Year 2002	0.014 (0.007)	0.024 (0.011)
Year 2007	0.047 (0.007)	0.090 (0.011)
Public service	0.170 (0.007)	0.159 (0.010)
Job tenure: 101-200 months	0.082 (0.007)	0.184 (0.012)
Job tenure: 201+ months	0.132 (0.008)	0.247 (0.016)
Part-time employee	-0.012 (0.007)	-0.088 (0.010)
R-squared	0.29	0.33
N	20,605	13,876

[a] Standard errors are in brackets.
[b] The omitted variables include: males, non-unionized, aged 20-29, high school graduates, Ontario, 1997, working at current establishment for 1-100 months, full-time employees and working at establishment with under 20 employees.
[c] All estimated coefficients are significant at the 10% level (two-tailed test).

Table 7 indicates that wage inequality based on education is lower in the unionized sector. For example, workers in the unionized sector that have the highest levels of educational attainment receive lower real wages compared to the same workers in the non-unionized sector. In addition, workers with the lowest levels receive higher real wages in the unionized sector compared to the same workers in the non-unionized sector. It should be noted that the education coefficients are only statistically different across the two sectors at the 10% level of significance.

Finally, Table 7 shows that the effect of being female is actually positive in the unionized sector while the effect in the non-unionized sector is negative. In all other estimated models, female workers earned lower real wages compared to males; therefore, based on Model (2), unions appear to lower gender inequality in the unionized health care sector. A t-test confirms that the female coefficient is statistically different between union and non-union sectors and this at the 1% level of significance.

Since Model (2) allows for the union effect to vary across observable characteristics, the effects are not easily comparable. I, therefore, followed the same approach as Simpson (1985): I began by estimating the equations in Model (2) using OLS. I then calculated the mean statistic for each variable in the model and finally calculated the estimated average log real wage for both equations as follows:

$$\ln(\overline{realwage})^{u} = \hat{\beta_0}^{u} + \overline{X}\hat{\gamma}^{u} + \overline{Z}\hat{\phi}^{u}$$

$$\ln(\overline{realwage})^{nu} = \hat{\beta_0}^{nu} + \overline{X}\hat{\gamma}^{nu} + \overline{Z}\hat{\phi}^{nu}$$

Where $\hat{\beta}_0$, $\hat{\gamma}$ and $\hat{\phi}$ represent the estimated parameter coefficients derived in (a); $\overline{X}$ and $\overline{Z}$ represent vectors of the mean variable statistics calculated in (b); and, $\ln(\overline{realwage})$ represents the estimated average log real wage.

To calculate the effect of unions on the real wage, I then used the following formula:

$$d = e^{\ln(\overline{realwage})^{u} - \ln(\overline{realwage})^{nu}} - 1$$

Where d represents the effect of unions on real wages.

I found that there is a 10% return to being unionized in the health care industry. In Model (1), the estimated return to being unionized was 9.7%, therefore the effect of unions on the real wages of health care workers, when allowing for other variables to vary, increases slightly.

4.3 Endogeneity

One problem with using basic OLS regressions to estimate the effects of unions on real wages is a problem with endogeneity. That is, there may exist unobservable individual characteristics that determine wages as well as the decision for an individual to choose a unionized job.

One method to correct for endogeneity is to augment Model (2) by including a self-selection equation, as shown below:

$$\ln(realwage)_{it}^{u} = \beta_0^{u} + X_{it}\gamma^{u} + Z_{it}\phi^{u} + \varepsilon_{it}^{u}$$
$$\ln(realwage)_{it}^{nu} = \beta_0^{nu} + X_{it}\gamma^{nu} + Z_{it}\phi^{nu} + \varepsilon_{it}^{nu} \quad (3)$$
$$I_{it} = W_{it}\tau + \mu_{it}$$

Where I is a latent variable. An individual is unionized if $I > 0$, and non-unionized otherwise. W represents a vector of observable characteristics that determine union status for individual i, in period t. Finally, μ represents the error term.

The vector X includes: female, age groups, educational attainment levels, provinces of residence and years of survey; and the vector Z includes: public sector status, job tenure and part-time employment status. I am therefore using the same set of explanatory variables as Specification (3) in Table 5 and 6. I also restrict my analysis to the group of interest, workers in the health care industry.

The reason a selection equation is necessary is because in Model (2) it's possible that the error term, ε, which includes unobservable individual characteristics[35] that determine wages, is correlated with the union status variable. As a result, the estimated effect of being unionized would be biased because it would be picking up the union effect on wages as well as other effects. The selection equation accounts for the unobservable individual characteristics.

[35] Examples of unobservable characteristics include: drive, ability, personality, motivation and passion.

The variables I chose to include in the vector W are all the variables in the wage equation plus whether an individual has small children (under the age of 6) and whether an individual's spouse is publicly employed.

I chose individuals with small children as the first characteristic because schooling doesn't begin until children reach a higher age. Parents must often decide between working (and paying for childcare) and not working (and staying home to care for their children). Having a unionized job improves the flexibility of work hours and facilitates parents' ability to both work and care for their children. Therefore, having small children will affect an individual's decision to accept a unionized job.

I chose individuals with a publicly employed spouse as the second characteristic because public sector employees are typically unionized and have greater job security. There are two possible ways that this variable could affect union status. First, the appeal of having a unionized job may be less essential and riskier opportunities may seem more rewarding. Therefore, having a spouse who is publicly employed will reduce the probability that the individual will accept a unionized job. Second, people who are married often share similar characteristics or might meet at work. Therefore, an individual is more likely to be unionized if their spouse works in the public sector.

I estimated Model (3) using the Heckman procedure for the health care industry. The results are presented in Table 8. In comparing Table 8 with Table 7, I find that the estimated coefficients are almost identical. In addition, the estimated coefficient for the

Table 8. Heckman model - Health care industry - Specification (3) - Sample 20-59 year old workers

Explanatory variables	Union	Non-union
Female	0.015*	-0.075***
	(0.008)	(0.015)
Age 30-39	0.068***	0.153***
	(0.008)	(0.012)
Age 40-49	0.076***	0.144***
	(0.009)	(0.012)
Age 50-59	0.068***	0.116***
	(0.010)	(0.014)
Did not finish high school	-0.113***	-0.166***
	(0.011)	(0.018)
College degree	0.192***	0.171***
	(0.007)	(0.012)
University- undergraduate degree	0.370***	0.332***
	(0.010)	(0.015)
University- graduate degree	0.438***	0.506***
	(0.020)	(0.022)
Atlantic	-0.180***	-0.318***
	(0.008)	(0.012)
Quebec	-0.098***	-0.151***
	(0.010)	(0.017)
Western	-0.124***	-0.116***
	(0.008)	(0.012)
B.C.	0.042***	0.017
	(0.011)	(0.018)
Year 2002	0.014**	0.023**
	(0.007)	(0.011)
Year 2007	0.045***	0.089***
	(0.007)	(0.011)
Public service	0.131***	0.120***
	(0.021)	(0.030)
Job tenure: 101-200 months	0.072***	0.173***
	(0.009)	(0.014)
Job tenure: 201+ months	0.118***	0.229***
	(0.010)	(0.020)
Part-time employee	-0.012*	-0.089***
	(0.007)	(0.010)
Lambda	-0.054	0.051
	(0.028)	(0.037)
N	34,481	34,481

Note: Standard errors are in brackets.
Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level (all two-tailed test).

self-selection term is not statistically significant. Therefore, accounting for self-selection does not affect the previous findings. It should be noted that having children under the age of six has a positive impact on whether an individual is unionized, as expected, and it is statistically significant at the 10% level. Having a spouse working in the public sector also has a positive impact in the selection equation and it is significant at the 1% level.

4.4 Robustness

The LFS public use files aggregate health care workers and social assistance workers together into one industry group; therefore, the estimated union-wage effects calculated in sections 4.1-4.3 are not entirely exclusive to the health care industry.

In order to better identify the effect of unions on the wages of health care workers alone, I followed the approach of Cleveland et al. (2003), and estimated Model (2) for specific occupations. I selected the following occupations: a) health care professionals (which also include nurses and nurse supervisors), b) other (e.g. technical, assisting and related) occupations in health, and c) clerical occupations. The results are presented in Table 9.

I found that for health care professionals, unions increase the real wage by nearly 7%. For other occupations in health care, I found a 4% union effect on wages, and for clerical occupations, I found a 5.5% effect. Although in all three occupations the effect of unions on the real wage is slightly lower than the estimated effect for the entire industry including social assistance, in each regression there was still a positive union effect.

Table 9. OLS regression - Health care occupations- Specification (3) - Sample 20-59-year-old workers

Explanatory variables	Health profess.		Other health		Clerical	
	Union	Non-union	Union	Non-union	Union	Non-union
Female	0.022	-0.016	-0.029	-0.036	-0.003	-0.030
	(0.020)	(0.058)	(0.013)	(0.030)	(0.026)	(0.054)
Age 30-39	0.089	0.191	0.034	0.128	0.029	0.180
	(0.014)	(0.041)	(0.013)	(0.025)	(0.020)	(0.028)
Age 40-49	0.122	0.211	0.029	0.064	0.068	0.168
	(0.015)	(0.039)	(0.014)	(0.026)	(0.019)	(0.026)
Age 50-59	0.125	0.167	-0.011	-0.044	0.040	0.164
	(0.018)	(0.044)	(0.016)	(0.031)	(0.022)	(0.033)
Did not finish high school	-0.159	-0.249	-0.076	-0.127	-0.069	-0.116
	(0.078)	(0.118)	(0.020)	(0.037)	(0.026)	(0.049)
College degree	0.149	0.227	0.107	0.217	0.022	0.028
	(0.038)	(0.079)	(0.012)	(0.023)	(0.013)	(0.021)
University-undergraduate degree	0.222	0.364	0.177	0.287	0.032	0.029
	(0.038)	(0.081)	(0.023)	(0.042)	(0.025)	(0.037)
University- graduate degree	0.153	0.346	0.201	0.424	0.080	0.250
	(0.046)	(0.087)	(0.046)	(0.059)	(0.046)	(0.118)
Atlantic	-0.118	-0.136	-0.183	-0.321	-0.242	-0.208
	(0.011)	(0.032)	(0.012)	(0.022)	(0.016)	(0.030)
Quebec	-0.118	-0.087	-0.083	-0.193	-0.134	-0.052
	(0.013)	(0.047)	(0.014)	(0.028)	(0.019)	(0.042)
Western	-0.048	-0.021	-0.135	-0.067	-0.154	-0.096
	(0.012)	(0.032)	(0.012)	(0.024)	(0.015)	(0.026)
B.C.	0.032	-0.073	0.098	0.133	0.070	0.115
	(0.015)	(0.046)	(0.013)	(0.037)	(0.019)	(0.028)
Year 2002	0.047	0.042	-0.011	0.030	0.014	0.030
	(0.010)	(0.031)	(0.011)	(0.023)	(0.014)	(0.024)
Year 2007	0.112	0.105	0.064	0.120	0.043	0.091
	(0.011)	(0.033)	(0.011)	(0.023)	(0.016)	(0.024)
Public service	0.107	0.106	0.136	0.040	0.112	0.124
	(0.017)	(0.028)	(0.010)	(0.022)	(0.026)	(0.024)
Job tenure: 101-200 months	0.052	0.115	0.099	0.229	0.040	0.128
	(0.013)	(0.030)	(0.012)	(0.025)	(0.016)	(0.025)
Job tenure: 201+ months	0.084	0.141	0.158	0.309	0.028	0.108
	(0.013)	(0.043)	(0.013)	(0.036)	(0.018)	(0.035)
Part-time employee	0.013	0.021	-0.012	-0.005	-0.023	-0.107
	(0.010)	(0.030)	(0.011)	(0.020)	(0.014)	(0.021
R-squared	0.167	0.169	0.258	0.275	0.296	0.296
N	6,148	1,525	6,234	3,043	1,386	1,470

[a] Standard errors are in brackets.

I also estimated Model (2) using a restricted model that removed occupations that were likely to be associated with social assistance. I found that the effect of unions on real wages was 8%. Therefore, when reducing the sample to include occupations that are certain to be related to health care, the key finding remains unchanged.

5. Conclusion

The examination of the union effect on wages of Canadian health care workers, using LFS data, has allowed me to make the following conclusions:

There is a positive effect of unions on the wages of health care workers in Canada. That is, a unionized health care worker will earn a higher real wage compared to a non-unionized health care worker. The estimated effect is a 10% higher real wage.

Wage inequality based on gender is low in the unionized health care sector. In fact, contrary to most research, in this case males earn lower real wages than females. In addition, wage inequality based on education is also low in the unionized health care sector.

The implication of a positive union effect on the wages of health care workers is that, when analyzing aspects of the cost of health care, it must be recognized that the cost of labour is linked to the extent of unionization within the health care industry. Since health care workers are typically unionized and because unions are able to achieve higher real

wages for workers, improving the future costs of labour in the health care industry will surely be a challenge.

Appendix

Appendix 1. Classification of industries

Riddell and Riddell (2004) –industry variables	LFS – NAICS
Primary	Agriculture, forestry, fishing, mining, oil, gas, utilities
Manufacturing: durable	Manufacturing: durables
Manufacturing: non-durable	Manufacturing: non-durables
Construction	Construction
Transportation, storage	Transportation, warehousing
Wholesale trade	Wholesale trade
Retail trade	Retail trade
Finance	Finance, insurance, real estate, leasing
Community services	Health care, social assistance, educational services, information, culture, recreation
Personal services	Professional, scientific and technical services; accommodation and food services
Business and misc.	Management, administrative and other support; other services
Public administration	Public administration

Appendix 2. Summary Statistics: Means and standard deviations in brackets

Industry	Rate of unionization (1997)	N	Rate of unionization (2002)	N	Rate of unionization (2007)	N
Primary	0.359 (0.479)	4,761	0.339 (0.473)	4,415	0.328 (0.469)	4,888
Manufacturing						
Durables	0.384 (0.486)	7,532	0.340 (0.474)	8,134	0.296 (0.456)	7,187
Nondurables	0.347 (0.476)	6,768	0.317 (0.465)	6,593	0.311 (0.463)	5,543
Construction	0.330 (0.470)	3,843	0.348 (0.476)	4,243	0.350 (0.477)	5,478
Transportation	0.445 (0.497)	4,385	0.442 (0.496)	4,466	0.438 (0.496)	4,727
Wholesale trade	0.126 (0.332)	2,656	0.099 (0.299)	2,986	0.104 (0.306)	3,233
Retail trade	0.152 (0.359)	10,148	0.150 (0.357)	10,037	0.154 (0.361)	10,532
Finance	0.097 (0.297)	4,877	0.106 (0.307)	4,760	0.120 (0.325)	5,074
Community services						
Health care and social assistance	0.552 (0.497)	10,468	0.572 (0.494)	11,700	0.566 (0.495)	12,313
Other services	0.591 (0.491)	11,193	0.585 (0.492)	11,375	0.576 (0.494)	11,967
Personal services	0.082 (0.275)	8,114	0.077 (0.267)	8,599	0.073 (0.260)	9,187
Business services and miscellaneous	0.133 (0.339)	5,504	0.141 (0.348)	5,781	0.139 (0.346)	6,521
Public administration	0.728 (0.444)	6,767	0.742 (0.437)	5,979	0.737 (0.440)	6,762

[a] All means are weighted.

Appendix 3. Summary Statistics: Means and standard deviations in brackets

Province	Health care industry	
	Rate of unionization	N
Newfoundland	0.642 (0.480)	1418
New Brunswick	0.574 (0.495)	2054
Prince Edward Island	0.629 (0.483)	977
Nova Scotia	0.555 (0.497)	2116
Quebec	0.664 (0.472)	6389
Ontario	0.460 (0.498)	9869
Manitoba	0.627 (0.484)	2985
Saskatchewan	0.663 (0.473)	2555
Alberta	0.513 (0.500)	2827
British Columbia	0.639 (0.480)	3297

[a] All means are weighted.
[b] Note: all survey years (i.e. 1997, 2002 and 2007) are included.

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