

Union Impact on Job Tenure

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Abstract

This paper examines the impact of union membership on workers' job tenure in Canada. Using the 2008 Labour Force Survey, I find that union membership has a positive impact on a worker's tenure. Females, seniors and the less educated are the three groups which have most been affected by the unions. I also explore for the existence of self-selection bias using a Heckman two-step procedure. Interestingly, accounting for self-selection does not materially affect my findings.

1. Introduction

According to common wisdom, the presence of a union in the workplace is expected to reduce exit behaviour and provide more senior workers with job security against lay-offs. Since unions are powerful institutions, they are able to provide an institutional backing for complaint rectification against exploitation, in the form of unfair treatment by employers or poor working conditions. As a result, the workers may be less likely to quit. Is this hypothesis true, and is the result the same in all countries?

Kuhn and Sweetman (1998) argue that when firms are downsizing and there is competition from imports, union workers will be affected mostly through a wage cut and a reduction in fringe benefits; union wages and benefits are usually much higher than in the non-union sector, leaving more room for cuts. The unionized worker may then choose to move within the industry, or quit to compensate for their loss. In other words, the exit behaviour of the worker who is covered by a union may be more obvious than the one who is not.

Some economists, on the other hand, hold the opinion that union power will decrease the productivity of the firm, so that the profitability of the firm will decline as well. Some argue that the senior workers who are protected by their union will hinder the development of organization and opportunities for the promotion of junior workers. The debate between the monopoly face and the collective voice face has already lasted for a couple of decades.¹

Freeman (1980b) provides empirical evidence that a reduction in exit behaviour lowers cost and increases productivity. Moreover, unions tend to defend the rights of more

¹ A monopoly face, associated with their monopolistic power to raise wages, and a collective voice/institutional response face, associated with their representation of organized workers within enterprises. (Freeman and Medoff 1984)

senior workers covering such issues as length of vacations, fringe benefits, and protection from lay-offs.

This paper explores the union effect discussed above. Instead of using United States data, which is the most common data source, I use data from the Canadian Labour Force Survey. This paper examines the impact of unions on job tenure with the same employer in the Canadian labour market. Three approaches are used in this analytical work. First, a straightforward model is introduced to show the general result of the union impact. Though this model is simplistic, I can still come to a conclusion regarding the union impact. Second, a two equation model is used to allow the covariate effects to vary as union status changes. Oaxaca-Blinder decomposition is to identify the source of the difference in tenure. Third, I apply the Heckman two-step procedure to eliminate the self-selection bias from the analysis.

The empirical analysis in this paper brings forth three interesting findings. First, the union impact on job tenure in Canada is similar to that found in the United States. Second, after the covariates are allowed to vary with union status, union membership has a marked effect on the tenure of particular groups – such as less educated workers, more senior workers and women workers. Third, self-selection bias does not have a large impact on my finding.

The main body of this paper is organized in six sections. A review of the literature is given in section 2. Section 3 describes the data used in this paper. Summary statistics are also provided. In section 4, I present three models for examining the union impact. Robustness checks are carried out in section 5. The conclusion is drawn in section 6.

2. Literature Review

Many economists have analyzed the effect of unions on workers' exit behaviour and seniority regarding lay-offs, such as Freeman (1980a), Freeman (1980b), Block (1978a) and Chaykowski and Slotave (1986). Most empirical work based on United States data suggests that there exists a negative relationship between union membership and quit rates, and a positive relationship between unionism and job tenure. In this section, I review the literature on quits, seniority in lay-offs and self-selection in sub-sections 2.1, 2.2 and 2.3, respectively.

2.1 Quit Rates

As non-wage outcomes became more important in labour economics, the exit-voice theory has started to arouse the interest of economists. What is the exit-voice theory, and how does it reduce the separation between workers and firms? When a worker is not satisfied with his firm – for instance, discontented with working conditions, salary, fringe benefits or the length of vacation – most probably he will choose to quit. Under the exit-voice theory, the worker may complain to his union and request that the unfair treatment be redressed. It does not mean all of his discontent will be eliminated, but at least it will decrease the possibility of quitting the job.

Freeman (1980a) explored whether the presence of a union reduces the chance that a worker would use the exit option, and by what extent. Freeman used data from the National Longitudinal Survey (NLS), the Michigan Panel Survey of Income Dynamics (PSID) and the Current Population Survey (CPS). The NLS and PSID are panel data, which means that one can determine whether an unemployed worker belonged to a union in

his or her last job. As expected, the presence of a union kept workers in the same firm for a longer period of time. If the union workers quit their job, then our expectation will not be realized. The importance of panel data is that the union impact is identified by observing if the worker was unionized in his or her last job.

Freeman (1980a) used data from the NLS on males aged 45 to 59 in 1966 and 1973. His regression function is of linear form and the parameters are estimated using the Ordinary Least Square (OLS) method. The dependent variable is tenure, which is the length of time the worker stayed in the same job. The key explanatory variables include union membership, log of earnings, years of school, age, and other control variables. The result shows that unions have a larger impact on tenure and quit rates than on wages. The main conclusion from this data set is that unionized workers are more attached to their firms than non-unionized workers.

The PSID data set (1974) covers the entire population and thus gives a more inclusive picture of the trade union impact than the older male NLS sample. Using the same method as the one used in the NLS, the union impact on exit behaviour was smaller than that exhibited in the NLS data set. Moreover, the wage effect in the PSID appears to be larger than the corresponding effect in the NLS. A possible reason is that a union will have a more modest impact on the younger workers who are included in this data set than on older workers.

The CPS is the largest of the three data sets used by Freeman (1980a). The advantage of these data is that the union status of individuals in their last job can be observed, so that the impact of unions on quit rates can be analyzed. He combined May 1973, May 1974 and May 1975 data, which resulted in a sample of 98,500 individuals. The method used was the same as with the other two data sets. The main finding from this

data is the reduction in quit rates due to the union effect is the same as the wage effect if one's wage is raised by 92%. Thus, the presence or absence of a union will have a dramatic impact compared with the wage effect.

Freeman (1980b) used the same data set used in Freeman (1980a) to analyze whether unions raise worker attachment to firms. In order to eliminate the individual's characteristic difference from the regression equation, Freeman (1980b) applies a different method.

Freeman (1980b) uses the probability of quitting to estimate the effect of union. He used a dummy variable, which measured whether the i -th person quit in period t , as the dependent variable. Two control variables are included: one is a dummy variable for whether (or not) the person is a union member and the other one is unobserved personal characteristics which raise the propensity to quit. To eliminate the personal characteristics, Freeman (1980b) uses the probability of quitting in the current period minus the probability of quitting last period. Since there is no difference in personal characteristics in the two periods, the characteristics term will not appear in the difference function.² The main findings of this paper are that trade unionism has a significant positive effect on the length of attachment between workers and firms, and reduces the quit rate of workers. Moreover, the grievance and arbitration system is the primary route to reduce the quit rate.

Block (1978a) also produced evidence that union-negotiated non-wage provisions have a significant impact on employee behaviour. The data set is from the Social Security Administration's Continuous Work History Sample for the year 1959 to 1963. Linear

² Freeman (1980a) uses linear regression on tenure through key control variables, such as age, education, union or non-union and so on. Panel data can be used to trace the person in the last few years on whether this person belonged to a union or not. However, what if the data does not contain an individual's characteristic? Then by using the same method, it is not possible to conclude that the presence of a union will raise tenure.

regression was used to estimate to what extent the key control variables affected the dependent variable, which is the percent of all employees in industry i in period t whose first job was in industry i and who are employed in more than one establishment in time period t . Other key control variables include the supplemental unemployment benefit plan (SUB), strength and extent of union-negotiated seniority-in-promotion-and-transfer provisions, a measure of the probability of an employee being covered by a supplemental unemployment benefit plan, the level of hourly earnings in the industry, the percentage of the labour force that is female and the median level of schooling.

The results show that all the control variables will have a negative effect on the possibility of changing jobs in the same industry. Specifically, if I hold the other variables constant, union-negotiated provisions will statistically and economically reduce employee movement. The author further states that the coefficient of SUB has only a modest impact on job changing in the form of quits but not lay-offs.

2.2 Seniority in lay-offs

As workers age, seniority in lay-offs becomes one of the most important issues in the labour market and many decisions which affect the labour supply will be made by individuals according to their age. Freeman and Medoff (1984) give the definition of seniority: "SENIORITY, defined as length of service in an employment unit, governs numerous personnel decisions in modern firms." The main issue regarding seniority is that when economic conditions experience a downturn, will the company decide to lay off junior workers under a last-in-first-out³ lay-offs policy, since the compensation of senior workers

³ Last In First Out (LIFO) means the most recent entry is the next to be processed, and the oldest is the last to be processed.

will exceed that of juniors? On the other hand, when economic conditions improve and the company decides to promote workers, will a senior worker be promoted prior to a junior worker, and will a senior receive more and higher-valued benefits than junior worker? Some benefits, like health insurance and paid vacation time, are more likely to be used by older workers. Other benefits, notably pensions, are more valuable to senior workers because they are nearer retirement.

Is a union seniority rule good or bad? Neither theory nor evidence can give a clear answer. Freeman and Medoff (1984) give a general idea of the merit of a union seniority rule,

If union seniority rules reduce efficiency greatly, we would probably judge them socially deleterious. If non-union management made blatantly unfair lay-offs and promotion decisions, I would probably judge union seniority rules socially beneficial.

Block (1978a) concentrates on analyzing if union-negotiated seniority provisions reduce labour turnover. In his paper, Block (1978a) introduces a new variable to measure union-negotiated provisions by giving a number to each category of provision. For example, if a firm makes the promotion decision based only on seniority, then the score assigned to this category will be 10. Therefore, zero means seniority has no influence by provisions in promotions. The data was available from The Bureau of Labor Statistics (BLS) studies based on the bureau's file of collective bargaining agreements that cover 1,000 or more workers. The dependent variable is the quit rate, and the key independent variables include hourly earnings, union-negotiated provisions, variables that measure characteristics of the labour force, the mean number of years of schooling, the percentage of the industry's employees who are nonwhites, the percentage of the industry's employees who are female, the average yearly weeks worked by the industry's employees, and the

mean weekly hours worked of the industry's employees. After running OLS estimates, Block (1978a) concludes from the result that the provisions related to promotion and transfers do have a significant impact on reducing quit rates.

2.3 Self-selection Bias

Self-selection bias is a serious problem in empirical work because some human behaviours are difficult to observe and some decisions are made on the basis of those behaviours. For instance, the ideal way to analyze the effect of unions on wage rates would be to randomly assign people into union or non-union without letting them know what the union impact could be. However, the decision of being union or non-union has already been made by the individuals concerned.

A problem may arise if people belonging to a union are more ambitious than those who do not belong to a union (or vice versa). Thus, the higher wage of people who belong to a union is not only because of the union effect, but also because of personal behaviours. Since the zero conditional mean assumption is not met in this case, there exists a relationship between the error term and the independent variables – an endogeneity problem. Similar examples of self-selection bias are the market wage for working women whose market wage is over their observed wage, or the earnings of migrants being higher than the earnings of non-migrants. Heckman (1979) introduces the two-step process for eliminating self-selection bias. Gronau (1974) states the problem of the difference between wage offered and observed wage by raising self-selection bias. Since people may choose to stay outside of the labour market when wage offer is less than observed wage, then labour supply could be biased by the self-selection issue.

Heckman (1979) in his paper offered a method to eliminate the self-selection bias. The general idea is to let people choose to be a union member or not and obtain the effect of the explanatory variables only on uncensored sample. The selection equation is designed to decide which group the individual is likely to join. If the value of the dependent variable in the selection equation is greater than or equal to zero, then the individual will join the union group, otherwise the individual will join the non-union group. Using this method, Heckman designed a new regression equation which includes the key control variables and a term that accounts for selection. The contribution of his method is that it enables analysts to use simple regression techniques to estimate behavioural functions free of selection bias in the case of a censored sample.

Gronau (1974) argued that the observed wage distribution is only a part of the wage-offer distribution since selectivity bias exists in this analysis. In other words, everyone's wage expectation is not same. One person might hope to receive a higher wage than another person even though those two people have the same level of education, age, gender and other characteristics. Thus, the average wage of the former must be higher than that of the latter. Only if the wage-offer is equal to or greater than the expected wage is the person willing to participate in the labour force. Otherwise, the probability of participating in the labour force will decline.

In order to eliminate the selectivity bias, Gronau (1974) uses the wage-offer distribution to show the wage differential among four groups of working women. The data Gronau (1974) used is a one-thousandth sample from the year 1960, and the sample size is 26,530 women belonging to urban primary families, spouse present. Finally, Gronau (1974) found that using the mean wage offer rather than the average wage of working women gives

a better estimation of the effect of the wage on labour force participation; otherwise an upward bias will appear if one uses the average wage of working women.

In summary, one can be concluded that there is a fairly extensive literature that has looked at the impact of union on non-wage outcomes from both theoretical and empirical aspects. On the theoretical aspect, the exit voice is used explain why the quit rate would decline (or job tenure would increase) with a union. Some other policies, such as the supplemental unemployment benefit plan and seniority-in-promotion-and-transfer provisions may also increase workers' job tenure and protect them from layoffs. On the empirical aspect, the empirical literature has found that the unions have a positive impact on job tenure and also leads to lower quits. These findings tend to be both economically and statistically significant. In addition, they tend to be robust to the choice of estimation method.

3. Data Set

To determine if union presence has an effect on tenure in the Canadian labour market, this study analyzes data from the Labour Force Survey (LFS). The LFS tracks the Canadian labour market by gathering employment and unemployment data. The LFS interviews approximately 54,000 households per month. The LFS also gathers information on individuals with respect to age, gender, education, union status, work status and so on.

The data used in this paper are from the public files, which mean that some information, for instance union status in the previous job, is hidden. It is impossible to determine whether union presence had a negative effect on the quit rate. Therefore, this paper will analyze whether a union presence increases job tenure.

My sample includes employed individuals 25 to 64 years of age who were not self-employed, in April and October of 2008. The reason for including data from two periods is because I am going to focus on some sub-groups, such as the public and private sectors. The larger the size of the groups, the clearer the result will be. I chose periods six months apart to avoid involving the same people in both months. I ruled out those younger than 24 or older than 65, since most of the senior people either have not had a job yet or are retired; thus it is hard to conclude that union presence will have a positive effect or that unemployment is due to the lack of a union. The self-employed are also dropped because the employee is also the employer; thus it does not make sense to talk about a tenure effect in this kind of situation. After imposing these restrictions, my sample consists of 87,515 individuals.

Some provinces, such as Prince Edward Island, have a very small population, so that random sampling of the Canadian population may result in few observations being drawn from Prince Edward Island (even with a relatively large sample). The LFS, therefore, oversamples in low-population provinces (e.g. Prince Edward Island) and undersamples in high-population provinces (e.g. Ontario). For example, let us suppose that I am going to look at the unemployment rate of senior workers in Canada. To better analyze this data, one must take a larger proportion of population from Prince Edward Island to show clear results. In my empirical work, I use the weights provided in the Labour Force Survey.

Table 1 provides mean and standard deviations of key variables by union status. Most variables are self-explanatory, but some need some explanations. Age is divided into 10-year age groups, i.e. 25 to 34, 35 to 44, 45 to 54 and 55 to 64.⁴ Education is measured

⁴ In the regression analysis, age will be divided into 5 year age groups instead of 10 year age groups.

in term of attainment, not years of education. *hsdrop* is for people who did not finish their high school. *hsgraduate* is for people who finished their high school. *college* is for people who finished some post-secondary or a post-secondary certificate or diploma. *university* is for people who got bachelor's degree or a graduate degree. The wage is measured in dollars. Tenure is measured in months. Finally, the region of residence is divided into four sub-groups. The west region includes British Columbia and Alberta, the centre region includes Saskatchewan and Manitoba, the east region includes Ontario and Quebec, and the Atlantic region includes New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland.

Some basic ideas are generated from this table. As expected, union presence seem to increase the attachment of workers with their employer. From Table 1, it can be seen that the union and non-union mean levels of job tenure are 122.468 and 79.094 months, respectively. The difference, which is 43.374 months, is economically significant.

Figure 1 shows important differences in the job tenure distribution of union and non-union workers. The differences are more important when tenure is very small and very large. The percentage of union people with job tenure of 0 to 2 years is much less than for non-union workers. In contrast, the number is relatively high for union workers if one looks at tenure above 12 years.

Table 1 also shows important age differences between unionized and non-unionized workers. In the younger group, 23% of workers are covered by a union; for the non-union sector it is much larger at almost 30%. The proportion of younger people in a union is smaller than the proportion of non-union by 7%. In contrast, the percentage of union people in the oldest group is 16.5% and the percentage of non-union is only 13.8%. It seems as if senior people are more inclined to belong to a union. Actually, this trend also

appears in the group aged 45 to 54. The share of union members in this group is 5% larger than the share of non-union people. This evidence strongly suggests that there are more people aged 45 to 64 in favour of the protection of union power in order to avoid quitting their job or being laid off. It seems that younger workers don't prefer joining unions as much as more senior workers do.

As regards education, the percentage of high-school drop out is very similar for union and non-union groups. The difference is only 2%. For high-school graduates the difference between union and non-union is almost 4%. University graduates and post-graduates (Master's or PhD's) are a little bit more prevalent in the union sample than in the non-union sample. Although the difference is very modest, I still can conclude that workers who belong to a union attained a higher education level than non-union workers.

One thing worth mentioning here is the distinction between private and public sector. From Table 1, one can see that 60% of union workers are in the public sector versus only 11% of non-union workers; despite the fact that the public sector is much smaller than the private sector. Thus, unionism occupies a significant place in public sector as opposed to the private sector.

Figure 2 and 3 provide the distribution of job tenure for the private and public sectors, respectively. There are three findings. First, in both sectors, the proportion of non-union workers is much more than that of union workers in the under 2 years of job tenure category. Second, still in both sectors, the proportion of union workers is much more than that of non-union workers above 20 years of job tenure. Third, there is a difference in the proportion of union members with less than 2 years of job tenure between union sector and non-union sector.

4. Empirical Model

To better analyze the union impact on job tenure, I have split this section into three parts. In the first part, I introduce a simple model to examine the effect of unions on tenure. In the second part, I estimate separate equations for the union and non-union sectors which allows for the covariate effects to vary by union and non-union sector. Moreover, I use the Oaxaca-Blinder decomposition to isolate the union and non-union differential that can explained by differences in individual characteristics. In the third part, I allow for self-selection. I use the Heckman two-step procedure to eliminate self-selection bias.

4.1 Simple Model

In this sub-section, I present a simple model of tenure determination. The model is as follows:

$$\ln tenure_{i,t} = \beta_0 + \beta_1 UNION_{i,t} + X_{i,t}\beta_2 + \varepsilon_{i,t} \quad (1)$$

where $\ln tenure_{i,t}$ is the log of *tenure* for individual i in year t .⁵ The *UNION* dummy is the main variable of interest for examining the union impact on the job tenure. X is a vector containing the control variables which include gender (male dummy), region of residence (four regions: west, centre, east and Atlantic), age (five-year intervals), educational attainment (high school drop out, high school graduate, college graduate and university graduate), wage, and a public sector dummy. In the following models, I use as base group female workers aged 40 to 44 who have graduated from high school and work in the private sector and live in the west region.⁶ Since the dependent variable is in log form,

⁵ Freeman (1980b) presents the coefficient obtained from linear and log-linear regressions of tenure on a measure of unionism.

⁶ I use the same base group in all my regressions.

the β_1 and β_2 parameters show the percentage change in tenure due to a change in the explanatory variable. For example, β_1 measures what would be the percentage change in tenure if people move from the non-union to the union sector.

This model makes two assumptions. First, it assumes that unions only have a level effect on tenure. The effects of covariates (other than union) are the same irrespective of whether the individual is unionized or not. Second, it assumes that there is no self-selection bias, i.e. it abstracts from the issue that the individual chooses whether to join a union or not. These assumptions will be relaxed in following sub-sections.

Table 2 shows OLS estimates and standard errors for Model (1). I discuss the key findings below.

Union Status

Table 2 shows that the union effect is both economically and statistically significant. It indicates that workers who belong to the union have 37.7% longer tenure with the same employer as compared to non-union workers. The positive union effect is in line with what the exit-voice theory would predict. It is also in line with the belief that a union protects workers from lay-offs.

Gender

Table 2 shows that gender matters. The male dummy coefficient shows that job tenure for men will be lower than for women by 12.8% holding other variables constant. This finding is counter intuitive as one might expect men to be more attached to their job. The large diversity of characteristics between men and women (such as men is more ambitious than women) may be the one explanation of this phenomenon. In addition,

women may fear social discrimination, such as firm would like to hire male workers rather than female workers under the same condition, so that they are more reluctant to change jobs than men.

Age

The coefficients of age groups are both economically and statistically significant. Compared to the base group (aged from 40 to 44), the younger groups all have the predicted negative sign and the older groups have the predicted positive sign. For example, the group aged from 25 to 29 has 72.6% shorter job tenure and the group aged from 60 to 64 has 48.0% longer tenure. As supposed, the older worker may have a larger probability to have a long tenure. Some older workers would like to spend their life with the same employer. The result is consistent with the hypothesis. Younger cohorts may be more dynamic in the labour market, i.e. switch jobs frequently. Compared to the base group, higher age cohorts have longer job tenure.

Education

Table 2 provides economically and statistically significant on education effect. Compared to the base group (high school graduate), high school drop out, college graduates and university graduates have shorter job tenure by 10.5%, 13.5% and 38.7% respectively. As expected, higher education will increase wages, so that exit behaviour will be lower. Since job tenure is associated with with exit behaviour, people will think that higher education will increase the job tenure. However, three negative coefficients contradict this hypothesis. The more education a person has, the later the individual will begin to participate (full time) in the labour market. Thus, there is a relatively lower chance that

one can stay in the same firm for a long time. One thing very interesting is people who drop out from high school should have longer work time. Then the chance of working for the same firm will be larger. However, the coefficient of high school drop out is also negative. The possible reason for this result is that the people who drop out from high school have only a low job skill, so that it may be hard for them to stay in the same job for a long time. To sum up, individuals in all three education categories have lower job tenure compared to the base group.

Income

By using the log of the wage, I can observe the percentage change on both dependent and independent variable. Table 2 shows that the wage effect is both economically and statistically significant. The coefficient of *lnwage* is 0.73, which means that a 10% wage increase will cause job tenure to increase by 7.3%, which I believe to be economically important. It is consistent with the finding of Freeman and Medoff (1984) who stated that the amount of increases of job tenure by increasing the wage by 10% will not overwhelm the amount of increases due to the union effect.⁷ The estimates from this dataset show that a 10% increase in wages will only raise job tenure by 7.3%. In contrast, joining the union will have increased tenure by 37.7%, which is much more than the wage effect. It is obvious that the collective voice of union makes a larger contribution to increasing job tenure than monopoly does. This result is also contrary to the theory which states that unionism increases social cost and lowers productivity.

⁷ See Freeman and Medoff (1984, 94).

Public and Private Sector

Table 2 shows that the coefficient of the public sector dummy variable is both economically and statistically significant. The coefficient indicates that people who work in the public sector have 10.8% longer job tenure compared with people who work in the private sector. It seems that a public work place tends to keep people in their current job. Since unions take a significant place in the public sector, I suspect the increase in tenure is due to union effect. To some extent, I can make a foolhardy conclusion that union impact in public sector will be larger than union impact in private sector. I will go into detail on this issue in the following sections.

Region

Table 2 shows that the region effect also matters. The results indicate that people living in the centre region (i.e. Saskatchewan and Manitoba) have 22.6% higher job tenure compared with the people living in the west region (i.e. British Columbia and Alberta). The east region (i.e. Ontario and Quebec) and the Atlantic region (i.e. Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick) reveal results similar to the centre region. People living in these two regions have 25.6% and 27.8% longer job tenure respectively compared with the base group. Thus, one interesting conclusion can be made that the length of attachment with firm will rise as people move toward to the east coast in Canada.

4.2 Dual Process on Difference in Characteristic versus Other Factors

In this sub-section, I will present a model that decomposes inequality in job tenure into contributing factors. The core idea is to explain the distribution of the outcome variable in question by a set of factors that vary systematically with socioeconomic status. In the first

part, I will present the model that allows for the covariates effects to vary by union status. Then I present OLS estimates and discuss the findings. In the second part, I apply the Oaxaca-Blinder Decomposition to separate the effects of an individual's personal characteristics from the unexplained part.

4.2.1 Two Equation Model

The two equation model based on union status is following,

$$\text{Intenure}_{i,t}^{NU} = \beta_0^{NU} + X_{i,t}^{NU} \beta_2^{NU} + \varepsilon_{i,t}^{NU} \quad (2)$$

$$\text{Intenure}_{i,t}^U = \beta_0^U + X_{i,t}^U \beta_2^U + \varepsilon_{i,t}^U \quad (3)$$

where the U superscript stands for union, and the NU superscript stands for non-union. The dependent and independent variables are same as in the simple model, i.e. Equation (1).

By using a two equation model, I relax the assumption that the effect of all covariates is the same irrespective to union status; the β_2 parameter has a union and non-union superscript. It should be noted that the two equation model does allow for a level effect which can be measured as $\beta_0^U - \beta_0^{NU}$. Table 3 shows the result separate OLS estimations of Equation (2) and (3) for the union and non-union sub-samples with standard errors in parentheses.

Table 3 shows that the gender impact in the union sector and the non-union sector is both economically and statistically significant. It indicates that unionized men have 7.8% shorter job tenure than unionized women. In contrast, compared to the non-union women, the non-union men have 15.4% shorter job tenure, which is almost double the number on the union side. Since the reduction in job tenure for male union workers is much less than for their non-union counterparts, on average, male union workers have longer tenure than male

non-union workers. The impact of gender on tenure is important in explaining tenure differences between union and non-union workers.

With respect to age, the seven age groups in the union sector and the non-union sector have the same coefficient signs and are both economically and statistically significant in Table 3. However, age has a larger impact on job tenure for people who belong to a union (both positive and negative effects) than people who do not. Compared to the base group, the age cohort 25 to 29 has 94.5% shorter job tenure if a union member but only 64.6% shorter job tenure if a non-union member. For older workers aged from 55 to 59, job tenure is 47.9% longer for union members and 38.7% longer for non-union members. The trend shows that unions do a good job of increasing senior workers' job tenure but not that of young people. This result is consistent with Block (1978b) who states that unions have a significant impact in protecting workers with seniority from lay-offs.

Table 3 shows that the education effect in the union sector and the non-union sector is both economically and statistically significant. Union people who drop out from high school will have longer tenure than their non-union counterparts. The number is -3.1% versus -11.8%. The results are opposite for college and university graduates. Union people who graduate from these two levels tend to have a greater reduction in job tenure than non-union people. The results are similar to the simple model in that a higher education level will prevent people achieving long job tenure, while people who drop out from high school may have too low work skills to continue his or her job for a long time. This trend indicates that unions may protect less educated people from being laid off.

Table 3 shows that the wage effect matters. A 1% wage increase for non-union people will increase his or her job tenure by 0.778% compared to 0.575% for the union workers. It indicates that increasing wages will have a larger impact on job tenure for the

non-union group than the union group. Thus, the wage effect on job tenure in the union sector is smaller than the effect in the non-union sector.

The public sector effect in Table 3 is both economically and statistically significant. The positive sign in both union sector and non-union sector is consistent with what I expect. The difference of this effect between union sector and non-union sector is 18 percentage points. Thus, union workers in the public sector have longer tenure than non-union workers in the public sector. This suggests that unions have a significant impact on job tenure in public sector.

Table 3 shows that the region effect is both economically and statistically significant. Compared to the west region (base group), all the other regions have a positive effect on job tenure in both the union and non-union sub-samples. This result is the same as that of the simple model. According to Table 3, the region effect is bigger in the non-union sector. For example, union people who work in the centre region have 16.2% higher tenure compared to 25.8% for non-union people. The differences between union and non-union are similar in the centre and east regions, but quite large in the Atlantic region. The constant term is larger in the union equation, which implies that job tenure is longer for the reference person who belongs to a union. It also indicates that union power is weaker in the Atlantic region than in the east and west regions.

4.2.2 Oaxaca-Blinder Decomposition

The Oaxaca-Blinder decomposition, developed by Blinder (1973) and Oaxaca (1973), is helpful for identifying and quantifying the separate contributions of differences in measurable characteristics, like education, gender, region and income, in union status gaps in outcomes. After regressing Equations (2) and (3) using OLS, one can write,

$$\text{Intenure}_{i,t}^{\text{NU}} = \hat{\beta}_0^{\text{NU}} + X_{i,t}^{\text{NU}} \hat{\beta}_2^{\text{NU}} + \hat{\varepsilon}_{i,t}^{\text{NU}} \quad (4)$$

$$\text{Intenure}_{i,t}^{\text{U}} = \hat{\beta}_0^{\text{U}} + X_{i,t}^{\text{U}} \hat{\beta}_2^{\text{U}} + \hat{\varepsilon}_{i,t}^{\text{U}} \quad (5)$$

where the $\hat{\beta}_2^{\text{U}}$ and $\hat{\beta}_2^{\text{NU}}$ are the OLS estimates.

Summing over all individuals in the sample of union workers and dividing by the number of union workers, I can get,

$$\overline{\text{Intenure}}^{\text{U}} = \hat{\beta}_0^{\text{U}} + \bar{X}^{\text{U}} \hat{\beta}_2^{\text{U}} + \bar{\varepsilon}^{\text{U}} \quad (6)$$

where the bar subscript denotes the average value. According to the properties of OLS, $\bar{\varepsilon}^{\text{U}} = 0$, thus,

$$\overline{\text{Intenure}}^{\text{U}} = \hat{\beta}_0^{\text{U}} + \bar{X}^{\text{U}} \hat{\beta}_2^{\text{U}}. \quad (7)$$

Similarly, using the sample of non-union workers, one can get,

$$\overline{\text{Intenure}}^{\text{NU}} = \hat{\beta}_0^{\text{NU}} + \bar{X}^{\text{NU}} \hat{\beta}_2^{\text{NU}}. \quad (8)$$

Applying a two-fold decomposition,

$$\begin{aligned} \overline{\text{Intenure}}^{\text{NU}} - \overline{\text{Intenure}}^{\text{U}} &= \hat{\beta}_0^{\text{NU}} - \hat{\beta}_0^{\text{U}} + \bar{X}^{\text{NU}} \hat{\beta}_2^{\text{NU}} - \bar{X}^{\text{U}} \hat{\beta}_2^{\text{U}} \\ &= \hat{\beta}_0^{\text{NU}} - \hat{\beta}_0^{\text{U}} + \bar{X}^{\text{NU}} \hat{\beta}_2^{\text{NU}} - \bar{X}^{\text{U}} \hat{\beta}_2^{\text{U}} + [\bar{X}^{\text{U}} \hat{\beta}_2^{\text{NU}} - \bar{X}^{\text{U}} \hat{\beta}_2^{\text{U}}] \\ &= [(\bar{X}^{\text{NU}} - \bar{X}^{\text{U}}) \hat{\beta}_2^{\text{NU}}] + [(\hat{\beta}_0^{\text{NU}} - \hat{\beta}_0^{\text{U}}) + \bar{X}^{\text{U}} (\hat{\beta}_2^{\text{NU}} - \hat{\beta}_2^{\text{U}})] \end{aligned} \quad (9)$$

or,

$$\begin{aligned} \overline{\text{Intenure}}^{\text{NU}} - \overline{\text{Intenure}}^{\text{U}} &= \hat{\beta}_0^{\text{NU}} - \hat{\beta}_0^{\text{U}} + \bar{X}^{\text{NU}} \hat{\beta}_2^{\text{NU}} - \bar{X}^{\text{U}} \hat{\beta}_2^{\text{U}} \\ &= \hat{\beta}_0^{\text{NU}} - \hat{\beta}_0^{\text{U}} + \bar{X}^{\text{NU}} \hat{\beta}_2^{\text{NU}} - \bar{X}^{\text{U}} \hat{\beta}_2^{\text{U}} + [\bar{X}^{\text{NU}} \hat{\beta}_2^{\text{U}} - \bar{X}^{\text{NU}} \hat{\beta}_2^{\text{U}}] \\ &= [(\bar{X}^{\text{NU}} - \bar{X}^{\text{U}}) \hat{\beta}_2^{\text{U}}] + [(\hat{\beta}_0^{\text{NU}} - \hat{\beta}_0^{\text{U}}) + \bar{X}^{\text{NU}} (\hat{\beta}_2^{\text{NU}} - \hat{\beta}_2^{\text{U}})] \end{aligned} \quad (10)$$

where the first component in brackets in Equations (9) and (10) is the “explained” part, which is the portion of the outcome differential that is explained by group differences in the explanatory variables. The second square bracket term is the “unexplained” part, which is usually attributed to the union effect, but it is important to notice that the unexplained part also captures all potential effects of differences in unobserved variables. Since the primary issue I am interested in is whether union can affect the job tenure against non-union, it is appropriate to use the Model (9), which uses the non-union worker group as the reference coefficients.⁸

From Table 4, I can observe that the mean value of log tenure in the non-union sample is 3.693, and the corresponding geometric mean is approximately 81 months. For the union sample, the mean value of log tenure is 4.350, and the geometric mean is approximately 126 months. Therefore, the difference in logs of tenure is -0.656, and the mean tenure difference is approximately -44 months.⁹ This result indicates that the job tenure of non-union workers will be 44 months less than union workers. What is the composition of this difference? Is the difference only due to a union effect or simply due to the fact that union jobs tend to involve more skilled workers?

Column (1) in Table 4, which is the “explained” part, describes the difference in tenure due to differences in worker characteristics. The tenure difference due to unobserved variables is shown in column (2), which is the “unexplained” part. I examine below the difference in detail.

⁸ Some analysts who used Equation (10) do so because they do not believe the union impact is the matter in the tenure structure, so that the tenure structure will be more likely to be close to the union tenure function than to the non-union tenure function. It has been shown in the literature that the choice of reference group does affect the findings.

⁹ Since the mean value of job tenure for non-union workers is less than the mean value of job tenure for union workers, the difference is negative.

Column (1) shows that a large part of the difference in log tenure can be explained by differences in log wages. The difference in (log) wage between the two sectors can explain -0.182 of the gap.¹⁰ In the other words, the (log) wage accounts for approximately 74% of the explained tenure difference and approximately 28% of the overall tenure difference.

The age categories account for approximately 24% of the explained tenure gap and only for approximately 9% of the overall tenure gap. It should be noted that I cannot identify the contribution of one particular age group. The results of one group (e.g. one age group) are sensitive to the choice of the base group. The other categories, like gender, region, education and social sector, make a very modest contribution in explaining the tenure difference.

In column (2), the public sector makes a relatively large contribution to the log tenure difference due to unobserved variables. The difference in the parameter estimate can explain -0.141 of the gap.¹¹ It accounts for approximately 34% of the tenure difference due to unobserved variables and approximately 22% of the overall tenure difference. This result indicates that union membership may be one of the primary determinants of tenure in the public sector. Other variables make too small a contribution to explaining the tenure difference, so I will ignore them from my attention.

It has been shown in literature that the choice which base group to use (e.g. which age group you meet in regression) does have impact on the constant as such one cannot interpret the constant. Moreover, in column (2), the statistical significant coefficient of log wage is expected to be a negative number, but opposite in the result.

¹⁰ The explained gap is -0.245 and the total gap is -0.656.

¹¹ The unexplained gap is -0.411 and the total gap is -0.656..

Overall, the union effect is not the only factor that creates a difference in tenure between union and non-union. People's characteristics also account for a large proportion of the tenure difference.

4.3 Self-selection Model

As discussed in Lee (1978) and Robinson and Tomes (1984), there are two choices available for each worker: He can become a member of union or stay in the non-union sector, depending on his own decisions and decisions by the union. Each worker will face two possible job tenures, the union tenure and non-union tenure. As such, there may be a self-selection issue that results from using non-randomly selected samples to estimate this behavioural relationship. The self-selection model takes the following form:

$$\text{Intenure}_{i,t}^{\text{NU}} = \beta_0^{\text{NU}} + X_{i,t}^{\text{NU}} \beta_2^{\text{NU}} + \varepsilon_{i,t}^{\text{NU}} \quad (11)$$

$$\text{Intenure}_{i,t}^{\text{U}} = \beta_0^{\text{U}} + X_{i,t}^{\text{U}} \beta_2^{\text{U}} + \varepsilon_{i,t}^{\text{U}} \quad (12)$$

$$I_{i,t} = \alpha_0 + W_{i,t} \alpha_1 + v_{i,t} \quad (13)$$

where Equation (13) is the selection equation. Workers will choose to join a union when $I_{i,t}$ is greater than zero and the non-union sector otherwise. The vector W contains all the variables that determine whether the person would like to be a union member. In my study, the vector W includes age, gender, marital status, education and firm size.

To tackle the self-selection problem I use the same method (the Heckman two-step procedure) that is commonly used in the wage determinants literature when looking at union versus non-union effects. Studies conducted by Robinson and Tomes (1984) and Kumar and Stengos (1986), both of whom used the Heckman procedure, have been able to show that self selection bias is an important problem which has to be tackled when analyzing the union effect on job tenure. However, a difficulty with the Heckman procedure is that it can

be hard to find instruments or variables which determine union participation, i.e. Equation (13) and are omitted from the tenure determinants equation, i.e., Equation (11) and (12). My two instruments are marital status and firm size. Marital status is divided into two categories: married and single. Firm size has been divided into four categories, which are the number of employee is less than 20, the number of employee is between 20 and 99, the number of employee is between 100 and 500 and the number of employee is more than 500. Why do I introduce two new variables into selection equation? First, I suppose that people who get married are more likely to want a stable job than singles. Then a union job is the perfect choice for them. Second, unionism will frequently exist in the large companies, such as Ford Company.¹² Therefore, the larger firm the one works at, the more opportunity he or she has to join a union. As for the other variables, like age, usually older people would like to join a union because union negotiating power will protect them from lay-offs and provide seniority benefits.¹³

The first step in the Heckman procedure is to estimate a selection model, which is the union participation model. The union participation equation is a probit model. The participation indicator is a binary variable which states whether the worker is a participant in a union or not.

Once the Heckman selection equation is estimated, one can construct a new variable called the Inverse Mills Ratio (IMR) which will act as a selectivity correction factor. The IMR is the ratio of the standard normal probability density function and cumulative density

¹² Automobile manufacturer in the United States of America.

¹³ These two variables have been used by other researcher (e.g. Lewis (1974)) in selection equation in wage determination literature.

function which are derived from the Union Participation equation estimated through the probit model, i.e.

$$\lambda_{i,t}^U = \varphi(W_{i,t}\hat{\alpha})/\phi(W_{i,t}\hat{\alpha}) \quad (14)$$

The formula to create the IMRs for the Union and Non-Union tenure equations will then depend on the assumption that the conditional mean of the error term in the truncated distribution is zero. Simply put, this method will enable the estimation of the wage function which will be free of selection bias in the case of a censored sample.

In the second step in the Heckman procedure, the respective IMRs for Union and non-Union Participants will be included in the initial tenure equation.

$$\text{Intenure}_{i,t}^U = \beta_0^U + X_{i,t}^U\beta_2^U + \beta_\lambda\lambda_{i,t}^U + \mu_{i,t}^U \quad (15)$$

If one compares Equation (12) and (15), the key difference is the third right hand side term, i.e. the IMR term.

The significance of the OLS coefficient of the IMR can be tested through a test of significance. The coefficient of the IMR, β_λ equals $\rho\sigma_\varepsilon$, where ρ is the correlation between unobserved determinants of joining a union, $V_{i,t}$ and unobserved tenure determinants, $\mu_{i,t}^U$. σ_ε is the standard deviation of the unobserved tenure determinants. Since $\sigma_\varepsilon > 0$, the test of significance of the coefficient of the IMR will effectively test whether $\rho = 0$. If the null hypothesis that the coefficient of $\hat{\lambda}_{i,t}$ is zero is rejected, then there selectivity bias is present. A positive coefficient of the IMR indicates that there are some unobserved tenure determinants which are positively correlated with Union Status and the union differential and the simple OLS method will understate the tenure differential for the worker and vice versa.

To deal with this approach, I estimate Equation (15) using OLS. The results are shown in Table 5. Table 5 shows that the coefficient of the self-selection term (IMR) is

statistically significant at the 5% level. This result indicates that there does exist a self-selection bias in the initial Equation (11) and (12). Since the coefficient of lambda is a negative number, the simple OLS estimates overstate the tenure differential for the worker.

The coefficients in the selection equation are all significant at the 5% significant level. This indicates that all of these variables are useful to make a decision whether the individual would join in the union (or not). Most importantly, the two instruments, marriage and firm size, which are in the selection equation but not in the other two equations, have statistically significant coefficients. Therefore, I am not using non-linearities in the IMR term to identify β_2 .

In Table 6, I combined two sets of results - when I do not correct for self-selection (Table 3 Column 1) and when I do using the Heckman two-step procedure (Table 6 Column 1). Table 6 shows that accounting for self-selection does not however, materially affect the other coefficient in the tenure equation. For example, university graduates have 42.2% shorter tenure in the two equation model and 42.8% shorter tenure in the Heckman two-step procedure as compared to high school graduates. However, one cannot say that self-selection is not a problem in this kind of studies or the Heckman two-step procedure is not good method to remove the self-selection bias. The possible reason for this modest change in most of key variables could be the data set I am using in this study or the instrument variables that I used in selection model is not enough to eliminate all the self-selection bias.¹⁴

Although the differences are very modest, one still can observe the upward bias from the two methods. Column (1) in Table 6 contains the estimates from the two equation

¹⁴ Base on the limitation of data set, the choosing of instrument variables are potential problem which need to be tackled in the future.

model and column (2) presents the estimates from the Heckman two-step procedure. The coefficients of *male* in column (1) and column (2) are -0.078 and -0.043 respectively. It is obvious that the gender effect on job tenure in the union sector, when estimated using the two equation model, is larger than the effect estimated using Heckman two-step procedure. Thus I can draw the conclusion that the two equation model overstates the tenure differential for workers. The other variables people are usually interested in are the older age groups, like *age_55_59* and *age_60_64*. Their coefficients display the same property as that of *male* – the estimate from the two equation model is around 6 percentage points larger than Heckman two-step procedure. The same phenomenon happened to the coefficient of *lnwage*, the upward bias is around 4 percentage points.

All in all, the Heckman two-step procedure is a very necessary procedure and worth effort when one deals with a similar study, such as the impact of unions or the migration decisions on wages. Although the result may not very clearly show the merit of doing this procedure, it will always help people to better measure the impact of each factor on the issue they care about.

5. Robustness Check

From the summary statistics in table 1, it is apparent that union members play a more significant role in the public sector as compared to union members in the private sector. Then the question is raised, will unions have a larger effect on job tenure in the public sector than in the private sector? From Figures 2 and 3, I can conclude that in the less than 2 years job tenure level, the percentage of union members in the public sector is 15%, compared to 22%, which is the percentage of union members in the private sector. But at

the more than 20 years level, the percentage of union members in the public sector is 28%, compared to 26%, which is the percentage of union members in the private sector; this difference between the public and private sectors is not statistically important. To further examine the differences between the two sectors, I will estimate Equations (1), (2) and (3) for the private sector only. The difference in the coefficients between the two results will be discussed in detail.

Table 7 shows that all the coefficients are both economically and statistically significant, with the same signs as those in Table 2. The impact of unions on job tenure is 33.3% larger than the non-union impact. Compared to the union impact in Table 2, which is 37.7%, the difference is very modest. In the education category, compared to the base group, all three groups show a very similar difference in job tenure compared to Table 2. The wage impact on job tenure also provides a result similar to that of Table 2. Other variables, such as gender, age and region do not show large differences from the ones in Table 2. Thus, there is no evidence to show that the presence of unions has less impact in the private sector than in the public sector.

In Table 8, one can see that all the coefficients are both economically and statistically significant with the same sign as the ones in Table 3. As for gender, male union workers have shorter job tenure, by 13.2%, compared to female union workers. This result is similar to the one in Table 3, which is 7.8%. The decrease in tenure for male non-union workers compared to female non-union workers is 17.0% versus 15.4%, which is the corresponding difference from Table 3. As for education, high school drop out, college graduates and university graduates in both the union and non-union sectors show similar results as Table 3 does. Since other coefficients do not show important difference to Table 3, I can come to the same conclusion as I did in Model (1).

6. Conclusion

In this paper, I examined the impact of union status on job tenure using three different models. First, a straight forward model was used to predict the union impact by including union variable. Second, a two equation model to introduced to allow the covariates to vary as union status changes. Third, the model was further enriched by allowing for self-selection.

This examination of the union impact on job tenure using LFS data has enabled me to draw the following conclusions. There is aggregate evidence of a positive union impact on job tenure under certain assumptions, namely that the effects of all covariates are the same irrespective of union status (the simple model). Although the parameters of key variables, such as gender, education and age do not vary as union status changes, I still observed that the presence of a union increases the job tenure.

When I allow for the covariate effect to vary by union status, I can observe not only a level difference, but also differences in the covariate effects. The main finding is that unions play a significant role in increasing the tenure especially with females, people whose age is above 45 years old and people with low education.

Finally, eliminating the self-selection bias does not affect my key results. This is in contrast to the wage determination literature which finds that it does matter. This last finding warrants further investigation.

As future work, I would be interested in further exploring the following two issues. First, one could directly tackle the union impact on quits and layoffs using the LFS master files. Second, it would have been interesting to see if there was much of a change in the

results of the Oaxaca-Blinder decomposition if both equations of the two equations model had been re-estimated using the Heckman method.

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Appendix A

Table 1: Summary Statistics by Union Status - Mean and Standard Deviation

	(1)	(2)
	UNION	NON-UNION
male	0.486 (0.500)	0.510 (0.500)
age_25_34	0.232 (0.422)	0.299 (0.458)
age_35_44	0.270 (0.444)	0.290 (0.454)
age_45_54	0.333 (0.471)	0.273 (0.445)
age_55_64	0.165 (0.371)	0.138 (0.345)
hsdrop	0.079 (0.270)	0.100 (0.300)
hsgraduate	0.166 (0.372)	0.201 (0.401)
college	0.464 (0.499)	0.437 (0.496)
university	0.290 (0.454)	0.262 (0.440)
wage	25.409 (9.451)	22.235 (12.174)
public	0.602 (0.489)	0.110 (0.312)
private	0.398 (0.489)	0.890 (0.312)
tenure	122.468 (88.060)	79.094 (77.496)
west	0.214 (0.410)	0.251 (0.434)
centre	0.076 (0.265)	0.057 (0.231)
east	0.638 (0.481)	0.626 (0.484)
Atlantic	0.072 (0.258)	0.067 (0.250)
N	30,798	56,717

Note: standard deviations in parentheses

Table 2: OLS Estimates for the Simple Model

(1)	
LNTENURE	
union_m	0.377*** (0.010)
male	-0.128*** (0.009)
age_25_29	-0.726*** (0.015)
age_30_34	-0.432*** (0.016)
age_35_39	-0.207*** (0.016)
age_45_49	0.231*** (0.015)
age_50_54	0.389*** (0.015)
age_55_59	0.425*** (0.017)
age_60_64	0.480*** (0.021)
hsdrop	-0.105*** (0.017)
college	-0.135*** (0.011)
university	-0.387*** (0.013)
lnwage	0.731*** (0.010)
public	0.108*** (0.012)
centre	0.226*** (0.019)
east	0.256*** (0.010)
Atlantic	0.278*** (0.018)
constant	1.597*** (0.032)
R ²	0.212
N	87,515

Note: standard errors in parentheses

* significant at 10% level

** significant at 5% level

*** significant at 1% level

Table 3: OLS Estimates for the Two Equation Model – by union sector

	(1)	(2)
	UNION	NON-UNION
	LNTENURE	LNTENURE
male	-0.078*** (0.013)	-0.154*** (0.011)
age_25_29	-0.945*** (0.025)	-0.646*** (0.020)
age_30_34	-0.560*** (0.024)	-0.381*** (0.020)
age_35_39	-0.254*** (0.024)	-0.189*** (0.020)
age_45_49	0.276*** (0.022)	0.203*** (0.020)
age_50_54	0.437*** (0.022)	0.354*** (0.021)
age_55_59	0.479*** (0.024)	0.387*** (0.023)
age_60_64	0.506*** (0.032)	0.470*** (0.028)
hsdrop	-0.031*** (0.011)	-0.118*** (0.021)
college	-0.198*** (0.018)	-0.107*** (0.015)
university	-0.424*** (0.021)	-0.364*** (0.017)
lnwage	0.575*** (0.018)	0.778*** (0.012)
public	0.214*** (0.014)	0.0417*** (0.018)
centre	0.162*** (0.026)	0.258*** (0.025)
east	0.232*** (0.016)	0.268*** (0.013)
Atlantic	0.178*** (0.027)	0.326*** (0.024)
constant	2.463*** (0.059)	1.439*** (0.039)
R ²	0.219	0.158
N	30,798	56,717

Note: standard errors in parentheses

* significant at 10% level

** significant at 5% level

*** significant at 1% level

Table 4: OLS Estimates for the Oaxaca - Blinder Decomposition Model

	(1)	(2)
	EXPLAINED	UNEXPLAINED
male	-0.004 ^{***} (0.001)	-0.041 ^{***} (0.009)
age_25_29	-0.028 ^{***} (0.002)	0.028 ^{***} (0.003)
age_30_34	-0.009 ^{***} (0.001)	0.022 ^{***} (0.004)
age_35_39	-0.003 ^{***} (0.001)	0.007 [*] (0.004)
age_45_49	-0.004 ^{***} (0.001)	-0.020 ^{***} (0.005)
age_50_54	-0.012 ^{***} (0.001)	-0.20 ^{***} (0.005)
age_55_59	-0.008 ^{***} (0.001)	-0.015 ^{***} (0.004)
age_60_64	0.002 ^{***} (0.001)	-0.003 (0.002)
hsdrop	-0.006 ^{***} (0.001)	-0.008 ^{***} (0.003)
college	0.004 ^{***} (0.001)	0.029 ^{**} (0.011)
university	0.018 ^{***} (0.001)	0.010 (0.007)
lnwage	-0.182 ^{***} (0.004)	0.811 ^{***} (0.071)
public	0.002 (0.009)	-0.141 ^{***} (0.014)
centre	-0.009 ^{***} (0.001)	0.013 ^{***} (0.005)
east	-0.008 ^{***} (0.001)	0.012 (0.011)
Atlantic	0.000 (0.001)	0.021 ^{***} (0.005)
constant	-	-1.116 ^{***} (0.074)
N	87,515	87,515

Overall	Mean	Standard Error
Group 1 (non-union)	3.694	0.006
Group 2 (union)	4.350	0.007
difference	-0.656	0.009
explained	-0.245	0.009
unexplained	-0.411	0.012

Note: standard errors in parentheses

* significant at 10% level

** significant at 5% level

*** significant at 1% level

Table 5: OLS Estimates - Heckman Two-step Procedure

	(1)	(2)
	LNTENURE	UNION
<i>Primary interested equation</i>		
male	-0.043 ^{***} (0.014)	-
age_25_29	-0.903 ^{***} (0.027)	-
age_30_34	-0.549 ^{***} (0.025)	-
age_35_39	-0.260 ^{***} (0.024)	-
age_45_49	0.238 ^{***} (0.023)	-
age_50_54	0.384 ^{***} (0.023)	-
age_55_59	0.423 ^{***} (0.025)	-
age_60_64	0.427 ^{***} (0.033)	-
hsdrop	-0.053 [*] (0.028)	-
college	-0.232 ^{***} (0.019)	-
university	-0.428 ^{***} (0.022)	-
lnwage	0.531 ^{***} (0.019)	-
public	0.183 ^{***} (0.015)	-
centre	0.202 ^{***} (0.022)	-
east	0.305 ^{***} (0.017)	-
Atlantic	0.222 ^{***} (0.022)	-
constant	3.002 ^{***} (0.070)	-
<i>Selection equation</i>		
age_25_34	-	-0.121 ^{***} (0.013)
age_45_54	-	0.162 ^{***} (0.012)
age_55_64	-	0.147 ^{***} (0.015)
male	-	-0.059 ^{***} (0.009)
married	-	0.022 ^{**} (0.010)
hsdrop	-	0.037 ^{**} (0.018)
college	-	0.206 ^{***} (0.013)
university	-	0.213 ^{***} (0.014)
less20	-	-1.156 ^{***} (0.019)
size20_99	-	-0.444 ^{***} (0.017)
more500	-	0.294 ^{***} (0.013)
constant	-	-0.515 ^{***} (0.019)
N	30,798	87,515
<i>Inverse mills ratio</i>		
λ	-0.437 ^{***} (0.026)	

Note: standard errors in parentheses

* significant at 10% level

** significant at 5% level

*** significant at 1% level

Table 6: Comparison of Union Job Tenure Equations

	(1) TWO EQUATION MODEL	(2) HECKMAN TWO-STEP PROCEDURE
	LNTENURE	LNTENURE
male	-0.078*** (0.013)	-0.043*** (0.014)
age_25_29	-0.945*** (0.025)	-0.903*** (0.027)
age_30_34	-0.560*** (0.024)	-0.549*** (0.025)
age_35_39	-0.254*** (0.024)	-0.260*** (0.024)
age_45_49	0.276*** (0.022)	0.238*** (0.023)
age_50_54	0.437*** (0.022)	0.384*** (0.023)
age_55_59	0.479*** (0.024)	0.423*** (0.025)
age_60_64	0.506*** (0.032)	0.427*** (0.033)
hsdrop	-0.031*** (0.011)	-0.053* (0.028)
college	-0.198*** (0.018)	-0.232*** (0.019)
university	-0.424*** (0.021)	-0.428*** (0.022)
lnwage	0.575*** (0.018)	0.531*** (0.019)
public	0.214*** (0.014)	0.183*** (0.015)
centre	0.162*** (0.026)	0.202*** (0.022)
east	0.232*** (0.016)	0.305*** (0.017)
Atlantic	0.178*** (0.027)	0.222*** (0.022)
contant	2.463*** (0.059)	3.002*** (0.070)
<i>N</i>	87,515	30,798

Note: standard errors in parentheses

* significant at 10% level

** significant at 5% level

*** significant at 1% level

Table 7: OLS Estimates for the Simple Model (Robustness Check in Private Sector)

(1)

LNTENURE

union_m	0.333 ^{***} (0.014)
male	-0.165 ^{***} (0.011)
age_25_29	-0.666 ^{***} (0.020)
age_30_34	-0.393 ^{***} (0.020)
age_35_39	-0.194 ^{***} (0.020)
age_45_49	0.184 ^{***} (0.019)
age_50_54	0.323 ^{***} (0.020)
age_55_59	0.356 ^{***} (0.022)
age_60_64	0.439 ^{***} (0.027)
hsdrop	-0.143 ^{***} (0.018)
college	-0.151 ^{***} (0.013)
university	-0.362 ^{***} (0.018)
lnwage	0.769 ^{***} (0.013)
centre	0.302 ^{***} (0.018)
east	0.369 ^{***} (0.013)
Atlantic	0.341 ^{***} (0.018)
constant	1.459 ^{***} (0.040)
R ²	0.159
N	61,216

Note: standard errors in parentheses

* significant at 10% level

** significant at 5% level

*** significant at 1% level

Table 8: OLS Estimates for the Two Equation Model – by union sector (Robustness check in private sector)

	(1)	(2)
	UNION	NON-UNION
	LNTENURE	LNTENURE
male	-0.132 ^{***} (0.027)	-0.170 ^{**} (0.012)
age_25_29	-0.855 ^{***} (0.047)	-0.633 ^{***} (0.022)
age_30_34	-0.533 ^{***} (0.047)	-0.366 ^{***} (0.022)
age_35_39	-0.254 ^{***} (0.045)	-0.184 ^{***} (0.022)
age_45_49	0.266 ^{***} (0.041)	0.161 ^{***} (0.021)
age_50_54	0.416 ^{***} (0.042)	0.299 ^{***} (0.022)
age_55_59	0.424 ^{***} (0.046)	0.337 ^{***} (0.025)
age_60_64	0.440 ^{***} (0.059)	0.442 ^{***} (0.030)
hsdrop	-0.086 ^{**} (0.038)	-0.161 ^{***} (0.021)
college	-0.210 ^{***} (0.029)	-0.132 ^{***} (0.015)
university	-0.428 ^{***} (0.046)	-0.356 ^{***} (0.019)
lnwage	0.548 ^{***} (0.033)	0.803 ^{***} (0.014)
centre	0.298 ^{***} (0.040)	0.301 ^{***} (0.020)
east	0.392 ^{***} (0.031)	0.360 ^{***} (0.015)
Atlantic	0.134 ^{***} (0.043)	0.380 ^{***} (0.019)
constant	2.490 ^{***} (0.106)	1.353 ^{***} (0.044)
R ²	0.210	0.197
N	11,580	49,636

Note: standard errors in parentheses

* significant at 10% level

** significant at 5% level

*** significant at 1% level

Appendix B

Figure 1: Job Tenure by Union Status, Population

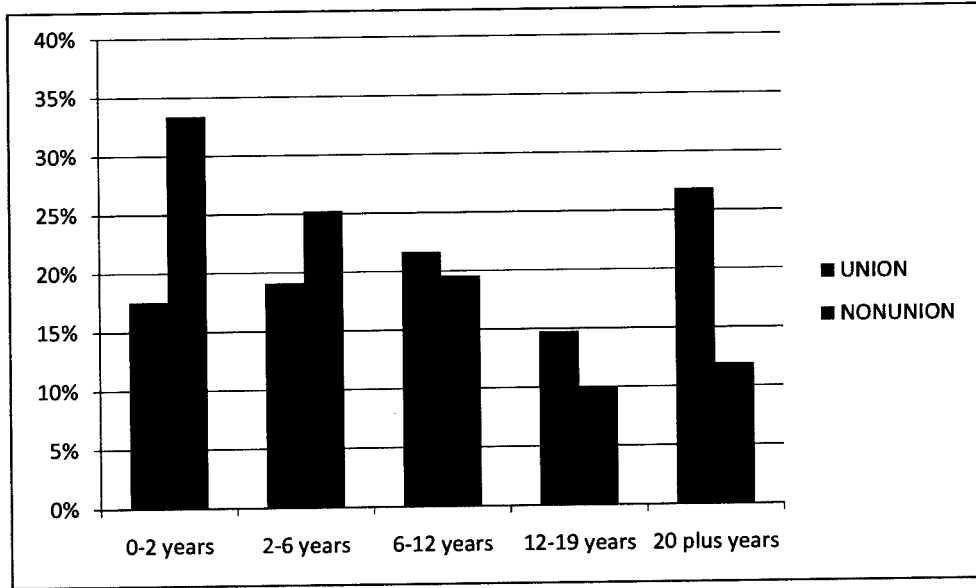


Figure 2: Job Tenure by Union Status, Private Sector

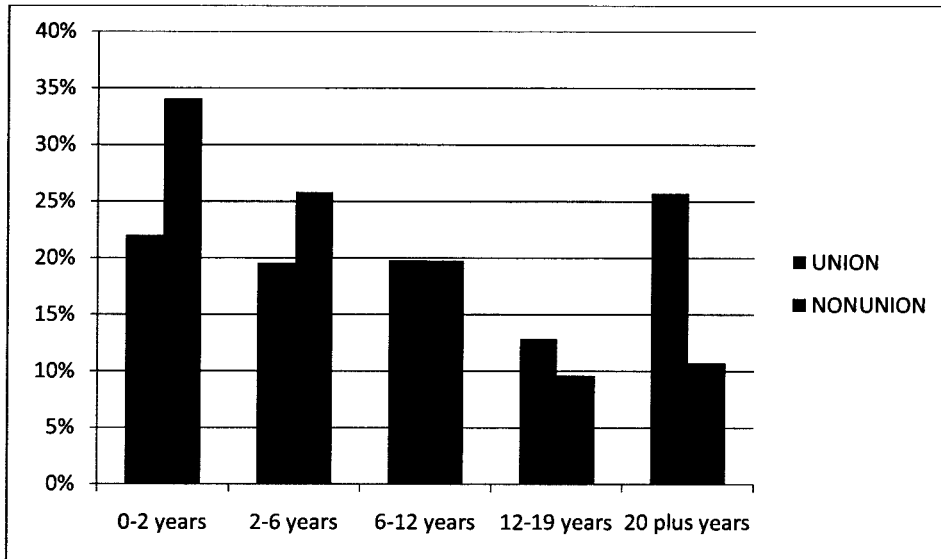


Figure 3: Job Tenure by Union Status, Public Sector

