Unions

Unions are essentially collective organizations whose primary objective is to improve the wellbeing of their members. This is performed through collective bargaining, where the representatives of the union negotiate on aspects from wages, benefits, and safety in the work place. The agreement is termed typically as collective agreement.

There are essentially 2 types of unions, Craft Unions, and Industrial unions. As their names imply, the former represents individuals of similar occupations, and or trade, while the latter supports workers within an industry regardless of trade, or occupation. Their impact may nonetheless extend beyond their constituents, since unions typically represent non-office workers, so that any changes will have externalities for office workers, as well as non-unionized labor in related industries, or within the same industry.

In Canada, the general trend in union membership has increased, between 1920 to 1980. Since then, the percentage has stagnated at close to 30% of non-agricultural paid workers. However, this is in stark contrast still compared to the U.S. whose union membership has been falling since the 1950, and particularly post 1970s, where it is less than half that in percentage terms compared to Canada.

Legal Framework

I will leave you to avail yourself of the history of unions in Canada, but will emphasize the Canadian Labor Policy since 1940s:

1. Workers who met the statutory definition of employee had the right to join and form unions.
2. Collective bargaining rights were protected under unfair labor practices legislation, which prevented neither the employers nor unions from interfering with employees' rights to collectively bargain.
3. A system defining the rules was created.
4. Once created, the union became the sole voice of its constituents.
5. Everyone was required to bargain in good faith.
6. The rights and obligations of both parties were controlled by either a labor relations board, or courts.

This together with the Industrial Disputes Investigation Act of 1907 collectively determined the legal framework. It includes the following,

1. If there is an impasses, there is a compulsory cooling off period, or postponement of strikes, and lockouts, coupled with compulsory mediation and/or conciliation procedures.
2. Strikes and Lockouts are prohibited during the term of the collective agreement. Further, the agreement must contain aspects that dictate how disagreements regarding the interpretation of the word of the agreement during the course of the agreement be resolved.
3. Other requirements on the collective agreement such as no strike/no lockout clauses, as well as clauses providing for peaceful resolution to disagreements.

Further, the Constitution Act of 1867 has been interpreted by the courts to imply that jurisdiction over labor relations matters are within the purview of the provincial governments, with the exception of certain occupations, and obviously includes federal employees.

The Growth of Unions
To understand the growth of unions we can examine it through the usual consumption leisure framework. Consider a worker in initial equilibrium where he works T-L* number of hours as a non-unionized labor. Now suppose a union organizer comes and promises that if he were to be part of the union, they could improve the employment package to w'>w*, thereby shifting the individual's budget constraint.

Slope of w'

Slope of w*

C*

U_h

U

U_l

L* L_g L_b
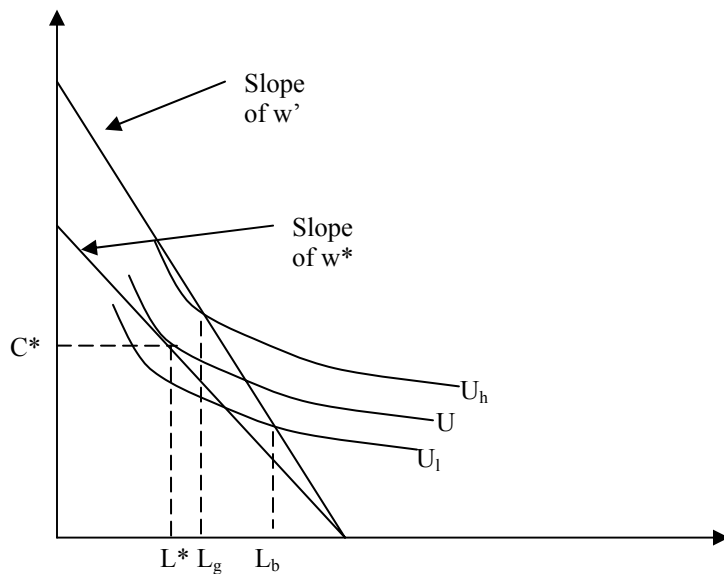
What is the catch then, since it looks like a sure bet? Well by forcing the firm's hand on wages, and benefits the firm could reduce the number of workers hired. Let's consider that the firm instead chooses to reduce the amount of labor hours instead. So since its demand is downward sloping, the greater the elasticity, the greater the reduction in labor hours. Suppose the firm's labor demand curve is very inelastic such that at w' it would choose to hire only T-L_b hours from the individual. This would mean a lower level of income, and lower level of utility. If however the firm's demand is inelastic, such that labor hours drop to only T-L_g, the individual would be better off. Hence whether the union is formed depends on the type of workers being represented, and the firm's labor demand elasticity. Another factor that will affect the degree of unionization is whether the union dues are high.

The equilibrium level of unionization also depends on the supply side. That is would a prospective union have enough power in the first place. This supply side is dependent on also,
1. Elasticity of the firm's or firms' labor demand,

2. The type of union activity permitted by the legal environment,
3. The level of resistance by the management of firms to union formation,
4. Whether there are in fact substantial rents to be extracted from the firm, that is how profitable the firm is.

Based on the above arguments can see why it is unions typically represent non-office workers? Consider the wage bill total for non-office workers, as opposed to Bankers, and some such. With technological change, and increased skill level, it is then not surprising that US union growth rates has fallen. But at the same time based on the same argument, do you think the relatively high percentage of unions in Canada is suggestions of a poor underlying economic structure.

Well actually maybe not, in the case of the US, he notes that most firms are now located in states which are not conducive to union formation, such as Right-to-Work laws. Further globalization of trade increased imports into U.S and Canada, thus driving down prices, and reducing rents that can be obtained through unions.

Why is there Aversion toward Unions?
The idea is very simple based on your standard demand and supply analysis. Recall your first year economics. Unions achieve their goals by bringing about a reduction in equilibrium labor hired. It is equivalent to a quota in analysis, and what it does is it causes a deadweight loss, that is allocation of scarce resources is inefficient in equilibrium. Further, holding the technology constant, it would be a lower level of GDP than what would have otherwise been obtained.

Efficient Bargaining

Isoprofit
But is it possible for everyone to reach a point where at least one party benefits without the other being worse off. That is an employment contract that does not lie along the demand curve. Let's first draw an isoprofit curve that describes a curve along which the firm gains the same amount of profit, as a function of wages, and employment. Now we know the marginal productivity increases initially and then fall. As it increases it is possible for the firm to increase the wage offered as employment increases. But it has to eventually fall to keep pace since marginal product of additional labor falls. Diagrammatically,
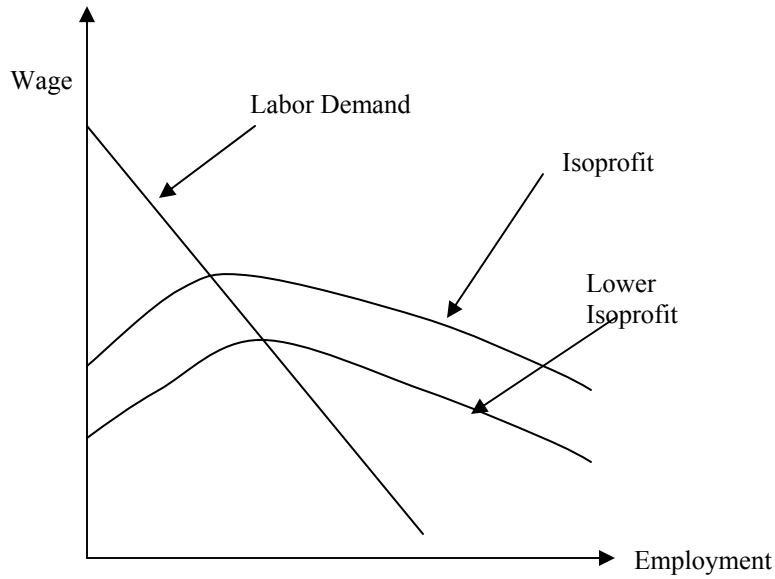
Note that the isoprofit line must be at its peak when it intersects the demand curve. Since the demand represents the locus of points it prefers. Further note that greater the profits, the closer the isoprofit curves would be to the horizontal axis.

The Contract Curve

The union's utility is of course is just like an individuals since wage and employment is substitutable. Augmenting that into the diagram, we get the following,
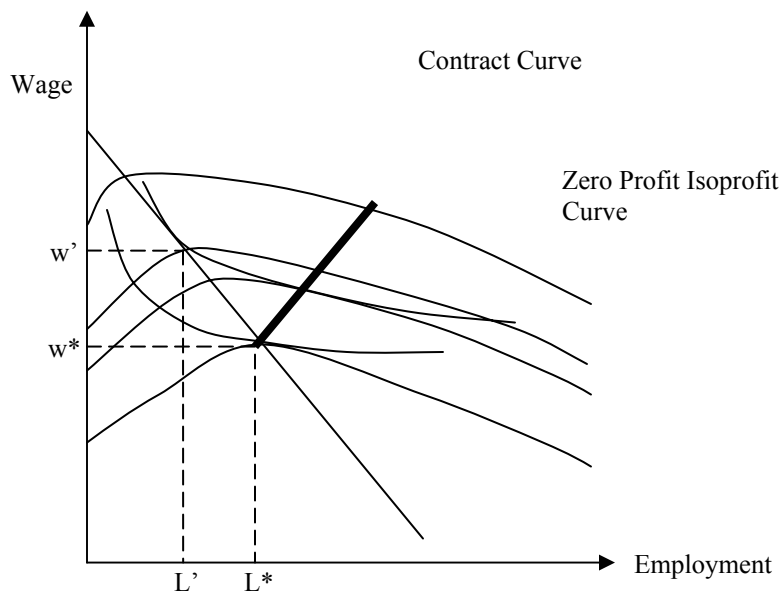
Let the equilibrium level of wage and employment be w* and L*. Suppose the union wants w' and L' instead, the question then is if there is a point where both parties might

be agreeable to. Note first that at w' and L', the firm's profit is lower than it would have been under the non-union scenario. However, moving along the union's utility curve, note that it is tangent to another lower isoprofit. This point represents a point of higher profit for the firm then what would be attained at w', L'. And the union is indifferent between this new point, that the tangency with the demand. This represents a possible off demand equilibrium. Where the firm hires more than what it would have under non-union equilibrium, but is better off that what the union proposed at first (This is also known as featherbedding, in a sense the firm hires more labor than it really needs, and may create situations where not all labor is used to its full potential. Have you wondered why you need police at road repair sites?). So this represents a pareto improvement, since the union is indifferent while the firm gains. In fact the line in bold represents all points where such equilibrium is possible. It is however bounded above by what the firm would find profitable. We call this curve, the contract curve. The question then is how to achieve a point on the contract curve. What this analysis tells us is that a pareto efficient outcome is achievable. Note that this is not to say the outcome subscribed here since as long as the equilibrium is not competitive, society suffers as a whole from misallocation of scarce resources. Further, if it is possible to have a vertical contract curve (or a negatively sloped one, obviously, the first diagram above is quite drastic) where wages can change off equilibrium and where labor hired does not change. This then would be equivalent to the case where negotiations pertain to how the firm's profits are shared between all the constituents.

Bargaining

We have already dealt with one form of bargaining, namely Nash Bargaining. We will consolidate the idea now, and add another due to Ariel Rubinstein. The difference is that the latter deals with the bargaining process, while the former deals with bargaining outcomes.

Nash Bargaining

The Nash Bargaining solution must follow essentially four axioms,
1. Pareto Efficiency: Only Pareto Efficient Outcomes can be solutions.
2. Symmetry: If the feasible set of solutions is symmetric, each party will get equal share of utility.
3. Invariance: Linear Transformations of either party will not affect the solution.
4. Independence of Irrelevant Alternatives: Exclusions of outcomes that is not the solution in the solution set will not affect the solution.

The problem is structured as follows:

1. A bargaining problem is a pair (U,d), where U is a set of couplets (pairs of numbers) that are payoffs to agreements and d is a couplet that describes the payoff to disagreement.
2. $d \in U$
3. For some couplets in U, such as (v_1, v_2) we have $v_1 > d_1$ and $v_2 > d_2$.

4. U is a convex set.
5. U is bounded (it is a subset of a larger set), and closed (every convergent sequence of members of U is in U.

The solution to such a problem is the maximization of $(v_1 - d_1)(v_2 - d_2)$.

I repeat the example I gave you earlier:
Let the total profit that is being bargained over between the union and firm be π. And let the threat of each party be T_u and T_f respectively. Then the Nash Bargaining solution is the solution to the following problem,

$$\max_{\lambda}(\lambda\pi - T_f)((1-\lambda)\pi - T_u)$$

Then

$$\pi((1-\lambda)\pi - T_u) - \pi(\lambda\pi - T_f) = 0$$
$$\Rightarrow \lambda = \frac{1}{2} + \frac{(T_f - T_u)}{2\pi}$$

Where λ describes the share of total profits.

Practice Question:
This question is culled from "An introduction to Game Theory" by Martin J Osborne.
A firm and a union representing *L* workers negotiate a wage-employment contract. The firm produces *f(l)* units of output when it employs *l* workers, where *f* is an increasing function. Each worker not hired by the firm obtains the payoff w_0 (the wage in another job, or perhaps the unemployment benefit). The contract (*w,l*), in which the firm pays the wage w and employs *l* workers, yield payoffs of *f(l)-w(l)* to the firm and $lw+(L-l)w_0$ to the union. In the event of disagreement, the firm's payoff is 0 and that of the union is Lw_0; let $d=(0,Lw_0)$. Assume that *f* is such that the set *U* of possible pairs of payoffs to agreements satisfies the assumptions on a bargaining problem. The Nash Bargaining solution of (*U,d*) involves the employment level *l** that maximizes $f(l)+(L-l)w_0$ (Which is the sum of both of their payoffs.) Find the wage level in the Nash Bargaining solution of (*U,d*).

Strategic Bargaining
Let's consider an alternative model, typically called An Infinite Horizon Game with Alternating Offers and Impatient Players (This section is summarize out of "An Introduction to Game Theory") Let the pie being divided be normalized to 1, so that all offers are between 0, and 1. We assume both players have perfect information. The setup of the game is as follows:
1. Players: Two Negotiators, let u be the index for the union and f be for the firm.
2. Terminal Histories: Every sequence of the form $(x^1, N, x^2, N,..., x^t, Y)$ for $t \geq 1$, and every (infinite) sequence of the form $(x^1, N, x^2, N,...)$, where each x^r is a division of the pie (that is it is a pair of numbers that sums to 1). This essentially describes the history of offers and decisions made at every point, and where *Y* and

N refers to agreement and disagreement respectively. For a more precise description, refer to the book.

3. Player function: $P(0) = u$ (The union makes the first offer or move), and

$$P(x^1, N, x^2, N,...x^t) = P(x^1, N, x^2, N,...x^t, N) = \begin{cases} u & \text{if } t \text{ is even} \\ f & \text{if } t \text{ is odd} \end{cases}$$

4. Preferences: For $i \in \{u, f\}$, i's payoff to the terminal history is $(x^1, N, x^2, N,..., x^t, Y)$ is $\delta_i^{t-1} x_i^t$ where $\delta_i \in (0,1)$ (is just the discount factor), and its payoff to any infinite history $(x^1, N, x^2, N,...)$ is 0.

To help get the idea, the game tree of an alternating offer game of 2 periods is depicted below, in the second period they either agree or both gets 0.
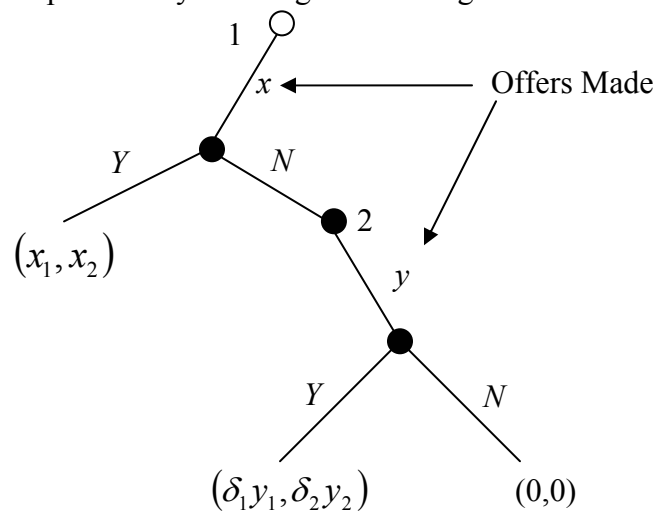
In our case here, the game can go on infinitely long. The essentially point of this model is to illustrate the process of bargaining.

Additional concepts we will require are

→ **Subgame Perfect Equilibrium**: It is a strategy profile $s*$ with the property that in no subgame can any player i do better by choosing a strategy different from s_i^*, given that every other player j adheres to s_j^*

→ A subgame perfect equilibrium is a strategy profile that induces a Nash equilibrium in every subgame.

Because of the stationary structure of the game we guess that the game has a subgame perfect equilibrium in which both the union, and the firm always makes the same proposal and always accepts the same set of proposals, i.e. both of the negotiating parties

strategy is stationary. (But just because the game is stationary does not mean that there will be equilibrium).

Let's start with the u always proposing x^* and accepts a proposal y given by the firm if and only if $y_u \geq y_u^*$, while the firm does the same, and always proposes z^* and accepts a proposal given by the union w if and only if $w_f \geq w_f^*$ for proposals x^*, y^*, z^*, and w^*.

Let's guess that every proposal is always accepted in equilibrium so that $x_f^* \geq w_f^*$ and $z_u^* \geq y_u^*$. In words it means that u's offer to f must be greater than or equal to what f is willing to accept, and the same is true for u. Note however that if any of the inequalities are strict, it would mean that either party is willing to accept an offer lower than what is offered, and it would only make sense that they offer less, and thereby raising their own offer. This can't be right, so in equilibrium, the inequalities must be equalities.

This means the equilibrium strategies are as follows: u always proposes x^* and accepts a proposal y given by the firm if and only if $y_u \geq y_u^*$, while the firm does the same, and always proposes y^* and accepts a proposal given by the union w if and only if $x_f \geq x_f^*$.

So let's start the game rolling. Let u make the first offer and f chooses whether to accept or reject. If f rejects it would counter offer with y^*, which u accepts, yielding f the payoff of y_f^*. But since there is a one period delay, f's payoff is $\delta_f y_f^*$. This means that f will reject any offer whereby $x_f < \delta_f y_f^*$, and accepts when $x_f > \delta_f y_f^*$. But f would be indifferent if $x_f = \delta_f y_f^*$, which u is cognizant of. If f were instead the first mover, we would get in return $y_u = \delta_u x_u^*$. Further by our initial normalization we have $x_f^* = 1 - x_u^*$ and $y_f^* = 1 - y_u^*$. And we obtain the following solution

$$x_u^* = \frac{1-\delta_f}{1-\delta_u\delta_f}$$

$$y_u^* = \frac{\delta_u\left(1-\delta_f\right)}{1-\delta_u\delta_f}$$

So u always proposes x^*, and f proposes y^* such that

$$x^* = \left(\frac{1-\delta_f}{1-\delta_u\delta_f}, \frac{\delta_f\left(1-\delta_u\right)}{1-\delta_u\delta_f}\right)$$

$$y^* = \left(\frac{\delta_u\left(1-\delta_f\right)}{1-\delta_u\delta_f}, \frac{1-\delta_u}{1-\delta_u\delta_f}\right)$$

Is this a subgame perfect equilibrium? The way to show that it is, is to examine if there is any impetus to deviate from such a strategy. We have to consider this from both the point of view of u the first mover, and f. Let's see if u would deviate. If u offers more than this strategy, u would be worse off, and so would not adopt that tact. If instead u offered less,

the offer would be rejected, and f would make a counter offer to u that is less than what u could have gotten in the first round should u kept to its strategy. The same argument holds if f were the first mover.

Consider now the response. If f rejects an offer of x^*, it would make the counter offer of y^*, which would be accepted. But the difference to f is that it would be discounted by one period. Since u would have realized this, the initial offer would have been this value, and f would be back to square one. So f has no impetus to deviate. The same arguments hold in the situation if the proposal were to be handled first by u.

So by the **One Deviation Property**, neither party would deviate from their strategies, and we have a subgame perfect equilibrium. In fact the equilibrium is unique.

Some interesting properties:
1. **Efficiency**: The offer is always accepted in the first period, and there is no wasted resources spent on delay.
2. **Patience**: Holding the other players patience, as own patience grows, or tends to 1 on the limit, own share of the pie rises.
3. **First Mover Advantage**: If all parties discount factor are the same, first mover obtains greater payoff. However if the level of patience is close to 1, the share each gets is very close to half.
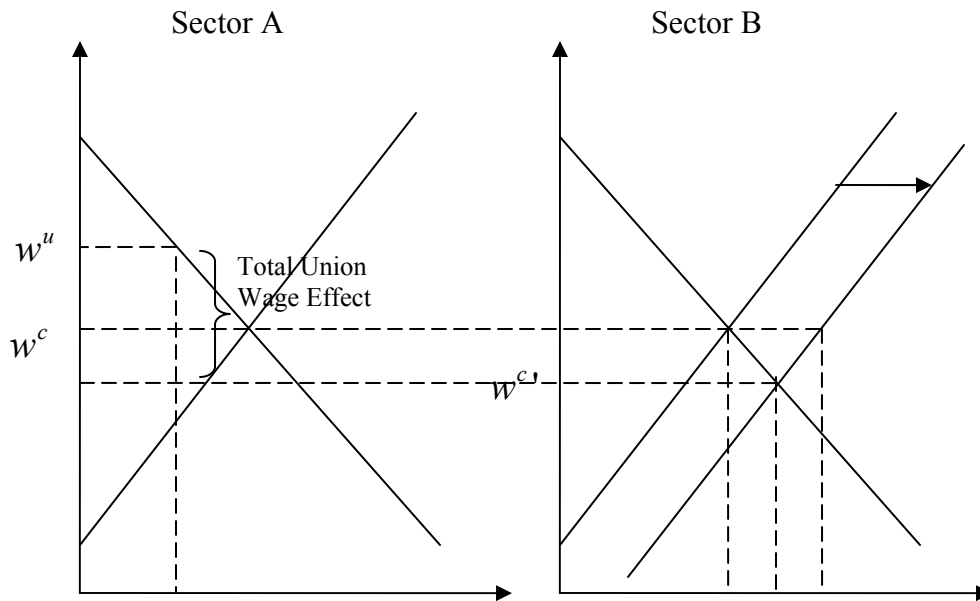
Union Wage Effect

A simple model of Union Wage Effect
Before we talk about how the effect of union wage differential is measured and possible complications, let's examine how the impact permeates through the economy. Because we are considering essentially two segments it hints that a general equilibrium model would give the relevant insight. We will adopt the following assumptions

1. There are two sectors, A and B
2. All workers are homogenous
3. There is a large number of firms and workers such that labor market is competitive. Let this competitive wage be w^c, with employment L^c.

Let a union organize workers in sector A such that they are able to obtain wages of w^u, thereby decreasing the equilibrium level of employment to L^u. Workers who are unable to find work in sector A now search for jobs in sector B. This then raises labor supply in sector B, reducing wages, and raising employment there hence, but note that the increase in employment in B will be less than the fall in employment in sector A. This is because individuals who find the new wage below their reservation wage now drop out of the labor market. Diagrammatically,

Sector A   Sector B

Note that the total union wage effect is greater than what you would have noted from just focusing on sector A. In truth, the magnitude of the union effect depends on
1. the elasticity of labor demand in each sector,
2. the ability of the union to raise wages in the organized sector, and
3. the elasticity of supply.

Threatened Non-Union Sector
It is sometimes argued that some employers may be sufficiently averse to union formation that in anticipation of union formation in their sector, they would likewise raise the wages offered to their workforce. We can examine this possibility using the same framework, albeit now we assume three sectors. Sector A is the union sector, Sector B is the threatened sector, and sector C is the Unthreatened sector. Diagrammatically, it is represented below. With union formation in sector A, sector B which is none unionized would prevent unionization by offering greater wages than under perfect competition. So sector C takes the increment in unemployed from both sector A and B, and this suppresses their wages by an even greater extent than what has been previously discussed. Sector C is typically referred to as the secondary labor market. However, this is not to say that the union effect is greater, since the wage effect in the non-union sector is the weighted sum of both sector B and C, and it depends on both magnitude differences, as well as the size of each sector.

Sector A   Sector B   Sector C

w^u w^{nu}

$w^{C\prime}$
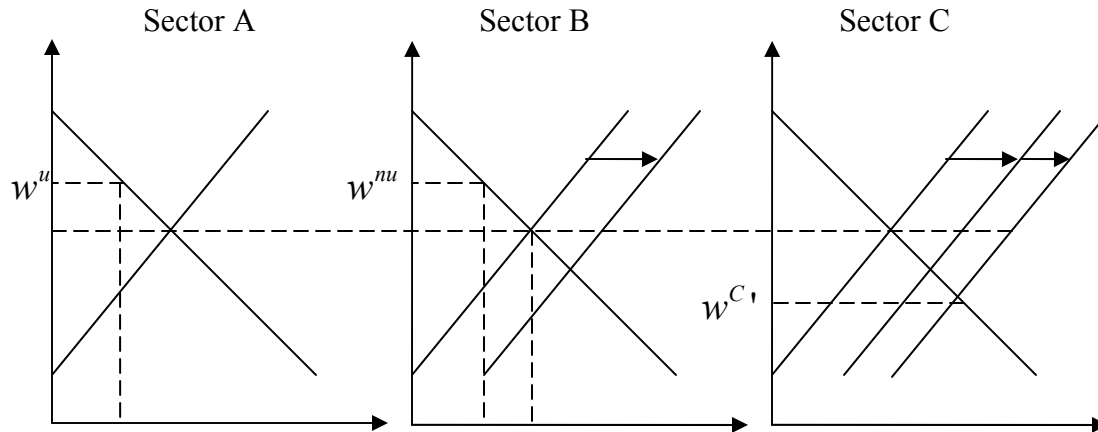
Recall in our earlier discussion that the contract curve could be vertical. If that is the case, the union sector simply decides on the share of the rents obtained by the firm, and there is no employment effects, so that there will be no changes to the supply in the non-union sector.

Wait or queue unemployment
There is also another scenario we can consider. What if there is sufficiently high turnover in the union sector and it is difficult to obtain union jobs once you're in a non-unionized sector. This means that some individuals would choose to wait for the opportunity to enter into the sector, thereby reducing the impact of increase in supply on the non-unionized sector.

Change in Demand
We have also ignored the possibility of changes in demand for labor. This may occur when the non-union firms capitalize on the wage differential to enlarge their market share (baring any differential in labor productivity between sectors). This would raise demand for non-union labor, thereby dissipating the income differential between union and non-union labor.

Other Variations

1. When firms hire both union and non-union labor, the outcome depends on whether they are substitutes or complements. If union raise union labor wages, and if union and non-union labor are substitutes (complements), then the firm would increase (decrease) demand for non-union labor, and thereby raising (lowering) wages of non-union labor.
2. However, these effects will be dissipated by union strategies of encouraging higher minimum wages, putting a lower bound on how low non-union wages could go.

The measurement of union wage effect

Ideally, in order for us to measure the union effect on wages we have to calculate the difference between what an individual i got as a non-unionized labor, w_i^n and as a union member, w_i^u. As a percentage, the formula is

$$\Delta_i = \frac{w_i^u - w_i^n}{w_i^n}$$

And the market on the whole as,

$$\text{Union Wage Gain} = \frac{\sum_{i=1}^{N} \Delta_i}{N}$$

where N is the total labor force in the market. However, this is usually not possible since we only observe either w_i^n or w_i^u. Further the issue is complicated if the wage increases with time, thus biasing our estimates. What has been done is that we instead calculate the union wage gap,

$$D = \frac{\overline{w}^u - \overline{w}^n}{\overline{w}^n}$$

which is just the percent wage difference between union and non-union labor. The union wage gap typically adjusts for differences in socioeconomic characteristics such as education, age, industry, and region of employment (by state, or city, or other census definition of areas). To be precise, let's say we estimate the following wage function

$$w^n = a_n + b_n x_n$$
$$w^u = a_u + b_u x_u$$

where x_n and x_u are just the socioeconomic characteristics of the different sub-groups. The difference between this two regressions can be written as follows,

$$\Delta \overline{w} = \overline{w}^u - \overline{w}^n = a_n - a_u + b_n x_n - b_u x_u$$

Notice it is possible for us to decompose this difference into components that is dependent on unionization and that which is purely a result of socio-economic characteristics.

$$\Delta \overline{w} = \overline{w}^u - \overline{w}^n = a_n - a_u + b_n x_n - b_u x_u + \left(b_n x_u - b_n x_u\right)$$
$$= \underbrace{\left(a_n - a_u\right) + \left(b_n - b_u\right)x_u}_{} + \underbrace{b_n \left(x_n - x_u\right)}_{}$$

Differential Due to Unions   Differential Due to Socio-Economic Characteristics

This is known as the **Oaxaca Decomposition** (Named after Ronald Oaxaca who introduced this in Economics)

What are some of the problems associated with estimation of union effect?
1. Inability to measure or quantify characteristics that distinguish quality perhaps due to the features being not directly observable. If union membership or formation is systematically correlated to these variables, then differences between union and non-union labor is purely a feature of this **selection bias**.
2. There is also the issue of causality. Are wages high because of unions, or is the formation of union because labor wants to have greater control over their work environment thus union formation. The wage differential here is purely because the firms considered are high wage firms, because of efficiency wage considerations to control for productivity and morale. This creates the problem of simultaneity which is another form of endogeneity.

How do we go about estimating the impact of union formation on wages, and wage differential?
1. The above discussion of problems suggests we need to estimate a **simultaneous equation model**. How do we go about it? Basically, we need to two sets of equations, one set dealing with how wages in the union sector is determined, and the other with how the non-union sector determines their wages, and the second equation models which workers are employed within each sector. This form of estimation unless obtained from a structural model, requires some identifying restriction for identification of the true value of the parameters we are trying to estimate. Using this method it has been found that union formation is more likely when wages are higher, and that union impact on the wage differential is smaller than when the reverse causality is not considered.
2. The other method would be to use **panel data**. We have talked about this, essentially what we are doing is to follow individuals across time, and what they choose given their characteristic at each particular time. First let the unobservable component of each individual in any particular period t be,
$$e_{it} = \lambda_i + v_{it}$$
This means that there is a constant component that does vary across time since the subscript pertains to one index, i only. While the other aspect is permitted to vary across time and is assumed to be totally random. Let the wage equation for the individual be your standard log wage regression,
$$\log w_{it} = a + BX_{it} + cI(\text{If Union} = 1) + \lambda_i + v_{it}$$
Where X is a vector of observable characteristics, and I is an indicator variable and is equal to 1 if the individuals chooses to join a union, and 0 otherwise. Suppose we only observe two periods in any individuals life, in period t the individual i may or may not be part of a union, and in period t+1 he may or may not join it. Then if we estimate the difference in log wages, we get
$$\log w_{it} - \log w_{it+1} = B(X_{it} - X_{it+1}) + c\{I_{t+1} - I_{t+1}\} + v_{it} - v_{it+1}$$
Notice the fixed unobservable component is deleted. This then mean that our estimator of the impact of union participation is unbiased. It has been generally found using this method that the union-nonunion wage differential is about 10%, which is smaller than that found using cross sectional estimates (approximately double what is found using panel data). However, the panel data strategy is not

without problems. There is evidence of measurement error in union status of individuals that actually cause the underestimation of wage effect. Also identification typically comes from a small proportion of the sample, which may make inferences highly spurious.

You should avail yourself of the comments in your text from pages 485 to 498.