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of workers' abilities. Moreover the exchange of labour services for compensation may take on several forms. In some situations only wages will be exchanged for labour services. This would occur particularly when the turnover rate is high or when the employer has otherwise no incentive to provide additional benefits over wages.⁴ Even in a situation in which an employee's total compensation is not entirely composed of wages, the agreement between the firm and a worker may be implicit in the sense that the costs of a formal transaction are prohibitive⁵ or because a formal contract may not be required due to custom in the relationship between the firm and its present workers. In the case where an informal employment arrangement exists between the employer and a worker the contract will be said to be implied. Occasionally an individual will wish to hire an agent to negotiate the labour contract on his behalf. Such an arrangement will be termed a consultant-agent labour contract. All of the above arrangements are, of course, bargained between the individual himself or his representative and the firm. These therefore represent individual-firm types of labour contracts. In contrast, there may be net gains to workers in contracting among themselves by hiring an agent who will then negotiate on the group's behalf. Such a collective would bargain with the firm, over working conditions, through its chosen representatives.⁶ It was

CHOOSING THE EMPLOYMENT CONTRACT:

INDIVIDUAL VERSUS COLLECTIVE

ARRANGEMENTS.

BY

PIERRE SIKLOS

A Thesis submitted to the Faculty of
Graduate Studies in partial fulfill-
ment of the requirements for the de-
gree of Doctor of Philosophy.

Department of Economics
Carleton University
Ottawa, Ontario

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Thesis Supervisor

Chairman, Department of Economics

Carleton University

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ABSTRACT

Two variables are used in this thesis to explain the contractual arrangements within the labour market. Two types of contracts are considered: the individual-firm arrangement in which the individual himself (or his consultant-agent) deals with the employer directly and the collective contract wherein a group of individuals together bargain with their employer. The union-firm arrangement is considered to be the most important type of collective contract. Majority voting is assumed to govern a group's decision about whether or not to organize a union.

Of the two variables in a theory of employment contracts the first concerns the incentive for signalling. It is shown that the likelihood of selecting the collective contract is affected by the composition of a group of workers in productivity terms, the average product of a group and signalling costs.

The second variable deals with the relationship between the components of an employment contract and the likelihood of selecting the union arrangement. Since many employee benefits are non rival in nature (e.g., 'public' goods) there is less incentive for workers to purchase such goods unless all the members of a group somehow share in the acquisition costs. Since the union arrangement can facilitate the purchase of these benefits the demand for them will be higher under unionism relative to an individual-firm employment contract.

Canadian data is then employed to test the empirical relationship between the aforementioned two variables and the likelihood of unionization.

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Chapter I

THE ROLE OF TRANSACTIONS COSTS

IN THE LABOUR MARKET

Introduction

Transactions costs affect the outcome of many market arrangements.¹ Whether it is the capital market, the car market or any other market where there is an opportunity for an agent to influence the uncertainty involved in purchasing goods and services, the costs of transacting between buyers and sellers will be important.² The same is true for the labour market. There exist between a firm and employees different types of arrangements and yet their coexistence within the same market has not been fully explained. In addition, choosing the employment contract may be influenced by the rules determining the organization of workers in employment. Clearly athletes, professionals and construction workers negotiate

employment contracts which are not alike in nature. The athlete will hire a consultant-agent to bargain on his behalf, the professional is more likely to negotiate individually with the firm, while construction workers will most probably organize a union. It will be argued in the next chapter that the probability of selecting one employment arrangement over another is influenced by two elements.

The first concerns the incentive for a majority to coerce the entire group into altering the capacity of the employer to tailor wages to each individual as opposed to a group as a whole. This is the so called signalling or screening issue.

The second element deals with the incentive for individuals as opposed to a group of workers to secure certain goods in the contract that are of a public goods nature, that is, commodities that would be consumed equally by all workers irrespective of the type of employment contract.

Furthermore, the coercive nature of certain institutional arrangements (viz, the Union) will lead the group to purchase different quantities of certain types of benefits, whose consumption is private, than under an alternative mode of contracting.

In this chapter we wish to outline briefly the types of information costs which exist in the labour market and to note the possible effects of these on the choice of the employment contract by a group of workers. We leave to the next chapter the detailed explanation on the likelihood of selecting between types of labour contracts.

1. Types of Transactions Costs Within the Labour Market.

Several types of information are generated within the labour market. On the employee side the most important ones are signalling, search and negotiations costs.

Signalling refers to differentiating activities undertaken by the sellers of labour services with respect to the information they provide to the firm. These are usually considered to be the costs of acquiring human capital.³ Search costs are those that incurred in looking for employment. Finally, in certain occupations, there may be costs incurred in negotiating the employment contract itself. Athletes and union negotiated employment contracts serve as examples. Some athletes hire an agent to negotiate the contract on their behalf while in a Union members share in the costs of the organization.

The firm must also bear some costs as a result of employees' information producing activities. Screening and monitoring expenses are particularly relevant in this respect. Screening refers to the evaluation of signals prior to employment. Monitoring refers to the evaluation of signals during employment. Since all of these activities are costly the capacity of individuals or institutions to affect such costs by producing or suppressing some information (e.g., signalling), either because of a comparative advantage or through coercion, will affect the choice of the employment contract. It is the nature of such effects which is being explored in this dissertation. Consequently, it seems instructive, for the

purposes of an introduction, to outline the types of information which circulate within the labour market and to note how these may be exploited under different types of arrangements.

Consider then Figure 1.

How much search is undertaken depends on whether individuals believe that additional search will produce higher returns. In any event, individuals will search until the net return from an additional search, that is, the difference in the wage offer from the last search, is equated to the cost of that extra search. Whether search costs can be reduced under different employment arrangements depends on characteristics of the occupation or industry. If turnover in firms is high (e.g., as in construction and textiles; see Freeman (1978) search costs may be reduced through an agent who, because he is the only or major source of workers, possesses the requisite knowledge about available employment opportunities. The Union is one such specialized agent although, as we shall see, it performs other functions as well.

Signalling represents yet another cost incurred in producing information. Resources are invested in signalling if the costs of acquiring the signals are less than the difference in compensation resulting from the increase in perceived productivity. Because employers have difficulty in assessing the contribution of each worker, especially prior to employment, hiring is ordinarily determined by a screening device which attempts to differentiate between workers on the basis of their investment in signalling activities (e.g., education). Moreover, since

FIGURE 1 - INFORMATIONAL FLOW IN THE LABOUR MARKET

signalling contributes only to income and not to productivity the resources invested in such activities represent a social cost as far as society is concerned while yielding no social benefits, only private ones.⁴ Even when competition along the signalling dimension enables employers to place workers in the most suitable jobs, thereby contributing to their performance, the social benefits will be smaller than the waste of resources incurred in acquiring signals which by themselves do not affect productivity (see Spence (1976)). This screening device is more efficient however, since employers modify the presumed relationship between signals and productivity as individuals change their investment patterns in the signal which in turn is determined by how employers read signals. The basic wastefulness of signalling, in the sense of a cost that has no equivalent impact on the social product, remains. Consequently, the private return to signalling will still exceed its contribution to productivity resulting in overinvestment in the information producing activity. Therefore some individuals may prefer an arrangement which reduces or even eliminates this kind of behaviour.

It shall be argued that Unions suppress signalling since wages tend to be standardized under such an arrangement. We will show in the next chapter that the decision by a group of workers to select a Union-firm contract depends on the resulting net benefits from the

suppression of signalling activity to the dominant faction of the group. This dominant faction, it will be seen, represents a majority of workers in the group since Union decisions affecting the rank and file in employment are based on the majority voting rule.

One of the essential differences between the Union and an individual-firm arrangement is that in the former a majority decides over the terms and conditions of employment while in the latter each individual bargains over such matters independently with the firm. As a result, one would expect the structure of the contract to be different under the two arrangements. This aspect of employment contracts shall be explored in greater detail in the next chapter. Essentially there are two reasons why such a result would occur. The first has to do with the fact that certain aspects of employment are such that they must be consumed in equal amounts by all workers. These are the public goods in employment (e.g., atmosphere in a plant).

While a collective choice mechanism, such as the Union's majority voting rule, is not necessary for the provision of such commodities, the costs to the firm in seeking individual workers preferences may be such that the inflexible working conditions negotiated through the Union arrangement is a less costly one for the firm. As far as the individual worker himself is concerned there is little incentive for him to purchase public goods on the job if he cannot

feasibly deny others from enjoying the same benefits while he alone incurred the acquisition costs. It is partly for this reason that the demand for such goods is more likely to be higher under unionism where, usually, all members must share in the costs of the collective arrangement. Otherwise the free rider problem remains. That is, as Olson (1965) has stated (p. 88):

A rational worker will not voluntarily contribute to a (large) Union providing a collective benefits since he alone would not perceptibly strengthen the Union, and since he would get the benefits of any Union whether or not he supported the Union.

The second source of change in the structure of the employment contract under unionism follows from the coercive nature of the decision making rule. The voting rule enables the majority to impose decisions on the group as a whole. This results in the purchase of certain types of benefits (e.g., pensions, fringes) in greater proportion to total compensation than under the alternative of individual-firm contracting. The reason for this, as we shall see in the following chapter, is the higher marginal evaluation placed on such benefits by the majority of workers in the group because of age or aversion to risk for example.

When an employee is hired there is monitoring, which is costly. It is at this point that the employer compares his prior expectations about the workers hired with actual performance. As a result, there is a positive probability that the worker

may be fired. In addition, perhaps because of poor economic conditions in the industry, the possibility of layoffs also exists. Finally, better terms elsewhere may prompt some individuals to leave the firm. In all of these situations the firm incurs turnover costs. It must not only find suitable replacements for the exiting workers but human capital investment specific to the firm will also be required.⁵ Since the collective and private benefits provided through the Union tend to be non-portable between firms the higher proportion of such benefits in total compensation under unionism would increase exit costs thus reducing the likelihood of quits. This is true for all workers but the change in the structure of the employment contract in the Union-firm arrangement could also render an otherwise less preferred contract for the minority which voted against union representation at least as preferred as the one they would have negotiated individually with the firm. Some, most notably Freeman (1976, 1978), have viewed particular benefits acquired under unionism, such as grievance procedures, as providing a 'voice' alternative to exit (e.g., a quit). Reducing the likelihood of exit implies that many information producing activities, such as search, need not be repeated as often under unionism since job tenure is lengthened as a result of the provision of other than wage benefits that are of a public or private

goods nature.⁶ To summarize, it will be argued that there are essentially two major determinants in the choice of the employment contract. One has to do with the incentive of the majority to suppress information in order to obtain a better employment contract. The other deals with the effect of the Union on the structure of the employment contract. While these two determinants provide separate explanations for the likelihood of selecting a Union-firm contract over an individual-firm arrangement they are nevertheless linked to each other in some respects. Since majority voting implies coercion, and raises therefore the possibility of exit, the role of the Union in changing the structure of the contract through the purchase of certain public and private goods clearly could have an effect on this decision if the utility derived from the resulting employment contract is also affected. While it is being suggested that these two determinants can explain the choice of contractual arrangements in the labour market other explanations for the existence of Unions in particular are not being replaced. Rather it is felt that the information producing and suppressing activities of the Union complement other theories. It should be stressed therefore that there are other aspects of unionism which serve to explain its emergence as a device to bargain with employers over working conditions. Except for the recent literature on the 'new economics of the labour

union,⁷ almost all theories of the labour union were concerned with their impact on wages and the resulting wage differentials between unionized and non-union employees.⁸ Chief among such views is that the Union as a monopolist is able to raise wages above the non union wage by restricting the supply of labour. As a result, employment in the union sector would fall and released workers would compete with non-union individuals thus driving down the wage rate in that segment of the labour market. Whether the average wage rate in the labour market with unionism is above or below the equilibrium wage rate with no unions depends on the elasticity of demand for labour.⁹ Considerable empirical evidence on the relative wage effects of unions has been accumulated both at the occupation (e.g., blue collar, manual workers) and industry (e.g., manufacturing) levels. The historical evidence for the U.S. and the U.K. suggests that the estimated differential between union and non union wage rates vary between 8% and 40%, though occasionally it has been statistically insignificant.¹⁰ However, other approaches for union relative wage effects have been suggested. One is to recognize that higher union wage rates result in a more careful screening of job applicants by employers.. This would imply that Union workers are relatively more productive than their non-union counterparts. We shall have more to say on the issue of screening and the labour Union in the next chapter. Yet another approach suggests that unionism brings forth a 'threat effect'.¹¹ That is, as a group becomes more unionized, resistance on the part of nonunion employers also

grows. Therefore to prevent unionization nonunion wage rates will keep pace with union wages. Finally, it has been suggested that part of the union nonunion wage differential may be explained by the more structured working conditions under unionism.¹² The uniformity of working conditions (e.g., lack of flexibility in the work schedule) is seen as causing a diminution in welfare due to the reduction in the choice of working arrangements. Since this problem is relatively less important in the non-union sector unionized workers' higher wages are partly due to a compensating differential for inflexible working conditions. Not all theories of unionism have exclusively been centred around the wage differential issue. Ashenfelter and Pencavel (1969) for instance have argued that unions are more successful in organizing sectors where workers are discontented as measured by the unemployment rate. It is thought that if unions appear to be successful in improving employment prospects, because of job security provisions and hiring restrictions in collective agreements, that the likelihood of unemployment will be less pronounced under unionism. Consequently, union membership should rise with the unemployment rate since under the collective arrangement the welfare of workers is thought to increase.¹³ In this connection, the hypothesis has recently been advanced that union workers are relatively more content than their nonunion colleagues as measured by

lower quit rates.¹⁴ Essentially this is because unions provide workers, through their employment contract, with so-called 'voice' mechanisms which offer dissatisfied workers the option of initiating grievance procedures against the firm as a substitute for a quit. Examples of voice mechanisms include grievance procedures, labour-management committees and safety and health committees. Finally, a few authors (see Freeman (1978a), Ichniowski (1978), Farber (1978), Farber and Sacks (1980)) have argued that unions raise the share of fringe benefits in total compensation. Differing views however have been presented to explain why this is so. Freeman (1978) argues that the variety of types of fringe benefits and pension plans provides an opportunity for an agent like the Union to monitor and provide advice on the purchase of such benefits. Farber (1978) posits that the reduction in the tax liability and a relatively higher aversion of unionized workers to the risks of unemployment results in more wages being foregone under unionism for types of benefits such as fringes and pension plans. In the next chapter, we offer a complementary explanation for the relatively higher share of other than wage benefits in total compensation under unionism. We should point to the fact that the variety of explanations for the union's existence and its differences with the non union segment of the labour market may be partly due to difficulties in the

measurement of relevant variables for use in empirical work. For example, if the employment effect of the Union is partly measured by the proportion of union workers in the relevant group (i.e., the occupation or industry) the values in the sample may be correlated with each other, as workers move from one industry to another or between related occupations because of changing employment conditions. Similarly, measuring the impact of unions on the 'quality' of workers at a point in time ignores the long run effect of this institution on investment patterns in human capital. One way the Union has accomplished this is by restricting entry into some occupations (e.g., licensing). Consequently, there are difficulties in measuring the impact of alternative institutional arrangements in the labour market.

NOTES TO CHAPTER I

¹ Transactions costs could be briefly described as those which arise out of an opportunity, through the accumulation and dissemination of information, to affect the allocation of benefits and costs between the parties to a transaction. Some would prefer to employ the term information costs. The two terms will be considered interchangeable as far as this analysis is concerned.

² See Barzel (1976, 1979). There are, of course, several references on the subject but many are reviewed by Barzel.

³ Education is the principal example.

⁴ See Spence (1973), Stiglitz (1975) and Arrow (1974). For an empirical test of the signalling hypothesis see Layard and Psacharopoulos (1974).

⁵ See Becker (1962).

⁶ The items that can be found in an employment contract are classified and defined in the next chapter.

⁷ See Freeman (1976, 1978), Ichniowski (1978), Farber (1978), Farber and Sacks (1980) and Duncan and Stafford (1980).

⁸ This section will be brief as several excellent surveys on wage aspects of Trade Unions exist. See Rees (1962), Addison and Siebert (1979) and Parsley (1980).

⁹ Addison and Siebert (1979), ch. 8.

¹⁰ For example see M. Friedman, 'Some comments on the significant Labour Unions for Economic Policy', in D.M. Wright, ed., The Impact of the Union, New York, Harcourt Brace, 1951.

¹¹ See Rosen (1969). Ashenfelter and Pencavel (1969) would argue that as the degree of unionization rises there are diminishing returns to organizing a union. Whether this is because of the 'threat effect' or not is not discussed by the authors.

¹² See Duncan and Stafford (1980).

¹³ Ashenfelter and Pencavel found this variable to be statistically significant. The authors were examining the determinants of Trade Union growth in the U.S. This is not an issue that will be considered here.

¹⁴ See Freeman (1978).

Chapter II
A THEORY OF CONTRACTUAL ARRANGEMENTS
WITHIN THE LABOUR MARKET

Introduction

In the previous chapter it was argued that various types of information are exchanged within the labour market for the purposes of arriving at an acceptable employment arrangement both to the firm and the employee. Furthermore the ability of institutions or individuals to affect the costs of accumulating and disseminating different types of information through an offer of specialized services opens the possibility for a variety of institutional arrangements. As a result, there may exist opportunities for workers to form a collective to negotiate an employment contract with the firm if the net returns from doing so, that is, total compensation less contracting costs, are greater than under any alternative arrangement, namely individual-firm contracting.¹ While several types of collectives exist the Union is the dominant form of collective arrangement in employment.² In this chapter it is shown that the selection by workers of the Union form of representation leads to a contract which, in terms of its contents, is likely to be different from an

individual-firm contract. Some provisions would probably only appear in a collective arrangement while yet other contractual items may be too costly to negotiate on an individual basis. However certain conditions must be met before the Union-firm contract can be declared the least costly form of employment arrangement. These conditions have to do with the amount of labour market information accumulated by individuals and the distribution of abilities within the group; the costs incurred in finding employment or in terminating it, as well as the costs of negotiating the employment contract itself. The determinants of contractual arrangements are also explored in this chapter. Examples are presented which demonstrate the effect of information costs on the choice of the labour contract.

1. Information Costs and the Selection of the Employment Contract

(a) Types of Employment Contracts

A contract incorporating legal sanctions exists wherever an exchange between two parties is not simultaneous or, which is similar, when an agreement is based on an exchange whose costs and benefits will become known only during or after the parties to the contract have fulfilled its terms.³ In the case of labour, the firm pays only after the workers have completed their tasks while the payment itself is usually based on an ex ante evaluation

of workers' abilities. Moreover the exchange of labour services for compensation may take on several forms. In some situations only wages will be exchanged for labour services. This would occur particularly when the turnover rate is high or when the employer has otherwise no incentive to provide additional benefits over wages.⁴ Even in a situation in which an employee's total compensation is not entirely composed of wages, the agreement between the firm and a worker may be implicit in the sense that the costs of a formal transaction are prohibitive⁵ or because a formal contract may not be required due to custom in the relationship between the firm and its present workers. In the case where an informal employment arrangement exists between the employer and a worker the contract will be said to be implied. Occasionally an individual will wish to hire an agent to negotiate the labour contract on his behalf. Such an arrangement will be termed a consultant-agent labour contract. All of the above arrangements are, of course, bargained between the individual himself or his representative and the firm. These therefore represent individual-firm types of labour contracts. In contrast, there may be net gains to workers in contracting among themselves by hiring an agent who will then negotiate on the group's behalf. Such a collective would bargain with the firm, over working conditions, through its chosen representatives.⁶ It was

stated earlier⁷ that the labour union is considered the dominant form of collective employment arrangement within the labour market. Therefore the Union-firm contract will, for our purposes, represent the collective labour contract.⁸

To summarize, we have defined three types of arrangements between firms and their employees. The implied contract, the consultant agent contract, both of which are individual-firm types of contracts and the Union-firm contract which represents the most important collective arrangement in employment.

(b) The Components Of an Employment Contract

Now that the types of employment contracts to be considered have been defined let us examine the components of an employment contract. Of course not all labour contracts will incorporate each and every one of the components to be described below. This is because, as we shall see, transactions costs¹⁰ shape the employment arrangement and this, in turn, will enable us to identify the emerging contract. Table 1 offers a fairly comprehensive list of possible ingredients which could be found in an employment contract. The organization of this particular classification will be apparent shortly.

Table I

THE COMPONENTS OF AN EMPLOYMENT CONTRACT

A. Pecuniary (Current) Provisions

1. Wage or Salary.
2. Wage adjustment during the term of the contract; or COLA.
3. Overtime pay.
4. Probationary period.
5. Paid: rest periods, clean up and wash time, portal to portal,^a meals, travel, extra pay for hazardous work, differential shift payment, clothing and uniform allowance, tool allowance, vacations, leave of absence.^b
6. Union dues and fees.
7. Minimum number of paid hours of work.^c

B. Pecuniary (Future) Provisions

1. Rules and benefits related to severance pay and supplemental unemployment benefits.
2. Pension plan benefits.
3. Guaranteed employment or earnings.

C. Non Pecuniary Provisions

1. Days off per week; flexibility in the work schedule; hours of work.
2. Administration of promotions (whether on the basis of seniority or performance).
3. Management rights provisions (viz, management residual rights only (hiring, firing, layoffs), or residual rights less additional rights conferred on labour.
4. Technological change provisions (viz, notice of a change, classification of new jobs, whether retraining is called for or not in the event of a change and which workers can benefit from this, arbitration in the event of a change, mechanism to eliminate redundant jobs in

- the event of a change (layoff, attrition or seniority)).
5. Length of the employment contract.
 6. Shop type (closed,^d open, union,^e Rand formula,^f Sloane formula^g).
 7. Seniority unit (employer (plant or bargaining unit); craft, department).
 8. Grievance procedures (who presents them, time allowed for the initiation of a grievance, accelerated procedure in the event of a disciplinary or dismissal case).
 9. Other provisions: labour-management committee, Occupational Safety and Health Committee, job evaluation plan, quality of work life programmes.
 10. Health and Welfare provisions.ⁱ

Notes:

- a. Time it takes to get up and down a mine shaft for example.
- b. For marriage, maternity, jury duty, care of a sick family member, sick leave, bereavement.
- c. Number of minimum hours paid when work is exhausted before the end of a regular working day.
- d. All employees in the bargaining unit must be Union members.
- e. Every new worker must become a Union member.
- f. Dues are checked off for everyone but union membership is optional.
- g. Similar to Rand formula except that non-union members have the right to vote in Union elections.
- h. Other types also exist: modified union shop (employees hired prior to an agreed upon date have the option to accept or reject Union membership) and maintenance of membership (all members of a Union when the collective agreement is ratified must remain Union members until prior to negotiating a new contract).

- i. Health, extended health, dental, accidental and death, dismemberment insurance.

The provisions listed under the A grouping in the table are all pecuniary in that monetary remuneration is involved and, in addition, they are current in the sense that payment occurs during employment.¹¹ Let us call this component of the contract the pecuniary (current) provisions.

The second category of clauses in an employment contract are also pecuniary because monetary payments are involved but differ from the previous grouping in that all of the benefits are to be realized in the future. This occurs either because employment has ceased, as in the case of 1B, or because of the age or the length of service of a worker, as in 2B, or finally because earnings or employment in the future are secured now but are to be realized in the future, as is illustrated by 3B.¹²

In the following section we will show why fewer resources may be required to secure provisions of the type listed under groupings B and C when this is accomplished through a collective organization.¹³ Let us therefore call items 1B to 3B pecuniary (future) provisions. The preceding distinction therefore is between monetary benefits received during (P_C) or after (P_F) employment.

The last set of items in Table I (grouping C)

represent the types of provisions that can usually only be consumed collectively. For example, in order to avoid turnover, the employer may be willing to offer some form of job security to a group of workers (e.g., item 7C). Similarly, workers negotiating with their employer through a Union could also secure these sorts of benefits but they would then be consumed collectively.¹⁴ While an individual may bargain with the firm to have such clauses incorporated into his labour contract it is unlikely he will do so since he could do little to deny others from reaping the same benefits. Other workers would be able to enjoy the same benefits quite costlessly simply by signing a contract in which the 'C' types of goods would be similar, if not identical, to ones procured by an individual through his own initiative. Moreover, they would act in this way since the inclusion of such benefits into their employment contract would surely add to their welfare in net terms.¹⁵ In other words, provisions 'C' of Table I are public in the sense that once they are already being enjoyed by one they cannot be feasibly prevented from benefiting others. Furthermore, it would be difficult for most individuals to secure some of these items in the contract for themselves because they lack the ability to do so or because the cost of purchasing the required expertise is too great. In still other cases the benefits can only be captured through a group arrangement.¹⁶ The

ways in which such factors affect the selection of the employment contract is the subject of the next section.

Since the items listed under the 'C' heading are generally non-monetary in nature let us call them non-pecuniary (NP) provisions.¹⁷

The preceding classification of the components of an employment contract is deliberate for in the third section I wish to show that a relatively higher proportion of pecuniary (future) and non-pecuniary benefits in total compensation is characteristic of Union-firm contracts. The major contributing factors to this outcome are the need to prevent "free riders"¹⁸ and the ability to increase exit costs through a collective arrangement. Furthermore, the Union will replace certain functions that would otherwise have been undertaken by the firm (see section 2 below). These factors partly explain why the collective option may be preferred by workers. It is not necessary, as will be seen later, to view the Union as possessing some sort of comparative advantage over the firm in assessing and disseminating information. Rather it is that the majority will prefer the Union option because of the way in which the benefits and costs are shared by the entire group once the organization is formed. In addition, it will be noted, though not the reasons for this, that the

firm itself may choose to let its employees be represented by a Union if this could be a less costly alternative in monitoring and in enforcing the terms of an employment contract.¹⁹ Since these facets of the employment relation involve pecuniary (future) and non-pecuniary items in particular, the structure²⁰ of Union-firm contracts will differ from that found in individual-firm contracts.²¹

To summarize, there are three parts in an employment contract, namely:

- pecuniary (current) provisions; these involve monetary payments during employment,
- pecuniary (future) provisions; these involve monetary payments after employment, for various reasons, has ceased;
- and, - non pecuniary provisions; these are consumed during or after employment but are non-monetary in nature.

We can now define the employment contract as follows. Let the employment contract (EC) be defined as a set the elements of which comprise the total value, in monetary terms, of the different parts of the contract, that is, P_C , P_F , and NP. Therefore write

$$EC = \{P_C, D\}$$

(1)

where D is a subset of EC such that

$$D = [P_F, NP]$$

and where NP is expressed here in terms of its monetary equivalent. Although different workers value P_F and NP differently we will abstract from this problem by selecting a particular workers from the Union and non-Union groups (see section 2.(a) below).

2. Choosing the Employment Contract

(a) Introduction

The following notation will be useful in understanding the analysis. Let Y_i^l = total compensation of worker i in group l . In the previous section we saw that the employment contract, EC , was made up of essentially three parts, namely: P_C , the pecuniary (current) provisions, P_F , the pecuniary (future) provisions and NP , the non-pecuniary items of the contract. Since total compensation represents the reward from the labour services of worker i , it should consist of not only the monetary aspects of the employment contract but it should also include the value of all the other benefits in the contract. In other words,

$$Y = P_C + P_F + NP, \quad (1)$$

where NP is expressed here in terms of its monetary equivalent and P_F is discounted to its current value. Given that $D = P_F + NP$, (1) becomes

$$Y = P_C + D .$$

(2) .

As we saw earlier,²² essentially two types of employment arrangements are being considered here: individual-firm (i.e., implied or consultant-agent) contracts and union-firm (collective) contracts. In the absence of unionization competition is presumed to prevail in which case the marginal worker sets the supply price for his services.²³ His total compensation^s will be denoted as Y_m^n , where the subscript identifies the marginal worker (m) and the superscript refers to the group under consideration as being non-union (n). In this case each member of the group negotiates a contract either on his own or through a consultant-agent. The Union on the other hand is generally viewed as being a majority voting institution. Majority voting is a reasonable way of describing the process of certification. Union constitution also generally require a majority vote to ratify a collective agreement or a strike mandate.²⁴ Several hypotheses have been suggested in approaching the problem of what unions do or, which is asking the same question, what is being maximized by Unions? While there is no general agreement on this issue certain points are clear.²⁵ In a Union representatives, who act as 'agents' for workers, are the ones that bargain with the firm over employment conditions.²⁶ In addition, the negotiated contract needs to be acceptable only to the majority of workers in the group. These features of unionization may be likened to the separation of ownership from control in firms.

Let us therefore select an individual from this majority and define y_r^u as this representative worker's (r) total compensation in a Union (u).²⁷ Total compensation is of course only one of the elements involved in the selection of employment arrangements. A second group of variables represent the costs of securing a contract. These I shall call contracting costs. Let C_i^l = total contracting costs for worker i in group l. Hence, C_r^u represents the costs of securing a Union-firm contract for the representative worker while C_m^n represents the marginal worker's contracting costs in an individual-firm bargaining situation. Furthermore, define

$$C_i^l = S_i^l + \Sigma_i^l + X_i^l, \quad i = i, m; \quad l = u, n. \quad (3)$$

The S term refers to search costs. The second term in (3), Σ , refers to signalling costs. These are incurred by sellers of labour services who undertake differentiating activities with respect to the information they provide to employers about their abilities. Education is an example of a signalling activity.²⁸ The X variable refers to those contracting costs not captured by the other terms in expression (3). In an individual-firm situation, that is X_m^n , such costs include those which are incurred by the marginal worker in monitoring other workers' productivities in order to assess the adequacy

of the relationship between his compensation and his marginal product. The costs of negotiating the employment contract itself are another such cost. In the case of a Union, X_r^u represents both the direct and indirect costs of unionization. Direct costs are the immediate costs of unionization. Union dues and fees represent such costs. Indirect costs arise due the nature of this collective organization. They include costs incurred by the members of the group which are the result of attempts by their 'agents' to acquire pecuniary or non-pecuniary benefits over and above their stated remuneration. What are called 'perks' fit into this category. Of course the rank and file of a Union also incurs costs in monitoring the agents' decisions. Union meetings and elections are good examples of this. Therefore, methods to 'control' the behaviour of the agents are costs as well. One is the cost borne by individuals in the bargaining unit who accept the contract as negotiated by their agents but which nevertheless is not the one that they would have preferred. For example some members might prefer an improved working environment over an increase in fringe benefits but will nevertheless vote in favour of ratifying the contract.

To summarize, unionization imposes direct (d) and indirect (I) costs on the representative worker. Therefore rewriting (3) in terms of union and non-union groups

respectively we have that,

$$C_r^u = S_r^u + \Sigma_r^u + d_r^u + I_r^u \quad (3a)$$

and
$$C_m^n = S_m^n + \Sigma_m^n + X_m^n \quad (3b)$$

The rule for selecting an employment contract must therefore be made by comparing the net returns from alternative arrangements. In other words, if

$$Y_r^u - C_r^u > Y_m^n - C_m^n \quad (4)$$

then a Union-firm employment contract will be selected (EC^u) whereas an individual-firm arrangement (EC^n) appears when the converse of (4) is true. Now, let $R_i^\ell = Y_i^\ell - C_i^\ell$, so that (4) can be rewritten as

$$R_r^u > R_m^n \quad (5)$$

Therefore, if $b = \text{prob} (EC = EC^u)$, then we can write

$$b = \Phi(R^\ell) = \begin{cases} 1 & \text{if } R^\ell > 0 \\ 0 & \text{if } R^\ell < 0 \end{cases} \quad (6)$$

where $R^\ell = R_r^u - R_m^n$. The selection of a particular type of

employment contract depends therefore on its comparative advantage over other employment arrangements. It will be argued that comparative advantage can be determined from two sources: One is the skewness of the distribution of productivities of a group of workers and the other is the demand price for pecuniary (future) and non pecuniary items in the employment contract. Therefore write

$$R^l = R(Sk^l, DPD^l) \quad (7)$$

where Sk refers to the skewness of the distribution of productivities in group l and DPD is the demand price for D goods in the contract. The measure of skewness (i.e., the third moment about the mean) indicates the position of the median with respect to the mean. It will be argued below that since unions standardize earnings within a group through the suppression of signalling and because they are also a majority voting institution the median productive worker will vote for or against union representation if his Union compensation is above or below his net of signalling costs return in an individual-firm contracting situation. The demand price variable refers to the evaluation of D types of goods in the contract by either the representative employee in a Union ($i = r$) or the marginal worker in an individual-firm type of setting ($i = m$). It shall be argued in section 2(c) below that

this value is deemed to be different under the two types of employment arrangements. From (7) and given (6) we can thus write:

$$b = \Phi(R(sk^l DPD^l)) ,$$

or in more summary fashion,

$$b = Z(sk^l, DPD^l). \quad (8)$$

In the following two sections a theory is suggested which proposes to explain the reasons why groups of workers will select individual as opposed to a collective type of employment contract. This is not meant to replace existing theories (see chapter I) but rather it is intended as a supplement to them with the hope that the reasons for the presence of different employment arrangements in the labour market may be better understood.

(b) Signalling and the Choice of the Employment Contract

- Introduction

Signalling refers to a situation which requires employers to make decisions about the 'quality' of applicants, for employment in this case, under uncertainty.²⁹

As a result, certain individuals may

invest in acquiring attributes which the employer will then correlate with the parameter of interest, namely productivity, in order to form a conditional expectation. Under an individual-firm setting each worker determines how much he will invest in providing information to employers. Under a Union arrangement, on the other hand, we shall argue that signalling is suppressed and that, as a result, the equilibrium contract will be different.

In choosing between individual-firm and union-firm employment contracts the equilibrium will be determined from the way Unions are organized. In other words, a group of workers is offered a choice between remaining in an individual-firm kind of world or shifting to a Union arrangement. The standard governing this possible change is majority voting.³⁰ Below we show how the signalling model may be employed in order to derive testable implications concerning the choice of employment contracts. The method of analysis in this section will be to employ numerical illustrations in order to determine the dominant outcome in terms of signalling equilibria in the labour market. This is both desirable and instructive in terms of explaining why certain groups of workers will want Union representation and others not.

- Analysis of Equilibria

Unions are observed to suppress signalling activity.

In terms of Spence's (1973) signalling model this means that unionization is equivalent to a no signalling equilibrium situation. Unions suppress signalling in several ways. The common practice of instituting a seniority on promotion rule in union-firm contracts effectively rules out or at least greatly reduces the signalling incentive as a means of advancing within the firm.³¹

Although the hiring hall emerged primarily as a response to unstable employment, it also has signalling implications. Where such a provision exists the Union effectively becomes an employment agency thus replacing the firm in its traditional role of screening workers for employment. This implies of course that Unions will enter the domain of establishing rules for entry into occupations through licensing requirements (e.g., electricians, plumbers, mechanics) and would consequently become involved in screening workers. Clearly, this has implications, not analyzed here, for the future in terms of individuals' investment patterns in human capital. Finally, Union security provisions such as the closed shop for example prevent non union workers from signalling to a firm. The individual must become or already be a union member in order to enjoy the right to work at the union negotiated rate. In each of these examples screening by the firm is being altered by the Union. This results in a standardization of earnings within the bargaining unit. In other words,

collective bargaining implies a reduction in the variance of intrafirm earnings. This result has been observed at least since the time of the Webbs (1920).³²

When there is no signalling or when signals are prevented from reaching the firm employers are unable to differentiate between workers in terms of how they are expected to perform on the job. Therefore every worker will be paid the average product of all workers in the firm. If, on the other hand, signalling does take place, workers receive their marginal product conditional on the amount they have invested in signalling. In other words, to attain a stable signalling equilibrium the employer must be correct in his interpretation of the signals. Otherwise his conditional beliefs must be readjusted to reflect new information about employees and, as a result, earnings of workers will be adjusted also. Finally, for signalling to take place, the net returns to the signalling workers must be greater than earnings without such investment. Therefore when signalling costs are too high there will be no signalling at all which is not the same as suppression of signalling. It is only when majority voting allows a groups of workers to alter the regime, that is to say, to move from a full signalling equilibrium to one in which there is no signalling that suppression of signalling takes place.³³ As a result, one would expect standardization or averaging of payments for labour services

under Unionism.³⁴ Two conditions must therefore be met in order for the Union representation vote to succeed. One is that the majority voting block secure net benefits in a shift from a full signalling to a Union or a suppression of signalling regime. A further requirement is that the minority group of workers should be discouraged from exiting the group, unless exit costs are prohibitive. Otherwise, as we shall see below, the net benefits accruing to the majority may disappear. Hence in a model where workers distinguish themselves through signalling the composition of a group, in terms of its members' productivities,³⁵ will be an important factor in determining the likelihood that a Union-firm contract will be selected. Furthermore the majority voting rule applied to the signalling model shows why the Union has often been viewed as a mechanism for the redistribution of income.

In the absence of signalling activity the firm pays each worker the average product. Thus, under unionism, individuals in the group will earn an average wage. Therefore the position of the mean income in this equilibrium will be critical. This occurs for the following reason. Every worker votes for his preferred position, that is, either in favour of or against Union representation. When unionization results in a preferred outcome as far as the median, productive individual in the population is concerned, and

hence the worker who receives the median income in the absence of the collective arrangement, then a majority of individuals' preferred alternative will be relatively closer to the position favourable towards union representation. This is because half of the distribution of productivities lies below the median voter's marginal product. As will be seen from the illustrations below however, the median voter cannot always be identified simply in terms of marginal productivity. Therefore, as a general rule, it is the median voter's position, which is determined by marginal productivity, signalling costs and the average product of a group of workers, under one employment arrangement relative to another that will determine the likelihood of unionization. In simple terms, for a continuous cumulative distribution function F , the median, Y_M , is a value of Y that satisfies the equation $F(Y) = 0.5$. For such F 's, Y_M is a value of Y having the probability to its left and the probability to its right both equal to one half ($\frac{1}{2}$). In discrete terms, if we have a sample of n Y 's, n odd, from the distribution F , the median of the distribution of the sample is the ($\frac{n+1}{2}$) observation of Y 's (observations assembled in the order of their sizes). A decision rule that enables us to establish the mean's position relative to the median is the third moment about the mean, which measures the skewness of the distribution and which, in standardized form, from a sample of the distribution F is written

$$Sk = \frac{\sum_{i=1}^n (Y_i - \bar{Y})^3}{P_s^3} \quad (9)$$

where Sk measures the skewness of the sample distribution of productivities, $\bar{Y}$ is the mean of the sample, P is the sample size (i.e., number of workers in the group) and S is the

standard deviation. If S_k is positive ($Y_M < \bar{Y}$) then the sample distribution is skewed to the right (Figure 1a) while a negative value for S_k implies a distribution of productivities which is skewed to the left ($Y_M > \bar{Y}$; Figure 1b). Therefore in terms of expression (8) above where the probability of selecting the union firm employment contract was defined as follows:

$$\Phi = Z(S_k, DPD) , \quad (8)$$

we have that $(\Phi | S_k > 0) > (\Phi | S_k < 0)$, ceteris paribus.

$(\Phi | S_k)$ refers to the probability of selecting the collective arrangement conditional on the value of S_k .

Figure 1a

Figure 1b

Let us now apply this decision rule to the problem faced by a group of workers in selecting between individual-firm and Union-firm employment contracts.³⁶

Following Spence (1973) signalling costs must be:

negatively correlated with productivity; otherwise, employers could not effectively distinguish between types of workers.

Also assume for the time being that signals do not contribute to perceived productivity. Now consider Table II.

Table II - Case 1

Productivity groups	I	II
Y, Compensation (Marginal Products)	1	2
Proportion (x) of the Population (P)	.6	.4
Signalling Costs (Σ)	Σ_I	$a\Sigma_I, a < 1$
Average Product ($\bar{Y}$)		1.4 ($=.6(1)+.4(2)$)

According to the Spence model a full signalling equilibrium will occur if, for productivity group II, the following conditions are met, namely

$$2 - a\Sigma_I > 1, \quad a\Sigma_I < 1$$

and $2 - \Sigma_I < 1, \quad \Sigma_I > 1$.

The first condition shows that type II individuals will invest in signalling if the net returns are greater than one. If some of these individuals did not signal their relatively superior abilities they would be treated as if they belonged to productivity group I. Consequently, the employer would

believe them to have each a marginal product of one. Moreover, while signalling costs are higher for the less productive workers these individuals would nevertheless invest in signals if by doing so they could benefit from being perceived as belonging to the type II category. For instance if $\Sigma_I = 1.1$ and $a\Sigma_I = .5$, type I workers will not signal while type II workers would each earn net returns of 1.5 ($=2-.5$) from signalling prompting them to make just such an investment. Let us now introduce majority voting and determine which of the two equilibria, full signalling or no signalling, would be selected. Under unionism signals are suppressed thereby prompting the employer to pay each member of the group the average product, namely 1.4 (see Table II for the calculation). Referring to the above example this equilibrium is to be contrasted with one under which type I workers would each earn one (1) while their type II colleagues would each receive two (2) and earn 1.5 ($=2-.5$) in net terms. Obviously type I workers would gain in the transition from an individual-firm to a Union-firm arrangement and majority voting allows them to succeed in imposing Union representation on the entire group since they represent sixty percent of workers. The total gain to type I workers from the Union-firm arrangement, equal to the total loss to the type II group, would be

$$(\bar{Y} - Y_I) x_I^P \text{ or}$$

$$(1.4 - 1) .6P$$

This result is further highlighted by the fact that the median voter is in the type I group. Since all individuals of type I are identical in terms of productivity and because sixty percent of workers belong to this group the median individual's payment in a full signalling equilibrium would be 1 which represents his marginal product. In a Union, type I workers would each be paid the no signalling income, 1.4. This results in a skewness measure of $Sk = + .4$. The positive value for the third moment indicates that the mean product, $\bar{Y}$, is above the median marginal product, Y_M , which is 1. Therefore $(\Phi | Sk > 0) > (\Phi | Sk < 0)$ ceteris paribus.

It is clear from the above illustration that unionization is the preferred outcome because the average product of the group as a whole is greater than the full signalling compensation of the majority group. Therefore the probability of unionization in case 1 depends on whether or not type II workers will exit the firm. Mobility costs of course may prevent exit. As type II workers leave the firm the average product of the group falls. Given signalling costs of .5 and therefore net earnings of 1.5 all type II individuals would exit, assuming zero mobility costs.

for simplicity. If mobility costs ($\bar{m}$) are positive and constant they must be less than .1 since type II workers will leave the group as long as $2 - a\bar{L}_I - m > 1.4$ or $1.5 - m > 1.4$. However when the more productive members of the group begin leaving the firm the average product declines thereby inducing further exit since the above constraint is relaxed (right hand side of the inequality falls) until all type II workers have left the group.³⁷

In the next section another feature of unionism is explored which in some respects is related to the signalling issue dealt with in this section. Many collectively provided goods are of a pecuniary (future) or a non-pecuniary nature (see section 1. of this chapter). While most of these could be provided by the firm without the Union, a collective arrangement offers employers the opportunity to economize on various information costs which is why more of them are likely to be provided under such an arrangement. However these types of goods also serve the purpose of reducing the rate of exit from the group by increasing its cost. Other things being equal, a Union-firm contract is less preferred than an individual-firm contract as far as the minority voting block of workers is concerned.

But the Union performs an additional function as well; that of altering the structure of the employment contract. In terms of worker preference for different employment arrangements a Union negotiated contract with a lower level of compensation than that which the minority would obtain under an

an individual-firm contract, may be at least as preferred because of the difference in structure of the two types of employment contracts.³⁸ In other words, the relatively more productive workers may not exit the group because they choose not to do so rather than because they may have been compelled to select that route, assuming mobility costs would not have prevented exit in the first place. Note that signalling costs have been assumed to be such that net earnings to type II workers were greater than compensation under Unionism. If a_{II} had been .7, say, resulting in a post-signalling return of 1.3 ($=2-.7$) for the more productive individuals, then everyone would prefer a no-signalling situation. Here everyone is worse off under a full signalling equilibrium. Type I workers because they could earn 1.4 under a collective arrangement while type II workers would also receive more in a Union-firm contract (1.4 versus 1.3 under full signalling). Furthermore there is no incentive for any member of the group to exit since everyone would be better off under unionism. In this particular case every worker is better off when signalling is suppressed and therefore will prefer the collective arrangement. Hence we find that there exists an alternative, namely the Union, to one of Spence's (1973) equilibrium solutions under which everyone suffers from a reduction in welfare as a result of signalling behaviour.

Now consider a situation in which the majorities in Table II are reversed so that type II workers formed 60%

of the population. The average product of the entire group and therefore the no signalling return is $1.6 (= .6(2) + .4(1))$. Once again we wish to compare a situation under which the group as a whole would opt for individual-firm arrangements with one which would result in a Union-firm employment contract. A full signalling equilibrium will occur if post signalling earnings exceeded one, which is the return to the less productive workers. In other words, the conditions are the same as in case 1, namely, $2 - a\sigma_I > 1$ and $2 - \sigma_I < 1$. If type II workers elected to provide information to employers about their productivity, and assuming signalling costs are .5, then everyone would be worse off under a full signalling regime. Type I workers because they could earn 1.6 under a collective employment contract and type II workers since their net return $(2-.5=)$ 1.5 is also below the Union compensation. Hence all would prefer a Union-firm contract. If, on the other hand, signalling costs for type II workers were .3, resulting in a net income of $(2-.3=)$ 1.7 for each member of that group, then a union representation vote would not succeed since type II workers form a majority and would be worse off by selecting the collective arrangement. In other words, in this latter case, the distribution of productivities is skewed to the left and this is confirmed by the value of S_k which is $-.4$. Therefore since the median voter's earnings lies to the right of the mean return which he would receive

under unionism type II workers will vote against union representation. Therefore $(\phi|S_k < 0) < (\phi|S_k > 0)$, ceteris paribus.

So far we have considered two productivity groups each of which was homogeneous as measured by the intra-group variance in productivities. Introducing a greater diversity of voting groups creates the problem of whether a stable majority coalition can be formed which would either block or support a union representation vote. By coalition it is meant that minority groups of workers are unified by a common interest in raising their income from what it is in a full signalling equilibrium, that is, the value of their marginal product (less signalling costs) to what it would be under unionism, namely, the average product. When two groups are treated alike because cost constrains signalling activity this does not result in a coalition. In such a situation firms view workers as being identical in terms of productivity. In other words, the market considers this to be one group as opposed to a Union or coalition of two groups. However the rule is still valid that as long as the median voter's net return under full signalling is below the mean income this will result in a majority vote in favour of union representation. Once again therefore the outcome depends on the skewness of the distribution of productivities. We illustrate with cases 3 and 4.

Let us say that there are three productivity groups, Ia, Ib and II. One can imagine such a situation as one in which it takes a different amount of time for each group to complete a particular kind of education with type Ia the longest time and type II the shortest time. In other words, members of the signalling population may not invest identical amounts in producing signals.

Table III - Case 3

Productivity groups	Ia	Ib	II
Compensation (Marginal Products)	.75	1.25	2
Proportion of the population	.3	.3	.4
Signalling costs	$\Sigma_I \underbrace{a \Sigma_I, a < 1; b \Sigma_I, b < a}_{1}$		
Average products	$\underbrace{1}_{1.4}$		

The characteristics of the model are the same as in the preceding case. That is, signalling costs are negatively correlated with ability. Furthermore signals have no impact on the productivities of workers. Note also that the average product of groups Ia and Ib is 1, the same as for group I in cases 1 and 2. What then is the likelihood of unionization in this situation? Consider first the conditions necessary for a full signalling equilibrium. As Table IV indicates the variety of possible signalling equilibria is greater than before because type Ib workers may or may not invest in signals

Table IV
SIGNALLING EQUILIBRIUM CONDITIONS FOR CASE 3

	Type Ia	Type Ib	Type II
Type Ib signals	$1.25 - \Sigma_I < .75$	$1.25 - a\Sigma_I > .75$ $a < 1$	$2 - b\Sigma_I > 1.46\left(\frac{3}{7}(.75) + \frac{4}{7}(2)\right)$ $b < a$
Type Ib does not signal	$2 - \Sigma_I < 1$	$2 - a\Sigma_I < 1$ $a < 1$	$2 - b\Sigma_I > 1$ $b < a$

Consider first row one. Assuming type Ib workers signal, type Ia individuals will not signal if the net returns from being perceived by the firm as belonging to the type Ib category of workers is below their marginal product which is .75. Similarly, a type Ib worker will signal only if the net returns from being screened by the firm as having a productivity of 1.25 is greater than .75 which is what such a worker would earn if he did not invest in signalling while others in this category did. Finally, type II workers will undertake to invest in signals if the net returns are greater than the average product of types Ia and II.³⁹ Now consider the second row. If we now assume that type Ib workers do not signal the population has essentially been reduced to two productivity categories, namely, types Ia and Ib together and the second group consisting of type II workers.

Since the average product of Ia and Ib is one, case 3 essentially reduces itself to case 1. However note that to prevent type Ia and Ib workers from being perceived as belonging to the type II category of workers, net returns to signalling must be smaller than 1 which is what they would earn without providing signals. Therefore, as Table V shows there are two possible compensation schedules.

Table V
COMPENSATION SCHEDULES AND SKEWNESS

	Compensation*			Skewness of Distribution*
	Type Ia	Type Ib	Type II	
Type Ib signals :	.75	1.25	2	+ .02
Type Ib does not signal	1	1	2	+ .43

*gross of signalling costs.

Regardless of whether type Ib workers produce information about themselves to the firm or not the median voter, who belongs to the type Ib category, will vote in favour of union representation. This can be seen by the values for the skewness measure. In addition, knowledge of the fact that the median income in a signalling equilibrium (gross

or net of signalling costs) is below the mean income that would be obtained under unionism (1.4, see Table III) where signalling is suppressed, also confirms the preceding results. In other words, since type Ia and Ib workers are always worse off under an individual-firm arrangement relative to unionization, whether or not type Ib workers signal, a majority will favour union representation. Therefore, type Ia and Ib workers are drawn into a coalition or Union in order to raise their income.

We see that the 'mix' of full signalling equilibria has not altered the principal result concerning the relationship between the skewness measure and the likelihood of selecting the union-firm employment contract. That is, $(\phi|Sk > 0) > (\phi|Sk < 0)$ still holds. The situation is complicated somewhat when we consider the case presented in Table VI. As always we wish to compare the net returns to the various productivity groups in a full signalling equilibrium, that is under an individual-firm arrangement, with the situation where the collective or Union-firm employment contract is chosen. Consider now a different situation as described by Table VI. Note that the average product of groups IIa and IIb is 2 which is the marginal product of group II in cases 1 and 2. Table VII like Table IV describes the conditions necessary for a full signalling equilibrium.

Table VI - Case 4

Productivity groups	I	IIa	IIb
Compensation	1	1.9	2.1
Proportion of the Population	.4	.3	.3
Signalling costs	Σ_I	$a\Sigma_I, a < 1$	$b\Sigma_I, b < a$
Average Products		$\underbrace{\underbrace{a\Sigma_I + b\Sigma_I}_{2}}_{1.6}$	

Table VII

SIGNALLING EQUILIBRIUM CONDITIONS FOR CASE 4

	Type I	Type IIa	Type IIb
Type IIa signals	$1.9 - \Sigma_I < 1$	$1.9 - a\Sigma_I > 1$	$2.1 - b\Sigma_I > 1.43$ $(=\frac{4}{7}(1) + \frac{3}{7}(2))$
Type IIb does not signal	$2.1 - \Sigma_I < 1.39$ $(=\frac{4}{7}(1) + \frac{3}{7}(1.9))$	$2.1 - a\Sigma_I < 1.39$	$2.1 - b\Sigma_I > 1.39$

Consider first row one. Assume that type IIa workers signal (i.e., $1.9 - a\Sigma_I$) and type I individuals do not (i.e., $1.9 - \Sigma_I < 1$). Then type IIb workers will invest in information producing activities if the return, net of signalling costs (i.e., $2.1 - b\Sigma_I$) is greater than the average product of rest of the population of workers (i.e., 1.43) who are perceived by firms to belong to the same productivity category. From the

second row we see that type I and IIa individuals form one category of workers as far as the firm is concerned due to the absence of signalling behaviour. This is because the net returns from investing in signals is less than the average product of the two groups (1.39). On the other hand, type IIb workers will differentiate themselves from other individuals through information provided to employers if, as a result, their net compensation is greater than under the alternative of being perceived as belonging to the other segment of the population comprising type I and IIa workers who earn 1.39. Signalling costs are therefore crucial in determining the 'mix' of full signalling equilibria. Two wage schedules are therefore possible and the skewness of the distribution of payments under these alternative signalling equilibria will dictate the likelihood of selecting the union-firm contract. This information is tabulated in Table VIII with certain numerical values being attached to signalling costs. Compensation under unionism would be the average product of the whole population, that is, 1.6. When both type IIa and IIb workers differentiate themselves through signalling a majority block of voters will vote against selecting the union-firm contract, unless signalling costs for type IIa workers were such that their net compensation fell below 1.6. Such a case is illustrated in row two of Table VIII. When the measure of skewness (Sk) is

Table VIII
COMPENSATION SCHEDULES AND SKEWNESS

	Type I	Compensation Type IIa	Type IIb	Skewness*
Type IIa signals	$1(\Sigma_I=1)$	$1.9-.2=1.7 > 1.6$ (a = .2)	$2.1-.1=2$ (b = .1)	-.20
	$1(\Sigma_I=1)$	$1.9-.4=1.5 < 1.6$ (a = .4)	$2.1-.1=2$ (b = .1)	+.14
Type IIa does not signal	1.39	1.39	$2.1-.1=2$ (b = .1)	+1.00

*net of signalling costs

negative, as in the top row, the median voter's income is above the mean income which he would receive if signalling was suppressed. In the case however where type I and IIa workers do not signal, resulting in a compensation of 1.39 to workers from these two categories, the median voter's income falls below the mean and this is confirmed by the positive value of the third moment ($Sk = +1.00$). Hence in the event that type Ib workers do not invest in signals, the group as a whole would elect to enter into a collective arrangement. Heterogeneity in the productivities of the population of workers serves to increase the variety of possible signalling equilibria. The basic result however is that what matters is the position of the median voter's net compensation with

respect to the mean. The mean is the reference point under unionism because in such a regime signalling is suppressed.

So far it has been assumed that signalling does not contribute to productivity. Individuals are seen however to respond to employers' screening prerequisites. The signalling rule is a response to the problems firms encounter in measuring marginal products. In some cases such measurements are not practical because the tasks to be accomplished must be performed by groups. In other words, only the average product of a team of workers can feasibly be measured.⁴¹ In yet other situations, such as in principal-agent relationships, one constraint on attempts by the agent to maximize his own self-interest instead of the firm's follows from the ability to measure each agent's performance. One of the ways such measurements can be made is by fostering competition between the agents of the sort which requires them to reveal information to the owners of the firm about their performance. Managers in a corporation are an example. Such individuals have goals which may not correspond with those of the corporation. The problem for the firm therefore is to develop a pricing scheme which will minimize the costs to the firm of managers' decisions. Therefore as

Spence (1976) has noted "... employers read education as a signal of productivity, but the content of the signal is determined by the pattern of investment in it by individuals, and that in turn is determined in part by the way it is rewarded in the market" (ibid., p. 51).⁴²

Let us therefore consider the effects of employee reactions to employer screening prerequisites on the likelihood of selecting the Union-firm contract. As we shall see the skewness measure still tells us which employment contract is more likely to be chosen in a signalling world. What competition does is to alter the distribution of productivities from what it was when signals did not affect productivity. Consider the data presented in Table IX which will serve as an illustration.

Table IX - Case 5

	Types of Jobs	
	a (low skill)/ signal costs	b (high skill)/ signal costs
Productivity (I)	$1/\Sigma I_a$	$.5/\Sigma I_a + \pi_I > \Sigma I_a$
Types (II)	$1.5/\beta \Sigma I_a, \beta < 1$	$2/\Sigma II_b = \beta \Sigma I_a + \pi_{II}$

Assume there are two kinds of jobs, a low skill job (a) and

high skill job (b) as well as two types of workers, I and II. The cells in Table IX indicate the marginal productivity of each type of worker in the different jobs as well as the signalling costs. Signalling costs are such that in order for the more productive individuals (type II) to advance from the first into the second job he must invest additional amounts in signals. Therefore $\beta \Sigma_{IIa} < \Sigma_{IIb}$ (signalling costs for II to enter into job b). Furthermore it is assumed that the less productive individuals (I) are more productive in the low skill job (a) than in the high skill one (b). Signals are also seen to enhance the income of type II workers since they can advance from job (a) to job (b) by investing π_{II} resources in signalling thus raising their compensation from 1.5 to 2. One can imagine this as a situation in which some individuals with high school diplomas who are also relatively more productive because, say, they were able to complete their education in less time than others, contemplate whether or not to invest π_{II} into obtaining a college education in order to raise their compensation to 2. Assume to begin with that type I workers represent sixty percent of the population. The signalling equilibria conditions are:

Type I workers do not signal if $1.5 - \Sigma_{IIa} < 1$.

Type II workers signal in job a if $1.5 - \beta \Sigma_{IIa} > 1$.

Type II workers will enhance their income through

additional signalling of $2 - \pi_{II} > 1.5$.

Type I individuals do not invest in signals since the net returns from being perceived by the firm as belonging to type II is below their no signalling compensation in job (a). Furthermore such individuals will not attempt to enter into job (b) because they are less productive in this job.⁴³ Type II individuals will, on the other hand, enter job (b) if $2 - \pi_{II}$, the net compensation in this job, after having incurred additional signalling costs, is greater than the gross return in job (a), namely 1.5.

Therefore two compensation schedules are possible depending on whether or not some type II individuals increase their income through an additional investment in signals. The results are shown in Table X which assume certain numerical values for signalling costs. Clearly, as the measures of skewness indicate, a majority of workers will vote in favour of union representation since the median voter's compensation is below his no signalling income under unionism. If the majorities were reversed and type II workers formed sixty percent of the group all the above conditions described in Tables IX and X would be the same except for the measures of skewness and the average products. Once again as was the case before (see Table X) positive values for the skewness measure indicate that a Union-firm

Table X

COMPENSATION SCHEDULES UNDER SIGNALLING - CASE 5

Compensation					
	Type Ia	Type IIa	Type IIb	Average product [†]	Skewness ^{††}
1. Some Type II workers screen for high skill job*	1 ($\Sigma I_a = .6$)	1.5-.3=1.2 ($\beta \Sigma I_a = .3$; $\beta = .5$)	2-.4=1.6 ($\Sigma I_{Ib} = .4$ $> \beta \Sigma I_a$)	1.3	+1
2. Type II workers do not screen for high skill job**	1 ($\Sigma I_a = .6$)	1.5-.48=1.02 ($\beta \Sigma I_a = .48$; $\beta = .6$)	2-.55=1.45 ($\Sigma I_{Ib} = .55$ $> \beta \Sigma I_a$)	1.2	+0.43

*Assumes $x_{Ia} = .6$; $x_{IIa} = .2$; $x_{IIb} = .2$

**Assumes $x_{Ia} = .6$; $x_{IIa} = .4$

[†] gross of signalling costs. The average product is bounded between 1.2 and 1.4.

^{††} net of signalling costs.

contract will be selected. The fact that a majority of workers have full signalling net returns which are below the average product further confirms this result.⁴⁴

Table XI

SKEWNESS WHEN TYPE II WORKERS ARE IN MAJORITY

	Average Product**	Skewness ⁺
(1)*	1.45	+1.00
(2)	1.3	+ .2

*See Table X. Assumes $x_{IIa} = .3$, $x_{IIb} = .3$; $x_I = .4$,

$x_{IIa} = .6$ (for row 2 case)

**Gross of signalling costs.

⁺Net of signalling costs.

In conclusion then we have, in comparing full signalling situations to cases where signalling is suppressed, that when the distribution of productivities is skewed to the right ($Sk > 0$) a group of workers will select a Union-firm contract. If this distribution is skewed to the left ($Sk < 0$) then individual-firm contracts will be selected since the median voter's earnings would be above the mean compensation.⁴⁵ In terms of expression (8) above, that is,

$$\phi = Z(Sk, DPD) \quad (8)$$

this means that, other things equal, $(\phi|Sk > 0) > (\phi|Sk < 0)$, where $(\phi|Sk)$ indicates the likelihood of selecting the Union-firm contract conditional on the value for the skewness of the distribution of compensations.

(c) The Structure of the Employment Contract

- Introduction

Another feature of union-firm versus individual-firm contracts concerns differences in the structure of these two types of arrangements. By structure we refer to the way in which parts of the contract make up the entire contract. For example, one finds that the share of fringe benefits in total compensation tends to be higher under unionism.⁴⁶

Earlier in this chapter (section 1.) we described the components of an employment contract as follows. Let,

$$EC = \{P_C, D\} \text{ where } D = \{P_F, NP\}.$$

EC refers to the employment contract and consists of three types of provisions. Some are monetary in nature which are consumed during employment. Wages and salaries are examples (see Table I, this chapter). These types of provisions were defined as pecuniary (current), P_C . Some aspects of the employment contract are also pecuniary in nature but are consumed after employment has ceased because of age, tenure or unemployment. Pension plans and supplemental unemploy-

ment benefits are considered to be examples of what was defined earlier as the pecuniary (future), P_F , provisions of a contract. Finally, there are provisions in the contract which are non-pecuniary in nature and usually consumed on the job. Provisions relating to general working conditions (hours of work for example) and fringe benefits illustrate the NP element of the employment contract. Together the NP and P_F segments represent the D-type benefits of an employment contract. Total compensation, also defined earlier (section 2.(a) above), is therefore the sum of the value of these three elements so that

$$Y = P_C + P_F + NP = P_C + D ,$$

where NP is expressed here in terms of its monetary equivalent.

In general, one finds a greater proportion of D-type provisions in total compensation in Union-firm contracts relative to individual-firm arrangements. It is argued in this section that one of the reasons for the difference in the structure of employment contracts lies in the unequal demand for D-type benefits between union and non-union groups, other things being equal.⁴⁷ In other words, we shall argue that

$$\left(\frac{D}{Y}\right)^u > \left(\frac{D}{Y}\right)^n$$

Part of the explanation for this difference has to do with the ability of the collective organization to provide itself with certain benefits whose consumption tends to be non-rival in nature and hence are akin to public goods.⁴⁸ While the firm could conceivably offer similar benefits it will be seen that the costs of doing so would likely be greater than if these were provided through a Union. As far as the worker is concerned if the likelihood of obtaining D-type benefits is greater under unionism the revealed demand for D-type benefits will be higher under such an arrangement. Furthermore, a majority voting rule usually results in some redistribution of benefits within the group. Therefore workers with a higher demand for D-type provisions will prefer the Union arrangement.

However, unions must also be concerned with exit particularly when, as a result of the suppression of signalling, the relatively more productive workers would leave the group in order to earn a higher net signalling wage. By altering the structure of the employment contract from what it would be in the absence of the collective arrangement the Union may be able to render an otherwise less preferred employment contract for the most productive workers at least as preferred as the one that would be negotiated under an individual-firm (i.e., full signalling) arrangement.⁴⁹ On the other hand, because there is coercion in majority voting institutions such as the Union the purchase of these D-type benefits could, in fact, result in exit by the relatively more productive workers who form the Union's 'tax' base. Of course, if this happens, the base upon which the Union 'finances' its redistributive schemes within the group will be eroded. The union must constrain such behaviour if it is to survive. Furthermore it is also conceivable that non-union

employers could 'imitate' union employers by offering the same types of employment contracts. However, there is the danger here of creating an adverse selection problem for signalling is suppressed in the Union arrangement. Since union workers vote on a 'package' of issues compromise is likely not only because of conflicting demands within the group but also because of the Union's concern about exit. Unless the non union employer is able to distinguish workers on the basis of the contract vote he will be incapable of attracting the relatively more productive workers from the unionized group. Since signalling is suppressed he cannot do so through screening. Furthermore the contract vote itself conceals actual preferences over separate issues (see discussion on this below) which would prevent the non unionized firm from distinguishing between types of union workers. Hence the process of 'imitating' union contracts for the purposes of attracting the better workers in the unionized group would appear to be a very costly one as will become apparent from the subsequent discussion. Although we will be concerned only with explaining the sources of the difference in the share of D-type provisions between union and non-union contracts another interesting problem is the question as to why the Union's voting procedures on an employment contract could be successful in preventing exit.

Once again we do not wish to imply that other explanations for unions (e.g., political, monopoly) are

being replaced by the arguments of this chapter. Rather we believe that the role of the Union as an information producing/suppressing device can complement other theories.⁵⁰

- An explanation for the difference in the structure of employment contracts.

The Trade Union form of collective organization owes its existence partly because of its ability to enforce compulsory membership or to ensure that all individuals in the group share in the costs of the organization (see Webb and Webb (1920), Olson (1965)). Otherwise there may be little incentive for any individual in the group to purchase certain goods if others could capture the same benefits at little or no cost to them.⁵¹ In other words, the Union can usually only prevent individuals from obtaining benefits by excluding the 'free riders' since some benefits are such that exclusion of the non-participating members would be too costly to enforce. Consider items such as working conditions (e.g., hours of work, atmosphere of the plant) which tend to be consumed in equal amounts by all workers. The voting procedure under unionism enables workers to reveal preferences on such issues as well as on many others whose consumption is private (e.g., fringe benefits). Through the consensus reached by the majority a more preferred structure for the employment contract may be attained by the Union than under

Assume, for simplicity, constant marginal cost of providing such benefits. It is to be understood that the firm 'supplies' the provisions in a contract and not the Union. Otherwise the Union itself would enter into a separate contract with workers to supply these provisions rather than include them in a Union-firm agreement. Q_D measures the quantity in dollars of D provisions where $D = P_F + NP$ and where NP is expressed here in terms of its monetary equivalent. P_D is the 'price' of obtaining quantities of D types of goods for a given compensation Y, that is, foregone P_C . The higher marginal evaluation by workers of P_F and NP for a given quantity of such goods implies that the demand for D-types of goods will be higher in the collective arrangement than in an individual-firm contract. This is shown in the figure as a shift from D_D^n to D_D^u . Therefore, ceteris paribus, the quantity of D goods purchased will be greater under unionism. In other words,

$$\frac{OQ_D^u}{Y} > \frac{OQ_D^n}{Y} \quad \text{or} \quad \left(\frac{D}{Y}\right)^u > \left(\frac{D}{Y}\right)^n$$

It is important to note that the higher demand under unionism results from the Union's ability to negotiate an employment contract with a different structure than one negotiated under an individual-firm arrangement. This ability, as we shall see, stems from the impact of the Union on the costs to the

firm of organizing and maintaining a labour force, on the exit rate from the group, and from the Union's ability to purchase for workers certain benefits of a public goods nature.

It should be noted that the differences in the demand curves refer to differences in revealed demand. Under a voting arrangement there is of course the incentive to overstate (particularly by the majority) or understate (especially by the minority) preferences concerning the purchase of D-type benefits in the employment contract. Furthermore because of the inability, due to costs, of the firm to seek out preferences of individual workers over the desired quantities of D-type benefits they would wish to purchase the demand for such goods may be understated under an individual-firm arrangement. Therefore the difference in total benefits between union and non-union provision of D-type benefits relates to the revealed and not the desired demand for these goods. This difference may be seen by comparing the areas above the marginal cost curve and below the two demand curves. According to Figure 2, the net benefits from the purchase of D-type benefits appear to be higher under unionism (area ABCE). However, from these higher net benefits must be subtracted the costs of the union organization itself. Earlier we defined two types of such costs: the immediate or direct costs of unionization (d^u ; union dues for example) and the indirect costs of unionization (I^u) which arise

partly because of the principal-agent relationship between the union leaders and the rank and file (see section III(A) above). For the two types of employment contracts to coexist, *ceteris paribus*, in the labour market the direct and indirect costs of unionization must offset the higher net benefits under unionism from the provision of D-type goods.

Workers of course also seek to minimize the costs of seeking a consensus on the amount of pensions for example to be purchased. One way they have resolved to do this is by electing past workers as union leaders. These individuals have over time accumulated plant and industry specific knowledge about the preferences of the workers they were elected to represent. While such union leaders may not possess expertise in bargaining techniques or knowledge about the types of pensions available they do have a comparative advantage in terms of information about workers' preferred employment contract in general. The resulting reduction in the costs of possible misrepresentation by the agents (union leaders) is one way that workers have affected the organization of the collective arrangement. Why then is there a higher demand for D-types of provisions under unionism?

The method of analysis will be to analyze each of the D types of provisions listed in Table I (section 1. of this chapter) in terms of why more of them would be purchased

through a union rather than directly through the firm or privately as in an individual-firm arrangement.

(i) the pecuniary (future) provisions:

supplemental unemployment benefits and severance pay:

Consider first the pecuniary (future) provisions. Severance pay and supplemental unemployment benefits, guaranteed earnings or income and pension plan provisions all have in common the fact that they represent monetary payments which are to be realized in the future. In other words, these goods represented deferred income. It is conceivable that unions serve to alter unemployment episodes in the sense of rearranging employment patterns into longer spells of employment coupled with longer terms of unemployment as opposed to irregular employment and unemployment spells. Gordon (1976) for instance argues that wage rigidity and involuntary unemployment may be explained by the fact that some workers have 'tenure'. That is, some are offered the possibility of exchanging employment at fluctuating wage rates for a stable wage labour contract.⁵³ At a more micro-economic level, Azariadis (1975) has also argued that workers prefer "lumpy leisure over entirely smooth ones" (p. 1195). Therefore they would be willing to exchange labour services for a "tacit or open commitment of the firm to guarantee its personnel that their wage rates, hours worked, employment

status, or a combination of all such factors, will be in some degree independent of the vicissitudes of the business cycle" (p. 1184). In other words, workers may be willing to exchange pecuniary (current) benefits (viz, wages) for a lower cost of future (and usually longer) episodes of unemployment. Therefore in order for some workers to accept variable unemployment episodes or for others to accept longer but 'lumpy' unemployment the firm would pay a compensating differential (or risk premium as in Azariadis (1976)). Severance pay and supplemental unemployment benefits fit this category. To a certain extent of course all leisure is 'lumpy'. What is meant here is that there exist differences in spells of employment and unemployment episodes between union and non union labour. While it is true that pecuniary (future) provisions need not be provided through the union supplemental unemployment benefits and severance pay provisions in particular appear to be more generous under unionism.⁵⁴ As a result, a higher incidence of job tenure among unionized workers can be expected since payments for labour services under unionism are rearranged to pay for expected unemployment episodes differently from non-union labour (for evidence see Freeman (1978a, 1979, 1979a)).

In the absence of a union the firm faces the problem of measuring the preferences of workers about the utility they derive from various employment horizons.

Differences in preferences across workers as well as the inability to introduce flexibility into the operation of the production process (i.e., flexible hours) may cause this to be a prohibitively costly search process. Under a union arrangement on the other hand workers must develop a consensus through the rule of majority voting so that preferences for particular employment and unemployment episodes may be measured at a smaller cost to the firm than in an individual firm arrangement. Unionized workers on the other hand bear part of the costs of reaching an agreement on such issues while the firm enjoys a reduction in the costs of seeking individuals' preferences. Of course since the younger members of the group are probably also the most affected by the 'tenure' of some employees one would expect these individuals to want to exit the group (seniority based job rationing is prevalent in unionism; see the discussion on this in (ii) below). However, modifying the length and timing of unemployment episodes from what it would have been under an individual-firm employment contract may provide them with sufficient incentive to remain in the unionized group.

In other words, consider an employment contract where $NP = 0$. The point being made here above is that a contract with $(P_C = 1.4, P_F = 0, NP = 0)$ is less preferred than a $(1.6, 0, 0)$ arrangement. On the other hand, if the

structure of the former contract had been (1.2, .2, 0) instead of (1.4, 0, 0) then it may be at least as preferred as the (1.6, 0, 0) arrangement.

.Pension plans

Pensions are another pecuniary (future) provision which appear to be relatively more important under unionism.⁵⁵ Why do unionized workers buy more pensions per dollar earned than their non union counterparts? Part of the explanation may have to do with the reduction in the tax liability from the purchase of pensions if the union can convey better information about how to best take advantage of such a tax break. One would expect therefore that workers would be willing to forego some pecuniary (current) benefits (viz., wages) in order to reduce the amount of taxes to be paid. However, since tax breaks benefit both union and non union workers there is no reason to expect differences in the share of compensation spent on pension plans between two labour groups to follow necessarily from the reduction in tax liabilities. It has been suggested however (Freeman, 1978) that non union workers are relatively more hesitant in selecting and participating in pension plans because they do not benefit from the services of an agent who "searches" for the plan which would yield maximum benefits. Furthermore, it is more costly, if not prohibitively so, to monitor and control private pension plans purchased outside the firm in terms of solvency and the type of investments being made. As a result, relatively more of these

benefits would be found under unionism.

A more promising explanation is that it may be cheaper for the firm to 'search' for the policy which is best suited to its workers through the union rather than to attempt to evaluate each individuals' preferences on this issue. A majority voting rule and thus unionism imposes the requirement that a consensus ultimately be reached. Such an accord among the members of a group could result in savings for the firm in the cost of seeking individual workers' demands for pensions while workers must bear some of the costs of reaching an agreement about how much pecuniary (current) benefits should be foregone in order to purchase the pecuniary (future) good.

The effect of a voting rule (and of electing former workers as union leaders) as a device to measure the preferences of workers is to increase the demand for other than wage benefits in the contract (see Figure 2 above). If preferences are homogeneous all members in the group are likely to vote the same way over the issue of purchasing pecuniary (future) benefits. In addition, if measurement were costless, the firm would provide these benefits since workers would no longer require agents to convey their preferences to the employer. On the other hand, because preferences are likely to be heterogeneous and because the measurement of preferences is not costless it is probable

that pecuniary (future) type benefits would be purchased in a greater proportion to total compensation in a collective arrangement than under an individual-firm type of employment contract. Therefore the firm faces a measurement problem since it has no way of determining beforehand the degree of homogeneity in workers' preferences unless a specific rule is applied. For example older workers may prefer pensions more than their younger colleagues. In this connection we can easily show, assuming older workers formed the majority in the group, that more pensions will be purchased under unionism. The explanation is due in part to the majority's ability to coerce the younger members into foregoing a greater amount of pecuniary (current) income than they otherwise would have under an individual-firm arrangement. We can illustrate this with the help of Figure 3.⁵⁶

*assume $NP=0$

Figure 3

On the horizontal axis expenditures in dollars for P_F (e.g., pensions) is being measured. On the vertical axis the price of purchasing quantities of P_F is measured in terms of foregone P_C (wages) benefits. The demand for pensions by a 'young' individual is represented by D_i^{Young} while the same demand by an older individual is measured by D_i^{old} . Under individual-firm arrangements each individual will purchase OQ_i^Y or OQ_i^O depending on their age. If all young and old individuals in their respective age groups have similar preferences regarding P_F type benefits then OQ^n will be purchased by nonunion workers since the sum of the different age groups' demands is D^n . If there are m young workers and l old workers $D^n = \sum_{i=1}^m D_i^{\text{Young}} + \sum_{i=1}^l D_i^{\text{old}} = m \cdot D_i^{\text{Young}} + l \cdot D_i^{\text{old}}$. Now assume that older workers form a majority in the group of size $m + l$. If they choose to form a union a consensus must be reached about how many P_F goods to purchase. Let us say that the individual demand for P_F under unionism, D_i^u , is somewhere between D_i^{Young} and D_i^{old} because the older members would not force each member of the collective to purchase OQ_i^O . Otherwise, the younger members who are coerced into foregoing more P_C type benefits under unionism, relative to a non union situation, would leave the group. The relatively lower marginal evaluation of P_F type provisions by the younger workers (represented by the segment AB for quantity OQ_i^u) accounts for this possible outcome. Therefore total

demand for P_F under unionism, D^u is equal to $(m+1) OQ_i^u$ since each individual in the collective must, in effect, purchase OQ_i^u . Therefore $D^u > D^n$ and, ceteris paribus, $(\frac{P_F}{Y})^u > (\frac{P_F}{Y})^n$, where Y = total compensation ($= P_C + P_F$ since $NP = 0$ was assumed for simplicity). If the majority were made up of younger members D_i^u would probably be to the left of where it is shown in Figure 3 indicating that $D^u - D^n$ would become smaller. It is conceivable that $D^u < D^n$ but the younger members also have to be concerned about exit by the older workers who have more experience and consequently may be the most productive members of the group (see section 2. (b) above). Furthermore, as was noted above, the information producing aspect of the union would tend to have a positive effect on D^u (indicating a rightward shift) relative to D^n . It should be added that if the younger workers happen also to be the most productive members of the group exit by these individuals could result, other things equal.

On the other hand if they are part of the relatively less productive majority which voted to suppress signalling, exit may not occur since they, as well as the older workers, benefit from the collective arrangement.

(ii) The non pecuniary provisions.

Hours of work

Let us now consider the non-pecuniary elements of the

employment contract. First on the list are hours of work. Depending on the flexibility of the production process the union may or may not have to provide the firm with a majority opinion relative to hours of work. In a sense hours of work are a public good under unionism since the good is consumed in equal amounts by all workers.

An imperfect matching of individuals' preferences with the production scheduling requirements of the firm will result under unionism especially when preferences are heterogeneous. If flexible scheduling is possible the firm may have to seek individuals' preferences relative to hours of work whereas a union could provide a relatively more inflexible schedule through majority voting. Since some workers will be worse off under such an arrangement they may exit. To prevent such behaviour a compensating differential would have to be paid. However the union would have to identify those individuals who are worse off under an inflexible hours arrangement. There is no reason to expect that the union has a comparative advantage over the firm in such measurements. The reason is that in the absence of a union the firm would impose the working arrangements on its workers. If the firm does not undertake to measure workers' preferences at all about working conditions exit by the most dissatisfied members of the group could result. Exit, of

course, implies turnover costs for the firm. On the other hand, preferences must be revealed through the union's voting mechanism and since, in addition, the union is also concerned with exit, provisions regulating general working conditions such as hours of work are more likely to appear in collective agreements rather than in individual-firm contracts when this is feasible.⁵⁷

• Seniority on promotions and 'voice' mechanisms

Another feature of union-firm employment contracts, not exclusive to the union, is the rule of seniority determining promotions. We saw in the previous section that signalling is suppressed and that, as a result, all workers in the group will be paid the average product. While signalling on the job is not completely discouraged under unionism, there may be little incentive for the individual to invest in such information producing activity if he is unable to capture the entire benefits from his efforts. Unions fix the payment schedule and because this distribution is relatively narrower under unionism⁵⁸ one would expect the incentive to signal on the job to be smaller under unionism. Consequently some other rule must replace on the job effort as the screening mechanism in determining promotions. This is accomplished by a rule of promotion on the basis of

seniority.⁵⁹ Management rights provisions, technological change provisions, grievance procedures and other such mechanisms of labour management cooperation (e.g., safety and health committees, job evaluation plans) represent yet other devices employed by the union to regulate or structure the work environment. In the absence of unionization the cost to the firm of assessing individual preferences over such matters may be prohibitive especially if the preferences of workers are heterogeneous.

Under a union arrangement, on the other hand, the majority of voters will determine the quantity and type of non-pecuniary benefits that will be purchased and the heterogeneity of preferences need not prevent the group from making a choice. If every voter votes, and votes for the share of NP (in total compensation) closest to his preferred choice the union leaders are driven towards the position favoured by the median voter. Despite the diversity of preferences a consensus is to be attained and the costs, especially for the firm, are likely to be different than under individual-firm arrangements. These types of benefits serve to increase exit costs thereby reducing the likelihood that those workers who did not support unionization in the first place, will leave.⁶⁰

Furthermore note that these types of benefits are to a certain extent 'public goods'. That is, they tend to

be consumed in equal amounts by all workers in the group. In the absence of the union while a particular individual could bargain to have such provisions included in his employment contract there is little he could do to deny others from enjoying the same benefits. In other words, "if one member does not help provide the collective good, no other member will be significantly affected and therefore none has any reason to act" (Olson (1965), p. 50). Therefore one would expect collective type benefits to be purchased under a collective arrangement, where the costs of the organization are shared by all the members of the group or where membership in the union is enforced, rather than under an individual-firm type arrangement where the incentive problem referred to by Olson exists. This feature of the union arrangement was one of the prime motivating factors in the unionization of the mining and railway industries. In mining for example, the union is involved in the regulation of the unit of output to prevent firms from 'cheating' on productivity measurements (see Farber (1978)). Unions appeared to have played a similar role in the railway industry.⁶¹ Had a single individual secured the same types of benefits he could not prevent others from enjoying them as well. Since in the unionized group all workers must usually share in the costs of the organization, collective goods are more likely to be provided through the union.

•Fringe benefits

The final type of non pecuniary provisions are the so-called fringe benefits. These include health, dental, life and other insurance and are non pecuniary because the benefits involved tend to be non monetary in nature (e.g., health care).⁶² Coercion is part and parcel of unionism and, as we shall show below, this also explains why relatively more insurance is likely to be purchased under unionism. When insurance is purchased through the union arrangement, as with other benefits in the union-firm contract, the quantities purchased are fixed in advance. One can then imagine how under a union arrangement the majority who wish to purchase relatively more insurance could, through a rearranging of the distribution of benefits between P_C and NP, coerce the minority into increasing the amount of P_C foregone from what it would have been in an individual-firm situation. This is because the demand price for D goods is higher under unionism. What are the risk characteristics of this majority group which leads to the purchase of relatively more insurance under unionism?

In order to see this we need to briefly examine how equilibria are determined in the market for insurance. Assume that an individual would receive compensation of Y_a in state a if he experienced a disability, a health problem or death, and Y_b in state b if he did not, where $Y_b > Y_a$.

Nature determines which state will, in actual fact, prevail but the probabilities associated with each state are assumed to be known and equal to p_a and p_b , so that $p_a + p_b = 1$. If all individuals in the group are identical and the insurance is 'fair',⁶³ then the equilibrium in the insurance market would be the one depicted in Figure 4.⁶⁴ The Ed segment represents situations under which a risk neutral insurance company would earn zero profit from the sale of insurance.

Figure 4

On the axes we have the compensations in the two states (a) and (b) where each individual's endowment (E) is such that $Y_b > Y_a$. At E each individual's welfare is represented by the indifference curve U^0 . If the individual is allowed to trade away from E to a point α by purchasing insurance his income in the hazardous state (a), he will do

so since he is risk averse. Whether employment arrangements are individual-firm or union-firm will not affect the quantity of insurance purchased at price π . This is because in this situation all individuals, since they are identical, will purchase worth of insurance.

Now let us examine the situation depicted by Figure 5 where individuals differ in terms of risk. In other words, for one group of individuals, the high risk workers (H), the probability that the hazardous state will occur, p_a^H , is greater than the probability that such an event will occur for the low risk workers, namely p_a^L .

FIGURE 5.

EF.- break even insurance contracts (market odds when a majority are high risk individuals). As long as EF is below contract B an equilibrium in the insurance market exists (see Rothschild and Stiglitz (1976)).

E_{π}^H) - price of insurance, for high risk (H) and low risk (L)

Once again E is each individual's endowment point. Therefore one can imagine this situation as one where regardless of whether workers belong to a union or not $E = (y_E^b, y_E^a)$. We wish to examine whether one group in equilibrium will purchase more insurance than the other. The segment EF represents different contributions of y_a, y_b such that firms offering insurance, permitting individuals to trade away from E , would break even from the sale of this insurance. The differences in the price of insurance for the two risk groups is shown in the figure by the segments $E\pi^H$ and $E\pi^L$. Given utility levels of U^H for high risk individuals and U^L for low risk workers the former group will purchase insurance at A by giving up $y_E^b y_A^b$ income in state (b) for $y_E^a y_A^a$ in state (a) while the low risk group would only give up $y_E^b y_C^b$ in state (b) for $y_E^a y_C^a$ more income in the hazardous state (a). In a world of imperfect information insurance companies face the problem of not being able to screen the high and low risk workers. Therefore if a firm were to offer insurance at C both groups H and L would purchase it since every individual is better off. That is, at C , compensation in both states of the world is higher for each of the two risk groups. However the firm would suffer a loss since the value of total claims will be greater than the total premiums taken in.⁶⁵ In other words, no pooling contract would lead to a stable equilibrium. Only separating

by such a provision. In Canada (1980; 300,120 workers, 965 collective agreements) 35% of union workers (50% of union contracts) have such a provision. While no figures are available for non union labour it is likely that seniority is less important in determining promotions for that segment of the labour market.

⁶⁰ Again no firm evidence exists although the general regulation of the workplace does appear to be a particular feature of unionism. See Duncan and Stafford (p. cit.), Farber and Sacks (1980) and Addison and Siebert (1979), ch. 8.

⁶¹ K. Strand, 'B.C. Rail's Internal Labour Market', seminar presented at Simon Fraser University, November 1979.

⁶² One of the problems of course in attempting to classify provisions in employment contracts according to type is that occasionally one item will not fit the definition perfectly. One could argue that fringe benefits represent one such case because some benefits appear to be monetary in nature (e.g., disability insurance). On the other hand since many fringe benefits cannot be exchanged for money (e.g., in plant clinic) the resulting provision may be best thought of as being non monetary in nature. The purpose however of our classification into P_C , P_F and N_P elements is to isolate the features which, in general, could be classified in an employment contract.

⁶³ That is, the amount mathematically expected to be paid out in claims equals the amount collected in premiums. In practice individuals will purchase insurance at an unfair price depending on their aversion to risk.

⁶⁴ The following analysis draws from Rothschild and Stiglitz (1976).

⁶⁵ This is known as the adverse selection problem.

⁶⁶ The low risk workers would in effect pay a higher price ($E\pi$ line flatter than $E\pi^L$; not shown in Figure 5).

⁶⁷ Ordinarily in union-firm contracts there is a certain amount of insurance for which the payment of premiums (by the employer and/or employees) is compulsory. Contributions are usually based on a cents per hour basis and can vary with the income of individuals. Additional types of insurance may or may not be compulsory (e.g., disability, extended health, extended medical). In non unionized firms

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ones (i.e., once for the H group and one for the L group) will be offered by firms selling insurance. Therefore an insurance contract for the low risk worker must be south-east of the insurance contract for the high risk worker in order to prevent adverse selection. This depicts a situation in which insurance is purchased in an individual firm contracting situation where individuals are not coerced. Let $\gamma^{H,L}$ represent the proportion of high risk or low risk workers.

Now introduce a union. If the majority of workers in the group belonged to the high risk category, that is $\gamma_H > .5$, they could coerce the entire group into purchasing more insurance than they otherwise would have. By altering the contribution structure of premiums such that low risk workers would in effect be subsidizing the payment of premiums by the high risk workers the high risk workers would in actual fact be paying a lower price for insurance, namely $E\pi_u^H$, than in an individual-firm situation.⁶⁶ At that price high risk workers would purchase y_{AD}^a more insurance in exchange for y_{AD}^b in state (b). The low risk workers on the other hand will purchase less insurance since $\pi_u > \pi^L$. However it is likely, since $\gamma^H > \gamma^L$, that the group as a whole will end up purchasing more insurance than under the alternative of individual-firm contracting.⁶⁷ In addition, since the union is concerned about exit, $(\pi^L - \pi_u)$ must not

be so great as to cause the low risk workers to exit. Of course if the more productive workers are also the low risk individuals then exit will result from coercion despite the modification in the structure of the contract, *ceteris paribus*.

Throughout this section we have demonstrated that a union will purchase for a group of workers D type goods which represent a relatively higher share of total compensation than in individual-firm employment contracts. Hence, other things equal, this implies that

$$\left(\frac{D}{Y}\right)^u > \left(\frac{D}{Y}\right)^n$$

as was argued at the beginning of this section. The higher marginal evaluation of D-type benefits means that since $DPD^u > DPD^n$, as Figure 2 illustrated, $\frac{\partial \Phi}{\partial DPD} > 0$, *ceteris paribus*.

Of course there will be an optimum amount of D (=D*) provisions in any employment contract. If we write $U(EC) = U(P_C, D)$ to signify the welfare from an employment contract EC then, for a given total compensation Y, D benefits will be purchased until the marginal rate of substitution between P_C and D equals the ratio of the demand prices. This optimum condition is written

$$\frac{dD}{dP_C} = - \frac{U_{P_C}}{U_D}$$

where

$$U_{P_C} = \frac{\partial U}{\partial P_C}$$

and

$$U_D = \frac{\partial U}{\partial D}$$

Since $U_D^u > U_D^n$ this implies that

$$\left(\frac{dD}{dP_C}\right)^u > \left(\frac{dD}{dP_C}\right)^n$$

Differences in demand prices for D-types of goods between union and nonunion labour probably also explain why the extent of unionism among women is lower than among males. The fact that turnover among women is relatively higher (for evidence see the next chapter) should reduce the demand for D-type benefit which are often dependent upon tenure. Married women also demand less D type benefits in their employment contract if their husbands already receive some of these benefits which are sometimes dependent upon marital status (e.g., life insurance and medical insurance).

(d) Summary

We have argued in this chapter that the likelihood of selecting an employment contract depends on the distribution of net signalling returns within the group as well as on the demand price for the D-types of provisions. These were defined in the chapter as comprising pecuniary (future) and non pecuniary benefits. The effect of the collective arrangements was summarized by expression (8), which was defined as follows:

$$\phi^l = Z(Sk^l, DPD^l)$$

where ϕ^l refers to the probability of selecting a union-firm contract for group l , Sk is a summary statistic for the distribution of net returns from signalling in group l (the third moment about the mean) while DPD^l refers to the demand price of D-type benefits. It was concluded that

$$(\phi | Sk > 0) > (\phi | Sk < 0)$$

and that $\frac{\partial \phi}{\partial DPD} > 0$ (subject to D^*).

When the majority of workers in the group receive a net compensation which is below the mean under an individual firm arrangement ($Sk > 0$), they would be better off by forming a union which would suppress signalling behaviour since they would earn the mean

product of the entire group. However if mobility costs would not prevent the relatively more productive workers from leaving the firm they would be worse off under unionism. To prevent exit the union affects the structure of the employment contract in such a way that the resulting distribution of benefits between types of provisions in the contract (P_C , P_F , NP) results in a contract that may be at least as preferred as the individual-firm one which, ceteris paribus, would appear to be a superior arrangement.

The structure of the employment contract is also affected because workers with a higher desired demand for D-type benefits are able to reveal a higher demand for these services under a union arrangement than under an individual-firm contract. In particular, only a majority of workers need to express a relatively higher preference for D-type goods in their contract since this is all that is needed to organize a union. At the same time however the majority must also be concerned with exit by the relatively more productive workers in a group.

In the following chapter the available empirical evidence is examined.

NOTES TO CHAPTER II

¹These terms will be defined below.

²This is mainly attributable to historical incidents. The first unions were formed "... not from any particular institution, but from every opportunity for the meeting together of wage earners of the same occupation" (from bk i, ch x, p. 59 of McCulloch's (1883) ed. of A. Smith's 'The Wealth of Nations'; as quoted in Webb and Webb (1920), p. 23). Later, labour legislation provided unions with the exclusive right to bargain on behalf of workers over the whole spectrum of issues related to employment (e.g., Wagner Act in the U.S.). In Canada Federal and Provincial laws coexist. In British Columbia for example: "Once the [Labour Relations] Board issues a certification, the Union becomes the exclusive bargaining agent for every employee in the bargaining unit, whether or not the employee is a member of the Union; the employer is not entitled to bypass the Union and negotiate separate and individual contracts of employment with any of the employees in the bargaining unit" (Guide to B.C. Labour Code, B.C. Ministry of Labour, 1980, p. 25; also B.C. Labour Code, sec. 39-51). The importance of the sole bargaining agent status of the Union will become clear in section 2. below.

³See R. Posner, Economic Analysis of Law, 2nd Edition, 1977, Little, Brown & Co., Boston. "The danger that the exchange may not be value maximizing is much greater when the exchange is not simultaneous or (what is analytically very similar) when the costs and benefits involved in the exchange may not become known to one party until he has completed his agreed-upon performance" (ibid., p. 65).

⁴As long as there is no incentive for the employer to pay other benefits in addition to wages turnover can be expected to be higher relative to a situation in which wages are not the only form of payment in employment. There are several reasons for this which mostly have to do with the costs of transacting both for the firm and the employees. The desire by employers for a stable labour force (see Gordon (1976)), the payment of a risk premium inclusive wage to compensate for possible future unemployment (see Azariadis (1975)), a significant amount of on the job training specific to the firm (see Becker (1962)) and State intervention in the labour market (e.g., unemployment compensation, minimum wages) are all examples of factors that can affect turnover

and therefore the composition of total compensation. Turn-over, it will be seen, plays a part in the choice of employment arrangements.

⁵ That is, the transactions costs involved in writing a formal legal document.

⁶ The procedure for the selection of such representatives will be discussed later.

⁷ Cf. n. 2 above.

⁸ Note that I have employed the term union-firm contract instead of, say, labour union contract. I am specifically interested in the determination of contractual arrangements between individuals and a firm in the private sector. Union-government labour contracts as such are not analyzed.

⁹ A fourth type of contract also exists whereby some aspects of the employment relation are negotiated individually while other parts of the contract are bargained through a collective arrangement. Athletes' contracts serve as an example. This type of arrangement is not explicitly considered here.

¹⁰ The nature and the effect of such costs on the selection of the labour contract will be examined in the next section.

¹¹ The pecuniary and current nature of the provisions listed under category A is clear except perhaps in the case of 4A. During a probationary period of employment an individual usually receives general and specific on the job training. Because employment is conditional and since the worker under apprenticeship can be expected to produce less than his potential contribution to output when fully trained, part of the costs of employment during this period will be borne by the individual himself. This is usually accomplished through a lower wage during the period of probation. Clearly the probation period is a current (viz., during employment) and pecuniary (viz., it affects the wage received) feature of employment. On issues related to types of on the job training see Becker, (1962), sec. II(A), pp. 12-24.

¹² A guaranteed employment or earnings clause in a labour contract specifies the maximum length of time an employer agrees to pay or maintain the employment of workers regardless of the impact economic conditions would otherwise have on employment or earnings.

¹³ These provisions need not necessarily be provided through a union which here is assumed to be the dominant collective employment arrangement. However in the next section we show why workers may prefer to purchase such benefits through a union arrangement (see section 2(c) in this chapter).

¹⁴ A collective or public good is defined analogously to Olson (1965, p. 14), namely as "... any good such that if person X_i in a group $X_1, \dots, X_i, \dots, X_n$ consumes it, it cannot feasibly be withheld from the others in that group." It should be stressed that the 'goods' in question become public, as it were, when the group is formed. It is in this sense that I define publicness. Therefore some provisions will be collective to one group (viz., as in a union) while at the same time possibly being private to another group of workers the members of which have each negotiated individual contracts. This will depend, as we shall see, on the costs of securing various employment arrangements.

¹⁵ M. Olson (1965) also argued that in large groups (called 'latent' by the author) "if one member does not help provide the collective good, no other member will be significantly affected and therefore none has any reason to act" (ibid., p. 50).

¹⁶ Cf. n. 14 above.

¹⁷ In the case of LOC a monetary payment may be involved either through the payment by workers of insurance premiums (unless the firm bears 100% of the cost) or in the possible use of one of the benefits provided (e.g., disability insurance). However, for simplicity, these will be included under the general definition of non-pecuniary provisions.

¹⁸ The 'free-rider' is one who enjoys the benefits from unionization without sharing in the costs of belonging to such an organization.

¹⁹ This thesis concerns itself specifically with the question as to why workers select different types of employment contracts and does not deal with the issue of why a firm would wish to 'vertically integrate' with a union.

²⁰ That is, the ways in which the parts of the contract make up the whole contract.

²¹ The work by Olson (1965) is relevant in this respect.

²² See section 1(a) above in this chapter.

²³ The supply price is the price at which an individual agrees to sell his labour services. It is therefore his total compensation.

²⁴ Although the precise form of the regulations vary slightly across the provinces they are essentially like the following: "... the percentage support the union can claim among the employees in the bargaining unit on the date of application will generally dictate how the Board treats the application. Employee support is determined by evidence of membership in good standing: less than 45% membership--the application is dismissed; 45 to 55% membership--a representation vote is ordered; the majority of employees who vote must favour union representation; more than 55% membership--the union is normally certified without a vote" (Guide To B.C. Labour Code, op. cit.; pp. 24-25; also sections 39-51, B.C. Labour Code). Similarly, majority voting is required in ratifying collective agreements and in order to strike (see B.C. Labour Code, sections 81-82A).

²⁵ See Atherton (1973), chapter I for a comprehensive review of the literature.

²⁶ In a union this 'group of workers' is, in effect, the so-called bargaining unit. In Canada, a Provincial Labour Relations Board decides the composition of the appropriate bargaining unit (see Guide To B.C. Labour Code, op. cit., p. 22).

²⁷ Such a reference worker could, for example, be the median voter in the union or perhaps some other member of the group (see Freeman (1973)). This type of Public Choice hypothesis views union behaviour as being dictated by the preferences of some average of workers--the median voter--who tends to be older and less mobile than the marginal individual in the group (see Freeman (1976) and Addison and Siebert (1979), p. 309). The median voter appears to be, currently, a popular person to model because one can then focus on an individual in the union rather than on the group as a whole. There seem to be other advantages as well. In particular, knowledge of the median voter's preferences, which is costly to measure, can, under various assumptions concerning the distribution of voters' attitudes towards an

issue, yield a majority of votes. On this question, see D. C. Mueller, *Public Choice*, Cambridge University Press, 1979. Admittedly, there are many aspects to the median voter model and I do not profess to know them in any great detail. Mainly, I wish to point to the existence of such a model since it is relevant to an analysis of majority voting institutions.

²⁸ See Spence (1973), Arrow (1973) and Stiglitz (1975).

²⁹ See chapter I.

³⁰ Cf. n. 24 above.

³¹ Ordinarily, seniority is the most important of several factors, such as performance on the job, in determining who gets promoted. In any event the incentive to signal is smaller than in a situation where a seniority rule does not exist.

³² For a recent empirical study which confirms this view see Freeman (1978b).

³³ Unionization is equivalent to a no signalling equilibrium. However a no signalling equilibrium, if it is attained because signalling costs are too great, will not lead workers to choose a union arrangement. This is because in this case it is the market which imposes the equilibrium contract and not a particular institution.

³⁴ In actual fact unions set a range of standard rates which varies according to seniority or occupation as in an Industrial Union.

³⁵ Every worker or group of workers is assumed to receive the value of their marginal product.

³⁶ Individuals here are thought of as choosing a union and not any particular type of union. Of course it would matter to individuals whether they were forming their own union, as opposed to an industrial or a craft union. Unions are treated as if they were identical. The justification is that we wish to explore the conditions under which a group of individuals will elect to organize a collective arrangement versus negotiating individual-firm employment contracts rather than to analyze why groups of individuals will select one form of union representation over another.

³⁷I am assuming of course that all other firms would at least pay type II workers the same, that is, 2. Gaining behaviour on the part of other firms is possible but there is the danger of an adverse selection problem (e.g., if type II workers were offered 2.6 by another firm and $\Sigma_I = 1.1$, type I workers would also exit since $2.6 - 1.1 > 1.4$). Such behaviour is not analyzed here.

³⁸For example, the employment contract was defined as a set of three elements namely P_C (pecuniary (current)), P_F (pecuniary (future)) and NP (non pecuniary) such that $Y = P_C + P_F + NP$ (see Table I, this chapter). In terms of case 1 (Table II) the more productive workers have to settle for $Y^u = 1.4$ instead of $Y^n = 1.6$. But a $Y^u = 1.4 = (.8 (=P_C) + .45 (=P_F) + .15 (=NP))$ may be at least as preferred as $Y^n = 1.6 = 1.6 + 0 + 0$.

³⁹Since in row one type Ib workers signal but Type Ia individuals do not opportunity earnings will be the average product of type Ia and type II workers' productivities, namely $1.46 (= 3/7 (.75) + 4/7 (2))$.

⁴⁰There is the debate, not explored here, as to whether signalling puts the right person into the right job as opposed to its other function as a mechanism used by firms to permit the tailoring of payments, according to productivity, to individuals in the same job. In the former situation signalling contributes to productivity (and earnings) while under the latter case signalling contributes only to earnings and hence has no social value.

⁴¹See Alchian and Demsetz (1972).

⁴²This explains why in recent years managers and other businessmen have increasingly sought to earn an M.B.A.

⁴³See Table IX, row 1, column 2.

⁴⁴One could just as easily construct an example where the skewness of the distribution of compensations was negative leading the majority to reject a union-firm contract. For example if $\beta = .2$ type IIa workers net signalling income would be $1.5 - .12 = 1.38$ which is greater than 1.2. If these workers were also in a majority position $Sk < 0$ and so $(\Phi|Sk < 0) < (\Phi|Sk > 0)$.

⁴⁵See Figure 1a, 1b.

⁴⁶See Freeman (1978) and Ichniowski (1978) for example.

⁴⁷ This does not mean that unions affect only the D side of the contract. The signalling section examined the possibility that the union affects compensation through the suppression of information. This effect may very well occur partly through the P_C element of the contract. Many union existence arguments are in terms of wage differentials (and therefore P_C differentials) between union and non union labour. See chapter I and Addison and Siebert (1979), chapter 8.

⁴⁸ See n. 14 above for the definition of the public good in this context.

⁴⁹ See n. 38 above for an example.

⁵⁰ The general concept of the union as an information producing institution has appeared in different forms. See Addison and Siebert (1979), ch. 9.

⁵¹ See Olson (1965), chapter I.

⁵² I do not deal in this dissertation with the issue of whether majority rule is the best mechanism for a group to reach a consensus. Rather I wish to point out that whereas the firm in an individual contracting situation would evaluate individual preferences (e.g.; to avoid turnover), the union replaces such measurement with a different rule the costs of which are partly borne by the workers themselves (in particular the minority members) thereby reducing these costs for the firm.

⁵³ This stable wage will be slightly lower than the average of fluctuating wages during the employment horizon. This is because employees would be willing to purchase an 'unfair' employment contract (in the sense of an 'unfair' price for the insurance against unemployment) depending on their aversion to risk.

⁵⁴ The Canada Labour Code (laws vary slightly across provinces) specifies a 2 weeks notice requirement on individual or group terminations (e.g., layoffs) for workers employed for at least 3 months. However employers are not bound by such a legal requirement (for notice of individual termination) in British Columbia. Therefore a look at severance pay provisions in B.C. collective agreements will give us a general idea of the differences between union and non union labour in this area. In 1979, 38.1% of B.C. workers representing 35.6% of collective agreements negotiated during that year had a provision for severance pay. In addition, 30.5% of workers covered by a collective agreement had a

provision for supplemental unemployment benefits in a survey of 965 collective agreements (federal jurisdiction) negotiated in 1980 up to March. There is no legal requirement for Canada as a whole for SUB payments since a state operated unemployment insurance programme exists. See Labour Standards in Canada, 1979, Labour Canada.

⁵⁵ 1978 costs estimates for Canada as a whole (all industries) based on a sample of firms with 250 employees or less and all firms with more than 250 employees reveals that pensions (not including deductions required under the Canada or Quebec Pension Plans) represent a cost for employers of 2.5% of annual total compensation per employee in the union sector while this figure represents 5.5% of total compensation in collective agreements. For data sources and details see the next chapter.

⁵⁶ There is some evidence in the U.S. that unionism is more prevalent in groups whose members are relatively old in the sense of number of years left to retirement. See Freeman (1978). Unfortunately Canadian census data does not distinguish between union and non union segments of the working population so that we are unable to determine whether or not the same would be true for Canada. It could also be noted that a younger worker's comparatively smaller demand for pensions may disappear if he is granted tenure early and has a high probability of being an older worker with the same firm.

⁵⁷ G. Duncan and F. Stafford in 'Do Union members receive compensating wage differentials?', American Economic Review, June 1980, make a similar point. The authors assume the internal demand revealing process to be a superior under unionism because of savings for the firm in the costs of measuring workers' preferences (except in a situation where there are no interdependencies or complementarities between hours worked of the different workers). They do not point out that the coercive nature of the union leads to a more structured environment within the firm and how the suppression of information can benefit the majority. As far as evidence is concerned no collective agreement in B.C. in 1979 calls for flexible hours and only 0.1% of collective agreements (0.2% of workers) in Canada in 1980, based on a sample of 965 such contracts, call for flexible work schedules.

⁵⁸ For evidence see the next chapter. Also see Rees (1960) and Addison and Siebert (1979), ch. 9.

⁵⁹ In fact, since some on the job signalling will occur, seniority will usually govern promotions where qualifications are equal or sufficient. In B.C. in 1979, 51% of workers who negotiated collective agreements that year (314077 workers; 66% of collective agreements) were covered

by such a provision. In Canada (1980; 300,120 workers, 965 collective agreements) 35% of union workers (50% of union contracts) have such a provision. While no figures are available for non union labour it is likely that seniority is less important in determining promotions for that segment of the labour market.

⁶⁰ Again no firm evidence exists although the general regulation of the workplace does appear to be a particular feature of unionism. See Duncan and Stafford (p. cit.), Farber and Sacks (1980) and Addison and Siebert (1979), ch. 8.

⁶¹ K. Strand, 'B.C. Rail's Internal Labour Market', seminar presented at Simon Fraser University, November 1979.

⁶² One of the problems of course in attempting to classify provisions in employment contracts according to type is that occasionally one item will not fit the definition perfectly. One could argue that fringe benefits represent one such case because some benefits appear to be monetary in nature (e.g., disability insurance). On the other hand since many fringe benefits cannot be exchanged for money (e.g., in plant clinic) the resulting provision may be best thought of as being non monetary in nature. The purpose however of our classification into PC, PF and NP elements is to isolate the features which, in general, could be classified in an employment contract.

⁶³ That is, the amount mathematically expected to be paid out in claims equals the amount collected in premiums. In practice individuals will purchase insurance at an unfair price depending on their aversion to risk.

⁶⁴ The following analysis draws from Rothschild and Stiglitz (1976).

⁶⁵ This is known as the adverse selection problem.

⁶⁶ The low risk workers would in effect pay a higher price ($E\pi$ line flatter than $E\pi^L$; not shown in Figure 5).

⁶⁷ Ordinarily in union-firm contracts there is a certain amount of insurance for which the payment of premiums (by the employer and/or employees) is compulsory. Contributions are usually based on a cents per hour basis and can vary with the income of individuals. Additional types of insurance may or may not be compulsory (e.g., disability, extended health, extended medical). In non unionized firms

contributions to all such life and health insurance plans are voluntary partly because the State provides health and disability (e.g., workmen's compensation) benefits. Therefore because of the compulsory nature of insurance programmes in unionized firms low risk workers may end up not being able to reduce the quantity of insurance purchased although its 'price' to them is higher than under a non union situation. Consequently, low risk workers will probably be worse off under unionism, ceteris paribus (cf. Figure 5 where at a price of $E\pi_U^L$ (not drawn) $> E\pi^L$, U_U^L (also not drawn) would be below U^L in equilibrium thus resulting in a reduction in welfare for the low risk workers).

Chapter III

EMPIRICAL ANALYSIS OF EMPLOYMENT CONTRACTS

Introduction

Ideally, one would like to obtain information about employment conditions prior and subsequent to union certification in order to isolate the reasons for unionization. Unfortunately, as in most analyses of economic issues, controlled experiments are not possible. One U.S. study of firefighters' unions however does make an attempt at such a comparison in testing for differences in the proportion of fringe benefits to total compensation between union and non union workers. Section (c) of this chapter deals with the issue. No such data are available for Canada.¹

In section (b) the statistical models employed to test the validity of the hypotheses presented in the previous chapter are explained and the results of the tests described. Also analyzed are U.S. studies that are supportive of some of the ideas developed in chapter II. The relevant articles are described in Part (c) below.

1. Degree of Unionization and Union Status Equations

(a) Proxying the Likelihood of Unionization

In the last chapter the discussion centred around the conditions which would affect the probability of selecting between different types of employment contracts. In particular, we isolated two variables that would explain, ϕ , the probability of choosing the union-firm employment contract. These were the skewness of the distribution of returns to labour services (net of signalling costs, if any) and the demand price for D-type provisions in an employment contract.

Two types of data will be employed to proxy ϕ . The first consists of binary observations (i.e., 0 or 1) which will permit us to identify the available information according to whether it refers to the union or non union segments of the labour market. Because of the type of statistical techniques to be employed however² another set of data is necessary to effect the required transformations. The second series therefore will consist of the degree of unionization as the proxy for the likelihood that a particular group of workers would select the union-firm employment contract. By 'degree of unionization' I refer to the proportion of union labour to total employment in a particular group. This measure indicates the extensiveness of union organization and thus reflects the attractiveness to members of the given group of entering into a union-firm contract.

This measure has been employed in several studies of unionization and it is considered to be an adequate measure of the attractiveness of the union arrangement.³ Of course, choosing the particular 'group' itself creates considerable difficulties.

In the preceding chapter we discussed the prospects of choosing the collective arrangement by a group of workers without specifying the composition of such a group. Both individuals employed in the same or related occupations as well as workers employed in different occupations organize unions. In the former case they are called craft Unions whereas the latter type of arrangement is termed an industrial Union. It is difficult therefore to provide a unique definition for the 'group'. Furthermore we would require data at the bargaining unit level in order to correctly assess the relationship between those variables said to affect group decisions in the selection of an employment contract and the actual choice made by that same group.⁴ Otherwise more aggregated data would encompass several groups having possibly made different choices about their employment contract.

Data permitting statistical testing of the hypotheses of this thesis was found although at a higher level of aggregation than desired.⁵ Two types of groups shall be considered: occupation and industry. The former is closest to the desired level of disaggregation.

Industry data do provide us with considerable

information about other than wage benefits in union and non-union employment contracts.⁶

2. A Model of the Selection of Employment Contracts

We are attempting to determine whether the skewness of the distribution of compensations (net of signalling costs, if any) and the demand price for D-type provisions in an employment contract can explain the likelihood of selecting the union-firm arrangement. To test this we have two sets of observations: one at the occupational level and another at the industry level. Let us consider the occupation data first.

(a) The occupational degree of unionization model.

We wish to specify a model to test equation (8) of the previous chapter. In other words, we would like to estimate the following relationship, namely

$$\phi = Z(Sk, DPD) ,$$

where ϕ is the likelihood of selecting a union-firm contract, Sk is the skewness of the distribution of compensations (net of signalling costs, if any) and DPD is the demand price for D-type provisions in the contract. The following econometric specification, using occupation data, shall be employed

$$\phi_i = a_0 + a_1 Sk_i + a_2 \left[\left(\frac{D}{Y} \right)^u - \left(\frac{D}{Y} \right)^n \right] \times 100 + a_3 \left[\frac{\bar{W}_i^u - \bar{W}_i^n}{\bar{W}_i^n} \times 100 \right]$$

$$+ a_4 OCCTYPE_i + a_5 SEX_i + a_6 IND_{ij} + \epsilon_i, \quad (1)$$

ϕ_i refers to the proxy for the likelihood of unionization in occupation i , Sk_i is the empirical measure of skewness, while the second term attempts to measure differences in the share of D-type provisions in total compensation between union and non union labour. The last set of variables attempt to control for the presence of other possibly statistically significant variables in determining the likelihood of unionization. The third term attempts to capture the so-called 'threat effect' (see Rosen (1969)) whereby the union-non-union wage differential may be reduced by employer action to forestall further union organization. The variable $OCCTYPE_i$ refers to whether the particular occupation is an office or a maintenance type occupation. Signalling prerequisites are different in the two types of occupations and since the prospects for advancement, considered to be a significant factor by some in determining the likelihood of unionization (Addison and Siebert (1974), Webb and Webb (1920)), are greater in office than in maintenance occupations the incentive to unionize may be different in the two types of occupations. The SEX_i variable identifies the sex of workers in the various occupations sampled. It was argued in the preceding chapter that women are less likely to organize unions than men. The final independent term in (1) represents a set of industry dummy variables (IND_{ij}).

j = various industries). Here we wish to capture features particular to an industry which could have an impact on the probability of choosing a union-firm employment contract. Below we examine each of these variables in detail before proceeding to the description of the econometric tests.

-Proxying the third moment about the mean

Assume that the group under consideration is the occupation. We have proxied the likelihood of unionization (see section (b) above) by the degree of unionization. In other words, for occupation i

$$\phi_i = \frac{U_i}{E_i} \quad (2)$$

where ϕ_i refers to the degree of unionization in occupation i , U_i , the number of union workers⁷ and E_i , total employment in occupation i .

In the last chapter we argued that there are two elements, among other factors,⁸ contributing to the explanation of why a group of workers would want union representation. The first concerns the distribution of workers' productivities.

It was argued that if the median voter's net returns from signalling, that is, the difference between his compensation, reflecting his 'worth' to the firm, and consequently his productivity, and signalling costs, is

greater than the average product paid under unionism, then a majority in the group would vote against of union representation. The reason is that under a collective arrangement, signalling is suppressed, thus preventing the firm from distinguishing between 'types' of individuals (i.e., workers with different productivities) through screening. As a result, workers in the group will each receive the average product as compensation for their labour services. Furthermore since half of the workers' returns in the groups will be below the median voter's income in the absence of the union his is the deciding vote.⁹

A measure of the median voter's position in the intra-firm distribution of compensations (net of signalling costs) is the third moment about the mean which measures the skew of a distribution. Unfortunately, neither total compensation nor signalling costs data are available for those occupations sampled (cf. n. 7 above). We shall therefore proxy the skewness of the distribution of net returns in employment by the skew in the distribution of wages.

Now, in the theory of chapter II two situations were compared. The first was when the group of workers was deciding whether or not to move from the individual-firm or full signalling equilibrium to a suppression of signalling of unionization equilibrium. Such a case is equivalent to a pre-union situation. The second situation illustrated the incomes of the members of the same group where the collective arrangement is selected.

This is equivalent to a post union representation vote situation. In practice, however, few groups are entirely union or non-union. Therefore, the following proxies for the third moment about the mean shall be employed. They are:

$$(a) \quad Sk_i = \left[\frac{W - WMN}{WMN} \right] \times 100 \quad (3)$$

and, (b)

$$Sk'_i = \frac{.175(WID^n - WMU)^3 + .2(WIQ^n - WMU)^3 + .25(WM^n - WMU)^3 + .2(W3Q^n - WMU)^3 + .175(W9D^n - WMU)^3}{S^3}$$

In (a) the proxy for skewness (Sk) is the percentage difference between the average overall wage in occupation i and the median wage in the non-unionized segment of occupation i. If the hypothesis of the preceding chapter is correct then high degrees of unionization in occupation i correspond to a situation where the average overall wage (the proxy for the group's average product) is above the median voters' wage in the non unionized segment of occupation i.

In other words, the reason for a high degree of unionization in a particular occupation, other things equal, is due to an average product which is above the median non union voter's wage. Since in fact the correct 'group' to be considered is the bargaining unit the coexistence of union and non union groups in the same occupation is due to other factors yet to

be explained. In particular note that, ideally, we should be comparing wage schedules at the bargaining unit level and that union and non union workers may coexist in the same occupation simply because in some bargaining units the median voter's wage is above the average wage of that group. In the absence of such data we compare the overall average to the overall median in an occupation.

Finally, it should be emphasized that the empirical measure of skewness suffers from possible biases. For example, much of the empirical evidence indicates that there exists a union-non-union wage differential (in chapter I). The presence of such a differential would affect the mean's position relative to the median in the distribution of wage rates and thus bias the measures in (3). In addition, the presence of a 'threat effect' on non-union wages (see chapter 2) raises the mean non-union wage in a way not captured by the theoretical measure of skewness described in chapter 2. This raises the possibility of another source of bias in (3).

To summarize, ceteris paribus, we would expect the degree of unionization in occupation i to be positively related to the measure of skewness Sk_i .¹⁰ The second proxy for the third moment about the mean is a better approximation of this measure.¹¹ Consider Figure 1 below which illustrates the concept behind the definition of Sk_i .

Figure 1

Assume that the wages of workers in an occupation are ordered from the smallest to the largest with the 0th worker having the lowest and the 100th (or 1000th, etc. . .) having the highest wage. Also assume for the purposes of simplicity of exposition that this results in a continuous function of wages. Available data consists of the first decile (W1D), the first quartile (W1Q), the mean ($\bar{W}$, not shown), the median (WM), the third quartile (W3Q) and the ninth decile (W9D). The position of these data in the wage distribution is shown in Figure 1. / In the absence of any additional information the skewness of the distribution will be approximated, much as an integral is an approximation, by assuming that a certain proportion of workers have identical wages about the available observations. The proportions were calculated first by taking the median wage as the midpoint of the distribution and then assigning equal wages to all workers on either side of the median until the midpoints between the median observation and the next observations (W1Q and W3Q) are attained. The same procedure was employed for all the other available wage data resulting in the proportions defined in (3b). Variable (3b) measures the skewness of the distribution of non union wages with respect to the median union wage. This last variable was assumed to proxy the 'average' product of the union group.¹²

The theory developed in the preceding chapter

predicts that groups of workers will select individual-firm employment contracts if the distribution of compensations (net of signalling costs, if any) is negatively skewed. In other words, if the median voter's net return from signalling under an individual-firm arrangement is above the average product of the group a majority will block union representation. Therefore, regardless of the extent of unionism, one would expect the distribution of non union wages to be skewed to the left (resulting in $S_k < 0$). This will result in a non positive relationship between ϕ_i , the degree of unionization in occupation i , and the proxy for the skewness of the distribution of non union wages.¹³

- Proxying the demand price of D-type provisions in the contract

In the preceding chapter total compensation was defined as the sum of three elements, namely the pecuniary (current) provisions, P_C , the pecuniary (future) provisions, P_F , and non-pecuniary provisions, NP . In other words, if Y stands for total compensation then

$$Y = P_C + P_F + NP$$

The P_C provisions are monetary in nature and are consumed during employment. Wages are an example (see Table I,

chapter II for a complete listing of provisions in an employment contract). Benefits which are pecuniary but are consumed after employment has ceased either because of age, tenure or unemployment represent the pecuniary (future) elements of the contract. Pensions and supplemental unemployment benefits are examples of such benefits. Finally, there are benefits which are non pecuniary in nature and are usually consumed on the job. Provisions related to working conditions (e.g., hours of work) illustrate the NP segment of the contract.

Empirically we are faced with two problems. One is the inability to measure the value of most non-pecuniary benefits in a contract. Except for fringe benefits and the effect of hours of work arrangements (reflected in overtime pay and shift premium pay for example) other NP type benefits are not readily quantifiable. While the P_F and P_C provisions of the contract are quantifiable only cost information is available. The second measurement problem we face therefore is that since the data refer to cost rather than benefits, the information which shall be employed for the purposes of statistical testing represent only an imperfect measure of the value of D-type benefits to workers. To test the significance of the difference in the share of D-type benefits in total compensation between union and non union labour the following statistic will be calculated, namely

$$\left[\left(\frac{D}{Y} \right)^u - \left(\frac{D}{Y} \right)^n \right] \times 100 \quad (4)$$

This variable attempts to determine whether differences in the share of D provisions in total compensation between union and non-union labour are significantly related to ϕ , the proxy for the likelihood of unionization.

In addition, since we lack cost data on D-type provisions at the occupation level the data necessary for expression (4) must be constructed from available industry level data. As a result, the difference in the share of D-type provisions in total compensation between union and non union labour for occupation i will be a weighted average of such differences at the industrial level. The weights themselves are determined by the proportion of workers in occupation i employed in industry j. In other words, the actual independent variable to be used in the place of expression (4) above, shall be

$$\sum_j m_{ij} \left[\left(\frac{D}{Y} \right)_j^u - \left(\frac{D}{Y} \right)_j^n \right] \times 100, \quad (4A)$$

where m_{ij} = proportion of workers in occupation i employed in industry j

$\left(\frac{D}{Y} \right)_j^{u,n}$ = share of D-type benefits in total compensation, Y, in industry j for union (u) or non union workers (n).

In addition, for empirical purposes, the terms D and Y will be proxied by

$$Y = W + P_F + \gamma NP, \quad \gamma < 1 \quad (a)$$

$$= W + D, \quad (5)$$

where $D = A + B + C + D + E \quad (b)$

Equation 5(a) says that total compensation is the sum of wages W, the pecuniary (future) provisions, P_F , as well as those NP benefits that are quantifiable. The sum of P_F and γNP represent the measureable D-type provisions. Equation 5(b) indicates that D is essentially made up of five different elements, namely

A = expenditure by employers on overtime, commissions and bonuses and shift premium pay,

B = expenditure by employers on paid absence (vacation pay and sick leave),

C = expenditure by employers on COLA, Christmas bonuses and taxable benefits (e.g., personal car used for business),

D = expenditure by employers on pension plans,

and, E = expenditure by employers on insurance plans (life and health plans).

Note that, in addition to these D-type benefits there are other legally required costs that must be incurred by the firm. Since these arise whether or not the workers involved are unionized these shall ~~not~~ be included under the definition above for D. These include: workmen's compensation contributions, Canada or Quebec Pension Plan contributions, Provincial Medicine Plans, 4% vacation pay, unemployment insurance and paid holidays.

In chapter II it was hypothesized that workers with a higher marginal evaluation for D-type benefits would most likely want to organize into a union. It was then argued that this would lead to $(D/Y)^u > (D/Y)^n$, ceteris paribus. Hence expression (5a) should be positively related to unionism.

- Other determinants in the choice of employment arrangements

In addition to skewness and the proportion of D-type benefits in the employment contract, other factors are likely to affect the choice of employment arrangements. It was argued in chapter II that women are less likely to vote for union representation than men on the basis of the D-type benefits.

Table I shows that, whether by occupation, industry, or even by Province, the extent of female union participation is smaller than male participation. The importance of D-types of benefits, that is, of pecuniary (future) and non-pecuniary provisions, in union-firm employment contracts relative to a non-union situation may explain this

TABLE I DISTRIBUTION OF UNION MEMBERSHIP, BY SEX*

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(A) By Occupation (Canada), 1977¹

OCCUPATION	Degree of Unionization	
	Male	Female
Accounting Clerk JR	28	21
Sr	26	16
Bookkeeper, SR	14	9
General Office Clerk JR	58	30
INT	75	58
SR	58	59
Computer Operator JR	28	24
SR	33	20
Computer Peripheral Equipment Op.	64	39
Cost Clerk	17	20
Office Boy/Girl	43	35
Programmer JR	27	28
SR	24	22
Secretary JR	18	41
SR	22	30
Stock records Clerk	38	14
Systems Analyst JR	48	50
SR	35	55
Elevator Operator	71	58
Janitor/Charwoman	72	61

(B) By Industry (Canada), 1977²

INDUSTRY		
Forestry, Fishing, Mining	40	16
Manufacturing	48	34
Construction	49	3
Transp., Comm., Utilities	50	46
Trade	8	7
Finance	3	2
Services	19	21
Public Administration	67	69

(C) By Industry (B.C.), 1978³

INDUSTRY	Degree of Unionization	
	Male	Female
Manufacturing	63	41
Construction	67	9
Trade & Services	30	29
Other Ind (Mining, Transp., Comm., Utilities)	77	59

(D) By Province, 1977⁴

Newfoundland	43	19
P.E.I.	20	19
Nova Scotia	35	16
New Brunswick	37	18
Quebec	34	27
Ontario	34	19
Manitoba	30	23
Saskatchewan	20	18
Alberta	24	15
British Columbia	44	26

* Degree of Unionization =
$$\frac{\text{no. of unionized workers in occ., ind., or Prov. i (M, F)}}{\text{average employment of Male/Female workers in occ., ind., Prov. i}}$$

Workers covered by a collective agreement and belonging to a bargaining unit in which 50% or more of the members are Union members are considered Unionized.

SOURCES: (1) Wage rates, Salaries and Hours of Labour, Labour Canada, 1977 (latest issue)

(2) CALURA report (STATSCAN), 71-202, various issues

(3) Labour Force Annual Averages (STATSCAN), 71-529 and B.C. Labour Directory (B.C. Ministry of Labour), 1978

(4) CALURA report (STATSCAN), 71-202.

differential. Table I shows that, in 1979, most part-time employment was taken up by women (74%) and that full time employment is male dominated (67%). As a result, one would expect the turnover rate among women to be higher than for men. Table II confirms this as far as B.C. is concerned.¹⁴ Not only is job tenure among men longer but, in addition, most part time employment is filled by women as opposed to full time employment which is mainly undertaken by men (part (B) of Table II). The higher turnover among female workers is probably also due to the fact that women invest in less earnings capacity relative to men since they expect a larger number of interruptions during their working lives. Consequently, because D-type benefits are often dependent on tenure and since they tend to be non-portable from one firm or industry to another one would expect, other things equal, that the demand price of D-type provision will be lower for women than for men. Therefore women would also be less likely than men to select a union-firm contract.

On the other hand, women are usually less well paid than men in the same occupations. Hence women in a particular group (with men) are likely to earn a wage which is below the median workers' income. Therefore female workers are likely to benefit from the suppression of signalling and on this basis would probably vote in favour of union representation. Consequently, it is not clear what the sign of SEX would be since there is no way of knowing the strengths

TABLE II - JOB TENURE AND EMPLOYMENT BY SEX (B.C., 1979)

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(A) JOB TENURE ¹	(%)	
	Men	Women
Total employment	61.4	38.6
<u>Tenure</u>		
less than 1 year	25	33
1. to 5 years	31	38
6 to 10 years	19	17
Over 10 years	25	12

(B) EMPLOYMENT ²	(% of Employment)	
	Men	Women
Full-time	86	
Men	67	
Women	33	
Part-time	14	
Men	26	
Women	74	

Notes: (1) From B.C. Labour Research Bulletin, March 1980, Table 11

(2) From B.C. Labour Research Bulletin, March 1980, Table 8.

of the two opposing effects just discussed. Yet another variable which would influence the choice of contractual arrangements in employment is the type of occupation. Clearly office type occupations¹⁵ are different from maintenance type occupations¹⁶ in terms of returns from signaling both on and off the job, and in terms of prospects for advancement. Since unions tend to regulate promotions by seniority and to standardize earnings within the bargaining unit the incentive to signal will be reduced under unionism (see section 2(b), chapter II). Since prospects for advancement are far greater in office occupations¹⁵ one would expect a relatively lower degree of unionization for such groups relative to maintenance type tasks. Hence, ceteris paribus, we would expect that

$$(\Phi | OCCTYPE = \text{office}) < (\Phi | OCCTYPE = \text{maintenance}) \quad (6)$$

where $OCCTYPE_i$ is a dummy variable with 0 = office and 1 = maintenance occupation.

Another independent variable attempts to capture indirectly features particular to certain industries which may affect the choice of employment contracts. Certain industries may be particularly easy or difficult to unionize depending on the extent to which it is already unionized for example. Also a factor is the fact that workers choose

between different types of unions (e.g., craft versus industrial). Since the size of these different types of unions varies so may the extent of unionism across industries. Consequently, the impact of the industry on the degree of unionization shall be measured by the proportion of workers in an occupation employed in different industries. In other words,

$$IND_{ij} = \frac{E_{ij}}{E_i} \quad (7)$$

where the subscript i refers to the occupation, E_{ij} represents employment of workers of occupation i in industry j and E_i is total employment in occupation i .

A final determinant of unionism relates to the so-called 'threat effect' whereby non union employers are able to forestall unionization by paying union level wages (see Rosen (1969)). We shall measure this effect by the percentage difference between average union and non-union wage in a particular occupation. That is,

$$\frac{\bar{w}_i^u - \bar{w}_i^n}{\bar{w}_i^n} \cdot 100 \quad (8)$$

where $\bar{w}_i^{u,n}$ is the average union or non union wage. If the threat effect is operative then $\bar{w}_i^u - \bar{w}_i^n$ would tend to zero as ϕ_i rises resulting in a negative sign for this coefficient.

If, on the other hand, the monopoly argument of union existence is correct then high degrees of unionization would result in a wider union non union wage differential (see chapter I).

-The statistical models

To estimate equation (1) it is preferable to effect some transformations to the dependent variable. Since we wish to refer to the dependent variable as the probability that a union-firm employment contract is selected all of the observations must lie in the $(0, 1)$ interval. We could, of course, use only the proxy for ϕ_i namely, the degree of unionization, but since this is only an approximation the actual distribution of probabilities may take on different shapes. Hence transformations, such as the Probit or Logit models, are in order.

Furthermore, it is well known (see Ashton (1972)) that ordinary least squares is an inappropriate technique when binary observations (i.e., zeros and ones) only are available for the dependent variable.

(i) The probit model:

The term probit or probability unit model is associated with the normal distribution. To understand this model, consider the following: let ϕ_i refer to the probability that a group

of workers will vote in favour of union representation.

Furthermore we hypothesize that ϕ_i is a linear function of an attribute, $\frac{U_i}{E_i}$ (expression (2) above), namely the degree of unionization. Therefore write,

$$F(\phi_i) = \frac{U_i}{E_i}$$

where $F(\phi_i)$ is a cumulative probability function of ϕ_i , or more generally

$$F(\phi_i) = \alpha + \beta(U_i/E_i)$$

In addition, let us assume that there exists a critical value, ϕ_i^* , such that if

$$\phi_i > \phi_i^*$$

the group votes in favour of union representation while if

$$\phi_i \leq \phi_i^*$$

the group blocks union representation. The probit model views ϕ_i^* as being a normally distributed random variable so that the probability that ϕ_i^* is less than or equal to ϕ_i can be calculated from the cumulative normal probability function. Therefore,

$$\text{probit}(\phi_i) = \text{normal deviate} + 5$$

(to avoid negative values).

We may interpret the probability estimated from the probit model above as the conditional probability that a group will select the union-firm contact given the degree of unionization in the reference group (i.e., the occupation or industry). A second model, and considered to be more appealing by some (see Ashton (1972)), is the logit model which we shall now briefly describe.

(ii) The logit model:

This model is based on the cumulative logistic probability function

$$F(\phi_i) = \frac{1}{1+e^{-\phi_i}} \quad (9)$$

where $F(\phi_i)$ is the cumulative probability function of ϕ_i , the likelihood of selecting the collective arrangement.

Rewrite (9) so that we have

$$(1+e^{-\phi_i}) F(\phi_i) = 1$$

Hence
$$e^{-\phi_i} = \frac{1-F(\phi_i)}{F(\phi_i)}$$

or
$$e^{\phi_i} = (F(\phi_i) / (1 - F(\phi_i)))$$

and taking logarithms of both sides yields,

$$\phi_i = \log (F(\phi_i) / (1 - F(\phi_i))) \quad (10)$$

Finally, since

$$F(\phi_i) = U_i / E_i$$

(14) becomes

$$\log ((U_i / E_i) / (1 - (U_i / E_i))) = \log (U_i / (E_i - U_i)) \quad (11)$$

It is argued in Pindyck and Rubinfeld (1976) that ordinary least squares can be applied to equation (11) since it is linear in its parameters. In addition, this procedure will yield consistent estimates if the size of the sample is 'large' (op.cit., p.250). However, it has also been suggested that weighted least squares be applied since the problem of heteroskedasticity often arises in this kind of estimation (see H. Theil, *Frontiers of Econometrics*, J. Wiley, p.635).¹⁸

- Regression results

Table III provides a list of the various occupations sampled.

Fifty-six are in the category of office occupations while

twenty-four are in the maintenance group. Thus the size of

the sample is eighty observations. Table IV displays means

and standard deviations for the various independent variables

described in the preceding sections as well as for the

dependent variable. In Table V it is clearly demonstrated

TABLE III - List of Occupations employed in the Degree of Unionization
Regressions (Canada, 1977)

OCCUPATION ¹	Male	Female	Office ²	Maintenance ³
Accounting Clerk JR	x	x	x	
SR	x	x	x	
Bookkeeper SR	x	x	x	
Clerk, General Office JR	x	x	x	
INT	x	x	x	
SR	x	x	x	
Computer Operator JR	x	x	x	
SR	x	x	x	
Computer Per., Equip. Op.	x	x	x	
Cost Clerk	x	x	x	
Draughtsman Apprentice	x		x	
JR	x		x	
SR	x		x	
INT	x		x	
File Clerk		x	x	
Keypunch Operator JR		x	x	
SR		x	x	
Machine Operator JR		x	x	
SR		x	x	
Office Boy/Girl	x	x	x	
Office Manager	x	x	x	
Order Clerk	x	x	x	
Programmer JR	x	x	x	
SR	x	x	x	
Secretary JR	x	x	x	
Secretary SR	x	x	x	
Stenographer JR		x	x	
SR		x	x	
Stock Records Clerk	x	x	x	
Systems Analyst JR	x	x	x	
SR	x	x	x	
Telephone Operator		x	x	
Transcribing Machine Op. JR		x	x	
SR		x	x	
Typist JR		x	x	
SR		x	x	
Carpenter	x			x
Electrical Repairman	x			x
Maintenance Machinist	x			x
Millwright	x			x
Painter, Brush	x			x
Pipe Fitter	x			x
Plumber	x			x
Tool&Die Maker	x			x
Welder	x			x
Boiler Operator	x			x
Charwoman		x		x
Cleaner	x			x

TABLE III (CONT'D)

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OCCUPATION	Male	Female	Office	Maintenance
Elevator Operator	x	x		x
Industrial Truck Operator	x			x
Janitor	x			x
Security Guard	x			x
Shipping Clerk	x			x
Stationary Engineer 1 st cl.	x			x
2 nd cl.	x			x
3 rd cl.	x			x
4 th cl.	x			x
Light and Heavy Truck Driver	x			x
Labourer, non production	x			x

Notes: (1) For a description of each of these occupations see 'Canadian Classification and Dictionary of Occupations', Canada Employment and Immigration, 1976.

(2) See n. 15 for the definition.

(3) See n. 16 for the definition.

Table IV
MEANS, STANDARD DEVIATIONS, AND LISTING OF VARIABLES
(sample = 80 occupations)*

Symbol	Variable Definition	Mean (\$)	Standard Deviation
Φ	Degree of unionization	47.0	25.87
WID ⁿ	90th highest wage (non-union).	164.15	41.40
WID ^u	90th highest wage (union).	194.64	51.64
WIQ ⁿ	75th highest wage (non-union).	186.57	49.79
WIQ ^u	75th highest wage (union).	217.05	58.55
WM ⁿ	50th highest wage (non-union).	213.14	58.60
WM ^u	50th highest wage (union).	239.10	62.00
W3Q ⁿ	25th highest wage (non-union).	244.01	67.86
W3Q ^u	25th highest wage (union).	266.80	64.12
W9D ⁿ	10th highest wage (non-union).	277.65	77.55
W9D ^u	10th highest wage (union).	286.35	69.37
TRANSP	Prop. of employees in transportation, communications, utilities.	9.6%	5.32
TRADE	Prop. of employees in trade.	11.4%	9.45
FINANCE	Prop. of employees in finance.	10.9%	11.78

Table IV (cont'd)

Symbol	Variable Definition	Mean (%)	Standard Deviation
P. ADMIN.	Prop. of employees in public administration.	17.5	13.41
SERVICES	Prop. of employees in services.	16.9	14.41
$[(\frac{D}{Y})^u - (\frac{D}{Y})^n] \times 100^a$	Prop. of D-type provisions in total compensation.	4.9	2.00
$\frac{\bar{W}^u - \bar{W}^n}{\bar{W}^n} \times 100$	Union/non-union wage differential.	11.8	9.25
Sk (1) ^b	Measure of skewness in the wage distribution.	.538	.613
(2) ^c	Measure of skewness in the wage distribution.	-.795	.725

*Wage rates, salaries and hours of labour, October (1977), (latest issue), Labour Canada.

^aSource, if from 'Employee Compensation in Canada', unpublished, 1978. (Some preliminary data (general) has recently been published however. See Statistics Canada, 72-619P.)

^bExpression (3a).

^cExpression (3b).

TABLE V - Coefficients of kurtosis*, Union and non-Union
Wage rates, for different Occupations 130

	Mean kurtosis	Standard Deviation	Variance	Minimum kurtosis	Maximum kurtosis
NON-UNION	3175.4	2387.4	5699600	.545.55	11806
UNION	1.959	.4688	.2197	1.437	5.093

Sample size:80

*Fourth moment about the Mean, $k = \frac{\sum_i (w_i^j - \bar{w}^j)^4}{P s^4}$, j=Union, Non-Union

Source: See Text.

that intra-union wage differentials are considerably narrower than intra non-union wage differences as measured by the fourth moment (Kurtosis) about the mean (see also Farber and Sachs (1980)).

Tables VI and VII provide us with the regression results. In the first and third columns the Probit and Logit specifications are those when degree of unionization, untransformed, is regressed against the independent variables listed on the left of the tables (see appendix for logit estimates when weighted least squares is used).

In particular, the first proxy for skewness (see expression (3a) above) is not significant under the Probit and Logit models while the preferred measure of skewness (3b) is highly significant in all cases as shown in Table VII. The negative sign on the coefficient of variable Sk' means that higher degrees of unionization are consistent with a positively skewed wage distribution. In other words, an increase of 1% in the positive skew of the wage distribution reduces the likelihood of unionization (as measured by ϕ_i) by 20% in the Probit Model and by approximately 32% in the logarithm of the degree of unionization (see equation (15) above). The D-type provisions variable also is statistically significant under Probit and Logit with the positive sign as expected in both Tables VI and VII. This indicates that workers with a relatively higher revealed demand for D-type provisions in total compensation are more likely to form a union.

The type of occupation is also a highly significant variable regardless of the specification employed indicating

Table VI
ESTIMATED REGRESSION COEFFICIENTS FROM VARIOUS DEGREES OF
UNIONIZATION EQUATIONS, FOR DIFFERENT OCCUPATIONS

CANADA, 1978

(dependent variable = degree of unionization)*

Independent Variables ¹	OLS Linear Probability	Degree of Unionization	Logit
<u>Industry Controls</u>			
Manufacturing	-0.015 (0.014)	-0.175 (0.443)	-0.029 (0.023)
Transportation	0.006 (0.012)	0.385 (0.397)	0.007 (0.02)
Trade	-0.031 ^c (0.011)	-0.697 ^b (0.375)	-0.058 ^c (0.019)
Finance	0.0025 (0.012)	0.084 (0.383)	0.0013 (0.02)
Public Administration	0.008 (0.011)	0.550 ^a (.349)	0.009 (0.018)
Services	-0.019 ^b (0.011)	-0.414 (0.347)	-0.035 ^b (0.018)
Sex	0.097 (0.081)	3.114 (2.64)	0.1596 (0.135)
Type of Occupation	1.294 ^c (0.113)	45.59 ^c (3.70)	2.113 ^c (0.189)
D-type Provisions	0.122 ^d (0.093)	2.34 (3.05)	0.2269 ^d (0.156)
Threat Effect	-0.744 ^d (0.546)	-30.94 ^b (17.80)	-1.169 (0.912)
Skewness ² (Sk)	0.0001 (0.0001)	0.004 ^d (0.003)	0.0001 (0.0001)

Table VI (cont'd)

Independent Variables	OLS Linear Probability	Degree of Unionization	Logit
Constant	3.995 ^c	-9.40	-1.24 (2.22)
R ² /S.E.E.	.903/.256	0.910/8.352	0.904/0.428
Durbin Watson	1.22	1.20	1.17
Sample size	80	80	80

(1) Standard errors in parentheses.

(2) Defined in the text.

- a. Significant at 5% level
- b. Significant at 2.5% level
- c. Significant at 1% level
- d. Significant at 7.5% level

68 degrees of freedom.

Sources: see text.

Table VII
ESTIMATED REGRESSION COEFFICIENTS FROM VARIOUS UNION
MEMBER EQUATIONS, FOR DIFFERENT OCCUPATIONS

CANADA, 1978

(dependent variable = degree of unionization)*

Independent Variables ¹	OLS Linear Probability	Degree of* Unionization	Logit
<u>Industry Controls</u>			
Manufacturing	-0.019 (0.013)	-0.3097 (0.416)	-0.036 ^a (.021)
Transportation, Communications, and other Utilities	0.06 (0.012)	0.377 (0.370)	0.006 (0.02)
Trade	-0.032 ^c (0.01)	-0.732 ^b (0.349)	-0.06 ^c (0.02)
Finance	0.003 (0.01)	0.068 (0.354)	0.002 (0.02)
Public Administration	0.008 (0.009)	0.54 (0.325)	0.008 (0.02)
Services	-0.019 ^b (0.009)	-.0417 (0.324)	-0.04 ^b (0.02)
Sex	0.044 (0.074)	1.263 (2.45)	0.08 (0.12)
Type of Occupation	1.287 ^c (0.100)	45.8 ^c (3.298)	2.098 ^c (0.168)
D-type of Provisions	0.149 ^b (0.086)	3.073 (2.843)	0.272 ^a (0.145)
Threat Effect	-1.44 ^c (0.452)	-48.36 ^c (14.888)	-2.35 ^c (0.758)
Skewness ² (Sk')	-0.197 ^b (0.056)	-6.351 ^c (1.833)	-0.323 ^c (0.093)

Table VII (cont'd)

Independent Variables	OLS Linear Probability	Degree of Unionization	Logit
Constant	4.853 ^c (0.872)	29.213 (28.692)	0.051 (1.46)
R ² /S.E.E.	.917/.237	.922/7.796	.918/-397
Durbin Watson	1.386	1.392	1.321
Sample size	80	80	80

(1) Standard errors in parentheses.

(2) Defined in the text.

a. Significant at 5% level.

b. Significant at 2.5% level.

c. Significant at 1% level.

*Sources: see text.

that the likelihood of unionization is at least twice as high in maintenance occupations than in office occupations. Once again this is consistent with the hypothesis. The SEX variable, interestingly enough, is not statistically significant as far as the results in Table VI are concerned. However, when weighted least squares is used, the SEX variables is significant with a negative sign indicating that women are less likely to unionize. We suggested earlier that this would be the case (see ch. II, 2. and the appendix).²⁰

The threat effect' on the probability of unionization does seem to be highly significant. Based on the usual interpretation of such a variable it appears that resistance on the part of non-union employers to unionization has a negative effect on the likelihood of unionization as measured by ϕ_i . To be more specific, a rise of 1% in the union non-union wage differential reduces the likelihood of unionization by .744 (Probit; Table VI) or 31% (deg. of unionization; Table VI). These figures are slightly higher in Table VII.

Finally, it appears that only the services and trade industries have a statistically significant impact on the probability of unionization. In both cases the signs are negative. Since the trade sector is characterized by small firms (i.e., few employees) which are more costly to unionize or where the free rider problem would be less important (see Olson (1965)), workers in such groups would be less likely to resort to a union arrangement. In the services industry, where turnover among workers is relatively high (i.e., in hotels and restaurants: these workers make up a sizeable portion of this industry), purchasing benefits

that are non portable and dependent in many instances upon tenure is less desirable than in other occupations. Therefore workers in this industry may have a lower demand price for D-type benefits than workers in other industries.

Hence, *ceteris paribus*, they are less likely to form a union.²¹ Let us now go on to describe the industry level statistical tests.

(b) The Industrial Union Membership Model

-The statistical model

A model similar to the one employed to test data by occupation was specified for industry level data. Let,

$$US_j = b_0 + b_1 Sk_j + b_2 \left(\frac{D}{Y}\right)_j + b_3 \bar{W}_j + b_4 HRS_j \\ + b_5 PERFEM_j + b_6 IND_j + b_7 PERSAL_j + v_j \quad (12)$$

The term US_j refers to union status in industry j . If $US_j = 1$ then we are dealing with the unionized segment of industry j while $US_j = 0$ identifies the non union sector of industry j . Since only binary data is available for the dependent variable in (12) ordinary least squares is clearly inappropriate. Ashton (1972, p39) suggests the use of working values for values 0 and 1 which gives good results in practice.

The variable Sk_j , as before, refers to a proxy for

the skewness of the distribution of compensations (net of signalling costs, if any). While this time we have data on total compensation, as opposed to wages only, there is no information about the distribution of compensations within an industry. Therefore some proxy for Sk must be employed. Essentially what we wish to do is to approximate the position of the median productive individual in a non union situation with the average product of the group as a whole when it is unionized. Since all groups are a combination of union and non union elements we propose to proxy Sk_j by using the following formula:

$$Sk_j = \sum_j \gamma_j^k (\bar{y}_j^k - \bar{y}_j)^3 / s^3, \quad (13)$$

where γ_j refers to the proportion of union ($k=u$) or non union ($k=n$) workers in industry j . The other terms represent average total compensation in industry j of union ($k=u$) or non union workers ($k=n$) while $\bar{y}_j$ represents the overall average total compensation in industry j . Since data on the median total compensations in various industries is unavailable we are obliged to use the mean as the average measure of y .²²

Now, it was argued in the last chapter that a group of workers would select a union-firm contract if the distribution of compensations (net of signalling costs, if

any) was positively skewed (i.e., $Sk > 0$) while individual-firm arrangements are chosen if $Sk < 0$. Here, since both union and non union workers coexist Sk_j will be affected by the presence of both types of groups within the same industry. If the theory in chapter II is correct then the non union group selected that route because $Sk < 0$ whereas the other workers formed unions since $Sk > 0$ was true in general for this group. The skew of the distribution is determined from the position of the mean with respect to the median. Since we have no information about the median total compensation in the various industries sampled an alternative, although admittedly a crude one, is to try to get an indication about whether it appears that one of the areas to the left or right of the mean industrial total compensation is higher than the other. If the distribution is negatively skewed then the difference between the mean non-union compensation and the overall mean weighted by the proportion of non-union workers will be larger than this same weighted difference for the union group. This would result in a positive value for Sk_j at low degrees of unionization. Consequently, one would expect a negative sign on the coefficient of Variable (13). The sign of Sk_j would therefore depend essentially on the degree of unionization in the various industries. The second variable in (12) refers, as before, to the share of D provisions in total compensation (see 2. (a) for the empirical definition of D). According to the hypotheses developed in chapter II we argued that workers with a relatively higher preference for D-type goods are more likely to

organize a union. The union's concern about exit together with the ability to coerce through a majority voting rule essentially contribute to this result. Therefore, we would expect to find that when $US_j = 1$, $(D/Y)^u$ is greater than when $US_j = 0$ in which case we get $(D/Y)^n$. Consequently, the sign on this coefficient should be positive according to the discussion in chapter II. The other terms in equation (16) are essentially controls for the effects of other explanations of unionism. $\bar{W}_j$ refers to the average wage (straight-time pay). If the monopoly effect of unionism operates then we would expect $\bar{W}_j^u - \bar{W}_j^n$ to increase with the extent of unionism whereas the opposite is true when the 'threat effect' occurs (see C(1) above). The variable HRS refers to the average total number of hours worked per annum. It has been argued (Ichniowski (1978)) that unions can employ monopoly power either through the wage side or through the number of hours worked side of employment. As a result, the number of hours worked is seen to be reduced under unionism. The last three variables are essentially the same as the ones used to test equation (1). PERFEM_j refers to the percentage of female workers employed in industry j (see 2(a) above), IND_j is an industry dummy variable, and PERSAL_j represents the proportion of office workers in total employment (see 2(a) above for discussion).

- The regression results

Industry level data for Canada, Quebec and Ontario (a separate test was performed on these) were used to estimate equation (12). Tables VIII and XI present some of the data that were employed in the estimation of the industry equation. From these two tables it does appear at a very general level that employer expenditure on other than wage benefits is higher under unionism relative to the non-union sector. Clearly, as in any statistical technique of the sort employed here, there is the problem of keeping track of feedback effects (see pp. 44-5, and section 2(a) above). In other words, a relatively higher preference for D-type benefits implies that $(D/Y)^u > (D/Y)^n$, other things equal. However, the possibility of imitation of collective contracts by non-union employers and the need to prevent exist by the union imply further effects on (D/Y) . Consequently, while we still expect the $(D/Y)^u > (D/Y)^n$ condition to hold the impact of the reasons for unionization as well as its consequences will both be picked up in the sample.

Consider first the regression results shown in Table X. In part (A) of Table X US_j was regressed on each kind of D-type benefit. Only insurance (life and health plans) programmes types of benefits appear to be statistically significant although D-type benefits as a whole are also significant. Table X(B) shows that a 1% rise in D/Y raises the likelihood of selecting the union-firm contract by almost 7% if there were no feedback effects like the ones described above. Average straight time pay also raises the odds of unionization (by .0003).

The industry variables do not appear to be statistically significant. However, given the level of aggregation

Table VIII
COMPOSITION OF EMPLOYER EXPENDITURES ON EMPLOYEES,
BY UNION STATUS AND MAJOR INDUSTRY
CANADA, 1978

(PERCENT OF TOTAL AVERAGE TOTAL COMPENSATION PER EMPLOYEE)

Expenditure	FORESTRY		MINING	
	Union	Non Union	Union	Non Union
Straight Pay ¹	72.1	72.6	63.1	67
Other Pay For Time Worked ¹	7.6	7.8	10.8	14.3
Paid Absence ²	2.1	2.4	3.3	2.1
Other Direct Payments ³	1.2	0.5	2.1	0.8
Private Pension Plans	1.1	1.7	3.9	1.6
Private Life, Health and Other Benefit Plans ⁴	1.6	1.4	2.6	1.2
Non-Legally Required Benefits	13.6	13.8	22.7	20.0
Legally Required Benefits ⁵	14.3	13.6	14.2	13.0

- Notes: (1) Includes commissions, incentive bonuses, overtime pay, shift premium and other premium pay.
 (2) Sick leave pay, vacation pay.
 (3) COLA, Christmas bonuses, taxable benefits not legally required.
 (4) Dental, disability insurance.
 (5) Workmen's Compensation, Canada or Quebec Pension Plan, Provincial Medicare Plans, 4% vacation pay, Unemployment insurance, paid holidays.

Table VIII (cont'd)

Expenditure	MANUFACTURING		TRANS., COMM., UT.	
	Union	Non Union	Union	Non Union
Straight Pay	68.4	73.9	67.8	71.1
Other Pay For Time Worked	9.1	6.5	8.1	7.2
Paid Absence	3.1	3.6	4.1	4.2
Other Direct Payments	2.1	1.2	1.8	1.6
Private Pension Plans	3.0	2.4	6.8	5.0
Private Life, Health and Other Benefit Plans	2.7	1.5	1.6	1.7
Non-Legally Required Benefits	20.0	15.2	22.4	19.7
Legally Required Benefits	11.6	10.9	9.8	9.2

Table VIII (cont'd)

Expenditure	FINANCE		CONSTRUCTION	
	Union	Non Union	Union	Non Union
Straight Pay	67.5	48.3	71.4	68.4
Other Pay For Time Worked	13.8	35.6	10.0	14.9
Paid Absence	4.2	2.5	3.3	2.8
Other Direct Payments	2.1	0.6	1.0	1.0
Private Pension Plans	2.3	3.4	1.2	1.0
Private Life, Health and Other Benefit Plans	1.3	1.5	1.7	0.4
Non-Legally Required Benefits	23.7	43.6	17.2	20.1
Legally Required Benefits	8.8	8.1	11.4	11.5

Table VIII (cont'd)

Expenditure	TRADE		PUBLIC ADMINIS.	
	Union	Non Union	Union	Non Union
Straight Pay	75.2	79.9	71.2	72.7
Other Pay For Time Worked	5.6	4.6	5.8	8.1
Paid Absence	4.1	4.0	5.2	2.9
Other Direct Payments	1.2	0.9	1.1	0.0
Private Pension Plans	2.2	0.9	5.6	4.1
Private Life, Health and Other Benefit Plans	1.7	0.7	1.3	1.8
Non-Legally Required Benefits	14.8	11.1	19.0	16.9
Legally Required Benefits	10.0	9.0	9.8	10.4

Table IX
 MEANS, STANDARD DEVIATIONS, AND LISTING OF VARIABLES
 CANADA, 1978
 (sample = 56 industries by union status)

Variable Name	Definition	Mean	Standard Deviation
D/Y	Expenditure on D-type provisions as a percentage of total compensation.	15.11	6.04
PERFEM	Female employment as a percentage of total employment.	28.49	18.97
Y	Average total compensation per annum.	15470	4034.7
W	Average straight time pay per annum.	11112	2316.2
HRS	Average number of hours worked per annum.	2007.5	112.43
PERSAL	Salaried employees as a percentage of total employment.	25.08	20.06
A	Average expenditure by employers, per annum, on overtime, commissions and bonuses, shift premium pay.	7.01	3.30
B	Average expenditure by employers, per annum on paid absence (vacation pay and sick leave).	2.61	1.23
C	Average expenditure by employers, per annum on COLA, Christmas bonuses and taxable benefits.	1.29	1.13
D	Average expenditure on pensions per annum by employers as percentage of total compensation.	2.56	2.09

Table IX (cont'd)

Variable Name	Definition	Mean	Standard Deviation
E	Average expenditure on insurance plans by employers per annum as percentage of total compensation (life and health insurance).	1.63	1.04
Sk ^a	Proxy measure for skewness of the distribution of total compensations.	-.45	1.24

^aSee the text for the definition.

Table X
ESTIMATED REGRESSION COEFFICIENTS, FROM VARIOUS UNION
MEMBERSHIP EQUATIONS, FOR SEVERAL INDUSTRIES
CANADA, 1978

(dependent variable = union status of industry)*

(A)		(B)	
Independent Variables	OLS Linear Probability	Independent Variables	OLS Linear Probability
% Female Employed	.039* (.015)	% Female Employed	.028 (.017)*
Average straight time pay	.0003* (.0001)	Average straight	(.0003 (.0001)*
D-type benefits ¹ Average hrs. worked per annum	.001 (.002)	D-type benefits Average hrs. worked per annum	.0002 (.0002)
A. Overtime	.012 (.07)	A+B+C+D+E ¹	.0698* (.0416)
B.	.149 (.201)	Industry Variables	
C.	-.007 (.165)	Forestry/Mining	-.623 (1.34)
D. Pension	.201 (.131)	Manufacturing	.103 (1.24)
E. Insurance	.744 (.219)*	Transportation	-.828 (1.32)
Skewness ²	-.256 (.156)*	Trade	1.12 (1.67)
Constant	-2.42 (4.48)	Finance	.147 (1.58)
R ² /S.E.E.	.22/1.45	Services	.597 (1.43)
D.W.	3.41	Construction	-.222 (1.685)
Sample size	56		

*Source: see text.

(1) Standard errors are in parentheses.

Table X (cont'd)

(B)	
Independent Variables	OLS Linear Probability
Skewness ²	-.368 (.231) *
Constant	-1.06 (4.77)
R ² /S.E.E.	.132/1.575
D.W.	3.64
Sample size	56

*Sources: see Table IV, note (a).

- (1) For description see Table IX.
- (2) See expression (17) for the definition.

Table XI
COMPOSITION OF EMPLOYER EXPENDITURES ON EMPLOYEES,
BY UNION STATUS AND MAJOR INDUSTRY
QUEBEC AND ONTARIO, 1978
(PERCENT OF AVERAGE TOTAL COMPENSATION PER EMPLOYEE)

FORESTRY				
Expenditure	Quebec		Ontario	
	Union	Non Union	Union	Non Union
Straight Pay	69.8	76.9	72.6	76.3
Other Pay For Time Worked ¹	4.8	3.9	7.4	1.8
Paid Absence ²	1.6	2.2	1.1	2.6
Other Direct Payments ³	2.1	0.9	1.1	1.3
Private Pension Plans	0.3	0.3	1.1	0.0
Private Life, Health and Other Benefit Plans ⁴	0.9	0.8	1.4	1.4
Non-Legally Required Benefits	9.7	8.1	12.1	7.1
Legally Required Benefits ⁵	20.5	15.	15.3	16.6

- Notes: (1) Includes commissions, incentive bonuses, overtime pay, shift premium and other premium-pay.
 (2) Sick leave and vacation pay.
 (3) COLA, Christmas bonuses, taxable benefits not legally required.
 (4) Dental, disability insurance.
 (5) Workmen's compensation, Canada or Quebec Pension Plan, Provincial Medicare Plans, 4% Vacation Pay, Unemployment insurance, paid holidays.

Table XI (cont'd)

MINING				
Expenditure	Quebec		Ontario	
	Union	Non Union	Union	Non Union
Straight Pay	66.2	66.3	61.1	68.2
Other Pay For Time Worked	9.2	11.2	7.3	7.0
Paid Absence	2.3	2.1	4.0	4.2
Other Direct Payments	2.2	0.7	2.0	1.9
Private Pension Plans	1.3	0.4	5.9	3.1
Private Life, Health and Other Benefit Plans	1.7	0.9	3.0	1.5
Non-Legally Required Benefits	16.7	15.3	22.2	17.7
Legally Required Benefits	17.1	18.4	16.7	14.1

Table XI (cont'd)

MANUFACTURING				
	Quebec		Ontario	
Expenditure	Union	Non Union	Union	Non Union
Straight Pay	71.7	73.5	65.4	72.6
Other Pay For Time Worked	8.6	7.4	9.9	6.3
Paid Absence	2.7	2.3	2.5	2.4
Other Direct Payments	0.7	1.5	3.1	1.7
Private Pension Plans	1.9	1.6	3.8	3.1
Private Life, Health and Other Benefit Plans	1.9	1.0	3.3	1.9
Non-Legally Required Benefits	15.8	13.8	22.6	15.4
Legally Required Benefits	12.5	12.7	12.0	12.0

Table XI (cont'd)

TRANSPORTATION, COMMUNICATIONS, UTILITIES				
Expenditure	Quebec		Ontario	
	Union	Non Union	Union	Non Union
Straight Pay	67.8	66.3	67.5	75.1
Other Pay For Time Worked	7.1	6.4	7.7	7.1
Paid Absence	3.9	3.0	3.4	2.5
Other Direct Payments	1.5	4.5	2.0	0.6
Private Pension Plans	6.8	7.6	6.8	2.3
Private Life, Health and Other Benefit Plans	1.4	2.2	2.0	1.8
Non-Legally Required Benefits	20.7	23.7	21.9	14.3
Legally Required Benefits	11.5	10.0	10.6	10.6

Table XI (cont'd)

FINANCE				
	Quebec		Ontario	
Expenditure	Union	Non Union	Union	Non Union
Straight Pay	81.7	76.4	75.6	72.
Other Pay For Time Worked	2.3	6.7	6.6	6.
Paid Absence	2.8	3.0	1.5	2.2
Other Direct Payments	0.1	0.2	0.2	0.4
Private Pension Plans	1.4	1.6	1.9	5.9
Private Life, Health and Other Benefit Plans	0.8	0.9	0.1	1.3
Non-Legally Required Benefits	7.4	12.4	10.3	16.7
Legally Required Benefits	10.9	11.2	14.1	10.8

Table XI (cont'd)

CONSTRUCTION				
Expenditure	Québec		Ontario	
	Union	Non Union	Union	Non Union
Straight Pay	66.4	68.7	76.6	80.1
Other Pay for Time Worked	12.7	12.2	5.0	1.8
Paid Absence	4.5	3.2	2.5	2.8
Other Direct Payments	0.7	1.9	1.8	0.5
Private Pension Plans	2.5	1.6	0.9	0.8
Private Life, Health and Other Benefit Plans	0.8	0.3	2.3	0.3
Non-Legally Required Benefits	21.2	19.2	12.5	6.2
Legally Required Benefits	12.4	12.1	10.9	13.7

Table XI (cont'd)

TRADE				
Expenditure	Quebec		Ontario	
	Union	Non Union	Union	Non Union
Straight Pay	72.9	78.7	75.2	80.7
Other Pay For Time Worked	7.6	5.5	4.2	3.6
Paid Absence	2.8	1.9	3.1	1.9
Other Direct Payments	1.5	0.3	1.5	1.1
Private Pension Plans	2.1	1.1	2.3	0.9
Private Life, Health and Other Benefit Plans	1.4	0.5	2.5	0.9
Non-Legally Required Benefits	15.4	9.3	13.6	8.4
Legally Required Benefits	11.7	12.0	11.2	10.9

Table XI (cont'd)

P. ADMIN.				
	Quebec		Ontario	
Expenditure	Union	Non Union	Union	Non Union
Straight Pay	68.5	n/a*	71.4	n/a
Other Pay For Time Worked	6.5	n/a	4.8	
Paid Absence	5.1	n/a	2.9	n/a
Other Direct Payments	1.0	n/a	0.8	n/a
Private Pension Plans	5.7	n/a	6.2	n/a
Private Life, Health and Other Benefit Plans	1.2	n/a	1.5	n/a
Non-Legally Required Benefits	19.5	n/a	16.2	n/a
Legally Required Benefits	12.0	n/a	12.4	n/a

*n/a = not applicable.

Table XII

MEANS, STANDARD DEVIATIONS, AND LISTING OF VARIABLES

QUEBEC, ONTARIO, 1978

(sample size = 108 industries by union status)

Variable Name	Definition	Mean	Standard Deviation
D/Y	Average expenditure on D-type provisions as a percentage of total compensation.	14.05	6.92
PERFEM	Female employment as a percentage of total employment.	26.54	20.69
PERSAL	Salaried employees as a percentage of total employment.	18.38	15.58
W	Average pay for time worked per annum.	11104	2610.3
Y	Average total compensation per annum.	14881	3727.1
HRS	Average number of hours worked per annum.	2028.6	118.22
A	Average expenditure by employers, per annum, on overtime, commissions and bonuses, shift premium pay, and other pay for time worked.	6.67	4.00
B	Average expenditure by employers, per annum, on paid absence (vacation pay, and sick leave).	2.30	1.00
C	Average expenditure by employers, per annum, on COLA, Christmas bonuses, severance pay and taxable benefits.	1.33	1.47

Table XII (cont'd)

Variable Name	Definition	Mean	Standard Deviation
D	Average expenditure by employers, per annum, on pension plans as a percentage of total compensation.	2.02	2.04
E	Average expenditure by employers per annum on insurance plans as a percentage of total compensation (life and health insurance).	1.46	.95
Sk ^a	Proxy measure for the skewness of the distribution of total compensations.	.188	1.83

^aSee expression (13) for the definition.

Table XIII

ESTIMATED REGRESSION COEFFICIENTS FROM VARIOUS UNION

MEMBERSHIP EQUATIONS, FOR SEVERAL INDUSTRIES

QUEBEC AND ONTARIO, 1978

(dependent variable = union status of industry)*

Independent Variables	OLS Linear Probability	
D-type benefits:	.063	x
A+B+C+D ¹	(.024)*	
Average hours worked per annum	-.0024 (.0015)*	-.001 (.001)
Average pay for time worked	.0001 (.0001)	-.00003 (.0001)
Provincial variable (0=Quebec, 1=Ontario)	-.148 (.296)	x
Industry variable: Forestry/Mining	-.549 (1.10)	x
Manufacturing	-.046 (.842)	x
Transportation	-.180 (.922)	x
Trade	.175 (1.04)	x
Finance	-.238 (1.13)	x
Services	.138 (1.16)	x
Construction	-.283 (1.14)	
Skewness ²	-.034 (.095)	-.049 (.071)
Constant	8.58* (2.98)	6.23 (2.53)*

Table XIII (cont'd)

Independent Variables	OLS Linear Probability	
<u>By type of D-type provision:</u>		
A	0.029 (0.037)	
B	0.297 (0.183)*	
C	-.225 (0.114)*	
D	0.035 (0.091)	
E	.518 (.172)*	
Sample size	108	108

*Sources: see Table IV, note (a).

(1) For description, see Table XII.

(2) See expression (13) for the definition.

in the dependent variable such outcome is perhaps not surprising. Finally, note also that the skewness measure is negative and statistically significant. The negative sign on the coefficient of Sk_j in Table X indicates once again that higher degrees of (industrial) unionization are consistent with a positively skewed distribution of average total compensations by industry as measured by variable (13). Such a result is supportive of the hypothesis developed in chapter II. The provincial results are similar although Sk_j is not statistically significant. While the wages variable too is not significant the hours variable is in one case (left hand column) so that hours worked appear to be lower under unionism. Neither the Provincial nor the Industry dummies are significant than in the regression on Canadian data. Expenditures on paid absence appears to be higher under unionism as does expenditure on insurance plans.

Expenditures on Cola, Christmas bonuses and taxable benefits (e.g., personal car used for business, company tools and clothes unless given to the worker; see tax guide under employee taxable benefits) are lower under unionism than in the non union sector. It is likely that taxable benefits are greater in non union arrangements than in Union-firm contracts which indicates that Unions are relatively more successful in channelling payments to workers into non-taxable type benefits. However, in the absence of a detailed expenditure breakdown one cannot conclude with certainty of this last point.

Overall, the results could be seen as supportive of the view that unions change the structure of the contract relative to what it would have been in a non-union situation.

(c) The Union Effect on Fringes: U.S. Evidence

The two studies to be discussed below, by Freeman (1978) and

Ichniowski (1978), employed the same techniques to test the significance of the difference in the share of the cost of fringe benefit (to employers) relative to total compensation between union and non union labour. Freeman's paper analyzes unionism among non-office workers while Ichniowski's paper dealt with the economic effects of the Firefighters' Union. Freeman (1978) hypothesizes that the share of fringes in union-firm contracts is greater than in the non-union case because union workers demand comparatively more such benefits as they are relatively less mobile (e.g., older) and less likely to quit (e.g., due to voice mechanisms purchased through the union). Table XIV gives the distribution of average total compensation between wages and fringe benefits. It appears once again that, on average, the percentage of non legislated fringe benefits in total compensation is higher under unionism (16.7% versus 10.6% of total compensation in the non union sample).

Freeman estimated the following model of the impact of unions on fringe benefits. He let

$$F_i = a + bC_i + cUN_i + dX_i + U_i \quad (1)$$

where, F_i = voluntary (i.e., non-legislated) fringes per man hour for blue collar workers,

C_i = total compensation per man hour,

UN_i = 0-1 dummy variable for the presence of a bargaining unit,

X_i = a vector of control variables (age, mean years of schooling, the ratio of office to non-office employees (as a measure of firm size)),

U_i = A random disturbance term.²⁴

TABLE XIV - Expenditure data on Fringes(U.S.),Private Sector*

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Type of Compensation	Union(4973 firms) ¹	Non-Union(5115 firms)
	(% of total Compensation)	
Straight Pay(Wages)	77.3	82.6
All Fringes	22.7	17.3
Legally required Fringes	6.5	6.7
By type of Fringe:		
Life,Accident,Health	3.6	1.7
Overtime,Shift Premium,		
Sick leave,Bonuses,Other ²	5.1	4.1
Vacation,Holiday	4.0	3.5
Pensions.	3.5	1.3
Total	<u>16.2</u>	<u>10.6</u>

*in 1967

Notes:(1)Workers belonging to a bargaining unit are considered Unionized when at least 50% of them belong to a Union

(2)Severance Pay,Savings Plans and Other Private Welfare Benefits.

Source:Freeman(op. cit.)

Table XV displays the principal results of the estimation of (1) corrected for simultaneity. The presence of a collective agreement raises expenditures on fringe benefits by almost 12¢ per hour. Hence, *ceteris paribus*, the presence of a union increases the share of fringes in total compensation. This increase represents approximately 24% of the mean level of expenditures on fringes according to Freeman's sample.²⁵

In elasticity terms, this effect translates into an elasticity of fringes with respect to compensation (resulting from a \$1 increase in straight pay) of \$1.42 ($\Delta F/\Delta C \times C/F = (.274/1) \times (2.54/.49)$) where 2.54 is the mean level of compensation and .49 is average expenditures on non-legislated fringes).²⁶

(In a paper investigating the economic effects of the Firefighters' Union, C. Ichniowski uses essentially the same model as Freeman's to test the union effect. His approach is nevertheless slightly different in that he was interested in the union effect at a point in time (as was Freeman) as well as the union's impact on wages and fringe benefits according to the length of time the union was organized (not analyzed by Freeman). His principal results are shown in Table XVI (see Ichniowski (1978), Table 2, p. 14). It is clear from this table that the union effect varies with the length of time organized although there are

few statistically significant independent variables. For example we see that the presence of a union contract in both years sampled (1976 and 1966) raises total compensation by 8.2% whereas this figure is only 2.6% for firefighters who had a contract in 1976 only. Also, firefighters no longer unionized in 1976 saw a drop of 6.2% in total compensation but since wages did not change significantly during the 1966-76 period it can be interpreted that almost all of the change was in terms of expenditures on fringe benefits (since $C_i = F_i + S_i$). This result, and the fact that the union effect is significantly greater on total compensation than on wages indicates a rise in the share of fringe benefits in total compensation in the presence of a union-firm contract. Furthermore we also notice from Table XVI that while the presence of a union reduces hours worked the difference between the 1966-1976 union firefighters (2.7% decline) and the 1966-only union firefighters (2.9% decline) is not significant.

Finally, in a larger sample of 1097 cities, Ichniowski found that the presence of a union contract raises expenditures of fringes by 9.4%.²⁷ It can be seen from U.S. evidence that unions alter the structure of the employment contract from what it would have been in a non-union situation. Such an outcome means that, ceteris paribus, $(D/Y)^u > (D/Y)^n$, where $D = P_F + NP$. The above statistical analyses have basically limited themselves to the fringe

TABLE XV - Union effect on Fringes*

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Dependent variable: Dollar per Man hour expended on other than legally required fringes

Independent variables	Coefficients	
	Linear Form	Log linear Form
Collective Bargaining *	.118(.012)	.178(.022)
Straight Pay	.274(.006)	1.109(.026)
Size(proportion of Office to non-Office Workers)	.04(.002)	.097(.005)

$R^2 = .61$
SEE = .224

*Source:Freeman(1978),p18. The estimates are for equation(1) corrected for simultaneity(cf n.24). The figures in parenthesis are the Standard errors..Figures are in cents. All independent variables are significant at the 5% level.

TABLE XVI - Firefighters' Union impact across time¹.

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	Contract in 1966 and 1976	1976 only ²	1966 only ³
Total Compensation	.082(.034)*	.026(.023)	-.061(.031)*
Wages (Salary/hour)	.079(.031)*	.036(.021)*	.009(.028)
Hours	-.027(.015)*	-.014(.01)	-.029(.013)*

- Notes: (1) For the list of control variables see Ichniowski (op. cit., p12). Standard errors are in parenthesis. An asterisk (*) signifies that the relevant independent variable was found to be statistically significant at the 5% level.
- (2) Signifies that the Firefighters in the relevant sample did not have a Collective Agreement in 1966.
- (3) Signifies that the Firefighters in this sample who had a Collective Agreement in 1966 were no longer Unionized in 1976.

Source: Freeman (op. cit.), Table 2, p14.

benefits and hours components of collective and individual-firm agreements so that the results only capture part of the union effect. But what these results demonstrate is that fringe benefits are an important feature of union-firm employment contracts.

Conclusions

The evidence presented in this chapter tends to support the hypothesized relationship between the two variables introduced in this thesis to explain contractual arrangements in the labour market (see Chapter II), namely

- (1) That those workers with a higher demand for D-type benefits are the most likely ones to unionize, and
- (2) the skewness of the distribution of wages or compensations also determines the likelihood of choosing the union-firm employment contract.

Furthermore these results seem to hold at different levels of aggregation in the data.

NOTES TO CHAPTER III

¹In addition to speaking with members of the Research and Planning Branch at the B.C. Ministry of Labour as well as Labour Canada and Statistics Canada officials I contacted several officials in unions and employers' associations in B.C. I was assured by all that no such data exist.

²Probit and Logit analysis. These are described later on.

³See Addison and Siebert (1979), ch. 8. Such an approximation for ϕ , the probability of selecting a union-firm contract, is reasonable if we view the degree of unionization as obeying the binomial probability distribution for which the mean frequency of occurrence is precisely this proxy. In turn, this signifies that we view the decision by a group about whether or not to unionize to be independent of a similar decision by other groups.

⁴Only recently (see Farber and Sacks (1980)) has an attempt been made to isolate, statistically, the reasons for unionization at the bargaining unit level.

⁵I am extremely grateful to the Labour Costs Unit of Statistics Canada for making available to me unpublished data on union and non union workers.

⁶This study is the first to make such extensive union non union statistical comparisons using Canadian data.

⁷A worker is considered to be a union member if at least 50% of the employees in an establishment are covered by a collective agreement. Where the employer sampled indicated that less than 50% of employees are covered by a union contract these workers were included in the non union category. Occupational categories are based on the Canadian Classification and dictionary of occupations published by Canada Employment and Immigration in collaboration with Statistics Canada. "The most important criteria used in selecting the occupations are the following: numerical importance, prevalence throughout the industry or community, importance in the production process, and capability of clear definition." See Wage rates, salaries and hours of labour, Labour Canada, October 1977.

⁸ These other factors have to do with complementary theories of union existence. See chapter I.

⁹ See section 2., chapter II.

¹⁰ Note that since we are using the overall mean wage and the median non union wage expression (3) is not equivalent to a test of the monopoly hypothesis of unionization.

¹¹ See section 2(b), chapter II. Skewness is defined as

$$Sk = \frac{\sum (Y_i - \bar{Y})^3}{Ps^3}$$

where Y is total compensation, $\bar{Y}$ is average total compensation, P the sample size and s the standard deviation of the sample.

¹² The mean union wage was also employed as well as the overall mean of union and non union wages. Regardless of the variables used the sign of Sk in the various regressions was the same.

¹³ In other words, the non union segment of an occupation is the best available proxy for what the wage distribution would be like in the absence of a union while the average union wage is our best available measure for the average product of the group if it were entirely unionized. Other factors of course may affect wages in both sectors and hence the likelihood of unionization. These are discussed later on.

¹⁴ The information comes from the most recent turnover data available (according to sex).

¹⁵ Included as office employees are, "supervisory, professional and technical staff, and personnel engaged in clerical, accounting, secretarial, sales, executive and administrative activities." See Wage rates, salaries and hours of labour, *ibid*.

¹⁶ Maintenance employees include "workers directly engaged in the production of goods or services and the provision of maintenance and auxiliary services closely associated with production operations." See Wage rates, salaries and hours of labour, *ibid*.

¹⁷ A list of all office and maintenance occupations is presented in Table III.

¹⁸Pindyck and Rubinfeld ((1976), p. 250) suggest that a slightly modified version of (11) be used in order to improve the estimation, namely

$$\log ((U_i + \frac{1}{2})/E_i - U_i + \frac{1}{2})).$$

The estimates presented in the text are based upon this suggested correction.

¹⁹Kurtosis measures the degree of 'peakedness' of a distribution. This usually implies that the distribution with the lower 'peak' is also the distribution with the greatest degree of dispersion which appears to be true of non union wages relative to union wages which have a far higher 'peak'.

²⁰Statistics Canada officials reported that one should be skeptical about wage information about female workers. Employers it appears (even though the names of employers are kept confidential) tend to provide false (and higher than actual) information about wages paid to female workers.

²¹The fact that a high proportion of women are employed in this industry may also have affected the sign of this coefficient.

²²Another proxy that was tried was the median of the mean total compensations of subindustries within an industry. When this proxy was employed instead of $\bar{Y}_j$ in Sk_j , its sign in the regressions (not shown) was not affected.

²³When regressing with Logit of US_j as the dependent variable no independent variable, except for W_j or $\ln(\bar{w}_j)$, was statistically significant when weighted least squares was not used. The results using weighted least squares, are presented in the appendix. The variables of interest (D and Sk) are not statistically significant but several of the industry dummies are significant with a negative sign for the coefficients in the Quebec and Ontario sample only.

²⁴The equation was also estimated in log linear form. Because $C_i = F_i + S_i$ (straight pay) this implies that $C_i - S_i = F_i$ and so there is a problem of simultaneity involved with the use of (1). Another equation was estimated to correct for this problem by substituting C_i in (1) with $F_i + S_i$ and solving for F_i .

²⁵ $.12/.49 \times 100 = 24\%$, where .49 is the mean expenditure on non-legislated benefits ($.70 \times .4973$) (union employees samples) + .29 (non-union exp. on non-leg. fringes) $\times .5115$, and .12 is the union effect referred to in the text.

.24 (= .12/.49)). The elasticity of fringes with respect to compensation (from a \$1 increase in straight pay) was also smaller (1.11 instead of 1.42).

²⁷See Ichniowski, *ibid.*, Table 3, p. 15.

Chapter IV

SUMMARY AND CONCLUSIONS

We have come a long way since describing the types of employment contracts that generally exist within the labour market (see chapter II, section 1.).

Two types of employment contracts were distinguished. The first, the so-called individual-firm employment contract, refers to an arrangement between a single individual and the firm. This mode of contracting may be implicit or explicit depending on such variables as custom or habit and, of course, the costs of setting up a formal legal document.

The other type of contract is a collective one whereby a group of individuals agree to a common set of terms and conditions with their employer. The dominant such arrangement in the labour market is the union-firm contract.

At the outset we established the goal of attempting to offer an explanation for the coexistence of these two types of arrangements within the same market. It was noted that while complementary theories of union existence have already been suggested our approach was novel in that it attempted to examine the determinants of the choice

of contractual arrangements by a group of workers considering the alternatives of whether or not to elect for union representation. In so doing we assumed that the union is a majority voting institution and that, as a result, coercion will exist.

Our analysis developed the following two major determinants in the selection of the employment contract. It was argued that since unions are seen to standardize wage rates this is equivalent to a situation where signalling is suppressed. Signalling is defined as an attempt by individuals to transmit, to prospective buyers, information about themselves that would be used to establish their level of compensation.

When signalling is suppressed the firm is unable to distinguish between workers according to productivity resulting in the payment of the average product instead of the marginal product which would be paid under a full signalling situation. This assumes of course that signalling results in the correct classification of workers according to their productivity. Otherwise there is not signalling and each worker receives the average product as his payment for labour services.

The choice therefore is between a compensation equal to the average product under unionism and a compensation equal to the marginal product (less signalling costs, if any) under an individual-firm arrangement. Since the deciding vote belongs to the median voter in a majority voting situation it is essentially his

choice which matters. If his net compensation under an individual-firm type contract is above the mean product of the group then a majority will vote down union representation. On the other hand if the median voter's net returns from signalling are below the group average product then a majority will prefer the union arrangement.

It was argued that the third moment about the mean, the measure of skewness in a distribution, would provide us with a decision rule that would enable us to evaluate a group's choice about the appropriate type of employment contract.

It was hypothesized in chapter II that unionized workers place a greater value on other than wage benefits in the employment contract relative to non-union workers. In other words, the demand price for such provisions is higher under unionism (see Figure 2, chapter II). These so-called D-type benefits include the pecuniary (future) and non-pecuniary provisions (see Table I, chapter II). Pecuniary (future) provisions are benefits which are consumed after employment has ceased because of age, tenure or unemployment. Pensions and supplemental unemployment benefits are examples of such benefits (see Table I, chapter II, for the complete list of contractual provisions). Non-pecuniary benefits are usually consumed during employment but are non monetary in nature. Examples include such items as grievance procedures, flexibility of work schedule and

atmosphere in the plant. Given this classification of the provisions of an employment contract we then asked ourselves why do union workers demand more of the D-type benefits than their non-union counterparts? It was argued (see section 2.(c), chapter II) that unions must concern themselves with exit, which would result in an erosion of its 'taxing' base because of the coercive nature of majority voting rule. Furthermore the public goods in employment would not be purchased by workers through the firm unless all the members of the bargaining unit shared in the costs of acquiring them. The union serves as the institution through which free riders are prevented from belonging to the group. As a result of these elements, it was concluded that $(D/Y)^u > (D/Y)^n$, where Y represents total compensation.

In the section on signalling we saw that the minority coerced into unionization would be worse off under such an arrangement. It was then argued that the minority may nevertheless be made at least as well off as it would have been in the absence of unionization by a change in the structure of the employment contract. In other words, modifying the distribution of benefits in the employment contract could result in an improvement of the welfare enjoyed from such a contract. Therefore a contract with a compensation of 1.5 may not necessarily be more preferred than a contract with a compensation of 1.0 if a significant

share in the latter contract is composed of D-type benefits. On the other hand, coercion by the majority could result in exit by the relatively more productive minority despite the modification in the contract structure. This would depend on the attributes of the minority group such as age, aversion to risk all of which enter into the determination of the amount of D-type benefits which are purchased through a collective arrangement.

To summarize, the skewness of the distribution of compensations (net of signalling costs, if any), Sk , as well as the demand price for D-type benefits in the contract, DPD , determine the likelihood, ϕ , of selecting the union-firm arrangement. In functional form this is written

$$\phi = Z(Sk, DPD)$$

where $(\phi | Sk > 0) > (\phi | Sk < 0)$ and $\partial \phi / \partial DPD > 0$, subject to an upper limit on the amount of D-type benefits in any contract.

In the last chapter considerable evidence was presented, albeit at a higher than desired level of aggregation, in support of the hypotheses of this thesis. Probit and Logit type specifications were employed to test the validity of the theory developed in chapter II. Using cost data on expenditure by employers on D-type benefits as well as wage distribution information it was found that the share of

D-type benefits relative to total compensation, employed as an empirical measure of the revealed demand for these types of benefits, partially determines the likelihood of unionization. Furthermore highly unionized occupations or industries are consistent with a positive value for estimated S_k as expected. Also true is a negative value for estimated S_k in occupations or industries with a low degree of unionization.

What is needed is more comprehensive information describing the union and non union segments of the labour market so that a more detailed test can be developed. A smaller degree of aggregation than is now available is necessary for this and it would be desirable if, someday, such an analysis using Canadian data were attempted. Hopefully, we have succeeded in demonstrating the basic features involved in the choice of contractual arrangements in the labour market as well as sorting out some of the issues involved in the selection process.

Appendix

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TABLE VI(a) - VII(a)
ESTIMATED REGRESSION COEFFICIENTS FROM VARIOUS DEGREES OF
UNIONIZATION EQUATIONS, FOR DIFFERENT OCCUPATIONS
CANADA, 1978
(dependent variable = degree of unionization)*

Independent variables ¹	WLS Logit	WLS Logit
<u>Industry controls</u>		
Manufacturing	-0.014 (0.028)	0.020 (0.070)
Transportation	0.019 (0.018)	0.014 (0.054)
Trade	0.046 ^a (0.019)	0.019 (0.054)
Finance	0.014 (0.019)	0.060 (0.063)
Public Administration	-0.003 (0.013)	0.037 (0.045)
Services	0.008 (0.014)	0.038 (0.048)
Sex	-0.288 ^b (0.179)	-0.11 (0.41)
Type of occupation	0.053 (0.224)	0.549 (0.659)
D-type provisions	0.209 (0.291)	0.336 (0.628)
Skewness ² (Sk')	0.128 (0.187)	
Skewness (Sk)		-0.006 (0.032)

3 3
OF / DE

Table VII(a) (cont'd)

Independent variables	WLS Logit	WLS Logit
Constant	163.14 (13.83)	978.21 ^c (631.58)
R ² /S.E.E.	0.42/58.67	.279/803.60
Durbin Watson	1.96	1.91
Sample size	80	80

- a. Significant at the 1% level
b. Significant at the 5% level
c. Significant at the 7.5% level
Sources: see text

Notes: (1) The threat effect variable was not statistically significant in any of the regressions.

TABLE X(a)
ESTIMATED REGRESSION COEFFICIENTS, FROM VARIOUS UNION
MEMBERSHIP EQUATIONS, FOR SEVERAL INDUSTRIES
CANADA, 1978

(dependent variable = union status of industry)*

(A)		(B)	
Independent variables	WLS logit	Independent variables	WLS Logit
		% Female Employed	-0.016 (0.017)
Average straight time pay	-0.0001 (0.150)	Average straight time pay	-0.001 ^a (0.0005)
D-type benefits		D-type benefits	
Average hrs worked per annum	0.0005 (0.001)	Average hrs worked per annum	0.0007 (0.0013)
A. Overtime	0.04 (0.07)	A+B+C+D+E ¹	-.119 (0.08)
B.	-0.497 ^b (0.306)		
C.	-0.051 (0.180)	Industry	
D. Pension	0.014 (0.124)	<u>Variables</u>	
E. Insurance	0.216 (0.255)	Forestry/Mining	1.452 (1.888)
Skewness ²	0.004 (0.161)	Manufacturing	1.666 (1.726)
Constant	82.05 (228.79)	Transportation	2.552 (2.00)
R ² /S.E.E.	.10/624.22	Trade	1.659 (1.592)
Sample size	70 (56 D.F.)	Finance	2.267 (2.372)
		Services	1.6414 (1.837)
		Construction	1.4361 (1.45)

standard errors are in parentheses

Table X(a) (cont'd)

(B)	
Independent variables	WLS Logit
Skewness ²	0.088 (0.179)
Constant	67.45 (241.15)
R ² /S.E.E.	.112/618.8
Sample size	70 (56 D.F)

*Sources: see Table IV, note (a)

(1) For description see Table IX

(2) See expression (17) for the definition

a. significant at the 2.5% level

b. significant at the 7.5% level

TABLE XIII(a)
 ESTIMATED REGRESSION COEFFICIENTS FROM VARIOUS UNION
 MEMBERSHIP EQUATIONS, FOR SEVERAL INDUSTRIES
 QUEBEC AND ONTARIO, 1978
 (dependent variable = union status of industry)*

Independent Variables	WLS Logit	WLS Logit
<u>D-type benefits:</u>		
A + B + C + D ¹	-0.02 (0.019)	X
Average hrs worked per annum	0.003 (0.007)	0.0008 ^a (0.0002)
Average pay for time worked	-0.0002 ^a (0.00007)	-0.00004 (0.00004)
Provincial variable (0=Quebec, 1=Ontario)	-0.071 (0.184)	X
<u>Industry variables:</u>		
Forestry/Mining	-1.552 (1.720)	X
Manufacturing	-2.687 ^a (1.386)	X
Transportation	-2.675 ^a (1.339)	X
Trade	-2.126 ^b (1.428)	X
Finance	-1.635 (1.644)	X
Services	-2.703 ^a (1.351)	X
Construction	-2.128 ^b (1.411)	X
Skewness ²	-0.067 (0.095)	-0.073 (0.074)
Constant	-203.66 (151.05)	-57.24 (80.83)

Table XIII(a) (cont'd)

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Independent variables	WLS Logit	WLS Logit
<u>By type of D-type provision:</u>		
A		0.115 (0.017)
B		-0.195 ^b (0.121)
C		0.0738 (0.076)
D		-0.09 (0.067)
E		-.262 ^a (0.077)
Sample size	108	108
R ² /S.E.E.	.275/515.18	.31/487.72

* Sources: see Table IV, note (a)

- (1) for description, see Table XII
 (2) See expression (13) for the definition

- a. significant at the 2.5% level
 b. significant at the 5% level

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END

1 | 6 | 0 | 6 | 8 | 3

FIN