Short-term or long-term labor contracts

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Abstract

This paper analyzes the duration of labor contracts and focuses on the strategic effect arising from the different lengths that labor contracts have. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

The first theoretical works on labor contract length were made by Gray (1978), Canzoneri (1980) and Dye (1985) and provide rigorous mathematical statements which refer to the underlying determinants of contract duration. The principal conclusion drawn from these models is that a higher degree of risk and uncertainty reduces contract length whereas greater contracting costs increase contract duration.

There are several empirical studies of contract duration supporting the hypothesis that uncertainty reduces contract length while greater contracting costs increase contract duration. Christofides and Wilton (1983), in the case of non-indexed contracts, and Christofides (1985) for indexed contracts, provide positive evidence by using Canadian data; similarly, Vroman (1989) and Murphy (1992) provide positive evidence by using US union contract data.

Although the first theoretical works on labor contract duration emphasized the existence of a negative relation between contract length and uncertainty, more
recent models reach a different result. Harris and Holmström (1987) and Danzinger (1988) point out that, under certain circumstances, contract length may be positively related to uncertainty. Wallace and Blanco (1991) find little empirical evidence of a negative relationship between contract duration and uncertainty when using observations based on union manufacturing contracts negotiated in the US between 1968 and 1980. They also find that there are significant differences across industries in the response of bargain duration to uncertainty.

Wallace and Blanco (1991) argue that there are several possible explanations of why they do not find empirical evidence of a negative relationship between contract duration and uncertainty. First, the variables used to measure uncertainty may not measure adequately the shocks affecting the parties that enter the negotiations. Second, they do not consider that a contract can provide insurance against risk (of wage fluctuation, for example) and, thus, there may be forces offsetting the way in which uncertainty affects the duration of contracts (see Danzinger, 1988). Lastly, contracts may increase their length with a greater uncertainty if there is a positive correlation between information costs and uncertainty (see Harris and Holmström, 1987).

Contract negotiation is a costly activity for firms. Jacoby and Mitchell (1984) provide evidence, by using a national survey made in the U.S. during the first half of 1983, indicating that the managers of firms prefer multiyear agreements. Long-term contracts reduce uncertainty and facilitate the planning and implementation of multiyear projects; they also reduce the possibility of a strike and fixed costs can be recovered over a longer period than when contracts expire less frequently.

Mitchell (1994) argues that management and unions in the U.S. usually sign long-term contracts; long-term contracts appeared as a management demand to stabilize industrial relations and avoid frequent strikes and negotiations. Mitchell (1994) points out, that in the period 1981-1991 the tendency for the average contract duration negotiated by unions was to lengthen the duration; the average of the period in all the US industries was 32 months (if Construction were left out, the average would be 34 months). Jacoby and Mitchell (1984) show that most of the respondents who engaged in collective bargaining indicated that their organizations signed multiyear contracts; for example, the proportion negotiating contracts of a duration greater than 1 year was 99.2% of the respondents in manufacturing, 92.3% in construction and 96.8% in the total sample.

Jacoby and Mitchell (1984) suggest that, contrary to the United States, long-term contracts in other countries between unions and employers (even where unioniza-

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General Motors and United Auto Workers were the first to develop the multi-year labor agreement in the late 1940s because they found that annual negotiations in the US were very costly. In the US, before 1948, practically all labor contracts were bargained every year, but by the 1960s, the three-year agreement was common and was the pattern in contract negotiations (see Freedman and Fulmer, 1982; Jacoby and Mitchell, 1984).
tion is strong) are unusual and annual bargaining rounds are common practice. For example, in Japan and the United Kingdom, collective agreements usually fix wage rates for only twelve months (see Adnett, 1989). In Japan, the bulk of Japanese labor unions is company based and wage bargaining takes place once a year. Sasajima (1993) points out that since 1995 many unions negotiate wages in the spring time (this is called the spring labor offensive) and that about 80% of the union members participate in the spring labor offensive. In the United Kingdom, according to the 1990 Workplace Industrial Relations Survey, 95% of the collective bargains run for 1 year (Millward et al., 1992). Addison and Siebert (1993) state that after 1980 only 5% of the agreements, approximately, have had a duration of over a year. For example, in 1997, 93% of the collective agreements in the manufacturing ran for 1 year.

The purpose of this paper is to analyze the length of labor contracts focusing on the strategic effect that arises when contracts have different duration and firms compete in the product market; this question has not been considered in the preceding papers which only analyze two factors: the negotiation costs and uncertainty. So as to stress the cited strategic effect, we do not consider other factors such as negotiation costs or uncertainty.

In this paper, we consider only two types of contracts between management and unions: long-term contracts (two periods) or short-term contracts (one period). To model negotiations on the length of the contracts, we would have to consider more than two periods; this would complicate the analysis and could lead to multiplicity of equilibria. Thus, the length of the contract in each firm will be decided upon by the agent, management or union with greater bargaining strength.3

In addition to the factors that influence the duration of contracts (negotiation costs and uncertainty), in this paper, we show that there is a strategic effect to be considered. If a firm and its union sign a long-term contract while the other firm and its union sign short-term contracts, the former are Stackelberg leaders in wages when bargaining the wage of the second period (and there is to note that wages are strategic complements). This fact benefits the firm signing short-term contracts and both unions, but harms the firm signing a long-term contract. Then, if the firms decide on the length of the contract we shall have, in equilibrium, short-term contracts (it is a dominant strategy for firms to choose short-term contracts). But, if unions choose the duration of the contract one union, in equilibrium, will choose short-term contracts while the other will choose a

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2 This question has been studied, in the case of managerial incentive contracts, by Bárcena-Ruiz and Espinosa (1996).
3 There are arguments supporting this simplification. For example, Stieber (1959, p. 140) shows that, as is the case in the United States, a long-term agreement is a substantial union concession. Freedman and Fulmer (1982) argue that the pattern of the negotiation used in the United States was broken in the late 1970s because the bargaining strength of the firms increased (among other strategies, firms threatened the unions with locating productive plants abroad).
long-term contract. Thus, the paper shows that there is a strategic effect to be considered. If the firms decide on the length of the contracts, then there is a tendency to shorten the length of the contracts, since it is a dominant strategy for firms to choose short-term contracts. If the unions decide on the length of the contracts, then one union will choose a long-term contract while the other union will choose a short-term contract; thus, there are factors that help the coexistence of contracts of different duration. The paper thus stresses that when analysing the length of the contracts, we must consider the degree of risk and uncertainty, the contracting costs and the strategic effect that arise when contracts of different duration coexist.

The paper is organized as follows: Section 2 states the model, Section 3 presents the main result of the paper and Section 4 offers conclusions.

2. The model

We consider a market for a single homogeneous good with two firms. Both firms have identical technology and face linear demand. Unions as well as firms possess the same level of risk aversion. The firms seek to maximize profits while the unions seek to maximize the wage bill. We consider a variant of the “right-to-manage” model of Nickell and Andrews (1983) where the union and firm bargain over a uniform wage rate while the employment is set unilaterally by the firm (see, for example, Dobson, 1994 or Davidson, 1988). The equilibrium concept considered is the two-person Nash bargain solution (see Binmore et al., 1986). We assume that each firm is unionized and reaches a closed-shop agreement with its union; i.e., bargaining takes place at firm level.

In this paper, we would like to analyze the factors that influence the length of the labor contracts. To simplify, we only consider two periods, with production in both periods. Thus, there are two options: firms and unions bargain the wages of each period (short-term labor contracts), or they negotiate the wage of the two periods at the beginning of the first period (a long-term labor contract).

The timing of the game is as follows. In the first stage, a decision has to be taken on whether there is a long-term contract or short-term contracts; the length of the contract is observed publicly. In the second stage, the wage for the first period or the wages for the two periods are negotiated. In a long-term labor contract, the wage for the two periods is negotiated; in a short-term labor contract,
only the wage for the first period is negotiated. In the third stage, firm owners make quantity decisions for the first production period simultaneously. In the fourth stage, the wage of the second period is negotiated in those firms with short-term labor contracts. In the last stage, firm owners make quantity decisions for the second production period simultaneously. We solve backwards to get a subgame perfect equilibrium.

Demand functions are assumed to be linear, stationary and independent across periods

\[ p = a - b(q_i + q_j) \quad a, b > 0, \quad t = 1, 2, \]

where \( p \) denotes the price and \( q_i \) is the output level of firm \( i \) in period \( t \). Each firm hires \( L_i \) workers with a uniform wage rate \( w_i \). Then, the wage income of the workers of each firm is \( S_i = L_i w_i \). Technology exhibits constant return to scale such that \( q_i = L_i \).

Given that we are considering two firms, there are three possible combinations of labor contracts: (i) short-term labor contracts in both firms, (ii) a long-term labor contract in both firms and, (iii) short-term contracts in one firm and a long-term contract in the other.

3. Results

We shall first consider the case in which there are short-term labor contracts in both firms, which is a straightforward extension of the static model of one period which is commonly used (see, for example, Dobson, 1994).

3.1. Short-term labor contracts in the two firms

In the fifth stage, firms simultaneously choose their output level. The profit function of firm \( i \) in the second period is

\[ \pi_i = [a - b(q_i + q_j) - w_i]q_i \quad i, j = A, B, \quad i \neq j, \quad t = 2. \]

Then, the Cournot–Nash equilibrium output (and therefore, employment) levels and profits, as a function of wage rates, are, respectively

\[ L_i(w_i, w_j) = \frac{1}{3b} \left( a - 2w_i + w_j \right), \quad \pi_i(w_i, w_j) = \frac{1}{9b} \left( a - 2w_i + w_j \right)^2, \]

\[ i, j = A, B, \quad i \neq j, \quad t = 2. \quad (1) \]

In the fourth stage, given Eq. (1), each union bargains with its employer for the wage of the second period. The disagreement payoff of both agents is zero since it
is a ‘‘one to one’’ negotiation. The solution to the bargaining problem is then given by

$$w_i^t(w_j^t) = \operatorname{arg\,max}_{w_i^t} \left[ \pi_i^t(w_i^t, w_j^t) \right]$$

$$[w_i^tL_i^t(w_i^t, w_j^t)]$$

$$i, j = A, B, \ i \neq j, \ t = 2.$$  \hspace{1cm} (2)

where $L_i^t(w_i^t, w_j^t)$ and $\pi_i^t(w_i^t, w_j^t)$ are given by Eq. 1. Solving Eq. (2) we get

$$w_i^t(w_j^t) = \frac{a + w_j^t}{8}, \ i, j = A, B, \ i \neq j, \ t = 2.$$  \hspace{1cm} (3)

From Eqs. (1) and (3), the wages, the union’s utility measured by the wage bill and the profits of the firms are, respectively

$$w_i^t = \frac{a}{7}, S_i^t = \frac{2a^2}{49b}, \ \pi_i^t = \frac{4a^2}{49b}, \ i = A, B; \ t = 2.$$  \hspace{1cm} (4)

The results of the first period are given by the preceding expression for $t = 1$. Then

$$\pi_i^{SS} = \pi_i^1 + \delta \pi_i^2 = \left(1 + \delta\right) \frac{4a^2}{49b}, \ S_i^{SS} = S_i^1 + \delta S_i^2 = \left(1 + \delta\right) \frac{2a^2}{49b},$$

$$i = A, B,$$

where $\pi_i^{SS}$ denotes firm i’s discounted profit when there are short-term contracts in the two firms; $S_i^{SS}$ denotes firm i’s union’s discounted utility and, finally, the discount factor is denoted by $\delta$.

3.2. Long-term labor contracts in the two firms

It is easy to see that, in this case, the output level (and, therefore, employment) is given by Eq. (1), assuming that $w_i^t = w_j^t$ and $w_j^t = w_j^t$, for all $t$. We assume that with long-term contracts the wage of the two periods is the same, since we do not consider factors such as cost-of-living adjustment clauses or productivity increases (see Freedman and Fulmer, 1982).

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The main result of the paper does not change if the wage can change from one period to the other in a long-term contract. Mitchell (1989) argues that, in the United States, the wage agreements reached in the 1970s and 1980s show an increase in the number of agreements in which the wage, during the years covered by the contract, remains the same as that of the first year (though clauses are usually included to cover unforeseen events).
Solving as in the preceding case, we get equilibrium employment levels and profits as a function of wage rates

\[ L_i'(w_i, w_j) = \frac{1}{3b} \left( a - 2w_i + w_j \right), \quad \pi_i'(w_i, w_j) = \frac{1}{9b} \left( a - 2w_i + w_j \right)^2, \]

\[ i, j = A, B, \quad i \neq j, \quad t = 1, 2. \]

Since we have long-term contracts, there is not a fourth stage. The wage, in each firm, for the two periods is negotiated in stage two and the solution to the bargaining problem is then given by

\[ w_i(w_j) = \text{argmax}_{w_i} \left[ \pi_i'(w_i, w_j) + \delta \pi_j'(w_i, w_j) \right] \left[ w_iL_i'(w_i, w_j) \right] + \delta w_iL_i'(w_i, w_j) \]

\[ i, j = A, B, \quad i \neq j \] (4)

Solving Eq. (4) we get

\[ w'_i = \frac{a}{7}, \quad S'_i = \frac{2a^2}{49b}, \quad \pi'_i = \frac{4a^2}{49b}, \quad i = A, B; \quad t = 1, 2, \]

and

\[ \pi_i^{LL} = \pi_i' + \delta \pi_j' = \left( 1 + \delta \right) \frac{4a^2}{49b}, \quad S_i^{LL} = S'_i + \delta S'_j = \left( 1 + \delta \right) \frac{2a^2}{49b}. \]

\[ i = A, B. \]

where \( \pi_i^{LL} \) denotes the discounted profit of firm \( i \) when there is a long-term contract in the two firms and \( S_i^{LL} \) denotes discounted utility of the union of firm \( i \).

Given our assumption that the demand function is stationary and independent across the periods, we obtain the same result as in Section 3.1. We shall now consider the asymmetric case in which there is a long-term labor contract in one firm and short-term labor contracts in the other.

3.3. There are short-term contracts in firm \( i \) and a long-term contract in firm \( j \)

In this section we consider the expressions given in Section 3.1 assuming that \( w'_i = w_j \). It is easy to see that the second (first) period equilibrium employment levels and profits are given by Eq. (1), for \( t = 2 \) (\( t = 1 \)).

In the fourth stage, firm \( i \) bargains with its union for the wage of the second period bearing in mind that firm \( j \) has already negotiated the wage of the second period. The solution to the bargaining problem is then given by Eq. (3) for \( t = 2 \).

In the second stage, firm \( i \) and its union negotiate the wage of the first period while firm \( j \) and its union bargain the wage for the two periods. Thus, on the one
hand, the solution to the bargaining problem between firm \( i \) and its union is given by Eq. (3) for \( t = 1 \) and, on the other hand, the solution to the bargaining problem between firm \( j \) and its union is given by
\[
\argmax_{w_j} \left[ \pi^1_j(w_j, w_i^1) + \delta \pi^2_j(w_j, w_i^2(w_j)) \right] 
\times \left[ w_j L_j^1(w_j, w_i^1) + \delta w_j L_j^2(w_j, w_i^2(w_j)) \right]
\]
(5)

Solving Eq. (5) and taking into account Eq. (1) for \( t = 1, 2 \) and Eq. (3) for \( t = 2 \), we get
\[
\left[ 8(a + w_i^1 - 4w_j) + 3\delta(3a - 10w_j) \right] \left[ 64(a + w_i^1 - 2w_j) \right]^2
\]
\[
+ 9\delta(3a - 5w_j)^2
\]
\[
- \left[ 8w_j(a + w_i^1 - 2w_j) + 3\delta w_j(3a - 5w_j) \right]
\times \left[ 256(a + w_i^1 - 2w_j) + 90\delta(3a - 5w_j) \right] = 0
\]
(6)

From Eqs. (6) and (3) for \( t = 1, 2 \), we get
\[
w_j = \frac{3a(1 + \delta)}{21 + 20\delta}, \quad w_i^1 = \frac{a(24 + 23\delta)}{8(21 + 20\delta)}, \quad t = 1, 2.
\]

Then
\[
\pi^1_i = \frac{a^2(1 + \delta)(24 + 23\delta)^2}{16b(21 + 20\delta)^2}, \quad \pi^1_j = \frac{a^2(1 + \delta)(48 + 45\delta)^2}{64b(21 + 20\delta)^2},
\]
\[
S^1_i = \frac{a^2(1 + \delta)(24 + 23\delta)^2}{32b(21 + 20\delta)^2}, \quad S^1_j = \frac{a^2(1 + \delta)^2(48 + 45\delta)}{8b(21 + 20\delta)^2},
\]
where \( \pi^1_i \) denotes firm \( i \)'s discounted profit in the case of a long-term contract in firm \( j \) and short-term contracts in firm \( i \) and, on the other hand, \( \pi^1_j \) denotes firm \( j \)'s discounted profit when there are short-term contracts in firm \( i \) and a long-term contract in firm \( j \); \( S^1_i \) and \( S^1_j \) are defined similarly.

It is easy to see that \( w_j > w_i^1 \) and this implies that firm \( j \) will hire a smaller number of workers obtaining a lower profit (\( \pi^1_i > \pi^1_j \)). But, on the contrary, the union of firm \( j \) will obtain a higher utility than the union of firm \( i \); \( S^1_i < S^1_j \).

The result obtained is due to the fact that wages are strategic complements and that firm \( j \) and its union bargain the wage of the second period before the other firm and its union do so (i.e., they are the leaders in wage bargaining). Thus, when firm \( j \) and its union bargain the wage of the two periods, the objective function considered is the product of the firm’s profits and the union’s utility; the weight of
the union’s utility on the objective function implies that, as they take the reaction function of the other firm for granted, they fix a higher wage than in the case of simultaneous wage bargaining. Then, firm \( j \) pays higher wages than firm \( i \). As a result, firm \( i \) will contract a greater number of workers obtaining a higher profit. But the union of firm \( j \) will obtain a higher utility than the union of firm \( i \).

3.4. Results

Once we have solved all the possible cases we must find a solution to the first stage of the game. We assume that this decision is taken by the agent, firm or union with greater bargaining strength and we shall consider all the possible cases. First, we assume that the firms decide on the length of the contracts. Second, we consider that this decision is taken by the unions and, finally, we analyze the case in which the length of the contract is decided upon by the owners of one firm and by the union of the other firm.

When the firms decide on the length of the contracts, each firm must choose short-term contracts or a long-term contract, given that the other firm makes the same decision simultaneously. By comparing profit levels, we have \( \pi_{SL} > \pi_{LL} = \pi_{SS} > \pi_{LS} \); this implies that the equilibrium of the game is given by the fact that both firms choose short-term contracts (i.e., the firms prefer to bargain with its union for the wage of each period). This result is due to the fact that if one firm chooses a long-term contract while the other chooses short-term contracts, the former will pay a higher wage obtaining a lower market share and, therefore, profits. Then, it is a dominant strategy to choose short-term contracts. If we compare the wage in the different cases, we have that the lowest possible wage is paid when both firms choose the same type of contract \( (w_{LS} > w_{SL} > w_{SS} = w_{LL}) \). Given the preceding wage levels, we can compare the output (and therefore employment) levels: \( q_{SL} > q_{LL} = q_{SS} > q_{LS} \); though the lowest possible wage is fixed when both firms choose the same type of contract, the highest output level is obtained by the firm with short-term contracts when the other firm chooses a long-term contract.

We now compare the case in which unions decide on the length of the contracts. By comparing the union’s utility in the different cases, we have that \( S^{LS} > S^{SL} > S^{LL} = S^{SS} \); though the total production of the industry and, thus, the number of workers is greater if there are short-term contracts or a long-term contract in both firms \( (q^{LL} + q^{LL} = q^{SS} + q^{SS} > q^{LS} + q^{SL}) \) and, at the same time, the wages are higher when one union chooses short-term contracts while the other

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\(^6\) We get the usual result, that is, when variables are strategic complements, the follower is always better off than the leader.
union chooses a long-term contract \((w^{LS} > w^{SL} > w^{SS} = w^{LL})\). As the second effect is stronger than the first effect, the unions obtain a higher utility level when they choose a different type of contract implying, thus, that the game has two equilibria: one union chooses short-term contracts while the other union chooses a long-term contract. But, in this case, the firm with a long-term contract will obtain a lower market share and profit than the firm with short-term contracts; then, the first firm will try to make his union accept short-term contracts.

Finally, if firm \(i\) is endowed with more bargaining power than union \(i\) (i.e., firm \(i\) decides on the length of the contract) and, at the same time, the union of firm \(j\) is endowed with more bargaining power than firm \(j\) (i.e., the union of firm \(j\) decides on the length of the contract), then, firm \(i\) will choose short-term contracts while firm \(j\)’s union will choose a long-term contract. As it is a dominant strategy for firm \(i\) to choose short-term contracts and the union of firm \(j\) is aware of this, the union of the latter will choose a long-term contract to obtain the highest possible utility level.

4. Conclusions

The cost of negotiations and the degree of risk and uncertainty are the factors identified in theoretical literature as determinants of contract duration. Thus, higher negotiating costs increase contract length whereas a greater degree of risk and uncertainty reduces the duration of the contract. In this paper, we analyze the length of labor contracts focusing on the strategic effect that arises when contracts have different duration and firms compete in the product market. Then, if firms decide on the length of the contract we shall have, in equilibrium, short-term contracts (it is a dominant strategy for firms to choose short-term contracts). But, if unions choose the duration of the contract one union, in equilibrium, will choose short-term contracts while the other will choose a long-term contract.

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7 As we do not consider uncertainty, risk and negotiating costs, we owe the results to strategic reasons. In the asymmetric case, where there is a long-term contract in firm \(j\) and a short-term contract in firm \(i\), firm \(j\) and its union (the leader) bargain the wage of the second period before the other firm (the follower) does so. Then, given that wage variables are strategic complements, the wages fixed in the asymmetric case are higher than those fixed in the symmetric case, since the leader wants to increase the wage when it is bargained simultaneously in both firms; this implies that the follower also increases its wage.

8 Given that \(S^{LS} > S^{SL}\), a coordination problem might arise in the game since both unions would like to make the first move. This may lead both unions to choose a long-term contract which decreases its rents \((S^{LS} > S^{SL} > S^{LL})\). Different characteristics which have not been included in the model could be useful to explain which union is the first to bargain, for example, which union has greater bargaining power (because the union has more affiliates, for example) or which firm has lower bargaining power (one firm could be unipant while the other could be a multinational corporation with several productive plants); internal agreements among the unions could also be reached if there were affiliated to an organization coordinating unions (for example, AFL-CIO in US).
To model negotiations on the length of the contracts we would have to consider more than two periods and the analysis would therefore become more complex and could lead to multiplicity of equilibria. If agreements that include wage negotiations of different duration are not considered (wages are bargained each one period, two periods, three periods, etc.), it is reasonable to think that the results hold, since the strategic effects arising in the two period model would also appear in a model with more than two periods. This will be the aim of future investigation.

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References