Endogenous scope of bargaining in a union–oligopoly model: when will firms and unions bargain over employment?

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Abstract

The scope of firm–union bargaining is shown to be endogenously determined in a union–oligopoly model with decentralized negotiations. If the unions’ power is sufficiently high, all bargaining units choose to negotiate over wages alone, i.e., universal right-to-manage bargaining emerges in equilibrium. Otherwise, wage/employment bargaining and right-to-manage bargaining coexist in the same industry. In equilibrium, some firm–union pairs will always choose to bargain over employment as well, since the firms become Stackelberg leaders in the market by committing to a particular output during the negotiations. The firms and their unions both benefit from the additional Stackelberg rents, provided that the unions’ power is small enough. Our analysis suggests that there is not necessarily a negative relationship between unions’ power and sectoral employment rates.

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1. Introduction

The scope of bargaining, i.e., the issues over which firms and unions negotiate, is a crucial institutional factor in the determination of wage and employment
outcomes in unionized labor markets. Whilst in most real-life cases bargaining takes place over wages alone (right-to-manage bargains, as in Nickell and Andrews, 1983), there is some evidence that negotiations may also involve employment directly, or indirectly through manning ratios, crew sizes, etc. The latter regime will be referred to as wage/employment bargaining. The literature, so far, seems to seek an explanation for the emergence and sustainability of wage/employment bargaining along the following lines. As this bargaining regime entails “over-manning” (i.e., the marginal revenue product of labor falls short of the wage), its sustainability depends on the union’s ability to “force” its firm to keep employment at the “efficient” level for any wage rate deal. Effectively, since only wage bargains are contractually binding, a union should convince its firm to set employment along the contract curve, by means of proper punishment strategies. The firm then, faced with credible punishment, would have no incentive to renege ex-post (after the wage bargain had been struck) and set employment along its labor demand curve (Espinosa and Rhee, 1989; Eberwein and Kollintzas, 1995). But how and when will wage/employment bargaining emerge in the first place?

Our general postulate is that labor market institutional arrangements emerge endogenously, so long as a winning coalition of involved parties (firms and unions), each acting in its own interest, finds their establishment beneficial (see also Petrakis and Vlassis, 1996). Assuming in this paper that the benchmark scope-of-bargaining institution is the right-to-manage bargaining, our postulate implies that wage/employment bargaining emerges (and can be sustained) only if firms agree with their unions to negotiate over both employment and wages in equilibrium. Thus, under decentralized firm–union negotiations, this line of reasoning requires that, inside a bargaining unit, wage/employment bargaining emerges only if the firm and its own union mutually agree on this arrangement.

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2 The bargaining agenda that directly, or indirectly, includes employment is sometimes referred to as “efficient bargaining” (McDonald and Solow, 1981; Oswald, 1985). However, this term can be misleading, since it does not always lead to Pareto superior outcomes even for the parties involved in the bargain. In particular, it is not always “efficient” (in that restricted sense) under decentralized firm/union bargaining in an oligopolistic industry. Of course, it is not efficient in a single industry, or in the macroeconomic context, when consumer surplus is also taken into account. Furthermore, even in terms of its unemployment implications, the role of efficient bargains is not clear. As Carlin and Soskice (1990) suggest, “the final result for the equilibrium rate of unemployment of efficient bargaining as opposed to the monopoly union setting is not predictable.”

3 Since, as mentioned earlier, wage/employment bargaining always entails “over-manning”, the “benchmark” institution should naturally be considered to be the right-to-manage bargaining.

4 In this paper, we assume that the level-of-bargaining (the degree of bargaining centralization) is given (decentralized bargaining). In Petrakis and Vlassis (1996), we show that asymmetries in productive efficiency and bargaining powers are responsible for the emergence of various degrees of bargaining centralization.
Universal wage/employment bargaining prevails only if all firm/union bargaining units select this institution in equilibrium. Otherwise, wage/employment bargaining may coexist with right-to-manage bargains within a single, or across different, labor markets. For instance, our approach suggests that, since negotiations are decentralized in the US, Japan and in many European countries, firms — whilst competing in international product markets — may be acting under various scope-of-bargaining arrangements inside their national labor markets.

We consider a homogenous good market where firms, endowed with possibly asymmetric technologies, compete in quantities. In the labor market, firms negotiate with their own unions at the firm level alone (decentralized bargaining) and unions possess identical bargaining power. Right-to-manage bargaining takes place so long as, inside each bargaining unit, the firm or its union chooses to bargain over wages alone, leaving the employment decision to the firm’s discretion. On the other hand, wage/employment bargaining emerges only if the firm and its union mutually agree to negotiate over both employment and wages. Negotiations are conducted in separate parallel sessions between each firm and its union. Employment and output decisions follow therefore, only if a subset of firm/union pairs select right-to-manage. If, however, some firms and their unions agree on wage/employment bargaining, their employment/output decisions are also taken during the parallel negotiations sessions.

Our central result is that if the unions’ bargaining power is low enough, wage/employment bargaining is always chosen by a subset of firm/union pairs in (the subgame perfect) equilibrium. A firm, by opting for wage/employment bargaining, can precommit to a particular production plan during the negotiations. This idea of a firm committing to a specific output through the negotiations with its own union is not novel in the literature. In Dewatripont (1987; 1988), for instance, an incumbent firm commits to a specific production plan by signing a contract with its union, in order to deter entry. In our model, a firm has an incentive to commit to a specific output (via wage/employment bargaining), only if it can enjoy a sufficiently large portion of the ensuing Stackelberg leader’s rent differential in comparison to Cournot competition to compensate for its extra labor costs due to over-manning. Its union will also opt for wage/employment bargaining, since it can thus enjoy a positive portion of the rent differential due to its firms’ Stackelberg leadership in the market. Hence, if the unions’ bargaining power — effectively, their share over their employers’ additional rents — is low enough to make it worthwhile for their firms to become Stackelberg leaders, wage/employment bargaining is established in some section of the labor market. Note that an equilibrium in which all firm/union pairs conduct wage/employm-
ment bargaining cannot be sustained. This is a straightforward extension of the well-known result that firms have no incentive to engage in Stackelberg warfare, since this turns out to be harmful to all firms. If a firm becomes a Stackelberg leader via wage/employment bargaining, the best response of its rival is to become a follower by postponing its employment-output decision. Of course, this is achieved by vetoing the inclusion of employment on the agenda of negotiations with its union.

If, on the other hand, the unions’ bargaining power is sufficiently high, firms always choose to bargain over wages alone. Therefore, despite the fact that their unions would like to negotiate over employment as well, Universal right-to-manage bargains emerge as the equilibrium institution. Interestingly, the critical value of the unions’ bargaining power for which a switch in the equilibrium institutional arrangement is observed does not depend on the union members’ risk aversion or the technological asymmetries among firms. In a duopoly, this critical value equals one half; that is, if unions are weaker than firms at the negotiation table, right-to-manage and wage/employment bargaining coexist in the same industry. Furthermore, the critical value of the unions’ bargaining power increases as the number of firms in the industry increases. Hence, our model predicts that it is more likely for wage/employment bargaining to be observed in less concentrated industries.

Our analysis reveals the critical role of the union power in the endogenous determination of the bargaining agenda in a homogeneous Cournot oligopoly with decentralized bargaining. In this partial equilibrium framework, we are also able to clarify the impact of union power on the “efficiency” properties of wage/employment outcomes in unionized labor markets. If we measure the relative efficiency of institutional arrangements in terms of their employment implications for the industry, then Universal right-to-manage bargains are clearly less efficient than if wage/employment bargaining coexists with right-to-manage bargains. In particular, an increase in the union power from (slightly) below its critical value will definitely lead to lower sectoral employment. In fact, as the increase in union power induces a switch in the scope of bargaining arrangement, sectoral employment jumps down initially. Then as the union power increases further, employment decreases in the industry. Note, however, that if unions are rather weak, then there is not necessarily a positive relationship between the unions’ power and the sectoral employment. Therefore, only if unions are sufficiently powerful can it be definitely claimed that the unions’ power is negatively related to “efficiency”, in the sense that it reduces employment in the particular industry. In fact, this is a major testable implication of our analysis. Nonetheless, our findings seem to be fairly much in line with the spirit of the

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6 This might be a reasonable measure of efficiency in our framework. As employment increases, industry output increases, output price falls and thus consumer surplus increases.
existing literature on “Efficient Bargaining” as opposed to the “Labour Demand” hypothesis (see, e.g., McDonald and Solow, 1981; Ashenfelter and Brown, 1986; Manning, 1987; Alogoskoufis and Manning, 1991). We further argue that, under product market imperfections, there is a critical value of the unions’ bargaining power beyond which an additional “inefficiency” is generated. In this case, all firms in the industry have an incentive to select employment along their labour demand schedules, and therefore, it is only then that the unions’ power clearly reduces equilibrium sectoral employment.\(^7\)

The rest of the paper is organized as follows: Section 2 presents our duopoly model. In Section 3, the scope of bargaining institutions are derived as part of the subgame perfect equilibrium outcome. In particular, Section 3.1 shows that Universal right-to-manage bargaining is the equilibrium labor market institution, whenever the power of the unions inside their own bargaining units is greater than the power of their firms. Section 3.2 shows that all firm/union units conducting wage/employment bargaining cannot be sustained in a pure-strategy equilibrium. Section 3.3 provides our key proposition: as long as firms possess more power than unions, one firm/union bargaining unit always opts for wage/employment bargaining, with the other choosing right-to-manage bargains. Section 4 extends these results in an \(n\)-firm symmetric Cournot oligopoly. In Section 5, our findings are briefly evaluated. All proofs are relegated to Appendix A.

2. The model

We consider a homogeneous good sector where two firms, on principle endowed with different technologies, compete in quantities. For simplicity, we assume that the production technology exhibits constant returns to scale and requires only labor input to produce the good.\(^8\) Firm \(i\)’s production function is \(y_i = N_i/A_i\), \(i = 1,2\), where \(y_i\) is output, \(N_i\) labor input, and \(1/A_i > 0\) the labor productivity of firm \(i\). We further assume, for tractability, that the market demand is linear and is given by \(P(Y) = a - Y\), where \(Y\) is aggregate output \((Y = y_1 + y_2)\).\(^9\) Labor is assumed to be firm specific. Each firm’s employees form a separate
union, which enters into negotiations (about wages alone, or wages and employment) with its own firm. Effectively, therefore, bargaining is decentralized. We assume that unions are identical and are endowed with the same bargaining power, $b$, during negotiations with their firms. Each union is of the utilitarian type, i.e., the union maximizes the sum of individual workers’ utilities. Then union $i$’s objective is to maximize

$$U_i(w_i,N_i) = (w_i - w_0)^\varphi N_i$$

where $\varphi \in (0,1]$ can be thought of as the representative member’s relative rate of risk aversion, provided that union membership is fixed and all members are identical (see, e.g., Oswald, 1982; Pencavel, 1991; Booth, 1995). Alternatively, $\varphi$ denotes the representative union member’s elasticity of substitution between wages and employment. Considering economy-wide real arguments, and assuming that the sector is sufficiently small relative to the whole economy, $w_i$ is firm $i$’s wage rate and $w_0$ is the outside option.

The timing of the game is as follows. In stage 1, firm/union bargaining units decide simultaneously on both their negotiation agenda (the issues to be negotiated over) and the values of the selected issues on the agenda. If the mutually agreed by the firm and its union agenda includes both wages and employment, we say that this firm/union pair conducts wage/employment bargaining, or (w,e)-bargaining. If (as a result of the veto effectively exercised by the firm) the negotiation agenda includes only wages, we say that this firm/union pair conducts right-to-manage bargains, or w-bargaining. In stage 2, firms that have conducted (w,e)-bargaining in the previous stage carry out their employment and output decisions, while

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10 This assumption attempts to capture the existing evidence from the US, Japan and many European countries showing that often negotiations are decentralized at the firm level. These negotiations take place among the firms’ managers and the firm-level trade unions or the firms’ workers’ councils (i.e., the workers’ representatives who are entitled to bargain at the firm-level, as, e.g., in UK and Germany) (see, e.g., Layard et al., 1991; Rogers and Streek, 1994). Note also that in the presence of asymmetries (i.e., in technology or in bargaining powers), this is an ex-ante appealing assumption, since such asymmetries usually generate conflicts of interest among workers from different firms. Moreover, so long as we claim that the option for firm specific “over-manning” (via wage/employment bargaining) may be carried out, a firm’s employees have an additional incentive to behave as a “closed-shop” union. Finally, note that conflicts of interest between various groups of workers will persist even inside an industry-wide union. In fact, our conjecture is that the basic results will be qualitatively similar if an industry-wide union conducts simultaneous bargains with the two firms.

11 The latter can be thought of as a weighted average of the competitive wage and the unemployment benefits with weights being the probability of being employed, or not, in the competitive sector. Note that the implicit assumption here is that a worker displaced from firm $i$ is unable to find a job in firm $j$. This is a direct consequence of the “closed-shop” assumption (see 10).

12 This is equivalent to a two-step procedure in which the firm and its union first vote for, or against, the inclusion of employment on their negotiation agenda, and then bargain over the issues selected. The inclusion of employment requires two votes, otherwise negotiations take place over wages alone. The crucial (and reasonable) assumption here is that firm/union $i$’s agreed upon agenda is not observable by its rival bargaining unit before negotiations are completed.
firms that have conducted w-bargaining decide upon (and carry out) their levels of employment and output based on their rivals’ strategy.

The above structure of the game allows us to capture the idea that contracts signed between firms and their unions must be renegotiation-proof (see, e.g., Dewatripont, 1988). It does not seem reasonable to assume, as the right-to-manage literature implicitly does, that a firm/union bargaining unit is unable to extend the scope of its negotiations to include employment, if such a decision will improve the welfare of both parties involved. We assume, on the contrary, that a firm and its union that mutually agree to sign a contract over both employment and wages cannot be prevented from doing so. On the other hand, if negotiating and thus signing a contract over employment hurts either the firm or its union, a wage contract is immune to renegotiations.

3. Equilibrium scope of bargaining institutions

In this section, we investigate the conditions under which various scope of bargaining institutional arrangements emerge in equilibrium. As is standard in the game theoretic literature, we first propose a candidate equilibrium configuration of institutions for the industry, and then check whether, or not, it survives all possible deviations. In particular, in Section 3.1 the candidate equilibrium institution is that all firm/union bargaining units conduct right-to-manage bargains. In this case there is only one possible type of deviation: a firm and its own union mutually decide to include employment on their negotiation agenda. In Section 3.2, the proposed equilibrium institution is that all firm/union bargaining units conduct wage/employment bargaining. There are two possible deviations here. The first is that a firm vetoes the inclusion of employment on the negotiation agenda, and the second is that the union refuses to negotiate over employment. Finally, in Section 3.3 the candidate equilibrium institutional configuration is the coexistence of w-bargaining and (w,e)-bargaining. All three of the aforementioned possible deviations have to be checked in the latter case. Note that the above exercise reflects the idea that right-to-manage bargaining is the benchmark labor market institution. While switching to wage/employment bargaining requires an agreement between both parties involved (the firm and its own union), the veto of one of them (either the firm or its union) over the inclusion of employment on the negotiations agenda is sufficient for right-to-manage bargaining to be sustained.

3.1. Universal right-to-manage bargaining

Suppose that right-to-manage bargaining is the existing labor market institution. Firm/union pairs bargain in parallel sessions about wages alone, leaving employment decisions to the firms’ discretion. We may then ask whether this is a stable
institutional arrangement under any labor and product market conditions. If no firm/union bargaining unit has an incentive to switch to wage/employment bargaining (by including employment on its negotiation agenda), then Universal right-to-manage bargaining is stable. Equivalently, Universal right-to-manage will endogenously emerge in the subgame perfect equilibrium.

Under right-to-manage bargaining, in the first stage firm/union pairs simultaneously bargain over wages. Then employment and production decisions are taken simultaneously by firms. In the second stage, firm $i$ chooses $y_i$ to maximize its profits,

$$\pi_i = (a - y_i - y_{ij}) y_i - w_i A_y y_i$$

(2)
given the output of its rival $y_j$, and the firm-specific wage rates negotiated in the previous stage. The first order condition (foc) of Eq. (2) provides firm $i$‘s reaction function, $R_i(y_i) = (a - A_j w_i - y_i)/2$. Then equilibrium outputs, profits and employment levels are:

$$y^*_i(w_i,w_j) = (a - 2 A_i w_i + A_j w_j)/3 \pi^*_i(w_i,w_j)$$

$$= y^*_i N^*_i(w_i,w_j) = A_i y^*_i \quad i, j = 1, 2$$

(3)

In the first stage, firm/union pairs bargain about firm-specific wages in parallel sessions, each taking into account how its decision will affect the competitiveness of its firm in the subsequent product market game. For instance, union $i$, while pushing for a wage increase above that of its rival firm’s, takes into account that such an increase in its own firm’s unit cost may significantly reduce its sales, and thus the number of union members employed in the firm. The negotiated wage in each bargaining session is derived using the Generalized Nash Bargaining solution. Taking as given the equilibrium outcomes of the production game (Eq. (3)), firm/union pair $i$ chooses $w_i$ to maximize

$$[\pi^*_i(w_i,w_j)]^{(1-b)} \left[ (w_i - w_0)^b N^*_i(w_i,w_j) \right]^b$$

(4)
given the wage negotiated in the firm/union bargaining unit $i, w_j$. From the foc of Eq. (4) we obtain the reaction function of firm/union bargaining unit $i$,

$$w_i(w_j) = \left\{ ab \varphi + 2 A_i w_0 (2 - b) + A_j b \varphi w_j \right\} / \left\{ 2 A_i (2 - b + b \varphi) \right\}$$

(5)

Note that $dw_i/dw_j = A_j b \varphi / 2 A_i (2 - b + b \varphi) > 0$, i.e., the wages are strategic complements for the firm/union bargaining units. From the system of linear equations (Eq. (5)), we get a unique stable solution for the negotiated wages,

$$w^*_i = \left\{ 2(2 - b + b \varphi) \left[ ab \varphi + 2 A_i w_0 (2 - b) \right] + b \varphi \left[ ab \varphi + 2 A_i w_0 (2 - b) \right] / A_i D \right\} / A_i D$$

(6)

13 Note that given our one-factor linear technologies, and that firms compete in quantities, a firm’s employment decision also determines its output.
$i,j = 1,2$, where $D = (4 - 2b + b\varphi)(4 - 2b + 3b\varphi)$. Then from Eq. (3), the firms’ equilibrium outputs are,  

$$y_i^* = \left[2(2 - b)\left\{a(4 - 2b + 3b\varphi) + 2A_iw_0(2 - b)\right\} - A_iw_0(8 - 4b + 3b\varphi)\right] / 3D \quad (7)$$

Also, $N_{ij}^* = A_iy_i^*$ and $\pi_i^* = y_i^*$. It can be checked that $U_i^* = (3b\varphi / 2(2 - b))A_iy_i^*$.  

Universal right-to-manage bargaining is an equilibrium institution only if no firm/union bargaining unit has an incentive to unilaterally deviate by including employment on its negotiation agenda. Of course, such an inclusion has to be profitable for both the firm and the union, otherwise the agent which is hurt will certainly veto it. Suppose, for instance, that firm/union 2 sticks to right-to-manage, but firm/union 1 decides to conduct wage/employment bargaining. It is easy to see that firm 1 now becomes a Stackelberg leader in the product market. Firm 1’s employment level, and hence its output, is decided during the firm/union 1 bargaining session, which precedes firm 2’s output decision. Therefore, firm 1, by signing a contract over employment, can precommit to a larger output (as in Dewatripont, 1987, 1988) and can thus increase its revenues in the product market. Since the Stackelberg follower’s (firm 2’s) optimal response will be to reduce its output in the next stage, firm 1’s labor demand curve shifts outward. On the other hand, firm 1 must evaluate the extra labor costs resulting from paying its employees a wage above its new labor demand curve. Interestingly, the wage resulting from the (w,e)-bargaining of the deviating firm/union pair 1 turns out to be the same as their negotiated wage under the right-to-manage institution (see Appendix A). As a result, firm 1’s extra labor costs are exclusively due to over-manning at the initial firm-specific wage. Since the negotiated wage under right-to-manage increases with the union’s bargaining power, and, moreover, the contract curve has a positive slope, the extent of over-manning (and thus the extra labor costs) increases with the union’s bargaining power. Therefore, a weak firm 1 at the negotiation table loses more in extra labor costs than it gains in revenues by becoming a Stackelberg leader in the product market. Hence, a weak firm will certainly veto the inclusion of employment on the negotiation agenda. Obviously,

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14 We shall restrict attention to values of the technology parameters $A_1$ and $A_2$ such that there is always an interior solution in the product market game, i.e., the equilibrium outputs $y_i^* > 0$.  
15 This provides an explanation of why the equilibrium institution does not depend on the degree of union members’ risk-aversion, $\varphi$. In fact, the firm and its union first decide on which issues to include on their negotiation agenda, and then bargain over those issues. This bargaining process leads to a value of the negotiated wage that is independent of $\varphi$, which in turn implies our independence of scope of bargaining institutional arrangement result. Of course, this finding is due to our specification of the model. However, it seems to suggest that, in a more general model, the equilibrium negotiation agenda will be rather insensitive to the degree of union members’ risk aversion.
a strong union prefers to expand the negotiation agenda, since it can thus guarantee employment to more of its members at the same wage rate. However, according to our postulate, the union is unable to unilaterally impose bargaining over employment. The following proposition summarizes.

**Proposition 1:** Universal right-to-manage bargaining (Scope of Bargaining about wages alone) is the subgame perfect equilibrium institution if and only if the unions’ bargaining power is sufficiently high, i.e., \( b \geq 0.5 \).

On the contrary, if the union’s bargaining power is sufficiently small \( (b < 0.5) \), firm 1 has more to gain by becoming a Stackelberg leader than it has to lose from employment concessions. In fact, firm/union pair 1, by conducting wage/employment bargaining, can jointly achieve the rents of a Stackelberg leader. A strong firm 1 will then receive the bulk of these joint rents, and thus has an incentive to bargain about employment as well. Further, union 1 will also opt for \((w,e)\)-bargaining, since it can thus guarantee employment to more of its members at the same wage rate. Therefore, both the firm and its own union mutually agree to switch to \((w,e)\)-bargaining whenever \( b \) is sufficiently small.

If Universal right-to-manage bargaining is the endogenously chosen institution \( (b \geq 0.5) \), how does aggregate employment vary with the unions’ bargaining power? Restricting attention to the symmetric case \( (i.e., A_i = A_j = A) \), aggregate employment is given by

\[
Y^*_b = 2y^*_i = 4(2 - b)(a - Aw_0)/3(4 - 2b + b\varphi)
\]

As \( \partial Y^*_b / \partial b < 0 \), aggregate employment decreases with the unions’ bargaining power. An increase in \( b \) results in higher negotiated wages, which in turn leads to lower employment levels, as firms choose employment from their downward sloping labor demand curves.

### 3.2. Universal wage / employment bargaining

If Universal right-to-manage bargaining cannot be sustained as the equilibrium institution whenever unions’ bargaining power is sufficiently low, then a candidate (pure strategy) equilibrium institution could be that all firm/union bargaining units conduct wage/employment bargaining. Is such an institutional arrangement stable? If **either** the firm or its union, inside a bargaining unit, is against the inclusion of employment on the negotiation agenda, then it has the right to veto negotiations over employment. The bargaining unit will then necessarily revert to right-to-manage. Under \((w,e)\)-bargaining, firm/union bargaining unit \( i \) selects \( w_i \) and \( N_i \) (or equivalently, \( y_i \)) to maximize the generalized Nash product,

\[
\left[(a - y_i - y_j) y_i - w_i A_j y_i\right]^{(1-b)}\left[(w_i - w_0)^A A_i y_i\right]^b
\]  
\[ (8) \]
The foci are, $i,j = 1,2$, 

$$b \varphi/[w_i - w_o] = (1 - b) A_i /[a - y_i - y_j - w_i A_i]$$

$$1/y_i = (1 - b)/[a - y_i - y_j - w_i A_i]$$

(9)

Note from Eq. (9) that $w_i - w_o = (b \varphi/A_i) y_j$ and $y_j(y_j) = (a - A_j w_o - y_j)/(2 - b + b \varphi)$. Thus, $-1 < d y_i/d y_j < 0$, i.e., outputs are strategic substitutes and there is a unique stable solution in the space of outputs. Moreover, as $w_j$ depends only on $y_j$, there is a unique vector of negotiated wages. Then from Eq. (9),

$$w_j^* = [a b \varphi (1 - b + b \varphi) + w_o (A_i b \varphi + A_j (3 - 4b + b^2 + 2b \varphi - b^2 \varphi))] / A_j F$$

(10)

$$y_i^* = [a (1 - b + b \varphi) - w_o (A_j (2 - b + b \varphi) - A_i)] / F$$

(11)

where $F = (2 - b + b \varphi)^2 - 1$. It can be checked that firm $i$’s profits are $\pi_i^* = (1 - b) y_i^*$.  

To check if Universal wage/employment bargaining can be sustained as an equilibrium institution, assume that firm/union 2 conducts (w,e)-bargaining. Does firm 1, or union 1, have an incentive to veto the inclusion of employment on the negotiation agenda of firm/union bargaining unit 1? It turns out that firm 1 will always veto negotiations over employment whenever firm/union pair 2 conducts wage/employment bargaining. As a result, Universal (w,e)-bargaining cannot be sustained in equilibrium. The following proposition summarizes.

**Proposition 2:** Universal wage/employment bargaining can never be the subgame perfect equilibrium institution.

This is in the spirit of the well-known result in the industrial organization literature that firms competing in quantities have no incentive to engage in Stackelberg warfare. If the timing of output selection is endogenous, firm 1’s optimal response is to wait and select its output at date 2 whenever its rival commits to an output at date 1. Firm 1 has no incentive to commit also to its output at date 1 (and thus act as a Stackelberg leader as well), because the resulting Stackelberg warfare leads to excessive aggregate output, and, hence, low price and profits for firm 1. A similar reasoning applies to our model. As firm 2, by conducting (w,e)-bargaining with its union, commits to an employment and output level, firm 1 prefers to postpone its decision on output. Obviously, this can be achieved if firm 1 vetoes the inclusion of employment on the negotiation agenda and thus unilaterally imposes right-to-manage bargaining for the firm/union pair 1. In this way, firm 1 is transformed into a Stackelberg follower, since its employment (and production) decisions will be taken at a later stage. Firm 1 will
then reduce employment and output, thus pushing the market-clearing price up. In addition, it will save on extra labor costs by moving back to its labor demand curve (i.e., eliminating over-manning). As a result, firm 1’s profits will increase by vetoing negotiations over employment.\textsuperscript{16}

It is worth mentioning that union 1’s welfare decreases as a result of firm/union 1 reverting to right-to-manage bargaining. Since the negotiated wage under right-to-manage turns out to be equal to the negotiated wage under (w,e)-bargaining, fewer union 1’s members are now employed at the initial wage.

In summary, Universal wage/employment bargaining can never be sustained as a pure strategy equilibrium institution. Right-to-manage, on the other hand, is universally chosen only if the unions’ bargaining power is sufficiently large. It remains, therefore, to determine the endogenously chosen institution whenever unions are relatively weaker than firms at the negotiation table. As is shown in Section 3.3, (w,e)-bargaining and w-bargaining may in fact coexist, even when product and labor market conditions are ex-ante symmetric.\textsuperscript{17}

3.3. Coexistence of right-to-manage and wage/employment bargaining

In this section, we show that if the unions’ bargaining power is sufficiently low, one firm/union bargaining unit negotiates about both wages and employment, while the other bargains about wages alone, leaving employment to its firm’s discretion. In the pure strategy equilibrium, different negotiation agendas (scope of bargaining) will be chosen by different firm/union bargaining pairs. This result holds even with ex-ante identical firms and unions. In the latter case, market shares and profits of ex-ante identical firms are different ex-post. Further, employment and wages differ across firms, and ex-ante identical unions achieve different levels of welfare ex-post in equilibrium.

Let firm/union pair 1 choose to negotiate over both wages and employment. Let firm/union pair 2 choose to bargain over wages alone.\textsuperscript{18} As we show, this is an equilibrium scope of bargaining configuration, whenever unions are weaker

\textsuperscript{16} This is a strong result which, however, persists in generalizations of the model. It can be checked that universal (w,e)-bargaining cannot be a pure strategy equilibrium institution even if unions differ in their bargaining powers.

\textsuperscript{17} We shall restrict attention to pure strategy equilibria alone. It is shown that right-to-manage and wage/employment bargaining coexist in an asymmetric equilibrium under some circumstances. Of course, besides the two asymmetric equilibria, there also exists a symmetric equilibrium in mixed strategies where each firm/union bargaining unit chooses to conduct (w,e)-bargaining with some probability and w-bargaining with the rest of the probability. Note that in the latter equilibrium, Universal wage/employment bargaining is always observed with some positive probability.

\textsuperscript{18} This is w.l.o.g. since, according to our assumptions, $A_1$ can be larger, equal to, or smaller than $A_2$.\textsuperscript{12}
than firms at the negotiation table. Firm/union bargaining unit 1 chooses \( w_1 \) and \( y_1 \) (equivalently, \( N_1 \)) to maximize

\[
\left[(a - y_1 - R_2(y_1))y_1 - w_1A_1y_1\right]^{(1-b)}\left[(w_1 - w_0)^bA_1y_1\right]^b
\]

(12)

taking as given the negotiated wage \( w_2 \), and firm 2’s optimal response to its employment (and output) decision in the subsequent production stage, i.e., \( R_2(y_1) = (a - w_2A_2 - y_1)/2 \). Substituting \( R_2(y_1) \) into Eq. (12), taking the focs and solving for \( w_1 \) and \( y_1 \) as functions of \( w_2 \), we get:

\[
w_1 = \left[ab\varphi + 2A_2(2-b)w_0 + b\varphi A_2w_2\right]/2A_1(2 - b + b\varphi)
\]

(13a)

\[
y_1 = \left[a - 2A_1w_0 + A_2w_2\right]/(2 - b + b\varphi)
\]

(13b)

Note from Eqs. (13a) and (13b) that firm/union 1’s contract curve is, \( w \equiv \left(a - y_1 - R_2(y_1)\right)R_2(y_1) - w_2A_2R_2(y_1)\)\(^{(1-b)}\) \times \left[(w_2 - w_0)^bA_2R_2(y_1)\right]^b

(14)

taking as given \( (w_1, y_1) \), and also firm 2’s optimal output response in the subsequent production stage, \( R_2(y_1) \). The foc of Eq. (14) then implies:

\[
w_2 = \left[ab\varphi + A_2(2-b)w_0 + b\varphi y_1\right]/A_2(2 - b + b\varphi)
\]

(15)

Hence, \( dw_2/dy_1 < 0 \). As firm 1 commits to a higher level of employment and output, firm/union pair 2 lowers its wage to preserve the competitiveness of firm 2, which in turn will guarantee a sufficient level of employment for union 2’s members. Solving the system of linear equations (Eqs. (13b) and (15)), we obtain a unique stable solution \( (w_1^*, y_1^*) \). Then \( w_1^* = w_0 + (b\varphi/2A_1)y_1^* \), and \( y_2^* = R_2(y_1^*) \). More specifically,

\[
w_1^* = \left[ab\varphi(2-b + b\varphi) + w_0\left(2A_1(2 - b)^2 + b\varphi(3 - b)\right)\right]/2A_1G
\]

\[
w_2^* = \left[ab\varphi(1 - b + b\varphi) + w_0\left(A_2(2 - b)^2 + 2b\varphi(A_1 + A_2) - A_2b\varphi\right)\right]/A_2G
\]

\[
y_1^* = \left[a(2-b + 2b\varphi) - w_0\left(2A_2(2 - b + b\varphi) - A_2(2 - b)\right)\right]/G
\]

\[
y_2^* = \left[(2-b)\left(a(1 - b + b\varphi) - w_0\left(A_2(3-b + b\varphi) - 2A_1\right)\right)\right]/2G
\]

(16)
where \( G = \{b\varphi + (b\varphi - b + 2)^2\} \). It can also be checked that \( \pi_1^R = (1 - b)\gamma_1^R/2 \), and \( \pi_2^R = \gamma_2^R/2 \).

As firm/union 2 conducts right-to-manage bargaining, while firm/union 1 conducts wage/employment bargaining, firm 2 becomes a Stackelberg follower in the product market. Clearly, firm/union pair 1, via firm 1’s Stackelberg leadership in the product market, achieves higher joint rents than if firm 1 had behaved as a Cournot competitor by imposing on its union right-to-manage bargaining. Note that in the latter case, firm 1’s labor demand curve would shift inward due to firm 2’s optimal reaction to increasing its output in the subsequent product market stage. Now, as long as firm 1 enjoys a sufficiently high portion of those extra joint rents, there is a clear incentive for firm 1 to stick to (w,e)-bargaining. Furthermore, union 1’s welfare is higher under (w,e)-bargaining, since it obviously enjoys a higher employment level at the initial firm-specific wage (see Appendix A).

On the other hand, since firm/union 1 conducts wage/employment bargaining, firm 2 has no incentive to propose to its union the inclusion of employment on their negotiation agenda. Firm/union pair 2’s switching to (w,e)-bargaining will definitely strengthen market competition, as both firms will precommit to a higher output, via employment agreements above their marginal revenue product of labor. Interestingly, the negotiated wage when a firm/union switches to (w,e)-bargaining turns out to be the same as the negotiated wage under right-to-manage. Therefore, due to Stackelberg warfare on the one hand, and over-manning on the other hand, firm 2’s profits decrease when firm/union 2 switches to wage/employment bargaining. As this reasoning is quite general, our conjecture is that firm/union 2 sticking to right-to-manage bargaining will resist generalizations of our model. The condition under which right-to-manage and wage/employment bargaining coexist in equilibrium is given in the following proposition.

**Proposition 3:** If the unions’ bargaining power is low enough, i.e., \( b \leq 0.5 \), right-to-manage bargaining and wage/employment bargaining coexist, each chosen by a different firm/union bargaining unit, in the subgame perfect equilibrium.

Surprisingly, neither the exact magnitude of union members’ relative risk aversion, \( \varphi \), nor the presence of technological asymmetries among firms (if \( A_1 \neq A_2 \)) plays any role in the endogenous determination of the scope of bargaining institutions. It is only the symmetric, in our context unions’ strength, \( b \), which effectively determines what type of institution will emerge in equilibrium. Note further that for \( b = 0.5 \), there are two equilibrium scope of bargaining institutional arrangements. Both Universal right-to-manage (Proposition 1) and coexistence of wage/employment with right-to-manage bargaining (Proposition 3) can be sustained as equilibrium institutional configurations.
If wage/employment bargaining coexists with right-to-manage \((b \leq 0.5)\), how does aggregate employment vary with the unions’ bargaining power? Restricting attention again to ex-ante symmetric firms \((A_i = A_j = A)\), we get from Eq. (16) the aggregate employment level \(Y^*_C = y^+_1 + y^+_2\).

\[
Y^*_C = (6 - 5b + b^2 + 6b\varphi - b^2\varphi)(a - Aw_0)/2G
\]

Contrary to the Universal right-to-manage bargaining, aggregate employment in this case may increase, or decrease, with the unions’ bargaining power, \(b\), depending on the value of the parameter \(\varphi\). In fact, if the unions’ members are sufficiently risk-averse (e.g., \(\varphi < 0.6\)), aggregate employment increases with \(b\). The opposite is true if the unions’ members are closer to being risk neutral (e.g., \(\varphi > 0.8\)). For intermediate values (e.g., \(\varphi = 0.7\)), aggregate employment initially decreases, and then increases with \(b\). Finally, for \(b = 0.5\), under Universal right-to-manage bargaining, aggregate employment is \(Y^*_R = 4(a - Aw_0)/(6 + \varphi)\), while under coexistence of institutions it is \(Y^*_C = (15 + 11\varphi)(a - Aw_0)/2(9 + 8\varphi + \varphi^2)\), with \(Y^*_C > Y^*_R\) for all values of \(\varphi\). Summarizing, as the unions’ bargaining power decreases, aggregate employment increases continuously initially, then jumps up for \(b = 0.5\). For further decreases of \(b\), however, aggregate employment may decrease or increase, depending on the degree of risk aversion of the unions’ members.

4. Extension to a symmetric oligopoly

Consider a \(n\)-firm homogeneous Cournot oligopoly. Firms are endowed with identical linear one-factor (labor) production functions; that is, firm \(i\)’s production function is \(y_i = N_i/A\) with \(1/A\) being the productivity of labor. The rest of the specification of the model is as in Section 2. The following proposition summarizes the results.

**Proposition 4:** In a \(n\)-firm symmetric homogeneous Cournot industry, (i) Universal right-to-manage bargaining is the equilibrium institution if, and only if, \(b \geq 1 - 1/n\). (ii) Universal wage/employment bargaining can never be sustained as an equilibrium institution. (iii) If \(b \leq 1 - 1/n\), then a subset of firm/union pairs conducts wage/employment bargaining with the rest conducting right-to-manage bargaining. \(^{19}\)

\(^{19}\) The proof of Proposition 4 is along the lines of the proofs of Propositions 1 and 2, and thus is not included in the present version of the paper. It is available from the authors upon request.
Universal wage/employment bargaining cannot be sustained as an equilibrium institution for the same reasons as in the duopoly case. Further, Universal right-to-manage is the equilibrium institution only if the unions’ bargaining power is sufficiently high. The critical value of $b$ is increasing in the number of firms in the industry. As the number of firms increases, the gains from becoming the unique Stackelberg leader in the product market increase. Then a firm’s incentive to include employment on its negotiations agenda becomes stronger, provided that all its rivals negotiate over wages alone. Indeed, as part (i) of the proposition indicates, when $n$ is sufficiently high, all firm/union pairs conducting right-to-manage bargains is an equilibrium institution only in case of (almost) Monopoly Unions. That is, only if unions possess (almost all) the power to set wages, are a firm’s extra labor costs from moving away from its labor demand curve higher than its gains from becoming the unique Stackelberg leader. It is only in this rather extreme case that no firm has incentive to revert to wage/employment bargaining, and Universal right-to-manage is the equilibrium institution. Otherwise, the equilibrium configuration of scope of bargaining institutions involves some firm/union pairs conducting wage/employment bargaining, while the rest conduct right-to-manage bargaining.

5. Conclusions

In this paper, the scope of firm–union decentralized bargaining is shown to be endogenously determined in an imperfectly competitive industry. The scope of bargaining emerges, inside each collective bargaining unit, as a subgame perfect equilibrium arrangement among firms and their own unions. Universal wage/employment bargaining can never be sustained as a pure strategy equilibrium outcome. Wage/employment bargaining, however, may in fact coexist with other arrangements (right-to-manage) within the labor market of a single industry.

Our findings seem to be in line with the widespread belief, during the last decades, that there is a positive relationship between unions’ activity and long-run unemployment rates. As our static union–oligopoly framework with decentralized bargaining predicts, if unions are militant (i.e., powerful) enough, “inefficient” (e.g., Universal right-to-manage) institutions may emerge, which in turn, ceteris paribus, lead to lower long-run sectoral employment rates. Our findings also fit the stylized facts showing significant variability, regarding sectoral employment rates. Given that the union power is not evenly distributed, one should not expect the scope of bargaining institution arrangements to be the same everywhere. Even in a widely decentralized bargaining environment (like in the US, Japan and many European countries), the unions’ bargaining power may still significantly differ, so as to sustain various rates of employment across different oligopolistic sectors.

Our model leads to a number of testable implications for unionized industries with decentralized bargaining. First, sectoral employment is negatively related to

\[\text{\ldots} \]
the unions’ power, but only in industries where unions are sufficiently strong. Second, as the sector becomes less concentrated, wage/employment bargaining is more likely to occur in some section of the industry. Finally, equilibrium scope-of-bargaining institutions are rather insensitive to union members’ risk aversion and technological asymmetries among firms.

There are two major limitations to our analysis: the first stems from assuming specific functional forms, while the second regards the testability of our main findings. Despite that, we are able to draw certain important implications about significant issues, such as labor market legislation and unemployment policies. First, as far as the scope of bargaining is concerned, labor market agents (firms and unions) are shown to be always self-motivated in the selection of the institutional arrangement. Second, provided that labor market legislation allows for the interested parties to choose their negotiations agenda, policies aimed at fighting long-run unemployment should typically concentrate on measures to restrain the unions’ power. Restricting the unions’ bargaining power may prevent the particular labor market from switching to more ‘inefficient’ arrangements, and thus lead to lower sectoral employment rates. Third, given that a variety of labor market arrangements exist across EU countries (De la Croix, 1992; Hartog and Teeuves, 1992), coordination of labor market legislation along the previous lines is needed before a unified labor market can effectively emerge.

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Appendix A

A.1. Proof of Proposition 1

We need to find the conditions under which no firm/union pair has incentives to switch to (w,e)-bargaining. Suppose, w.l.o.g., that firm/union 1 unilaterally

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Note: The number in the citation [20] refers to the page number of the reference in the bibliography. The note at the bottom of the page provides clarification on the measurement of union strength and the limitations of the empirical proxies used.

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deviates by bargaining over employment as well. By determining \( N_1^d \), and thus \( y_1^d \), firm 1 becomes a Stackelberg leader. Given that the negotiated wage of firm/union 2 is \( w^*_2 \) (given in Eq. (6)), and that firm 2's optimal response to \( y_1^d \) is \( R_2(y_1^d) = (a - w^*_2 A_2 - y_1^d)/2 \), firm/union 1 chooses \((y_1^d,w^*_2)\) to maximize,

\[
(a - y_1^d - R_2(y_1^d))y_1^d - w^*_1 A_1 y_1^d \left[ (w^*_1 - w_0)^b A_1 y_1^d \right]^{(1-b)}
\]

Taking the focs, substituting \( w^*_2 \) from Eq. (6), and solving the system of equations we get:

\[
y_1^d = \left[ 2a(4 - 2b + 3b\varphi) + 2A_2w_0(2 - b) - A_1w_0(8 - 4b + 3b\varphi) \right] / D
\]

\[
w_2^d = \left[ 2(2 - b + b\varphi)(ab\varphi + 2A_1w_0(2-b)) + b\varphi(2A_1w_0(2-b)) \right] / A_1 D
\]

where \( D = (4 - 2b + b\varphi)(4 - 2b + 3b\varphi) \). Note that \( w_2^d = w_1^s \) (given in Eq. (6)). It can also be checked that \( \pi_2^d = (1 - b)(y_1^d)^2/2 \). Then

\[
\pi_1^d / \pi_1^s = (1 - b)\left( y_1^d \right)^2 / 2( y_1^s)^2 = 9(1 - b)/2(2 - b)^2
\]

where \( y_1^s \) is given in Eq. (7). Firm 1 has an incentive to switch to wage/employment bargaining as long as \( \pi_1^d > \pi_1^s \), which is true whenever \( b < 0.5 \). Nonetheless, union 1 always prefers bargaining over employment as well, since \( U_1^d / U_1^s = 3/(2 - b) > 1 \) always. Therefore, if \( b \geq 0.5 \), right-to-manage bargaining is the subgame perfect equilibrium institution. Q.E.D

A.2. Proof of Proposition 2

Does a firm or a union have an incentive to exclude employment from the negotiation agenda? W.l.o.g. we need only to show that firm 2 enjoys higher profits by opting for right-to-manage bargaining. Given that firm/union 1 chooses \((w_1^*, y_1^*)\) (given in Eq. (10)), and that firm 2 will optimally respond to \( y_1^* \) in the product market, \( R_2(y_1^*) = (a - w_2^d A_2 - y_1^* )/2 \), firm/union 2 negotiates over \( w_2^d \) according to:

\[
\max \left[ (a - y_1^* - R_2(y_1^*))R_2(y_1^*) - w_2^d A_2 R_2(y_1^*) \right]^{(1-b)}
\]

\[
\times \left[ (w_2^d - w_0)^b A_2 R_2(y_1^*) \right]^{b}
\]

Taking the foc and substituting \( y_1^* \) from Eq. (10), we obtain

\[
w_2^d = \left[ ab\varphi(1 - b + b\varphi) + w_0\left( A_1b\varphi + A_2(3 - 4b + b^2 + 2b\varphi - b^2\varphi) \right) \right] / A_2 F
\]
where $F = (2 - b + \phi)^2 - 1$. Then from firm 2’s reaction function we get,
\[ y_2^* = \left( (2 - b) \left\{ a(1 - b + \phi) - w_0(A_2(2 - b + \phi) - A_1) \right\} \right) / 2F \quad (A7) \]
Note that $w_2^d = w_2^*$. Further, it can be checked that $\pi_2^d = (y_2^d)^2$. Then $\pi_2^d / \pi_2^* = (y_2^d)^2 / (1 - b)y_2^2 = (2 - b)^2 / 4(1 - b)$, which is always greater than 1. Hence, firm 2 has always an incentive to veto the inclusion of employment on the negotiation agenda. That is, wage/employment bargaining can never be the universally chosen institution in the subgame perfect equilibrium. Q.E.D.

### A.3. Proof of Proposition 3

We first prove that firm/union 2 has no incentives to switch to (w,e)-bargaining. To do so, we need only to show that firm 2 enjoys lower profits by including employment on the negotiation agenda. Given firm 1’s choice of $(w_1^*, y_1^*)$ (given in Eq. (16)), firm/union 2 chooses $(w_2^*, y_2^*)$ to maximize
\[ \left[ (a - y_2^* - y_2^d)y_2^d - w_2^dA_2y_2^2 \right]^{(1 - b)} \left[ (w_2^d - w_0)^* A_2y_2^2 \right]^b \quad (A8) \]
Taking the foc, substituting $(w_1^*, y_1^*)$ from Eq. (16), and solving the system of equations we get:
\[ w_2^d = \left\{ a(1 - b + \phi) - w_0(A_2(2 - b)^2 + 2b\phi(A_1 + A_2) - A_2b^2\phi) \right\} / A_2G \quad (A9) \]
\[ y_2^d = \left( a(1 - b + \phi) - w_0(A_2(3 - b + \phi) - 2A_1) \right) / 2G \quad (A10) \]
where $G = (b\phi + (b\phi - b + 2)^2)$. Note again that $w_2^d = w_2^*$. It can also be checked that $\pi_2^d = 4(1 - b)^2(y_2^d)^2$. Then $\pi_2^d / \pi_2^* = 4(1 - b)(y_2^d)^2 / y_2^2 = 4(1 - b)/(2 - b)^2$, which is less than 1 for all $b$. Hence, firm 2 prefers right-to-manage bargaining always.

We next show that neither firm 1 nor its union has an incentive to switch to right-to-manage bargaining if $b < 0.5$. Given that firm/union 2 chooses $w_2^*$ (given in Eq. (16)), and then leaves employment decisions to firm 2’s discretion, whenever firm/union 1 bargains over wages $(w_1^*)$ alone, firm 1 chooses $y_1^*$ to maximize its profits at the subsequent production game. Then from Eq. (3), we have $y_1^* = (a - 2A_1w_1^* + A_2w_2^*) / 3$, with $\pi_1^* = (y_1^*)^2$. Taking this into account, firm/union 1 chooses $w_1^*$ to maximize,
\[ \left[ \pi_1^*(w_1^*, y_1^*) \right]^{(1 - b)} \left[ (w_1^* - w_0)^* A_1y_1^* \right]^b \quad (A11) \]
Taking the foc, substituting $w_2^*$ from Eq. (16), and solving for $w_1^*$ we get,
\[ w_1^* = \left\{ a\phi(2 - b + 2b\phi) + w_0 \left( 2A_1((2 - b)^2 + b\phi(3 - b)) \right. \right. \]
\[ + A_2b\phi(2 - b) \right\} / 2A_1G \quad (A12) \]
Note again that \( w^*_1 = w^*_2 \). Also,
\[
y^*_1 = \left[ \left( 2 - b \right) \left\{ a(2 - b + 2b\varphi) - w_0(2A_s(2 - b + b\varphi) \\
&- A_s(2 - b)) \right\} \right] / 3G
\]  
(A13)

It can be checked that \( \pi^*_1 = (y^*_1)^2 \). Therefore, \( \pi^*_1 / \pi^*_1 = 2(y^*_1)^2 / (1 - b) y^*_1 = 2(2 - b)^2 / 9(1 - b) \), which is \( \leq 1 \) as long as \( b \leq 0.5 \). Further, \( U^*_1 / U^*_1 = y^*_1 / y^*_1 = (2 - b) / 3 < 1 \) for all \( b \). Hence, neither firm 1, nor union 1, has an incentive to switch to right-to-manage if \( b \leq 0.5 \). Q.E.D.

References