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MERGER PROFITABILITY IN UNIONIZED OLIGOPOLY

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ABSTRACT

Merger Profitability in Unionized Oligopoly*

We examine how a merger affects wages of unionized labour and, in turn, the profitability of a merger under Cournot competition in differentiated products. If unions are plant-specific, we find that a merger is more profitable than in a corresponding model with exogenous wages. In contrast to the received literature, we find that it can be more profitable to take part in a merger than to be an outsider. For firm-specific unions, on the other hand, results are reversed.

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NON-TECHNICAL SUMMARY

Traditional merger theory has dealt primarily with two questions: firstly, are mergers without cost savings (that is, purely anti-competitive mergers) profitable? Second, if such anti-competitive mergers prove to be profitable, how is the situation for non-merging firms in the same industry affected?

The classic result is that anti-competitive mergers are often unprofitable. In the case of quantity competition (Cournot markets) in homogeneous goods, a merger must lead almost to full monopolization of the relevant market before it is profitable. The key intuition is that with constant returns to scale, there is a serious free-rider problem involved. The merging parties have an incentive to reduce their total output, but much of the advantage of the resulting price increase spills over to the non-participants.

If one uses the other workhorse of oligopoly modelling, the Bertrand model of price-setting firms, the conclusion of non-profitable anti-competitive mergers is turned around: such mergers turn out to be profitable in this context. However, the free-rider logic still applies: Even though such mergers now are profitable, it is even more profitable to be a non-participant in the same industry as the merger candidates.

These results are disturbing. Mergers seem to be an all-important aspect of business life, so does this mean that mergers typically are driven by cost reductions or other synergies, rather than by the wish to achieve market power? If the free-rider problem is so important, firms would be expected to hesitate to enter merger processes, trying to outwait other firms in the industry, but casually one gets the impression that the opposite holds.

While traditional merger theories basically have studied how a merger influences the strategic interplay between firms in an industry, the present Paper tries to incorporate also unionized labour as strategic players. How will a merger influence wage setting in merging and outside firms? How does this affect merger profitability? It turns out that the exact modelling of union structure is crucially important. Under one set of assumptions, a merger most likely leads wages to fall enough to make anti-competitive mergers profitable. And notably, it becomes more profitable to be an insider to the merger than an outsider. This might appear to be stating the obvious – that if a merger leads to sufficient cost savings for the participants, the merger will be profitable, and it will be more attractive to participate in the merger than not. But note that the cost saving here is not exogenously assumed, but endogenized. This means that we use a model of rational unionism to explain under what circumstances a merger can lead wages to fall sufficiently.

We employ a standard linear oligopoly model, with Cournot competition and differentiated products. The unions are assumed to be monopoly unions that

have the power to set wages, but that must take the employment decisions of the firms as given. We discuss in the Paper the robustness of our findings when the assumptions of this simple model are altered. The level of unionism proves to be important. We distinguish between plant-specific, firm-specific and industry-wide unions. In the latter case, it proves that mergers have no effect on wages, so the bulk of the Paper discusses a comparison of plant-specific and firm-specific unionism.

Plant-specific unionism is precisely the case where mergers most likely lead wages to fall so that anti-competitive mergers become profitable. A merger will probably lead the merged unit to cut back its total output (one cannot be totally sure about this in the current context, as opposed to what is predicted by the 'standard' model). Unions might want to cushion the drop in employment by lowering wages. But the most important effect is that the merged unit is now able to pit two isolated unions against each other in a fight to get a higher share of the merged entity's total production. This is typically very wage dampening. In most instances, the wage drop will be sufficient to make anti-competitive mergers profitable. The exceptions are when unions care very much about employment or when products are very differentiated. Unions that are almost solely employment-oriented will set a wage very close to the competitive level anyway, so there is not much room for wage drops after a merger. Differentiated products offer unions some protection against being pitted against one another, since moving production from one plant to another will after all produce quite a different product.

The wage in the outside firm can increase or decrease, but it turns out that the wage will always fall more in the merged firm than in the outsider firm. This means that anti-competitive mergers not only tend to be profitable, but it is more attractive to be an insider than an outsider. This result holds as long as unions are not too employment oriented. Again, strong employment orientation on the part of the unions means that advantage from a wage drop is small, because wages were low even to begin with, before the merger.

Firm-specific unions produce almost completely opposite results. Firm-specific unions imply that as a firm merges, their unions merge too. This means that competition among unions in the oligopoly is reduced, as we move from a situation with three independent unions to two unions. This tends to imply that wages in the merged unit *go up* after merger, and it is even more unlikely that an anti-competitive merger is profitable here than in a non-unionized framework. Mergers are now profitable only when products are very differentiated and unions very employment oriented. The free-rider problem reappears: mergers are always more profitable for an outsider than for a participant.

Since union structure is so important for the results, we need a discussion in which assumption is more relevant. International mergers often lead to a merger between firms without a merger between unions. This could imply that firms seek out international rather than domestic merger possibilities, because international mergers have a discipline effect for unions that domestic mergers have not. Also, in some countries, a very decentralized bargaining structure combined with product differentiation might mimic what we have dubbed plant-specific unionism.

We think that our analysis is important for empirical work. The results on how mergers influence wages have so far been very unclear, and we suggest that distinguishing clearly between the cases where one should expect wage drops and where one would expect wage increase would be clarifying. We intend to delve more into the policy consequences of the model in a sequel Paper. Wage drops lead to lower prices, so mergers are less of a competition problem (but perhaps more of a problem from a distributional viewpoint). Even though each merger might, however, be less of a problem from a competition viewpoint, the wage drop might induce more anti-competitive mergers, so that merger policy in fact becomes more important.

Merger Profitability in Unionized Oligopoly[*]

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January 18, 2001

Abstract

We examine how a merger affects wages of unionized labor and, in turn, the profitability of a merger under Cournot competition in differentiated products. If unions are plant-specific, we find that a merger is more profitable than in a corresponding model with exogenous wages. In contrast to the received literature, we find that it can be more profitable to take part in a merger than being an outsider. For firm-specific unions, on the other hand, results are reversed.

Keywords: merger profitability, trade unions, endogenous wages
JEL classification: J51, L13, L41

1 Introduction

Empirical literature suggests that mergers may affect wages (see e.g. Peoples *et al.*, 1993, and McGuckin *et al.*, 1995). Despite this evidence, the theoretical literature on mergers does not investigate any possible

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links between mergers and wages.[1] It is mainly concerned with how a merger affects the rivalry between firms. The purpose of this paper is to help filling this gap by analyzing mergers in a unionized oligopoly. Since we observe that union structures vary, from plant-specific unions in some countries to firm- or industry-specific unions in other countries (or industries), we investigate how different union structures affect the profitability of a horizontal merger. We argue that this has important implications not only for firms' business strategies, but also for anti-trust policy as well as the empirical testing of possible links between mergers and wages.

In a seminal paper, Salant, Switzer and Reynolds (1983) show that in a Cournot oligopoly with homogeneous goods, linear demand and constant marginal costs, a merger is unprofitable unless the merging coalition consists of more than 80 per cent of all firms in the industry. More recent studies have shown how a relaxation of some of the assumptions in Salant *et al.* (1983) may restore the perhaps more intuitive result that mergers are most often profitable. This could be done by, on the demand side, introducing differentiated products or by, on the cost side, adding a capital stock that affects marginal costs, or by changing the strategic choice variables from quantities (Cournot) to prices (Bertrand).[2] Predictions from theory are then that a merger without any cost savings is typically profitable under Bertrand competition,

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[1] There are a few notable exceptions. González-Maestre and López-Cuñat (1999) analyse merger in a homogeneous Cournot model where each owner delegates output decisions to a manager. The manager's incentive scheme, which is endogenous in the model and thereby affected by a merger, can be regarded as a wage. Since the incentive scheme is set by the owner, their setting is distinctly different from ours where we have unions that can bargain over wage (and possibly employment). In Bárcena-Ruiz and Garzón (2000) a merger affects wage setting. However, they analyse a merger from duopoly to monopoly. Horn and Wolinsky (1988) apply a bargaining model to analyse a merger from duopoly to monopoly, either upstream (unions) or downstream (firms) merger. Our approach is different in several ways, though. Horn and Wolinsky consider downstream merger only in the case of a single upstream input supplier. For our purposes, this turns out to be the least interesting case. Furthermore, since we are concerned about the well known free rider problem in the merger literature, we apply a model which includes a non-merging firm.

[2] As anticipated in Deneckere and Davidson (1985) and shown in Lommerud and Sørgard (1997), a merger is more profitable if the products are differentiated than what is the case with homogeneous products. On the cost side, the assumption that the capital stock lowers marginal costs implies that a merger is more profitable than what is the case with constant marginal costs. This is shown in, for instance, Perry and Porter (1985) and McAfee and Williams (1992). Finally, Deneckere and Davidson (1985) show that the result in Salant *et al.* (1983) can also be reversed by changing the nature of competition. They examine the case of differentiated products and price competition, and find that a merger is *always* profitable in such a setting.

and typically unprofitable under Cournot competition unless products are sufficiently differentiated.[3]

More clear-cut is the theory's prediction concerning the insiders' versus the outsiders' gain from a merger. As far as we know, no studies find that it is more profitable to be one of the merging firms than to be one of the non-merging firms unless there are some exogenous cost savings following a merger. One could then argue that each firm should wait, hoping that other firms merge and then be a free rider on such a merger.[4]

Our model is in much the same spirit as Salant *et al.* (1983). We apply a Cournot model of differentiated products, with Salant *et al.*'s homogeneous goods model as a special case.[5] The results in the literature are reproduced in a benchmark version of our model, where wages - the firms' input prices - are exogenous.

In the model, labor is the only input to production and the workers are organized in trade unions that are concerned about both wages and employment.[6] Applying a monopoly union model, we assume that wages are set by the unions at a stage prior to the Cournot subgame, in which employment is indirectly determined.[7]

We distinguish between three different ways to organize the labor market: the unions can either be plant-specific, firm-specific or industry-specific. In the latter case all workers in the industry are organized in a single union. The central monopoly union is then not only a monopolist in the labor market, but a back-seat monopolist in the product market as well. A merger is irrelevant for wage setting in such a context, because what matters is product market demand. The results from the standard

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[3]Several studies try to explain unprofitable mergers and acquisitions. Faulí-Oller and Motta (1996) show that unprofitable mergers can occur in a setting with strategic delegation of decisions to managers. Shleifer and Vishny (1988) argue that managers with other motives than value maximization, such as the size of their organization, can trigger unprofitable mergers. Roll (1986) argues that those overestimating their ability most are also most likely to buy a firm (winner's curse). Nilssen and Sørgard (1998) and Fridolfsson and Stennek (2000b) show that a merger that is unprofitable seen in isolation may be undertaken either to prevent or to encourage future mergers.

[4]This free rider problem was first pointed out in Stigler (1950). Fridolfsson and Stennek (2000a) show that this mechanism may delay a merger rather than prevent it completely.

[5]It can be shown that our results are valid also for the case of Bertrand competition and differentiated products, see Lommerud, Straume and Sørgard (2000).

[6]The literature on unionized oligopoly is quite sizeable; see for example Brander and Spencer (1988), Dowrick (1989), Naylor (1998), Lommerud and Sørgard (1999) and Straume (2001). There is no mention of mergers in these papers.

[7]It can be shown that our results are valid also in a setting with an efficient bargaining model rather than a monopoly union, see Lommerud, Straume and Sørgard (2000).

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literature still apply.

Our main focus is directed towards the case of plant-specific union-ism, which dramatically changes the results from the benchmark model. A plant-specific union organizes only the workers at one plant. In this case a merger between two firms does not change the number of unions, but it changes the rivalry between them. The two merged firms' unions compete more fiercely on wages to serve the merged firm. Furthermore, the initial reduction in sales would imply that employment suffers, and the union will want to set a low wage as a response to a merger to dampen the reduction in employment. We find that, in contrast to the standard literature, a merger is now profitable unless the unions are very employment-oriented. An employment-oriented union would imply that wages are close to the competitive level initially, so that a merger has only a limited effect on wages.

We show that the merging firm's wages are always lower than the non-merging firms' wages. We find that a merger can be more profitable for a merging than for a non-merging firm. This holds if the unions are sufficiently wage-oriented.

If the unions are firm- rather than plant-specific, our results are reversed. In the case of firm-specific unionism, a merger between two firms implies that the merging firms' unions also merge. We then have a higher concentration in the labor market, which reduces the rivalry between the unions. In this case a merger results in higher wages, and the merging firms now face higher wages than the non-merging firm. Not surprisingly then, a merger is now less profitable than in the case with exogenous wages. We find that in this case a merger is unprofitable under Cournot competition unless the products are very differentiated and the unions are extremely employment oriented. Since wages increase more for the merging than the non-merging firms, an outsider earns more from a merger than a participant. Thus, we see that the traditional result in the literature is restored in this respect.

The distinction between plant-specific and firm-specific bargaining has turned out to be very important. A natural question is when which model best describes a particular industry. We think international merg-ers, which gain in importance, point towards the plant-specific union model. Trade unions tend not to transcend national borders. Moreover, when the oligopoly in question produces differentiated goods, decentral-ized bargaining can imply something close to plant-specific unionism.

2 Some preliminaries

Consider an oligopoly industry that consists of three firms, each produc-ing one brand of a differentiated product. Let firm i produce brand i in

quantity q_i. There is no entry or threat of entry, and firms compete in a Cournot fashion. Firms 1 and 2 are the merger candidates,[8] and we assume that the merged firm continues to produce two brands (1 and 2), making it 'larger' than either of the pre-merger firms. The outsider (firm 3) continues to produce one brand (3). Let us here first show the results found in a benchmark model without trade unions, and then introduce unions.

A benchmark

Demand for the differentiated product is characterized by a symmetric demand system, where the inverse demand function for brand 1 is given by

$$p_1 = 1 - q_1 - b\,(q_2 + q_3) \tag{1}$$

with a corresponding structure for the inverse demand functions for the other brands. The parameter $b \in \langle 0, 1 \rangle$ is a measure of substitutability in demand. If $b \to 0$ the brands are regarded as (almost) unrelated, whereas $b \to 1$ corresponds to the case of (almost) homogeneous goods.

Labor is the only factor of production, and each worker supplies one unit of labor to the firm at a price w per unit (wage). We assume that the labor force is homogeneous and that different brands are produced by using the same production technology, so that the only factor that ties a certain brand to a firm is patent rights.

We adopt a very simple linear production function, given by

$$q_i = l_i \tag{2}$$

where q_i is total quantity produced (of brand i) by firm i, and l_i is the total amount of labor employed by firm i. In this case, output and employment are equivalent.

As a benchmark for later comparison, consider the following result:

Lemma 1 *If wages are exogenous, a merger is profitable if $b < 0.55$, and more profitable for the outsider than for a participant.*

Proof Results follow directly from Lommerud and Sørgard (1997). ∎

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[8]This is the conventional approach in the literature on merger incentives. Ideally, an approach in which the merger formation is endogenously determined would be preferrable. Horn and Persson (2001) suggest such an approach, based on cooperative game theory. However, for a symmetric oligopoly with three firms (owners) it coincides with the conventional approach.

An outsider's best response to a reduction in sales by the merging firm is to *increase* its sales, thereby reducing the profitability of a merger. As shown in Salant *et al.* (1983), for the case of homogeneous products, the effect of the outsiders' response may dominate so that a merger is unprofitable. However, each outsider's response is dampened if products are differentiated. This explains why merger can be profitable under Cournot competition if products are sufficiently differentiated.

Irrespective of the nature of competition, the outsider will be a free rider on the merger. It will experience higher prices *and* higher sales. It will thus gain more from the merger than the insiders, who experience a reduction in sales.

The labor market

We assume that wages are unilaterally set by monopoly unions.[9] They are characterized by identical Stone-Geary utility functions, given by

$$U_i = (w_i - \overline{w})^\theta (l_i)^{1-\theta} \tag{3}$$

where the parameter $\theta \in [0, 1]$ captures the relative importance of wages and employment to the unions.[10] The reservation wage, $\overline{w}$, is equal to the wage that could be earned in the competitive sector of the economy. For simplicity, $\overline{w}$ will be set equal to zero.

The union structure is assumed to be exogenously given. From Horn and Wolinsky (1988) we know that if we allow the union structure to be endogenously determined, the unions will have an incentive to form a single encompassing union, as long as the products are substitutes. However, the observation of great variation in union structure across different countries indicates the importance of various institutional determinants of union structure. In addition, in markets where firms are located in different countries, there are obviously both geographical and cultural obstacles to union cooperation. In fact, whereas international mergers is a highly prevalent phenomenon among firms,[11] we hardly ever observe a formal cooperation between unions across borders. One main reason is probably that capital is highly mobile between countries, whereas labor is generally not.

In the present model we attempt to explore the incentives for corporate mergers under different exogenous union structures. In particular,

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[9] As pointed out by Dowrick (1989), this can be viewed as a limiting case of the wage-bargaining union, where the union has all the bargaining strength.

[10] θ is a measure of the labor market distortion caused by unions. When $\theta \to 0$ the wage approaches the competitive level. θ is assumed to be equal for all unions.

[11] In 1999, the share of all mergers and aquisitions, in terms of value, that was cross-border reached nearly 31 per cent (UNCTAD, 2000).

our main focus is directed towards the case which we find most interesting, namely that of plant-specific unionism, in which unions are unable to coordinate their wage demands across different plants. We believe this to be a highly relevant feature of a unionized international oligopoly.

The rules of the game

We assume the following sequence of moves:

Stage 1: Firm 1 and 2 decide whether or not to merge.

Stage 2: The unions simultaneously set wages.

Stage 3: The firms simultaneously set quantities.

Note that employment is indirectly determined at stage 3 of the game, when the firms choose production quantities.

3 Plant-specific unionism

Under plant-specific unionism wages are determined at plant level, and it is implicitly assumed that unions at different plants are unable to coordinate their wage demands.

The decision of whether or not to merge, is assumed to be based on a payoff comparison with the no-merger benchmark equilibrium. In the no-merger game, firm i chooses l_i to maximize

$$\pi_i = (p_i - w_i) \, l_i \tag{4}$$

where w_i is the wage set by firm i's union, which maximizes

$$U_i = (w_i)^\theta \, (l_i)^{1-\theta} \tag{5}$$

In the *post-merger* game, the merged firm chooses l_1 and l_2 to maximize

$$\pi_m = (p_1 - w_1) \, l_1 + (p_2 - w_2) \, l_2 \tag{6}$$

where w_1 is the wage set by the union at plant 1, and w_2 is the wage set by the union at plant 2. These unions set their wages simultaneously by maximizing, respectively,

$$U_1 = (w_1)^\theta \, (l_1)^{1-\theta} \tag{7}$$

and

$$U_2 = (w_2)^\theta \, (l_2)^{1-\theta} \tag{8}$$

Regarding the wage response to a merger, we have the following result:[12]

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[12] All remaining proofs are presented in the appendix. Regarding notation, subscript i refer to the no-merger outcome, whereas all other subscripts refer to the post-merger outcome.

Lemma 2 *(i)* $w_3 > w_i$ *if* $\theta < \frac{1}{2}$ *or* b *is sufficiently low.*
(ii) $w_i > w_1 = w_2$.
(iii) $w_3 > w_1 = w_2$.

The merging firms' wages fall, while the wage set by the outsider's union will increase *or* decrease, depending on union preferences and the degree of product differentiation. Importantly, though, the merged firm always faces lower wages than do the outsider.

A merger would, *ceteris paribus*, result in lower sales for the merging parties. This is bad news for workers in the merging firms, since employment suffers. The two unions in the merging firms will respond by reducing wages and thereby soften the reduction in employment.

More importantly, though, a merger triggers an increased degree of competition between the two unions supplying workers to the merged firm. Consider a wage reduction by one of the two unions. The merged firm is then free to reshuffle its total sales by reducing production supplied by the high-wage union and increasing production supplied by the low-wage union. The degree of this inter-union competition is determined by the degree of product differentiation. A higher degree of substitutability in demand implies that under-bidding of wages is more effective, from the unions' points of view. In the extreme case, when products are homogeneous, the merged firm will want to locate the entire production at the low-cost plant, and inter-union competition will drive wages down to the reservation level.[13] Thus, product differentiation implies a certain degree of protection for unionized labor in a context of plant-specific unionism.

It is important to emphasize that inter-union competition is the dominant force behind wage responses to a merger. It can easily be shown that if the unions are wage oriented, i.e. if θ is relatively high, a merger would trigger an *expansion* of sales by the merging firms. This is due to the fact that pre-merger profits, as well as output, are low, making it profitable for the merging firms to increase output as a response to a decrease in wages. Thus, if θ is sufficiently high, the rivalry in the labor market triggered by the merger results in lower wages *and* higher employment in the merging firms.

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[13] In the case of homogenous goods, the equilibrium strategy for the merged firm is of course to continue production at both plants, in order to preserve the effect of inter-union competition. If, on the other hand, there are fixed costs associated with operating a production plant, the merged firm faces the trade-off between producing at both plants, and thereby inducing variable cost synergies through inter-union competition, or concentrating production at one plant, and thereby inducing fixed cost synergies. We want to focus solely on the effect of inter-union rivalry, and do not pursue the assumption of fixed cost synergies.

Absent unions, a non-merging firm would increase sales following a merger. This suggests that the union in the non-merging firm would respond to a merger by increasing wages, and thereby obtain increased wages *and* increased employment following the merger. However, as explained above, if unions are sufficiently wage oriented, the inter-union rivalry following a merger may result in an expansion of sales by the merging firms. If so, the non-merging firm would face a lower sale following a merger. The union's best response would then be to lower its wage. We see from Lemma 2 that this is true if the products are sufficiently close substitutes, implying that the spillover effect on the non-merging firm from a sales increase by the merging firm is large.

However, due to the intensified rivalry between the merging firms' unions, the wage reduction is always larger in the merged firm than in non-merged firm.

Proposition 1 *Under plant-specific unionism, a merger is (i) always profitable for the participants unless $b > 0.55$ and θ is close to zero, and (ii) more profitable for a participant than for the outsider if the unions are not too employment oriented.*

We see from Proposition 1 that the results in the received literature - referred to in Lemma 1 - is reproduced when θ approaches zero. This is the case where the union in the limit is concerned only about employment and not about wages and thus wages approach the competitive level. In this case, a merger (in the limit) has no effect on wages, and it is profitable only if the products are sufficiently differentiated ($b < 0.55$).

When $\theta > 0$, wage matters for the unions. They are then concerned about *both* wages and employment. We find the existence of a hump-shaped relationship between θ and post-merger wage responses.[14] This, in turn, determines a similar relationship between θ and merger profitability. For low levels of θ, pre-merger wages are close to the competitive level, and there is not much room for wage reductions. As θ increases, though, the larger is the wage reduction following a merger, increasing the profitability for the merger participants. However, for very high values of θ, the unions have a strong preference for high wages, and even though there are considerable room for wage reductions, a merger will only trigger small adjustments in wages. Nevertheless, for values of θ close to 1, even a marginal reduction in post-merger wages will make a merger profitable for the participants.

Product differentiation triggers two opposing forces in our model, and the strength of these forces are determined by the degree of differentiation: On the one hand, a lower degree of product differentiation

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[14]Equilibrium wages and profits are provided in the appendix.

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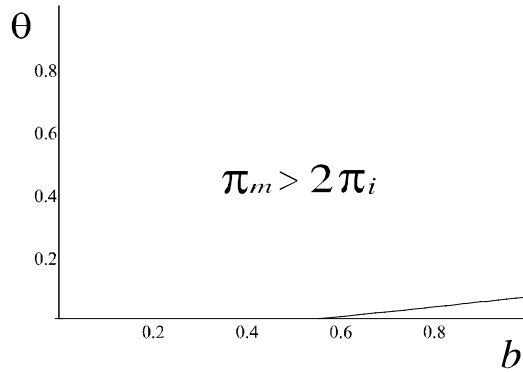
Figure 1: Merger profitability under plant-specific unionism.
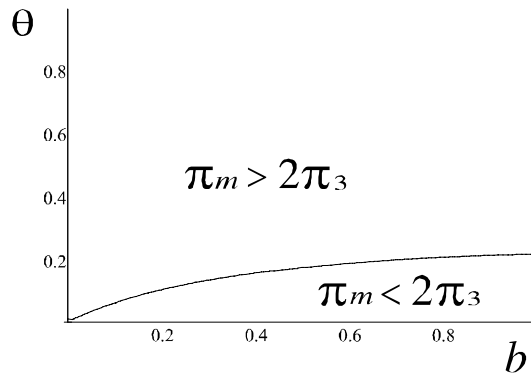
Figure 2: Insider versus outsider profitability of a merger under plant-specific unionism.

makes the outsider's aggressive response stronger, which tends to make a merger less profitable (cf. Lemma 1). On the other hand, if products are close substitutes, the degree of inter-union competition is high, making a merger highly effective as a disciplinary device towards the unions. From Proposition 1 it is apparent that, as long as the unions are not too employment oriented, these two effects tend towards cancelling each other out, making a merger profitable for every degree of product differentiation. As shown in Figure 1, a merger is profitable even if products are (almost) identical as long as θ is above a certain treshold level.

>From Lemma 2 we know that the wage reduction following a merger is always larger in the merged firm than in the non-merged firm. This helps explain the result illustrated in Figure 2: A merging firm gains more from a merger than what is the case for the non-merged firm, as long as the unions are sufficiently wage-oriented.

4 Other types of union structure

Plant-specific unionism seems to be a realistic assumption when labor is immobile between plants. In this case, we find it rather unlikely that workers at different plants would form a single trade union. This view is also supported empirically by the extremely low prevalence of cross-border unionism. The unions would still have incentives to coordinate their wage demands, though, in order to reduce inter-union competition. This kind of union collusion is not further pursued in the present paper.[15] Leaving the possibility of union collusion aside, we will more briefly consider two other types of exogenous labor market structures: The case of *firm-specific unionism*, in which workers are organized according to firm boundaries, and the case of *a single union* organizing all the workers in the industry.

4.1 Firm-specific unionism

Firm-specific unionism refers to the case in which a corporate merger triggers a formal cooperation between the trade unions of the merger participants, so that post-merger wages for the merged firm is set by a single union. This would realistically require that the merger participants recruit workers from an integrated labor market (*i.e.* workers are mobile across plants).[16]

If unions are organized at firm level, a merger between two or more firms will implicitly lead to a higher degree of centralization in wage setting, since the merged firm only confronts one union in the post-merger game. In the second stage of the post-merger game, the merged firm chooses l_1 and l_2 to maximize

$$\pi_m = (p_1 - w_m) l_1 + (p_2 - w_m) l_2 \tag{9}$$

where w_m is the wage set by the merged firm's union, which maximizes

$$U_m = (w_m)^\theta (l_1 + l_2)^{1-\theta} \tag{10}$$

Lemma 3 $w_m > w_3 > w_i$.

After the merger, equilibrium wages increase for both the insiders and the outsider, but the merged firm faces a higher wage than the

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[15]This kind of union collusion is analysed, within the context of an international duopoly, in Straume (2001).

[16]We implicitly assume the existence of some institutional obstacles to union co-operation across different firms. A corporate merger could then be viewed as an institutional change that facilitates a formal union cooperation *within* the merged firm.

outsider. Comparing with Lemma 2, the results are reversed when we go from plant-specific to firm-specific unions.

At first glance, the result in Lemma 3 may come as a surprise. As was the case for plant-specific unions, the merging firm would, *ceteris paribus*, reduce sales and thereby reduce employment following a merger. In response, we would expect the union to lower wages, in order to soften the reduction in employment. However, in this case the merger between the firms also implies that the two unions merge. This, in turn, facilitates an internalization of a negative externality, allowing the union to *increase* wages. As shown in Lemma 3, this dampening-of-competition effect in the labor market, due to a higher degree of centralization in wage setting, more than offsets the tendency to lower wages to dampen the reduction in employment.

Note the difference between plant-specific and firm-specific unions. Under plant-specific unionism, there is a tendency that unions undercut each other in the wage setting, in order to capture a larger number of jobs for their own plant. Consequently, a merger creates a variable cost synergy due to increased inter-union rivalry. What firm-specific unionism does in this particular setting, is essentially to preclude mergers as a disciplinary device vis-á-vis the unions, since the union at the merged firm cares about the total level of employment, *but not the allocation of employment between plants.*

After the merger, there is an asymmetry between the firms. The merging firm offers two brands while the non-merging firm offers one brand. For a uniform wage in the industry, this would imply that the wage/employment ratio is lower for the merged firm's union. Since the unions are assumed to have preferences for both wages and employment, it will be optimal for the merged firm's union to set a wage in excess of the wage in the outside firm. Consequently, the wage increase due to the merger is larger for the merged firm than for the non-merged firm.

Implications for merger profitability are stated in the following proposition:

Proposition 2 *Under firm-specific unionism, a merger is (i) profitable for the participants only if $b < 0.55$ and θ is close to zero, and (ii) more profitable for the outsider than for a participant.*

In Figure 3 we have shown the set of parameter values for which the merger is profitable for the participants. We see that except for a few combinations of low θ and low b, a merger is unprofitable. It suggests that for a merger to be profitable in the presence of firm-specific unions we have to impose extremely strong additional assumptions regarding union preferences. This is no surprise, given that a merger triggers a
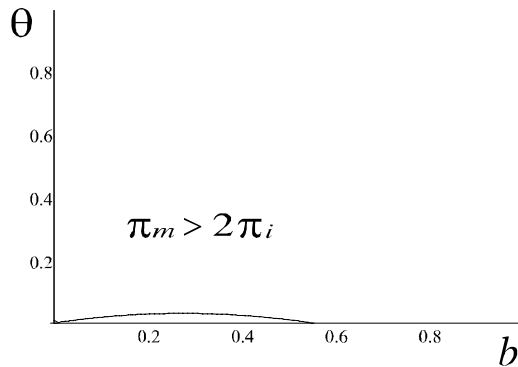
$$\pi_m > 2\,\pi_i$$

Figure 3: Merger profitability under firm-specific unionism.

wage increase in the merged firm and this wage increase is larger than the one in the non-merged firm. By comparing with Figure 2, we see the importance of the union structure. While it is very likely that a merger is profitable under plant-specific unionism, it is very unlikely that a corresponding merger in an industry with firm-specific unions is profitable.

Note also from part (ii) of Proposition 2 that in this case it is better being the outsider than being a participant in the merger. This is in contrast to our results with plant-specific unions. However, it is in line with the results in the received literature. Since we know that a merger with exogenous wages is more profitable for an outsider than for an insider, it is obvious that this conclusion still holds when a merger results in a higher wage increase for the merged firm than for the non-merged firm.

4.2 Industry-specific unionism

If there are no obstacles to union cooperation, and all the firms in the industry recruit workers from an integrated labor market with a high degree of worker mobility, we would reasonably expect the workers to be organized in a single union (cf. Horn and Wolinsky, 1988).

It is easily shown that, in this model, an industry-specific union will set the wage

$$w = \theta \tag{11}$$

regardless of the number of firms in the industry. Thus, a merger would not affect wages at all. In Lommerud, Straume and Sørgard (2000) we show that this result also holds for Bertrand competition.[17]

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[17]In fact, this result is more general, and does not hinge on the assumption of

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A central monopoly union can drive an oligopoly from the back-seat, so-to-speak. It controls the strategic interaction among firms by having the ability to fix the marginal production costs of all the participants. By increasing wages, product prices will have to increase and employment will fall. What matters for wage setting is only product market demand and the union's own relative preference for wage over employment. A merger is irrelevant for wage setting in this context.

5 Extensions

Our basic model is rather stylized, so it is natural to check the robustness of our results. Let us therefore explain how results may change when we extend our basic model in two different directions. For more details, see Lommerud, Straume and Sørgard (2000).

Bertrand competition. We know from the literature that if Bertrand competition prevails in a differentiated products industry, then a merger with exogenous wages is always profitable. With plant-specific unions, we find that this result is reinforced. More interestingly, we find that - as is the case with Cournot competition and endogenous wages - an insider can be better off than an outsider as a result of a merger. If unions are firm-specific, though, a merger can be unprofitable even in a setting with Bertrand competition. The driving force is the wage increase following a merger. Hence, our main results hold also in this extended version of our model. The reason is that the change in wages following a merger most of all depends on the rivalry between the unions, and the nature of this rivalry - wages being strategic complements - is independent of the nature of competition in the product market.

Efficient bargaining. In the basic model we have applied a monopoly union model in which the union unilaterally sets the wage while the firm has complete discretion over employment decisions. This is special case of the right-to-manage model, where the union and the firm bargain over wage while the firm sets employment. In the literature this model is often contrasted with the efficient bargaining model, where the union has the same relative bargaining strength over wage setting as employment decisions (and possibly other relevant decision variables). The existing literature suggests that the bargaining game that will emerge as the equilibrium outcome depends on the characteristics of the industry in

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linear demand. Under the assumption of constant elasticity of demand, Dowrick (1989) shows that if the union is organized on an industry-wide basis, the wage is independent of the degree of product market competitiveness, while Riley (1995) shows that this result holds for a general demand function, *i.e.*, the elasticity of industry labor demand is independent of the degree of product market competition.

question.[18] It is then natural to check whether our results still hold if we apply an efficient bargaining model rather than a monopoly union model. We have only investigated the case of plant-specific unions. It turns out that the qualitative results depends on the relative bargaining strength of the players. However, we find that our main results are still valid. A merger can be profitable even in a Cournot setting without any exogenous fixed costs savings, and the insider may earn more from a merger than an outsider. The intuition is that efficient bargaining introduces two opposing forces. On the one hand, the unions can extract a share of the potential profit increase following a merger. This tends to make a merger less profitable in a setting with efficient bargaining. On the other hand, the merged firm will have a better bargaining position since it can bargain with two different unions.[19] Once again, the two opposing forces tend towards cancelling each other out for a large set of parameter values.

6 Conclusions

In this paper we have shown that unions matter for the profitability of a merger, and that even union structure is of large importance. While plant-specific unions tend to increase the profitability of a merger and may even make it more profitable to take part in a merger than being an outsider, the results are reversed in a setting with firm-specific unions.

Our results suggest that firms considering to merge in a unionized oligopoly should be concerned about how the unions respond to a possible merger. The existence of plant-specific unions is an argument in favor of a merger, from firms' point of view. In contrast to the received literature, there is no free-rider problem. On the contrary, each merging firm may gain more than a non-merging firm and there are thus incentives to merge rather than wait and hope that other firms should merge.

This paper has not contained a welfare theoretic analysis that could guide anti-trust policy. Since union utility is not measured in monetary terms, our model specification is not well suited for such analysis. Still, we could offer some intuitive speculations: On the one hand, with plant-specific unions there will be a tendency to lower wages. The price increase following a merger then is dampened, making the merger less

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[18]Bughin (1999) finds that efficient bargaining is the most likely equilibrium outcome, even more so under the threat of entry. Petrakis and Vlassis (2000) finds that right-to-manage bargaining is the equilibrium outcome if the unions' bargaining power is sufficiently high, while Espinosa and Rhee (1989) find that efficient bargaining may emerge as an equilibrium outcome in infinitely repeated games.

[19]See also Davidson (1988).

of a problem from a competition policy viewpoint. On the other hand, the wage decrease can trigger a higher number of profitable mergers that harm competition. For firm-specific unions, the arguments are reversed.

Finally, we think our results could guide future empirical research on the wage effects of mergers. The results in the received empirical literature are mixed. Some find support for a wage increase following a merger, some for a wage cut, while others find no effect at all.[20] If one in the same data material combines mergers with plant-specific and firm-specific unions, one might find that mergers have - if any - only a limited effect on wages. According to our results the underlying truth could be that some mergers result in wage drops while others give wage rises. A proper empirical test should then start with a detailed study of the union structure which, in turn, should lead to a discrimination in the data material between industries with plant- and firm-specific unions.

A   Proofs of Lemmas and Propositions

Solving the no-merger game by backwards induction, we find that wages and profits in the symmetric Nash equilibrium are given by

$$w_i = \frac{\theta(2-b)}{2+b-2\theta b} \tag{A.1}$$

$$\pi_i = \frac{(2+b)^2(1-\theta)^2}{4(1+b)^2(2+b-2\theta b)^2} \tag{A.2}$$

In the case of *plant-specific unionism*, wages and profits in the asymmetric post-merger Nash equilibrium are given by

$$w_1 = w_2 = \frac{2\theta(2-b+\theta b-2b^2-\theta b^2+b^3)}{\eta} \tag{A.3}$$

$$w_3 = \frac{\theta(4-b^2-5\theta b^2+2\theta b^3)}{\eta} \tag{A.4}$$

$$\pi_m = \frac{(1-\theta)^2(2-b)^2(2+b)^2(b+1)(2+b+\theta b-b^2)^2}{2(2+2b-b^2)^2\eta^2} \tag{A.5}$$

$$\pi_3 = \frac{(1-\theta)^2(1+b)^2(4-b^2-5\theta b^2+2\theta b^3)^2}{(2+2b-b^2)^2\eta^2} \tag{A.6}$$

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[20] Cremieux *et al.* (1996) and Peoples *et al.* (1993) find support for a wage cut following a merger, while McGuckin *et al.* (1995) find the opposite result. Hekmat (1995) find no evidence of any link between mergers and wages, while Gokhale *et al.* (1993) find no or only limited evidence of a link between takeovers and wages.

where

$$\eta = 4 + 4b - 4\theta b - b^2 - 3\theta b^2 - 2\theta^2 b^2 - b^3 + \theta b^3 + 2\theta^2 b^3 > 0$$

In the case of *firm-specific unionism*, wages and profits in the asymmetric post-merger Nash equilibrium are given by

$$w_m = \frac{\theta\left(2 + b + \theta b - b^2\right)}{2 + 2b - \theta^2 b^2} \tag{A.7}$$

$$w_3 = \frac{\theta\left(2 + 2\theta b - \theta b^2\right)}{2 + 2b - \theta^2 b^2} \tag{A.8}$$

$$\pi_m = \frac{2\left(1 - \theta\right)^2\left(1 + b\right)\left(2 + b + \theta b - b^2\right)^2}{\left(2 + 2b - \theta^2 b^2\right)^2\left(2 + 2b - b^2\right)^2} \tag{A.9}$$

$$\pi_3 = \frac{\left(1 - \theta\right)^2\left(1 + b\right)^2\left(2 + 2\theta b - \theta b^2\right)^2}{\left(2 + 2b - \theta^2 b^2\right)^2\left(2 + 2b - b^2\right)^2} \tag{A.10}$$

Proof of Lemma 2. (i) From (A.1) and (A.4), $w_3 > w_i$ if

$$\frac{\theta b^2\left(1 - \theta\right)\left(4 - 4\theta - 4\theta b + 2\theta b^2 - b^2\right)}{\eta\left(2 + b - 2\theta b\right)} > 0.$$

The denominator is obviously positive for $\theta, b \in \langle 0, 1\rangle$. The numerator is positive if $\left(4 - 4\theta - 4\theta b + 2\theta b^2 - b^2\right) > 0$. Rearranging yields $4\left(1 - \theta\left(1 + b\right)\right) + b^2\left(2\theta - 1\right) > 0$. We see that this condition holds if $\theta < \frac{1}{2}$ or if b is sufficiently low.

(ii) From (A.1) and (A.3), $w_i > w_1 = w_2$ reduces to

$$\frac{\theta b\left(1 - \theta\right)\left(4 + 4b - b^2 - b^3 - 2\theta b^2\left(1 - b\right)\right)}{\left(2 + b - 2\theta b\right)\eta} > 0.$$

which holds for $\theta, b \in \langle 0, 1\rangle$.

(iii) From (A.3) and (A.4), $w_3 > w_1 = w_2$ reduces to

$$\frac{\theta b\left(2b + 1\right)\left(2 - b\right)\left(1 - \theta\right)}{\eta} > 0$$

which is true for $\theta, b \in \langle 0, 1\rangle$. ∎

Proof of Proposition 1 (i) A merger is profitable if $\pi_m - 2\pi_i > 0$. From Lemma 1 we know that this is true if $\theta = 0$ and $b < 0.55$. From Lemma 2 it must be the case that this is also true for $b < 0.55$ and $\theta > 0$.

For $b > 0.55$ we know (from Lemma 1) that $\pi_m - 2\pi_i < 0$ if $\theta = 0$. Setting $b = 1$, we can from (A.2) and (A.5) find that $\pi_m - 2\pi_i > 0$ if:

$$\frac{-9 + 138\theta - 127\theta^2 + 8\theta^3(1 + \theta)}{72(2\theta - 3)^2} > 0.$$

This condition is met if $\theta > 0.07$. Then we know that for $\theta \in \langle 0, 1 \rangle$ and $b \in \langle 0.55, 1 \rangle$ there are critical values where $\pi_m = 2\pi_i$. In Figure 1 (section 3) we have plotted the curve where $\pi_m = 2\pi_i$ in a (θ, b)-diagram, using the expressions in (A.2) and (A.5). It follows immediately that $\pi_m > 2\pi_i$ above the curve.

(ii) A participant earns $\pi_m/2$ and the non-merging firm π_3 in the post-merger equilibrium. We know from Lemma 1 that for $\theta = 0$, then $\pi_m - 2\pi_3 < 0$. Setting $b = 1$ and using the expressions reported in (A.2) and (A.6), we have that $\pi_m - 2\pi_3 < 0$ if $20\theta - 7\theta^2 > 4$. This condition is met if $\theta < 0.21$. Then we know that for $\theta, b \in \langle 0, 1 \rangle$ there are critical values where $\pi_m - 2\pi_3 = 0$. In Figure 2 (section 3) we have plotted the curve where $\pi_m = 2\pi_3$ in a (θ, b)-diagram, using the expressions in (A.2) and (A.6). Obviously, $\pi_m > 2\pi_3$ above the curve . ∎

Proof of Lemma 3 From (A.1), (A.7) and (A.8), and after rearranging, $w_m > w_3$ reduces to

$$\frac{\theta b \left(1 - b\right) \left(1 - \theta\right)}{\left(2 + 2b - \theta^2 b^2\right)} > 0$$

whereas $w_3 > w_i$ reduces to

$$\frac{\theta b^2 \left(1 - \theta\right) \left(2 + 2\theta - \theta b\right)}{\left(2 + 2b - \theta^2 b^2\right) \left(2 + b - 2\theta b\right)} > 0$$

It can easily be seen that both inequalities hold for $b, \theta \in \langle 0, 1 \rangle$. ∎

Proof of Proposition 2 (i) We know from Lemma 1 that if $\theta = 0$, then $\pi_m > (<) 2\pi_i$ if $b < (>) 0.55$. From Lemma 3 it must also be the case that $\pi_m < 2\pi_i$ if $b > 0.55$ and $\theta > 0$. Then we know that there are combinations of $\theta \in \langle 0, 1 \rangle$ and $b \in \langle 0, 0.55 \rangle$ such that $\pi_m = 2\pi_i$. By using the expressions in (A.2) and (A.9), we find these combinations of θ and b. They are plotted in a (θ, b)-diagram in Figure 3 (section 4.1). Obviously, above the curve shown in Figure 3 $\pi_m < 2\pi_i$.

(ii) We know from Lemma 1 that for exogenous wages, $\pi_m < 2\pi_3$. Given the result in Lemma 3, it is trivial to see that the result in Lemma 1 applies in this case too. ∎

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