Non-rigid wages and merger profitability reversal under convex costs and centralised unionisation

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Third revised version: September 9, 2013

Abstract

Can a merger from duopoly to monopoly be detrimental for profits? This paper deals with this issue by focusing on the interaction between decreasing returns to labour (which imply firms' convex costs) and centralised unionisation. Firstly, it is highlighted that a wage "non-rigidity" result applies: the post-merger wage is higher than in the pre-merger equilibrium. Secondly, it is shown that a "reversal result" in relation to merger profitability actually realises when the union is sufficiently oriented towards wages. Moreover, the higher the reservation wage, the degree of product differentiation and the union's relative bargaining power, the higher the probability that merger reduces profits.

JEL: D43, L13, J50

Keywords: wage rigidity result, merger profitability, unionised duopoly, convex costs

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1 Introduction

In recent decades the question whether a merger that is wholly anti-competitive is profitable has been increasingly addressed. In their seminal paper, Salant *et al.* (1983) developed a model with homogeneous goods, Cournot competition and *constant* as well as *exogenously given* marginal costs, showing that mergers that almost lead to a full-blown monopoly would be profitable.[1] In this paper, we examine whether the result that a merger leading to a monopoly is always profitable still applies in a duopoly model, in which production costs are endogenous and the factor input displays diminishing returns. In particular, following the established literature on unionised oligopolies (e.g. Horn and Wolinsky 1988; Dowrick 1989; Naylor 1999; Correa-López and Naylor 2004; Brekke 2004; Lommerud *et al.* 2005; Correa-López 2007; Symeonidis 2010), we consider a duopoly where wages are no longer exogenously given but are the outcome of a strategic game played between firms and a centralised (industry-wide) labour union. Indeed, centralised wage setting assumes particular relevance in concentrated industries (such as duopolies) because their characteristics increase the likelihood of union success in organizing at the industry level as well as maintaining its monopolistic position over time (see, e.g., Wallerstein 1999 in addition to the seminal papers by Segal 1964 and Weiss 1966).[2]

Starting from Horn and Wolinsky (1988), extensions of the question raised by Salant *et al.* (1983) to unionised or vertically related industries have attracted considerable attention. Specifically, Horn and Wolinsky (1988, Section 5) pointed out that when products are substitutes

[1] Literally, "[m]erger to monopoly is always profitable. When all the firms in an n-firm equilibrium collude, so that there are no outsiders, profits must increase, since joint profits will then be maximized" (Salant *et al.* 1983, p. 193). At the same time, they also demonstrated that only when a very large share of the market merges can the participants earn profits as a result of the merger, giving rise to the literature on the so-called "merger paradox" (see, e.g., Deneckere and Davidson 1985; Perry and Porter 1985; Farrell and Shapiro 1990a, 1990b; McAfee and Williams 1992; Heywood and McGinty 2007). As will be clarified below, by considering the case of a merger between duopolists this paper does not deal with the merger paradox.

[2] This is also consistent with the dominant (albeit not unanimous) view that wages tend to be higher in more concentrated industries (e.g. Blanchflower 1986; Dickens and Katz 1987; Belman 1988). For instance, Belman (1988) showed that wage elasticity with respect to market concentration (concentration effect) is positive and much of the concentration effect is indirect, that is, it is mediated through unionisation.

and a common upstream input supplier bargains *separately* with downstream firms over a price of a homogeneous input, the profit of a downstream monopoly is *less* than the total downstream industry's profit when it is a duopoly. This is because the input price under a downstream monopoly is higher than under a downstream duopoly, and this more than offsets the gains from monopolising the downstream industry.

While Horn and Wolinsky's (1988) result can be extended to a *coordinated* wage setting regime where an industry union coordinates the wage demands for all firms at the firm-level, we consider here a different context. We refer to a *centralised* wage setting, in which an industry-wide union sets a uniform wage for the entire industry. When wage negotiations are centralised at the industry level, Dhillon and Petrakis (2002) showed that a well-known "wage rigidity result" applies: under fairly general conditions, the competitive regime facing downstream firms has no effect on the wage. In turn, since wages are the same under a downstream duopoly and downstream monopoly, this should imply that a merger between downstream firms is always profitable. Accordingly, Brekke (2004) and Lommerud *et al.* (2005) investigate downstream mergers with upstream monopoly unions[3] and, although they contemplate the central union case, mainly concentrate on plant-specific and firm-specific unions (for which Dhillon and Petrakis's (2002) "wage rigidity result" does not apply). Brekke (2004) refers specifically to the hospital industry, showing that "if hospitals compete in prices and quality, and the wage is set by a central union, a merger will not influence the wage and the results [among which, that hospital mergers are always profitable] are still valid" (Brekke 2004, Proposition 1). Instead, Lommerud *et al.* (2005) develop a unionised oligopoly model including a non-merging firm (an oligopoly with three rather than two firms) and focus on the merger between a domestic firm and either another domestic firm or a foreign firm, concluding that the equilibrium market structure is very likely a cross-border merger.[4] Similarly to Brekke (2004), they also point out that in the presence of a central union (industry-

[3] Monopoly central union is a limiting case (with union having all the bargaining power *vis-à-vis* the employer federation, representing all firms in the industry; e.g. Dowrick 1989) of a scenario where wage negotiations are centralised at the industry level. Hence, the "wage rigidity result" should generally apply to this case.

[4] Notice that the case with a merger between two firms out of three is in some sense "weaker" than a merger from duopoly to monopoly on which we concentrate. Hence, we are confident that if a "reversal result" on merger profitability applies to our case, it should apply also to the former.

specific input supplier) "a merger would not affect input prices at all" (Lommerud *et al.* 2005, p. 732).[5]

To challenge the conventional result that under a centralised wage setting the competitive regime facing downstream firms has no effect on the wage and a downstream merger from duopoly to monopoly is always profitable, we depart from the above-mentioned literature by assuming that firms' production technology exhibits decreasing returns to labour, which implies that firms have convex (increasing marginal) costs. Indeed, despite the tremendous growth experienced over the last few decades by this strand of IO literature, the effects produced by introducing labour decreasing returns in an unionised oligopoly framework have so far not been investigated.[6]

Perry and Porter (1985) and Heywood and McGinty (2007) consider the role of increasing marginal costs for merger issues in oligopolistic markets. However, in their models (convex) costs are exogenously given and the effects of unionisation are not taken into account. Moreover, they focus on the so-called "merger paradox", hence neglecting the case of a merger from duopoly to monopoly.[7] Remarkably, while they introduce the role of convex costs to solve the paradox (that is, to restore merger profitability even when it does not lead to a full-blown monopoly), we point out that in our framework convex costs (labour decreasing returns) play instead the "opposite" role: together with unionised labour markets, they are used to establish the result that a merger from duopoly to monopoly can actually be detrimental for profits.

Our main outcomes can be summarised as follows. First, in a basic framework with monopoly (central) union, homogeneous product and Cournot competition, we show that a wage "non-rigidity" result applies: the post-merger wage fixed by the union is higher than in the pre-

[5] In the same vein, Symeonidis (2010) argues that the case with an industry-wide upstream agent (union) is "straightforward [since] when firms participate in centralised bargaining before competing in the downstream market […] the input price is the same whether the downstream firms merge or not" (Symeonidis 2010, p. 234).

[6] Exceptions are Fanti and Meccheri (2011, 2012) in which decreasing returns to labour have been introduced in a unionised duopoly model (with decentralised unions and a central union, respectively) to compare profits under Cournot and Bertrand competition.

[7] Consider a market with n independent firms. Following Salant *et al.*'s (1983) seminal work, "the merger paradox" implies that if m firms merge, then merging is not profitable for firms that participate whenever $m < 0.8n$. Clearly, the merger paradox does not refer to the case analysed in this paper, where $m = n$ (= 2).

merger/Cournot equilibrium.[8] Secondly, we point out that the decision by firms whether or not to merge is affected by the central union's orientation towards wages with respect to employment. In particular, a "reversal result" on merger profitability (i.e. moving from duopoly to monopoly is detrimental for profits) actually holds true when the union's preference towards wages is sufficiently high. Moreover, the higher the workers' reservation wage, the higher *ceteris paribus* the probability that profits decrease as a result of the merger.

We also extend in different directions the above results, initially derived in the basic framework. In particular, we introduce into the analysis product differentiation, price competition and the presence of (centralised) wage bargaining between the central union and an employers' federation. More specifically, it is shown that the wage non-rigidity result is robust with respect to all the above-mentioned extensions of the basic framework. Furthermore, the higher the degree of product differentiation and the union's relative bargaining power, the higher the probability that a merger is detrimental for profits. Finally, even if the same results are also obtained when firms compete in prices, the merger profitability reversal is less likely *ceteris paribus* to happen with respect to the case in which firms compete in quantities.

The remaining part of the paper is organised as follows. In Section 2 a basic Cournot homogeneous duopoly model with an industry-wide monopoly union is developed. The equilibrium outcomes are derived for the pre-merger and post-merger cases and subsequently compared. In Section 3, the basic framework of the previous section is extended in various directions (product differentiation, price competition and wage bargaining). Finally, Section 4 concludes.

2 Basic framework

We consider a homogeneous product market where each firm sets its output – given pre-determined wages – to maximise profits (that is, competition is *à la* Cournot). The inverse market demand function is linear and given by:

[8] Brekke (2004) also obtains that the wage rigidity result does not apply when firms (hospitals) compete in quality under *regulated* prices. However, while in our case diminishing returns to labour play a crucial role, Brekke (2004) holds the constant returns standard assumption. Hence the mechanism behind his result is clearly different from ours.

(1) $p(Q) = \alpha - Q$

where $Q = q_i + q_j$ is total output, with q_i and q_j denoting outputs by firm i and j ($i, j = 1, 2$ with $i \neq j$), respectively, and $\alpha > 0$. As usual, we consider that labour is the sole productive input. As already discussed in the Introduction, the previous literature on unionised oligopolies generally assumes constant returns to labour. However, also a decreasing returns to labour technology is rather realistic and thus in this paper we hypothesise that the two firms have access to the same technology which, for the representative firm i, is summarised by the following production function:

(2) $q_i = \sqrt{l_i}$

with l_i representing the units of labour employed by firm i. The choice of the specific technology represented by (2) allows for the achievement of analytical results and amounts to saying that firms have quadratic costs, which is the typical example of convex costs in the literature (e.g. Perry and Porter 1985; Heywood and McGinty 2007).

We consider a three-stage game with observable actions: at stage 1, the firms decide whether or not to merge; at stage 2, wages are set; finally, at stage 3, the firms choose output, hence employment. The game is solved by backwards induction. In this basic framework we assume that, at stage 2, a "monopolistic" industry-wide union fixes a uniform wage for this industry $w_i = w_j = w$. In particular, we consider that union utility takes the following Stone-Geary functional form (e.g. Dowrick and Spencer 1994):

(3) $V = (w - w^{\circ})^{\theta} L$

where $L = l_1 + l_2$ is overall employment in the industry, $w < \alpha$ is the union's wage and $w^{\circ} \geq 0$ is the reservation wage, which may be assumed to be higher in industries with a higher fraction of skilled manpower (e.g. Pencavel 1985; Dowrick and Spencer 1994). Instead, θ represents the weight placed by the union over wage with respect to employment. For instance, a value of $\theta = 1$ refers to

the rent-maximising case.[9] In order to preserve the economic meaningfulness of our results, in what follows we will assume that $\theta \in (0, 2)$.[10]

2.1 Pre-merger (Cournot) case

In the pre-merger game, at stage 3, firm i chooses quantity q_i to maximise:

$$\pi_i = pq_i - wq_i^2. \tag{4}$$

From (1) and (4), under profit-maximisation, firm i's best-reply function is:

$$q_i(q_j) = \frac{\alpha - q_j}{2(1+w)} \tag{5}$$

and, from (5) and its equivalent for firm j, we get firms' output as a function of the wage w chosen by the union at the previous stage:

$$q_i(w) = q_j(w) = \frac{\alpha}{3+2w}. \tag{6}$$

As regards wage setting at stage 2, after substitution of (6) in the union's utility function (taking into account that $l_i = q_i^2$) and maximising, we obtain the equilibrium wage chosen by the union:

$$w^C = \frac{4w^\circ + 3\theta}{2(2-\theta)} \tag{7}$$

where the superscript C recalls that it is obtained under Cournot competition in the product market (that is, it refers to the pre-merger case). Finally, by substituting for (7), we get pre-merger

[9] Remarkably, in this latter case the union maximisation problem is equivalent to that facing a profit-maximising upstream monopoly that is allowed to set the price of an input it supplies to downstream firms.

[10] Notice that Pencavel (1985) argues for an empirical value of θ generally no higher than one.

equilibrium output and profit as, respectively:

(8) $$q_i^C = q_j^C = q^C = \frac{\alpha(2-\theta)}{6+4w^\circ}$$

(9) $$\pi_i^C = \pi_j^C = \pi^C = \frac{\alpha^2(2-\theta)(4+4w^\circ+\theta)}{8(3+2w^\circ)^2}.$$

2.2 Post-merger case

In the post-merger game, the merged firm is a multi-plant monopoly that, at stage 3 of the game, sets outputs to maximise:

(10) $$\Pi = \pi_i + \pi_j = (pq_i - wq_i^2) + (pq_j - wq_j^2)$$

yielding the following outcomes in terms of overall quantity (as a function of the wage):

(11) $$Q(w) = \frac{\alpha}{2+w}.$$[11]

In this case, taking (11) into account, the equilibrium wage chosen by the union at stage 2 is:

(12) $$w^M = \frac{2w^\circ + 2\theta}{2-\theta}.$$

Substituting for (12), we get the following post-merger equilibrium firm's output and profit:

(13) $$Q^M = \frac{\alpha(2-\theta)}{2(2+w^\circ)}$$

[11] Clearly, due to the firms' symmetric position, we have $q_i(w) = q_j(w) = Q(w)/2$. Also notice that, due to the presence of decreasing returns to labour, it is always better for the merged entity to split the optimal output between the two existing plants instead of shutting down one, even if goods are perfect substitutes.

$$(14) \qquad \Pi^M = \frac{\alpha^2(2-\theta)}{4(2+w^\circ)}.$$

2.3 Non-rigid wages and merger profitability reversal

In this subsection we first investigate whether and, if so, how the merger affects the equilibrium wage; in other words, whether a "wage rigidity result" (Dhillon and Petrakis 2002) still applies in this context with diminishing returns to labour. We then address the possibility of a "reversal result" in relation to the merger profitability.

Proposition 1 [wage non-rigidity result]. *The post-merger wage is always higher than when the firms are independent. Furthermore, the wage differential is increasing in* θ.

Proof. See Appendix A.

The fact that the merger affects the wage set by a central union is rather novel from a theoretical viewpoint since the received result is that the labour price fixed by a central union is the same regardless of whether it faces one merged firm or two competing firms, which also implicitly means that the labour demand elasticity with respect to the wage does not change as a result of the merger.[12] However, in our framework with decreasing returns to labour, the central union no longer charges the same wage independently of the degree of market competition. Indeed, the net effect of a merger on wage elasticity is to make employment less responsive to wage changes, enabling the union to increase wage claims.[13]

Before turning to analyse merger profitability, we define the following preliminary outcome, which (together with Proposition 1) will be useful to understand the rationale behind the merger/profitability nexus in this context.

[12] From an empirical research perspective, instead, the wage effects of mergers are rather controversial. For instance, Cremieux and Van Audenrode (1996) and Peoples *et al.* (1993) found support for a wage cut following a merger, while McGuckin *et al.* (1995) obtained the opposite result. Hekmat (1995) found no evidence of any link between mergers and wages, while Gokhale *et al.* (1995) found no or only limited evidence of a link between takeovers and wages.

[13] In the working paper version (Fanti and Meccheri 2013), we provide further analyses and details.

Lemma 1. *Overall quantity produced by the merged firm is less than that produced when firms are independent. This also implies that price is higher in the post-merger case. Moreover, the (negative) output differential is decreasing in* θ *and* w°.

Proof. See Appendix B.

According to Lemma 1, the ability to reduce output (and increase price) through a merger, so as to exploit market power, decreases when the union's orientation towards wages and the workers' reservation wage increase. Accordingly, we can state the following result in relation to merger profitability.

Proposition 2 [merger profitability reversal]. *A "reversal result" applies in relation to merger profitability (i.e. post-merger industry profits are lower than pre-merger industry profits) if and only if* $\theta > 1/(2 + w^{\circ})$*, that is, the central union is sufficiently interested in wages with respect to employment. Moreover, the higher the workers' reservation wage, the higher the probability that the merger is detrimental for profits.*

Proof. See Appendix C.

Given Proposition 1 and Lemma 1, stated above, Proposition 2 is rather intuitive. Indeed, θ positively affects the probability that a merger decreases profits by both increasing the wage differential and reducing the post/pre-merger output differential. In particular, when $\theta \to 0$, hence the central union tends to care only about employment, the reversal result never applies. This is because when $\theta \to 0$, $w \to w^{\circ}$ (see (7) and (12)) and with an exogenous (reservation) wage the conventional result still applies even in the presence of convex labour costs. Moreover, notice that when $\theta = 1$ the merger is always detrimental for profits (i.e. the "reversal result" always applies). This is particularly interesting since such a case relates to vertically related industries: in the presence of a profit-maximising upstream monopoly that provides a common input for downstream duopolists, merging is never profitable for the latter. The workers' reservation wage, instead, does not affect the wage differential (since the unionised wage ultimately results in a mark-up on the reservation wage, the latter affects the pre-merger and the post-merger wage to the same extent),

while it reduces the output differential. Hence, the higher $w°$, the higher the probability that the "reversal result" applies.[14]

3 Some extensions

In order to assess the robustness of the previous results, in this section we extend the above-analysed basic framework in various directions, namely product differentiation, price competition and wage bargaining.

3.1 Product differentiation

We consider now a differentiated product market where goods are assumed to be (imperfect) substitutes. Specifically, each firm i is faced with the following (inverse) demand function, which replaces (1) in the analysis (since we showed in the previous section that the market parameter α does not play any relevant role for our results, from here onwards we normalise it to one in order to simplify the analysis somewhat):

$$(15) \qquad p_i(q_i, q_j) = 1 - q_i - \gamma q_j$$

[14] Notice that if the *monopoly* union coordinates the wage demands, *possibly* setting different wages for each firm, its objective function would be $V = (w_i - w°)^{\theta} l_i + (w_j - w°)^{\theta} l_j$. Nevertheless, as long as firms are symmetric, our results still apply. This is because firm symmetry means that, in equilibrium, the union's choice collapses to a single wage, which is the same irrespective of the monopoly union's strategy in setting wages (e.g. Haucup and Wey 2004). Clearly, admitting for some form of asymmetries between firms would make the results more heterogeneous (the analysis of an "asymmetric" context lies beyond the scope of this work and is left for future research). Moreover, as correctly remarked by an anonymous referee, the analysis would be more elaborate by introducing wage bargaining between the union and each single firm, due to the role played by the union's disagreement payoff (whose proper specification, as discussed in Horn and Wolinsky 1988 and Davidson 1988, is not an obvious matter). For the reason explained in Section 3.3, when we extend the basic framework with monopoly union to wage bargaining, we refer instead to a centralised context where the union bargains *vis-à-vis* a single employers' federation maximising the firms' joint profit.

where $\gamma \in (0,1)$ is a measure of substitutability in demand between products. In particular, if $\gamma \to 0$ the brands are regarded as unrelated, whereas $\gamma \to 1$ corresponds to the case, studied above, of homogeneous goods. In this context, undertaking the analysis of the previous section, we get the following equilibrium outcomes:

$$(16) \quad w_{PD}^{C} = \frac{4w^{\circ} + \theta(2+\gamma)}{2(2-\theta)}; \; q_{PD}^{C} = \frac{2-\theta}{2\left[2(1+w^{\circ})+\gamma)\right]}; \; \pi_{PD}^{C} = \frac{(2-\theta)\left[4(1+w^{\circ})+\theta\gamma\right]}{8\left[2(1+w^{\circ})+\gamma\right]^{2}}$$

$$(17) \quad w_{PD}^{M} = \frac{2w^{\circ} + \theta(1+\gamma)}{2-\theta}; \; Q_{PD}^{M} = \frac{2-\theta}{2(1+w^{\circ}+\gamma)}; \; \Pi_{PD}^{M} = \frac{2-\theta}{4(1+w^{\circ}+\gamma)}$$

where the subscript *PD* refers to the product differentiation case.

As shown in Appendix D, from (16) and (17), the following results highlighting the role of the degree of product differentiation/substitutability can be stated:

- the post-merger wage is always higher than when the firms are independent. Furthermore, the wage differential is increasing in γ;
- overall quantity produced by the merged firm is less than that produced when firms are independent and the (negative) output differential is increasing in γ;
- a "reversal result" applies in relation to the merger profitability if and only if $\theta > \gamma/(1+w^{\circ}+\gamma)$. Hence, the higher the degree of product differentiation (i.e. the lower is γ), the higher the probability that merger is detrimental for profits.

The above findings qualitatively confirm the non-rigidity wage result and the merger profitability reversal as obtained in the basic framework with homogeneous goods. Most importantly, they point out the role played by the degree of product differentiation. In particular, the role of γ in affecting the possibility of a "reversal result" concerning merger profitability is twofold. On the one hand, when γ increases the (negative) output differential increases too, permitting the merged firm to largely exploit market power. This makes sense. When $\gamma \to 0$, independent firms operate as monopolists in different markets and there is no room to further increase market power through a merger. By contrast, competition between independent firms is fiercer when products are higher substitutes (i.e. for higher γ values) and, in such a case, merging can actually permit greater

market power to be exploited, resulting in lower output levels. On the other hand, however, also the wage differential increases with γ, reducing merger profitability. Nevertheless, the former (positive) effect always outweighs the latter (negative) effect, implying that the probability that a merger is actually detrimental for profits decreases *ceteris paribus* with γ.

3.2 Price competition

Now we consider a model of differentiated duopoly where firms compete in prices, i.e. a Bertrand model. From (15) and its counterpart for firm *j*, we can write firm *i*'s product demand as:

$$(18) \qquad q_i(p_i, p_j) = \frac{1 - p_i - \gamma(1 - p_j)}{1 - \gamma^2}.$$

While equilibrium outcomes regarding the post-merger (monopoly) case are obviously the same as in the quantity setting case (see (17)), in this section we derive equilibrium results for the pre-merger (Bertrand) case. By using (4) and (18), profit-maximisation leads to the choice of the price by firm *i* as a function of the price chosen by firm *j* as:

$$(19) \qquad p_i(p_j) = \frac{\left(1 + 2w - \gamma^2\right)\left[1 - \gamma(1 - p_j)\right]}{2\left(1 + w - \gamma^2\right)}$$

from which, taking the corresponding expression of firm *j* into account, we get the Bertrand equilibrium prices for a given wage rate:

$$(20) \qquad p_i(w) = \frac{1 + 2w - \gamma^2}{2(1 + w) + \gamma(1 - \gamma)}.$$

Hence, by substituting in (18) we obtain output as a function of the wage rate:

(21) $$q_i(w) = \frac{1}{2(1+w)+\gamma(1-\gamma)}.$$ [15]

At stage 2, after substitution of (21) in the union utility function and maximising, we obtain the equilibrium wage chosen by the union:

(22) $$w^B = \frac{4w^\circ + \theta\left[2+\gamma(1-\gamma)\right]}{2(2-\theta)}$$

where the superscript *B* recalls that it is obtained under Bertrand competition in the product market. Finally, by substituting back, we get the equilibrium output and profits for this case:

(23) $$q^B = \frac{2-\theta}{2\left[2(1+w^\circ)+\gamma(1-\gamma)\right]};\quad \pi^B = \frac{(2-\theta)\left[4\left(1+w^\circ+\gamma^2\right)+\theta\gamma(1+\gamma)\right]}{8\left[2(1+w^\circ)+\gamma(1-\gamma)\right]^2}.$$

In Appendix E, by using the results of this section, we show that our previous findings regarding the non-rigidity wage result and the merger profitability reversal hold true also when firms compete in prices. In particular, a "reversal result" applies in relation to the merger profitability if and only if $\theta > \gamma(1+\gamma)/(1+w^\circ+\gamma)$. By comparing such a critical value for θ against that obtained under Cournot competition ($\gamma/(1+w^\circ+\gamma)$), it is also possible to infer that (*ceteris paribus*) the reversal result is more likely when firms compete *à la* Cournot instead of *à la* Bertrand.

[15] By passing, notice that for $\gamma = 1$ (homogeneous goods) Dastidar (1995) proves that with identical, continuous and convex cost functions, price competition typically leads to multiple pure strategy Nash equilibria, with the standard profit-maximising price belonging to the range of equilibrium prices (see André *et al.* 2009, for an application). Although we refer to a framework with differentiated goods, also note that for the limit case with $\gamma \to 1$, the equilibrium result of the product market stage tends to the Bertrand reference case in which price is equal to marginal cost.

3.3 Wage bargaining

In this section we introduce wage bargaining into the analysis. In particular, we adopt a Right-to-Manage model, in which, at stage two, the wage is negotiated between parties while, at stage three, the downstream agents choose final output or price (hence, employment). Moreover, since we are interested in assessing the robustness in this framework of the "wage rigidity result", we consider a situation in which wage negotiation is centralised at the industry level. Thus the central union bargains *vis-à-vis* an employers' federation which maximises overall profits (Dhillon and Petrakis 2002).[16] Accordingly, the general asymmetric Nash bargain over wage between union-employers federation solves:

$$(24) \qquad w = \arg\max\left\{\Omega = V^{\beta}\Pi^{1-\beta}\right\}$$

where β is the union's relative bargaining power parameter ($\beta \in (0,1)$). Furthermore, since the role played by the reservation wage, the union's preference towards wages and the degree of product differentiation have been already elucidated above, we are now interested in specifically assessing the role of bargaining power distribution. Hence we fix $w^{\circ} = 0$, $\theta = 1$ (i.e. total wage bill maximising union) and $\gamma = 1$. This allows us to simplify the analysis, permitting its algebraic tractability.

[16] The issue of what unions and firms bargain over is a subject that has been widely discussed. It has often been claimed that trade unions *do not* bargain directly over employment, and that employment setting lies firmly in the hands of firms. As pointed out, e.g., by Machin *et al.* (1993, p. 169), this stylised fact (which is in favour of the Right-to-Manage model against Efficient Bargaining) "receives support from a number of sources, including the content of actual contracts and consideration of institutional arrangements under which wage and employment setting occur". Moreover, also notice that, since we refer to a situation where bargaining involves a centralised union *vis-à-vis* a firms' federation which cares of the *joint* profits, if parties bargain simultaneously on wage and employment (i.e. Efficient Bargaining), the bargaining outcomes would be trivially the same in the pre and post-merger cases (clearly, this is not true in a Right-to-Manage framework due to the fact that employment is individually chosen by the firm(s) at the final stage). In other words, under Efficient Bargaining, the possibility of the occurrence of a "wage non-rigidity result" would be *a priori* prevented.

Considering competition *à la* Cournot, by substituting the proper values from Section 2.1 in (24), maximising and solving with respect to *w*, we get:

$$(25) \qquad w_{BAR}^{C} = \frac{1 + 2\beta + \sqrt{4\beta^2 + 20\beta + 1}}{4}$$

where the subscript *BAR* recalls that it is obtained under wage bargaining. By substituting (25) in (6) and (4), we get the firm's equilibrium profit for this case:

$$(26) \qquad \pi_{BAR}^{C} = \frac{3 + 2\beta + \sqrt{4\beta^2 + 20\beta + 1}}{\left(5 + 2\beta + \sqrt{4\beta^2 + 20\beta + 1}\right)^2}.$$

Instead, in the post-merger game, by substituting from Section 2.2 in (24), maximising and solving with respect to *w*, we get:

$$(27) \qquad w_{BAR}^{M} = 2\beta$$

and, by substituting back, the following equilibrium profit:

$$(28) \qquad \Pi_{BAR}^{M} = \frac{1}{4(1+\beta)}.$$

Accordingly, in Appendix F we show that the post-merger wage is higher provided that the union's bargaining power is sufficiently high (i.e. $\beta > 0.25$). Moreover, this also implies that a "reversal result" on merger profitability actually applies when the union is relatively stronger than the employers' federation (i.e. $\beta > 0.5$).

By means of numerical analysis, Table 1 reports the threshold value for θ above which the "reversal result" on merger profitability applies, for different parameter combinations including β. In line with the above results, the merger profitability reversal is *ceteris paribus* more likely

to occur (i.e. the threshold for θ is lower), the higher $w°$ and β, and the lower γ.[17]

Table 1. "Profitability reversal" under Cournot competition: θ thresholds for different parameters[18]

$w° = 0.25$				
		$\beta =$		
		0.25	**0.5**	**0.75**
$\gamma =$	**0.25**	0.9756	0.3634	0.2239
	0.5	1.5668	0.6064	0.3796
	0.75	1.9436	0.7778	0.4937
$w° = 0.5$				
		$\beta =$		
		0.25	**0.5**	**0.75**
$\gamma =$	**0.25**	0.8457	0.3131	0.1923
	0.5	1.4000	0.5352	0.3333
	0.75	1.7748	0.6991	0.4408
$w° = 0.75$				
		$\beta =$		
		0.25	**0.5**	**0.75**
$\gamma =$	**0.25**	0.7460	0.2749	0.1685
	0.5	1.2639	0.4788	0.2971
	0.75	1.6309	0.6345	0.3980

4 Conclusion

Can a merger from duopoly to monopoly be detrimental for profits? This paper dealt with this issue by focusing on the interaction between decreasing returns to labour (which imply firms' convex costs) and centralised unionisation. A particular focus was whether a merger from duopoly to

[17] In the working paper version (Fanti and Meccheri 2013) we show that, under wage bargaining, the same qualitative results hold true when firms compete in prices instead of in quantities. Furthermore, it is also confirmed in this more general framework that (*ceteris paribus*) the reversal result is always more likely when (independent) firms compete *à la* Cournot instead of *à la* Bertrand.

[18] For different combinations of the other parameters, each cell shows the θ value, above which the merger profitability reversal applies. For instance, for $w° = \beta = \gamma = 0.25$, merger reduces profitability for $\theta > 0.9756$. All the results are derived in MAPLE (programs available from the authors upon request).

monopoly in the downstream market may influence centralised wage setting and how, in turn, this affects the profitability of the merger. In doing so, our work challenged the common wisdom, suggesting that centralised wage setting is unaffected by the number of competing firms in the (downstream) product market and, as a consequence, the standard result that the merger is profitable can never be reversed.

We showed that, in the presence of decreasing returns to labour, centralised wage setting is actually affected by the structure of the downstream market. In other words, the standard "wage rigidity result" of centralised wage setting no longer applies. Specifically, the post-merger wage is higher than before the merger, hence reducing its profitability. In particular, a "reversal result" in relation to merger profitability can occur when the union's preference towards wages is sufficiently high. Moreover, the higher the reservation wage, the degree of product differentiation and the union's bargaining power *vis-à-vis* the employers' federation, the higher the probability that profits decrease as a result of the merger.

Supporting Information

Appendix A. Proof of Proposition 1

Appendix B. Proof of Lemma 1

Appendix C. Proof of Proposition 2

Appendix D. Product differentiation

Appendix E. Price competition

Appendix F. Wage bargaining

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