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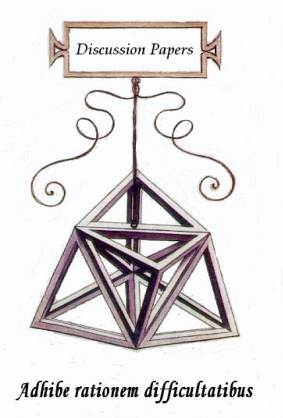

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Differentiated duopoly and horizontal merger profitability under monopoly central union and convex costs

Discussion Paper n. 134

2012

Discussion Paper n. 134, presentato: **marzo 2012**

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Si prega di citare così:
Fanti L., Meccheri N. (2012), "Differentiated duopoly and horizontal merger profitability under monopoly central union and convex costs", Discussion Papers del Dipartimento di Scienze Economiche – Università di Pisa, n. 134 (http://www-dse.ec.unipi.it/ricerca/discussion-papers.htm).

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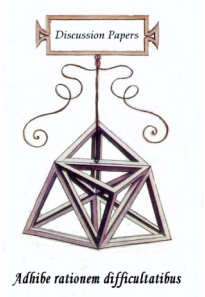

Luciano Fanti - Nicola Meccheri

Differentiated duopoly and horizontal merger profitability under monopoly central union and convex costs

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 production costs) and centralised unionisation in a differentiated duopoly model. It is pointed out that the wage fixed by a monopoly central union in the post-merger case is higher than in the pre-merger/Cournot equilibrium, opening up the possibility that merger reduces profits. Indeed, it is shown that this "reversal result" actually applies when the central union is sufficiently little interested to wages with respect to employment. Moreover, the lower the degree of substitutability between firms' products and the higher the workers' reservation wage, the higher ceteris paribus the probability that profits decrease as a result of the merger.

Classificazione JEL: D43, L13, J50
Keywords: merger profitability, unionised duopoly, convex costs

1 Introduction

Since the seminal paper by Salant et al. (1983), the question whether a merger that is wholly anti-competitive is profitable has been increasingly addressed. Particularly, Salant et al. (1983) developed a model with homogeneous goods, Cournot competition, linear demand 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 study if the result that a merger leading to a monopoly is always profitable remains true in a Cournot duopoly model, in which production costs are endogenously fixed by a common upstream *monopoly* supplier 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 Cournot duopoly market game, in which wages are no longer exogenously given for firms, but they are the outcome of a strategic game played between firms and a centralised (industry-wide) labour union before the former take production decisions. Indeed, centralised wage setting assumes particular relevance in concentrated industries (such as duopolies). This is because the characteristics of the latter increase the likelihood of union success in organizing at the industry level as well as to

[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 could 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 later, by considering the case of a merger between duopolists, this paper does not deal with the merger paradox.

maintain its monopolistic position over time (see, e.g., Wallerstein 1999 further than the seminal papers by Segal 1964 and Weiss 1966).[2]

Starting from the seminal work by Horn and Wolinsky (1988), extensions of the question raised by Salant et al. (1983) to unionised or vertically related industries have attracted considerable attention. Particularly, Horn and Wolinsky (1988, Section 5) first showed that when products are substitutes and a common upstream input supplier bargains *separately* with downstream firms over a uniform input price (with input supplier and downstream firms having equal bargaining power), the profit of a downstream monopoly is *less* than the total downstream industry's profit when it is a duopoly. This is because the *bargained* price under downstream monopoly is higher than under downstream duopoly and this more than offset the usual gains from monopolising the downstream industry.

However, in relation to Horn and Wolinsky's (1988) above finding, the context with a monopoly central union (common input supplier), treated in this work, represents a very challenging situation. Indeed, it is a limiting case of a scenario where wage negotiations are *centralised* at the industry level[3] and Dhillon and Petrakis (2002) have shown that in such a scenario (which is clearly different from that considered by Horn and Wolinsky (1988) where agents bargain individually) 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, this should imply that, since wages are the same

[2] This is also consistent with the dominant (even if 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 the elasticity of the wage with respect to market concentration (concentration's effect) is positive and much of concentration's effect is indirect, that is, it is mediated through unionisation.

[3] Clearly, this is the case where the central union, representing all workers, has all the bargaining power vis-à-vis the employer federation, representing all firms in the industry (e.g. Dowrick 1989).

under downstream duopoly and downstream monopoly, a merger between downstream firms is always profitable.[4]

Due to the considerations summarised above, the idea that a "merger profitability result" is foregone in a duopoly industry where a monopoly union sets input price (wage) is clearly present in a number of more recent works. For instance, Brekke (2004) and Lommerud et al. (2005) investigate downstream mergers with upstream monopoly unions 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). Particularly, Brekke (2004) specifically refers 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 hospitals merger is always profitable] are still valid" (Brekke 2004, Proposition 1). Lommerud et al. (2005), instead, develop an unionised oligopoly model including a non-merging firm (an oligopoly with three rather than two firms) and focalise 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. Furthermore, similarly to Brekke (2004), they point out that in the presence of a central union (industry-specific input supplier) "a merger would not affect input prices at all" (Lommerud et al. 2005, p. 732).[5]

[4] Notice that this also implies that by continuity the result against merger profitability does not apply even if, as in Horn and Wolinsky (1988), the central union bargains separately with each single firm, provided that the union's bargaining power is sufficiently large.

[5] See also Symeonidis (2010). Although the latter does not assume a monopoly union but consider a model with wage bargaining between firms and rent-maximising union(s), he also argue that the case with 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).

In order to fly in the face of conventional result that under a monopoly central union the competitive regime facing downstream firms has no effect on the wage, hence a downstream merger from duopoly to monopoly is always profitable, we depart from the previous literature mentioned above by assuming that firms' production technology exhibits decreasing returns to labour, which implies that firms face with convex costs (increasing marginal costs). Indeed, although the tremendous growth experienced over the last decades by this strand of IO literature, the effects produced by introducing labour decreasing returns in a unionised oligopoly framework have so far not been investigated.[6]

The role of increasing marginal costs in relation to merger issues in oligopolistic markets is studied by Perry and Porter (1985) and Heywood and McGinty (2007). However, they do not consider the role of unions in determining firms' production costs (wages), thus in their models (convex) costs are exogenously given. Moreover, their analyses focalise on the so-called "merger paradox", hence neglecting the case of a merger from duopoly to monopoly.[7] This produces important aspects that differentiate our work from theirs. Most notable, while in their frameworks the role of convex costs is studied in relation to the possibility to solve the paradox, that is, to restore the merger profitability (even when the merger does not lead to a full-blown monopoly), in our model, as we will show, convex costs (labour decreasing returns) play instead the "opposite" role: they (as well as unionised labour

[6] An exception is Fanti and Meccheri (2011) in which decreasing returns to labour have been introduced in a unionised duopoly model in order to compare profits under Cournot and Bertrand competition. In particular, it is shown that decreasing returns tend to reinforce the mechanisms that contribute to the "reversal result" (i.e. higher profits under Bertrand instead of under Cournot competition), making this event possible for a wider range of situations, with respect to those identified by the previous literature (Correa-López and Naylor 2004).

[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).

markets) are necessary to establish the result that merging from duopoly to monopoly can actually be detrimental for profits.

Our main outcomes can be summarised as follows. Firstly, we show that in our framework a wage rigidity result only applies under labour constant returns (linear costs), while it vanishes by introducing labour decreasing returns (convex costs) into the analysis.[8] In particular, in the latter case, we find that the post-merger wage fixed by the central union is higher than in the pre-merger/Cournot equilibrium, opening up the possibility that merger reduces profits. Furthermore, we highlight that the post/pre-merger wage differential depends on product market as well as labour market parameters.

Secondly, moving from the outcome decribed above, we demonstrate that the decision by firms of whether merging or not is actually affected by the central union's orientation towards wages with respect to employment as well as by the degree of firms' product differentiation. Particularly, we show that the "reversal result" (i.e. merging from duopoly to monopoly is detrimental for profits) actually holds true when the union is sufficiently little interested to wages with respect to employment. Moreover, the lower the degree of product substitutability and the higher the workers' reservation wage, the higher ceteris paribus the probability that profits reduce as a result of the merger.

The remaining part of the paper is structured as follows. In Section 2 a duopoly model with a monopoly central union is developed and the corresponding equilibrium outcomes are derived for the pre-merger and post-merger cases, respectively. In Section 3 the analysis of the merger profitability is conducted. Finally, Section 4 concludes, while the final Appendix provides further results, which are useful for the analysis conducted in the main text.

2 The model

[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.

We consider a differentiated product market where each firm sets its output – given pre-determined wages – to maximize profits (that is, compete *à la* Cournot). Products are assumed to be (imperfect) substitute and characterised by a symmetric demand system, where the inverse demand function for brand i is linear and given by:

$$p_i(q_i, q_j) = 1 - q_i - \gamma q_j \tag{1}$$

and a corresponding demand structure for the other firm j (brand j), with q_i, q_j denoting outputs by firm i and j (i, j = 1, 2 with $i \neq j$), respectively. The parameter $\gamma \in (0, 1)$, instead, is a measure of substitutability in demand between products. Particularly, if $\gamma \to 0$ the brands are regarded as unrelated, whereas $\gamma \to 1$ corresponds to the case of homogeneous goods. As usual, we assume that labour is the sole productive input. As already discussed in the Introduction, related literature generally assumes constant returns to labour too. However, also a decreasing returns to labour technology is rather realistic and thus in this paper we hypothesise that the two firms face with the same technology which, for the representative firm i, is summarised by the following production function:

$$q_i = \sqrt{L_i} \tag{2}$$

with L_i represents the units of labour employed by the firm i. The choice of the specific technology represented by (2) allows for the achievement of analytical results and amount to say that firms have quadratic costs, which is the typical example of convex costs in the literature.

The following rules of the game are applied: at stage 1, the firms decide to merge or not; at stage 2, the central union sets wages; finally, at stage 3, the firms set quantity. The game is solved by backwards induction and decisions are taken at each stage anticipating the outcome of subsequent stages (also note that employment is indirectly determined at stage 3 of the game).

In particular, at stage 2, we assume that a "monopolistic" industry-wide union fixes a uniform wage for this industry $w_i = w_j = w$. As known, union objectives are not necessarily dominated by wages. In order to derive tractable results for wage determination, we consider that union utility takes the following Stone-Geary functional form (e.g. Dowrick and Spencer 1994):

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

where L is the overall employment in the industry, w 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] while smaller (larger) values of θ imply that the union is less (more) concerned about wages and more (less) concerned about jobs. In particular, in order to preserve the economic meaningfulness of our results, in what follows we will assume that $\theta \in (0, 2)$.[10]

In particular, since workers are organised in a industry-wide union, in the *pre-merger game*, the union will set a wage w so as to maximise $V^C = (w - w^{\circ})^{\theta}(L_i^C + L_j^C)$ anticipating labour demand by firms (as a function of wage), (L_i^C, L_j^C), from the standard Cournot or pre-merger market game. In the *post-merger game*, instead, the union will set a wage so as to maximise $V^M = (w - w^{\circ})^{\theta} L^M$, where L^M is the anticipated labour demand of the merged firm.

Finally, at stage 3, firms optimally choose the output (and factor input) levels given the technology and factor prices as determined at the prior stage. Clearly, the optimal output choices depend on the fact that decisions are taken

[9] Remarkably, in this latter case the union maximisation problem is equivalent to the one 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 not higher than one.

by two independent firms (pre-merger or Cournot case) or instead by a single merged firm (post-merger case).

2.1 Pre-merger (Cournot) case

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

$$\pi_i = p_i q_i - w q_i^2. \tag{4}$$

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

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

hence, as expected, the best-reply functions are downward-sloping. From (5) and its equivalent for the firm j, we get firms' output as a function of the wage w chosen by the union at the previous stage as:

$$q_i(w) = q_j(w) = \frac{1}{2(1 + w) + \gamma}. \tag{6}$$

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

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

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 the firm i's pre-merger equilibrium output and profits as, respectively:

$$q_i^C = q_j^C = q^C = \frac{2-\theta}{2\left[2(1+w^\circ)+\gamma\right]} \tag{8}$$

$$\pi_i^C = \pi_j^C = \pi^C = \frac{(2-\theta)\left[4(1+w^\circ)+\gamma\theta\right]}{8\left[2(1+w^\circ)+\gamma\right]^2}. \tag{9}$$

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:

$$\Pi = \pi_i + \pi_j = (p_i q_i - w q_i^2) + (p_j q_j - w q_j^2) \tag{10}$$

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

$$q(w) = \frac{1}{1+w+\gamma}.^{11} \tag{11}$$

In this case, taking (11) (and $L = q^2$) into account, the equilibrium wage chosen by the union at stage 2 is:

$$w^M = \frac{2w^\circ + (1+\gamma)\theta}{2-\theta}. \tag{12}$$

Substituting for (12), the following post-merger equilibrium firm's output and profits, respectively, are obtained:

$$q^M = \frac{2-\theta}{2(1+w^\circ+\gamma)} \tag{13}$$

[11] Clearly, due to the firms' symmetric position, we have that $q_i(w) = q_j(w) = q(w)/2$.

$$\Pi^M = \frac{2-\theta}{4(1+w^\circ+\gamma)}. \tag{14}$$

3 Merger profitability

Armed with previous findings, in this section we investigate the issue of the merger profitability in the presence of a monopoly central union and convex costs. Furthermore, we also address the important question whether and how, with respect to the case in which the wage is exogenously given, the profitability of a merger can be affected. We first define some preliminary outcomes, which are useful for the analysis that follows.

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 increasing in γ and decreasing in θ and w°.*

Proof. Lemma 1 simply derives by noting that:

$$\Delta q = q^M - 2q^C = -\frac{\gamma(2-\theta)}{2\left[2(1+w^\circ)+\gamma\right](1+w^\circ+\gamma)} < 0, \text{ for any } w^\circ > 0, \gamma \in (0,1) \text{ and } \theta \in (0,2)$$

which also implies that, for any $w^\circ > 0, \gamma \in (0,1)$ and $\theta \in (0,2)$, the following apply:

$$\frac{\partial(\Delta q)}{\partial \gamma} = \frac{(2-\theta)\left[\gamma^2 - 2 - 2w^\circ(2+w^\circ)\right]}{2A^2B^2} < 0, \quad \frac{\partial(\Delta q)}{\partial \theta} = \frac{\gamma}{2AB} > 0,$$

$$\frac{\partial(\Delta q)}{\partial w^\circ} = \frac{\gamma(2-\theta)\left[4(1+w^\circ)+3\gamma\right]}{2A^2B^2} > 0$$

with $A \equiv \left[2(1+w^\circ)+\gamma\right]$ and $B \equiv \left(1+w^\circ+\gamma\right)$. ***Q.E.D.***

Indeed, as pointed out by the previous literature (e.g. Heywood and McGinty 2007, p. 345), if the output of the merged firm remained identical to the sum of that of its constituent pre-merger firms (and the wage did not change because the merger) the total cost to produce that output would be unchanged and, as a consequence, the merger by itself does not immediately provide cost savings. Hence, the point of the merger remains to reduce output (and increase price) to exploit market power. Furthermore, according to Lemma 1, this possibility increases as long as substitutability of products by merging firms increases. This is because competition between independent firms is fiercer when products are higher substitutes (i.e. for higher γ's values), resulting in higher output levels. By contrast, the output differential, hence the ability of the merger to exploit market power, decreases when the union's orientation towards wages as well as the workers' reservation wage increase.

Moreover, in this context, we obtain another important (and, in the presence of a *monopoly* central union, rather novel) result, namely the merger affects the equilibrium wage too. The following statement affirms such a finding.

Lemma 2. *The post-merger wage is always higher than when the firms are independent. Furthermore, the wage differential is increasing in γ and θ.*

Proof. Taking (7) and (12) into account, we get:

$$\Delta w = w^M - w^C = \frac{\gamma\theta}{2(2-\theta)} > 0, \text{ for any } \gamma \in (0,1) \text{ and } \theta \in (0,2)$$

which clearly implies also $\partial(\Delta w)/\partial\gamma > 0$ and $\partial(\Delta w)/\partial\theta > 0$,
for any $\gamma \in (0,1)$ and $\theta \in (0,2)$. ***Q.E.D.***

Lemma 2 deserves some more comments because, as already stressed in the Introduction, the fact that the merger affects the wage sets by a central

union is rather novel from a theoretical viewpoint.[12] Indeed, a common result by the received literature is that, under fairly general conditions, the competitive regime facing downstream firms has no effect on the wage when firms participate in centralised bargaining before competing in the downstream market. In particular, Dhillon and Petrakis (2002) show that a "wage rigidity result" holds in unionised markets for a number of product market features as well as bargaining models, as long as negotiations are centralised at the industry level and, obviously, monopoly union represents a limiting case (with union having all bargaining power vis-à-vis firms) of such a situation. Thus the common 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 wage elasticity is unchanged as a result of the merger.

Indeed, we may state that, in general (i.e. regardless of the specific technology), the net effect of a merger on the wage elasticity may be disentangled as follows (e.g. Brekke 2004; Lommerud et al. 2005). From one hand, since for a given wage a merger induces an output reduction (see Lemma 1) there is a "demand shifting effect" which implies a lower demand for labour. In turn, this drives the central union to lower wages to dampen the reduction in employment. From the other hand, a merger also causes a change in the slope of the labour demand curve. In particular, the previous literature has shown as the labour demand curve's slope becomes steeper after a merger, implying that the demand of labour becomes less responsive to changes in the wage level. Thus a central union may increase wages without, ceteris paribus, loosing too much employment. As provided by Dhillon and Petrakis (2002), these two

[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) founds 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.

opposing effects on wages exactly offset each other for several market characteristics and bargaining settings.

However, in our framework with decreasing returns to labour the central union does no longer charge the same wage independently from the degree of market competition. Indeed, we obtain that the merger effect that makes the labour demand curve steeper outweighs the "demand shifting effect", producing an increase of the wage after the merger. In other words, defining with η the wage elasticity, we find that $\left|\eta^M\right| < \left|\eta^C\right|$ (a formal proof is provided in the final Appendix, Section A.1, where the crucial role of decreasing returns to labour in obtaining such a result is also highlighted). Therefore, the net effect of a merger on the wage elasticity is to make employment less responsive to wage changes, thus enabling the monopoly (central) union to increase wage claims. Furthermore, since the wage always increases after the merger, this also could make the merger less profitable with respect to the case in which the wage is exogenously given.

Now, taking (9) and (14) into account, we can compute the post/pre-merger profit differential as:[13]

$$\Delta\pi = \Pi^M - 2\pi^C = \frac{\gamma(2-\theta)\left[\gamma - \theta(1+w^\circ+\gamma)\right]}{4\left[2(1+w^\circ)+\gamma\right]^2\left(1+w^\circ+\gamma\right)} \tag{15}$$

which implies:

$$\Delta\pi \underset{<}{\overset{>}{}} 0 \Leftrightarrow \theta \underset{>}{\overset{<}{}} \bar{\theta} \equiv \frac{\gamma}{1+w^\circ+\gamma}. \tag{16}$$

From (16), it clearly appears that the union should be not excessively wage oriented for post-merger overall profits to be higher than pre-merger

[13] The critical comparison determining the profitability of merger is between the profit earned by the post-merger firm and the *sum* of profits earned by the independent firms before the merger, the latter representing the merger (overall) opportunity-cost. Indeed, there is profit from merger only when this value is positive.

ones. For instance, in the simplified case, in which the reservation wage is zero and goods tend to be perfect substitutes (i.e. $w^\circ = 0$, $\gamma \to 1$), the merger is profitable if and only if $\theta < 0.5$. Furthermore, it is easy to check that the threshold $\overline{\theta}$ is increasing in γ, while it is decreasing with respect to the reservation wage w°.

The following statement summarises such findings.

Result. *Post-merger industry profits are higher than pre-merger industry profits if and only if the central union is sufficiently little interested to wages with respect to employment. Moreover, the lower the degree of product substitutability and the higher the workers' reservation wage, the higher the probability that, ceteris paribus, the merger is detrimental for profits.*

Given Lemmas 1 and 2, the Result outlined above is rather intuitive. Indeed, in relation to making the merger actually profitable, the role played by γ, that is, the degree of product differentiation, is twofold. From one side, according to Lemma 1, when γ increases the (negative) output differential increases too, permitting the merged firm to largely exploit market power. On the other side, according to Lemma 2, also the wage fixed by the central union increases with γ, hence reducing the merger profitability. However, the above result suggests that the former (positive) effect always outweighs the latter (negative) effect, implying that, ceteris paribus, the probability that merger is actually profitable increases with γ.

Instead, the role of θ and w° (i.e. the union's preference for wages with respect to employment and the workers' reservation wage) is clear-cut. Indeed, θ negatively affects the profitability of a merger by both reducing the post/pre-merger output differential and increasing the wage differential. 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, thus the latter affecting the pre-merger and the post-merger wage to the same extent), while it reduces the output differential. Hence, both tend to hurt the

profitability of a merger or, in other words, the higher θ and $w°$, the lower ceteris paribus the probability that merger is actually profitable.

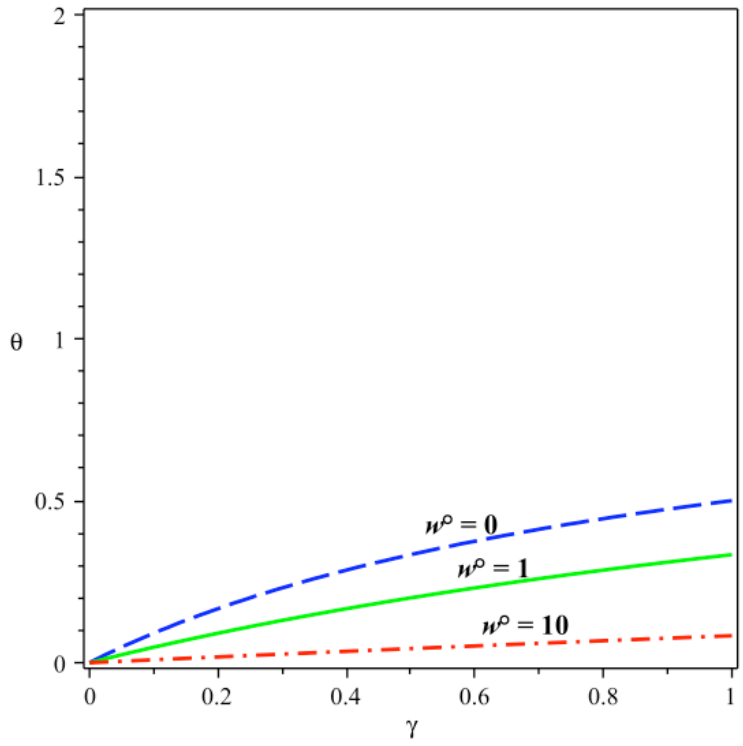

Figure 1: Plot of the "threshold curves" in {γ-θ}-space for different values of $w°$.[a]

[a] Each curve is drawn for a given value of $w°$ ($w°$ = 0: dash blue; $w°$ = 1: solid green; $w°$ = 10: dash dot red). For all γ-θ combinations along each curve, $\Delta\pi$ = 0 (given $w°$) holds true. For all γ-θ combinations below (above) each curve, post-merger profit is higher (lower) than pre-merger overall profit, that is (given $w°$), $\Delta\pi$ > (<) 0.

Figure 1 above provides a graphical illustration of such outcomes. In particular, inside the box, all the γ-θ combinations that lie below (above) each curve (linked to a selected value of $w°$; see the figure's caption for details) are those for which merger is actually profitable (detrimental for profits). Clearly, in line with (16), only when θ is sufficiently low the possibility that merger is profitable applies. Moreover, since the curves' slope is positively related to γ, the area below each curve becomes larger (i.e. the probability that merger is

profitable increases) when product differentiation (which is inversely related to γ) decreases. Instead, curves shift downwards when w° increases, shirking the area for which merger is profitable, hence making this event less likely.

Finally, also notice that when $\theta \to 0$, i.e. the central union tends to care only about employment, the "reversal result" (i.e. merger is detrimental for profits) never applies. Recalling that when $\theta \to 0$, $w \to w^{\circ}$, i.e. under both pre-merger and post-merger cases the perfectly competitive labour market result is replicated (see also (7) and (12)), this also implies that, in our model, labour cost convexity is necessary[14] but not sufficient to trigger the "reversal result", since an unionised labour market is also needed (a formal proof of the fact that with convex labour costs and exogenous (reservation) wage the conventional result still applies is provided in the final Appendix, Section A.2).[15]

[14] Indeed, under constant returns the "wage rigidity result" applies (see Appendix, Section A.1), implying that merging is always profitable for duopolists.

[15] As discussed in the Introduction section, the role of convex costs is also considered by the literature analysing a related but different issue, namely the so-called "merger paradox" (e.g. Barry and Porter 1985; Heywood and McGinty 2007). In this regards, it is also worth noting that Heywood and McGinty (2007) point out that, while a merger of two firms is never profitable in the canonical model of constant marginal cost even when there are only three firms in total, when two firms merge under a triopolistic industry the merger is profitable in the case of upward sloping marginal costs whenever the wage is *sufficiently high*. Since they abstract from the case of a merger from duopoly to a monopoly, their triopoly case is clearly that closer to our model. However, in our framework, equilibrium wages as well as post-pre merger wage differential are increasing in θ, implying that merger profitability applies when the wage is *sufficiently low*, which is in sharp contrast with Heywood and McGinty's (2007) result (which is obtained, however, without contemplating the role played by union, hence the possibility that the latter sets different wages according to the number of firms it faces with).

5 Conclusion

Can a merger from duopoly to monopoly be detrimental for profits? This paper has dealt with this issue by focusing on the interaction between decreasing returns to labour (which imply firms' convex costs) and centralised unionisation in a differentiated duopoly model. Particularly, it has been analysed whether a merger may influence the wage choice of a monopoly central union and how, in turn, this may affect the merger profitability. In doing so, our work has challenged a common wisdom suggesting that centralised wage setting is unaffected by the number of competing firms in the product market and, as a consequence, the presence of a monopoly industry-wide union in the labour market cannot modify the general rule that merging from duopoly to monopoly always leads to larger overall profits.

Our results have revealed, instead, that under decreasing returns to labour the presence of a centralised wage setting union actually determines the profitability of the merger, hence affecting the decision of whether merging or not by firms.[16] This is because the wage fixed by the union in the post-merger case is higher than in the pre-merger/Cournot equilibrium, hence reducing the profitability of the merger. Furthermore, the post/pre-merger wage differential relates to both the union's orientation towards wages with respect to employment and the degree of product differentiation between firms. More in detail, it has been shown that, ceteris paribus, the higher the central union orientation towards wages, the workers' reservation wage and the degree of product differentiation, the higher the probability that a "reversal result" (that is, merger is detrimental for profits) actually realises.

[16] Notice that while we have derived our results in the case of a monopoly central union, they hold true by continuity also in a wage bargaining model, provided that (central) union bargaining power is sufficiently large.

Appendix

A.1 Wage elasticity of labour demand under constant and decreasing returns

Here, we analyse the sensitivity to wage changes of the slope of the labour demand curve and the wage elasticity of the labour demand (η), which defines the equilibrium wage choice by the union. In particular, we will perform such analysis for both the constant returns to labour case (*CRL*) and the case considered in the main text with decreasing returns to labour (*DRL*). We will show that, while under *CRL* the firms' merger does not modify the equilibrium wage elasticity of labour demand (implying that pre- and post-merger equilibrium wages are the same), this no longer applies under *DRL*.

i) CRL

Under *CRL*, we have $q_i = L_i$. Indicating with $L^C|_{CRL}$ the Cournot equilibrium (overall) labour demand, the following applies:

(A1) $$L^C\big|_{CRL} = \frac{2(1-w)}{2+\gamma} \Rightarrow \left.\frac{\partial L^C(w)}{\partial w}\right|_{CRL} = -\frac{2}{2+\gamma}.$$ [17]

Instead, by indicating with $L^C|_{CRL}$ the equilibrium post-merger labour demand under *CRL*, we have:

(A2) $$L^M\big|_{CRL} = \frac{1-w}{1+\gamma} \Rightarrow \left.\frac{\partial L^M(w)}{\partial w}\right|_{CRL} = -\frac{1}{1+\gamma}.$$

[17] In order to preserve the economic meaningfulness of results, in this benchmark case with constant returns to labour we admit that $w < 1$. Notice, however, that under decreasing returns to labour such assumption is unnecessary for this scope.

From (A1) and (A2), it follows that:

$$\text{(A3)} \qquad \left(\frac{\partial L^M(w)}{\partial w} - \frac{\partial L^C(w)}{\partial w}\right)\Bigg|_{CRL} = \frac{1}{3(1+\gamma)} > 0, \text{ for any } \gamma \in (0,1).$$

Hence, the post-merger slope of the demand for labour is steeper than the pre-merger one. Moreover, in this case, we also have that:

$$\text{(A4)} \qquad \eta^M\big|_{CRL} = \eta^C\big|_{CRL} = -\frac{w}{1-w}$$

that is, the wage elasticity is the same in pre-merger and post-merger cases, implying that equilibrium wages are also the same.

ii) DRS

Now, we indicate with $L^C|_{DRL}$ the Cournot equilibrium labour demand under *DRL*, getting:

$$\text{(A5)} \qquad L^C\big|_{DRL} = 2\left[\frac{1}{[2(1+w)+\gamma]}\right]^2 \Rightarrow \frac{\partial L^C(w)}{\partial w}\Bigg|_{DRL} = -\frac{1}{[2(1+w)+\gamma]^3}$$

while, for the post-merger case, we have:

$$\text{(A6)} \qquad L^M\big|_{DRL} = 2\left[\frac{1}{2(1+w+\gamma)}\right]^2 \Rightarrow \frac{\partial L^M(w)}{\partial w}\Bigg|_{DRL} = -\frac{1}{(1+w+\gamma)^3}.$$

It follows that:

(A7)

$$\left(\frac{\partial L^M(w)}{\partial w} - \frac{\partial L^C(w)}{\partial w}\right)\Bigg|_{DRL} = \frac{\gamma\left[7\gamma^2 + 18\gamma + 12 + 6w(3\gamma+4) + 12w^2\right]}{\left[2(1+w)+\gamma\right]^3(1+w+\gamma)^3} > 0, \text{ for any } w > 0, \gamma \in (0,1)$$

.

Hence, the post-merger slope of the demand for labour is steeper than the pre-merger one. Furthermore, we also get:

(A8) $$\eta^M\big|_{DRL} = -\frac{2w}{1+w+\gamma}; \quad \eta^M\big|_{DRL} = -\frac{4w}{2(1+w)+\gamma}$$

which implies:

(A9)

$$\left|\eta^M\big|_{DRL}\right| - \left|\eta^C\big|_{DRL}\right| = -\frac{2w\gamma}{\left[2(1+w)+\gamma\right](1+w+\gamma)} < 0, \text{ for any } w > 0, \gamma \in (0,1)$$

that is, the wage elasticity is lower (in absolute value) in the post-merger case, which also implies that the post/pre-merger wage differential is positive.

A.2 Exogenous wage

We consider here the main results concerning the issue of the merger's profitability in the model with an exogenously given wage (hence, a wage that does not modify as a result of a merger between firms in the product market). In particular, without loss of generality, we assume that the wage equals the competitive, or reservation, level w° (which also corresponds to the case in which firms have all bargaining power vis-à-vis union). In such a case, using (4) and (6), and (10) and (11) of Section 2, we obtain that pre-merger (Cournot) equilibrium profit is given by:

(A10) $$\bar{\pi}^C = \frac{w^\circ}{\left[2(1+w^\circ)+\gamma\right]^2}$$

while the post-merger equilibrium profit is:

$$\text{(A11)} \qquad \overline{\Pi}^{M} = \frac{1}{2(1+w^{\circ}+\gamma)}.$$

Hence, the profit differential is:

(A12)

$$\Delta\overline{\pi} = \overline{\Pi}^{M} - 2\overline{\pi}^{C} = \frac{\gamma^{2}}{2\left[2(1+w^{\circ})+\gamma\right]^{2}\left(1+w^{\circ}+\gamma\right)} > 0, \text{ for any } w^{\circ} > 0,\ \gamma \in (0,1)$$

which implies that when the wage is exogenous, hence does not change after firms' merger, the standard result (i.e. merger is always profitable for duopolists) applies even with decreasing returns to labour.

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