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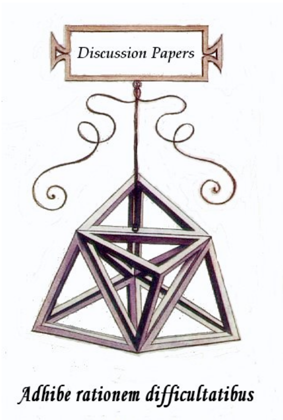

Luciano Fanti – Nicola Meccheri

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

Discussion Paper n. 167

2013

Discussion Paper n. 167, presentato: **Luglio 2013**

Indirizzo dell'Autore:

Luciano Fanti
Dipartimento di Economia e Management, via Ridolfi 10, 56100 PISA – Italy
tel. (39 +) 050 2216 369
fax: (39 +) 050 2216 384
Email: lfanti@ec.unipi.it

Nicola Meccheri
Dipartimento di Economia e Management, via Ridolfi 10, 56100 PISA – Italy
tel. (39 +) 050 2216 377
fax: (39 +) 050 2216 384
Email: meccheri@ec.unipi.it

Si prega di citare così:
Luciano Fanti and Nicola Meccheri (2013), "Non-rigid wages and merger profitability reversal under convex costs and centralised unionisation", Discussion Papers del Dipartimento di Economia e Management – Università di Pisa, n. 167 (http://www-dse.ec.unipi.it/ricerca/discussion-papers.htm).

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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.

Classificazione JEL: D43, L13, J50

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

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, 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 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]

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[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

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 and a common upstream input supplier bargains *separately* with downstream firms over a homogeneous input price, the profit of a downstream monopoly is *less* than the total downstream industry's profit when it is a duopoly. This is because the 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 promptly 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 regime, 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, the idea that a "merger profitability result" is nearly foregone in such a framework is clearly present in a number of recent works. For instance, Brekke (2004) and Lommerud et al. (2005) investigate downstream mergers with upstream monopoly unions[3] and,

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.

[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.

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-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

[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.

[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).

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-merger/Cournot equilibrium. Furthermore, we show that the presence of convex costs is essential to obtain such an outcome. In other words, the labour demand elasticity with respect to the wage changes as a result of the merger only if labour displays decreasing returns.[8]

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[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).

[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

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 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. This leads us to affirm our main results in relation to wage behaviour (the "wage non-rigidity result") and profitability of a merger (the "merger profitability reversal"). In Section 3, the basic framework of the previous section is extended in various directions (product differentiation, price competition and wage bargaining), permitting us to generalise and further qualify our findings. Finally, Section 4 concludes, while technical proofs and further details, which are useful for the analysis conducted in the main text, are provided in the final Appendix.

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returns standard assumption. Hence the mechanism behind his result is clearly different from ours.

2 Basic framework

As a 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:

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

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:

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

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 particular, in this basic framework we assume that, at stage 2, a "monopolistic" industry-wide union fixes a uniform wage for this industry $w_i = w_j = w$. As is well 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):

(3) $$V = (w - w°)^{\theta} L$$

where $L = l_1 + l_2$ is overall employment in the industry, $w < \alpha$ is the union's wage and $w° \geq 0$ 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]

Since workers are organised in an industry-wide union, in the *pre-merger game*, the union will set a wage w so as to maximise $V^C = (w - w°)^{\theta}(l_i^C + l_j^C)$, anticipating labour demand by firms (as a function of wage) 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 $V^M = (w - w°)^{\theta} L^M$, where L^M is the anticipated labour demand of the merged (monopoly) firm.

2.1 Pre-merger (Cournot) case

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

(4) $$\pi_i = pq_i - wq_i^2.$$

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[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.

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

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

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:

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

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:

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

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 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 (multi-plant) firm's output and profit:

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

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

[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 when goods are perfect substitutes.

2.3 Non-rigid wages and merger profitability reversal

In this section 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.

Result 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 the final appendix (Section A.1.1).

The fact that the merger affects the wage sets 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]

In general (i.e. regardless of the specific technology), the net effect of a merger on labour demand may be disentangled as follows. On the one hand, since for a given wage a merger induces an output reduction,[13] there is a

[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] As pointed out by, 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, for given marginal costs, the total cost to produce that output would be

"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. On the other, a merger also causes a change in the slope of the labour demand curve. In particular, the previous literature (e.g. Brekke 2004; Lommerud et al. 2005) shows that the labour demand curve slope becomes steeper after a merger, meaning that the demand for labour becomes less responsive to changes in the wage level. Thus a central union may *ceteris paribus* increase wages without losing too much employment. Specifically, Dhillon and Petrakis (2002) show that, for several market characteristics and bargaining settings, these two opposing effects on wages exactly offset each other, thus maintaining the wage unchanged (i.e. rigid).

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 merger effect that makes the labour demand curve steeper outweighs the demand shifting effect, producing an increase in the wage after the merger. In other words, with η standing for labour demand elasticity with respect to the wage, we obtain that $\left|\eta^M\right| < \left|\eta^C\right|$ (a formal proof is provided in the final Appendix, Section A.2, where the critical role played by decreasing returns to labour for obtaining such an outcome is highlighted). Therefore, 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.

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

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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.

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 the final appendix (Section A.1.2).

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.

Result 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 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 the final appendix (Section A.1.3).

Given Result 1 and Lemma 1, stated above, Result 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. 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 θ and $w°$, the higher the probability that the "reversal result" (i.e. merger is detrimental for profits) applies.

In particular, notice that when $\theta \to 0$, hence the central union tends to care only about employment, the reversal result never applies. This is because when $\theta \to 0$, $w \to w°$ (see (7) and (12)) and, as formally shown in the final appendix (Section A.3), with an exogenous (reservation) wage the conventional result still applies even in the presence of convex labour costs. In turn, this also implies that labour cost convexity is *necessary but not sufficient* to trigger the "reversal result", since a unionised labour market (in which the wage is endogenously determined) is also needed.[14]

On the other hand, when $\theta \to 1$ 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.

To conclude this section, it is worth noting that an alternative scenario with respect to that considered above, where an industry union sets (*a priori*) a *uniform* wage rate for both firms, could be represented by one industry union setting individual, *possibly different*, wages for each firm; in this latter case, the union's objective function would be given by $V = (w_i - w°)^{\theta} l_i + (w_j - w°)^{\theta} l_j$

[14] As discussed in the Introduction, 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 regard, 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 the union, hence the possibility that the latter sets different wages according to the number of firms it deals with).

(e.g. Haucup and Wey 2004). Nevertheless, as long as firms are symmetric, our results still apply to that case. This is because firm symmetry means that, in equilibrium, the union's choice collapses to the same wage $w_i = w_j = w$, i.e. the wage fixed by the industry-wide union is the same for all workers in the industry, irrespective of the union's strategy in setting wages (uniform wage vs. individual wages).[15]

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):

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

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 $\gamma \to 1$

[15] Clearly, admitting for some form of asymmetries between firms would make the results more elaborate. The analysis of an "asymmetric" context lies beyond the scope of this work and is left for future research.

corresponds to the case, studied above, of homogeneous goods. In general, the lower is γ, the higher the degree of product differentiation.

In this context, undertaking the analysis of the previous section, we get the following equilibrium outcomes:

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

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

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

where the subscript *PD* refers to the product differentiation case. From (16) and (17), the following results highlighting the role of the degree of product differentiation/substitutability can be stated:

Result 3. *In the presence of product differentiation, the following outcomes apply:*

i) *the post-merger wage is always higher than when the firms are independent. Furthermore, the wage differential is increasing in γ;*

ii) *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;*

iii) *a "reversal result" applies in relation to the merger profitability if and only if the central union is sufficiently interested in wages with respect to employment. Moreover, the higher the degree of product differentiation (i.e. the lower is γ), the higher the probability that merger is detrimental for profits.*

Proof. See the final appendix (Section A.1.4).

First, Result 3 fully confirms the un-rigidity wage result and the merger profitability reversal as obtained in the basic framework with homogeneous goods.[16] Secondly, it points 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 to 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 above result suggests that 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:

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

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[16] In particular, from the equations of the proof of Result 3 in Section A.1.4, it is easy to verify that the role played by both θ and $w°$ is exactly the same as that described in the basic framework.

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:

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

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

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

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:

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

According to the previous findings, the following result can be stated for the case with price competition.

Result 4. *Under price competition, the results obtained under Cournot competition are confirmed. In particular, the following outcomes apply:*

i) *the post-merger wage is always higher than when firms are independent. Furthermore, the wage differential is increasing in θ and γ;*

ii) *overall quantity produced by the merged firm is less than that produced when firms are independent and the (negative) output differential is decreasing in θ and w° and increasing in γ;*

iii) *a "reversal result" applies in relation to the merger profitability if and only if the central union is sufficiently interested in wages with respect to employment. Moreover, the higher the reservation wage and the degree of product differentiation, the higher the probability that the merger is detrimental for profits.*

Proof. See the final appendix (Section A.1.5).

Hence, our previous findings regarding the un-rigidity wage result and the merger profitability reversal prove to be fully robust with respect to the competition regime in the product market.

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).[17] 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. 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 $w° = 0$, $\theta = 1$ (i.e. total wage bill maximising union) and $\gamma = 1$. This allows us to simplify the analysis, permitting its algebraic tractability.[18]

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[17] 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”.

[18] We provide below numerical results confirming that, even in the presence of wage bargaining, the roles played by $w°$, θ and γ are those expected according to the analyses conducted in the previous sections.

When firms compete *à la* Cournot, by substituting the proper values from Section 2.1 (or 3.1) 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:

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

Similarly, by using (24) and the expressions from Section 2.3, we can also derive the corresponding equilibrium values under Bertrand competition as follows:[19]

[19] Notice that, due to the presence of increasing marginal costs, the "Bertrand paradox" with homogeneous goods ($\gamma = 1$) does not apply.

(29) $\quad w^{B}_{BAR} = 1; \quad \pi^{B}_{BAR} = \frac{1}{16} = 0.0625$

while post-merger (monopoly) equilibrium results clearly correspond to (27) and (28), respectively.

Accordingly, the following result referring to a framework with wage bargaining can be stated.

Result 5. *Under wage bargaining (with homogeneous products and a total wage bill maximising union), the following outcomes apply:*

i) *irrespectively of the competition mode (Cournot or Bertrand), the un-rigidity result is confirmed. That is, wages differ according to whether or not firms merge. Specifically, post-merger wage is higher provided that the union's bargaining power is sufficiently high (i.e. $\beta > 0.25$ under Cournot and $\beta > 0.5$ under Bertrand);*

ii) *under Cournot competition, a "reversal result" actually applies in relation to merger profitability if and only if the union's bargaining power is sufficiently high (i.e. $\beta > 0.5$). By contrast, under Bertrand competition, post-merger profits are always higher than with independent firms.*

Proof. See the final appendix (Section A.1.6).

By means of numerical analysis, Result 5 can be better qualified for different values of $w°$, θ and γ. In particular, Tables 1 and 2 report the threshold value for β above which the "reversal result" on merger profitability applies, for different parameter combinations and alternative competition regimes (Cournot in Table 1 and Bertrand in Table 2). All the numerical results are in line with those of previous sections. In particular, under both Cournot and Bertrand competition, the merger profitability reversal is *ceteris paribus* more likely to occur (i.e. the threshold for β is lower), the higher $w°$ and θ, and the lower γ. In particular, notice that under Bertrand competition, the reversal result, which never applies for the case with $w° = 0$ and $\theta = \gamma = 1$ (see Result 5), becomes a possible event for "proper" parameter values. Finally, by comparing numerical results in Table 1 against those in Table 2, it is also confirmed that (*ceteris paribus*) the reversal result is always more likely when (independent) firms compete *à la* Cournot instead of *à la* Bertrand.

Table 1. "Profitability reversal" under Cournot competition: β thresholds for different parameters[20]

$w° = .25$				
		$\theta =$		
		.25	**.5**	**.75**
$\gamma =$	**.25**	.6798	.3941	.2974
	.5	--	.5863	.4236
	.75	--	.7408	.5153
$w° = .5$				
		$\theta =$		
		.25	**.5**	**.75**
$\gamma =$	**.25**	.5981	.3551	.2703
	.5	--	.5280	.3867
	.75	--	.6667	.4724
$w° = .75$				
		$\theta =$		
		.25	**.5**	**.75**
$\gamma =$	**.25**	.5384	.3253	.2491
	.5	.8854	.4833	.3576
	.75	--	.6100	.4383

[20] For different combinations of the other parameters (i.e. the reservation wage, the union's preference towards wages and the degree of product differentiation), each cell shows the β value, above which the merger profitability reversal applies. For instance, for $w° = \theta = \gamma = 0.25$, the reversal result (i.e. merger reduces profitability) applies for $\beta > 0.6798$. Notice that "--" means that, for the corresponding parameter values, the "reversal result" does not apply for any $\beta \in (0,1)$. All the results are derived in MAPLE, and the programs are available from the authors upon request.

Table 2. "Profitability reversal" under Bertrand competition: β thresholds for different parameters

$w° = .25$				
		$\theta =$		
		.25	**.5**	**.75**
$\gamma =$	**.25**	.8315	.4611	.3429
	.5	--	.8435	.5714
	.75	--	--	.8459
$w° = .5$				
		$\theta =$		
		.25	**.5**	**.75**
$\gamma =$	**.25**	.7218	.4133	.3106
	.5	--	.7408	.5153
	.75	--	--	.7481
$w° = .75$				
		$\theta =$		
		.25	**.5**	**.75**
$\gamma =$	**.25**	.6437	.3771	.2857
	.5	--	.6667	.4724
	.75	--	--	.6779

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 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 actually occurs 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.

Appendix

A.1 Proofs

A.1.1 Proof of Result 1

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

$$\text{(A1)} \quad \Delta w = w^M - w^C = \frac{\theta}{2(2-\theta)} > 0, \text{ for any } \theta \in (0,2)$$

which also clearly implies $\partial(\Delta w)/\partial\theta > 0$, for any $\theta \in (0,2)$.

Q.E.D.

A.1.2 Proof of Lemma 1

Proof. From (8) and (13), we get:

$$\text{(A2)} \, \Delta Q = Q^M - 2q^C = -\frac{(2-\theta)}{2(3+2w^\circ)(2+w^\circ)} < 0, \text{ for any } w^\circ > 0 \text{ and } \theta \in (0,2)$$

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

(A3) $$\frac{\partial(\Delta Q)}{\partial\theta} = \frac{1}{2(3+2w°)(2+w°)} > 0, \quad \frac{\partial(\Delta Q)}{\partial w°} = \frac{(2-\theta)(7+4w°)}{2(3+2w°)^2(2+w°)^2} > 0.$$

Q.E.D.

A.1.3 Proof of Result 2

Proof. Taking (9) and (14) into account, we get:

(A4) $$\Delta\Pi = \Pi^M - 2\pi^C = \frac{(2-\theta)\left[1-\theta(2+w°)\right]}{4(3+2w°)^2(2+w°)}$$

which implies:

(A5) $$\Delta\Pi \gtreqless 0 \Leftrightarrow \theta \lesseqgtr \frac{1}{2+w°}.$$

Q.E.D.

A.1.4 Proof of Result 3

Proof. Taking (16) and (17) into account, we get:

(A6) $$\Delta w_{PD} = w_{PD}^M - w_{PD}^C = \frac{\theta\gamma}{2(2-\theta)} > 0, \text{ for any } \gamma \in (0,1) \text{ and } \theta \in (0,2)$$

which also implies $\partial(\Delta w_{PD})/\partial\gamma > 0$, for any $\gamma \in (0,1)$ and $\theta \in (0,2)$.

(A7)

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

which also implies:

(A8)

$$\frac{\partial(\Delta q_{PD})}{\partial\gamma} = -\frac{(2-\theta)\left[2+2w^{\circ}(2+w^{\circ})-\gamma^2\right]}{2\left[2(1+w^{\circ})+\gamma\right]^2(1+w^{\circ}+\gamma)^2} < 0, \text{ for any } \gamma \in (0,1) \text{ and } \theta \in (0,2).$$

(A9) $$\Delta\Pi_{PD} = \frac{\gamma(2-\theta)\left[\gamma-\theta(1+w^{\circ}+\gamma)\right]}{4\left[2(1+w^{\circ})+\gamma\right]^2(1+w^{\circ}+\gamma)}$$

which implies:

(A10) $$\Delta\Pi_{PD} = \Pi^{M}_{PD} - 2\pi^{C}_{PD} \gtrless 0 \Leftrightarrow \gamma \gtrless \frac{\theta(1+w^{\circ})}{1-\theta}.$$

However, also notice that whatever γ and w°, $\Delta\Pi_{PD}$ is never (always) positive for $\theta \to 1$ (0); hence in such a case a merger always reduces (increases) profits. In other words, θ must be sufficiently high for profits decreasing with a merger.
Q.E.D.

A.1.5 Proof of Result 4

Proof. By comparing (22) and (23) against (17), we get:

(A11) $$\Delta w^{B} = w^{M}_{PD} - w^{B} = \frac{\theta\gamma(1+\gamma)}{2(2-\theta)} > 0, \text{ for any } \gamma \in (0,1) \text{ and } \theta \in (0,2)$$

which also implies $\partial(\Delta w^{B})/\partial\theta > 0$ and $\partial(\Delta w^{B})/\partial\gamma > 0$,
for any $\gamma \in (0,1)$ and $\theta \in (0,2)$.

(A12)

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

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

$$\text{(A13)}\quad \frac{\partial(\Delta q^B)}{\partial\theta} = \frac{\gamma(1+\gamma)}{2[2(1+w^\circ)+\gamma(1-\gamma)](1+w^\circ+\gamma)} > 0;$$

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

$$\frac{\partial(\Delta q^B)}{\partial\gamma} = -\frac{(2-\theta)\left[w^\circ\left(4\gamma^2+8\gamma+4\right)+w^{\circ 2}(4\gamma+2)+\gamma^4+2\gamma^3+3\gamma^2+4\gamma+2\right]}{2[2(1+w^\circ)+\gamma(1-\gamma)]^2(1+w^\circ+\gamma)^2} < 0$$

.

$$\text{(A14)}\quad \Delta\Pi^B = \Pi^M_{PD} - 2\pi_B = \frac{A}{4[2(1+w^\circ)+\gamma(1-\gamma)]^2(1+w^\circ+\gamma)}$$

where
$A \equiv \theta^2+\theta^2 w^\circ+\theta^2 w^\circ\gamma+\theta^2\gamma^2+2\theta^2\gamma-2\theta-2\theta w^\circ-2\theta w^\circ\gamma-5\theta\gamma-4\theta\gamma^2-\theta\gamma^3+2\gamma^3+4\gamma^2+2\gamma$
. Notice that for $\theta \in (0,2)$ A has only one root in $\theta = \gamma(1+\gamma)/(1+w^\circ+\gamma)$. Specifically, the following applies:

$$\text{(A15)}\quad \Delta\Pi^B \underset{<}{\overset{>}{-}} 0 \Leftrightarrow A \underset{<}{\overset{>}{-}} 0 \Leftrightarrow \theta \underset{>}{\overset{<}{-}} \frac{\gamma(1+\gamma)}{1+w^\circ+\gamma}.$$

from which it is easy to check that the critical threshold for θ is decreasing in w° and increasing in γ.[21] Moreover, as above in the Cournot case, whatever γ (and w°), $\Delta\Pi^B$ is never (always) positive for $\theta \to 1$ (0).

Q.E.D.

A.1.6 Proof of Result 5

Proof. By comparing (25) and (29), respectively, against (27), we get:

[21] Specifically, by differentiating the critical threshold for θ with respect to γ, we get $[(1+w^\circ)(1+2\gamma)+\gamma^2]/(1+w^\circ+\gamma)^2 > 0$, for any $w^\circ \geq 0$ and $\gamma \in (0,1)$.

$$\text{(A16)}\quad \Delta w^{C}_{BAR} = w^{M}_{BAR} - w^{C}_{BAR} = \frac{1+6\beta-\sqrt{4\beta^2+20\beta+1}}{4} \gtrless 0 \Leftrightarrow \beta \gtrless 0.25$$

$$\text{(A17)}\quad \Delta w^{B}_{BAR} = w^{M}_{BAR} - w^{B}_{BAR} = 2\beta - 1 \gtrless 0 \Leftrightarrow \beta \gtrless 0.5\,.$$

Moreover, in relation to merger profitability, by using (26), (28) and (29), we get:

$$\text{(A18)}\,\Delta\Pi^{C}_{BAR} = \Pi^{M}_{BAR} - 2\pi^{C}_{BAR} = \frac{(1-2\beta)\left(1+2\beta+\sqrt{4\beta^2+20\beta+1}\right)}{2(1+\beta)\left(5+2\beta+\sqrt{4\beta^2+20\beta+1}\right)} \gtrless 0 \Leftrightarrow \beta \lessgtr 0.5$$

$$\text{(A19)}\quad \Delta\Pi^{B}_{BAR} = \Pi^{M}_{BAR} - 2\pi^{B}_{BAR} = \frac{1-\beta}{8(1+\beta)} > 0, \text{ for any } \beta \in (0,1).$$

Q.E.D.

A.2 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 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 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*.

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

(A20) $L^C\Big|_{CRL} = \frac{2(\alpha - w)}{3} \Rightarrow \frac{\partial L^C(w)}{\partial w}\Bigg|_{CRL} = -\frac{2}{3}.$[22]

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

(A21) $L^M\Big|_{CRL} = \frac{\alpha - w}{2} \Rightarrow \frac{\partial L^M(w)}{\partial w}\Bigg|_{CRL} = -\frac{1}{2}.$

From (A20) and (A21), it follows that:

(A22) $\left(\frac{\partial L^M(w)}{\partial w} - \frac{\partial L^C(w)}{\partial w}\right)\Bigg|_{CRL} = \frac{1}{6} > 0$, for any $\gamma \in (0,1)$.

Hence, the post-merger slope of the demand for labour is steeper than the pre-merger one. Moreover, given that $\eta = (\partial L/\partial w)(w/L)$, we also have:

(A23) $\eta^M\Big|_{CRL} = \eta^C\Big|_{CRL} = -\frac{w}{\alpha - w}$

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

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

(A24) $L^C\Big|_{DRL} = 2\left(\frac{\alpha}{3 + 2w}\right)^2 \Rightarrow \frac{\partial L^C(w)}{\partial w}\Bigg|_{DRL} = -\frac{\alpha^2}{(3 + 2w)^3}$

[22] In order to preserve the economic significance of results, in this benchmark case with constant returns to labour we admit that $w < \alpha$. Notice, however, that under decreasing returns to labour such an assumption is unnecessary for this purpose.

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

(A25) $L^M\Big|_{DRL} = 2\left[\dfrac{\alpha}{2(2+w)}\right]^2 \Rightarrow \dfrac{\partial L^M(w)}{\partial w}\bigg|_{DRL} = -\dfrac{\alpha^2}{(2+w)^3}$.

It follows that:

(A26) $\left(\dfrac{\partial L^M(w)}{\partial w} - \dfrac{\partial L^C(w)}{\partial w}\right)\bigg|_{DRL} = \dfrac{\alpha^2(12w^2+42w+37)}{(3+2w)^3(2+w)^3} > 0$, for any $w > 0$.

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

(A27) $\eta^M\Big|_{DRL} = -\dfrac{2w}{2+w}$; $\eta^M\Big|_{DRL} = -\dfrac{4w}{3+2w}$

which implies:

(A28) $\left|\eta^M\Big|_{DRL}\right| - \left|\eta^C\Big|_{DRL}\right| = -\dfrac{2w}{(3+2w)(2+w)} < 0$, for any $w > 0$

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.3 Exogenous wage

We consider here the main results concerning the issue of the merger's profitability in a 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 $\alpha = 1$ and the wage equals the competitive, or reservation, level $w°$ (which also corresponds to the case in which firms have all the bargaining power *vis-à-vis* the 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:

$$\text{(A29)} \quad \bar{\pi}^C = \frac{w^\circ}{(3+2w^\circ)^2}$$

while the post-merger equilibrium profit is:

$$\text{(A30)} \quad \overline{\Pi}^M = \frac{1}{2(2+w^\circ)}.$$

Hence, the profit differential is:

$$\text{(A31)} \quad \Delta\bar{\pi} = \overline{\Pi}^M - 2\bar{\pi}^C = \frac{1}{2(3+2w^\circ)^2(2+w^\circ)} > 0, \text{ for any } w^\circ > 0$$

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

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