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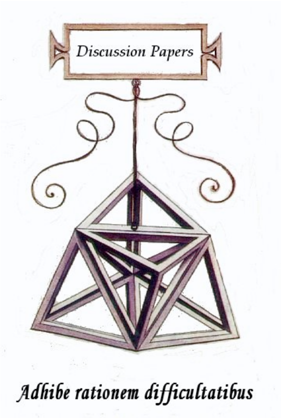

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Price competition, merger and welfare under firm-specific unions: on the role of unions' preference towards wages

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Discussion Paper
n. 136

Luciano Fanti - Nicola Meccheri

Price competition, merger and welfare under firm-specific unions: on the role of unions' preference towards wages

Abstract

This paper analyses the effects of a downstream merger in a differentiated duopoly under price competition and firm-specific unions. In contrast with the acquired wisdom, we show that a downstream merger may increase overall welfare when products are sufficienly substitutes and unions are sufficiently oriented towards wages.

Classificazione JEL: D43, L13, J50
Keywords: mergers, social welfare, firm-specific unions, duopoly, price competition

1 Introduction

Starting from the seminal work by Horn and Wolinsky (1988), the growing literature on *unionised oligopolies* (e.g. Dowrick 1989; Naylor 1999; Correa-López and Naylor 2004; Correa-López 2007; Lommerud et al. 2005) has neatly characterised the effects of alternative unionisation structures (i.e. plant-specific, firm-specific or industry-wide unions) on merger's *profitability* when products are differentiated and firms compete in quantities or in prices. However, despite this increasing literature, the effects of mergers on *overall welfare* under price competition in the product market and unionised labour markets has been less investigated.

Particularly, Symeonidis (2010, Section 4, Prop. 6) shows that under Cournot competition and firm-specific unions, post-merger consumer surplus and total social welfare are always lower than when firms are independent. Moreover, the acquired wisdom would maintain that if the traditional welfare result holds even under Cournot competition, it should be valid *a fortiori* under Bertrand competition. Indeed, while Symeonidis (2010, Section 3) investigates welfare effects of mergers also with price setting firms under plant-specific unions, the welfare effects of mergers under Bertrand competition with firm-specific unions is not specifically investigated, arguing that in such a case the welfare conventional results necessarily hold true. Literally, "[…] the standard welfare results of oligopoly theory are restored: a downstream merger always reduces consumer surplus and social welfare" (Symeonidis 2010, p. 231).[1]

The aim of this paper is to investigate whether the acquired wisdom is justified or, rather, the traditional result may be reversed and, eventually, how this "reversal result" may occur. In particular, in this paper we consider a duopoly in which firms compete in prices and may decide to merge or not. Firms use only labour in production and the labour market is unionised. Particularly, in contrast with Symeonidis (2010) who focalizes on upstream

[1] Brekke (2004) and Lommerud et al. (2005) investigate also mergers with firm-specific unions under price-setting firms, but both neglect to analyse social welfare issues.

rent-maximizing firms (unions), we admit that wages are set by firm-specific unions maximizing a more general Stone-Geary utility function, which is usually adopted by the literature for representing unions' preferences (e.g. Pencavel 1984, 1985). Firstly, we show that, given that post-merger wages are increased, the post-merger profit may become lower than the pre-merger one when unions are sufficiently wage-interested. Then, despite the fact that post-merger profits may be lower, we show that the standard welfare results may actually be reversed. In particular, this applies when unions are sufficiently wage-oriented and the degree of product substitutability is sufficiently large.

This result can be explained by the fact that the post-merger unions' utility may become so high that it overweighs both profits and consumer surplus losses due to the merger. This welfare reversal result is rather novel and, referring to firm-specific unions and price competition, it contributes to the increasing literature on mergers in unionised oligopoly.

The remaining part of the paper is structured as follows. Section 2 describes the general framework with exogenous wage costs. Section 3 examines the equilibrium results in the presence of firm-specific unions both for the case in which firms compete *à la* Bertrand and for a post-merger case. Section 4 studies the merger welfare outcomes in comparison with the pre-merger ones. Finally, Section 5 concludes.

2 The model

We consider a unionized duopoly model with product differentiation. In particular, two firms $\{i, j\}$ compete *à la* Betrand – given pre-determined wages – to maximize profits. Preferences of the representative consumer are given by:

$$U(q_i, q_j) = a(q_i + q_j) - \frac{(q_i^2 + 2cq_iq_j + q_j^2)}{2} \tag{1}$$

where q_i, q_j denote outputs by firm i and j, respectively, $a > 0$, and $c \in (0, 1)$ denotes the extent of product differentiation with goods assumed to be imperfect substitutes. The derived product market demand is linear and, for instance, for firm i is given by:

$$(2) \qquad p_i(q_i,q_j) = a - cq_j - q_i \ .$$

Labour is assumed to be the sole productive input and production technology is characterised by constant returns. Following the established literature on unionised oligopolies, it is assumed that wages are no longer exogenously given, but they are arise as strategic decisions taken by firm-specific upstream suppliers (i.e. labour union). Particularly, the following stages of the game apply. At Stage 1, the firms decide to merge or not and such decision is assumed to be based on a payoff comparison with the no-merger benchmark equilibrium. At Stage 2, firm-specific unions set wages for workers in corresponding firms. At Stage 3, the firms take wages as chosen by unions and set price to maximize profits. The game is solved by backwards induction.

2.1 Bertrand equilibrium with firm-specific unions

In this section, we derive equilibrium results for the case in which firms are independent and compete *à la* Bertrand. From (2) and its counterpart for firm j, we can write product demand facing firm i as:

$$(3) \qquad q_i(p_i,p_j) = \frac{a(1-c) - p_i + cp_j}{(1-c^2)}$$

and profits of the firm i are given by:

$$(4) \qquad \pi_i = p_i\left[\frac{a(1-c) - p_i + cp_j}{(1-c^2)}\right] - w_i\left[\frac{a(1-c) - p_i + cp_j}{(1-c^2)}\right].$$

From (4), the first-order condition for profit-maximization gives the choice of price of the firm *i* as a function of the price chosen by the firm *j*:

$$p_i(p_j) = \frac{\left[a(1-c) + cp_j + w_i\right]}{2} \tag{5}$$

hence, for $c > 0$, the Bertrand product market game is played in strategic complements. Substituting for (5) in (3), the sub-game perfect output in function of wage rates, which is taken by unions in the first stage of the game, is given by:

$$q_i(w_i, w_j) = \frac{\left[(2+c)(1-c)a - (2-c^2)w_i + cw_j\right]}{\left(4-c^2\right)^2(1-c^2)}. \tag{6}$$

At Stage 2, the unions fix wages to maximize their utility functions that, in relation to the union of firm *i*, is assumed to be given as:

$$V_i^B = \left(w_i^B\right)^\theta L_i^B \tag{7}$$

where L_i is the employment of the *i*-th firm and $\theta > 0$.[2] In particular, the latter permits to analyze different possible situations in relation to unions' preferences towards wages with respect to employment and its role will prove to be extremely important for our final results.

Recalling that under constant returns technology $L_i = q_i$, after substitution of (6) in (7) and maximising with respect to w_i, we obtain the following wage reply function for the union *i*:

[2] A more general Stone-Geary functional form adopted in many works (e.g. Pencavel 1984, 1985; Dowrick and Spencer 1994; Petrakis and Vlassis 2000) is $V_i^B = \left(w_i^B - w_i^{\circ}\right)^\theta L_i^B$, where w° is the workers' reservation wage. Since this does not produce any important changes on our final results, we have chosen to normalize to zero the reservation wage ($w^{\circ} = 0$).

(8)
$$w_i(w_j) = \frac{\theta\left[a(2-c^2-c)+cw_j\right]}{(2-c^2)(1+\theta)}$$

that in the symmetric pre-merger Bertrand-Nash equilibrium ($w_i = w_j$) leads to the following equilibrium wage:

(9)
$$w_i = w_j = w^B = \frac{a\theta(1-c)(2+c)}{(2-c^2)(1+\theta)-c\theta}.$$

We are now in a position to derive explicit equilibrium solutions for the unionized Bertrand duopoly. Firm i's Bertrand equilibrium output, price and profits are given by, respectively:

(10)
$$q^B = \frac{a(2-c^2)}{(2-c)\left[(2-c^2)(1+\theta)-c\theta\right](1+c)}$$

(11)
$$p^B = \frac{a(1-c)\left[\theta(4-c^2)+2-c^2\right]}{(2-c)\left[(2-c^2)(1+\theta)-c\theta\right]}$$

(12)
$$\pi^B = \frac{a^2(1-c)(2-c^2)^2}{(2-c)^2\left[(2-c^2)(1+\theta)-c\theta\right]^2(1+c)}.$$

Furthermore, equilibrium consumer surplus, union's utility and overall welfare are given by, respectively:

(13)
$$CS^B = \frac{a^2(2-c^2)^2}{(2-c)^2\left[(2-c^2)(1+\theta)-c\theta\right]^2(1+c)}$$

(14)
$$V^B = \frac{a(2-c^2)\left[\dfrac{a\theta(1-c)(2+c)}{(2-c^2)(1+\theta)-c\theta}\right]^{\theta}}{(2-c)\left[(2-c^2)(1+\theta)-c\theta\right](1+c)}$$

(15) $$SW^B = \frac{a(2-c^2)\left\{2(2-c)\left[(2-c^2)(1+\theta)-c\theta\right]\left[\frac{a\theta(1-c)(2+c)}{(2-c^2)(1+\theta)-c\theta}\right]^{\theta}+a(2-c^2)(3-2c)\right\}}{(2-c)^2\left[(2-c^2)(1+\theta)-c\theta\right](1+c)}.$$

2.2 Post-merger equilibrium

In the post-merger game, the merged firm, at stage 3 of the game, sets prices p_i, p_j to maximise:

(16) $$\Pi^M = \pi_i + \pi_j = (p_i q_i - w_i q_i) + (p_j q_j - w_j q_j)$$

yielding the following outcomes in terms of quantities (we are interested to quantities because they represent employment at the level of each plant and thus they are an argument of the unions' utility)

(17) $$q_i(w_i, w_j) = \frac{a(1-c) - w_i + cw_j}{2(1-c^2)}.$$

Note that when the unions are firm-specific, they also merge when the downstream firms merge. Therefore, in the post-merger game there is a unique post-merger firm union which sets wage, by maximising

(18) $$V^M = \left(w^M\right)^{\theta} L^M$$

where L^M is the post-merger employment and w^M is the input prices set by the post-merger firm union.

It is easy to show that the maximisation of (18) leads to the following equilibrium wage:

(19) $$w^M = \frac{a\theta}{1+\theta}.$$

Therefore, given the labour price fixed by unions, the unionised *post-merger* firm equilibrium results are, respectively:

(20) $$q^M = \frac{a}{(1+\theta)(1+c)}$$

(21) $$p^M = \frac{a[1+2\theta]}{(1+\theta)(1+c)}$$

(22) $$\pi^M = \frac{a^2}{2(1+c)[1+\theta]^2}.$$

(23) $$CS^M = \frac{a^2}{4(1+c)[1+\theta]^2}$$

(24) $$V^M = \frac{a\left[\frac{a\theta}{1+\theta}\right]^\theta}{(1+c)(1+\theta)}$$

(25) $$SW^M = \frac{a\left[4(1+\theta)\left[\frac{a\theta}{1+\theta}\right]^\theta + 3a\right]}{4(1+c)(1+\theta)^2}.$$

3 Results

Regarding the input price response to a merger, we have the following result:

Result 1. *When downstream firms are price setting, firm specific unions set post merger wages higher than the pre-merger ones.*

Proof: Since the wage differential (Δw) is given by:

(26) $$\Delta w = w^M - w^B = \frac{ac\theta}{\left[2(1+\theta) - c^2(1+\theta) - c\theta\right](1+\theta)} > 0$$

then Result 1 is proved.

Q.E.D.

This result is similar to those obtained in different contexts by Brekke (2004), Lommerud et al. (2005) and Symeonidis (2010) and also the intuition behind such results is similar. In a nutshell, when the unions are firm-specific, they also merge when the downstream firms merge and therefore “the rivalry between them is eliminated and this causes the input price to rise” (Symeonidis, 2010, p. 235).

The quantity differential (Δq) is given by:

$$(27) \qquad \Delta q = q^M - 2q^B = -\frac{ac\left[2(1+2\theta) - c^2(1+\theta) - c\theta\right]}{\left[(2-c)(1+\theta)(1+c)\right]\left[2(1+\theta) - c^2(1+\theta) - c\theta\right]} < 0.$$

From (27) the following result holds:

Result 2. *The post-merger quantity is always lower than the pre-merger one.*

This result is expected, given that the merger reduces the market competition.

The profit differential is the following:

$$(28) \qquad \Delta\pi = \Pi^M - 2\pi^B = \frac{a^2 c(\theta^2 P_1 + \theta P_2 + P_3)}{2\left[2(1+\theta) - c^2(1+\theta) - c\theta\right]^2 (1+c)(2-c)^2(1+\theta)^2}$$

where

$P_1 = (c^5 + 2c^4 - 11c^3 + 24c - 16)$, $P_2 = (-16 + 2c^4 - 16c^3 + 2c^5 + 4c^2 + 24c)$ and $P_3 = (c^5 - 4c^3 + 4c)$.

Result 3. *In a duopoly with firm specific unions, a merger is profitable only if the unions are not too much wage interested.*

Proof: Since the sigh of $\Delta\pi$ depends on the sign of the numerator of (28), it is easy to show that: 1) for any $c < 1$, $P_1 < 0$, $P_2 < 0$, $P_3 > 0$; 2) then, by invoking the Descartes theorem, only one, if any, positive real solution θ^* does exist; 3) given that $P_3 > 0$ and $\lim_{\theta \to \infty}(\theta^2 P_1 + \theta P_2 + P_3) = -\infty$, then $\Delta\pi \gtrless 0 \Leftrightarrow \theta \lessgtr \theta°$, where

$$\theta° \equiv \frac{\sqrt{1-c}\,(4-c)^2(2-c^2) + 2(2-c^2)(2-c)}{\left(16-8c-8c^2+3c^3+c^4\right)\sqrt{1-c}}.$$

Q.E.D.

The intuition behind Result 3 is simple. As known, when wage is exogenously given the traditional result is that a merger is always profitable. However we have shown that when firm specific unions are present the post-merger wage is always increased (see Result 1): then it follows that, for a too much high wage (due to a strong unions' preference for wages over employment) it is expected that the profitability of the merger may be compromised. Moreover Fig. 1 below shows that for large values of θ, the profit differential, although always negative, tends to become negligible and this implies that - as will be seen later more in detail when social welfares in the Bertrand and in the Cournot situations are compared - the positive effect of the profits differential in favour of the Bertrand situation on the social welfare differential tend to reduce for very high values of θ.

Finally Fig. 1 clearly reveals that the lower the product differentiation (the higher c), the more likely the profitability of the merger is.

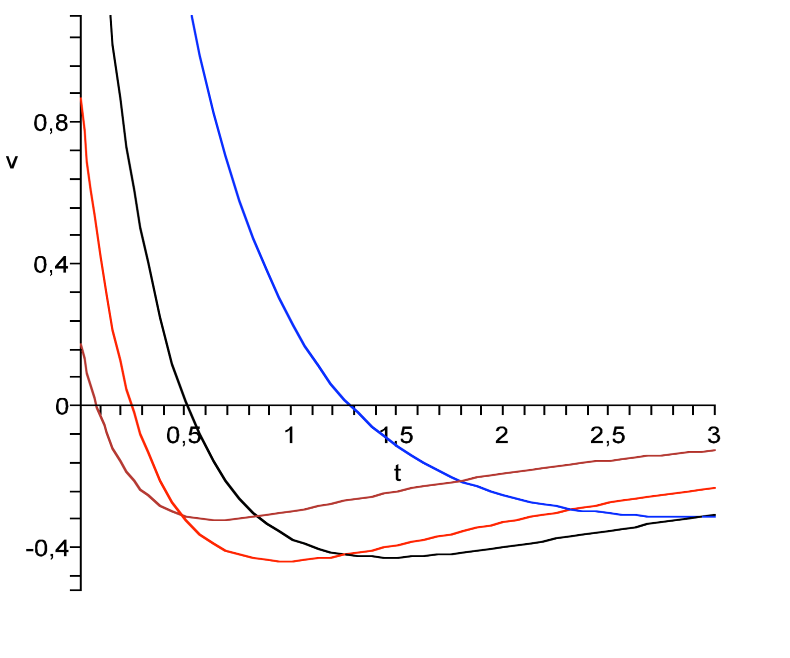

Fig. 1. Profits differential for a varying θ $(0 < \theta < 3)$

[c = 0.9 (blue), c = 0.7 (black), c = 0.5 (red), c = 0.25 (brown); a = 5]

The consumer surplus differential (ΔCS) is:

(29)

$$\Delta CS = CS^M - CS^B = \frac{a^2 c(\theta(1+c)+c)(\theta(c^2+c-4)+c^2-4)}{4\left[2(1+\theta)-c^2(1+\theta)-c\theta\right]^2(1+c)(1+\theta)^2} < 0 .$$

From (29) it is derived the following result:

Result 4. *The post-merger consumer surplus is always lower than under duopolistic Bertrand competition.*

This is a rather conventional result. However we note that, despite the consumer surplus is always higher, as expected, in the Bertrand competitive market structure, a higher unions' wage orientation dampens the "size" of the surplus consumer differential in favour of the Bertrand competition (this dampening effect is clearly displayed in Figure 4 below): this implies that if unions are strongly wage-oriented then the weight of the consumer surplus differential in favour of the Bertrand case on the total welfare differential becomes relatively small, and thus the possibility of the social welfare reversal result is more likely (given that on the other hand such a strong unions' wage orientation amplifies the workers' utility differential in favour of the merger, as shown in the following result).

The unions' utility differential is given by:

$$\Delta V = V^M - V^B = \frac{a\begin{bmatrix} -2(1+\theta)(2-c^2)\left[\dfrac{a\theta(1-c)(2+c)}{2(1+\theta)-c^2(1+\theta)-c\theta}\right]^\theta + \\ +(2-c)\left[2(1+\theta)-c^2(1+\theta)-c\theta\right]\left[\dfrac{a\theta}{1+\theta}\right]^\theta \end{bmatrix}}{(2-c)\left[2(1+\theta)-c^2(1+\theta)-c\theta\right](1+c)(1+\theta)}. \tag{30}$$

Result 5. *The aggregate unions' utility is lower (higher) in the post-merger case than when firms are independent if the unions are sufficiently less (more) wage than employment oriented.*

The effect of the firms' merger on the unions' utility can be decomposed in two effects: a positive effect due to an increased post-merger wage and a negative effect due to the reduced employment. Extensive numerical simulations have revealed the possibility of a threefold different behaviour of the utility differential for an increasing wage-orientation parameter: 1) if a and c are sufficiently high then the utility differential is always increasing for increasing θ; 2) if a is sufficiently high but c is sufficiently low, then the utility differential becomes positive for a sufficiently high critical level of θ, but for further increases of θ such a differential, although remaining positive, tends to reduce and become very small; 3) if a and c are sufficiently low the utility differential always remains negative for increasing θ and may become either very small or very large depending on whether both a and c are not too much small or very small. These behaviours of the unions' utility differential will be crucial in determining the effect of the unionisation on the social welfare as a whole. Indeed, in the first case in which the workers' utility differential in favour of the merger is always increasing with θ, such a differential may become so large that it overweighs both the profit and consumer surplus losses (as it will be detailed below).

Finally,the overall social welfare differential is given by:

(31)

$$\Delta SW = SW^M - SW^B = \frac{a\begin{bmatrix} -8(2-c^2)(2-c)(1+\theta)^2\left[(2-c^2)(1+\theta)-c\theta\right]\left[\dfrac{a\theta(2-c-c^2)}{(2-c^2)(1+\theta)-c\theta}\right]^{\theta} + \\ +4S_1\left[\dfrac{a\theta}{1+\theta}\right]^{\theta} + acS_2 \end{bmatrix}}{4(2-c)^2\left[(2-c^2)(1+\theta)-c\theta\right]^2(1+c)(1+\theta)^2}$$

where

$S_1 = (1+\theta)(2-c^2)\left[2-c^2-\theta(c^2+c-2)\right]$ and $S_2 = \theta^2(3c^5+2c^4-33c^3+16c^2+72c-64)+$
$+2\theta(c^2-2)(3c^2-c^2-18c+20)+(c^2-2)(3c^3-4c^2-6c+8)$

Equation (31) may have a priori any sign. The nonlinearity of such an expression prevents us from using algebraic methods to ascertain its sign. However, an exhaustive numerical analysis of (31) shows that, in contrast with the standard result of the preceding literature, there may be a welfare "reversal". In particular the following applies.

Result 6. *Post-merger social welfare may be higher than when firms are independent, under the following conditions: a sufficiently low degree of product differentiation, a sufficiently large market size and a sufficiently strong unions' wage orientation.*

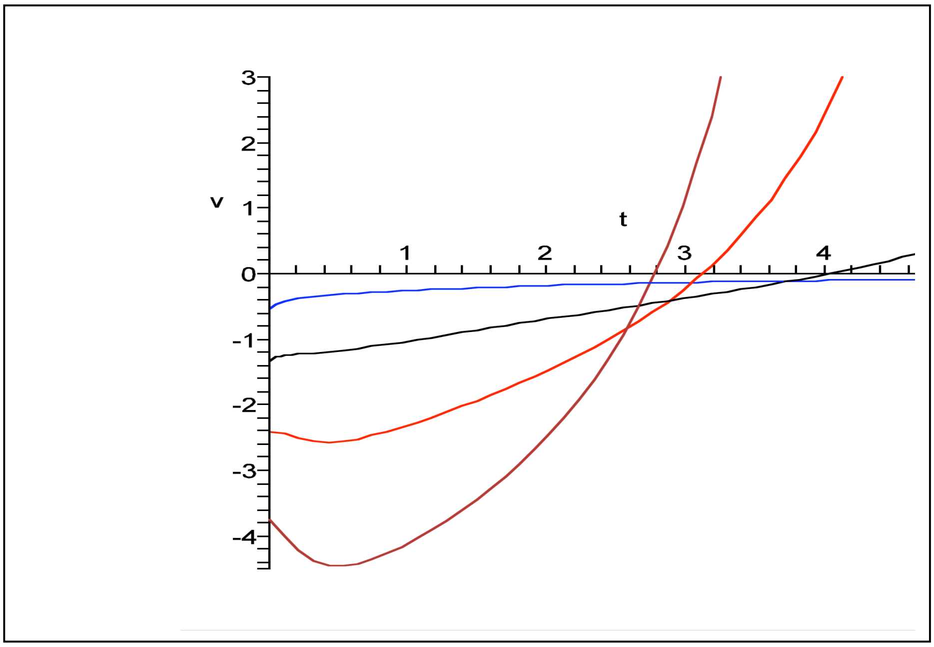

Fig. 2. Welfare differential for varying θ , c = 0.9 and different values of a [a =1 (blue), a =2 (black), a =3 (red), a =4 (brown)]

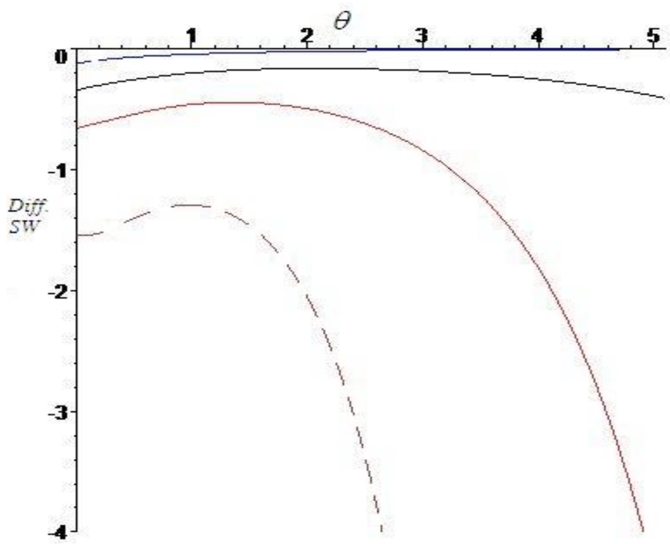

Fig. 3. Welfare differential for a varying θ, c = 0.2 and different values of a [a =1 (blue), a =2 (black), a =3 (red), a =5 (dashed)]

The above figures numerically illustrate whether and how the welfare reversal result occurs. In particular, Figure 2 shows that, given a sufficiently low product differentiation (c = 0.9) and provided that a is sufficiently high (e.g. higher than unity), the social welfare reversal result occurs when unions are distinctly wage oriented: e.g. for $a = 2$ when $\theta = 4$, for $a = 3$ when $\theta = 3.1$ and for $a = 4$ when $\theta = 2.8$). Instead, in contrast with Figure 2, Figure 3 shows that if the product differentiation is relatively high ($c=0.2$) the traditional welfare result is always restored and is even "magnified" by increasing both a and θ.

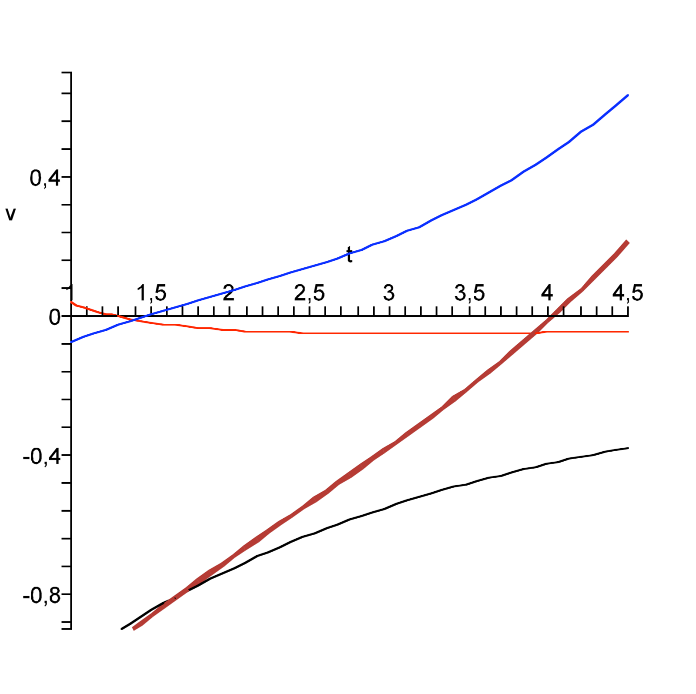

Fig. 4. Differentials of unions' utility (blue), profit (red), consumer surplus (black) and welfare (brown thick) for a varying θ

[$c = 0.9$, $a = 2$]

Finally, Figure 4 clearly illustrates how the "reversal" result occurs when c = 0.9 (i.e. a case of high product substitutability) and a = 2. When the unions' preference for wage is beyond the threshold value $\theta^* = 1.47$, the post-merger aggregate workers' utility becomes larger than that under Bertrand competition and the differential is increasing for increasing θ at a rate significantly higher than that at which profit differential is initially decreasing for increasing θ (for the sake of precision, as shown by Fig. 4, the profit differential tends to reduce initially with θ and subsequently for further increases of θ remain substantially unchanged). On the other hand, the consumer surplus differential, although it always remains in favour of the Bertrand case, tends to reduce for increasing θ. Therefore, in the overall, for increasing θ the social welfare differential must necessarily become positive beyond a critical level of θ (which is, under this parametric example, $\theta^* = 4.05$).

4 Conclusions

This paper analyses the effects of a downstream merger in a differentiated oligopoly under price competition when there are firm specific unions. We show, in contrast with the acquired wisdom, that a downstream merger may increase social welfare, despite the reduced market competition. This occurs when unions are sufficiently wage oriented. The economic reason behind this reversal result may be resumed through two effects: 1) provided that there are a sufficiently high product substitutability and a sufficiently large market size, the more wage-interested unions, the higher the post-merger (relatively to the pre-merger) unions' utility will be); 2) since both profits and consumer surplus tend to become more and more quantitatively similar in both (pre and post-merger) situations (although always remaining higher under the Bertrand situation) for increasing unions' wage preference parameter values, then necessarily a sufficiently high critical value of the "wage preference" such that the post merger social welfare is higher does exist. To sum up, the novel result of this paper, in contrast with the received literature, is that if price-setting downstream firms merge and the labour input price is fixed by sufficiently wage-interested firm-specific unions, then social welfare may be increased.

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