

Unionisation regimes, capacity choice by firms and welfare outcomes

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Abstract

This paper studies how unionisation regimes that differ in the degree of wage setting centralisation interplay with the strategic choice of production capacity by firms and how this affects product market outcomes. When labour markets are unionised and firms compete in quantities, they typically opt for under-capacity in order to dampen the unions' wage claims. This is in contrast with the conventional choice of over-capacity that applies when labour markets are competitive. Moreover, the level of capacity is generally more efficient under centralised unionisation than in a decentralised structure. Relative to more general welfare outcomes, profits are always higher under decentralised unionisation, but both consumer surplus and overall welfare can be higher under a centralised structure, depending on the unions' preference towards wages or employment.

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1 Introduction

For some years, the debate on the economic effects of alternative unions' regimes is high on the political agenda in many countries (e.g. OECD, 2004). At the industry level, a decentralised wage setting structure, involving firm-specific unions, is commonly contrasted with a completely centralised one, in which a single industry union sets a standard wage for the entire industry. At the country level, centralised unions representing all workers in an industry are widespread in continental Europe while firm-specific unions and decentralised wage setting are largely predominant in UK, North America and Japan (e.g. Calmfors and Driffill, 1988; Freeman, 1988; Layard and Nickell, 1999; Flanagan, 1999). However, it has been documented that decentralised unions are gaining popularity in countries such as Sweden, Germany and Italy, which are recently moving towards a more decentralised unionisation structure (Katz, 1993; Del Boca et al., 1999; Haucap et al., 2007). Indeed, the greater rigidities associated with centralised wage setting have currently come under attack in the policy debate, so that any move towards a more decentralised structure is commonly considered as good for overall economic prosperity.

Starting from the seminal works by Horn and Wolinsky (1988) and Dowrick (1989), the prominent role played by unions on industrial organization outcomes has been recently recognised by the growing literature on unionised oligopolies.¹ In such a framework, recent theoretical contributions have studied in detail the performance of alternative unionisation institutions in relation to both firms' profitability and overall welfare. For instance, the role of alternative unionisation structures is considered in affecting innovation and R&D incentives (Haucap and Wey, 2004; Manasakis and Petrakis, 2009; Mukherjee and Pennings, 2011), incentives for foreign direct investment (Mukherjee and Zhao, 2007; Mukherjee and Suetrong, 2012), as well as the welfare effects of downstream mergers (Brekke, 2004; Symeonidis, 2010) and managerial delegation (Fanti and Meccheri, 2013; Meccheri and Fanti,

¹Among others, see also Naylor, 1999; Correa-López and Naylor, 2004; Lommerud et al., 2005; Correa-López, 2007.

2014).

Up to now, however, the literature on unionised oligopolies has devoted no attention to the effects of unionisation on social welfare when firms can strategically manipulate production capacity. Such a latter issue has been extensively treated as a sequential game of “capacity-then-quantity” (e.g. Spence, 1977; Dixit, 1980; Brander and Spencer, 1983), showing that firms generally maintain over-capacity in order to lead their rivals to reduce output.² Analysing if this still applies when firms’ production costs are set by unions and, particularly, how alternative unionisation structures differently affect final social outcomes in such a framework is obviously relevant to the concerns of labour economics and industrial organization, as well as to provide new insights to the debate on the desirability of alternative unionisation regimes.

The contribution we aim to provide with this paper is twofold. From one hand, extending the literature on unionised oligopoly – so far focused on firms’ competition in the product market – to the case in which firms strategically compete also on capacities, and investigating the role of alternative unionisation structures in such a context. On the other hand, analysing if the conventional result by the literature of dynamic (strategic) capacity choice, namely investing in over-capacity represents a strategic incentive for firms despite its cost-inefficiency, is robust to unionisation.³

We analyse a three-stage duopoly game: at the first stage, each firm chooses its production capacity; at the second stage, unions (that can be

²Extensions to a non-pure oligopoly, such as to a situation in which profit-maximising firms compete with labour-managed firms (Stewart, 1991; Zhang, 1993; Haruna, 1996), to mixed oligopolies (Wen and Sasaki, 2001; Nishimori and Ogawa, 2004; Lu and Poddar, 2005, 2006, 2009; Ogawa, 2006; Bárcena-Ruiz and Garzón, 2007; Fernández-Ruiz, 2012), or in the presence of managerial delegation (Tomaru et al., 2009), lead to more various results depending on the modelling environment.

³Further than inducing incumbent rivals to reduce output, another important reason for holding idle capacity, highlighted by the literature, is to deter market entry (see, also, Bulow et al., 1985; Basu and Singh, 1990; Horiba and Tsutsui, 2000). We will not consider market entry in this paper, deferring to future research the study of such an issue in our framework.

decentralised or centralised) set wages; at the third stage, each firm decides its optimal (profit-maximising) output. Our main results can be summarised as follows. Firstly, introducing unionisation in a duopoly model with capacity choice leads to an important effect (a *wage effect*) that acts against the standard *strategic capacity-choice effect*, or *capacity competition effect*, highlighted by the received literature. This “wage effect” relates to the fact that firms have an incentive to reduce capacity in order to dampen the unions’ wage claims. Moreover, in general (that is, unless unions are extremely oriented towards employment), the “wage effect” outweighs the “capacity competition effect”, hence the standard result is reversed: firms choose *under-capacity* and this applies irrespective of the unionisation regime.

Secondly, the “wage effect” is stronger when unionisation is decentralised with respect to the case in which there is a single industry-wide union. More exactly, in the presence of firm-specific unions, wages prove to be more responsive to changes in production capacity, implying that firms have greater incentives to reduce it and, as a consequence, under-capacity is more severe under such unionisation regime. In other words, the “stickier” wage under centralised unionisation (generally) leads to a more efficient outcome in terms of capacity choice by firms.

Finally, in relation to the comparison between alternative unionisation structures in terms of welfare outcomes, we show that, while profits are (as intuitive) always higher under decentralised unionisation, both consumer surplus and overall welfare can be (rather counter-intuitively) higher under a centralised structure. In particular, this actually applies, for consumer surplus, when unions are strongly oriented towards employment, and, for social welfare, unless unions are extremely oriented towards employment or sufficiently oriented towards wages. These represent novel results since, due to the fact that a central union fixes a higher wage, output (consumer surplus) and welfare as a whole are generally larger in a decentralised structure. We point out how our unconventional results strongly relate to the interplay between the unions’ role in setting wages and the strategic capacity choice by firms.

The remaining part of the paper is organised as follows. In Section 2,

we introduce the basic model and present results of the benchmark case without unions. Section 3 introduces unions into the analysis; we derive the equilibrium outcomes with both decentralised (firm-specific) and centralised (industry-wide) union(s), discussing the main results concerning capacity choice. In Section 4, we analyse and compare alternative unionisation regimes in terms of welfare outcomes. Finally, Section 5 concludes.

2 Model

We consider a duopolistic Cournot market for a single homogeneous product, with inverse demand given by:

$$p = 1 - Q \tag{1}$$

where p denotes price and Q is the sum of firms' output ($Q = q_1 + q_2$).⁴ We also assume that firms have identical cost functions and, following an established literature, we assume that, in relation the generic firm i ($i, j = 1, 2, i \neq j$), it takes the following form:

$$C_i = w_i l_i + (x_i - q_i)^2 \tag{2}$$

where w_i is the per-worker wage (with $w_i < 1$), l_i is the employment level of the firm i and x_i is its production capacity, hence $(x_i - q_i)$ represents the (positive or negative) “excess capacity”. Particularly, under this cost function, it is easy to infer that the long-run average cost is minimised when quantity equals production capacity, hence both over-capacity and under-capacity are “inefficient”.⁵ Accordingly, the firm i 's profits are defined as

⁴Notice that the more general inverse demand $p' = a - bQ'$ can be obtained from this normalised model simply by fixing $p = p'/a$ and $Q = (b/a)Q'$.

⁵A situation in which firms can produce and sell more than capacity (considered as the efficient scale of operation) at an increasing marginal cost has been originally introduced and analysed in Vives (1986), to which we defer for greater details (see also Spencer and Brander, 1992). The particular (quadratic) form here adopted of the “excess capacity cost” refers to the one used in several works that analyse capacity choice in a non-pure oligopoly framework (e.g. Horiba and Tsutsui, 2000; Nishimori and Ogawa, 2004; Lu and

follows:

$$\pi_i = (1 - Q)q_i - w_i l_i - (x_i - q_i)^2. \quad (3)$$

Moreover, we assume a one-to-one relationship between employment and output, $q_i = l_i$, and following the unionised oligopolies literature, we consider a situation in which wages are monopolistically chosen by union(s).⁶ Specifically, we consider the following three-stage game: in the first stage, each firm chooses its production capacity; in the second stage, unions choose wages; in the third stage, each firm chooses its output level. Figure 1 summarises the timing of events.

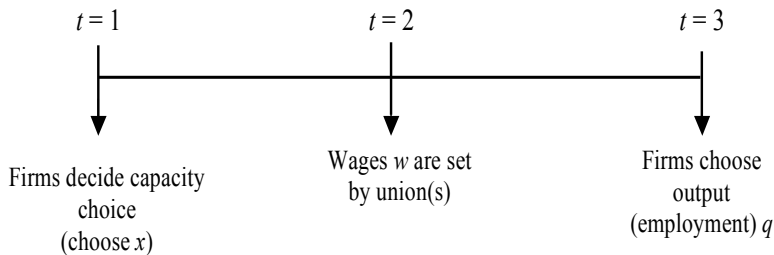


Figure 1: Timing

Particularly, in relation to the second stage, we analyse two alternative scenarios: i) unionisation is decentralised, hence two firm-specific unions (Poddar, 2005). Notice that it means that the cost of having over- or under-capacity is symmetric, while in the seminal work by Vives (1986) production beyond planned capacity is considered to be extra costly than production within the capacity-limit chosen before (see Lu and Poddar, 2005, for a discussion on this point). Finally, it is also worth pointing out that the particular cost structure that relates to the capacity investment makes it different from a cost-reducing (or productivity-enhancing) investment, for instance, in R&D (e.g. d’Aspremont and Jacquemin, 1988). This also implies that the issue we study in this paper is largely different from the hold-up problem associated with the presence of unions, as studied in Haucap and Wey (2004).

⁶The monopoly union model is widely adopted in the unionised oligopolies literature (e.g. Brekke, 2004; Haucap and Wey, 2004; Lommerud et al., 2005). For some preliminary considerations on extending our results to wage bargaining, we refer to the concluding section.

choose wages for their own employees (firms); ii) unionisation is centralised, hence an industry-wide union chooses an uniform wage for all employees (firms) in the industry. This will permit us to compare the performances of those alternative unionisation regimes.

As usual, to look for a subgame perfect equilibrium, we solve the game backwards. At the third stage (the market game), firms choose output to maximise (3). In relation to the generic firm i , the first-order condition for profit maximisation leads to the firm's reaction function as:

$$q_i(q_j) = \frac{1 - w_i - q_j + 2x_i}{4} \quad (4)$$

and from (4), by substituting for the corresponding expression for the firm j , we get the equilibrium output by firm i , for given wages and production capacities:

$$q_i(\mathbf{w}, \mathbf{x}) = \frac{3 - 4w_i + w_j + 8x_i - 2x_j}{15} \quad (5)$$

with $\mathbf{w} = (w_1, w_2)$ and $\mathbf{x} = (x_1, x_2)$.

2.1 A benchmark case: capacity choice without unionisation

For following comparisons and discussion, it can be useful to recall equilibrium outcomes without unionisation. In this benchmark case, only two stages apply: in the first stage, each firm chooses its production capacity; in the second stage, each firm chooses its output level, given firms' production capacities.

Without loss of generality, let normalise to zero the exogenous wage for (non-unionised) workers, i.e. $w_i = w_j = 0$. By substituting (5) and the corresponding for firm j in (3), and maximising with respect to x_i drives to the following reaction function in capacity space:

$$x_i(x_j) = \frac{48 - 32x_j}{97} \quad (6)$$

which, in turn, leads to the following (symmetric) equilibrium choice of capacity and output:

$$x = \frac{16}{43}; \quad q = \frac{15}{43}. \quad (7)$$

Remark 1 *When wages are exogenously given, firms always choose over-capacity.*

3 Capacity choice under unionisation

3.1 Decentralised unionisation

In the presence of labour (monopoly) unions, the latter set wages at the second stage of the game (see Figure 1). Specifically, when unionisation is decentralised, firm-specific (symmetric) unions simultaneously fix wages for their own workers. We consider that unions have weighted preferences over wage and employment (e.g. Pencavel, 1984, 1985; Dowrick and Spencer, 1994) and, in particular, the utility of the firm i 's union is given by the following utility function:

$$V_i = w_i^\theta l_i^{1-\theta} \quad (8)$$

where $\theta \in (0, 1)$ is the relative weight placed by unions on wages with respect to employment. In particular, for $\theta > (<) 0.5$ unions have preferences relatively more wage-oriented (employment-oriented), while $\theta = 0.5$ refers to the special case of total wage bill-maximising unions.⁷

Unions maximise their objective functions with respect to wages, taking firms' output decision into account. Substituting (5) in (8) and maximising with respect to w_i , we get:

⁷A more general Stone-Geary expression for the unions' utility function would be $V_i = (w_i - \bar{w})^\theta l_i^{1-\theta}$, which also includes the workers' reservation wage \bar{w} . Since our results would not change qualitatively, in order to streamline the exposition somewhat, we omit \bar{w} (that can be thought as normalised to zero, such as the exogenous wage of Section 2.1).

$$w_i(w_j) = \frac{\theta(3 + w_j + 8x_i - 2x_j)}{4} \quad (9)$$

which defines the sub-game perfect best-reply function in wages of the union-firm pair i , under the assumption of a non-cooperative Cournot-Nash equilibrium in the product market. Solving the system composed by (9) and its counterpart for j , we get the sub-game perfect equilibrium wage, for given capacity choices x_i and x_j :

$$w_i(\mathbf{x}) = \frac{\theta^2(3 - 2x_i + 8x_j) + \theta(12 + 32x_i - 8x_j)}{16 - \theta^2} \quad (10)$$

and, by substituting (10) in (5) and (3), we get output and profit as a function of the capacity choices. At the first stage, firms simultaneously choose capacity to maximise their own profits, which leads to the following reaction function for the firm i :

$$x_i(x_j) = \frac{64 [192 - 348\theta + 117\theta^2 + 42\theta^3 - 3\theta^4 - (128 - 392\theta + 408\theta^2 - 152\theta^3 + 8\theta^4)x_j]}{24832 + 69632\theta - 48288\theta^2 + 4352\theta^3 + 97\theta^4} \quad (11)$$

and, in symmetric equilibrium, we get:

$$x^{DU} = \frac{64(16 - 33\theta + 18\theta^2 - \theta^3)}{2752 + 3024\theta - 2604\theta^2 + 203\theta^3} \quad (12)$$

$$q^{DU} = \frac{60(16 - 16\theta - \theta^2 + \theta^3)}{2752 + 3024\theta - 2604\theta^2 + 203\theta^3} \quad (13)$$

where the superscript DU recalls that they are obtained under decentralised unionisation.

Now, by exploiting (12) and (13), we determine the choice of the (positive or negative) excess capacity which, interestingly, depends on the union's preference parameter.

Result 1 *Under decentralised unionisation, firms choose under-capacity unless unions are extremely oriented towards employment. When θ is extremely low, they choose instead over-capacity.*

Proof. By using (12) and (13), we get that, for $\theta \in (0, 1)$:

$$x^{DU} - q^{DU} = \frac{4(16 - 288\theta + 303\theta^2 - 31\theta^3)}{2752 + 3024\theta - 2604\theta^2 + 203\theta^3} \geq 0 \Leftrightarrow \theta \leq \frac{136 - 60\sqrt{5}}{31} = 0.0592. \quad (14)$$

■

By defining as “capacity inefficiency” the absolute value of the excess capacity, by numerical comparison between equilibrium excess capacity in the benchmark (without unions) case and (14), we also get:⁸

$$\begin{cases} |x - q| > |x^{DU} - q^{DU}| & \text{if } \theta < 0.1384 \text{ and } \theta > 0.8997 \\ |x - q| < |x^{DU} - q^{DU}| & \text{otherwise} \end{cases} \quad (15)$$

hence, the following result can be stated in relation to the comparison between capacity-efficiency under decentralised unionisation and the case without unions.

Result 2 *When unions are distinctly oriented towards wages or towards employment, firms are more “capacity-efficient” under decentralised unionisation than in the case without unionisation.*

Figure 2 provides a graphical proof of Result 2 (as well as of Result 1). In particular, it displays the behaviour of $(x^{DU} - q^{DU})$ (red line) and compares it with that of $(x - q)$ (black line). Notice that, in order to provide a clear-cut comparison of capacity-efficiency under the two alternative regimes, the excess capacity for the case without unionisation, which is always positive, is “mirrored” also with negative sign (dotted-dashed curve). Clearly, for a given θ value, capacity inefficiency is larger when the curve is farther from the x-axis.

⁸All the numerical results and the graphical proofs that follow are derived in MAPLE (programs available from the authors upon request).

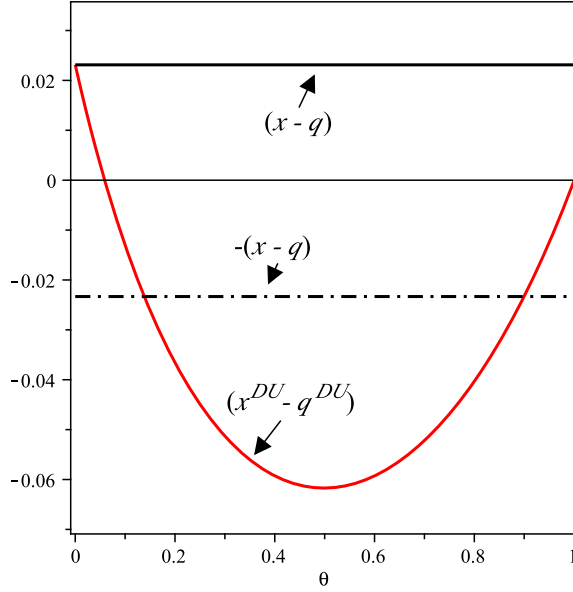


Figure 2: Excess capacity: decentralised unionisation vs. non-unionisation

In line with Result 2, Figure 2 shows that, for intermediate values of θ , the non-unionisation regime is more capacity-efficient than decentralised unionisation, while the reverse holds true for extreme values of θ . In particular, when unions only care about employment (i.e. $\theta \rightarrow 0$), wages are *de facto* exogenous,⁹ so they do not depend on production capacity by firms and equilibrium outcomes (including capacity choice) parallel those of the benchmark case without unions. However, when unions also care about wages, from (10), we get a positive relationship between wages and production capacity:

$$\frac{\partial w_i(\mathbf{x})}{\partial x_i} = \frac{2\theta(16 - \theta)}{16 - \theta^2} > 0 \quad \text{for any } \theta \in (0, 1). \quad (16)$$

Such a positive relationship can be explained by the fact that the higher the production capacity by a firm, the higher its output level (see also Eq. (5)). But if unions are oriented to both wages and employment, the higher the level of employment (output), the stronger the unions' wage aggressiveness. This “wage effect” also implies that firms have an incentive to reduce

⁹They correspond to the workers' reservation wage which is normalised to zero in this model.

production capacity in order to dampen the unions' wage claims. Hence, production capacity decreases when θ increases and, as a consequence, also excess capacity reduces, becoming even negative when unions are sufficiently oriented towards wages. In other words, when θ is sufficiently large, the “wage effect” outweighs the standard “capacity competition effect”, so that firms opt for under-capacity.¹⁰

Moreover, the mechanism above described has two implications that are worth remarking. Firstly, while in the non-unionised case there is always capacity-inefficiency, under decentralised unions a recover of efficiency in capacity choice does exist for a given value of the unions' preferences parameter (that is, $\theta = 0.0592$). Secondly, for intermediate values of θ , the “wage effect” is very strong and under-capacity is particularly severe,¹¹ implying that, for such values, capacity-efficiency is higher in the benchmark (without unions) case.

Finally, also notice that when $\theta \rightarrow 1$, i.e. unions only care about wages, excess capacity is null. However, such a result is not so relevant and can be related to the well-known “Cheshire Cat” union problem, in which setting extremely high wages would lead unions into extinction due to the fact that firms' output and employment collapse to zero (e.g. Burda, 1990). Obviously, when firms do not produce, also production capacity will be (optimally) set to zero, explaining why excess capacity disappears.

¹⁰Notice that this applies even if unionisation leads to a higher wage and lower output, implying that the reduction in production capacity chosen by firms is generally larger than the decrease of output.

¹¹This makes sense and refers to the fact that a change in wages takes place if reducing production capacity affects the trade-off for unions between wages and employment. This actually occurs especially when both wages and employment matter for unions (i.e. for medium values of θ) since, for small values of θ , wages are low and there is not much room for wage reductions, while for very high values, unions have a strong preference for high wages and, even though there is considerable room for wage reductions, a change in production capacity will only trigger small wage adjustments.

3.2 Centralised unionisation

Now we consider the case of centralised unionisation. A monopoly industry-wide union chooses a single wage for all workers in the industry ($w_i = w_j = w$) to maximise:¹²

$$V = w^\theta (l_i + l_j)^{1-\theta}. \quad (17)$$

By substituting (5) and the corresponding equation of firm j (with $w_i = w_j = w$) in (17) and maximising with respect to w , we get:

$$w(\mathbf{x}) = \theta(1 + x_i + x_j). \quad (18)$$

Again, by substituting (18) in (5) and (3), we get output and profit as a function of the capacity choices. Firms simultaneously choose capacity at the first stage to maximise their own profits, which leads to the following reaction function for the firm i :

$$x_i(x_j) = \frac{2 [24 - 33\theta + 9\theta^2 - (16 + 18\theta - 9\theta^2)x_j]}{97 + 96\theta - 18\theta^2} \quad (19)$$

and, in symmetric equilibrium, we get:

$$x^{CU} = \frac{2(8 - 11\theta + 3\theta^2)}{43 + 44\theta - 12\theta^2} \quad (20)$$

$$q^{CU} = \frac{15(1 - \theta)}{43 + 44\theta - 12\theta^2} \quad (21)$$

where the superscript CU recalls that they are obtained with a central union.

Result 3 *Under centralised unionisation, firms choose under-capacity unless union is sufficiently oriented towards employment. When θ is sufficiently low, they choose instead over-capacity.*

Proof. By using (20) and (21), we get that, for $\theta \in (0, 1)$:

¹²Clearly, since there is only one union, we do not need to use an index anymore to denote it.

$$x^{CU} - q^{CU} = \frac{1 - 7\theta + 6\theta^2}{43 + 44\theta - 12\theta^2} \geq 0 \Leftrightarrow \theta \leq \frac{1}{6} = 0.1667. \quad (22)$$

■

Result 4 *Firms are always more “capacity-efficient” under centralised unionisation than in the case without unionisation. That is, the following always applies:*

$$|x^{CU} - q^{CU}| < |x - q| \text{ for any } \theta \in (0, 1).$$

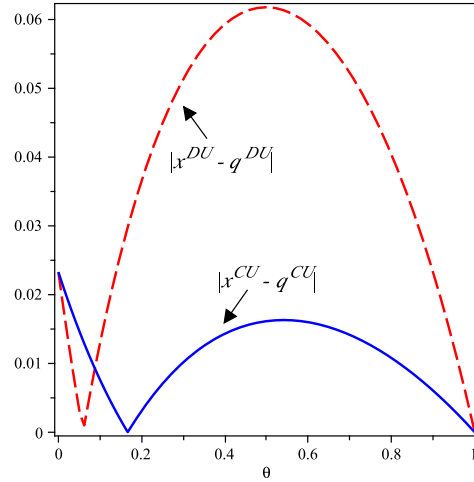
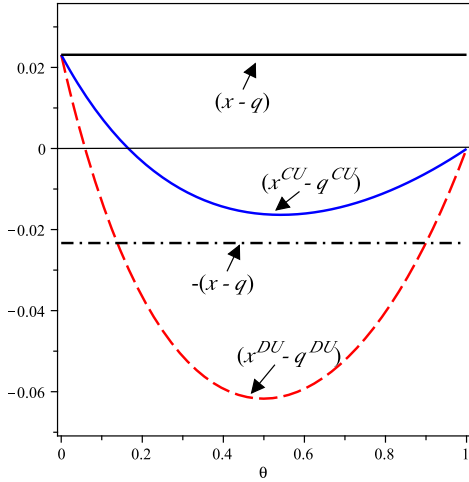


Figure 3: Excess capacity: centralised, decentralised and non-unionisation Figure 4: Excess capacity (absolute values): decentralised vs. centralised unionisation

Figure 3 provides a graphical proof of Result 4. Furthermore, it also compares the behaviour of the excess capacity under centralised unionisation (blue line) and decentralised unionisation (red dashed line), showing that, unless unions are very strongly oriented towards employment, a centralised structure leads to a more efficient outcome (this appears even more clearly in Figure 4, in which excess capacity behaviour under alternative unionisation structure is plotted in absolute value).

In particular, by numerical comparison between (14) and (22), we get:

$$|x^{DU} - q^{DU}| > |x^{CU} - q^{CU}| \text{ if } \theta > 0.0876 \quad (23)$$

and the following result can be stated.

Result 5 *Generally, firms are more “capacity-efficient” under centralised unionisation than under decentralised unionisation. Indeed, the reverse only applies when unions are very strongly oriented towards employment.*

In order to understand the economic intuition behind the above results, by deriving the sub-game equilibrium wage under centralised unionisation (Eq. (18)) with respect to the production capacity chosen by a given firm, we obtain:

$$\frac{\partial w(\mathbf{x})}{\partial x_i} = \theta > 0 \text{ for any } \theta \in (0, 1) \quad (24)$$

which implies that the “wage effect” described and discussed in Section 3.1, for the decentralised unionisation case, also applies to a situation in which unionisation is centralised. This explains why, also in such a unionisation regime, firms generally opt for under-capacity.

However, if we compare Eq. (24) against Eq. (16), we can also deduce that the “wage effect” is always stronger when unionisation is decentralised.¹³ In other words, the wage under centralised unionisation is always less responsive to the level of capacity (i.e. it is “stickier”) than that fixed by firm-specific unions. This implies that, for a given marginal cost in reducing capacity, firms have greater incentives to do it in the presence of firm-specific unions since, in such a case, the marginal benefit (in terms of lower wages) is higher than with an industry-wide union. In turn, this leads to the result that the production capacity chosen by firms under centralised unionisation is always higher, hence under-capacity is lower, than in a decentralised structure. Paradoxically, the greater “wage stickiness” associated with centralised unionisation contributes to (generally) make more efficient the capacity choice by firms in such a regime.

¹³This simply derives by noting in (16) that $2(16 - \theta)/(16 - \theta^2) > 1$ for any $\theta \in (0, 1)$.

4 Welfare results under alternative unionisation structures: a comparison

In this section, starting from the equilibrium outcomes above obtained, we perform a welfare analysis. This will also permit to assess whether the conventional wisdom that decentralised unions should be welfare-preferred still applies to a duopolistic setting with (strategic) capacity choice.

In particular, by using (3), (10), (12), (13) and (18), (20), (21), we get that equilibrium wage and profit under alternative unionisation regimes are given by, respectively:

$$w^{DU} = \frac{225\theta(16 - \theta^2)}{2752 + 3024\theta - 2604\theta^2 + 203\theta^3} \quad (25)$$

$$\pi^{DU} = \frac{32(24832 + 19968\theta - 162720\theta^2 + 170560\theta^3 - 56895\theta^4 + 4158\theta^5 + 97\theta^6)}{(2752 + 3024\theta - 2604\theta^2 + 203\theta^3)^2} \quad (26)$$

and

$$w^{CU} = \frac{75\theta}{43 + 44\theta - 12\theta^2} \quad (27)$$

$$\pi^{CU} = \frac{2(97 - 98\theta - 113\theta^2 + 132\theta^3 - 18\theta^4)}{(43 + 44\theta - 12\theta^2)^2}. \quad (28)$$

Furthermore, by considering that consumer surplus is $CS = 2q^2$ and overall welfare is $SW = 2\pi + 2wl + CS$, we get that:

$$SW^{DU} = \frac{8(429056 + 562944\theta - 1964160\theta^2 + 1314080\theta^3 - 375060\theta^4 + 34839\theta^5 - 1699\theta^6)}{(2752 + 3024\theta - 2604\theta^2 + 203\theta^3)^2} \quad (29)$$

$$SW^{CU} = \frac{2(419 + 479\theta - 1126\theta^2 + 264\theta^3 - 36\theta^4)}{(43 + 44\theta - 12\theta^2)^2} \quad (30)$$

and the following results can be stated:¹⁴

¹⁴Notice that we use the total wage bill instead of union utility in the welfare function. In this choice we follow many others in the literature (e.g. Brander and Spencer, 1988; Mezzetti and Dinopoulos, 1991; Zhao, 2001) and this can be explained by the fact that

Result 6 (welfare comparisons) *By comparing equilibrium outcomes under alternative unionisation structures, the following results apply:*

- *firms' profits are always higher under decentralised unionisation than under centralised unionisation;*
- *unless unions are strongly oriented towards wages, total wage bill is higher under centralised unionisation than under decentralised unionisation. Instead, the reverse holds when $\theta > 0.7090$;*
- *unless unions are strongly oriented towards employment, consumer surplus is higher under decentralised unionisation than under centralised unionisation. In particular, the reverse holds when $\theta < 0.1287$;*
- *social welfare as a whole is higher under centralised unionisation unless unions are extremely oriented towards employment or sufficiently oriented towards wages, that is for $0.037 < \theta < 0.2873$. Otherwise, it is higher under decentralised unionisation.*

unions' members are also final good consumers. Alternatively, since in our case the wage bill also corresponds to the union's rent (reservation wage is normalised to zero), the latter can be considered as a part of the producer surplus (Bughin and Vannini, 1995).

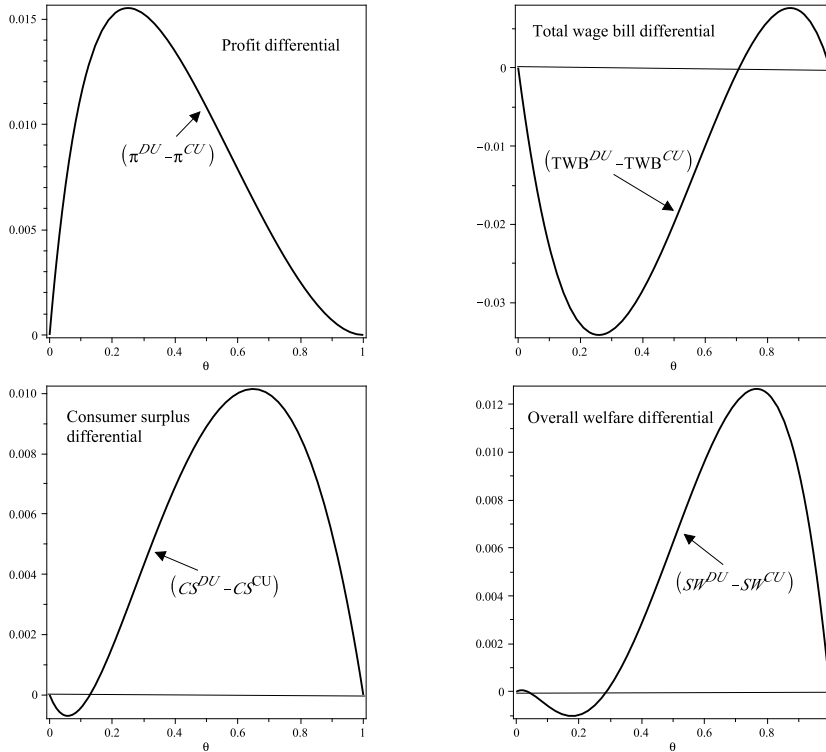


Figure 5: Decentralised vs. centralised unionisation: welfare comparisons

Figure 5 provides a graphical proof of Result 6, which economic intuition can be explained as follows. Firstly, notice that, although cost-inefficiency linked to excess capacity is generally higher with firm-specific unions, the standard result that profits are larger under decentralised unionisation is always confirmed. This means that larger excess-capacity costs under decentralised unionisation are more than offset by the higher wages fixed by a central union. However, for reasons that have already been discussed, the profit differential in favour of firm-specific unions tends to reduce rapidly as θ increases.

On the other side, unless unions are not too much wage-aggressive, the total wage bill is always higher with a central union. Moreover, if unions are strongly employment-oriented, also the consumer surplus is higher under centralised unionisation. The latter is a novel result since, due to the fact that a central union sets a higher wage than firm-specific unions, resulting out-

put (hence, consumer surplus) is generally lower in the former unionisation structure.¹⁵

The unconventional result related to the consumer surplus strongly relates here to the interplay between wage determination by unions and capacity choice by firms. In fact, there are two conflicting effects that affect output and consumer surplus under alternative regimes. From one hand, since under centralised unionisation firms choose higher capacity, they also increase output to reduce cost-inefficiency associated with excess capacity.¹⁶ On the other hand, the wage fixed by an industry wide-union is higher than that set by firm-specific unions, and this drives towards a lower level of output under centralisation. However, when unions are distinctly oriented towards employment, there is not too much difference between wages under different unionisation regimes. Hence, when θ is low, the former effect linked to the capacity choice prevails and output (hence, consumer surplus) is higher under centralisation. Moreover, there exists a range, for which unions are properly employment-oriented, where consumer surplus and total wage bill differentials (in favour of centralised unionisation) together prevail on profit differential (in favour of decentralised unionisation) and, as a consequence, also social welfare as a whole is actually higher in a centralised structure.

5 Conclusion

In this paper, we have studied how unionisation regimes that differ in the degree of wage setting centralisation interplay with the strategic choice of production capacity by firms, and how this affects product market and welfare outcomes. Our findings have shown that under unionisation firms generally opt for under-capacity, in sharp contrast with the traditional choice of over-

¹⁵In Fanti and Meccheri (2013), it is established an “irrelevance result” in the presence of managerial delegation (i.e. firms’ owners delegate output decisions to managers), according to which consumer surplus (and overall welfare) does not depend on the unions’ structure. However, the (strict) preference by consumers and society for a centralised wage setting structure has not yet been affirmed in the unionised oligopoly literature.

¹⁶Recall that when θ is very low, excess capacity is positive also under unionisation.

capacity. This is because, in the presence of unionisation, the “distortions” in the labour market (the “wage effect”) and the product market (the standard “capacity competition effect”) operate one against another, and (generally) the former prevails on the latter. Furthermore, due to the fact that wages are less responsive to the production capacity by firms, capacity-efficiency is generally (i.e. unless unions are strongly oriented towards employment) higher under centralised unionisation than in a decentralised structure.

Relative to more general welfare outcomes, we have pointed out that, while profits are always higher under decentralised unionisation, both consumer surplus and overall welfare can be higher under a centralised structure. In particular, this actually applies, for consumer surplus, when unions are strongly oriented towards employment, and, for social welfare, unless unions are extremely oriented towards employment or sufficiently oriented towards wages.¹⁷

These represent novel results since, due to the fact that a central union fixes a higher wage, the conventional belief would be that output (consumer surplus) and welfare as a whole are generally larger in a decentralised structure. Instead, our (unconventional) results, that strongly relate to the interaction between the unions’ role in setting wages and the strategic capacity choice by firms, shed new light on the issue of which unionisation structure is more desirable from a welfare viewpoint and, in particular, provide a reason against the dominant wisdom that a decentralised structure is generally preferable.

Future research directed to further extend our model can be carried out along possible different lines. For instance, we have adopted a framework in which unions set wages after than firms have chosen capacity. This can be

¹⁷In the working paper version (Fanti and Meccheri, 2014), we also assess the robustness of such results by extending the framework with homogeneous goods and quantity competition to the cases of product differentiation and price competition. Our findings prove to be qualitatively robust to such extensions. In particular, introducing product differentiation and price competition enlarges the range of situations, in which centralised unionisation outperforms a decentralised structure in terms of both capacity choice-efficiency and welfare outcomes.

rationalised by the fact that, at least in the short-medium run, production capacity is generally an irreversible choice (i.e. modifying production capacity entails very large costs for firms), while revising workers' wages can be done more frequently. Nevertheless, considering also an alternative scenario, where the timing of moves relative to capacity choice and wage setting is reversed, deserves a future research. Furthermore, also market entry and union(s)-firms bargaining in determining wages are worth investigating in our framework. Notice, however, that in relation to wage bargaining, while we have to leave the final answers to further research, some preliminary intuitions could arise from this work by recalling that the monopoly union model, considered in this paper, represents a special case of the bargaining model where unions have all the bargaining power. On the other hand, the benchmark (without unions) model corresponds to the case with firms having all the bargaining power in determining wages. Hence, this suggests that in a more general bargaining model, the under-capacity result generally obtained here with unions (which contrasts with the over-capacity result of the benchmark case) should apply, provided that unions' bargaining power *vis-à-vis* firms is sufficiently large.

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