

Unionisation regimes, capacity choice by firms and welfare outcomes*

Luciano Fanti[†] and Nicola Meccheri[‡]

April 19, 2016

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, firms 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, unless unions are distinctly oriented towards employment, the level of capacity is 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.

*We are extremely grateful to three anonymous referees for their comments and suggestions. We would like to thank also participants at AIEL 2014 (Pisa), SIE 2014 (Trento), and seminar attendants at the University of Pisa for useful remarks. Usual disclaimers apply.

[†]Department of Economics and Management, University of Pisa. E-mail: luciano.fanti@unipi.it

[‡]Department of Economics and Management, University of Pisa and The Rimini Centre for Economic Analysis (RCEA). E-mail: nicola.meccheri@unipi.it (corresponding author)

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), Davidson (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, 2015; Meccheri

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

and Fanti, 2014).

Up to now, however, the literature on unionised oligopolies has devoted no attention to the effects of unionisation 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 market 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.

In this paper, we aim at 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. This will permit also to assess 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 decentralised or centralised) set wages; at the third stage, each firm decides its optimal (profit-maximising) output. Our main results can be summarised

²Extensions 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, 2010; 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, also highlighted by the above-mentioned 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.

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, 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.⁴

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; 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

⁴This is reminiscent of the well-known under-investment or hold-up result in the presence of unionisation (e.g. Grout, 1984, and Manning, 1987, for capital investments; Haucap and Wey, 2004, and Lommerud and Straume, 2012, for investments in technology and innovation). However, the issue we study is different from the hold-up problem for various reasons. Most notably, as it will be pointed out, the particular cost structure that relates here to the capacity investment, makes it different from a standard cost-reducing (or productivity-enhancing) investment. Moreover, while the hold-up literature does not deal with the interplay between the capacity competition effect and the wage effect, this is crucial in determining the equilibrium (under-)capacity result in our framework.

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.⁵ 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.

Our analysis and results may also shed new light on the relationship among unions, wages and firm size, considering firms' production capacity as a proxy for the latter. Indeed, there exists a sizable empirical literature documenting that unionised and non-unionised firms may differ along a number of dimensions (e.g. geography, firm size, industry), which may independently influence wage levels (e.g. DiNardo and Lee, 2004). In this work we highlight a theoretical reason, which has not been considered before, affecting the link between firm size and wages according to the structure of unionisation. Indeed, firms can strategically have an incentive to choose its plant size (or capacity) in order to affect their workers' wages, and we point out how this incentive can differ substantially in relation to the unionisation regime.

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.

⁵For instance, Bárcena-Ruiz (2003) shows that “the consumer surplus is greater when negotiations are decentralized since the stronger the bargaining position of the workers is, the greater the wage paid by firms is, the lower the output level of industry and, thus, the consumer surplus” (Bárcena-Ruiz, 2003, p. 350). Horn and Wolinsky (1988) and Davidson (1988) first showed that centralised unionisation results in higher wages, hence workers (unions) prefer centralisation, while firms prefer a decentralised unionisation structure.

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 ($Q = q_i + q_j$, with $i, j = 1, 2, i \neq j$).⁶ Firms produce according to an identical cost function and, following an established literature, we assume that, in relation the generic firm i , 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”, which also implies that the long-run average cost is minimised when quantity equals production capacity, hence both over-capacity and under-capacity are “inefficient”. In particular, this (quadratic) form of the cost function has been widely adopted by the previous literature that analyses capacity choice (e.g. Horiba and Tsutsui, 2000; Nishimori and Ogawa, 2004; Lu and Poddar, 2005; Bárcena-Ruiz and Garzón, 2010). On the one hand, it aims at capturing a situation, originally investigated by Vives (1986), in which firms can produce and sell more than capacity (considered as the efficient scale of operation) at an increasing marginal cost (see also Spencer and Brander, 1992). On the other hand, it also considers the presence of idle capacity costs (such as depreciation, maintenance, rent, cost arising due to defective materials, other opportunity-costs and costs remain unabsorbed or uncovered due to under-utilisation of plant capacity), which is largely recognised by the cost accounting literature (e.g. Lal, 2002, ch. 7).⁷

⁶Notice that the more general inverse demand $p' = a - bQ'$ can be obtained from this normalised model simply by fixing $p = p'/a$ and $Q = (b/a)Q'$.

⁷Notice that due to its quadratic form, the cost function here adopted implies that the cost of having over- or under-capacity is symmetric, while in the seminal work by

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.*⁹

⁹As expected (and shown below), equilibrium wages in the presence of unions are

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.¹⁰

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:

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

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

greater than zero (i.e. the exogenous or non-unionised wage of this section), then profits are lower under unionisation (irrespective of the regime). Moreover, since higher wages lead to lower output, also consumer surplus and overall welfare are lower when labour market is unionised. In Section 3, we will compare relative profits, consumer surplus and social welfare under alternative (decentralised or centralised) unionisation regimes.

¹⁰A 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).

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 :

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

The reaction function in production capacity, as described by (11), is downward-sloping (i.e. firms' capacities are *strategic substitutes*) for the usual reason highlighted by the received literature: by increasing production capacity, a firm induces its rival to reduce output and, since excess capacity is costly, also production capacity. Furthermore, the above reaction function highlights the role played by unions. Particularly, according to (11), when the unions' aggressiveness on wages, captured by θ , increases, the firm's i reaction function undergoes a non-parallel and downward shift. Thus, for a given level of the rival's production capacity, the firm i reduces its own capacity in order to dampen its union's (stronger) wage claims.¹¹

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.

¹¹This effect will be discussed below in greater detail.

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:¹²

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

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

¹²All the numerical results and the graphical proofs that follow are derived in MAPLE (programs available from the authors upon request).

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.

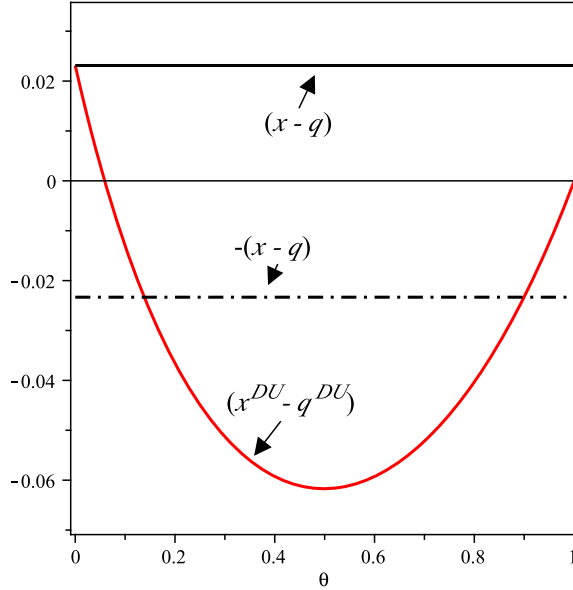


Figure 2: Excess capacity: decentralised unionisation vs. non-unionisation

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,¹³ 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:

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

¹³They correspond to the workers’ reservation wage which is normalised to zero in this model.

In order to provide a general intuition on the effect of higher capacity on wages, from Eq. (8), we can note that the first-order condition for the optimal wage set by union i leads to:¹⁴

$$\eta_i = \frac{\theta}{1 - \theta} \quad (17)$$

where $\eta_i \equiv -\frac{\partial l_i}{\partial w_i} \cdot \frac{w_i}{l_i}$ is the wage elasticity of the firm i 's labour demand. Higher capacity chosen by firm i will lead to higher output and therefore higher employment. This reduces labour demand elasticity and, as a consequence, leads the union i to increase wages. Moreover, this effect is increasing in θ . Indeed, a more wage-oriented union will set the wage on a part of the labour demand curve, where w_i is higher relative to l_i and the reduction of labour demand elasticity due to an increase of employment is more sizeable. Thus, the higher the union orientation towards wages, the larger the reduction in labour demand elasticity due to a marginal increase in employment, leading to a larger wage increase. This “wage effect” also implies that firms have an incentive to reduce production capacity in order to dampen the unions’ wage claims and this incentive is stronger, the higher θ . 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.¹⁵

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, for $\theta = 0.0592$). Secondly, even if, for the reason above explained, the “wage effect” (i.e. $\partial w/\partial x$) is monotonically increasing in θ , under-capacity is particularly severe for intermediate values of θ . This is due to the fact that θ does not only affect the choice of x , but also that of q . This makes

¹⁴We are extremely grateful to an anonymous referee for having suggested such interpretation.

¹⁵Notice 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 in output.

the difference $(x - q)$ non-monotonic with respect to θ , implying that, when θ is neither sufficiently high nor sufficiently low, capacity-efficiency is higher in the benchmark (without unions) case.¹⁶

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:

$$V = w^\theta(l_i + l_j)^{1-\theta}. \quad (18)$$

By substituting (5) and the corresponding equation of firm j (with $w_i = w_j = w$) in (18) and maximising with respect to w , we get:

$$w(\mathbf{x}) = \theta(1 + x_i + x_j). \quad (19)$$

Again, by substituting (19) 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 :¹⁷

$$x_i(x_j) = \frac{2[24 - 33\theta + 9\theta^2 - (16 + 18\theta - 9\theta^2)x_j]}{97 + 96\theta - 18\theta^2} \quad (20)$$

and, in symmetric equilibrium, we get:

$$x^{CU} = \frac{2(8 - 11\theta + 3\theta^2)}{43 + 44\theta - 12\theta^2} \quad (21)$$

¹⁶Also notice that when $\theta \rightarrow 1$ (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.

¹⁷It displays the same characteristics described and discussed above for the case with decentralised unions (see Eq. (11)). In particular, it is downward-sloping and shifts downward following an increase in θ .

$$q^{CU} = \frac{15(1 - \theta)}{43 + 44\theta - 12\theta^2} \quad (22)$$

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 (21) and (22), we get that, for $\theta \in (0, 1)$:

$$x^{CU} - q^{CU} = \frac{1 - 7\theta + 6\theta^2}{43 + 44\theta - 12\theta^2} \geq 0 \Leftrightarrow \theta \leq \frac{1}{6} = 0.1667. \quad (23)$$

■

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

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

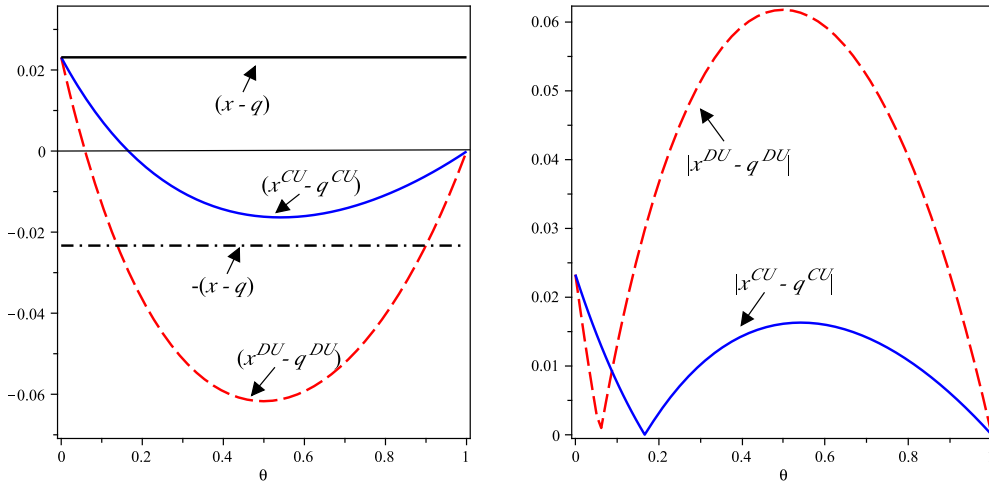


Figure 3: Excess capacity: centralised, decentralised and non-unionisation

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 (23), we get:

$$|x^{DU} - q^{DU}| > |x^{CU} - q^{CU}| \text{ if } \theta > 0.0876 \quad (24)$$

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. (19)) with respect to the production capacity chosen by a given firm, we obtain:

$$\frac{\partial w(\mathbf{x})}{\partial x_i} = \theta > 0 \text{ for any } \theta \in (0, 1) \quad (25)$$

which implies that the “wage effect”, described and discussed 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. (25) against Eq. (16), we can also deduce that the “wage effect” is always stronger when unionisation is decentralised.¹⁸ The intuition behind such result can be provided, as already done in Section 3.1, by noting that, from the first-order condition for the optimal wage set by the central union, we get:

¹⁸This simply derives by noting in (16) that $2(16 - \theta)/(16 - \theta^2) > 1$ for any $\theta \in (0, 1)$.

$$-\frac{\partial(l_i + l_j)}{\partial w} \cdot \frac{w}{l_i + l_j} = \frac{\theta}{1 - \theta}. \quad (26)$$

In this case, when firm i increases x_i , the positive effect on *overall* employment is made less sizable by the fact that firm j reacts by reducing its production capacity (see Eq. (20)), hence its output and employment. Since the central union is concerned with employment as a whole, this implies that, for any given value of labour demand elasticity (or θ), the wage increase following that in x_i is lower than in the decentralised regime, where (firm-specific) unions are only concerned with their own employment.

In other words, under centralised unionisation, the wage is always less responsive to the level of capacity (i.e. it is “stickier”) than that fixed by firm-specific unions, hence firms have less incentives to reduce capacity in order to dampen the industry-wide union’s wage claims. As a consequence, production capacity is higher, hence under-capacity is lower, than in a decentralised structure.

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 (19), (21), (22), we get that equilibrium wage and profit under alternative unionisation regimes are given by, respectively:

$$w^{DU} = \frac{225\theta(16 - \theta^2)}{2752 + 3024\theta - 2604\theta^2 + 203\theta^3} \quad (27)$$

$$\pi^{DU} = \frac{32(24832 + 19968\theta - 162720\theta^2 + 170560\theta^3 - 56895\theta^4 + 4158\theta^5 + 97\theta^6)}{(2752 + 3024\theta - 2604\theta^2 + 203\theta^3)^2} \quad (28)$$

and

$$w^{CU} = \frac{75\theta}{43 + 44\theta - 12\theta^2} \quad (29)$$

$$\pi^{CU} = \frac{2(97 - 98\theta - 113\theta^2 + 132\theta^3 - 18\theta^4)}{(43 + 44\theta - 12\theta^2)^2}. \quad (30)$$

Furthermore, by considering that consumer surplus is $CS = 2q^2$ and overall welfare is $SW = 2\pi + 2wl + CS$, we get that:¹⁹

$$SW^{DU} = \frac{8(429056 + 562944\theta - 1964160\theta^2 + 1314080\theta^3 - 375060\theta^4 + 34839\theta^5 - 1699\theta^6)}{(2752 + 3024\theta - 2604\theta^2 + 203\theta^3)^2} \quad (31)$$

$$SW^{CU} = \frac{2(419 + 479\theta - 1126\theta^2 + 264\theta^3 - 36\theta^4)}{(43 + 44\theta - 12\theta^2)^2}. \quad (32)$$

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 $\theta < 0.1287$;*

¹⁹Notice 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 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).

- *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.*

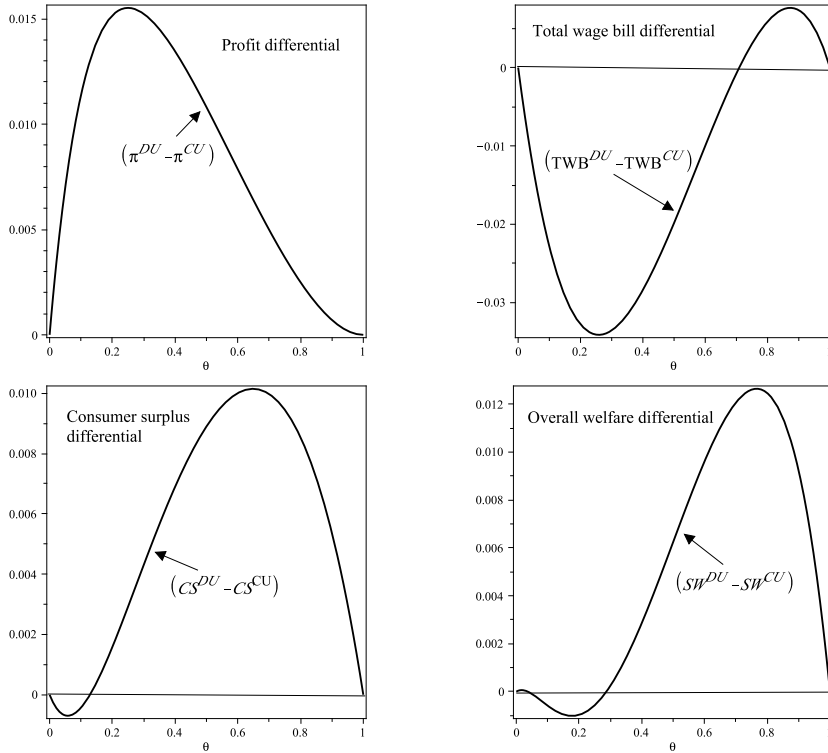


Figure 5: Decentralised vs. centralised unionisation: welfare comparisons

Figure 5 provides a graphical proof of Result 6, the economic intuition of which 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 too much wage-aggressive, the total wage bill is 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 output (hence, consumer surplus) is generally lower in the former unionisation structure.²⁰

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. On the one hand, since under centralised unionisation firms choose higher capacity, they also increase output to reduce cost-inefficiency associated with excess capacity.²¹ On the other hand, the wage fixed by an industry wide-union is higher than that set by firm-specific unions, and this drives to a lower level of output under centralisation. However, when unions are distinctly oriented towards employment, there is not too much difference between wages under alternative 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 becomes higher in a centralised structure.

²⁰In 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.

²¹Recall that when θ is very low, excess capacity is positive also under unionisation.

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-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 upon 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 employment-oriented, and, for social welfare, unless unions are extremely oriented towards employment or sufficiently oriented towards wages.²²

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, providing a reason against the

²²In the working paper version (Fanti and Meccheri, 2014), we also assess the robustness of such results by also considering product differentiation and price competition (such extensions are shown in the Appendix, provided as Supplementary material). 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.

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, in order to maintain the analysis as simple as possible, we have considered a cost function according to which producing below capacity is equally costly as producing above capacity. We have mentioned various reasons for which holding idle capacity is itself costly, but a more realistic scenario should provide that producing above capacity is more costly. Hence, it is worth investigating how our main results are affected by introducing such an asymmetry in under/over capacity costs. In this regard, while we have to leave the final answers to further research, a preliminary intuition could arise by noting that the case analysed in this paper (with symmetric costs) can be considered as a special case contrasting the other limiting case, studied by the received literature on strategic capacity choice, in which producing above capacity entails infinite extra-costs (that is, it is not possible to produce over and above the installed production capacity). Taking into account that our framework generally leads to an under-capacity (equilibrium) result against the standard over-capacity result by the standard literature, this seems to suggest that introducing cost-asymmetry would weaken our results but, at the same time, they would continue to apply qualitatively providing that costs of producing above capacity are not excessively higher than those of producing below capacity.

Moreover, we have studied a framework where unions set wages after than firms have chosen capacity. This can be 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 investigation. Finally, further extensions of this model could be performed by considering an oligopoly framework with more than two firms, which could also permit to analyse a scenario where decentralised wage setting applies to some firms and centralised wage setting to other firms, or by introducing market entry and union(s)-firms bargaining in determining wages into the analysis.

References

- [1] Bàrcena-Ruiz, J.C. (2003). Politically preferred wage bargaining structures. *European Journal of Political Economy* 19, 341-353.
- [2] Bàrcena-Ruiz, J.C. and Garzòn, M.B (2007). Capacity choice in a mixed duopoly under price competition. *Economics Bulletin* 26, 1-7.
- [3] Bàrcena-Ruiz, J.C. and Garzòn, M.B (2010). Endogenous timing in a mixed duopoly with capacity choice. *The Manchester School* 78, 93-109.
- [4] Basu, K. and Singh, N. (1990). Entry deterrence in Stackelberg perfect equilibria. *International Economic Review* 31, 61-71.
- [5] Brander, J.A. and Spencer, B.J. (1983). Strategic commitment with R&D: The symmetric case. *Bell Journal of Economics* 14, 225-235.
- [6] Brander, J.A. and Spencer, B.J. (1988). Unionized oligopoly and international trade policy. *Journal of International Economics* 24, 217-234.
- [7] Brekke, K.R. (2004). Competition or coordination in hospital markets with unionised labour. *International Journal of Health Care Finance and Economics* 4, 65-89.
- [8] Bughin, J. and Vannini, S. (1995). Strategic direct investment under unionized oligopoly. *International Journal of Industrial Organization* 13, 127-145.
- [9] Bulow, J., Geanakoplos, J. and Klemperer, P. (1985). Holding idle capacity to deter entry. *Economic Journal* 95, 178-182.
- [10] Burda, M.C. (1990). Membership, seniority and wage-setting in democratic labour unions. *Economica* 57, 455-466.
- [11] Calmfors, L. and Driffill, J. (1988). Centralisation and wage bargaining. *Economic Policy* 6, 13-61.

- [12] Correa-López, M. (2007). Price and quantity competition in a differentiated duopoly with upstream suppliers. *Journal of Economics & Management Strategy* 169, 469-505.
- [13] Correa-López, M. and Naylor, R.A. (2004). The Cournot-Bertrand profit differential: A reversal result in a differentiated duopoly with wage bargaining. *European Economic Review* 48, 681-696.
- [14] d'Aspremont, C. and Jacquemin, A. (1988). Cooperative and noncooperative R&D in duopoly with spillovers. *American Economic Review* 78, 1133-1137
- [15] Davidson, C. (1988). Multiunit bargaining in oligopolistic industries. *Journal of Labor Economics* 6, 397-422.
- [16] Del Boca, A., Pendleton, A. and Kruse, D. (1999). Decentralisation of bargaining systems and financial participation: A comparative study of Italy, UK and the US. *Lavoro e Relazioni Industriali* 1, 9-49.
- [17] DiNardo, J. and David S.L. (2004), Economic impacts of new unionization on private sector employers: 1984-2001. *Quarterly Journal of Economics* 119, 1383-1441.
- [18] Dixit, A. (1980). The role of investment in entry deterrence. *Economic Journal* 90, 95-106.
- [19] Dowrick, S. (1989). Union-oligopoly bargaining. *Economic Journal* 99, 1123-1142.
- [20] Dowrick, S. and Spencer, B.J. (1994). Union attitudes to labor-saving innovation: When are unions Luddites? *Journal of Labor Economics* 12, 316-344.
- [21] Fanti, L. and Meccheri, N. (2013). Managerial delegation under alternative unionisation structures. *Labour* 27, 38-57.

- [22] Fanti, L. and Meccheri, N. (2015). On the Cournot-Bertrand profit differential and the structure of unionisation in a managerial duopoly. *Australian Economic Papers* 54, 266-287.
- [23] Fanti, L. and Meccheri, N. (2014). Capacity choice and welfare under alternative unionisation structures. RCEA Working Paper Series n.12/14. The Rimini Centre for Economic Analysis.
- [24] Fernández-Ruiz, J.F. (2012). Capacity choice in a mixed duopoly with a foreign competitor. *Economics Bulletin* 32, 2653-2661.
- [25] Flanagan, R.J. (1999). Macroeconomic performance and collective bargaining: An international perspective. *Journal of Economic Literature* 37, 1150-1175.
- [26] Freeman, R. (1988). Labour markets. *Economic Policy* 6, 63-80.
- [27] Grout, P.A. (1984), Investment and wages in the absence of binding contracts – a Nash bargaining approach. *Econometrica* 52, 449-460.
- [28] Haruna, S. (1996). A note on holding excess capacity to deter entry in a labour managed industry. *Canadian Journal of Economics* 29, 493-499.
- [29] Haucap, J., Pauly, U. and Wey, C. (2007). A cartel analysis of the German labor institutions and its implications for labor market reforms. *Journal of Institutional and Theoretical Economics* 163, 503-516.
- [30] Haucap, J. and Wey, C. (2004). Unionisation structures and innovation incentives. *Economic Journal* 114, 149-165.
- [31] Horiba, Y. and Tsutsui, S. (2000). International duopoly, tariff policies and the case of free trade. *Japanese Economic Review* 51, 207-220.
- [32] Horn, H. and Wolinsky, A. (1988). Bilateral monopolies and incentives for merger. *RAND Journal of Economics* 19, 408-419.
- [33] Katz, H.C. (1993). A decentralisation of collective bargaining: A literature review and comparative analysis. *Industrial & Labor Relations Review* 47, 3-22.

- [34] Lal, J. (2002). *Cost Accounting*, 3ed. New Delhi, Tata McGraw-Hill.
- [35] Layard, R. and Nickell, S. (1999). Labor market institutions and economic performance. In Ashenfelter, O.C. and Card, D. (eds.), *Handbook of Labor Economics*, vol. 3, Amsterdam, North Holland.
- [36] Lommerud, K.E. and Straume, O.R. (2012). Employment protection versus flexicurity: On technology adoption in unionised firms. *Scandinavian Journal of Economics* 114, 177-199.
- [37] Lommerud, K.E., Straume, O.R. and Sørsgard, L. (2005). Downstream merger with upstream market power. *European Economic Review* 49, 717-743.
- [38] Lu, Y. and Poddar, S. (2005). Mixed oligopoly and the choice of capacity. *Research in Economics* 59, 365-374.
- [39] Lu, Y. and Poddar, S. (2006). The choice of capacity in mixed duopoly under demand uncertainty. *The Manchester School* 74, 266-272.
- [40] Lu, Y. and Poddar, S. (2009). Endogenous timing in a mixed duopoly and private duopoly ‘capacity-then-quantity’ game: The linear demand case. *Australian Economic Papers* 48, 138-150.
- [41] Manasakis, C. and Petrakis, E. (2009). Union structure and firms’ incentives for cooperative R&D investments. *Canadian Journal of Economics* 42, 665-693.
- [42] Manning, A. (1987). An integration of trade union models in a sequential bargaining framework. *Economic Journal* 97, 121-139.
- [43] Meccheri, N. and Fanti, L. (2014). Managerial delegation contracts under centralised unionisation. *Managerial and Decision Economics* 35, 51-66.
- [44] Mezzetti, C. and Dinopoulos, E. (1991). Domestic unionization and import competition. *Journal of International Economics* 31, 79-100.

- [45] Mukherjee, A. and Pennings, E. (2011). Unionization structure, licensing and innovation. *International Journal of Industrial Organization* 29, 232-241.
- [46] Mukherjee, A. and Suetrong, K. (2012). Unionisation structure and outward foreign direct investment. *Journal of Institutional and Theoretical Economics* 168, 266-279.
- [47] Mukherjee, A. and Zhao, L. (2007). Unionization structure and the incentives for foreign direct investment. Discussion Paper Series 202, Research Institute for Economics & Business Administration, Kobe University.
- [48] Naylor, R.A. (1999). Union wage strategies and international trade. *Economic Journal* 109, 102-125.
- [49] Nishimori, A. and Ogawa, H. (2004). Do firms always choose excess capacity? *Economics Bulletin* 12, 1-7.
- [50] OECD (2004). *OECD Employment Outlook*. Paris, OECD Publishing.
- [51] Ogawa, H. (2006). Capacity choice in the mixed duopoly with product differentiation. *Economics Bulletin* 12, 1-6.
- [52] Pencavel, J.H. (1984). The tradeoff between wages and employment in trade union objectives. *Quarterly Journal of Economics* 99, 215-231.
- [53] Pencavel, J.H. (1985). Wages and employment under trade unionism: Microeconomic models and macroeconomic applications. *Scandinavian Journal of Economics* 87, 197-225.
- [54] Spence, A.M. (1977). Entry, capacity investment and oligopolistic pricing. *Bell Journal of Economics* 8, 534-544.
- [55] Spencer, B.J. and Brander, J.A. (1992). Pre-commitment and flexibility: Applications to oligopoly theory. *European Economic Review* 36, 1601-1626.

- [56] Stewart, G. (1991) Strategic entry interactions involving profit maximising and labour-managed firms. *Oxford Economic Papers* 43, 570-583.
- [57] Symeonidis, G. (2010). Downstream merger and welfare in a bilateral oligopoly. *International Journal of Industrial Organization* 28, 230-243.
- [58] Tomaru, Y., Nakamura, Y. and Saito, M. (2009). Capacity choice in a mixed duopoly with managerial delegation. *Economics Bulletin* 29, 1904-1924.
- [59] Vives, X. (1986). Commitment flexibility, and market outcomes. *International Journal of Industrial Organization* 4, 217-229.
- [60] Wen, M. and Sasaki, D. (2001). Would excess capacity in public firms be socially optimal? *Economic Record* 77, 283-290.
- [61] Zhang, J. (2001). Holding excess capacity to deter entry in a labour-managed industry. *Canadian Journal of Economics* 26, 222-234.
- [62] Zhao, L. (2001). Unionization, vertical markets, and the outsourcing of multinationals. *Journal of International Economics* 55, 187-202.