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When more competition may damage welfare with socially responsible firms

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Abstract

When more competition may damage welfare with socially responsible firms

Considering a Cournot monopoly/duopoly model with linear/quadratic production costs and Corporate Social Responsibility (CSR) activities, this note shows that, in contrast to the common view, entry may reduce social welfare. Moreover, we remark that the higher the CSR activities are, the more likely the welfare-damaging entry effect may occur, and the social welfare changes following a firm's entry crucially depend on the degree of convexity of the cost function.

1. Introduction

The common wisdom with regard to product market competition is that entry of a firm in an industry by increasing competition increases social welfare as well. However, several papers have recently questioned this view. The papers of Klemperer (1988) and Lahiri and Ono (1988) have early conducted the challenge showing that, if there is a marginal cost difference between incumbents and entrants, then entry may reduce welfare in a Cournot oligopoly: in particular, this occurs if the constant marginal cost of the entrant is sufficiently higher than that of the incumbent. Subsequently, Lahiri and Ono (1999) and Kitahara and Matsumura (2006) have extend the previous unconventional results as regards the welfare effects under optimal tax/subsidy policies and cost reducing innovation. In recent past, and differently from the previous literature, Mukerjee and Ray (2014) have shown, although only through specific examples, a welfare reducing effect of entry 1) even if the firms have symmetric initial production costs but differ in terms of the R&D costs, and 2) even if the entrant is a firm with high R&D capability. However, none of the above mentioned papers considers the presence of Corporate Social Responsibility (CSR) rules adopted by firms. Indeed, the academic literature has more frequently discussed the engagement of firms in social responsible activities (e.g. Baron 2001, 2009; Jensen 2001; Goering 2007, 2008; Lambertini 2013; Lambertini & Tampieri 2012, 2015; Lambertini et al. 2016; Benabou & Tirole 2010; Kopel & Brand 2012; Manasakis et al. 2014). Moreover, the adoption of CSR rules is a globally observed business practice. In fact, as the KPMG Survey of Corporate responsibility reporting (KPMG 2013) indicates, at least 62 percent of companies in 15 different sectors surveyed have declared the completion of CSR activities. Forbes (2014) mentions the results of the Reputation Institute (2014) CSR survey, which confirms that several, large companies are worldwide engaged in CSR activities.

Thus, our paper brings the arguments of two separate literatures studying 1) the effects of a change in the market structure on social welfare and 2) firms adopting CSR rules. We argue that the firms' widespread introduction of CSR rules may pose some challenges to the traditional "social welfare increasing" effect. In fact, this paper shows that such a view is not necessarily true, because the change in the market structure when firms adopt CSR behaviours has an impact on social welfare which may be dependent upon the interaction between 1) the level of social concerns; and 2) the less or more decreasing returns to scale technology with which the socially concerned firms operate.

In particular, considering a Cournot monopoly/duopoly model with linear/ quadratic production costs, in contrast to the common view we show that, if entry occurs, it may reduce social welfare. The convexity of the cost function tends to favour the profits of duopoly relatively to those of monopoly. On the other hand, we note that the higher the CSR activities are, the more likely the relatively lower profit reduction under monopoly than under duopoly may overweigh the advantage of the consumer under duopoly and, ultimately, given an opportune intensity of decreasing returns to scale (DRS), the welfare-damaging effect may occur. Furthermore, the larger the weight on consumer surplus in the firms' objective is, the more damaging is the effect, and the direction of the change of social welfare after the modification of the market structure may crucially depend on whether the average cost function is sufficiently steeply sloped. Thus, this paper identifies an alternative reason for challenging the traditional view, arguing for a social welfare-reducing effect due to firms' social concerns together with adequately DRS. The paper's findings may also have implications in terms of Anti-Trust policies.

The remainder of this note is organised as follows. Section 2 introduces the monopoly and duopoly models with firms adopting CSR rules and facing a linear/ quadratic cost function. The analysis of entry in this context is discussed in Section 3. The last section concludes our findings.

2. The model

Our analysis starts by building the monopoly model. The inverse demand function is:

$$p = a - q \tag{1}$$

where p and q denote the price and the quantity of the goods, respectively. To focus on the effects of the adoption of CSR rules in this industry under rather general technological context, we consider a linear/quadratic cost function:

$$C = cq + zq^2. \tag{2}$$

This cost function allows for a technology with constant (i.e. z = 0) or decreasing (i.e. z > 0) returns to scale (DRS). In particular, the parameter z determines the steepness of the average cost's U-shape: if z is small (large), then the average cost curve tends to be flat (steeply sloped).

Given (1) and (2), the monopolist's profit function is:

$$\pi = (a - q - c - zq)q. \tag{3}$$

Partially following the recent established literature (e.g. Goering 2007, 2008; Lambertini 2013; Lambertini & Tampieri 2012, 2015; Lambertini et al. 2016; Kopel & Brand 2012; Fanti & Buccella 2016, 2017 a, b) our model assumes that all the social concerns can be interpreted as part of the consumer surplus. As a consequence, we suppose that the firm, in its objective, aspires to maximise profits plus *k* times the consumer surplus, with $k \ge 0$. When $0 \le k \le 1$, the company weighs the consumer surplus less than its profits. On the other hand, when k > 1, the firm ponders the consumer surplus more than the profits in its objective function. Thus, a simple parameterised combination of profits and consumer surplus characterises the CSR firm's objective function¹ (*W*), which can be expressed as:

¹ Goering (2007, 2008) assigns this objective function also to the non-profit organizations (NPO) which compete in commercial markets in sectors such as university bookstores (Schiff & Weisbrod 1991), water utility, rail track maintenance company, private air-traffic control organization (Bennett et al. 2003), and even in high-tech markets (Benz 2005). Thus, commercial NPOs selling

$$W = \pi + kCS = (a - q - c - zq)q + k\frac{q^2}{2}$$
(4)

The analysis is carried as usual through the maximisation of (4) with respect to the quantity. The first order condition (FOC) of (4) and subsequent usual passages lead to the equilibrium output level:

$$q^M = \frac{a-c}{2z+2-k} \tag{5}$$

After substitution of (5) into (3), the monopoly profits are

$$\pi^{M} = \frac{(a-c)^{2} (1+z-k)}{(2z+2-k)^{2}}$$
(6)

where the upper script M stands for "monopoly". Consider now the case of duopoly. In duopoly, the inverse demand function becomes

$$p = a - q_i - q_j \tag{7}$$

where q_i and q_j are the firms' output levels for i, j = 1, 2 and $i \neq j$. We assume that both firms follow the same exogenous CSR rules, k: in fact, because firms compete for the same clients within an industry, it can be fairly assumed that the CSR level requested by stakeholders is identical for the companies. Thus, the firms' CSR objective functions (W_i) are:

$$W_i = \pi_i + kCS = (a - q_i - q_j - c - zq_i)q_i + k\frac{(q_i + q_j)^2}{2}$$
(8)

for i, j = 1, 2 and $i \neq j$. Given (8), the firms' maximisation problem and the solution of the system of FOCs leads to the firms' output decision,

$$q^D = \frac{a-c}{2z+3-2k} \tag{9}$$

products and services, which provide them revenues, can be considered CSR firms. Another characteristic of the objective function is the exogenous value of the level of "social concern", *k*. Stakeholders "influence" the firm's goals, and once involved in the governance, fix the level of "social engagement". Thus, in the current model, the firm's owners take *k*, the engagement level in CSR activities, as exogenously given, determined by the stakeholders" "customary toughness". This assumption is coherent with the results of the empirical study of Spitzeck & Hansen (2010) who have found that the engagement mechanism of the stakeholders is usually limited to "dialogue & issues" advisory.

where the upper script D stands for "duopoly". Substituting (9) into the firms' profit functions, we get the duopoly profits in equilibrium

$$\pi_1^D = \pi_2^D = \pi^D = \frac{(a-c)^2 \left(1+z-2k\right)}{(2z+3-2k)^2} \tag{10}$$

Note that the satisfaction of the non-negativity constraints on profits requires that $z \ge z^* = (2k - 1)$ or, alternatively, $k \le k^* = \frac{1+z}{2}$, that is, the firms' interest for the consumer's welfare has not to be too high, especially if returns to scale are not too decreasing. This inequality is assumed to hold true for the rest of the paper.

3. Analysis of monopoly/duopoly market structures

We may now compare the two industry structures (i.e. monopoly/duopoly) in terms of profit, consumer surplus and social welfare. Let us briefly discuss the results. First, we investigate the change in profit levels for the "former" monopolist (incumbent) firm. Defining

$$\Delta \pi = \pi^{M} - \pi^{D} = \frac{(a-c)^{2} \left[4z^{2} + z(3k^{2} - 8k + 9) - (2k^{3} - 7k^{2} + 9k - 5)\right]}{(2z+3-2k)^{2}(2z+2-k)^{2}}$$
(11)

the following Result holds:

Result 1: *The monopoly/duopoly profit differential is always positive, but it is reduced by an increasing DRS parameter (z).*

Proof: in the relevant parameter space, it always holds true that $\Delta \pi > 0$ because $\Delta \pi \ge 0 \Leftrightarrow z \ge z^{\circ} = \frac{(k-1)\sqrt{9k^2 + 2k + 1} - (3k^2 - 8k + 9)}{8}$ but $z^{\circ} < z^*$. Nonetheless differentiation shows that $\forall z \ge z^* \equiv (2k-1), \frac{\partial \Delta \pi}{\partial z} < 0$. See also Figs. 1 and 2.

The economic intuition behind Result 1 is straightforward: the quantity that each firm produces in duopoly is smaller than the one of a monopolist (and obviously this also holds in the absence of CSR rules). This implies that the monopolist faces decreasing returns (i.e. diseconomies of scale) more intense than a firm in duopoly. Then, the more the decreasing returns to scale are (i.e. the higher the level of z), the less intensely duopoly costs tend to increase with respect to those of monopoly. Moreover, the presence of CSR rules reinforces this effect, because the quantity tends to increase with an increasing level of k both in monopoly and in duopoly. Thus, the cost differential tends to increase more than proportionally due to the effect of DRS, regardless of the fact that the quantity in duopoly increases more than in monopoly. In other words, the reduction of the profit differential (11) due to the working of DRS is more pronounced in the presence of CSR rules, as it is easily confirmed by noting that $\frac{\partial \Delta \pi}{\partial z \partial k} < 0$.

On the other hand, the fact that the quantity in duopoly increases more than in monopoly (as easily observed by inspection of (5) and (9)) implies that the profit differential increases with an increasing level of CSR activities. Indeed, a further analytical inspection reveals that $\frac{\partial \Delta \pi}{\partial k} > 0$: the higher *k* is, the larger the profit differential is, confirming that the adoption of CSR rules decreases the profitability of a firm in duopoly in a more intense way because of a larger production, relatively to the monopoly case (see Fig. 2). However, noting also that $\frac{\partial \Delta \pi}{\partial z \partial k} < 0$, it is argued that the profit advantage of the monopoly caused by CSR it is reduced by the working of the DRS. The interplay between the latter two derivatives will be crucial later to explain the possible unconventional occurrence of the welfare-reducing effect of the more competitive market structure.

The expressions for the consumer surplus are given by

$$CS^{M} = \frac{(a-c)^{2}}{2[2(1+z)-k]^{2}}$$
(12)

$$CS^{D} = \frac{2(a-c)^{2}}{[3+2z-2k]^{2}}$$
(13)

By defining the consumer surplus differential as

$$\Delta CS = CS^{M} - CS^{D} = -\frac{2(a-c)^{2} (1+2z)(7+6z-4k)}{[3+2z-2k]^{2}[4(1+z)-2k]^{2}}$$
(14)

the following Lemma holds:

Lemma. The consumer surplus differential is 1) always negative, 2) increasing (resp. decreasing) in absolute value with an increasing k (resp. z).

Proof: 1) by simple inspection of (14), recalling the condition $z \ge z^*$; 2) $\frac{\partial |\Delta CS|}{\partial k} > 0$, $\frac{\partial |\Delta CS|}{\partial z} < 0$.

The welfare of consumers, as expected, increases (resp. reduces) with the intensity of CSR activities (resp. of the DRS) more under duopoly than monopoly. Therefore, from Result 1 and Lemma above, it emerges that the presence of CSR rules and DRS work in opposite direction over the two differentials (11) and (14) (as displayed in Figures 1 and 2, below), rendering a priori ambiguous their final effect on social welfare as a whole.



Figure 1. Plot of profit, consumer surplus and social welfare differentials, $\Delta \pi$ (dotted blue line), ΔCS (dashed red line) and $\Delta \sigma$ (black solid line), respectively, with an increasing z for a given level of firms' social concerns (k = 6), in the interval z ϵ (11,12.5).

Source: Authors' own calculations.

As regards social welfare, we recall its standard definition in the cases of monopoly and duopoly: $SW^M = \pi^M + CS^M$ and $SW^D = \pi_1^D + \pi_2^D + CS^D$, respectively. By defining

$$\Delta \sigma = SW^M - SW^D =$$

$$= -\frac{(a-c)^2 \{ [8z^3 + z^2(28 - 24k) + z(12k^2 - 32k + 26)] + 4k^2 - 10k + 5) \}}{2[3 + 2(z-k)]^2 [4(1+z) - 2k]^2}$$
(15)

the following Result holds:²

² The expression of the social welfare differential, $\Delta\sigma$, can be decomposed in the following way: $\Delta\sigma = \pi^M - 2\pi^D + CS^M - CS^D$, which can be re-arranged as $\Delta\sigma = \Delta\pi + \Delta CS - \pi^D$. However, in the above analysis, we have presented the results in terms of $\Delta\pi$ and ΔCS to investigate how the change in the market structure affects the welfare of the single agents in the "former" monopoly, namely the incumbent and the consumers. In particular, the analysis of $\Delta\pi$ allows us to investigate how the change in profit levels for the "former" monopolist (incumbent) firm impacts the overall social welfare and, therefore, how it contributes to the emergence of the unconventional result of a duopoly market structure, more competitive than a monopoly, which is welfare damaging. We are extremely grateful to an anonymous referee for giving us the opportunity of clarifying this point.

Result 2: A sufficiently high CSR parameter can make welfare-damaging a duopoly market structure with respect to of a monopoly, for a given level of z. Conversely, a sufficiently high DRS parameter always tends to restore the conventional wisdom that more competition is welfare-improving.

Proof:
$$\Delta \sigma \stackrel{>}{=} 0 \Leftrightarrow k \stackrel{>}{=} k^{\circ} = \frac{\sqrt{48z^4 + 112z^3 + 96z^2 + 36z + 5} + 12z^2 + 20z + 5}{4(1+3z)}$$

See also Figure 3, in which is displayed k° .

Given the algebraic intractability of the differentials above, a graphical analysis exhaustively illustrates the content of Results 1 and 2. Figure 1 shows the behaviour of profit, consumer surplus and social welfare differentials with an increasing z for a given level of firms' social concerns (k = 6). It can be easily seen that social welfare, although is initially larger under monopoly than duopoly, then, as expected, it tends to become smaller for an increasing z. On the other hand, the profit (resp. consumer surplus) differential is always decreasing (resp. increasing) with increasing z.

To better understand the unconventional result of the inefficiency of more competition behaviour, it suffices to observe Figure 2 displaying the behaviour of the social welfare differential as a whole and its two components — profits and consumer surplus — with an increasing level of k for a given level of the DRS parameter (z = 10). It can be easily observed that the presence of an increasing CRS acts under DRS in opposite directions with regard to profits and consumer surplus, on the one side increasing the profit differential in favour of monopoly (namely, "profit differential effect" by CSR) and on the other side increasing the consumer surplus differential in favour of duopoly (namely "consumer surplus effect" by CSR).



Figure 2. Plot of profit, consumer surplus and social welfare differentials, $\Delta \pi$ (dotted blue line), ΔCS (dashed red line) and $\Delta \sigma$ (black solid line), respectively, with an increasing k for a given steepness of the average cost curve (z = 10), in the "feasible" interval k ϵ (0,k* = 5.5).

Source: Authors' own calculations.

Moreover, it is easy to see that these opposite actions are of different intensity: in fact, the "profit differential effect" tends to be more intense than the "consumer surplus effect" with an increasing k, up to the point that when $k > k^{\circ}$, profits under monopoly becomes larger than those under duopoly to such an extent that outweighs the larger increase of consumer surplus under duopoly than monopoly.

Therefore, we question whether, from the complicated interplay of the effects of the forces of CSR and DRS on the components of social welfare under monopoly and duopoly, clearly displayed in Figures 1 and 2, a welfare reducing effect of the more competitive market structure may emerge. The answer is, counter-intuitively, positive for an opportune parametric combination. Fig. 3 shows the area of the combination of the two parameters of interest in which the welfare-reducing effect emerges (i.e. region *B*).

Therefore, the appearance of the welfare-reducing effect requires a sufficiently high CSR parameter (high penalisation on profits)³ and a sufficiently high but not too high — DRS parameter. That is, it is required: 1) on the one hand, a sufficiently high DRS parameter such that the penalisation on profits required by stakeholders/consumers (i.e. a high k) does not nullify the same profits (recalling that the condition for positivity of profits requires $z \ge z^*$); 2) on the other hand, a sufficiently low (not too high) DRS parameter such that the profit disadvantage of the monopoly with respect to the duopoly consisting in larger output reduction (a higher cost increase) caused by DRS has to be sufficiently small to allow that the "profit differential effect" — which is, as shown by Figure 2 above, driven by high levels of k — outweighs the "consumer surplus effect". In other words, it is the interplay between the relative intensity of $\frac{\partial \Delta \pi}{\partial k} > 0$ and $\frac{\partial \Delta \pi}{\partial z \partial k} < 0$ which allows for the possibility of the occurrence of the unconventional welfare-reducing effect of the more competitive market structure. This reasoning is translated in terms of Figure 3 by noting that necessary conditions for the appearance of the welfare-reducing effect are k > 2.5 and z > 4, but for example, if we assume k = 6 (see Figure 1), then the unconventional effect occurs for the window $11 \le z \le 12.2$.

³ This requires that CSR-type firms are very sensible to the interest of stakeholders/consumers or, alternatively, that the latter have a predominant role in the firms' governance.



Figure 3. Plot of the curve $\Delta \sigma = 0$ (that is k°(z)) (solid line) and $\pi^{D} = 0$ (long-dashed line) in the space (z,k). Legend: at the left (resp. right) of the curve $\Delta \sigma = 0$, $\Delta \sigma > 0$, (resp. $\Delta \sigma < 0$); at the left of the curve $\pi^{D} = 0$ (shadowed region), $\pi^{D} < 0$ (i.e. economy is unfeasible).

Source: Authors' own calculations.

4. Conclusions

Considering a Cournot monopoly/duopoly model with linear/quadratic production costs and where firms follow Corporate Social Responsibility (CSR) behaviours, this note shows that, in contrast to the common view, the social welfare under duopoly can be lower than under monopoly. Moreover, the note remarks that the higher the CSR activities are, the more likely the welfare-damaging effect may occur when the market structure becomes more competitive and that the direction of the social welfare changes may crucially depend on the degree of convexity of the cost function.

The latter result is at odds with conventional wisdom and shows another channel so far not explored by the preceding literature for the possibility that a market structure, a priori, should be more competitive than monopoly results to be welfare-damaging. In particular, while the preceding literature had as a crucial ingredient an asymmetry between firms, we find that the welfare-reducing effect may occur even with symmetric firms, provided that they have sufficiently high social concerns. These findings contribute to the increasing policy debate on firms' social concern, showing evident implications for antitrust and competition policies when the market is characterised by socially responsible firm and decreasing returns to scale.

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