

Volume 36, Issue 4

Network externalities and corporate social responsibility

Luciano Fanti

*Department of Economics and Management, University
of Pisa*

Domenico Buccella

Department of Economics, Kozminski University

Abstract

This paper examines a duopoly market with Corporate Social Responsibility (CSR) firms (sensitive to consumer surplus). It is shown that, in contrast to the conventional result that the higher the weight on CSR the lower the firms' profitability, when network externalities in consumption are present even the firms' profitability may be enhanced by the presence of social concerns. This finding opens a new view of CSR rules by the most worldwide engaged in social activities firms that operate in the more and more increasing sectors of network goods.

Luciano Fanti, Department of Economics and Management, University of Pisa, Via Cosimo Ridolfi, 10, I-56124 Pisa (PI), Italy. E-mail: lfanti@ec.unipi.it; tel.: +39 050 22 16 369; fax: +39 050 22 16 384. Domenico Buccella, Department of Economics, Kozminski University, Jagellońska Street, 57/59 – 03301 – Warsaw, Poland. E-mail: buccella@kozminski.edu.pl; tel.: + 48 22 51 92 153 We thank an anonymous referee for valuable comments which have contributed to improve substantially the quality and clarity of this paper. The usual disclaimers apply.

Citation: Luciano Fanti and Domenico Buccella, (2016) "Network externalities and corporate social responsibility", *Economics Bulletin*, Volume 36, Issue 4, pages 2043-2050

Contact: Luciano Fanti - lfanti@ec.unipi.it, Domenico Buccella - buccella@kozminski.edu.pl

Submitted: March 22, 2016. **Published:** November 09, 2016.

1. Introduction

In the recent years the firms' Corporate Social Responsibility (CSR) has been an economic issue more and more frequented also in the academic literature (e.g. Baron 2001, 2009; Jensen, 2001; Goering, 2007, 2008; Lambertini and Tampieri, 2010; Benabou and Tirole, 2010).

The standard finding is that profits are expected to reduce when a CSR behaviour is followed. This, for instance, always holds true in the basic Cournot duopoly model with CSR firms. Then, this makes rather puzzling to show why firms should engage themselves in social activities if the latter are harming their profits. Thus, the literature has very recently focused on possible indirect positive feedbacks that CSR firms may have from its social concerns.¹

While the traditional literature has implicitly assumed that people's demands for a good are independent of one another, it has been increasingly acknowledged that for some goods, however, one person's demand also depends on the demands of other people, or, in other words, a network externality in consumption exists. It is known that, for many products, the utility derived by one consumer of the good increases with the number of other consumers of that good; that is, the welfare of each consumer is enhanced by the total sales of the good. A typical example of positive network externality is the so-called Bandwagon Effect: the desire to have a good because almost everyone else has it (i.e. clothing). Other typical examples of network goods are telephone and software: it is natural to observe that the utility of a particular consumer from using a telephone or a software increases with the number of other telephone or software users. The simple mechanism of network effects assumed here, in the spirit of Katz and Shapiro (1985), is that the surplus that a firm's client obtains increases directly with the number of other clients of this firm.

Because of the dramatic development pace of network industries in recent years, an increasing number of scholars has started studying how the presence of positive consumption externalities/network effects may alter the results of the standard models of imperfect competition (e.g. Katz and Shapiro, 1985), focusing currently on the role of strategic delegation (Hoernig, 2012; Chirco and Scrimatore, 2013; Battacharjee and Pal, 2014).

However, the issue of CSR in network industries has been largely, and surprisingly, neglected. In fact, as reported by KPMG, CSR activities are unquestionably a mainstream business practice worldwide: 71 percent of 4,100 companies surveyed in 41 countries in 2013. In particular, among the sectors which experienced an impressive development pace over the recent years, noteworthy the telecommunications & media sectors increased their CSR reporting from 47 percent in 2008 to 75 percent in 2013, and electronics & computers from 58 percent to 78 percent, two of the highest levels among the surveyed industries (KPMG, 2013). Moreover, the Reputation Institute global CSR survey shows that, among the world's top ten companies with the best CSR reputations, companies operating in network industries are predominant: Google ranks first, Microsoft 4th, Apple 7th and Intel 8th (Reputation Institute, 2015).

Therefore, the present work aims to fill this gap and indeed it investigates whether and how the standard finding that profits are expected to reduce adopting a CSR behaviour also holds when the Cournot competition occurs in network goods industries. The key result of the paper is the following. In a Cournot duopoly with network goods, if both firms adopt CSR rules (i.e., they are sensitive to consumer surplus), the equilibrium profits that they may obtain are larger than they were only profit-seeking. Notably, an optimal degree of social care by firms does exist. This finding has a remarkable consequence. It opens a new perspective on the rationale for firms to operate

¹ The literature has pointed out that CSR could have the potential to ameliorate even firms' profitability through various channels: for instance by reducing turnover rates, and operating costs, by enhancing efficiency, by attracting better and/or more loyal and motivated employees (e.g. Nurn and Tan, 2010), and finally by strategically increasing rivals' costs when rivals are only profit-seeking (e.g. Goering, 2007; Kopel and Brand, 2012). However, in the absence of the above mentioned motives, the expected result is that a CSR behaviour always lowers the firm's profit (even in a strategic context if all the firms follow CSR rules).

under CSR rules: the choice to pursue social interest is dictated by profit-enhancing reasons rather than “philanthropic” purposes.

Moreover this result is qualitatively confirmed also in the case in which the private firm competes with a public firm (i.e. in a mixed duopoly), as shown in the Appendix.

The remainder of the article is organized as follows. Section 2 describes the model: first, the basic ingredients of an industry with network effects and CSR behaviours are presented and then the main result is derived. Finally, the last section brings the paper to its conclusions and suggests further directions of research on the subject.

2. The model

We assume a duopoly in which firms produce homogeneous network goods. The inverse demand functions (see, e.g., Hoernig 2012; Chirco and Scrimatore, 2013; Battacharjee and Pal, 2014; Fanti and Buccella, 2016) are as follows,

$$p = a - q_i - q_j + n(y_i + y_j), \quad (1)$$

where p is the price of goods, q_i denotes the quantity of the goods produced by firm i ($i = 1, 2$), y_i denotes the consumers' expectation about firm i 's equilibrium network size, the parameter $n \in [0, 1]$ indicates the strength of network effects (i.e. the higher the value of the parameter the stronger the network effects), and $a > 0$ is a demand parameter.² The firm i 's profit function is given by:

$$\pi_i = (p - c)q_i, \quad (2)$$

where c is the constant marginal cost. For tractability, and without loss of generality, marginal costs are assumed to be zero.

Following the recent established literature (e.g. Goering 2007, 2008; Lambertini and Tampieri, 2010; Kopel and Brand, 2012), we define the inclusion of a part of the market consumer surplus k as the firm's “social concern” or care for consumer outcomes in the market. Consequently, the CSR firm's objective function may be specified as a simple parameterized combination of profits and consumer surplus. Thus, the CSR firm objective function (W) is:

$$W_i = \pi_i + kCS = \left[a - q_i - q_j + n(y_i + y_j) \right] q_i + k \left[\frac{(q_i + q_j)^2 - n(y_i + y_j)^2}{2} \right] \quad (3)$$

where $k \in [0, 1]$ denotes the weight that CSR firm assigns to consumer surplus.^{3,4}

² The works of Hoernig (2012), Chirco and Scrimatore (2013) and Battacharjee and Pal (2014) consider differentiated goods; however, by setting the differentiation parameter equal to 1 in those contributions, the demand function in (1) is immediately obtained.

³ Therefore, stakeholders exercise “pressure” as regards the firm's objective and, once involved in the firm's governance, set the level of “social engagement”. Thus, in the current model, the private owners of the socially responsible firm takes the level of “social concern” k as exogenously given, for instance, by the “customary toughness” of the stakeholders integrated in the firm's objective function. This is consistent with the results of the empirical study of Spitzeck and Hansen (2010), who find that the stakeholder engagement mechanism is mainly confined to “dialogue & issues” advisory. In addition, because the firms compete for the same clients in the industry, it can be reasonably assumed that the social engagement level stakeholders demand is the same for both companies.

Firms compete on the product market à la Cournot. Given the CSR firm's objective function (3), the equilibrium of the second stage of the game (the market game) must satisfy:

$$\frac{\partial W_i}{\partial q_i} = a - 2q_i - q_j + n(y_i + y_j) + k(q_i + q_j) = 0 \quad (4)$$

for $i, j = 1, 2$ and $i \neq j$. From (4), we obtain the reaction functions⁵

$$q_i(q_j, y_i, y_j) = \frac{a - (1 - k)q_j + n(y_i + y_j)}{2 - k} \quad (5)$$

As usual, then we impose the additional "rational expectations" conditions, that is $y_1 = q_1$ and $y_2 = q_2$. Hence, solving the system composed by (5) and its counterpart for firm j , we obtain the final equilibrium output and profit:

$$q_i = q_j = q = \frac{a}{3 - 2(n - k)} \quad (6)$$

$$\pi_i = \pi_j = \pi = \frac{a^2(1 - 2k)}{[3 - 2(n - k)]^2} \quad (7)$$

Note that the satisfaction of the non-negativity constraint on profits requires ultimately that $k \leq k^\circ = \frac{1}{2}$ (that is, the firm's interest for the consumer's welfare has not to be too high), which we assume to hold throughout the paper.⁶

As expected, the social concerns should not be too large for ensuring a viable equilibrium industry. Hence, the following noteworthy result holds:

Result 1. *If the network effect is sufficiently intense, there is always a threshold value k^* below (above) which the higher k the higher (lower) profit is.*

⁴ The value of the consumer surplus derives from the maximisation of the representative consumer utility function minus the expenditure for the goods consumed, that is, $CS = U - p(q_i + q_j)$ (see, for instance, Nakamura, 2013), where

$$U = a(q_i + q_j) - \frac{1}{2}(q_i^2 + q_j^2 + 2q_i q_j) + n \left[(y_i + y_j)q_i + (y_i + y_j)q_j - \frac{1}{2}(y_i^2 + y_j^2 + 2y_i y_j) \right]$$

with $i, j = 1, 2$; $i \neq j$ (see Battacharjee and Pal, 2014). When rational expectations realize, i.e. $y_i = q_i$, $i, j = 1, 2$,

the value of the consumer surplus boils down to $CS = (1 - n) \frac{(q_i + q_j)^2}{2}$, both with the current as well as the

standard definition of the value of the area comprises between the demand function and the price paid by consumers.

⁵ By passing, notice that the reaction functions are, as expected, negatively sloped, that is products are perceived by firms as strategic substitutes (i.e. network effects do not affect the inclination of the reaction functions).

⁶ In fact, it can be easily observed from eq. (6) that the equilibrium quantity is positive for any $k \in [0, 1]$.

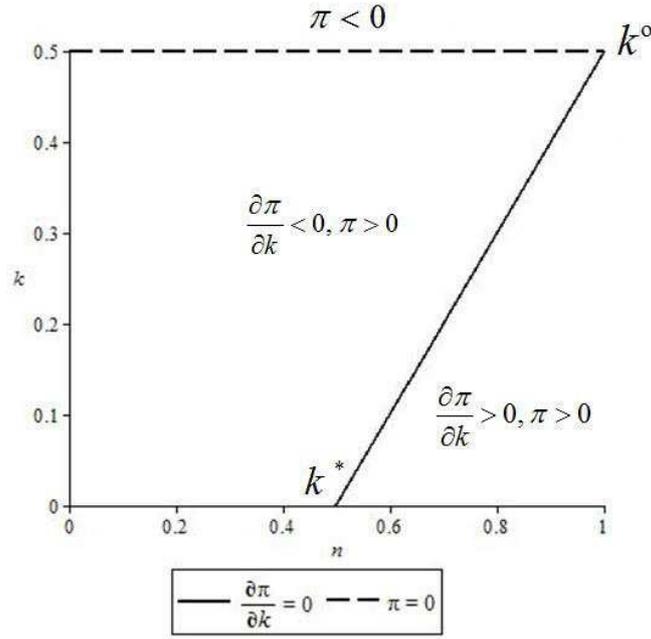


Fig. 1. Plot of the “threshold curves” $\frac{\partial \pi}{\partial k} = 0$, $\pi = 0$ in the $[n, k]$ -space. Legend: The curves are drawn for a given value of $a = 1$.

Proof: This result is proved by observing that

$$\frac{\partial \pi}{\partial k} = \frac{a^2[2 - 4(n - k)]}{[3 - 2(n - k)]^3} \quad (8)$$

$$\text{and } \frac{\partial \pi}{\partial k} \geq 0 \Leftrightarrow k \leq k^* = n - \frac{1}{2}.$$

Corollary. *Provided that $n > 0.50$, an optimal positive value of k^* always does exist and this optimal value is increasing with n : the larger is the network externality, the higher is the optimal level of the sensitivity to consumer surplus by firms.*

Fig.1 gives a graphical representation of the contents of Result 1 and the Corollary, in which it is easy to see that if the network effect is sufficiently intense (at least $n > 0.5$, and k is not too large) an optimal positive value of the parameter measuring the social concern maximising firms’ profits does always exist. This means that the presence of very intense network effects may make convenient for firms to be consumers’ welfare-interested (but not too much interested): interestingly, provided that $n > 0.50$, there is always a value of the social concern, k^* , which maximises profits.

3. Conclusions

This paper is motivated by the widely observed presence of firms operating in network industries and adopting CSR rules. The paper shows that, in a Cournot duopoly with network goods, if both firms adopt CSR rules (i.e., they are sensitive to consumer surplus), they may obtain profits higher

than they were only profit-seeking. In particular, an optimal degree of social care by firms does exist.

The implication of our findings is striking. The choice to have social interest is not “philanthropic”: it is motivated by profit-enhancing reasons. This finding opens a new view of CSR rules by firms operating in the more and more increasing sectors of network goods, and seems to provide with a plausible explanation of the empirical evidence that firms following CSR rules are increasingly present in network industries such as telecommunications & media and electronics & computers.⁷

So far the analysis puts aside the possibility that firms can choose to be either CSR or profit-seeking. Thus, although it is natural to believe that when the CSR firm makes higher profits (i.e. it is delegating and is enough sensitive to social cares) also the profit-seeking firm finds convenient to shift to CSR, the equilibrium type should be endogenously determined in a sequential play. This is left for further research.

Appendix

The mixed duopoly model: public firm vs private firm with CSR

We consider here a mixed duopoly with network effects and CSR activities in the spirit of Nakamura (2013) who, however, studies the case of differentiated products.

We focus here on the issue of the possibility that, in a market for network goods, a private firm may reach a higher profit with CSR behaviours than being only profit-seeking also when the rival firm is a public firm maximizing, as usual, the social welfare. In other words, we check the robustness to the mixed duopoly of the result obtained for the private duopoly (in the main text).

One public firm, denoted by 1, and one private firm, denoted by 2, produce homogeneous network goods. The inverse demand functions is as in eq. (1) in the main text. With respect to the main model, it is assumed the presence of a quadratic cost function⁸ $C(q) = cq_i^2$, $c \geq 1$, $i = 1, 2$. The public firm maximizes the overall social welfare (SW) and, thus, the firm’s objective function can be specified as the sum of own profits, the profits of the private firm and the overall consumer surplus

$$SW_1 = \pi_1 + \pi_2 + CS \tag{1.A}$$

which equals

$$SW_1 = \{[a - q_1 - q_2 + n(y_1 + y_2)]q_1 - cq_1^2\} + \{[a - q_1 - q_2 + n(y_1 + y_2)]q_2 - cq_2^2\} + \left[\frac{(q_1 + q_2)^2 - n(y_1 + y_2)^2}{2} \right] \tag{1.A bis}$$

while the CSR private firms maximizes

⁷ This result also seems to meet the sentiment of the participants in a debate organized by the Economist Intelligence Unit (2013), in which 75% of the contributors expressed the opinion that CSR gives companies a competitive advantage, and responsibility is a real business issue.

⁸ Notice that the assumption of a decreasing returns to scale technology (quadratic costs) is common in the study of mixed duopoly to avoid the appearance of a public monopoly in the presence of linear costs. De Fraja (1993, p.462, footnote 8) illustrates the rationale for this finding: a simple linear functional form with constant average and marginal cost leads to the unwelcome result that, if private and public firms have the same cost, then only the public firm produces all the output, forcing out of the market the private one.

$$W_2 = \pi_2 + kCS \quad (2.A)$$

that is

$$W_2 = \{[a - q_1 - q_2 + n(y_1 + y_2)]q_2 - cq_2^2\} + k \left[\frac{(q_1 + q_2)^2 - n(y_1 + y_2)^2}{2} \right] \quad (2.A \text{ bis})$$

where $k \in [0,1]$ denotes, as usual, the level of social engagement.

Firms compete on the product market à la Cournot. Given the objective functions (1.S bis) and (2.S bis), the equilibrium of the second stage of the game (the market game) must satisfy $\frac{\partial SW_1}{\partial q_1} = 0$, $\frac{\partial W_2}{\partial q_2} = 0$. From (3), after the usual imposition of the additional “rational expectations” conditions, that is $y_1 = q_1$ and $y_2 = q_2$, we obtain the reaction functions

$$q_1 = \frac{a - (1-n)q_2}{1-n+2c}, \quad q_2 = \frac{a - (1-n-k)q_1}{2(1+c) - (n+k)} \quad (3.A)$$

Solving the system in (3.A), we obtain the final equilibrium output and profit:

$$q_1 = \frac{a(1-k+2c)}{1-n+2c(3-2n-k)+4c^2} \quad (4.A)$$

$$q_2 = \frac{a(k+2c)}{1-n+2c(3-2n-k)+4c^2} \quad (5.A)$$

$$\pi_1 = \frac{a^2c(1+2c-k)^2}{[1-n+2c(3-2n-k)+4c^2]^2} \quad (6.A)$$

$$\pi_2 = \frac{a^2c(k+2c)[2(1+c)-3k]}{[1-n+2c(3-2n-k)+4c^2]^2} \quad (7.A)$$

As a consequence, the following result holds:

Result 1.A *In a mixed duopoly, 1) the private firm engaged in CSR activities always generates profits; 2) CSR activities always reduces the profit of the public firm; however, the network externalities have a positive effect on the public firm's profits; 3) as for the private duopoly, if the network effect is sufficiently intense, there is always a threshold value k^{**} below (above) which the higher k the higher (lower) the profit of the private CSR firm is.*

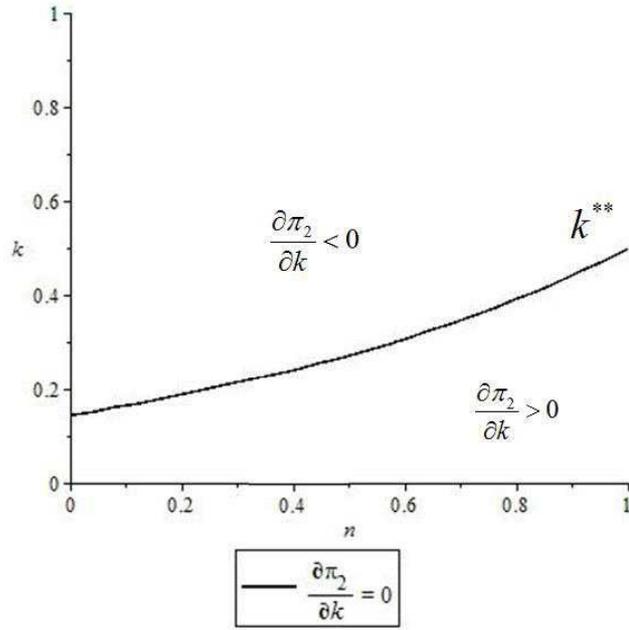


Fig. 2. Plot of the “threshold curves” $\frac{\partial \pi_2}{\partial k} = 0$ in the $[n, k]$ -space. Legend: The curve is drawn for given values $a = c = 1$.

Proof: This result is proved by observing that

$$1) \pi_2 \geq 0 \text{ if } 2(1+c) - 3k \geq 0 \Rightarrow k \leq \frac{2(1+c)}{3}, \text{ which is always true because } c \geq 1;$$

$$2) \frac{\partial \pi_1}{\partial k} = \frac{2a^2c(1+2c-k)[(1-n)(1-4c)]}{[1-n+2c(3-2n-k)+4c^2]^3} \quad (9.A)$$

$$\text{and } \frac{\partial \pi_1}{\partial k} < 0 \forall k \in [0,1] \vee n \in [0,1), \quad \frac{\partial \pi_1}{\partial n} > 0 \forall k \in [0,1] \vee n \in [0,1)$$

$$3) \frac{\partial \pi_2}{\partial k} = -\frac{2a^2c(1+4c)[(1-n)(1+3k)+c(4k-2n)]}{[1-n+2c(3-2n-k)+4c^2]^3} \quad (10.A)$$

$$\text{and } \frac{\partial \pi_2}{\partial k} \geq 0 \Leftrightarrow k \leq k^{**} = \frac{1-n(1-2c)}{3(1-n)+4c}.$$

Figure 2 graphically depicts this result. Therefore, despite the presence of a public firm, the key result in the main text is confirmed. However, notable differences arise. In fact, first, the private firm earns positive profits whichever the level of CSR engagement is; second, the optimal CSR engagement's value of the private company exists for every level of the network effects. As a consequence the latter result reinforces the possibility that CSR behaviours may be profitable for the private shareholder's profits, showing that this may be the case even for standard goods (i.e. in the absence of network effect) provided that the private firm is competing with a public firm.

References

- Baron, D.P. (2009) "A Positive Theory of Moral Management, Social Pressure, and Corporate Social Performance" *Journal of Economics and Management Strategy* **18**, 7-43.
- Baron, D.P. (2001) "Private Politics, Corporate Social Responsibility, and Integrated Strategy" *Journal of Economics and Management Strategy* **10**, 7-45.
- Bhattacharjee, T. and R. Pal (2014) "Network externalities and strategic managerial delegation in Cournot duopoly: Is there a prisoners dilemma?" *Review of Network Economics* **12**, 343-353.
- Benabou, R. and J. Tirole (2010) "Individual and Corporate Social Responsibility" *Economica* **77**, 1-19.
- Chirco, A. and M. Scrimatore (2013) "Choosing price or quantity? The role of delegation and network externalities" *Economics Letters* **121**, 482-486.
- De Fraja, G. (1993) "Unions and wages in public and private firms: a game-theoretic analysis" *Oxford Economic Papers* **45**, 457-469.
- Fanti, L. and D. Buccella (2016) "Bargaining Agenda and Entry in a Unionised Model with Network Effects" *Italian Economic Journal* **2**, 91-121.
- Goering, G.E. (2007) "The strategic use of managerial incentives in a non-profit firm mixed duopoly" *Managerial and Decision Economics* **28**, 83-91.
- Goering, G.E. (2008) "Welfare impacts of a non-profit firm in mixed commercial markets" *Economic Systems* **32**, 326-334.
- Hoernig, S. (2012) "Strategic delegation under price competition and network effects" *Economics Letters* **117**, 487-489.
- Katz, M. and C. Shapiro (1985) "Network externalities, competition, and compatibility" *American Economic Review* **75**, 424-440.
- Kopel, M. and B. Brand (2012) "Socially responsible firms and endogenous choice of strategic incentives" *Economic Modelling* **29**, 982-989.
- KPMG (2013) "KPMG Survey of Corporate responsibility reporting 2013" Available online at <https://assets.kpmg.com/content/dam/kpmg/pdf/2015/08/kpmg-survey-of-corporate-responsibility-reporting-2013.pdf>
- Lambertini, L. and A. Tampieri (2010) "Corporate Social Responsibility in a Mixed Oligopoly" Department of Economics, University of Bologna working paper number 723.
- Nakamura, Y. (2013) "Social welfare under quantity competition and price competition in a mixed duopoly with network effects: an analysis" *Theoretical Economics Letters* **3**, 211-215.
- Nurn, C. W. and G. Tan (2010) "Obtaining intangible and tangible benefits from corporate social responsibility" *International Review of Business Research Papers* **6**, 360-371.
- Reputation Institute (2015) "2015 Global CSR RepTrak 100" Available online at <http://www.reputationinstitute.com/CMSPages/GetAzureFile.aspx?path=~\media\media\documents\2015-global-csr-reptrak-results.pdf&hash=f375854351576541ae88db1e043e7417e9f057f83955bb3768454dd8e0417353&ext=.pdf>
- Spitzeck, H. and E. G. Hansen (2010) "Stakeholder governance: how stakeholders influence corporate decision making" *Corporate Governance: The International Journal of Business in Society* **10**, 378-391.
- The Economist Intelligence Unit (2013) "The Corporations and Communities Debate Series: "CSR has nothing to do with charity." March 4th-March 15th 2013. A summary paper from the Economist Intelligence Unit.