

Corporate Social Responsibility and Customer Orientation in a Bertrand Duopoly with Differentiated Products

Kazuhiro Ohnishi

Institute for Economic Sciences, Japan

Abstract: This paper investigates the strategic effects of corporate social responsibility (CSR) and customer orientation (CO) in a Bertrand duopoly with differentiated products. Extending prior research on quantity competition, the study develops a three-stage game in which two firms first choose between CSR and CO cultures, then set their respective levels, and finally compete in prices. The result shows that, unlike under Cournot competition, neither CSR nor CO increases firm profits under price competition. The incentive for firms to care for all consumers or only their own customers disappears when competition is based on prices rather than quantities.

Keywords: Bertrand model; Customer orientation; Corporate social responsibility; Differentiated products; Subgame perfection

I. INTRODUCTION

The modern theory of corporate social responsibility (CSR) in oligopoly markets has developed along several complementary lines, all of which highlight how firms' concern for consumer welfare or broader social objectives can strategically reshape market outcomes. The economics literature on CSR has grown substantially over the last two decades. Early theoretical contributions establish CSR as a strategic instrument that allows firms to incorporate social and stakeholder concerns into their decision-making processes. Baron (2001) develops a framework of private politics and integrated strategy and shows that firms may voluntarily engage in socially responsible activities as part of their competitive strategy. Subsequently, Baron (2008) examines the relationship between managerial compensation and CSR, demonstrating how managerial contracts can be designed to align profit objectives with socially responsible behavior.

Several studies explore CSR from the perspective of public goods and stakeholder welfare. Kotchen (2006) develops a model of private provision of a public good through green consumption and shows that green markets may either enhance or diminish environmental quality and social welfare, depending on market conditions. Besley and Ghatak (2007) analyze CSR as a mechanism through which private firms contribute to the provision of public goods, emphasizing the role of consumer preferences and mission-oriented production.

Another strand of the literature investigates the interaction between CSR and market competition. Goering (2008) examines

socially concerned firms in durable-goods markets, while Xu (2014) analyzes the effects of CSR in a hospital duopoly with both price and quality competition. Lambertini and Tampieri (2012) study the relationship between CSR and collusion, showing that socially responsible behavior may affect firms' incentives to cooperate. More recently, García, Leal, and Lee (2019) analyze endogenous timing decisions in a mixed market with a socially responsible firm and demonstrate that CSR can influence firms' strategic choices regarding the timing of their decisions.

The role of CSR in mixed oligopoly settings has received considerable attention. Goering (2007) investigates managerial incentives in a mixed duopoly involving a nonprofit firm. Kopel (2015) compares price and quantity contracts in a mixed duopoly with a socially concerned firm, while Kopel, Lamantia, and Szidarovszky (2014) explore the evolutionary dynamics of competition in mixed markets with socially concerned firms. Han (2019) examines the implications of partial public ownership in the presence of CSR, and Ouattara (2017) analyzes strategic privatization policies when a socially responsible firm competes with a profit-maximizing rival. Wang and Wang (2022) further investigate the interaction between CSR, vertical product differentiation, and privatization policy.

Researchers have also examined how CSR affects firms' strategic incentives and profitability. Kopel and Brand (2012) show that firms may endogenously choose managerial incentive schemes that support socially responsible behavior. Fanti and Buccella (2016, 2018) demonstrate that network externalities can significantly influence the profitability of CSR and the strategic advantages associated with socially responsible activities. These studies suggest that the performance effects of CSR depend crucially on market characteristics and the nature of competition.

Recent work has extended CSR analysis to managerial delegation, labor contracts, and long-term commitments. Ohnishi (2021, 2022, 2023, 2024) shows that lifetime employment, wage-rise contracts, and complementary goods can serve as strategic devices for socially concerned firms, influencing reaction functions and equilibrium outcomes in Cournot markets. These studies highlight that CSR interacts with internal organizational design as much as with external market competition.

Within this broad landscape, Planer-Friedrich and Sahm (2018) provide a particularly important contribution for the present study. They show that under Cournot competition, firms may prefer to care for all consumers (CSR), not only their own customers (CO), because doing so strategically increases output and improves welfare.

Despite this extensive development, a Bertrand counterpart to the Cournot model of Planer-Friedrich and Sahm (2018) remains unexplored. Planer-Friedrich and Sahm (2020) examine the effects of strategic CSR under imperfect Bertrand competition; however, they do not analyze strategic customer orientation (CO). Therefore, we extend Planer-Friedrich and Sahm (2018) by analyzing a Bertrand duopoly model. We consider a three-stage game. In the first stage, the firms simultaneously choose whether to adopt a CSR or CO corporate culture. In the second stage, the firms simultaneously choose the intensity of their CSR or CO orientation. In the third stage, the firms simultaneously choose prices to maximize their objective functions. We derive the subgame-perfect equilibrium of the model and find that the equilibrium outcome contrasts sharply with that of the Cournot model in Planer-Friedrich and Sahm (2018). Although previous studies have separately examined endogenous CSR under Bertrand competition and customer orientation in differentiated markets, the endogenous choice between CSR and CO, together with the endogenous intensity of each orientation, has not been systematically compared in a unified three-stage Bertrand duopoly.

The remainder of this paper proceeds as follows. In Section II, we describe the model. Section III presents the model's equilibrium. Finally, Section IV concludes the paper.

II. MODEL

We consider a duopoly model with two firms, denoted by firms 1 and 2, producing differentiated products. Throughout this paper, subscripts 1 and 2 refer to firm 1 and firm 2, respectively. When i and j are used as firm indices, $i, j \in \{1, 2\}$ and $i \neq j$. There is no possibility of entry or exit. The inverse demand function is given by $p_i = 1 - q_i - \lambda q_j$, where $p_i \in [0, \infty)$ denotes the price of product i , $q_i \in [0, \infty)$ and $q_j \in [0, \infty)$ are respectively outputs of firm i and firm j , and λ is an index of product differentiation. We consider that firms compete by setting prices, and accordingly, the demand function faced by firm i is $q_i = \frac{a}{1+\lambda} - \frac{1}{1-\lambda^2} p_i + \frac{\lambda}{1-\lambda^2} p_j$. We assume that $\lambda = 0.5$. Production technologies of both firms are assumed to be identical. Firm i 's profit function is given by

$$\pi_i = (p_i - c)q_i, \quad (1)$$

where c denotes the marginal cost of production, which is normalized to zero for simplicity.

We examine whether firms prefer to focus on CSR or on CO. The former is aggregate consumer surplus, denoted by CS (see, e.g., Goering, 2007; Kopel and Brand, 2012; Kopel, Lamantia, and Szidarovszky, 2014; Planer-Friedrich and Sahm, 2018; Ohnishi 2026a), where

$$CS(q_i, q_j) = \frac{1}{2} [q_i(p_i, p_j) + q_j(p_i, p_j)]^2,$$

and the latter represents the surplus enjoyed by firm i 's customers, denoted by C_i (see, e.g., Königstein and Müller, 2001; Planer-Friedrich and Sahm, 2018; Ohnishi 2026a), where

$$C_i(q_i, q_j) = \frac{1}{2} [q_i(p_i, p_j)]^2.$$

Accordingly, firm i 's objective function is given by

$$V_i^S(p_i, p_j) = \pi_i(p_i, p_j) + \theta_i^S CS(p_i, p_j) = \left[1 - q_i(p_i, p_j) - \frac{1}{2} q_j(p_i, p_j) \right] q_i(p_i, p_j) + \frac{1}{2} \theta_i^S [q_i(p_i, p_j) + q_j(p_i, p_j)]^2, \quad (2)$$

and

$$V_i^C = \pi_i + \theta_i^C C_i = \left[1 - q_i(p_i, p_j) - \frac{1}{2} q_j(p_i, p_j) \right] q_i(p_i, p_j) + \frac{1}{2} \theta_i^C [q_i(p_i, p_j)]^2, \quad (3)$$

where $\theta \in [0, 1]$ denotes the intensity of the firm's corporate culture.

Following Planer-Friedrich and Sahm (2018), we consider a three-stage game. In the first stage, the firms simultaneously choose whether to adopt a socially responsible (CSR) or customer-oriented (CO) corporate culture. In the second stage, the firms simultaneously choose the intensity of their CSR or CO orientation, represented by the weight θ^S or θ^C . In the third stage, the firms simultaneously choose prices to maximize their objective functions. In this study, we derive the subgame-perfect equilibrium of the game.

III. ANALYSIS

In this section, we characterize the equilibrium of the model introduced in the previous section. The equilibrium is derived by backward induction and characterized as a subgame-perfect equilibrium. In subsections 3.1-3.3, we examine the three different situations that may arise after the first stage.

3.1 Competition between two CSR firms

First, suppose that both firms have chosen CSR as their corporate culture in the first stage and that each firm i has chosen its CSR level θ_i^S in the second stage. At the third stage, firm i chooses its price p_i to maximize its objective function (2) for any

given weight θ_j^S of the rival firm. From the first-order condition $\frac{\partial V_i^S}{\partial p_i} = 0$ we derive firm i 's best response function:

$$p_i(p_j) = \frac{1 - \theta_i^S + (1 - \theta_i^S)p_j}{2(2 - \theta_i^S)}.$$

Substituting one reaction function into the other, we derive the equilibrium price of firm i as a function of θ_i^S and θ_j^S :

$$p_i = \frac{5 - 5\theta_i^S - 3\theta_j^S + 3\theta_i^S\theta_j^S}{15 - 7\theta_i^S - 7\theta_j^S + 3\theta_i^S\theta_j^S}.$$

At the second stage, each firm anticipates these prices and the corresponding quantities and chooses the CSR level θ_i^S to maximize the corresponding profit:

$$\pi_i^S = \frac{4(5 - 3\theta_i^S)(5 - 5\theta_i^S - 3\theta_j^S + 3\theta_i^S\theta_j^S)}{3(15 - 7\theta_i^S - 7\theta_j^S + 3\theta_i^S\theta_j^S)^2}.$$

Exploiting the symmetry of the firms: $\theta_i^S = \theta_j^S$, we compute the equilibrium weights on consumer surplus. Table 1 shows the corresponding values of π^{SS} when θ^{SS} changes.

Table 1. Competition between two CSR firms

θ^{SS}	p^{SS}	q^{SS}	π^{SS}
0	0.333	0.444	0.148
0.1	0.310	0.460	0.143
0.2	0.286	0.476	0.136
0.3	0.259	0.494	0.128
0.4	0.231	0.512	0.118
0.5	0.200	0.533	0.107
0.6	0.167	0.556	0.093
0.7	0.130	0.580	0.076
0.8	0.091	0.605	0.055
0.9	0.048	0.636	0.030
1.0	0.000	0.667	0.000

As can be seen from this table, as θ^{SS} increases from 0 to 1.0, π^{SS} decreases monotonically and reaches zero when $\theta^{SS} = 1.0$. The maximum value of π^{SS} , equal to 0.148, is attained when $\theta^{SS} = 0$. This result is consistent with the findings reported by Planer-Friedrich and Sahm (2020).

3.2 Competition between two CO firms

Now suppose that both firms have chosen CO as their corporate culture at the first stage and that each firm i has chosen its CO level θ_i^C at the second stage. At the third stage, firm i chooses its price p_i to maximize its objective function (3) for any given weight θ_j^C of the rival firm. From the first-order condition $\frac{\partial V_i^C}{\partial p_i} = 0$, we derive firm i 's best response function:

$$p_i(p_j) = \frac{3 - 4\theta_i^C + (3 - 4\theta_i^C)p_j}{4(3 - 2\theta_i^C)}.$$

Substituting one reaction function into the other, we derive the equilibrium price of firm i as a function of θ_i^C and θ_j^C :

$$p_i = \frac{45 - 60\theta_i^C - 36\theta_j^C + 48\theta_i^C\theta_j^C}{135 - 84\theta_i^C - 84\theta_j^C + 48\theta_i^C\theta_j^C}.$$

In stage two, each firm anticipates these prices and the corresponding quantities and chooses θ_i^C in order to maximize the corresponding profit:

$$\pi_i^C = \frac{24(5 - 4\theta_j^C)(15 - 20\theta_i^C - 12\theta_j^C + 16\theta_i^C\theta_j^C)}{(135 - 84\theta_i^C - 84\theta_j^C + 48\theta_i^C\theta_j^C)^2}.$$

Using the symmetry of firms: $\theta_i^C = \theta^{CC}$, we compute the equilibrium weights on customer surplus. Table 2 shows the corresponding values of π^{CC} when θ^{CC} changes.

Table 2. Competition between two CO firms

θ^{CC}	p^{CC}	q^{CC}	π^{CC}
0	0.333	0.444	0.148
0.1	0.302	0.465	0.141
0.2	0.268	0.488	0.131
0.3	0.231	0.513	0.118
0.4	0.189	0.541	0.102
0.5	0.143	0.571	0.082
0.6	0.091	0.606	0.055
0.7	0.032	0.645	0.021

As shown in Table 2, as θ^{CC} increases from 0, π^{CC} decreases monotonically. When $\theta^{CC} = 0$, $\pi^{CC} = 0.148$, which is its maximum value.

3.3 Competition between one CSR firm and one CO firm

Finally, suppose that one firm, S, has adopted CSR, whereas the other firm, C, has adopted CO as its corporate culture at the first stage. Suppose further that each firm $k \in \{S, C\}$ has chosen its weight θ^k at the second stage. At the third stage, firm $k \in \{S, C\}$ chooses its price p^k to maximize its objective function θ^k for any given weight θ^l chosen by firm $l \neq k$, where V^S and V^C are given by (2) and (3). From the first-order conditions $\frac{\partial V^k}{\partial p^k} = 0$, we derive the best response functions:

$$p^S(p^C) = \frac{1 - \theta^S + (1 - \theta^S)p^C}{2(2 - \theta^S)},$$

and

$$p^C(p^S) = \frac{3 - 4\theta^C + (3 - 4\theta^C)p^S}{4(3 - 2\theta^C)}.$$

Solving these yields the equilibrium price functions:

$$p^S = \frac{15 - 15\theta^S - 12\theta^C + 12\theta^S\theta^C}{45 - 21\theta^S - 28\theta^C + 12\theta^S\theta^C},$$

and

$$p^C = \frac{15 - 9\theta^S - 20\theta^C + 12\theta^S\theta^C}{45 - 21\theta^S - 28\theta^C + 12\theta^S\theta^C}.$$

In stage two, the firms maximize their profits:

$$\pi^S = \frac{6(10 - 5\theta^S - 8\theta^C)(5 - 5\theta^S - 4\theta^C + 4\theta^S\theta^C)}{(45 - 21\theta^S - 28\theta^C + 12\theta^S\theta^C)^2},$$

and

$$\pi^C = \frac{4(5 - 3\theta^S)(15 - 9\theta^S - 20\theta^C + 12\theta^S\theta^C)}{(45 - 21\theta^S - 28\theta^C + 12\theta^S\theta^C)^2}.$$

Using the symmetry of firms: $\theta^S = \theta^C = \theta^{SC}$, we compute the equilibrium weights on consumer surplus. Table 3 shows the respective values of π^S and π^C when θ^{SC} changes.

Table 3. Competition between one CSR firm and one CO firm

θ^{SC}	p^S	q^S	π^S	p^C	q^C	π^C
0	0.333	0.444	0.148	0.333	0.444	0.148
0.1	0.309	0.433	0.134	0.304	0.467	0.142
0.2	0.283	0.415	0.117	0.271	0.493	0.134
0.3	0.254	0.389	0.099	0.235	0.523	0.123
0.4	0.224	0.352	0.079	0.195	0.557	0.108
0.5	0.191	0.298	0.057	0.149	0.596	0.089
0.6	0.157	0.221	0.035	0.096	0.643	0.062
0.7	0.119	0.109	0.013	0.035	0.700	0.024

As shown in Table 3, both π^S and π^C decrease monotonically as θ^{SC} increases from 0. Both π^S and π^C attain their maximum value of 0.148 when $\theta^{SC} = 0$.

3.4 Equilibrium

In this subsection, we present the equilibrium of the model introduced in Section II. As shown in Subsections 3.1–3.3, $\pi_i^{SS} = \pi_i^S = \pi_i^C = \pi_i^{CC}$.

The main result of this paper is stated in the following proposition.

PROPOSITION 1: *In the three-stage Bertrand duopoly model, neither CSR nor CO increases profits for either firm.*

This result demonstrates that, unlike in Cournot competition, adopting either a CSR or customer-oriented strategy does not enhance firm profitability under Bertrand price competition. Therefore, the strategic incentive for firms to care for all consumers or only their own customers disappears when competition is based on prices rather than quantities. This result contrasts with Planer-Friedrich and Sahm (2018), where CSR may enhance profitability under quantity competition.

IV. CONCLUSION

This study has shown that, in a Bertrand duopoly with differentiated products, neither corporate social responsibility (CSR) nor customer orientation (CO) increases firm profits under price competition. Unlike in Cournot competition, where such strategies can enhance profitability and welfare, the incentive for firms to care for all consumers (CSR) or only their own customers (CO) disappears when competition is based on prices. The findings highlight a fundamental difference in the strategic value of CSR and CO between price and quantity competition, suggesting that socially responsible strategies may not yield competitive advantages in price-driven markets.

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