

Duopoly competition in food industry considering corporate social responsibility

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RESEARCH ARTICLE

Abstract

This paper describes the effects of corporate social responsibility (CSR) on food industry and some interesting conclusions are achieved. Firstly, CSR improves both the quality and the quantity of the food for the CSR firm, while it reduces those for the maximising profit (MP) firm. Secondly, both the total quality and the quantity in the industry are promoted by CSR. Thirdly, CSR reduces the MP firm's profits, while there is an inverse U-shaped relationship between CSR and the CSR firm's profits. Finally, CSR improves the consumer surplus and the social welfare.

Keywords: corporate social responsibility (CSR), food quality, food safety, game theory, non-cooperative

1. Introduction

The World Health Organization estimates that foodborne and waterborne diarrhoeal diseases taken together kill about 2.2 million people annually, 1.9 million of them are children and there exist many serious incidents about food safety in recently years and food security attracts global attention. Therefore, food quality has crucial effects on people all over the world (Nie, 2013; Nie and Chen, 2014).

Unsafe food causes many acute and life-long diseases, ranging from diarrhoeal diseases to various forms of cancer and many factors affect food quality or yield food safety in practice. Pinstrup-Andersen (2009) defined food security and remarked the measure. On one hand, technological and natural conditions importantly determine the food safety¹. For example, Tirado *et al.* (2010) concluded that climate change relates food safety. Bruhn and Schutz (1999) pointed out that food safety requires proper handling from production through consumption. On the other hand, social

factors also affect food security. Diagne *et al.* (2013) found that self-sufficiency policy relates to food quality. Kong (2012) examined the relationship between corporate social responsibility (CSR) and food industry.

This paper further develops the theoretic conclusions about food industry related CSR, which is fallen into the community of the social factors inducing food safety, by capturing the effects of CSR on food quality, quantity, firms' profits and the consumer surplus.

CSR has important effects on many types of firms' strategies, such as managerial contract (Baron, 2008), firms' outputs (Kopel and Brand, 2012), buying behaviours (Mohr *et al.*, 2001; Starks, 2009), emission (Nie and Meng, 2013) and firms' performance (Brammer and Millington, 2008; Kitzmueller and Shimshack, 2012; Orlitzky *et al.*, 2003).

There exist rare papers investigating the food industry with CSR except Kong (2012), Jones and Nisbet (2011), Hartmann (2011) and Nie (2013). The papers investigating CSR in industrial organisation about food industry include Kong (2012) and Nie (2013). Kong (2012) addressed the effects of CSR on food industry with a nature experiment in China. Hartmann (2011) stressed that the CSR has important effects on food sector. Jones and Nisbet (2011) focused on CSR as a type of firms' strategy. Nie (2013)

¹ Based on the views of Food and Agriculture Organization of the United Nations, Pinstrup-Andersen (2009) defined that the food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life. Therefore, food security includes food safety.

developed theory about the food industry under monopoly with CSR and argued that regulation reduces the social welfare under complete information. This paper extends the work of Nie (2013) to duopoly case and examines the effects of CSR on food industry. Compared with Nie (2013), there exist three differences. Firstly, this paper considers linear demand while Nie (2013) employed Cobb-Douglas utility function. Secondly, this paper introduces two firms in the food industry while Nie (2013) focused on the monopolist. Finally, conclusions in this paper significantly differ from Nie (2013) because multiple firms are addressed. Compared with Hartmann (2011), this paper captures the effects of CSR on food sector under duopoly.

The rest of this paper is organised as follows: The model under duopoly is established in the next section. Here we establish a two-stage duopoly model with a CSR firm competing with a MP firm in the food industry. At the first stage, two firms choose the quality and determine the quantity at the second stage. The model is analysed in Section 3. The effects of CSR on quality, quantity and the profits are all addressed. Section 4 outlines numerical simulation results of the theoretical propositions. Then, some remarks are presented in the final section.

2. Model

Here we establish the duopoly model about food quality with CSR. There are two producers in this food industry, which are denoted $i \in \{1, 2\}$. The firms' quality for the products is correspondingly identified $x = (x_1, x_2)$, where x_1 is the first firm's quality and x_2 denotes the quality of the second firm. Similarly, the corresponding quantity is $q = (q_1, q_2)$ along with the price $p = (p_1, p_2)$. Following, we address the functions of the utility-maximising consumers as well as the profit-maximising producers.

Consumers

Given $x = (x_1, x_2)$, $q = (q_1, q_2)$ and $p = (p_1, p_2)$, here we introduce the utility function of the representative consumer as follows:

$$u(q, x) = \alpha x_1 q_1 + \alpha x_2 q_2 - p_1 q_1 - p_2 q_2 - \frac{1}{2}(q_1^2 + q_2^2) - \gamma q_1 q_2 \quad (1)$$

Where the constant $\alpha > 0$ and $\gamma \in [0, 1]$ stands for the product substitutability. For $i, j = 1, 2, i \neq j$ the corresponding inverse demands are:

$$p_i = \alpha x_i - q_i - \gamma q_j \quad (2)$$

Equation 2 indicates that price increases with the quality while decreases with both the quantity of the products and the outputs of the rival's. The consumer surplus is:

$$CS = \frac{1}{2}(q_1^2 + q_2^2) + \gamma q_1 q_2$$

Producers

Here we model two producers, a CSR firm and a maximising profit (MP) one, in the food industry. Only the CSR firm integrates its business operation into corporate social responsibility. Without loss of generality, we assume that the first firm is a CSR one and the second is an MP competitor.

The timing table of the game is: At the first stage, two firms commit the quality level of the products. At the second stage, according to the quality level, firms price and support the quantity of the products, while consumers determine the quantity to consume.

Since the first firm integrates CSR into its business operation, the CSR firm aims to maximise the profits plus the weighted consumer surplus and the objective function of the first firm (CSR firm) is:

$$\begin{aligned} \Pi_1 = \pi_1 + \mu CS = & (p_1 - x_1)q_1 \\ & + \mu \left[\frac{1}{2}(q_1^2 + q_2^2) + \gamma q_1 q_2 \right] - \tau(x_1^2 - x_1) \end{aligned} \quad (3)$$

In Equation 3, the costs incurred with products of the food q_1 with the quality x_1 are $q_1 x_1$. $\mu \in [0, 1]$ stands for the degree of the CSR. $\mu = 0$ means a maximising profit (MP) firm and $\mu = 1$ stands for a public firm. $\pi_1 = (p_1 - x_1)q_1$ is the profits of the CSR firm while $\tau(x_1^2 - x_1)$ means the fixed costs for quality x_1 .

The second firm, as an MP one, maximises its profits, which is:

$$\max \pi_2 = (p_2 - x_2)q_2 - \tau(x_2^2 - x_2) \quad (4)$$

The model based on Equation 1-4 is investigated in the subsequent section. Actually, Dixit (1979) and Sheshinski (1976) modelled quality and quantity competitions in general cases. This paper address quality and quantity competition in food industry and the CSR is introduced. Moreover, this work considers dynamic situation. Besides, compared with Nie (2013), this paper addresses the duopoly cases and employs linear demand function, which is easy to handle.

3. Primary analysis

The above model is solved by backward induction. At the second stage, we focus on the quantity. Equation 3 and 4 are concave in $q = (q_1, q_2)$. We therefore have the following first-order optimal conditions:

$$\frac{\partial \Pi_1}{\partial q_1} = (\alpha - 1)x_1 - \gamma q_2 - 2q_1 + \mu q_1 + \gamma \mu q_2 = 0, \quad \frac{\partial \pi_2}{\partial q_2} = (\alpha - 1)x_2 - \gamma q_1 - 2q_2 = 0$$

We thus achieve:

$$q = (q_1, q_2) = ((\alpha - 1) \frac{2x_1 - \gamma(1 - \mu)x_2}{2(2 - \mu) - \gamma^2(1 - \mu)}, (\alpha - 1) \frac{(2 - \mu)x_2 - \gamma x_1}{2(2 - \mu) - \gamma^2(1 - \mu)}) \tag{5}$$

Substituting Equation 5 into Equation 3 and 4, we have:

$$\begin{aligned} \Pi_1 &= \frac{\mu}{2}q_2^2 + (1 - \frac{\mu}{2})q_1^2 - \tau(x_1^2 - x_1) \\ &= \frac{(\alpha - 1)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \{ \frac{\mu}{2}[(2 - \mu)x_2 - \gamma x_1]^2 + (1 - \frac{\mu}{2})[2x_1 - \gamma(1 - \mu)x_2]^2 \} - \tau(x_1^2 - x_1) \end{aligned} \tag{6}$$

$$\pi_2 = q_1^2 - \tau(x_2^2 - x_2) = \frac{(\alpha - 1)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} [(2 - \mu)x_2 - \gamma x_1]^2 - \tau(x_2^2 - x_2) \tag{7}$$

At the first stage, Equation 6 and 7 jointly determine the equilibrium quality. For Equation 6 and 7, we launch the following assumption to guarantee the existence of the unique solution.

Assumption 1: Equation 6 and 7 are concave in $x=(x_1, x_2)$.

We also point out that the above assumption is met for large enough τ . The equilibrium quality is determined by the first-order optimal conditions of Equation 6 and 7.

$$\frac{\partial \Pi_1}{\partial x_1} = \frac{(\alpha - 1)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \{ 2(2 - \mu)[2x_1 - \gamma(1 - \mu)x_2] - \mu\gamma[(2 - \mu)x_2 - \gamma x_1] \} - 2\tau x_1 + \tau = 0 \tag{8}$$

$$\frac{\partial \pi_2}{\partial x_2} = \frac{2(\alpha - 1)^2(2 - \mu)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} [(2 - \mu)x_2 - \gamma x_1] - 2\tau x_2 + \tau = 0 \tag{9}$$

The equilibrium quality is:

$$\begin{aligned} x^* = (x_1^*, x_2^*) = & \left(\frac{\det \begin{bmatrix} \tau & \frac{(\alpha - 1)^2(2 - \mu)^2\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \\ \tau & 2\tau - \frac{2(\alpha - 1)^2(2 - \mu)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \end{bmatrix}}{\det \begin{bmatrix} 2\tau - \frac{(\alpha - 1)^2(8 + \mu\gamma^2 - 4\mu)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & \frac{(\alpha - 1)^2(2 - \mu)\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \\ \frac{2(\alpha - 1)^2(2 - \mu)\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & 2\tau - \frac{2(\alpha - 1)^2(2 - \mu)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \end{bmatrix}}, \right. \\ & \left. \frac{\det \begin{bmatrix} 2\tau - \frac{(\alpha - 1)^2(8 + \mu\gamma^2 - 4\mu)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & \tau \\ \frac{2(\alpha - 1)^2(2 - \mu)\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & \tau \end{bmatrix}}{\det \begin{bmatrix} 2\tau - \frac{(\alpha - 1)^2(8 + \mu\gamma^2 - 4\mu)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & \frac{(\alpha - 1)^2(2 - \mu)\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \\ \frac{2(\alpha - 1)^2(2 - \mu)\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & 2\tau - \frac{2(\alpha - 1)^2(2 - \mu)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \end{bmatrix}} \right) \tag{10} \end{aligned}$$

Denote

$$K = \det \begin{bmatrix} 2\tau - \frac{(\alpha - 1)^2(8 + \mu\gamma^2 - 4\mu)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & \frac{(\alpha - 1)^2(2 - \mu)\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \\ \frac{2(\alpha - 1)^2(2 - \mu)\gamma}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & 2\tau - \frac{2(\alpha - 1)^2(2 - \mu)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} \end{bmatrix}$$

By Equation 5, we have:

$$\begin{aligned}
 q^* &= (q_1^*, q_2^*) = ((\alpha - 1) \frac{2x_1^* - \gamma(1 - \mu)x_2^*}{2(2 - \mu) - \gamma^2(1 - \mu)}, (\alpha - 1) \frac{(2 - \mu)x_2^* - \gamma x_1^*}{2(2 - \mu) - \gamma^2(1 - \mu)}) \\
 &= \frac{(\alpha - 1)\tau}{[2(2 - \mu) - \gamma^2(1 - \mu)]K} \left(\det \begin{bmatrix} 1 & \frac{(\alpha - 1)^2 \gamma(4\mu + 3\mu\gamma^2 - 2\mu^2)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} + 2\gamma(1 - \mu)\tau \\ 1 & \frac{2(\alpha - 1)^2(2 - \mu)(\gamma^2 - \mu\gamma^2 - 4 + 2\mu)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} + 4\tau \end{bmatrix} \right) \\
 &\det \begin{bmatrix} 2(2 - \mu)\tau - \frac{(\alpha - 1)^2(2 - \mu)(8 + 2\mu\gamma^2 - 4\mu - 2\gamma^2)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} & 1 \\ 2\tau\gamma & 1 \end{bmatrix}
 \end{aligned} \tag{11}$$

By Equation 6 and 7, the corresponding price $p^* = (p_1^*, p_2^*)$ is:

$$\begin{aligned}
 p_1^* &= (p_1^*, p_2^*) = (\alpha x_1^* - q_1^* - \gamma q_2^*, \alpha x_2^* - q_2^* - \gamma q_1^*) \\
 &= (\alpha \left[\frac{(2 - 2\mu + \gamma^2\mu)x_1^* - \gamma x_2^*}{2(2 - \mu) - \gamma^2(1 - \mu)} \right] + \frac{(2 - \gamma^2)x_1^* + \gamma x_2^*}{2(2 - \mu) - \gamma^2(1 - \mu)}, \\
 &\alpha \left[\frac{(2 - \mu)x_2^* - \gamma x_1^*}{2(2 - \mu) - \gamma^2(1 - \mu)} \right] + \frac{(2 - \mu - \gamma^2 + \gamma^2\mu)x_2^* + \gamma x_1^*}{2(2 - \mu) - \gamma^2(1 - \mu)})
 \end{aligned} \tag{12}$$

In Equation 10, $x^* = (x_1^*, x_2^*)$ is given by Equation 8. The corresponding profits are:

$$\begin{aligned}
 \pi^* &= (\pi_1^*, \pi_2^*) \\
 &= ((\alpha - 1)^2 \frac{(2 - 2\mu + \gamma^2\mu)x_1^* - \gamma x_2^*}{2(2 - \mu) - \gamma^2(1 - \mu)} \frac{2x_1^* - \gamma(1 - \mu)x_2^*}{2(2 - \mu) - \gamma^2(1 - \mu)} - \tau[(x_1^*)^2 - x_1^*], \\
 &\frac{(\alpha - 1)^2}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2} [(2 - \mu)x_2^* - \gamma x_1^*]^2 - \tau[(x_2^*)^2 - x_2^*])
 \end{aligned} \tag{13}$$

For the quality and the outputs of two firms, we have the following relationship between two firms.

Proposition 1: The quality and the quantity of CSR firm are all larger than those of MP firm.

Proof: In supplementary material.

Remarks: This result describes the relationship of the quality and the quantity between the CSR firm and the MP one. The CSR firm produces more than its MP competitor. This is a general conclusion. Interestingly, CSR firm produces higher quality products than those of the MP firm, which implies CSR stimulates CSR firm to raise quality. This proposition describes the quality relationship of two firms.

According to $p_1^* - p_2^* = \alpha(x_1^* - x_2^*) - (1 - \gamma)(q_1^* - q_2^*)$, the quality difference enlarges the price difference, while the quantity difference reduces the price difference. By Equation 12, we have:

$$\begin{aligned}
 p_1^* - p_2^* &= \alpha(x_1^* - x_2^*) - (1 - \gamma)(q_1^* - q_2^*) \\
 &= \alpha(x_1^* - x_2^*) - \frac{(\alpha - 1)(1 - \gamma)}{2(2 - \mu) - \gamma^2(1 - \mu)} [(2 + \gamma)x_1^* - (2 - \mu + \gamma - \mu\gamma)x_2^*] \\
 &= \{(\alpha - 1) \frac{(8\mu\gamma - 2\mu\gamma^2) + 2\mu(2 - \mu - \gamma)}{2(2 - \mu) - \gamma^2(1 - \mu)} \left[\alpha - \frac{(\alpha - 1)(2 - \gamma - \gamma^2)}{2(2 - \mu) - \gamma^2(1 - \mu)} \right] \right. \\
 &\left. - (1 - \gamma)^2 [2\tau - \frac{(\alpha - 1)^2(8 + \mu\gamma^2 - 4\mu + 4\gamma - 2\mu\gamma)}{[2(2 - \mu) - \gamma^2(1 - \mu)]^2}] \right\} \frac{\tau(\alpha - 1)}{[2(2 - \mu) - \gamma^2(1 - \mu)]K}
 \end{aligned} \tag{14}$$

The above equation yields $p_1^* - p_2^* |_{\gamma=1} \geq 0$ and $p_1^* - p_2^* |_{\gamma=0, \mu < \tau} \leq 0$ for small $\varepsilon > 0$. Therefore, the sign of $p_1^* - p_2^*$ is uncertain. Surprisingly, for perfect substitute goods, the CSR firm price higher than the MP one because quality difference with weighted α dominates the weighted quantity difference with the weight $1-\gamma$.

Here we address the effects of the CSR on the quality and the quantity. For the CSR's effects, we have the following conclusion.

Proposition 2: The CSR firm's quality and quantity of the food all increase with the degree of the CSR, while CSR reduces MP firm's quality and quantity of the products.

Proof: In supplementary material.

Remarks: This proposition illustrates that CSR has stimulating effects on the CSR firm's quality and has the deterring effects on MP firm's quality. Moreover, x_1^* increases with μ and x_2^* decreases with μ yield that the quality difference increases with CSR. This is consistent with Kong's conclusion or we give a theoretic explanation to Kong's experiment results (2012). Moreover, compared with Kong (2012), the above conclusions describe the relationship between food quality and CSR in detail. Compared with the food industry under monopoly Nie (2013), we argued that the CSR has significant effects on the quality.

Denote the quality difference as $\Delta x^* = x_1^* - x_2^*$ and quantity difference as $\Delta q^* = q_1^* - q_2^*$. We have the following conclusions

Proposition 3: Quality difference and quantity difference all increase with the degree of CSR. The total quality and outputs also increase with the degree of CSR.

Proof: In supplementary material.

Remark: This proposition indicates CSR enlarges the difference of two firms. Moreover, the total outputs are also promoted because the negative effects of the CSR on the MP firm are less than those positive effects on the CSR one. Similarly, the quality also has the same relationship as outputs.

Further, we consider the effects of CSR on profits and social welfare and have the following conclusions.

Proposition 4: There exists an inverse U-shape relationship between the profits of the CSR firm and CSR degree. For the MP firm, CSR always reduces its profits.

Proof: In supplementary material.

Remarks: This proposition is consistent with that in Nie and Meng (2013). Here we give an explanation about the inverse-U shape relationship between the profits of the CSR firm and CSR degree. When the degree of CSR is large enough or CSR firm's market power is large enough, the increase of CSR yields the reduction of the CSR firm's profits. This is highly consistent with Nie's conclusion about food industry under monopoly (2013).

The corresponding consumer surplus (CS*) is:

$$CS^* = \frac{1}{2}[(q_1^*)^2 + (q_2^*)^2] + \eta q_1^* q_2^* \quad (15)$$

The corresponding social welfare (SW*) is:

$$SW^* = CS^* + \pi_1^* + \pi_2^* \quad (16)$$

For the consumer surplus and the social welfare, we have the following conclusion.

Proposition 5: CSR improves the consumer surplus as well as the social welfare.

Proof: In supplementary material.

Remarks: Since CSR improves the consumer surplus, consumers benefits from CSR. The policy implication lies in that the government focusing on consumer surplus always encourages the CSR. Moreover, we argue that the CSR increases the social welfare. Nie and Meng (2013) considered the emission and drawn the conclusion that the social welfare has an inverse U-shape with the CSR. This conclusion is different from Nie and Meng (2013) because emission is neglected. Therefore, the policy implication is to encourage the CSR.

4. Numerical simulation

Here, we supply numerical simulation results of Proposition 1-3 in Figure 1-4. For the expressions of firms' profits, consumer surplus and social welfare are complex, this paper omits the numerical simulation results of Proposition 4 and 5.

Let $\alpha=2$, $\gamma=1/2$ and $\tau=1/2$, we get the final expressions of the quality and quantity of the firms:

$$x_1^* = \frac{(15 - 7\mu)(65 - 50\mu + 9\mu^2)}{2(8897 - 21992\mu + 18574\mu^2 - 6568\mu^3 + 833\mu^4)}$$

$$x_2^* = \frac{(15 - 7\mu)(65 - 134\mu + 49\mu^2)}{2(8897 - 21992\mu + 18574\mu^2 - 6568\mu^3 + 833\mu^4)} \quad (17)$$

$$q_1^* = \frac{(15 - 7\mu)(13 + 6\mu - 7\mu^2)}{8897 - 21992\mu + 18574\mu^2 - 6568\mu^3 + 833\mu^4}$$

$$q_2^* = \frac{(15 - 7\mu)(13 - 35\mu + 14\mu^2)}{8897 - 21992\mu + 18574\mu^2 - 6568\mu^3 + 833\mu^4} \quad (18)$$

Then, we obtain the following numerical simulation results by Mathematica 9.0 (Figure 1-4). The results of Figure 1-4 show that numerical simulation results are consistent with theoretical propositions.

5. Concluding remarks

This paper develops the theory of CSR on food industry under duopoly with a two-stage game theory model. We argued that the CSR improves the quality and the quantity of the food for CSR firm, while reduces the rival's quality,

quantity as well as profits. Interestingly, there exists an inverse U-shaped relationship between the CSR firm's profits and the degree of the CSR. A rational explanation is supported. As we known, this is the first paper address the CSR in the food industry under duopoly. Moreover, we argue that CSR promotes both the consumer surplus and the social welfare. Encouragement of the CSR is an important policy to improve the social welfare. The conclusions of this paper show that food production firms have original stimulation to undertake CSR in some cases, so it will be

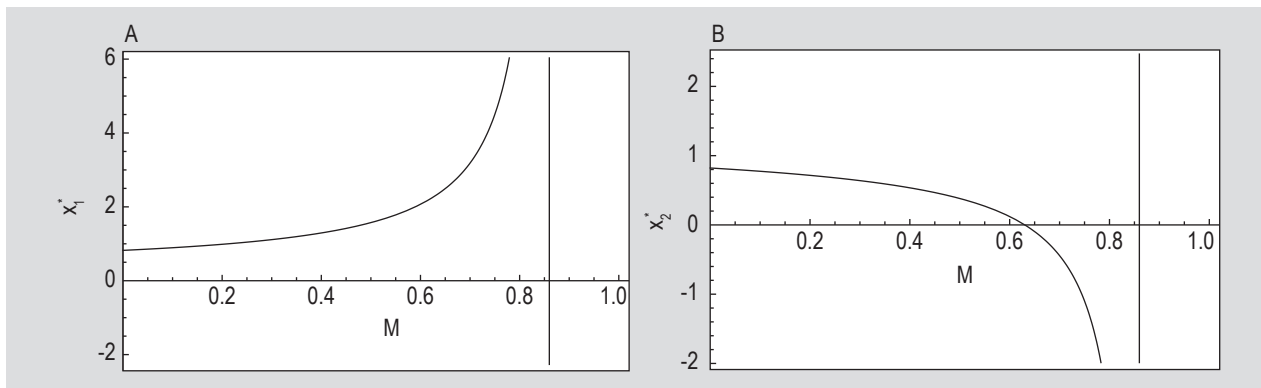


Figure 1. Numerical simulation of the quality of the two firms; (A) corporate social responsibility firm and (B) maximising profit firm.

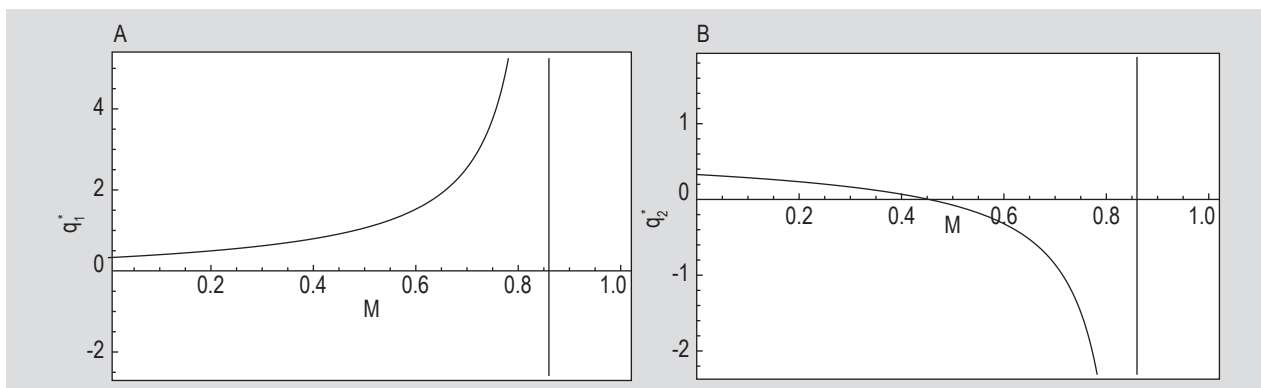


Figure 2. Numerical simulation of the quantity of the two firms; (A) corporate social responsibility firm and (B) maximising profit firm.

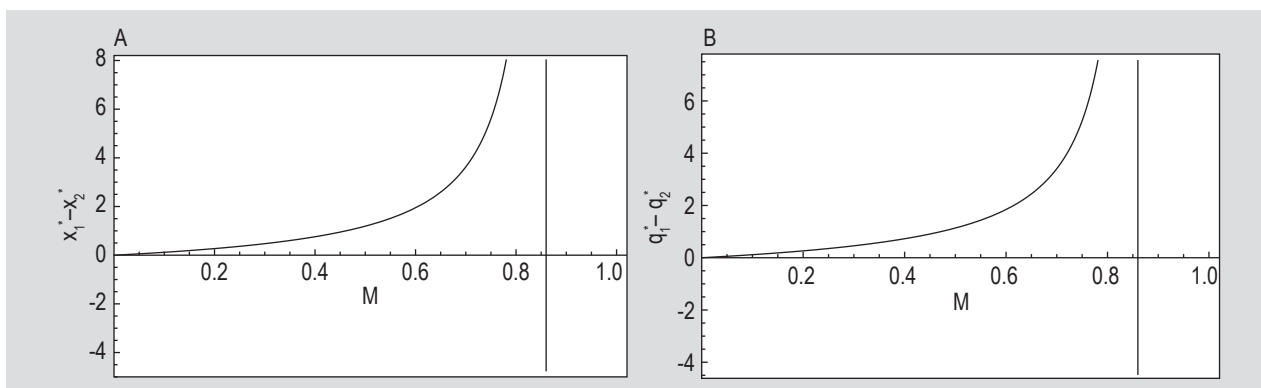


Figure 3. Numerical simulation of the (A) quality and (B) quantity gaps of the two firms.

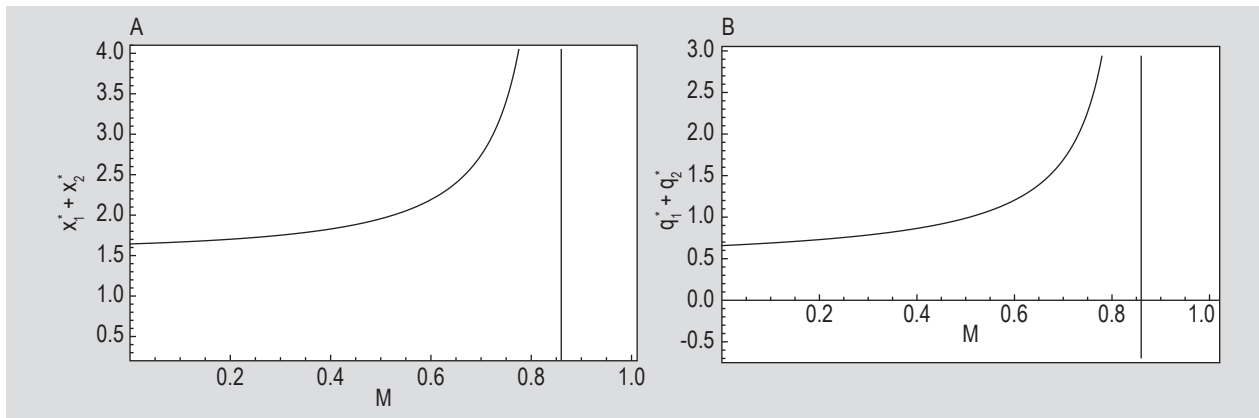


Figure 4. Numerical simulation of the total (A) quality and (B) quantity of the two firms.

helpful to guarantee food safety if the government gives them suitable encouragement.

This paper neglects governmental regulation because it is too difficult to capture the regulation under duopoly, which is our further researching topic. Compared with existed conclusions about the food industry considering the CSR, this paper testifies the experiment results of Kong (2012) and extends Nie (2013) to duopoly situation. Moreover, the conclusions are mainly different from Nie (2013) because multiple firms are introduced. When there are two or multiple firms in the food industry, the CSR has significant effects on the food quality. The food policy implication to food industry is to encourage the CSR firm. Moreover, encouragement of competition can also improve the quality of the food.

Numerous studies show that CSR bring firm with high costs and that why many firms have little stimulation to undertake CSR, but the results of this study illustrate that firm can use CSR as an ethical argument to establish a competitive advantage in the market and as a positioning strategy tool.

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Conflict of interest

The authors declare that there is no conflict of interest.

Supplementary material

Supplementary material can be found online at <http://dx.doi.org/10.3920/QAS2014.0479>.

Proof of Proposition 1.

Proof of Proposition 2.

Proof of Proposition 3.

Proof of Proposition 4.

Proof of Proposition 5.

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