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Abstract

This study investigates an interplay between strategic CSR (corporate social responsibility) by a multiproduct corporation and merger decisions by rival firms each having single plant. We examine and compare two different timings of choosing CSR, i.e., "merge-then-CSR" and "CSR-then-merge" games. In the former case, we show that the level of CSR increases in products substitutability, but its level under merger is lower than that without merger. In the latter case where a multiproduct corporation can commit to a higher level of CSR before rival firms' mergers, however, the level of CSR decreases in products substitutability and it might increase not only consumer surplus but social welfare.

Keywords: multiproduct corporation; strategic CSR; timing of commitment; products substitutability; merger decision;

1. Introduction

As corporate social responsibility (CSR) waves are explosively expanding among the industries and societies, mostly the large firm's voluntary engagement of CSR activities has become a global business practice.[1] Accordingly, in the academic literature, research debate on the motives pushing firms to engage in CSR activities has been also becoming increasingly prominent.[2] In particular, from the profit-oriented motivations for adopting CSR activities, the shareholder's viewpoint regards CSR as a strategic device of the firm's choice variable, which reflects management's incentive contract to engage in business strategy. For example, strategic

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[1]According to the PWC Global CEO survey (2016), for example, 64% of the CEOs see CSR as a core part of their business and 59% of them believe social values are important to attract top employees. The importance of CSR is expected to rise within the next 5 years, and 87% of the companies become aware of the strategic dimension of societal outcome measurement. The global phenomenon that firms concern with CSR has been also confirmed by various surveys, such as KPMG (2013, 2015) and UN Global Compact-Accenture CEO Study (2010, 2013).

[2]Baron (2001) described two polar definitions between shareholder theory and stakeholder theory. The difference concerns whether such CSR activities are chosen by insiders (shareholders) to achieve certain philanthropy or the levels of ethical CSR may be given to satisfy social philanthropy. See also Benabou and Tirole (2010), Schreck (2011), Kitzmueller and Shimshack (2012), Crifo and Forget (2015), and Kim et al. (2019).

CSR-initiatives of consumer-friendliness enhances a firm's reputation and image signaling concerns to increase firm value.

Recent papers have formulated the instrumental model of strategic choice of CSR in a managerial delegation contract and seek to explain the firm's profit-maximizing use of CSR. For instance, in a theoretical model with strategic CSR, the firm adopts consumer surplus as its CSR concerns and puts a higher weight on output productions to take care of consumers, which induces rivals to reduce their outputs under strategic substitutes relationship.[3] In recent literature, Goering (2012), Brand and Grothe (2013) and Garcia et al. (2018) considered a bilateral model while Kopel and Brand (2012), Lambertini and Tampieri (2015) and Leal et al. (2018) examined a horizontal competition. As further extensions, Fanti and Buccella (2016) examined network effects, Fanti and Buccella (2017) and Planer-Friedrich and Sahm (2020) studied the relation with entry decisions, and Liu et al. (2015), Hirose et al. (2017) and Lee and Park (2019) incorporated environmental concern. They showed that the aim of maximizing profits can be a motive for the firm's engagement in CSR because the adoption of CSR may increase the firm's profits at the market equilibrium.

However, most previous theoretical works assumed that industry consists of a few firms which hold a single plant. In plenty of empirical works, however, multiproduct firms are regarded as realistic identities in the listed firms data. Eckel and Neary (2010) and Armstrong and Vickers (2018) also point out that one characteristic of current economies is the presence of multiproduct firms. In the real world, many corporations comprise firms that produce various types of goods at various production plants. Examples include BMW, Google, Apple, as well as business markets for processed materials, and various types of industrial machinery. Furthermore, multiproduct firms involve mergers. This is reflected in the recent literature on merger simulation and the upward-pricing pressure of mergers.[4] Therefore, an open question is what extent the insights derived in that earlier literature of strategic CSR carry over to more realistic models of multiproduct firms which might invlove mergers.

To our knowledge, theoretical studies on market concentration to understand how multiproduct firms strategically utilize the CSR-initiatives are limited.[5] In this paper, we consider a multiproduct context and analyze an interplay between product differentiation and strategic concern for consumers.[6] We then examine

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[3]The approach that CSR concerns account for consumer surplus is very closely related to the literature on strategic delegation and sales targets for managers in oligopolies. Then, owners may choose non-profit maximization as the optimal managerial incentives and include sales to commit the managers to more aggressive behavior in the output market.

[4]Recent works by Farrell and Shapiro (2010), Nocke and Whinston (2010, 2013) and Jaffe and Weyl (2013) have heavily influenced antitrust practice.

[5]Empirical studies already explored the link between CSR and firm's profitability in mergers. See Deng et al. (2013), Flammer (2015), and Bereskin et al. (2018) among others.

[6]As related studies, Moner-Colonques et al. (2004) considered delegation model with multiproduct firms and Straume (2006) considered delegation model and merger decisions. Nocke and Schutz (2018) considered mergers between multiproduct firms with horizontally differentiated products and showed that many of the clasic results from single product markets hold, such as mergers

the strategic effect of CSR by a multiproduct corporation on the merger decisions of rival firms and welfare consequences.

In specific, we consider a three-firm model in which a multiproduct corporate commits on CSR and competes with two rival firms each having a single plant in each market. In adopting the strategic aspect of CSR, we take the form of "consumer-friendly" activities, in which the corporate cares for consumer surplus as a proxy of its CSR concerns and thus, a CSR-related incentive combines both profitability and consumer surplus. In a quantity-setting framework with two-products, CSR can induce multiproduct corporation to be aggressive to produce more outputs, which results in the increase of intra-firm output in each market, but also induce rival firm to reduce outputs, which results in inter-firm output interactions.

However, regarding merger decision between the rival firms, it needs to reflect different responses of output-decreasing effect from the strategic interaction. That is, via the use of CSR, the multiproduct corporation can not only influence its rival's profitability but also induce them to merge if this is in the corporation's interest. In that process, we highlight that products substitutability can play a key role to determine the interplay between the profitability of a rival firm's merger decision and the strategic CSR.[7] In particular, committed higher level of CSR can encourage a merger between rival firms, which might lead to a reduction in the total industry outputs, depending on the products substitutability, but a higher CSR can increase a multiproduct corporation's production. Thus, a multiproduct firm might choose a CSR as a strategic device to induce rival firm's merger and increase its profits.

Our analysis of strategic CSR can be also applied to welfare consequences of market concentration from the merger. That is, a higher level of CSR can increase consumer surplus and thus firm's merger decision can be beneficial to the society in the presence of a multiproduct corporation.[8]

We examine the different timings of commitment to CSR, i.e., "merge-then-CSR" and "CSR-then-merge." That is, we consider the ability of the multiproduct corporation to commit credibly to the level of CSR before or after rival firm's merger decisions and examine the effects of CSR on the firm's profitability and consumer surplus.

In the former case, we examine the case of strategic CSR after merger decisions where single plant firms first select their decisions on merge and then the multiproduct corporation sets the degree of CSR. We show that products substitutability increases the strategic CSR, because fierce competition will cause aggressive

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can reduce consumer surplus. However, the effect of strategic delegation with CSR by a multiproduct firm on the merger decisions is not investigated.

[7]In the literature of merger policy, the profitability of merger decisions strongly depends on the degree of product differentiation. See Lommerud and Sørgard (1997), Heywood and McGinty (2008), Hsu and Wang (2010), Gelves (2014), and Nie (2018).

[8]As a related paper, Garcia et al. (2020) examined an endogenous choice of mergers between a consumer-friendly multiproduct corporation and a single product firm, and showed that mergers can increase consumer surplus and welfare under the exogenous level of CSR by a merged firms.

3

output expansion, but its level of CSR under merger is lower than that without rival firms' merger due to the reduced pressure of competition. We also show that both single plant firms merge when the substitutability is high, irrespective of the level of CSR, which will always increase the profit of multiproduct corporation.

In the latter case with the reversed timing of the commitment to CSR, the multiproduct firm sets the level of CSR then the rival firms, taking the degree of CSR as given, choose whether to merge or not. We show that rival firms' decision on merger depends not only on the degree of products substitutability but the strategic level of CSR. In particular, both single plant firms will be induced to merge when the committed CSR level is higher than the profit-maximizing CSR level. This is because a higher level of CSR can be a threat for a fierce competition, which brings about a higher incentive to merge. In that case, due to the reduced pressure of competition, the strategic CSR level is decreasing in the products substitutability and the merger decision by rival firms also increases the profit of multiproduct corporation.

We conclude that a multiproduct corporation will commit to a higher CSR in a CSR-then-merge game as a strategic device to induce rival firm's merger and increase its profit especially when the substitutability is intermediate. However, compared to the merger-then-CSR game, it can increase not only consumer surplus (as long as the products are not close substitutes) but social welfare. Hence, in the presence of higher CSR by the multiproduct firm, merger in a Cournot competition can be beneficial to the firms and consumers as well, depending on the products differentiation.

Our findings indicate the pro-competitive effects of CSR under the horizontal mergers with differentiated products. In the literature of merger policy, horizontal merger paradox is well-known by Salant et al. (1983), which states that merger in a homogeneous Cournot competition can be harmful for merging firms and consumers, but not for non-merging firms. Several studies have caught attention of researchers regarding different and various models and resolved the merger paradox. Perry and Porter (1985) introduced convex cost, Lommerud and Sørgard (1997) considered differentiated products, Huck et al. (2001) assumed leadership, and Faulí-Oller (2002) considered cost asymmetries. More recent literature has focused on a combination of key factors that resolve the merger paradox. Heywood and McGinty (2008) considered convex cost and leadership, Gelves (2010) leadership and cost asymmetries, and Hsu and Wang (2010) and Gelves (2014) considered product differentiation and cost asymmetries. Therefore, our findings complement the literature of horizontal merger by highlighting that under the pre-commitment on the higher CSR by a multiproduct corporation, merger between Cournot competitors can be beneficial to the firms and consumers as well.

The remainder of this paper is organized as follows. In section 2, we formulate a quantity-setting multiproduct model with a consumer-friendly multiproduct corporation. In section 3, we analyze output decisions by single plant firms under non-merged case and under merged case, respectively. We then consider merger decisions in a merge-then-CSR game and in a CSR-then-merge game, respectively, in section 4 and 5. In section 6, we compare the two games and provide main findings on the relationship between CSR and merger. We conclude the paper in section 7.

4

2. Model

We consider two differentiated products markets with a CSR-corporation, A, which has two plants and produces goods in market 1 and 2, denoted by $A1$ and $A2$, respectively, and two single plant for-profit (FP) firms in each market, denoted by $B1$, and $B2$, respectively. When firm $B1$ and firm $B2$ merge (or when one of them acquires the other), we assume that they can reorganize their organizational structure by setting up a multiproduct corporation after the merger, which has two divisions/plants, each producing one goods.

On the demand side, there is a continuum of consumers of the same type. The representative consumer has a utility function $U(q_1, q_2)$, which is quadratic, strictly concave and symmetric in q_1 and q_2: $U(q_1, q_2) = (q_1 + q_2) - ((q_1^2 + 2\gamma q_1 q_2 + q_2^2))/2$, where γ represents the degree of product differentiation and q_{ki} is the output produced by firm or plant ki, $k = A, B$; $i = 1, 2$. Then, the consumer maximizes $U(q_1, q_2) - p_1 q_1 - p_2 q_2$, where p_i is the price of good i, $q_1 = q_{A1} + q_{B1}$ and $q_2 = q_{A2} + q_{B2}$ are the quantity of good 1 and 2 respectively. The inverse demand functions are linear and given by:

$$p_i = 1 - (q_{Ai} + q_{Bi}) - \gamma(q_{Aj} + q_{Bj}), \ \ i \neq j, \ \ i, j = 1, 2; \tag{1}$$

where parameter[9] $\gamma \in (0, 1]$ and thus products are regarded as homogeneous products if $\gamma = 1$ while independent if γ approaches 0.

On the supply side, we assume that firms have identical technologies represented by the following quadratic cost function: $C(q_{ki}) = \frac{q_{ki}^2}{2}$, $k = A, B$; $i = 1, 2$. Thus, the profit function of a plant or firm ki is:

$$\pi_{ki} = p_i q_{ki} - \frac{q_{ki}^2}{2}, \ \ k = A, B; \ \ i = 1, 2 \tag{2}$$

and the profit of the multiplant CSR-corporation is:

$$\pi_A = \pi_{A1} + \pi_{A2} \tag{3}$$

We consider a managerial delegation model of the CSR-corporation, in which the owner and the manager are separated. To maximize the joint profits in (3), the owner of CSR-corporation specifies an incentive contract with the manager. In specific, the manager is assumed to maximize the joint profits of its two plants plus a fraction (θ) of consumer surplus (CS) in production, which is determined by the owner. Thus, the objective function of the manager of CSR-corporation is given by:

$$V = \pi_A + \theta CS \tag{4}$$

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[9]Note that the substitutability can play an important role in the profitability of merger decisions in the literature, such as Deneckere and Davidson (1985), Lommerud and Sørgard (1997), Heywood and McGinty (2008), Hsu and Wang (2010), Gelves (2014), and Nie (2018). In appendix B, we allow for the complements case where $\gamma \in (-1, 0)$ and find that competition with complements always yields profitable mergers. Thus, the timing of strategic CSR does not change the merger decisions of FP firms with complementary products.

where $CS = ((q_{A1} + q_{B1})^2 + 2\gamma(q_{A1} + q_{B1})(q_{A2} + q_{B2}) + (q_{A2} + q_{B2})^2)/2$. Note that parameter $\theta \in [0, 1]$ measures the degree of concern on consumer surplus when the corporation adopts CSR activities, i.e., the level of CSR.

The FP firms can decide to merge and set up a multiproduct firm with two divisions, 1 and 2. If they merge, the profit of the multiplant FP-corporation is:

$$\pi_B = \pi_{B1} + \pi_{B2} \tag{5}$$

Our goal is to study the profit-motivated decision to merge by FP firms and understand how the strategic CSR works as an inducement device toward FP firm's merge decision. When FP firms can voluntarily decide to merge under the profit-incentive compatible constraint, we will consider and compare two scenarios: (i) merger-then-CSR game and (ii) CSR-then-merger game. Under scenario (i), the FP firms decide whether to merge and set up a multiproduct firm in the first stage. In the second stage, a CSR corporation determines its degree of CSR. That is, the strategic choice of CSR by a multiproduct CSR firm is arranged in the second stage. Then, firms compete with outputs in the last stage. Under scenario (ii), however, a CSR corporation moves first and determines its level of CSR in the first stage. Then, the FP firms decide whether to merge and set up a multiproduct firm in the second stage. In the last stage, firms compete with outputs.

Finally, we will compare the profits of a CSR corporation between the two scenarios (i) and (ii), and provide the profit-incentive of CSR. In particular, we will provide a condition of product differentiation in which the CSR corporation can increase its profit under the scenario (ii) where the commitment to CSR can encourage the rival FP firm's merger decision. We also investigate the welfare consequences of strategic commitment to CSR in scenario (ii).

3. Analysis of output stage

In the last stage, we solve equilibrium output decisions of the games. Given that FP firms will decide whether to merge or not, we have two cases in each scenario. In the first non-merger case, FP firms do not merge, in which a CSR-corporation competes with 2 independent FP firms, which will be denoted by the superscript $\star$. In the second merger case, firms merge and set up a multiproduct corporation, in which a CSR-corporation competes with a FP-corporation, which will be denoted by the superscript $\dagger$.

3.1. CSR-corp. competes with 2 independent FP firms

First, we consider the non-merger case when there is a CSR-corporation competing with 2 single plant FP firms. The manager of the CSR-corporation A chooses the outputs q_{A1} and q_{A2} that maximise eqn. (4). FP firm Bi chooses the output q_{Bi} that maximises its profit given by eqn. (2), respectively.

Hence, the equilibrium of the third stage of the game (the output game) must satisfy:

$$\frac{\partial V}{\partial q_{Ai}} = 1 - (3-\theta)q_{Ai} - 2\gamma q_{Aj} - q_{Bi} - \gamma q_{Bj} + \theta\left(q_{Bi} + \gamma\left(q_{Bj} + q_{Aj}\right)\right) = 0$$

$$\frac{\partial \pi_{Bi}}{\partial q_{Bi}} = 1 - 3q_{Bi} - q_{Ai} - \gamma q_{Aj} - \gamma q_{Bj} = 0 \tag{6}$$

for $i, j = 1, 2$ and $i \neq j$. From (6), we obtain the reaction functions

$$q_{Ai} = \frac{1 - 2\gamma q_{Aj} - q_{Bi} - \gamma q_{Bj} + \theta\left(q_{Bi} + \gamma\left(q_{Bj} + q_{Aj}\right)\right)}{3 - \theta}$$

$$q_{Bi} = \frac{1}{3}\left(1 - q_{Ai} - \gamma q_{Aj} - \gamma q_{Bj}\right) \tag{7}$$

From (7), it is easy to see that output of CSR-corp. A (q_{Ai}, $i = 1, 2$) decreases with that of FP firm Bi, and the output produced by one plant of CSR-corp. A decreases with that of the other, i.e. outputs are strategic substitutes. Solving them, we obtain the following Lemma.

Lemma 1. *When a CSR-corp. competes with 2 single plant FP firms, the outputs and profits are*

$$q_{Ai}^{\star} = \frac{2 + \theta(1+\gamma)}{8 + 7\gamma + \gamma^2 - 2\theta(1+\gamma)}, \qquad\qquad q_{Bi}^{\star} = \frac{2 - \theta(1+\gamma) + \gamma}{8 + 7\gamma + \gamma^2 - 2(1+\gamma)\theta}$$

$$\pi_A^{\star} = \frac{(2 + \theta(1+\gamma))(6 + 4\gamma - 5\theta(1+\gamma))}{\left(8 + 7\gamma + \gamma^2 - 2\theta(1+\gamma)\right)^2}, \qquad \pi_{Bi}^{\star} = \frac{3(2 + \gamma - (1+\gamma)\theta)^2}{2\left(8 + 7\gamma + \gamma^2 - 2\theta(1+\gamma)\right)^2} \quad i = 1, 2$$

From Lemma 1 we have that $\frac{\partial q_{Ai}^{\star}}{\partial\theta} > 0$, $\frac{\partial q_{Bi}^{\star}}{\partial\theta} < 0$ and $\frac{\partial q_i^{\star}}{\partial\theta} > 0$ where $q_i = q_{Ai} + q_{Bi}$. Then, from last inequality, we have that the market output always increases with CSR effort. Furthermore, $\frac{\partial q_{Ai}^{\star}}{\partial\gamma} < 0$ and $\frac{\partial q_{Bi}^{\star}}{\partial\gamma} < 0$. Note also that the level of CSR decreases rival firm's profit whereas the products substitutability decreases all firms' profits because of fierce competition. That is, $\frac{\partial \pi_A^{\star}}{\partial\theta} \gtreqless 0$ if $\theta \lesseqgtr \frac{2(1+\gamma)}{11+5\gamma}$ and $\frac{\partial \pi_{Bi}^{\star}}{\partial\theta} < 0$ whereas $\frac{\partial \pi_A^{\star}}{\partial\gamma} < 0$ and $\frac{\partial \pi_{Bi}^{\star}}{\partial\gamma} < 0$.

3.2. CSR-corp. competes with a merged FP-corp.

Now we consider the merger case when the two FP firms merge and set up a multiproduct FP-corp. that chooses the values of q_{B1} and q_{B2} that maximize (5). Hence, the equilibrium of the third stage of the game must satisfy:

$$\frac{\partial V}{\partial q_{Ai}} = 0 \quad \text{and} \quad \frac{\partial \pi_B}{\partial q_{Bi}} = 0 \tag{8}$$

for $i, j = 1, 2$ and $i \neq j$. From (8), we obtain the reaction functions

$$q_{Ai} = \frac{1 - 2\gamma q_{Aj} - q_{Bi} - \gamma q_{Bj} + \theta\left(q_{Bi} + \gamma\left(q_{Bj} + q_{Aj}\right)\right)}{3 - \theta}$$

$$q_{Bi} = \frac{1}{3}\left(1 - q_{Ai} - \gamma q_{Aj} - 2\gamma q_{Bj}\right) \tag{9}$$

After the usual calculations, one gets:

Lemma 2. *When a CSR-corp. competes with a merged FP-corp., the outputs and profits are*

$$q^{\dagger}_{Ai} = \frac{2 + \theta(1 + \gamma) + \gamma}{(2 + \gamma)(4 + 3\gamma - (1 + \gamma)\theta)}, \qquad\qquad q^{\dagger}_{Bi} = \frac{2 - \theta(1 + \gamma) + \gamma}{(2 + \gamma)(4 + 3\gamma - (1 + \gamma)\theta)}$$

$$\pi^{\dagger}_A = \frac{\left(6 + 7\gamma + 2\gamma^2 - \left(5 + 7\gamma + 2\gamma^2\right)\theta\right)(2 + \gamma + (1 + \gamma)\theta)}{(2 + \gamma)^2(4 + 3\gamma - (1 + \gamma)\theta)^2}, \quad \pi^{\dagger}_B = \frac{(3 + 2\gamma)(2 + \gamma - (1 + \gamma)\theta)^2}{(2 + \gamma)^2(4 + 3\gamma - (1 + \gamma)\theta)^2} \quad i = 1,2$$

From Lemma 2 we have that $\frac{\partial q^{\dagger}_{Ai}}{\partial\theta} > 0$, $\frac{\partial q^{\dagger}_{Bi}}{\partial\theta} < 0$ and $\frac{\partial q^{\dagger}_i}{\partial\theta} > 0$. Then, from last inequality, we have that the market output always increases with CSR effort. Furthermore, $\frac{\partial q^{\dagger}_{Ai}}{\partial\gamma} < 0$ and $\frac{\partial q^{\dagger}_{Bi}}{\partial\gamma} < 0$. Note also that the level of CSR decreases rival firm's profit while the products substitutability decreases all firms' profits. That

145 is, $\frac{\partial\pi^{\dagger}_A}{\partial\theta} \gtrless 0$ if $\theta \lessgtr \frac{2 + 3\gamma + \gamma^2}{11 + 12\gamma + 3\gamma^2}$ and $\frac{\partial\pi^{\dagger}_B}{\partial\theta} < 0$ whereas $\frac{\partial\pi^{\dagger}_A}{\partial\gamma} < 0$ and $\frac{\partial\pi^{\dagger}_B}{\partial\gamma} < 0$.

In the below, we examine a merger-then-CSR game and a CSR-then-merger game, respectively, depending on the two cases that FP firms will decide whether to merge or not.

4. Analysis of Merge-then-CSR Game: MC Case

In the second stage of this game, the owner of CSR-corp. chooses parameter θ to maximize its profits. We
150 need to consider both non-merger and merger cases, respectively, given in the output stage.

4.1. CSR-corp. competes with 2 independent FP firms

The owner of CSR-corp. chooses parameter θ to maximize (3), that is, according to $\frac{\partial\pi^{*}_A}{\partial\theta} = 0$, we obtain the following result:

Lemma 3. *In a merge-then-CSR game, when a CSR-corp. competes with 2 single plant FP firms:*

$$\theta^{\star MC} = \frac{2(1 + \gamma)}{11 + 5\gamma}; \qquad\qquad q^{\star MC}_{Ai} = \frac{2}{7 + 5\gamma}; \qquad\qquad q^{\star MC}_{Bi} = \frac{5 + 3\gamma}{21 + 22\gamma + 5\gamma^2}$$

$$\pi^{\star MC}_A = \frac{4}{21 + 22\gamma + 5\gamma^2}; \qquad \pi^{\star MC}_{Bi} = \frac{3(5 + 3\gamma)^2}{2\left(21 + 22\gamma + 5\gamma^2\right)^2} \quad i = 1,2$$

$$CS^{\star MC} = \frac{(1 + \gamma)(11 + 5\gamma)^2}{(21 + 22\gamma + 5\gamma^2)^2}; \qquad W^{\star MC} = \frac{280 + 409\gamma + 182\gamma^2 + 25\gamma^3}{(21 + 22\gamma + 5\gamma^2)^2}$$

Note from Lemma 3 that $\frac{d\theta^{\star MC}}{d\gamma} > 0$ and $\frac{d^2\theta^{\star MC}}{d\gamma^2} < 0$. It means that the CSR monotonically increases with
155 the degree of substitution, and this effect is weakened as the degree of substitution increases. This indicates that the aggressiveness of a CSR-corp. in production via a higher CSR is stronger under fierce competition with rival firms. Furthermore, $q^{\star MC}_{Ai} \geq q^{\star MC}_{Bi}$ for any $\gamma \in (0,1]$.

4.2. CSR-corp. competes with a merged FP-corp.

The owner of CSR-corp. chooses parameter θ to maximize (3), that is, according to $\frac{\partial\pi^{\dagger}_A}{\partial\theta} = 0$, we get:

Lemma 4. *In a merge-then-CSR game, when a CSR-corp. competes with a merged FP-corp:*

$$\theta^{\dagger MC} = \frac{2 + 3\gamma + \gamma^2}{11 + 12\gamma + 3\gamma^2}; \qquad q_{Ai}^{\dagger MC} = \frac{2 + \gamma}{7 + 8\gamma + 2\gamma^2}; \qquad q_{Bi}^{\dagger MC} = \frac{5 + 5\gamma + \gamma^2}{(3 + 2\gamma)(7 + 8\gamma + 2\gamma^2)}$$

$$\pi_A^{\dagger MC} = \frac{(2 + \gamma)^2}{(3 + 2\gamma)(7 + 8\gamma + 2\gamma^2)}; \qquad \pi_B^{\dagger MC} = \frac{\left(5 + 5\gamma + \gamma^2\right)^2}{(3 + 2\gamma)(7 + 8\gamma + 2\gamma^2)^2}$$

$$CS^{\dagger MC} = \frac{(1 + \gamma)\left(11 + 12\gamma + 3\gamma^2\right)^2}{\left((3 + 2\gamma)(7 + 8\gamma + 2\gamma^2)\right)^2}; \qquad W^{\dagger MC} = \frac{280 + 821\gamma + 940\gamma^2 + 524\gamma^3 + 142\gamma^4 + 15\gamma^5}{\left((3 + 2\gamma)(7 + 8\gamma + 2\gamma^2)\right)^2} \tag{10}$$

Note from Lemma 4 that $\frac{d\theta^{\dagger MC}}{d\gamma} > 0$ and $\frac{d^2\theta^{\dagger MC}}{d\gamma^2} < 0$. It also means that the CSR monotonically increases with the degree of substitution, and this effect is weakened as the degree of substitution increases. This also indicates that the aggressiveness of a CSR-corp. in production via a higher CSR is stronger under fierce competition with rival firms. Furthermore, $q_{Ai}^{\dagger MC} > q_{Bi}^{\dagger MC}$ for any $\gamma \in (0, 1]$.

4.3. FP firms' merger decisions in the first stage

Lemma 5. *Comparing the two cases in a merge-then-CSR game, we have the following results:*[10]

(i) $\theta^{\star MC} > \theta^{\dagger MC}$

(ii) $q_{A1}^{\star MC} + q_{A2}^{\star MC} < q_{A1}^{\dagger MC} + q_{A2}^{\dagger MC}$, $q_{B1}^{\star MC} + q_{B2}^{\star MC} > q_{B1}^{\dagger MC} + q_{B2}^{\dagger MC}$ *and* $Q^{\star MC} > Q^{\dagger MC}$

(iii) $CS^{\star MC} > CS^{\dagger MC}$

(iv) $W^{\star MC} > W^{\dagger MC}$

Lemma 5 in a merge-then-CSR game states that (i) the strategic level of CSR under independent rivals is higher than that under rival firms' merger. Thus, merger decision by FP firms reduce the aggressive production of CSR-corp. Then, it is shown that (ii) CSR-corp. can increase its output from rivals' merger whereas rival firms' outputs and industry outputs decrease after their merger. It represents that both its output-increasing effect of the CSR-corp. and market price-increasing effect from the reduction of total market outputs provide a beneficial effect to the profit profile of CSR-corp. Finally, both the level of consumer surplus and social welfare under independent rivals are higher than those under rival firms' merger.

Proposition 1. *In a merge-then-CSR game, products substitutability can increase CSR, but the strategic level of CSR under merger is lower than that without merger.*

In the first stage, we shall now analyze whether FP firms want to merge and set up a multiproduct FP-corporation. They will accept the merger if the profit that they will obtain in the multiproduct firm, $\frac{\pi_B^{\dagger MC}}{2}$, is greater than the profit obtained when competing as 2 single plant FP firms, $\pi_{Bi}^{\star MC}$ $i = 1, 2$. Let $\bar{\gamma}$ denote the value of parameter γ such that $\pi_{Bi}^{\star MC} = \frac{\pi_B^{\dagger MC}}{2}$.

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[10]In appendix A, we provide the proofs of lemmas and propositions.

Proposition 2. *In a merge-then-CSR game, merged FP firms could generate more profit than non-merged FP firms when CSR-corp. products are close substitutes. That is* $\pi_{Bi}^{\star MC} \underset{>}{\overset{\leq}{}} \frac{\pi_B^{\dagger MC}}{2}$ *if* $\gamma \underset{<}{\overset{\geq}{}} \bar{\gamma} \approx 0.883$.

Proposition 2 states that both FP firms will merge when products are close substitutes while they prefer to stay as single plant FP firms when products are highly differentiated. It complements the findings in the previous literature of merger paradox, such as Lommerud and Sørgard (1997), Heywood and McGinty (2008), Hsu and Wang (2010), Gelves (2014), and Nie (2018) who showed that mergers are more likely to be profitable when differentiation is high. It produces the following proposition under merge-then-CSR game:

Proposition 3. *In a merge-then-CSR game, CSR-corporation prefers to compete with a multiproduct FP-corporation rather than compete with 2 single plant FP firms. That is* $\pi_A^{\star MC} < \pi_A^{\dagger MC}$.

It implies that the necessary condition of rival firms' merger decision in Proposition 2, which is independent of the level of CSR, is sufficient to support the merger equilibrium of this game. In the absence of CSR, for example, Proposition 3 and Lemma 5(iv) support the previous findings in the literature that outsiders always benefit more when excluded from the merger, but welfare always decreases after the merger.

5. Analysis of CSR-then-Merge Game: CM Case

As in the MC case the equilibrium outputs of the third stage are the same. The second stage of this game consists on the FP firms decision whether to merge or not. This case implies that the CSR corp. can pre-commit to its level of CSR before the FP firms choose their merger decision. If both FP firms admit this commitment to CSR is credible, they will treat CSR as an exogenous variable.

5.1. FP firms' merger decisions in the second stage

From Lemma 1 and 2, they will accept the merger if the profit that they will obtain in the multiproduct firm, $\frac{\pi_B^\dagger}{2} = \frac{\pi_B^{\dagger CM}}{2}$, is greater than the profit obtained when competing as 2 single plant FP firms, $\pi_{Bi}^{\star} = \pi_{Bi}^{\star CM}$ $i = 1, 2$; where superscript CM stands for 'CSR-then-Merge'. Let $\bar{\theta}$ denote the value of parameter θ such that $\pi_{Bi}^{\star CM} = \frac{\pi_B^{\dagger CM}}{2}$:

$$\bar{\theta}(\gamma) = \frac{10 + 14\gamma + 5\gamma^2}{(1 + \gamma)(4 + 3\gamma)} - \sqrt{\frac{3\left(12 + 20\gamma + 11\gamma^2 + 2\gamma^3\right)}{(4 + 3\gamma)^2}}$$

Proposition 4. *In a CSR-then-merge game, merged FP firms could generate more profit than non-merged FP firms when the level of CSR is large. That is* $\pi_{Bi}^{\star CM} \underset{>}{\overset{\leq}{}} \frac{\pi_B^{\dagger CM}}{2}$ *if* $\theta \underset{<}{\overset{\geq}{}} \bar{\theta}(\gamma) \in [0, 1]$.

Thus, only when the CSR is high, merger decision is profitable to the FP firms. Note that if we compare the profits of the CSR-corp. in Lemma 1 and 2, we obtain that $\pi_A^{\star} < \pi_A^{\dagger}$ for any $\theta \in [0, 1]$ and $\gamma \in (0, 1)$. This means that CSR-corp. prefers to compete with a multiproduct FP-corp. rather than compete with 2 single plant FP firms as far as the level of CSR is the same.

10

5.2. CSR decision by a CSR-Corp. in the first stage

In the first stage, the owner of CSR-corporation can commit to its level of CSR, expecting the merger decisions in the second stage, which depends on parameter θ. Then, it chooses θ to maximize (3) in each case. From Figure 1, we have the following two cases:[11]

First, when the FP firms do not merge in the second stage, where $\theta \leq \bar{\theta}(\gamma)$, then CSR-corp. chooses $\theta^{\star CM} = \theta^{\star MC}$. Then, the profit that CSR-corp. obtains is $\pi_A^{\star CM} = \pi_A^{\star MC} = \frac{4}{21+22\gamma+5\gamma^2}$. However, when the FP firms merge in the second stage, where $\theta \geq \bar{\theta}(\gamma)$, then CSR-corp. chooses $\bar{\theta}$, that is, $\theta^{\dagger CM} = \bar{\theta}$. Then, the profit that CSR-corp. obtains is $\pi_A^{\dagger}(\bar{\theta}) = \pi_A^{\dagger CM}$ at equilibrium. It is noteworthy that the profit of CSR-corp. from CSR-then-merge case is lower than that obtained from merge-then-CSR case, i.e., $\pi_A^{\dagger CM} < \pi_A^{\dagger}(\theta^{\dagger MC}) = \pi_A^{\dagger MC}$.
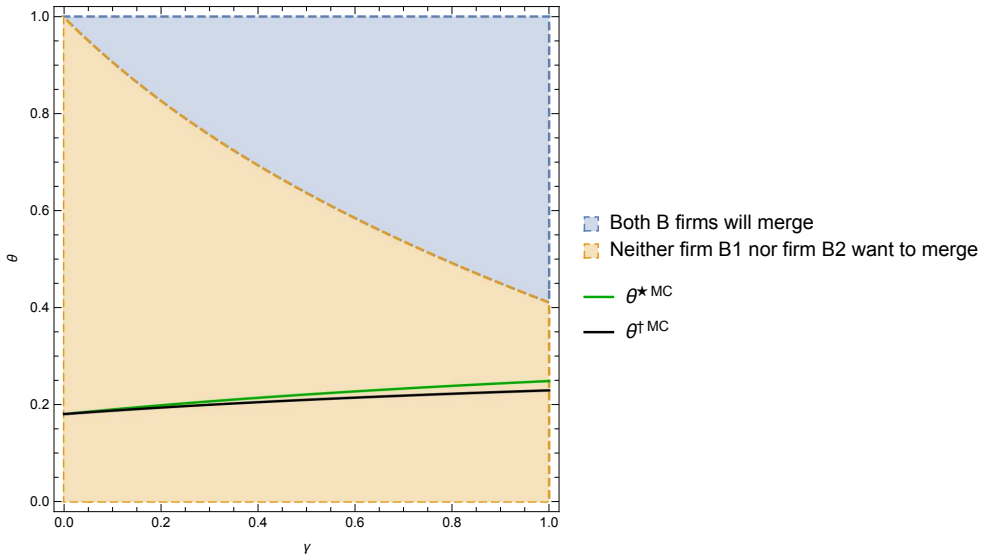

Figure 1: CSR and merger decisions

Lemma 6. *Comparing the two cases in a CSR-then-merge game, we have the following results:*

(i) $\theta^{\star CM} < \theta^{\dagger CM}$.

(ii) $q_{A1}^{\star CM} + q_{A2}^{\star CM} < q_{A1}^{\dagger CM} + q_{A2}^{\dagger CM}$, $q_{B1}^{\star CM} + q_{B2}^{\star CM} > q_{B1}^{\dagger CM} + q_{B2}^{\dagger CM}$ *and* $Q^{\star CM} \gtreqless Q^{\dagger CM}$ *if* $\gamma \lesseqgtr \gamma_1 \approx 0.852$, *which denotes the value of parameter* γ *such that* $Q^{\star CM} = Q^{\dagger}(\bar{\theta})$.

(iii) $CS^{\star CM} \gtreqless CS^{\dagger CM}$ *if* $\gamma \lesseqgtr \gamma_1$.

(iii) $W^{\star CM} > W^{\dagger CM}$.

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[11]In Figure 1, we can show that $\theta^{\star MC} < \bar{\theta}(\gamma)$ and from Lemma 1 we obtain that $\frac{\partial \pi_A^{\star}}{\partial \theta} \gtreqless 0$ if $\theta \lesseqgtr \frac{2(1+\gamma)}{11+5\gamma} = \theta^{\star MC}$. Also, we can show that $\theta^{\dagger MC} < \bar{\theta}(\gamma)$ and from Lemma 2 we obtain that $\frac{\partial \pi_A^{\dagger}}{\partial \theta} \gtreqless 0$ if $\theta \lesseqgtr \frac{2+3\gamma+\gamma^2}{11+12\gamma+3\gamma^2} = \theta^{\dagger MC}$.

Lemma 6 in a CSR-then-merge game states that (i) CSR-corp. will set a higher level of CSR for inducing rival firm's merger than that under independent rivals. Then, due to the aggressive production of the CSR-corp. two FP firms decide to merge and reduce their outputs in order to lessen competition. Note that the strategic level of CSR is decreasing in product differentiation. That is, when the products are highly substitutes and thus fierce competition emerges, two FP firms have a more incentive to merge and thus the CSR-corp. can set a lower level of CSR. Thus, (ii) CSR-corp. can increase its outputs from rivals' merger whereas rival firms' outputs decrease after their merger. However, the change of total outputs depends on the degree of product differentiation, i.e., (iii) consumer surplus under independent rivals is higher (lower) than that under rival firms' merger when the products are (less) close substitutes. However, (iv) social welfare under independent rivals is higher than that under rival firms' merger.

Proposition 5. *In a CSR-then-merge game, strategic CSR by a multiproduct corporation is higher than that in a merge-then-CSR game, but the level of CSR decreases in products substitutability.*

Now, let $\hat{\gamma}$ such that $\pi_A^{\star CM} = \pi_A^{\dagger CM}$. Then, $\pi_A^{\star CM} \lesseqgtr \pi_A^{\dagger CM}$ if $\gamma \gtreqless \hat{\gamma} \approx 0.573$.

Proposition 6. *In a CSR-then-merge game, CSR-corporation prefers to compete with a merged multiproduct FP-corporation if product are highly substitutes. Otherwise, CSR-corporation prefers to compete with 2 independent FP firms.*

It implies that the necessary condition of rival firms' merger decision in Proposition 4, which depends on the level of CSR, is not sufficient to support the merger equilibrium of this game. Only when the products are highly substitutes, merger decision is profitable to a CSR-corp. and social desirable.

6. Effects of the commitment to CSR

In this section, we proceed to investigate whether the CSR corp. will choose scenario (i) or (ii), i.e., whether it will move first or second in determining its strategic level of CSR. Then, we need to compare the profits of CSR corp. between merge-then-CSR case and CSR-then-merge case. We also further analyze the welfare effects of the commitment to strategic CSR in a scenario (ii).

On one hand, from Lemma 3, 4 and Proposition 2, we have that: FP firms will not merge if $\gamma < \bar{\gamma} \approx 0.883$ while they merge if $\gamma > \bar{\gamma}$. Then, CSR-corp. sets $\theta^{\star MC}$ if $\gamma < \bar{\gamma}$ while it sets $\theta^{\dagger MC}$ if $\gamma > \bar{\gamma}$, which will increase the profit of both CSR-corporation and FP-corporation. On the other hand, from Propositions 4 and 6, we have that: FP firms will not merge if $\theta < \bar{\theta}$ while they merge if $\theta > \bar{\theta}$. Furthermore, CSR-corp. will set $\theta^{\star CM}$ if $\gamma < \hat{\gamma} \approx 0.573$ while it sets $\bar{\theta}$ if $\gamma > \hat{\gamma}$.

Hence, we can summarize the following findings from Figure 2:

a) If $\gamma < \hat{\gamma}$, CSR-corp. might want FP firms to merge under scenario (i), but it is not in FP firms interests. Thus, CSR-corp. sets $\theta^{\star MC} = \theta^{\star CM}$. In that region, the strategic CSR level is increasing in the substitutability of the products.

b) If $\hat{\gamma} < \gamma < \bar{\gamma}$, CSR-corp. still wants FP firms to merge under scenario (i) but it is not in FP firms interests. However, in this region, CSR-corp. would commit to a higher level of CSR in advance and set $\bar{\theta}$ in scenario (ii). In that region, the strategic CSR level is very high but it is decreasing in the substitutability of the products.

c) If $\gamma > \bar{\gamma}$, CSR-corp. wants FP firms to merge in (i), which is in FP firms interests. Thus, CSR-corp. sets $\theta^{\dagger MC}$. In that region, the strategic CSR level is increasing in the substitutability of the products.
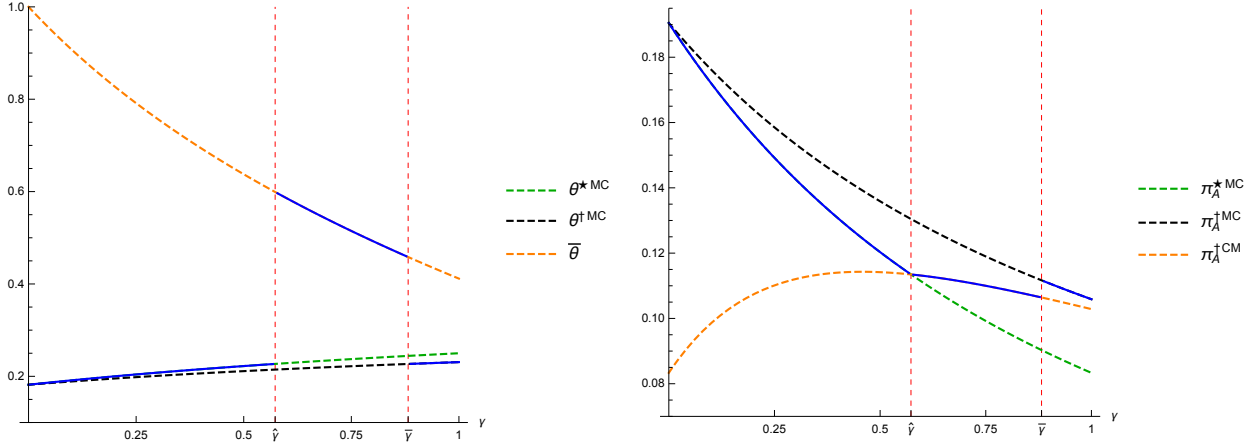

Figure 2: CSR and the profits of CSR-corporation

Therefore, knowing that CSR-corp. can not obtain higher profit that will come from rival's merger under a merge-then-CSR game when $\gamma < 0.883$, the CSR-corp. has the interest to commit to the strategic CSR level before rival firms' choose merger decision. In particular, when the products substitutability is intermediate, i.e., $\hat{\gamma} < \gamma < \bar{\gamma}$, it is profitable for the multiproduct corp. to commit to a higher level of CSR, $\bar{\theta}$, in a CSR-then-merge game, which is a higher level than $\theta^{\dagger MC}$. Note that merger decision by rival firms increases the profit of multiproduct corporation larger than that under the no-merger case.

Proposition 7. *When the products substitutability is intermediate, the multiproduct CSR-corp. will commit to a higher level of strategic CSR.*

Finally, we now compare the effects of commitment to a higher CSR on consumer surplus and social welfare.

Lemma 7. *Comparing the merger outcomes between CSR-then-merge and merge-then-CSR games, we have the following results:*

(i) $CS^{\dagger CM} > CS^{\dagger MC}$ for any $\gamma \in (0,1)$

(ii) Let γ_2 denote the value of γ such that $W^{\dagger MC} = W^{\dagger CM}$. Then, $W^{\dagger MC} \gtreqless W^{\dagger CM}$ if $\gamma \lesseqgtr \gamma_2 \approx 0.262$

13

It states that when FP firms merge, consumer surplus under a merge-then-CSR game is higher than that under a CSR-then-merge game while social welfare is only when products are highly differentiated. Otherwise, the social welfare under a CSR-then-merge game is higher.

Summing up the lemmas in 5, 6 and 7, we have the following results in Figure 3.

Proposition 8. *In a CSR-then-merge game, strategic commitment to a higher CSR by a multi-product corporation can increase not only consumer surplus (as long as products are not close substitutes) but social welfare.*

Therefore, the preemption of strategic CSR that induces rival firms to merge can be not only profitable to the multiproduct corp. but beneficial to the society. This indicates the pro-competitive effects of CSR under horizontal mergers.
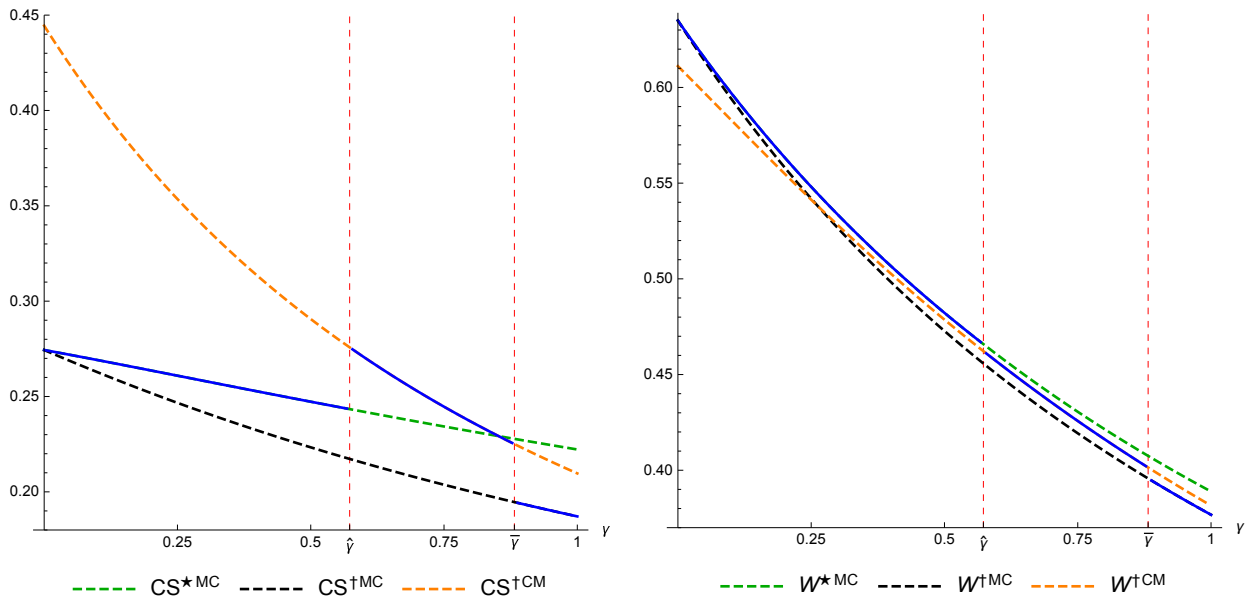

Figure 3: Consumer surplus and welfare

7. Concluding Remarks

We considered a multiproducts model in which a multiproduct CSR-corporation competes with a rival firm having single plant in each market, and analyzed the interplay between the strategic choice of CSR by a CSR-corporation and merger incentives of rival firms. We examined the ability of commitment to the level of CSR before or after rival firm's merger decisions in the different timings of CSR, and investigated the effects of preemptive CSR on the firm's profitability and social welfare.

We showed that CSR can induce multiproduct corporation to be aggressive to produce more outputs, which results in intra-firm substitution, but also induce single plant rival firm to merge and reduce outputs, which

14

results in inter-firm substitution. Thus, the substitutability of the products can play a key role to determine not only the profitability of a rival firm's merger decision but the strategic timing of CSR level of a CSR-corporation. We then showed that a merger might lead to a reduction in the total industry outputs and thus it is profitable to both merged firms even though CSR-initiatives increase a CSR-corp.'s production. However, a multiproduct corp. can commit to a higher CSR level as a strategic device to induce rival firm's merger and increase its profits especially when the substitutability is intermediate. Compared to the merger-then-CSR game, the preemption of strategic CSR can increase not only consumer surplus (as long as the products are not close substitutes) but social welfare. This finding highlights the pro-competitive effects of CSR under the horizontal mergers. That is. in the presence of higher CSR by a multiproduct firm, rival firms' merger in a Cournot competition can be beneficial to the firms and consumers as well.

There remain some limitations of our analysis. We considered an asymmetric case that only a multiproduct-corp. adopts CSR but rival firms are pure profit-maximizers. We can extend the analysis into an endogenous choice model where all firms decide whether to choose CSR or not.[12] We also adopted a managerial delegation model as an indirect device of strategic CSR-initiatives. In reality, however, the credibility of the commitment to CSR depends on the signaling effect of actual CSR activities. For example, if a multiproduct corp. should take an irreversible investment to commit to a higher CSR, analytic consideration on the cost effect of CSR investment might be an important factor for choosing a strategic device. Furthermore, if the commitment to (costless) CSR activities are not credible, the firm might want to invest in product R&D, which change the characteristics of the products or upgrade the quality of products, which can affect the products substitutability. These are future research directions for real practice in CSR activities.

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[12]Regarding endogenous choices of CSR, see Fanti and Buccella (2017), Planer-Friedrich and Sahm (2020) and Garcia et al. (2020).

15

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