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THE TRADE-OFF BETWEEN CORPORATE SOCIAL RESPONSIBILITY AND COMPETITIVE ADVANTAGE: A BIFORM GAME MODEL

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Abstract. This paper uses a biform game model to study firms' trade-offs between corporate social responsibility (CSR) and competitive advantage. We focus on the context in which a competitive advantage may lead to a non-profitable scenario. It is possible that the first mover's investment in competitive strength may deter itself from the market, which encourages firms' investment in CSR over competitive strength. As a result, in some circumstances, firms may actively choose a CSR strategy over a competitive strategy. Our results show that (1) technological characteristics, (2) industrial structure, and (3) institutional environments are factors that influence the rational equilibrium of our model and the balance between competitive advantage and CSR. The mechanism and boundary on how firms make trade-offs between CSR activities and competitive strength are exhibited by our model, which provides a framework for decision-making and adds new insights into the strategic balance between market and non-market strategies.

Keywords: CSR, competitive advantage, biform game.

JEL Classification: D21, M14, M21.

Introduction

Corporate social responsibility (CSR) has become a central concept in strategic management research beyond economic profits because of the significance of legitimacy among stakeholders, such as consumers, investors, and governments (Aguinis & Glavas, 2012; Mellahi et al., 2016; Tan, 2009). To gain greater performance, a focal firm must understand the relationship between CSR and competitive advantage and achieve strategic fit in a certain environment, leveraging both legitimacy and competitiveness (Aguilera et al., 2007; Porter

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& Kramer, 2006). Therefore, discussions about the complementarity and trade-off between CSR and competitive advantage have become important topics both in theory and practice (Margolis & Walsh, 2003; McWilliams & Siegel, 2011; Peloza, 2009). While important, these issues have not been well addressed in the literature (Du et al., 2011; Vilanova et al., 2009) because previous research focused on examining the relationship between CSR and firm performance or risk aversion (Burke & Logsdon, 1996; Galbreath, 2009; Kölbel et al., 2017; Shiu & Yang, 2017; Wang & Qian, 2011).

Following the logic of competitive advantage, a firm with a competitive advantage will capture more value from a specific market (Brandenburger & Stuart, 1996). CSR as a strategy focusing on non-profit-oriented goals seems not an apparent priority compared to competitive advantage. However, this is not always the case. Firms sometimes choose a CSR strategy over a competitive strategy, such as China Shenhua Energy Company Limited in 2018, invest more in CSR (e.g., donations) than in developing competitive strength (e.g., R&D) (China Shenhua Energy Company Limited, 2018). For a focal firm in certain environments, choosing to invest in CSR rather than competitive advantage may lead to better performance.

This study aims to extend our understanding of how the trade-off between CSR and competitive strength varies with the environment. Specifically, there is a possibility that investment in competitive strength may lead to a non-profitable scenario in certain environments. We examine how internal, industrial, and institutional environments impact the risk of the being deterred by improving competitive strength and when firms may choose CSR over competitive advantage. In addition to internal capabilities, industrial structure and institutional demands – such as barriers to entry, bargaining power, differentiation structure, and demands from different stakeholders – were incorporated into our model (Baron, 2001). As shown in the analysis below, firms may choose to invest in CSR over competitive strength in a highly regulated and fragmented market where the suppliers obtain high bargaining power and the technologies are mature.

It is difficult to measure the context and influential factors for firms addressing a trade-off between CSR and competitive advantage on a daily basis. Therefore, we constructed a formal model to analyze the strategic choice by applying first principles. The results of the model delineate the factors that impact the trade-off between CSR and competitive strength. The premise of this study is that the model connects macro- and micro-level analyses of the trade-off between competitive strategy and CSR strategy (Aguinis & Glavas, 2012). Thus, cross-level factors – including individual consumer expectation, informal institutional pressure, firms' capability, market structure – could be assimilated in our analyses (Du et al., 2011). In doing so, this study attempts to integrate institutions, industrial structure, corporate strategy, and consumer behavior in a biform game framework that better elicits the process of value creation and value capture from market strategies and non-market strategies.

1. Literature review

In a market economy, competition is a core principle; to ensure profitability, businesses must be competitive. However, pursuing economic profits sometimes dampens social performance, which may be contrary to stakeholders' expectations. As society has become more aware

of the CSR, its incorporation into firms' strategic portfolios is well accepted by scholars and practitioners (Aguilera et al., 2007; Carroll, 1999; Flammer et al., 2019; Flammer & Kacperczyk, 2019; Galbreath, 2009). Previous research has attempted to reconcile competitive strategies and CSR strategies from different perspectives (Maxfield, 2008). At the macro level, firms focusing on maximizing economic performance are good to long-term social welfare, according to the classical economic view (Allinson, 2004). Neoclassical economic theory attempted to justify CSR activities by arguing that CSR could contribute to, or at least no harm, profitability given market imperfections (Maxfield, 2008), but studies obtained inconclusive empirical results. The evolutionary economic paradigm connects CSR with innovation and social engagement (Husted, 2005). Institutional entrepreneurship and mimetic behavior under institutional convergence pressure also explain the prevalence of CSR strategies (Quairel-Lanoizelée, 2011). From the meso-level perspective, namely the industrial organization framework, CSR strategy is related to shared value with stakeholders to promote long-term sustainability (Bosch-Badia et al., 2013; Porter & Kramer, 2006).

From the micro-level perspective, some argue that CSR could contribute to firms' sustainable competitive advantage based on the resource-based view (Branco & Rodrigues, 2006; Falkenberg & Brunsæl, 2011; McWilliams & Siegel, 2001; Porter & Kramer, 2002, 2006). Considering CSR as an approach to avoid negative impacts, others believe that CSR could be a constraint for firms' competitive strength, especially for those operating in a highly competitive environment (Quairel-Lanoizelée, 2011). With the constraint of deployable resources, competitive strategies and CSR strategies may compete for firms' attention and resources (Lockett & Thompson, 2001). Thus, the trade-off between competitive strategy and CSR strategy is an important strategic decision (Vilanova et al., 2009). However, little attention has been paid to the constraints and dilemmas posed by the trade-off between CSR and competition strategy (Carroll, 1979; Donaldson & Preston, 1995; Quairel-Lanoizelée, 2011; Wood, 1991). Focusing on the payoff of CSR, previous research has focused on conceptual and theoretical advancements as well as empirical tests between CSR and firm performance or risk aversion (Burke & Logsdon, 1996; Galbreath, 2009; Kölbel et al., 2017; Shiu & Yang, 2017; Wang & Qian, 2011). Few studies have used a formal methodological model to study the trade-off between competition and CSR strategies. Our study is among the first studies to conduct a formal methodology method to analyze the balance between CSR activities and competitive strength (Aguinis & Glavas, 2012). Furthermore, micro- and macro-level perspectives are combined to study the trade-off between competitive strategy and CSR strategies; this combined approach also elucidates reasons for incorporating CRS into firms' strategic portfolio (Aguinis et al., 2011; Aguinis & Glavas, 2012).

2. Model

Our model is built on the framework of the biform game theory, which synthesizes noncooperative game theory and coalitional game theory (Brandenburger & Stuart, 2007). The biform game model is suitable for our research questions for the several reasons. First, integrating of CSR and competitive strength into a strategic framework requires consideration of competition and cooperation simultaneously, which is consistent with the principle of

biform game theory. Biform game theory provides a new perspective and a formal methodology for understanding firms' strategic choices because firms' strategies typically resort to both cooperative and competitive interactions (Feess & Thun, 2014). Second, to understand the effects of CSR and competitive strength on firm performance, the model illustrates the mechanisms of value creation and value appropriation, which provides new insights. Competitive interactions shape a competitive landscape, whereas cooperative interactions determine firms' value creation and value capture in an industrial chain or cooperative network (Ryall & Sorenson, 2007). Through a three-stage analysis using the biform game theory, we incorporate both the ideas of competition and cooperation. In our model, there is a firm labeled *A* for a first mover and potentially advantaged firm, which faces a rival, labeled *D* for a latecomer and potentially disadvantaged firm. A firm's competitive advantage is represented by the difference between the willingness to pay and the cost of a firm's product.

We assume that firm *A* and firm *D* successively make moves in the market. In the first stage of our model, firm *A* first decides the investment in its competitive strength. Then, in the second stage, firm *A* and firm *D* sequentially and non-cooperatively determine whether to invest in CSR activities, which provides its basic legitimacy for participation in the market. This is consistent with the idea that firms face an institutional pressure to invest in CSR activities when entering a market as a bottom line for operations in a social environment (Carroll & Shabana, 2010). This CSR investment can also be interpreted as a combination of CSR and market participation costs, which does not influence our model's insights. In the third stage, the firms and buyers cooperatively create and capture value together in a specific market structure. We assume that the product is indivisible during both the production and transaction stages, and that firms have no capacity constraints. Therefore, both firm *A* and firm *D* are capable of meeting total market demand at constant marginal costs of $c_D = c_A = \tau$ where the subscript denotes the firm's label. The basic willingness to pay for the product is ω, and the utility of firm *A*'s product for each buyer is increased by $2\theta\delta^2$ if firm *A* invests in competitive strength with the cost δ. θ indicates firm *A*'s capability of enhancing competitive advantage (i.e., R&D capacity). The market in our model is assumed to be horizontally differentiated. On the demand side, there are two buyers, labeled *a* and *d*. Each buyer represents an independent market segment. In the horizontally differentiated market, we assume that buyer *a* is willing to pay a higher price for firm *A*'s product than for firm *D*'s product. By contrast, buyer *d* is willing to pay a higher price for firm *D*'s product than for firm *A*'s. Each buyer only consumes one unit of the product. The buyers have a higher willingness to pay $w_{aA} = w_{dD} = \omega$ in their preferred market segment, and a lower willingness to pay $w_{aD} = w_{dA} = \omega - \lambda$ in their less preferred market segment. The potential transaction between firms and buyers is denoted in the subscript. In addition, we assume that $\omega > \lambda > 0$ and $\omega - \lambda > \tau$, which assures positive potential gains for agents in the market.

As stated above, in the second stage, firm *A* and firm *D* successively and non-cooperatively decide whether to participate in the market and invest in CSR activities that provide legitimacy for participation in the market. For both firms *A* and *D*, there is a fixed investment *p*. Furthermore, we assume that there are different expectations or requirements for firms' CSR investment level, which is consistent with the fact that the more successful or visible firms receive more attention and pressure to engage in CSR behaviors either because of buyers' heterogenous perceptions and expectations or because of governments' informal interven-

tions (Awaysheh et al., 2020; Porter & Kramer, 2006). This assumption also refers to the situation in which the first mover who connects a competitive strategy with CSR activities tries to construct an entry barrier for other firms, where the first mover often invests more in CSR for a demonstration effect (Planer-Friedrich & Sahm, 2020). Therefore, in our model, the CSR level for firm *A* is higher than that of firm *D* by $2\beta\theta\delta^{\frac{1}{2}}$, where $0 \le \beta < 1$ denotes the increase in CSR level performance for the firm with competitive advantage, which is firm *A*. Therefore, the CSR investments for firms *A* and *D* are $p + 2\beta\theta\delta^{\frac{1}{2}}$ and *p*, respectively, where p is a basic investment in CSR. For instance, consumers usually have higher expectations of leading firms in terms of environmental performance and charity activities, such as donation for disaster relief (Muller & Kräussl, 2011). However, the additional investments in CSR should not be greater than those in competitive advantage. Otherwise, there will be insufficient motivation to invest in competitive strength in the first place. In this stage, firm *A* decides whether to pay the CSR costs first, and then firm *D* makes the decision in turn. The decision-making sequence gives firm *A* more options because it can expect the possible results of the game and behave pre-emptively (Von Stackelberg, 1934). This setting of the sequence is suitable for our research question because firm *A* is our focal firm (Makadok & Ross, 2018).

In the third stage of our model, the firms and buyers form transactions based on their supplies and demands. They create and capture values in a coalition under a specific market structure. A possible coalition structure is formed when no subset of the agents can perform better by forming an alternative coalition. A firm's added value to a coalition is the value that a focal firm can create over any other alternative firm in the market (Brandenburger & Stuart, 2007; Ross, 2018). In a coalition, each agent captures a part of its added value. We set a parameter $\alpha \in (0,1]$ which indicates the bargaining power of firms over buyers. The firm *i's* profit under each scenario *s* is π_i^s.

In our model, there are two disjointed sets of players, where at least one player from each set could obtain a positive value. Furthermore, since neither capacity constraints nor economies/diseconomies of scale are modeled in our analysis, positive and negative externalities should not be a concern. Therefore, the core exists which means that firms obtain a part of their added value and the remainder is given to buyers (Chatain & Zemsky, 2007; Stuart, 2004). In addition, bargaining complementarities do not exist in our model, suggesting that the added value for any agent will not increase due to the participation of other agents. Thus, the parameter α can be seen as a consistent measure of bargaining power when other parameters are controlled (Chatain & Zemsky, 2007).

3. Equilibrium analysis

In this section, we analyze our model using backwards induction. First, focusing on the third stage, we present how coalitions are formed and the how value is captured in the coalitional game. Second, we derive firms' CSR investments and participation decisions based on the results of the first step. In this step, we take firm *A*'s investment in competitive strength as a given parameter. Finally, we solve firm *A*'s decision of investment on competitive strength using information of participation decisions in the previous step. During the three steps of our analysis, we will provide two propositions.

Coalitional game step. In the third stage of our model, the economic value of each player is determined based on the characteristic function of a specific coalition structure. The value is created through transactions between firms and buyers. Hence, in a coalition with only firms or buyers, there will be no value created. The value of a coalition equals to the difference in total willingness to pay and total costs during available transactions. In any possible coalition, a buyer needs to choose a firm with a higher willingness to pay for a product transaction. The value created by every possible coalition is presented in Table 1.

Next, based on the results in Table 1, we obtain the minimum and maximum amounts of value that each participant can appropriate in a coalition. The principle is that the maximum value a player can get in the coalition equals to its marginal product or added value (MacDonald & Ryall, 2004). Because the properties of our model conform to constant marginal utility, constant marginal cost, no product complementarities, and no network economies, the added value of any firm can be computed by the added value in all transactions with the buyers. Each participant's minimum appropriation is determined by the stability requirement, which implies that each participant will at least appropriate the value they could create by breaking away on their own. (MacDonald & Ryall, 2004). The minimum and maximum appropriations for each participant are delineated in Table 2 as $\pi_p^{\min(s)}$ and $\pi_p^{\max(s)}$.

Table 1. Value created by all possible coalitions

Possible coalitions	Value
Ø	$v_{\varnothing} = v_a = v_d = v_A = v_D = 0$
ad or *AD*	$v_{ad} = v_{AD} = 0$
aA	$v_{aA} = w_{aA} - c_A = \omega - \left(\tau - 2\theta\delta^{\frac{1}{2}}\right)$
dA	$v_{dA} = w_{dA} - c_A = (\omega - \lambda) - \left(\tau - 2\theta\delta^{\frac{1}{2}}\right)$
aD	$v_{aD} = w_{aD} - c_D = (\omega - \lambda) - \tau$
dD	$v_{dD} = w_{dD} - c_D = \omega - \tau$
adA	$v_{adA} = v_{aA} + v_{dA} = 2(\omega - \tau) + 4\theta\delta^{\frac{1}{2}} - \lambda$
adD	$v_{adD} = v_{aD} + v_{dD} = 2(\omega - \tau) - \lambda$
aAD	$v_{aAD} = \max\{v_{aA}, v_{aD}\} = \omega - \tau + 2\theta\delta^{\frac{1}{2}}$
dAD	$v_{dAD} = \max\{v_{dA}, v_{dD}\} = \omega - \tau + \max\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\}$
adAD	$v_{adAD} = v_{aAD} + v_{dAD} = 2(\omega - \tau) + 2\theta\delta^{\frac{1}{2}} + \max\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\}$

Furthermore, we derive the firms' anticipated net profits in the scenarios using the amounts of minimum and maximum appropriations. If a firm is not a participant in the market, its anticipated net profit is zero. If a firm participates in the market, its net profit is calculated as $\pi_p^s = \alpha\pi_p^{\max(s)} + (1-\alpha)\pi_p^{\min(s)} - \kappa$. The anticipated net profits are reported in Table 2.

We imposed several parameter restrictions to increase the validity of our model. The following condition ensures that the market is profitable, so that at least one firm will enter in the market: $2(\omega-\tau)-\lambda > p/\alpha$. We also assume $\lambda > p/\alpha$, so that $\pi_D^{AD} > 0$. This inequality ensures that firm *D* can survive in competition with firm *A* if firm *A* does not invest in competitive strength when $\delta = 0$.

CSR decisions. In the second stage of our model, firms subsequently make the CSR and market participation decisions. We solve for the two firms' optimal choices about whether to invest in CSR activities and participate in the market, assuming that each firm is non-cooperatively maximizing its own respective anticipated net profit function from the previous section, as shown in the last column of Table 2. Figure 1 shows the decision tree of participation decision. The decision tree was also derived using backward induction. We first analyze the decision of firm *D*, with firm *A* already making its CSR decision. If firm *A* does not participate, then firm *D* will participate under any circumstances. If firm *A* participates, then firm *D* will participate only if $\lambda - 2\theta\delta^{\frac{1}{2}} \geq \frac{p}{\alpha}$. Then, firm *A* will maximize its profit, knowing that firm *D* follows the decision rules above. In Figure 1, the conditions for all four possible outcomes are presented.

In the right column of Figure 1, it is evident that the relative CSR requirement parameter $\sigma = \frac{p}{\alpha}$, CSR surplus for advantage firm $\frac{\beta}{\alpha}$, and the effectiveness of investment in competitive strength $2\theta\delta^{\frac{1}{2}}$ determine the firms' participation condition in the market. Taking δ as a given value, the results combining the second and third stages of the model are presented. We state the results and propose that firm *A*'s equilibrium profits are as follows:

Proposition 1: Firm A's equilibrium profit (π_A), *with conditions in terms of* $\frac{p}{\alpha}$ *and* $2\theta\delta^{\frac{1}{2}}$, *is as follows in Table 3.*

With the restriction of $\lambda > \frac{p}{\alpha}$ in hand, the conditions under which different scenarios occur can be determined, assuming that p, α, β are fixed parameters. Turning to the influence of competitive strength on the equilibrium of the model, a sufficiently low competitive strength that meets $\min\left\{\lambda - 2\theta\delta^{\frac{1}{2}}, \lambda - 2\left(\frac{\beta}{\alpha}-1\right)\theta\delta^{\frac{1}{2}}\right\} > \frac{p}{\alpha}$ will allow all firms *A* and *D* to participate in the market, so scenario AD occurs. Scenario A0 occurs when $\left[2(\omega-\tau)-\lambda+\left(2-\frac{\beta}{\alpha}\right)2\theta\delta^{\frac{1}{2}}\right] > \frac{p}{\alpha} > \left[\lambda - 2\theta\delta^{\frac{1}{2}}\right]$ holds, which suggests that the competition is high enough to deter firm *D* from the market. Scenario 0D occurs when $\lambda - 2\theta\delta^{\frac{1}{2}} > \frac{p}{\alpha} > \lambda - \left(\frac{\beta}{\alpha}-1\right)2\theta\delta^{\frac{1}{2}}$ or $\frac{p}{\alpha} > \left[2(\omega-\tau)-\lambda+\left(2-\frac{\beta}{\alpha}\right)2\theta\delta^{\frac{1}{2}}\right]$ holds, which means that consumers have high CSR expectations for firm *A*; as a result, firm *A*'s profit from market competition is decreased or the competition is too high for firm *A* to enter the market at all.

Table 2. Minimum, maximum, and anticipated payoffs in second-stage game under various market participation scenarios

Scenario	Participating Players' Minimum Appropriation	Participating Players' Maximum Appropriation	All Firms' Anticipated Net Profits After Participation Costs and CSR investments
Scenario 00: No firms participate in market	$\pi_a^{\min(00)} = v_a^{00} = 0;$ $\pi_d^{\min(00)} = v_d^{00} = 0;$	$\pi_a^{\max(00)} = v_{ad}^{00} - v_d^{00} = 0;$ $\pi_d^{\max(00)} = v_{ad}^{00} - v_a^{00} = 0$	$\pi_A^{00} = 0;$ $\pi_D^{00} = 0$
Scenario 0*D*: Only *D* participates in market	$\pi_a^{\min(0D)} = v_a^{0D} = 0;$ $\pi_d^{\min(0D)} = v_d^{0D} = 0;$ $\pi_D^{\min(0D)} = v_D^{0D} = 0$	$\pi_a^{\max(0D)} = v_{adD}^{0D} - v_{dD}^{0D} = (\omega - \lambda) - \tau;$ $\pi_d^{\max(0D)} = v_{adD}^{0D} - v_{aD}^{0D} = \omega - \tau;$ $\pi_D^{\max(0D)} = v_{adD}^{0D} - v_{ad}^{0D} = 2(\omega - \tau) - \lambda$	$\pi_A^{0D} = 0;$ $\pi_D^{0D} = \alpha\left[2(\omega - \tau) - \lambda\right] - p$
Scenario *A*0: Only A participates in market	$\pi_a^{\min(A0)} = v_a^{A0} = 0;$ $\pi_d^{\min(A0)} = v_d^{A0} = 0;$ $\pi_A^{\min(A0)} = v_A^{A0} = 0$	$\pi_a^{\max(A0)} = v_{adA}^{A0} - v_{dA}^{A0} = \omega - \left(\tau - 2\theta\delta^{\frac{1}{2}}\right);$ $\pi_d^{\max(A0)} = v_{adA}^{A0} - v_{aA}^{A0} = (\omega - \lambda) - \left(\tau - 2\theta\delta^{\frac{1}{2}}\right);$ $\pi_A^{\max(A0)} = v_{adA}^{A0} - v_{ad}^{A0} = 2\left(\omega - \tau + 2\theta\delta^{\frac{1}{2}}\right) - \lambda$	$\pi_A^{A0} = \alpha\left[2\left(\omega - \tau + 2\theta\delta^{\frac{1}{2}}\right) - \lambda\right] - p - 2\beta\theta\delta^{\frac{1}{2}};$ $\pi_D^{A0} = 0$
Scenario *AD*: A and *D* participate in market	$\pi_a^{\min(AD)} = \min\left\{v_{aA}^{AD}, v_{aD}^{AD}\right\} = \omega - \lambda - \tau;$ $\pi_d^{\min(AD)} = \min\left\{v_{dA}^{AD}, v_{dD}^{AD}\right\} = (\omega - \tau) + \min\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\};$ $\pi_A^{\min(AD)} = v_A^{AD0} = 0;$ $\pi_D^{\min(AD)} = v_D^{AD} = 0$	$\pi_a^{\max(AD)} = v_{adAD}^{AD} - v_{dAD}^{AD} = (\omega - \tau) + 2\theta\delta^{\frac{1}{2}};$ $\pi_d^{\max(AD)} = v_{adAD}^{AD} - v_{aAD}^{AD} = \omega - \tau + \max\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\};$ $\pi_A^{\max(AD)} = v_{adAD}^{AD} - v_{adD}^{AD} = 2\theta\delta^{\frac{1}{2}} + \lambda + \max\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\};$ $\pi_D^{\max(AD)} = v_{adAD}^{AD} - v_{adA}^{AD} = \lambda - 2\theta\delta^{\frac{1}{2}} + \max\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\}$	$\pi_A^{AD} = \alpha\left[2\theta\delta^{\frac{1}{2}} + \lambda + \max\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\}\right] - 2\beta\theta\delta^{\frac{1}{2}} - p;$ $\pi_D^{AD} = \alpha\left[\lambda - 2\theta\delta^{\frac{1}{2}} + \max\left\{2\theta\delta^{\frac{1}{2}} - \lambda, 0\right\}\right] - p$

Table 3. Firm *A*'s equilibrium profit under different conditions

Scenario	Firm A's profit (π_A)	Conditions in terms of $\frac{p}{\alpha}$
AD	$\alpha\left(2\theta\delta^{\frac{1}{2}}+\lambda\right)-2\beta\theta\delta^{\frac{1}{2}}-p$	$\min\left\{\lambda-2\theta\delta^{\frac{1}{2}},\lambda-2\left(\frac{\beta}{\alpha}-1\right)\theta\delta^{\frac{1}{2}}\right\}>\frac{p}{\alpha}$
A0	$\alpha\left[2\left(\omega-\tau+2\theta\delta^{\frac{1}{2}}\right)-\lambda\right]-2\beta\theta\delta^{\frac{1}{2}}-p$	$\left[2(\omega-\tau)-\lambda+\left(2-\frac{\beta}{\alpha}\right)2\theta\delta^{\frac{1}{2}}\right]>\frac{p}{\alpha}>\left[\lambda-2\theta\delta^{\frac{1}{2}}\right]$
0D	0	$\left\{\lambda-2\theta\delta^{\frac{1}{2}}>\frac{p}{\alpha}>\lambda-\left(\frac{\beta}{\alpha}-1\right)2\theta\delta^{\frac{1}{2}}\right\}\cup$ $\left\{\frac{p}{\alpha}>\left[2(\omega-\tau)-\lambda+\left(2-\frac{\beta}{\alpha}\right)2\theta\delta^{\frac{1}{2}}\right]\right\}$
00	0	Otherwise

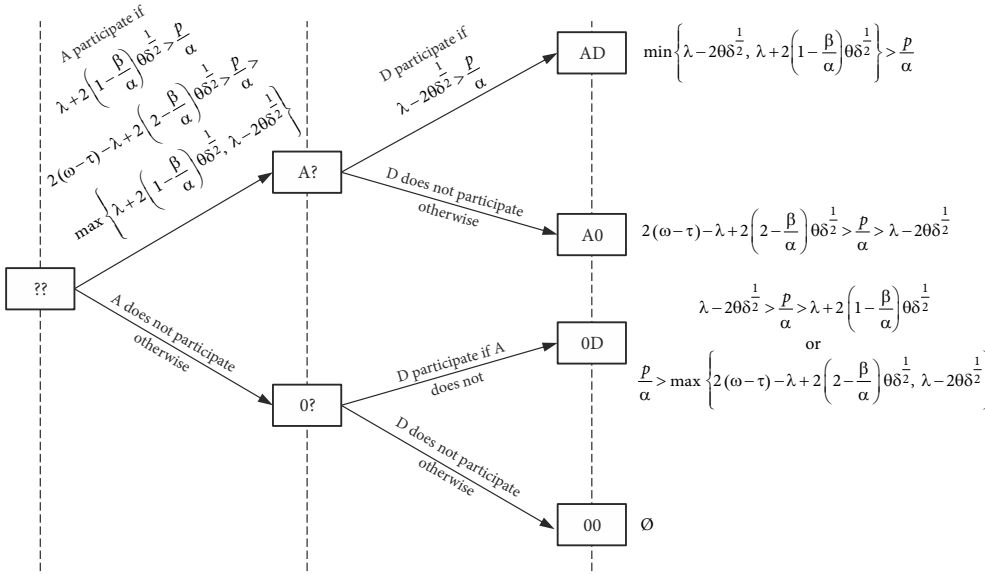

Figure 1. Decision tree for firms' sequential participation decisions

For firm *A*, the best outcome is to be the monopolist in the market in scenario A0. According to the results in Proposition 1, A0 occurs when $\lambda-\frac{p}{\alpha}-2\theta\delta^{\frac{1}{2}}$ turns from positive to negative when firm *D* expects that there is no chance of survival when competing against firm *A*. Thus, we propose the following:

Corollary 1.1: Firm A could monopolize the market if λ *decreases,* δ *increases, or* $\frac{p}{\alpha}$ *increases to a level where* $2\theta\delta^{\frac{1}{2}}>\lambda-\frac{p}{\alpha}$ *, if* $\frac{\beta}{\alpha}<\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}}+3$*. If not, scenario A0 never happens.*

The implication of Corollary 1.1 is that firm *A* may dominate the market in the following ways: a decrease in market friction, an increase in its competitive strength over competitors, or an increase in CSR requirement in a certain institutional environment. We conclude these conditions by proposing another corollary:

Corollary 1.2: The probability of a monopoly for firm A is determined by the value of $\frac{\beta}{\alpha}$. *If* $2 > \frac{\beta}{\alpha}$, *A0 happens when* $2\theta\delta^{\frac{1}{2}} > \lambda - \frac{p}{\alpha}$. *If* $\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}} + 3 > \frac{\beta}{\alpha} > 2, A\ 0$ *happens when* $\frac{2\left(\omega-\tau\right)-\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-2} > 2\theta\delta^{\frac{1}{2}} > \lambda - \frac{p}{\alpha}$. *A0 never happens if* $\frac{\beta}{\alpha} > \frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}} + 3$.

Firm *A*'s investment in its competitive strength. Based on firms' participation decisions, we can solve firm *A*'s local optimal investment in competitive advantage in the first stage. Then, we separately derive the globally optimal solution in the first stage with different conditions in terms of $\frac{\beta}{\alpha}$. Based on the results of the participation decision and local profit in the second and the third stages, the change in firm *A*'s profit graphically influenced by $2\theta\delta^{\frac{1}{2}}$ is illustrated in Figures 2, 3, and 4 based on different conditions of $\frac{\beta}{\alpha}$. The net profit of firm *A* is reported in Table 4. Combining the local optimal results and firm *A*'s global net profit, the global optimal investment in competitive strength is obtained.

Table 4. Firm *A*'s net profit function

Outcome	Firm A's Expected Net Profit	Conditions
AD	$2\theta\delta^{\frac{1}{2}} + \lambda - \frac{2\beta\theta\delta^{\frac{1}{2}} + p}{\alpha} - \delta$	$\min\left\{\lambda - \frac{p}{\alpha}, \frac{\lambda - \frac{p}{\alpha}}{\frac{\beta}{\alpha} - 1}\right\} > 2\theta\delta^{\frac{1}{2}}$
A0	$2\left(\omega - \tau + 2\theta\delta^{\frac{1}{2}}\right) - \lambda - \frac{2\beta\theta\delta^{\frac{1}{2}} + p}{\alpha} - \delta$	$\frac{2\left(\omega-\tau\right)-\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-2} > 2\theta\delta^{\frac{1}{2}} > \lambda - \frac{p}{\alpha}$
0D	$-\delta$	$\lambda - \frac{p}{\alpha} > 2\theta\delta^{\frac{1}{2}} > \frac{\lambda - \frac{p}{\alpha}}{\frac{\beta}{\alpha} - 1}$ or $2\theta\delta^{\frac{1}{2}} > \frac{2\left(\omega-\tau\right)-\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-2}$
00	0	Otherwise

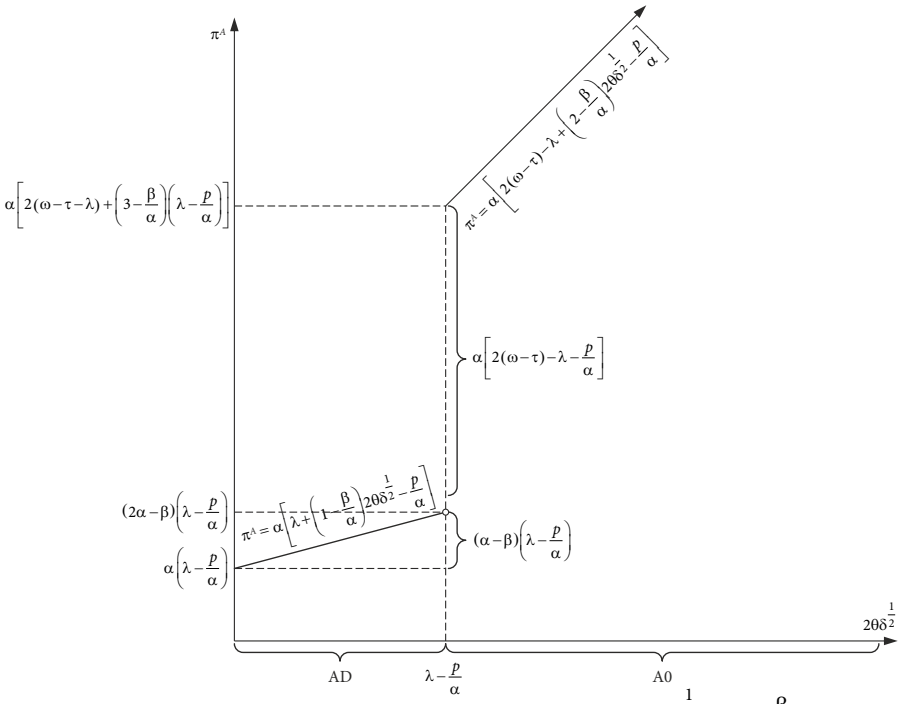

Figure 2. Firm *A*'s net profit (π_A) as a function of $2\theta\delta^{\frac{1}{2}}$ when $\frac{\beta}{\alpha}<2$

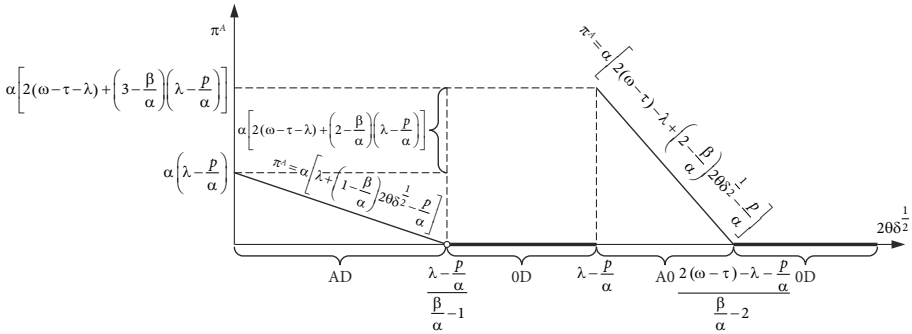

Figure 3. Firm *A*'s net profit (π_A) as a function of $2\theta\delta^{\frac{1}{2}}$ when $\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}}+3>\frac{\beta}{\alpha}>2$

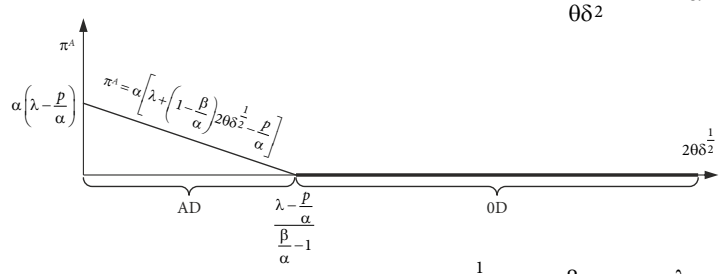

Figure 4. Firm *A*'s net profit (π_A) as a function of $2\theta\delta^{\frac{1}{2}}$ when $\frac{\beta}{\alpha}>\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}}+3$

Note: Figure 2, Figure 3, and Figure 4 are not drawn to the same scale.

As shown in the Figure 2, if $\frac{\beta}{\alpha}<2$, firm *A*'s profit grows $1-\frac{\beta}{\alpha}$ as $2\theta\delta^{\frac{1}{2}}$ increases by one unit. When $2\theta\delta^{\frac{1}{2}}$ exceeds $\lambda-\frac{p}{\alpha}$, firm *A* overpowers firm *D*, where firm *D*'s has no motivation to pay the CSR legitimacy cost of *p*. Thus, firm *D* will not pay the CSR legitimacy cost or participate in the market. The scenario changes from AD to A0. Firm *A*'s net profit begins to rise discontinuously from $(2\alpha-\beta)\left(\lambda-\frac{p}{\alpha}\right)$ to $\alpha\left[2(\omega-\tau-\lambda)+\left(3-\frac{\beta}{\alpha}\right)\left(\lambda-\frac{p}{\alpha}\right)\right]$, an increase in size $\alpha\left[2(\omega-\tau)-\lambda-\frac{p}{\alpha})\right]$. Then, firm *A*'s net profit grows at a rate of $2-\frac{\beta}{\alpha}$ as $2\theta\delta^{\frac{1}{2}}$ increases by one unit.

In Figure 3, $2<\frac{\beta}{\alpha}<\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}}+3$, both firms *A* and *D* pay the legitimacy cost and participate in the market if $2\theta\delta^{\frac{1}{2}}<\frac{\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-1}$. In this scenario AD, firm *A*'s profit decreases $1-\frac{\beta}{\alpha}$ with a one-unit growth of $2\theta\delta^{\frac{1}{2}}$. When $\lambda-\frac{p}{\alpha}>2\theta\delta^{\frac{1}{2}}>\frac{\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-1}$, the high CSR heterogeneity level and relatively low competitive advantage deter firm *A* from the market. In this case, firm *A* is deterred from the market by itself when choosing to invest in its competitive advantage. Then, as $2\theta\delta^{\frac{1}{2}}$ rises further, if $\frac{2(\omega-\tau)-\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-2}>2\theta\delta^{\frac{1}{2}}>\lambda-\frac{p}{\alpha}$ holds, firm *D* will be deterred from the market as firm *A*'s competitive advantage overpowers CSR costs and firm *D*'s horizontal market friction is not high enough to retain its customers. Firm *A*'s net profit increases discontinuously at the point $\lambda-\frac{p}{\alpha}$ from 0 to $\alpha\left[2(\omega-\tau-\lambda)+\left(3-\frac{\beta}{\alpha}\right)\left(\lambda-\frac{p}{\alpha}\right)\right]$, and firm *A*'s profit diminishes $\frac{\beta}{\alpha}-2$ with a one-unit growth of $2\theta\delta^{\frac{1}{2}}$. Finally, if $2\theta\delta^{\frac{1}{2}}>\frac{2(\omega-\tau)-\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-2}$, firm *A* will not participate in the market because of the high CSR cost, where firm *D* could join the market, as it finds that firm *A* has no interest in the participating in the market. Firm *A*'s net profit is zero in this case.

In Figure 4, $\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}}+3<\frac{\beta}{\alpha}$, both firms *A* and *D* pay the CSR cost and participate in the market if $2\theta\delta^{\frac{1}{2}}<\frac{\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-1}$. In this scenario AD, firm *A*'s profit decreases $1-\frac{\beta}{\alpha}$ with a one-unit growth of $2\theta\delta^{\frac{1}{2}}$. When $2\theta\delta^{\frac{1}{2}}>\frac{\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-1}$, the high CSR heterogeneity level and relatively low

competitive advantage deter firm *A* from the market. Firm *A* can be deterred by itself from the market when choosing to invest in its competitive advantage.

From the analysis of each possible scenario (AD, A0, 0D, 00) and the results of global net profit under different scenarios, we compare the values at every segment and obtain the global optimal investment. The global optimal investment of firm *A* is stated as a formal proposition.

Proposition 2: Firm A's optimal investment δ, *with conditions in terms of* $2\theta\delta^{\frac{1}{2}}$, *is as follows in Table 5.*

The overall global optimum is illustrated as follows: If $0<\frac{\beta}{\alpha}<1$, when firm *A* has a high capability of developing competitive strength $\theta^2>\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(1-\frac{\beta}{\alpha}\right)}$, then the global optimal solution for δ will be $\left(2-\frac{\beta}{\alpha}\right)^2\theta^2$ where firm *A* monopolizes the market. When $\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(1-\frac{\beta}{\alpha}\right)}>\theta^2>\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(2-\frac{\beta}{\alpha}\right)}$, the global optimal solution for δ will still be $\left(2-\frac{\beta}{\alpha}\right)^2\theta^2$ where firm *A* monopolizes the market. If $\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(2-\frac{\beta}{\alpha}\right)}>\theta^2$, the global optimal solution for δ is $\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$ where firm *A* monopolizes the market. Thus, we have:

Corollary 2.1: If $0<\frac{\beta}{\alpha}<1$, *a first mover with a high capability to develop competitive strength has an optimal strategy of high-level investment* $\left(2-\frac{\beta}{\alpha}\right)^2\theta^2$ *in competitive strength and deters firm D from the market. A first mover with a low capability of developing competitive strength would deter latecomers from the market through low-level investment* $\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$.

If $2>\frac{\beta}{\alpha}>1$, when firm *A* has a high capability of developing competitive strength $\theta^2>\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(2-\frac{\beta}{\alpha}\right)}$, then the global optimal solution for δ will be $\left(2-\frac{\beta}{\alpha}\right)^2\theta^2$ where firm *A* monopolizes the market. When $\theta^2<\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(2-\frac{\beta}{\alpha}\right)}$, the global optimal solution for δ will still be $\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$ where firm *A* also monopolizes the market. Thus, we have:

Table 5. Global optimal of firm A's investment on competitive strength for different conditions as a function of $2\theta\delta^{\frac{1}{2}}$

Outcome	Global optimal	If $\frac{\beta}{\alpha}<1$	If $1<\frac{\beta}{\alpha}<2$	If $2<\frac{\beta}{\alpha}<\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}}+3$	If $\frac{\beta}{\alpha}>\frac{\omega-\tau-\lambda}{\theta\delta^{\frac{1}{2}}}+3$
AD	$\min\left[\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2, \left(1-\frac{\beta}{\alpha}\right)^2\theta^2\right]$	$\lambda-\frac{p}{\alpha}>2\theta\delta^{\frac{1}{2}}$			
A0	$\max\left[\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2, \left(2-\frac{\beta}{\alpha}\right)^2\theta^2\right]$	$2\theta\delta^{\frac{1}{2}}\geq\lambda-\frac{p}{\alpha}$			
AD	0		$\lambda-\frac{p}{\alpha}>2\theta\delta^{\frac{1}{2}}$		
A0	$\max\left[\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2, \left(2-\frac{\beta}{\alpha}\right)^2\theta^2\right]$		$2\theta\delta^{\frac{1}{2}}>\lambda-\frac{p}{\alpha}$		
AD	0			$\frac{\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-1}>2\theta\delta^{\frac{1}{2}}$	
A0	$\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$			$\frac{2(\omega-\tau)-\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-2}>$ $2\theta\delta^{\frac{1}{2}}>\lambda-\frac{p}{\alpha}$	
AD	0				$\frac{\lambda-\frac{p}{\alpha}}{\frac{\beta}{\alpha}-1}>2\theta\delta^{\frac{1}{2}}$

Corollary 2.2: If $2 > \frac{\beta}{\alpha} > 1$, *a first mover with a high capability to develop competitive strength has an optimal strategy of high-level investment* $\left(2-\frac{\beta}{\alpha}\right)^2\theta^2$ *in competitive strength and deters firm D from the market. A first mover with a low capability of developing competitive strength will deter latecomers from the market by low-level investment* $\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$.

If $\frac{\omega-\tau-\lambda}{\lambda-\frac{p}{\alpha}}+3>\frac{\beta}{\alpha}>2$, then the global optimal solution for δ will be $\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$ where firm *A* monopolizes the market. Thus, we have:

Corollary 2.3: If $\frac{\omega-\tau-\lambda}{\lambda-\frac{p}{\alpha}}+3>\frac{\beta}{\alpha}>2$, *firm A's global optimal solution for* δ *will be* $\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$ *where firm A monopolizes the market.*

If $\frac{\beta}{\alpha}>\frac{\omega-\tau-\lambda}{\lambda-\frac{p}{\alpha}}+3$, then the global optimal solution for δ will be 0 where firm *A* does not invest in competitive strength and both firms will enter the market with basic CSR costs. Thus, we have:

Corollary 2.4: If $\frac{\beta}{\alpha}>\frac{\omega-\tau-\lambda}{\lambda-\frac{p}{\alpha}}+3$, *firm A's global optimal solution for* δ *will be 0 where firm A has no advantage over firm D and both firms enter the market with the basic CSR costs.*

Proposition 2 and the corollaries considering the global optimal investment of competitive strength suggest that there are two thresholds of heterogenous CSR expectation for advantaged firm β, which impact the first mover's decision. If it is below the threshold 2α, the first mover, firm *A*, can always adjust investment in competitive strength and deter firm *D* from the market. Scenario 0D cannot arise in a rational equilibrium. In this case, firm *A* with high capability, which meets $\theta^2>\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(2-\frac{\beta}{\alpha}\right)}$, will invest $\left(2-\frac{\beta}{\alpha}\right)^2\theta^2$ in competitive strength to deter latecomers from the market. Firm *A* will move to the right range of the A0 region as its capability rises. Firm *A* with low capability, which meets $\theta^2<\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\left(2-\frac{\beta}{\alpha}\right)}$, will invest $\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$ in competitive strength to deter the latecomer from the market. Firm *A* stays at the left end of the A0 region. If β ranges from 2α to $\alpha\left(\frac{\omega-\tau-\lambda}{\lambda-\frac{p}{\alpha}}+3\right)$, firm *A* will invest

$\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2$ in competitive strength and deter firm *D*, where firm *A* stays at the left endpoint of A0 region. If β is above the threshold $\alpha\left(\frac{\omega-\tau-\lambda}{\lambda-\frac{p}{\alpha}}+3\right)$, firm *A* will not invest in competitive strength and will coexist with firm *D* in the market with the same competitive strength.

However, in most circumstances, the situation of heterogenous CSR expectations is uncertain and even accidental. Then, the illumination is that firm *A* faces more risk when the CSR expectation for advantage is high. Firm *A* would easily fall into the scenario 0D if the heterogenous CSR expectation is higher than 2α. However, there is a relatively safe area under scenario AD, where firm *A* limits its investment in competitive strength below $\min\left\{\left(\frac{\lambda-\frac{p}{\alpha}}{2\theta}\right)^2, \left[\frac{\left(\lambda-\frac{p}{\alpha}\right)}{2\theta\left(\frac{\beta}{\alpha}-1\right)}\right]^2\right\}$. The profit of a monopoly situation is what motivates the first mover to take the risk. Market friction, bargaining power, and basic CSR requirements are factors beyond heterogenous CSR expectations, which influence firm *A*'s risk of being ruled out of the market by itself.

4. Discussion

This study examines the interaction between CSR and competitive strength in a three-stage model, which provides insights into the trade-off between CSR strategy and competitive strategy. In the first stage, the first mover makes decisions regarding investment in competitive strength. Investment will enhance competitive strength and incur higher CSR expectations from or requirements by consumers or governments. In the second stage, firms decide whether to pay CSR costs and subsequently enter the market. In the third stage, firms and buyers create and capture value in a coalitional game.

The biggest contribution of our findings is to explore the mechanism and boundary of how firms balance CSR activities with competitive strength. Sometimes, heterogenous CSR demands may hurt firms' motivation to invest in competitive strength. The threat is that a firm may face a non-profitable situation if it invests in competitive strength but ignores the heterogenous demands on the CSR of different firms. Proposition 1 and its corollaries show that, holding all else constant, the market participation scenario is influenced by four market structure factors: (1) market friction/product differentiation, or (2) CSR heterogeneity level, or (3) basic CSR requirement, and (4) industry bargaining skill vis-à-vis buyers.

The risk of being deterred happens when the investment in competitive strength exceeds a threshold. Therefore, in an uncertain environment, a wider safe space might lead to a moderate investment in competitive strength. A high threshold suggests a larger range safe space for investment. High market frictions lead to high barriers to competition, which may increase the safe space for investing in competitive strength. Therefore, high market frictions may motivate the first mover to invest moderately in competitive strength. A high basic CSR

requirement could decrease the safe space for investment, thus makes first mover more cautious to invest in competitive strength. A high level of CSR heterogeneity increases the risk of a negative outcome of investment in competitive strength, thus adding a preference for CSR. Finally, high industry bargaining power could decrease the risk of negative impacts of competitive strength and increase the safe range for investing in competitive strength, thus enlarging the possibility of moderate investment in competitive strength.

Proposition 2 suggests that the optimal investment in competitive strength for the first mover is influenced by CSR heterogeneity and the first mover's capability. A high CSR heterogeneity level will make the first mover more cautious about investing in competitive strength. Firms with high capability are more likely to invest more in competitive strength. In an environment with very high CSR heterogeneity, firms might have no motivation to develop new products, improve their efficiency, or expand their market. They may focus on CSR activities, where it is difficult to obtain a sufficiently high competitive advantage to overcome the unnecessary attention and excessive CSR levels.

Most studies on the value of innovation strategies implicitly regard them as unambiguously profit-enhancing by virtue of conferring a competitive advantage. An implication of our analysis is that a firm may not always profit from improving efficiency because it may change stakeholders' expectations or requirements of CSR performance and reduce value capture. Our results offer a new boundary condition for theories to explain when firms should consider limiting the investment in innovation activities.

Conclusions

Based on a formal biform model, this study presents a balanced perspective of firms' investments on CSR and competitive strength. Our model has implications for balancing competitive and CSR strategies, given that these two aspects sometimes compete for slack resources. We recommend that firms consider technological characteristics, industrial structure, and institutional environments – such as market friction, bargaining power, stakeholder demands, and capability – when deciding the balance of competitive strength and CSR strategies. We also suggest that the interactions of institutional demands and industrial structure, stakeholder demands, and bargaining power, are very important in the process of value capture and value appropriation, which gives insights into how CSR activities should be viewed beyond the relationship between CSR and firm performance.

Our study provides vital insights for managerial implications as CSR strategies are becoming more prevalent in today's business environment. Firms often face the paradox of profits and ethics. We offer a new perspective to evaluate the balance of profits and ethics in a horizontally differentiated market. Top managers should consider the heterogenous expectations or requirements of stakeholders in advantaged firms. Based on a comprehensive consideration of capability, market expectations, bargaining power, and market friction, firms can create a strategic balance between competitive strength and CSR activities.

Although intriguing, our model has limitation that should be addressed in the future research. First, we did not consider that firms can invest different levels of resources in CSR strategies. Second, for simplicity, our model only considered a model with two firms.

Third, we did not take into account the complementary effects between CSR activities and competitive strength. In the future, we could extend our study by building a comprehensive theoretical and simulation model to test the influences of those factors.

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Conflict of interest

The authors declare that they have no conflict of interest.

Availability of data

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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