Encoding and Decoding Aspiration Information for Improved Performance:

A Competitive Dynamics Perspective

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Abstract

The study investigates the impact of competition on firms’ aspiration setting and adjustment. Two related mechanisms in firm cognitive frameworks are considered here: making sense of (i.e. decoding) and giving sense of (i.e. encoding) aspiration information. Grounded in the competitive dynamics literature, a theoretical model is developed to further explore the closed-loop system of encoding and decoding mechanisms. Formal modeling is then applied to operationalize the theoretical model and verify the proposed hypotheses. The simulation experiment results show that the competitive dynamics perspective completes the conventional wisdoms. The analysis derives three new managerial insights: 1) the firm with high aspirations may not decode information comprehensively, which is detrimental to its performance in competition; 2) the firm can act aggressively to diminish the dysfunction of high aspirations; and 3) the firm is able to deliberately encode public signals to manipulate rivals’ understanding on competitive pressure, seducing them to take inappropriate actions in pursuit of its improved performance.
Declaration

This is to certify that:

I. the thesis comprises only my original work towards the Masters,

II. due acknowledgement has been made in the text to all other material used,

III. the thesis is 20,000-22,000 words in length, inclusive of footnotes, bibliographies, and appendices, but exclusive of tables and illustrations.
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Encoding and Decoding Aspiration Information for Improved Performance: A Competitive Dynamics Perspective

1. Introduction

How does competition affect a firm’s aspiration setting and adjustment in pursuit of better performance? Aspiration is a certain level of accomplishment that a firm intends to achieve (Cyert and March 1963). The existing behavioral literature has mainly investigated aspiration setting and adjustment based on performance feedback from itself and comparable others, i.e. ‘sense-making’ (e.g., Greve 1998, 2003). Little effort has been devoted to exploring ‘sense-giving’ in competition: the firm leverages competitive environment to deliberately manipulate how others make sense of its performance information. Several anecdotal evidences suggest that firms can publicly deceive rivals’ aspired performance and take advantage of it. Pepsi, for example, took a blind taste test in late 1970s and vigorously advertised the favorable outcome to challenge Coke’s belief on its popularity among consumers (Fournier 2001). Pepsi utilized public information to seduce Coke to solely focus on the cola flavor, underestimating the role of brand image and identity. Coke’s ultimate response to give up the original recipe, as Pepsi wished, led to damaged brand loyalty and decreased market share. This study fills the gap by considering the sense-giving process of aspiration information in competitive performance feedback as a strategic weapon to surpass rivals.

Indeed, an influential legacy of Cyert and March’s A Behavior Theory of the Firm in 1963 is to examine the ‘dynamics’ between the firm and its external competitive environment. Recently, Argote and Greve (2007) also encourage a resurgence of interest in
the alignment between internal processes and external competitive relationships. Just as Bromiley (2005) proposes, “competition offers fascinating and exciting research challenges” (p 123). Our study just echoes their work: we investigate the impact of competition on setting firm’s aspirations and misleading rival’s aspirations in order to attain better performance.

Competition underlines interdependent relationships between competing firms. The firms then are able to exercise individual impacts on each other (Porter 1980). Specifically, a firm sets its own aspiration by making sense of interfirm rivalry. Meanwhile, it also gives sense of competitive information to disturb rivals’ aspirations in pursuit of better performance. By explicating the sense-making (i.e. ‘decoding’) and sense-giving (i.e. ‘encoding’) processes of aspiration setting and adjustment, this study complements the behavioral literature with a dynamics perspective.

Dynamic perspective is the core of the competitive dynamics literature. This research stream provides rather valuable insights on competitive relationships and interfirm rivalry (see Smith et al. 2001 for a comprehensive review). Competitive dynamics studies adopt competitive move as the unit of analysis to explore the micro-dynamics of competition (Chen 1996). Scholars propose that firms, in pursuit of aspired performance, starts to actively ‘recognize’ and ‘create’ competitive advantages through encoding (action) and decoding (reaction) activities, respectively (e.g., Chen et al. 1992, Smith et al. 1991). During such continuous interaction, rivals may reveal, or are tricked to reveal their weaknesses, leaving the firm with valuable opportunities for improved performance. Overlooking how to take advantage of competitive relationships to manipulate rivals’ aspiration settings is a missing piece in behavioral research.
The paper seeks to provide a conceptual framework from the perspective of competition and study the resulting impacts on firm performance. Grounded in the behavioral and competitive dynamics literatures, we develop a formal model to demonstrate how competition influences aspiration setting and adjustment between rivals. Two mechanisms are embedded in a closed feedback system: (1) *decoding mechanism*, where the firm receives and interprets the available information from itself and rivals; and (2) *encoding mechanism*, where the firm creates and sends public information to rivals. These dynamic causal mechanisms could advance the effective setting of aspirations in competition. We use formal modeling to investigate the aspiration settings in a dyad-level competition (Davis et al. 2007, Harrison et al. 2007). The key to our innovative analysis is how firms interpret and contribute to their dynamic competitive relationships.

The analysis leads to the following main insights. Internally, a firm with high aspirations may not decode information comprehensively, which is detrimental to its performance in competition. Yet the firm can act aggressively to diminish the dysfunction of high aspirations.Externally, the firm is able to deliberately encode information visibly to manipulate rivals’ understanding on competitive pressure, seducing them to take inappropriate actions in pursuit of its improved performance. Rivals may be forced to respond the public attacks rapidly in order to protect their reputation (Chen et al. 2002). This strategy works better when rivals are ambitious to set high aspiration level. In short, the firm attains the best possible performance if it simultaneously prepares itself to capture opportunities and irritates rivals to look for opportunities.

To the best of our knowledge, very few scholars have investigated the role of competition in manipulating rival’s aspirations for improved performance. The general
contribution of this study is to advance our understanding on effective aspiration-performance feedback. The firm needs not only decode the available competitive information thoroughly but also be careful of any trick encoded by the rival.

The remainder of the paper is organized as follows. First, we critically review the behavioral literature on aspiration setting and later offer a competitive dynamics perspective. We then develop a number of hypotheses to explore the respective effects of aspiration setting at the firm and competition level. Next, we build a formal model and conduct simulation experiments to investigate firm performance in the proposed competition-based framework. Finally, the paper ends with discussing managerial insights and empirical implications for further research.

2. Motivating Case: The New Coke Campaign

Our study is motivated by the attack-response exchange between Pepsi and Coke in the New Coke taste campaign in late 1970s. Pepsi has come a long way to compete with Coke since 1939. In 1950, Coke still outsold Pepsi by 5 to 1. The milestone that Pepsi broke away from the pack to become Coke’s major competitor is the taste test initiated by Pepsi Challenge in 1977. Pepsi Challenge conducted a scientific research on a blind taste test of Coke versus Pepsi in the United States. The result showed that 58 percent of customers preferred Pepsi’s cola taste to that of the Coke. Pepsi then heavily propagated the ‘scientific’ result to impose intensive pressure on Coke. Finally, it triggered Coke’s response in the way that changed its cola formula: the New Coke was tasted quite like Pepsi. However, the New Coke turned out to be a big failure and Coke decided to bring back its original flavor in 1985. Due to Pepsi’s effective action of taste tests, Coke’s lead
was cut down to be about 1.15 to 1 (The Washington Post 23/8/1985). So, what is the secret of Pepsi’s success?

Grimm et al. (2006) argue that it is attributed to Pepsi’s superior cola formula. However, Coke’s imitation of Pepsi’s taste was indeed successful: Consumers believed the New Coke tasted just like Pepsi. So, it is questionable to conclude that cola formula is the key to Pepsi’s success.

A plausible explanation would be that Pepsi gives sense of the blind test outcome that cola taste is the most significant factor influencing consumers’ purchase decision. Thus Coke is greatly threatened by this public information since it competes with Pepsi in a common market. The very formula that had made Coke successful originally becomes something of a liability in light of Pepsi’s taste campaign. This biased perception is further reinforced when Coke’s own taste tests validated Pepsi’s claims that customers preferred a sweeter product (Fournier 2001). Then Coke seems being forced to adjust the anticipated return and lower aspirations for future performance accordingly. In order to maintain the market position and protect its reputation, Coke could only respond by changing its formula. Indeed, the unsuccessful introduction of New Coke reveals the fact that it is more than just the taste to influence customers’ choice. Brand image and identity also matters. The very success of Pepsi underlies that opportunities are not always static and being there. Rather, a firm is able to create one by assigning meanings to certain event in competition. In particular, it is much easier to seduce rivals under intensive competitive relationship since they are pressured to take rapid responses.

Apart from the encoding mechanism to seduce Coke, Pepsi’s high aim and continuous investment are also vital to create and catch the opportunity. Such opportunities are not
sustainable for firms to discover. An opportunity is like a shooting star. A firm thus needs to prepare itself all the time in order to capture any possible opportunity. Just as Samuel Craig said, who is a professor of marketing at New York University’s Graduate School of Business Administration, “Pepsi was always the underdog, so it had to be aggressive and persistent” (The Washington Post 23/8/1985). Therefore, both external exploration and internal readiness for taking opportunities are crucial for effective aspirations.

The New Coke campaign reveals that the firm can go beyond simply ‘recognizing’ its own strengths and rivals’ vulnerability. ‘Creating’ strategic advantages through the encoding mechanism is rather effective to deceive rivals’ aspirations, contributing to improved competitive performance. Interestingly, firms do not have to keep quiet and stay marginal as being entrepreneurs (Grimm et al. 2006). Firms could act rather visibly and vigorously to influence the dynamics of competition and decrease the rivals’ return. Next, we will explore the causal mechanism on competitive interaction to better understand this distinctive phenomenon.

3. Theoretical Motivation: What are the disturbances to set effective aspirations?

The firm constantly adopt the corresponding aspiration as a reference to compare with actual performance and diagnose the difference (e.g., Bromiley 2005, Lant and Montgomery 1987). ‘Search’ may be stimulated both when firm’s aspiration is below and above actual performance (i.e. slack- and problemistic-driven search) (Cyert and March 1963). Intuitively, effective aspirations are aligned with internal capability and external competition. They will guide the firm to take necessary actions in a timely manner to attain superior performance. On the contrary, ineffective aspirations yield undesirable outcomes. Therefore, it is vital to recognize the potential disturbance to set and adjust aspirations.
3.1 Behavioral Perspective

The behavioral literature investigates the disturbance back to the sources of aspirations. Aspirations arise from the following two sources of comparison. The first is a historical comparison with the firm’s own experiences\(^1\). The second is a social comparison with the performance of comparable others\(^2\) (Cyert and March 1963, Greve 1998). Scholars have identified a number of disturbances as follow.

Prior literature suggests two potential disturbances regarding historical comparison. First, the firm may overestimate its internal capability in achieving sustainable high performance. Consider a leading firm with valuable resources. It did dominate the market in the past. Following the past performance standard historical comparison inspires it to be ambitious in the future (Cyert and March 1963). However, in the era of hypercompetition, such historical comparison becomes much less useful. Hypercompetition is “characterized by

\[ L_t = A L_{t-1} + (1 - A) P_{t-1}, \]

where \(L_t\) is the aspiration level at time \(t\), \(P_{t-1}\) is the performance from the previous time period \(t-1\), and \(A\) gives the weight of the previous aspiration level when setting the new one. In other words, \(A\) reflects the importance of the new available performance information. A low \(A\) means that the firm makes decisions more relying on updated information. This decision rule ensures that the firm makes realistic forecast based on the existing information (e.g., Greve 2003). Besides, the information is always accurate and ready for collection. This characteristic makes it even more attractive when external information is absent or unreliable.

\(P_{at}\) is the actual performance of reference firm \(a\) at time \(t\), and \(w\) is the weight assigned to a reference firm indicating its importance in setting the benchmark (Greve 2003).

Intuitively, social comparison is vital in dynamic competitive environment. The firm could better adapt to rapid changes by keeping pace with comparable competitors. Additionally, some well-known third parties, such as mass media, collect information and publish rankings on several forms of firm performance.

\(^1\) The past performance indicates how well it can perform. It would easily become a standard for future performance (Greve 2003). A common way to set historical aspirations is by gradually updating the aspiration level based on the most recent performance information (e.g. Baum et al. 2005, Greve 1998). Levinthal and March (1981) formalize this rule as an exponentially weighted average model:

\[ L_t = A L_{t-1} + (1 - A) P_{t-1}, \]

\(^2\) Social comparison utilizes information from other comparable firms to set aspiration levels. The focal firm needs to clearly identify a set of referent firms such as the competitors that are easily observed (Clark and Montgomery 1999). Once their performance details are available, the firm could combine all the information to set “social aspirations” (i.e. external benchmarking), formally:

\[ L_t = \sum_{a \in \mathcal{R}} w_a P_{at}, \]
intense and rapid competitive moves, in which competitors must move quickly to build [new] advantages and erode the advantages of their rivals” (D’Aveni, 1994, p 217-218). Discontinuous changes are fairly frequent in such a dynamic environment (e.g., Tushman and Anderson 1986). The current valuable capabilities may become less important in the near future. Therefore, an exclusive consideration of past capabilities can produce misjudged aspirations that fail to adapt to the ever-changing environment.

Second, the firm overlooks the motivating perspective of aspirations. Essentially, aspiration is a target that indicates the highest possible outcome (Cyert and March 1963). It expects to not only reflect the best performance in the past, but also suggest an even better objective in the future. That is, the firm is not supposed to be limited by its current conditions (Greve 2003). This time, take the example of a firm with few valuable resources. Arguably, it might not perform well in the past. The historical comparison can underestimate the potential. The firm can hardly be inspired to make innovative changes, which is deemed vital for long-term development.

Prior literature also points out two disturbances in relative to social comparison. First, the firm may be biased towards choosing high-performing firms as external references. An effective social comparison depends on two sequential steps: choose appropriate reference firms and then collect social information about them (Cyert and March 1963, Greve 2003). Gathering social information is indeed a difficult task. So firms may take a reverse sequence: they measure the availability of social information first and then apply the

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3 There is less research evidence on social comparison than historical comparison (see Greve 1998). Therefore, the norm about choosing reference group is less studied. Considering that other competing firms do have an impact on the firm’s aspiration setting, we complement the behavioral literature with a competitive perspective (Greve 2003).
information as the references accordingly. High performers, due to their high visibility and readily available information, are always adopted as referent firms (Clark and Montgomery 1999), such as Toyota in car manufacturing industry, and Coke in beverage industry. However, market leaders are not comparable to every other firm in the industry. Their performance is not necessarily a good indicator and might be overwhelming for some firms (Locke and Latham 1990, Greve 2003). The corresponding aspiration level misaligns with the firm’s internal capabilities and ultimately is detrimental to long-term development.

Second, the firm may be trapped into a suboptimal goal to simply follow the reference group, without further commitment on specialized learning. Social comparison overlooks individual differences between competing firms (Greve 2003). It then slows down learning-by-doing, resulting in limited self-centered search behaviors (Herriott et al. 1985). Those aspirations, however, are rather less optimal than the ones aiming for specialized learning. They may serve as a bias towards disregarding the firm’s strengths to create unique capabilities.

Acknowledging the potential causes of ineffective aspirations, we can find ways to improve aspiration settings, such as consider competition, choose corresponding inspiring but attainable references, and balance improvement and innovation. In response, Levinthal and March (1981) have investigated a choice between searching for a new technology and investing in improving the old one. However, little effort has been devoted to the study of competition (Bromiley 2005) and the organizational process of choosing referent firms based on competitive information (Argote and Greve 2003).

Furthermore, one underlying assumption for the specified four disturbances is that the collected information is accurate. The effectiveness of aspirations is determined by the
firm’s ability to select and interpret the information (via decoding mechanism). It overlooks the fact that competing firms may deliberately send misleading information (via encoding mechanism) in order to seduce the rival to take inappropriate actions. Competitive dynamics expands the scope of research from sing-firm level to competition level. It greatly exaggerates the conventional disturbances identified in the behavioral literature. This is the focus of our study.

Specifically, based on both competitive dynamics and organizational decision-making literature (introduced later), we propose a competitive perspective on aspiration setting. First, we explicate the process of organizations on interpreting competitive information to integrate historical and social comparisons. The bridge is on the basis of risk attitudes following March and Sapira (1992) and competitive tension following Chen, Su, and Tsai (2007). Furthermore, a threshold to initiate search actions is used to illustrate the choice of reference. Later, we clarify the effect of information interpretation in misleading rivals’ aspiration settings through public actions (see Moore 1992).

3.2. Competitive Dynamics Perspective

The effect of aspirations is to enforce effective search actions to achieve the pre-defined goals (Greve 2003). Competitive dynamics adopts action/reaction as the unit of analysis and hence greatly fits into the behavioral perspective. How to set effective aspirations is rather consistent with the central research topic in competitive dynamics literature: how to initiate effective actions to achieve the anticipated return (e.g. Chen 1996, Smith et al. 2001).

We expect to set and adjust effective aspirations without any disturbance during information collection and interpretation. Likewise, the ultimate effectiveness of any
competitive move, as Porter (1980) noted, largely depends on whether it goes ‘unchallenged’ to fulfill the strategic intention. Otherwise, when rival takes unexpected countermoves like creative disruption, the past experience will be less relevant for the firm to adjust its aspiration effectively. The counteractions are indeed major disturbances in competition.

On the other hand, ineffective aspirations in behavior theory are equivalent to inconsiderable actions in competitive dynamics, resulting in decreased performance. Such actions can take the following forms: 1) after initiating actions to pursue high aspirations, firms are unable to cope with the undesired aggressive retaliation from rivals, and 2) firms, either being too conservative (due to unmotivated historical comparison) or easily satisfied with current accomplishment (due to suboptimal social comparison), fail to take a competitive move when it is necessary. In short, from the competitive dynamics perspective the effectiveness of aspiration settings is all about 1) the likelihood of attacks and 2) the likelihood of responses.

The competitive dynamics perspective embraces a holistic view on decoding and encoding mechanisms in pursuit of improved performance. The best possible performance is achieved when the firm’s decoding actions are functional to produce effective aspirations, and the encoding actions are going unchallenged as well.

In the following section, we first introduce organization decision-making process to illustrate the micro-dynamics: how aspirations stimulate search actions. Later, we will further apply the competitive dynamics literature to elaborate the action/reaction measurement.
3.2.1 The non-Linear organizational decision-making process

When comparing aspiration with actual performance, there will be two possible types of gaps between them. A favorable gap is a gain domain where performance exceeds aspiration, namely *positive discrepancy framing*; while an unfavorable gap is a loss domain where performance falls below aspiration, namely *negative discrepancy framing* (Chen and Miller 2007, Cyert and March 1963). Accordingly, it would be valuable to further explore the impacts of different discrepancy framings on taking risks of initiating search actions.

Indeed, the organizational decision-making literature has explored that firms demonstrate different risk attitudes towards the diverse framing effects (e.g., Bromiley 1991, Chen and Miller 2007). Scholars argue that firms are more willing to take higher risks when actual performance is below aspiration (loss) than when it is above it (gain) (Lant and Montgomery 1987). For example, Shapira (1986) and MacCrimmon and Wehrung (1986) have conducted manager interviews to investigate their risk attitudes. Both studies suggest: managers believe that fewer risks should, and would, be taken when firms are outperforming. Yet when things are not going well, they would expect to make risky decisions. Thus, we could observe an asymmetric risk-attitude relationship between positive and negative discrepancy framings. In short, the firm will be more inclined to take risks in initiating search actions when it experiences a loss than a gain.

However, managers may not take risky actions in all ‘bad’ situations. For example, they would not risk organization’s survival when the failure leads to severe consequences (March and Shapira 1987, Shapira 1986). We could interpret it as attitudes towards the scales of negative performance discrepancy. That is, managers see themselves who are taking reasonable risks when the gap is relatively small to catch up; hence, they are
confident of potential success (March and Shapira 1987). However, a relatively large gap would be viewed as a gamble to close the gap by just one shot (Shapira 1986). Thus, they would be less motivated to respond to such high risks. On the other hand, if a firm experiences an extensive gain, managers tend to be reluctant to engage in further innovation due to high organizational inertia. Accordingly, the motivation level derived from both framing effects is expected to decrease as the gap increases (Cyert and March 1963, Lant 1992).

A simple graphic example helps to illustrate the effects. Based on the discussion above, we model the overall framing effects of target gaps as concave for the gain domain (i.e. risk-aversion) and convex for the loss domain (i.e. risk-seeking), thus forming an asymmetric S-curved value function in Figure 1 (e.g., Lant and Montgomery 1987). The aspiration level acts as the reference point, which is point A. In Figure 1, different levels of performance yield diverse values to the firm. According to March and Shapira’s work in 1986, 1987, and 1992, performance gap should have a nonlinear influence on the firm’s risk attitude. That is, performance well above or below the aspiration level should decrease its motivation on taking risks, and performance near aspiration should increase it (Bromiley 1991, 2010). Thus, the slope of the value function plausibly captures this nonlinear effect of organizational decision-making (Bromiley 2009). For example, the motivation level at point B is $B'$. Note that the slope is much steeper in the loss domain over the gain domain, decreasing along with the scale of the loss. Specifically, with an equal distance with the performance goal A ($|BA| = |AC|$), the slope at point B ($B'$ at the loss domain) is much greater than that at point C ($C'$ at the gain domain); that is, $B' > C'$. In addition, when both
are at the loss domain ($|BA| < |DA|$), the slope at point B ($B'$) is greater than that at point D ($D'$), i.e., $B' > D'$. Therefore, the S-curve in Figure 1 serves well as a generic model of aspiration effect.

**FIGURE 1**
An S-Curve Illustration of Aspiration Effect

Notable, the attitude towards risky decisions (derived from performance discrepancy) is the antecedent of re/actions decisions in the competitive dynamics literature. An action occurs when the firm experiences a ‘reasonable’ gap between performance and aspiration. The gap further motivates itself to take substantial actions (Smith et al. 1991). As one major implication of aspiration setting, the action propensity derived from the performance discrepancy is vital to keep the firm motivated to initiate search behaviors. Indeed, scholars propose switching between multiple aspiration levels, such as survival and aspiration levels
are the key to maintain the firm’s activeness (Audia and Greve 2006, Greve 1998, March and Shapira 1992). However, their work takes a passive view that the firm just receives historical and social information and makes corresponding judgement, without further consideration on how the firm actively misleads rivals by managing competitive relationship. This missing piece is exactly what Pepsi did in the New Coke campaign.

Actually, in a competitive relationship, an action would cause, at least be intended to cause, perceived effect ‘at the expense of’ its rivals or of reducing the ‘anticipated returns’ to rivals (Smith et al. 2001, p 315). The rivals, as a result, needs to sense the impact of the competitive actions on aspirations (i.e. a stimulus) and develop corresponding response /non-response decisions based on the its perceived performance discrepancy (Chen et al. 1992). Therefore, it is quite beneficial to embed competitive dynamics research into the framework of aspiration effects.

Recently, Chen, Su and Tsai (2007) study the generic breaking point for re/actions in interfirm rivalry. Indeed, they propose one critical factor to influence firms’ re/action decisions: competitive tension. If the focal firm manages rivals’ perceived competitive tension well to avoid extensive responses, it actually develops a valuable opportunity to outperform rivals in competition. This study provides valuable insights on how to take advantage of competitive tension systematically. For example, the authors argue that attack volume is of significant importance in influencing rivals’ competitive tension. It then determines the motivation for the following response decisions (Chen et al. 2007). Their work is a start to consider creating opportunities by influencing rivals’ aspiration during the action-reaction exchange.
3.2.2 Competitive characteristic in decoding mechanism

Decoding mechanism internalizes information to initiate aspiration settings. This sense-making process represents a firm’s mental model in perceiving and interpreting the nature of competitive environment (Smith et al. 2001). A firm sets its aspiration based on an overall assessment of internal capability and external competitive relationship. Later, the firm gets performance discrepancy framing, in terms of either gain or loss. According to Figure 1, the framing, ultimately, determines the corresponding incentives to take re/actions.

One interesting yet underexplored topic in behavioral perspective is how a firm chooses among multiple aspirations. As Greve (1998) argued, the switching rules lack clear evidence. Therefore, it is not explicit why the firm will prefer one aspiration level to another. The well-established construct ‘aggressiveness’ in the competitive dynamics literature (e.g., Young et al. 1996, Ferrier 2001) is valuable to provide some insights. According to Lumpkin and Dess (1996), competitive aggressiveness is defined as the firm’s “propensity to directly and intensely challenge its competitors to improve its competitive position; … being responsive to competitive challenges (pp 148-149).” Such a firm walks the talk as shown in the past competitive behaviors, hence having a reputation of playing tough. Therefore, any aspiration generates the highest propensity to search will be selected. When the firm is no longer motivated to take search actions, it will switch to another aspiration. This is consistent with bounded rationality, where the firm is satisficing with the first available choice (Cyert and March 1963). If the current aspiration can generate acceptable outcome, the firm will not look for alternatives.
Empirically, competitive aggressiveness is measured as the number of competitive moves over a finite time period as well as the speed with which they are implemented (Ferrier 2001, Smith et al. 2001). An aggressive firm has a reputation of being proactive and responsive to improve itself; and, the actions launched tends to be frequent and intensive. Such a firm is inclined to take rapid and intensive actions in response to a large performance discrepancy. In contrast, a conservative firm is reluctant to take actions and only responds small gaps. The tipping point between action and non-action is called action threshold. The firm would initiate re/actions as long as the perceived performance discrepancy below that predefined level. According to Figure 1, competitive aggressiveness is the motivation level (i.e. the slope) derived from a predefined level of performance discrepancy.

Diverse competitive aggressiveness and the resulting action thresholds lead to different competitive outcomes. Based on past action history, an aggressive firm will be more likely to initiate attack or retaliate in the future (Miller and Chen 1994). This high action propensity will impose great pressure on the rivals (Porter 1980). On the other hand, a continuous low attack and/or response rate in a given period indicates that the firm is not aggressive. It in turn decreases the propensity of taking the next move. Indeed, firms may behave differently towards certain pressure. Some firms tend to be quite aggressive and take actions frequently. Some may just respond passively yet seldom initiate actions.

In sum, competitive aggressiveness can improve our understanding on the breaking point of attack initiation, i.e. action threshold. Action threshold seems a missing piece in the competitive dynamics literature. We believe that it acts as a critical bridge between aspirations and search actions.
3.2.3. Encoding Mechanism – Action Visibility

Encoding mechanism externalizes the firm’s information to rivals and allows them to make social comparison. The information indicates the firm’s determination to compete with rivals and achieve superior performance. For example, market leaders always send credible threats in order to deter the challenges from followers (Grimm et al. 2006). More importantly, encoding mechanism could serve as a channel to mislead rivals to understand the competition incorrectly. Back to the opening case, Pepsi enthusiastically advertised its tasty flavor in public, which made Coke believe that it was at a disadvantageous position in competition. And the only way to improve the situation is to give up the current flavor and invest a new one. As the information is soundly credible, it successfully tricks the rival, letting it believe that the firm is fully commitment and the action is irreversible. Then the imposed tension strongly influences the rival’s expectation about the future.

Indeed, one prerequisite to seduce rivals is to make sure they receive the signals clearly. According to the competitive dynamics literature, action visibility suggests whether a competitive move is easy to be noticed by the rival (MacMillan et al. 1985, Chen and Miller 1994, Chen and Hambrick 1995). Prior literature posits that the more obvious an attack, the greater the likelihood that it will be countered (Kiesler and Sproull 1982). This argument, however, is greatly challenged facing ‘deterrent’ attacks. Deterrent actions are a popular strategy among market leaders (e.g., Porter 1980). They would send strong public signal to rivals in order to intimidate them and then defend their dominant position. Apparently, those attacks are intended to be visible and easy to be noticed by rivals. The
inconsistent findings can be resolved by employing the concept of action irreversibility proposed by Chen and colleagues (1992, 2002).

Action irreversibility is specified into two components - “internal commitment” and “public commitment” (Chen et al. 2002). Internal commitment is generated from economic costs associated with sunk costs of investment, political efforts associated with the need to be a determined and consistent leader, and organizational changes associated with structure inertia (Chen et al. 2002, Hannah and Freeman 1984, Whyte 1986). Public commitment, on the other hand, is derived from social and institutional pressures to protect firms’ reputation (Chen et al. 2002). According to the competitive dynamics literature (e.g. Chen and MacMillan 1992, Chen et al. 2002), each competitive move contains a resource allocation between internal and public commitments. In our study, we are interested in exploring how the motivation is allocated between these two commitment components. Visibility just indicates the ratio assigned to the public commitment.

Action irreversibility sends credible threats to rivals, indicating the firm’s commitment not to back down (Chen and MacMillan 1992). The actions committed to internal investments and capabilities, such as deterrent actions, are mildly visible and associated with decreased tendencies to respond. The actions committed to public reputation, such as price cuts, are associated with increased tendencies to respond (Chen et al. 2002). Publicly committed actions are inherently much more salient to capture rivals’ attention (MacMillan et al. 1985, Smith et al. 1991). Even if rivals can disregard the attacker’s internal commitment, they are less likely to overlook the public committed attacks threw onto their face (Hoff and Ocasio 2001). Then the attacker’s expected return would be eroded during the action-reaction exchanges.
In the encoding mechanism, firms need to determine the visibility in order to achieve expected return and create opportunities for the future rent. According to Miller and Chen (1994), actions that provoke more responses would result in a worse performance. Scholars have examined that internal commitment could effectively reduce the likelihood of response, and that public commitment would increase it (Chen et al. 2002). While attacks with absolute internal commitment seem more attractive, they require extensive resource investments that not all firms could afford. Besides, public commitment is beneficial to some occasions. As illustrated in Pepsi’s case, public commitment could distort rivals’ interpretation on competitive dynamics, hence taking blind responses that are detrimental to their performance. Therefore, public commitment could be an effective strategic weapon to influence rivals’ aspirations in competition (Moore 1992, Prabhu and Stewart 2001).

3.3. Causal Loop Model Illustration

According to the arguments, we develop a conceptual framework to elaborate the closed loop feedback relationships constructed by these two mechanisms (as illustrated in Figure 2).

In Figure 2, two types of causal loops are presented. One is the ‘reinforcing’ loop, labeled as “R”; the other is the ‘balancing’ loop, labeled as “B”. Reinforcing loops indicate self-reinforcing processes; and balancing loops work to close the gap between desired and actual situations (see Sterman 2000). According to the arguments, four causal loops are considered in our model:

**Market position (R1).** Firms will constantly compare aspiration level with actual performance to diagnose performance discrepancy. An improved actual performance will reduce the gap; an increased aspiration level will enlarge the gap. The gap could be either
favorable (where actual performance is higher) or unfavorable (where aspiration is higher), leading to positive and negative framing of motivation respectively. And a larger gap

FIGURE 2
The Competition-based Causal-loop Model of Aspiration Framework

gives less incentive to firms to seek solutions (Cyert and March 1963). This process has been illustrated by the S-shaped curve in Figure 1. If the motivation level exceeds the action threshold, firms will actively commit to the internal development, such as R&D and learning activities. As a result, firms can continuously accumulate resources/capabilities to
gain a larger size of market share. The greater market share indicates a better performance that will reduce the performance discrepancy.

**Market expansion (R2).** This loop follows the same logic as R1. The distinct effect is that firms can accumulate resources to explore new opportunities of expanding the market size. Firms can invest aggressively in product/process innovation and development. They are then able to create more values from an even larger potential market.

**Self adjustment (B1).** Normally, when a pre-defined aspiration has not been fulfilled, firms may experience extensive pressure to adjust goals. It is because firms may perceive the initial expectation as unachievable at the current stage. Moreover, firms operate in a competitive environment. When they become reluctant to take actions due to the overwhelmed goals, they might lose opportunities to maintain desirable positions in the market. Accordingly, the perceived competitive tension will forces firms to adjust their aspiration levels to be more realistic in parallel with market position (R1) and market expansion (R2) behaviors (Bromiley 2009).

**Competition initiation (R3).** With great incentives to take actions, firms are comfortable about engaging in competitive relationships with rivals. Thus, they may attack high public commitment to send signals to others. While all competitive interactions involve potential risks, firms will take them into consideration for setting the performance target. When perceiving a higher level of tension in the market, they tend to update the information. As a result, they may hold an even more realistic estimation about what they could possibly achieve from the competition (Reger and Palmer 1996).

In Figure 2, we also include the impacts from the rival. Note that both attacker and defender employ the same decision process, since an attacker who initiates actions could
also be a defender who takes reactions (Smith et al. 2001). For instance, the rival’s public commitment frames the visibility of its countermoves, hence affecting the competitive tension perceived by the firm. Also, its resource accumulation derived from countermoves will jointly determine the market size and the distribution of market share. In the current individual firm model, we treat them as exogenous factors to simplify the organizational decision making process. We will relax them endogenously and further explore the competition model later in the Model section.

In sum, operating in a competitive environment, firms decode the historical and social comparison to set aspirations. The sensation of the intensity of rivalry leads to decisions on whether to take re/action against rivals. If a move decision is preferred, firms will encode the public information to rivals through: 1) internal commitment to directly accumulate resources for a higher future performance; and 2) public commitment to indirectly influence their aspiration level. Note that the action itself would change the competition dynamics in the next-round encounter. Therefore, firms would continuously modify their aspiration levels to adapt to the dynamic environment and form re/actions (Levinthal and March 1981).

4. Hypothesis Development

This section will apply the proposed framework (see Figure 2) to investigate aspiration change under competition according to the perspective of performance feedback. As discussed in the previous section, in order to outperform rivals a firm could not only set effective aspirations to guide its competitive actions but also disturb rivals’ aspiration settings. In this section, we will analyze how 1) the decoding mechanism (i.e. make sense of external competition and respond with search decisions) and 2) the encoding mechanism
(i.e. impose competitive pressure on rivals via visible actions) contribute to performance improvement.

The impact of aspirations on performance is achieved via the implementation of substantial actions such as search activities. According to the competitive dynamics literature, firms that initiate more actions in the competitive relationship are expected to capture more opportunities to develop superior performance (Chen and MacMillan 1992, Ferrier et al. 1999, Young et al. 1996). It is because firms pursue profits through the series of actions and reactions (e.g., Smith et al. 2001). Without a move, a firm could hardly improve its relative competitive position. The performance is mostly boosted by the number of actions initiated (Ferrier et al. 1999). The organizational change literature also suggests that risk taking has a positively influence on performance (e.g., Aaker and Jacobson 1987). Accordingly, in this study we assume that firms’ efforts on search actions could positively contribute to their performance. This assumption is widely used in the behaviour literature (e.g., Baum et al. 2005, Cyert and March 1963). Its detail will be further discussed in the latter section when modeling competition.

Specifically, this section first investigates the two aspiration mechanisms on firm performance. In the competitive dynamics studies, the competition outcome, i.e. firm performance, could be a relative level of market share (e.g., Ferrier et al. 1999), firm performance (e.g., Smith et al. 1991), stock market returns (e.g., Ferrier and Lee 2000), and such forth. This study therefore adopts market share as the measurement for competitive outcomes in our model. Next, the domination between these two mechanisms is examined through comparing the impact of aggressiveness on competitive outcomes with that of
action visibility. Finally, different firm capabilities are considered to moderate the encoding mechanism on competitive outcomes.

4.1. Decoding Aspiration Information

After sensing an interfirm rivalry, a firm may adjust its aspiration at a relatively high or low level comparing with its performance. Of course a firm has more than one option in setting the aspiration level. According to the behavioral literature, a high aspiration level goes beyond actual performance and results in a sense of loss. The firm thus experiences an unfavorable gap. Then it would be rather ambitious to conduct search behaviors in order to find solutions to close the gap. On the contrary, a low aspiration level falls below actual performance and leads to a sense of gain. The resulting favorable gap implies that few problems are required for exploring solutions; thus, search behaviors are less likely to be initiated (e.g., Cyert and March 1963, Levinthal and March 1981).

According to Smith et al. (2001) and Chen (1996), the felt-needs to act creatively in competition is the prerequisite of any move. The aspiration to surpass historical performance and comparable others equip the firm with greater possibility to pursue higher organizational target, hence better possible performance (Smith et al. 1991, Tsai et al. forthcoming). In contrast, being satisfied with the current achievement would result in poor decisions of strategic moves. When the firm is less active to respond to market opportunities and threats, the firm’s performance can hardly be improved. This may be a possible explanation for the case that a market leader would eventually be dethroned by highly aspired challengers (Ferrier et al. 1999). Formally,

*Hypothesis 1. Aspiration level is positively proportional to the firm’s performance.*
After scanning internal and external environment, a firm may take action or not. Competitive aggressiveness is expected to moderate the effect of attention on the firm performance. Intuitively, the firm would selectively pursue market opportunities and react to threats. A conservative firm commonly fails to take as many risky actions as an aggressive firm. It would rather adjust aspiration to a lower level rather than taking the risk (Greve 2003). Likewise, aggressive actions enable the firm to respond to most perceived opportunities and challenges. Comparably, the firm may miss a number of opportunities when it only acts infrequently. Arguably, firms may decline to undertake action if they are not willing to predict risky outcomes with confidence (Smith et al. 1991). They are less responsive to performance gaps, hence becoming the victim of fierce competition. A positive moderating effect of competitive aggressiveness is therefore expected.

In sum, competitive aggressiveness manages the occurrence of search behavior in pursuing the firm’s full potential. Note that the motivation level decreases along with the magnitude of performance gap (Cyert and March 1963, Lant 1992). Consider the gain domain. If the favorable gap is relatively small, the firm accumulates a moderate level of slacks. And those slacks provide the firm a strategic advantage to further create and capture market opportunities. However, if the aspiration is too easy to achieve, the firm will have a quite low incentive to initiate actions to further explore the market (Argote and Greve 2007, Bromiley 1991). This argument is supported by the inversed U-shape relationship between slacks and innovation (Nohria and Gulati 1996). Yet high aggressiveness means the firm is still motivated even under a low incentive and willing to take the risk for search actions. Formally,
Hypothesis 2. Competitive aggressiveness could strengthen the positive relationship between aspiration level and the firm’s performance.

4.2. Decoding Aspiration Information

Apart from passively accepting and interpreting the external (competitive) pressures, firms may actively seek to influence competition outcome in a desirable way. It could be achieved through effectively managing the visibility of each competitive move. That is, to what extent the firm expects to expose the action to the competitors and public.

Our study distinguishes two major types of search actions, depending on the magnitude of action visibility. If an action is mildly visible, i.e. internal commitment accounts for more than 50%, then it is dominated by internal commitment. Otherwise, if action visibility is high, i.e. public commitment is higher than 50%, then the action is dominated by public commitment. For each type of action, the corresponding outcome largely depends on the effect of the dominated commitment. For example, as public commitment could increase the likelihood of response (Chen et al. 2002), then an action with high visibility would attract greater responses, regardless the effects of the internal component, vice versa. In other words, the impact of the dominant public commitment outweighs that of the subordinate internal commitment.

According to Chen and colleagues (2002), internal commitment will discourage reversing the action once it has already been implemented. It informs rivals that the focal firm highly commits to the current move, no matter with/out their responses. Consequently, internal commitment is associated with a decreased likelihood of response (Chen et al.
2002). Therefore, it could indeed improve the firm’s performance. On the other hand, public commitment will provoke great responses as the rival also seek protection for its public image (Chen et al. 2002). Therefore, public commitment is associated with increased likelihood of responses, leading to a worse market performance (Chen et al. 2002). When the firm sets a high aspiration level and takes search actions to close the gap, the positive contribution to firm performance is still largely moderated by the number of responses triggered by its actions. In other words, if the firm attaches overwhelming public commitment to an action, the expected return could be hardly achieved due to the massive responses. This negative influence further enlarges performance gap due to the worse market performance. This perspective complements the role of risk taking under competition.

The firm could take risks smartly by concentrating on internal commitment of search actions. Then rivals will not vigorously disturb its plan. Otherwise, rivals would be active in defending themselves. The resulting performance of the focal firm would rather be worse off. The firm thus could hardly achieve the intended outcome from a high aspiration. Formally,

*Hypothesis 3. Action Visibility could weaken the positive relationship between aspiration level and the firm's performance.*

### 4.3. Domination between Encoding and Decoding Mechanisms

In addition to the individual effect resulted from competitive aggressiveness or action visibility on firm performance, there are some interesting empirical observations, especially in the loss domain. The empirical literature suggests that it is tough to challenge a firm with frequent and forceful attacks (Young et al. 1996, Ferrier et al. 1999). The competitive
moves in rapid succession delay rivals’ reactions since they are confused about which move to respond to (Ferrier 2001). When those actions are overt and demonstrable, they will elicit strong retaliation from rivals (Ferrier et al. 2002, MacMillan et al. 1985). Then the escalated rivalry intensity between competing firms will negatively affect the firm performance. In short, the greater the number of attacks a firm initiates, the better its performance; yet the more responses a firm’s attack provokes, the worse its performance. However, Young et al. (1996) show that the positive effects would normally outweigh the negative consequences, expect for the condition that rivalry intensity caused by an action is rather extreme. So we propose a dominated moderating effect:

_Hypothesis 4. Competitive aggressiveness is a stronger predictor of the firm’s performance than action visibility._

### 4.4. The Effect of Diverse Firm Capabilities

It is recognized that there is an asymmetric relationship between competing firms (Chen, 1996). That is since firms are inherently different from each other. For example, while one firm treats one another as the primary rival, the firm does not necessarily perceive the same way (Chen et al. 2007). Firm capability is a common asymmetric factor discussed so far (Chen 1996, Ferrier et al. 1999). Capability herein refers to the firm’s resource deployment and the ability to implement competitive moves (Chen et al. 2007).

Chen and Hambrick’s (1995) find that small firms with less capability act quite differently from their large competitors. Small firms are more likely to engage in indirect actions that evoke less competition intensity. Yet large firms are always willing to make their actions visible to others and then intimidate potential rivals (Chen and Hambrick 1995, Grimm et al. 2006). For example, Samsung, the world’s leading technology company,
recently announced a “massive” investment plan. It included 11 trillion won ($9.7 billion) on memory chips, 5 trillion won ($4.4 billion) on liquid-crystal displays, and 2 trillion won ($1.8 billion) on televisions and mobile-phones (Korea Times 14 May 2010).

The empirical evidence suggests that competitive moves would become difficult to respond while the firm commits considerable capability to implementation (MacMillan et al. 1985, Chen and Miller 1994). Consequently, it can greatly support the firm’s attainment of improved competitive performance. Then it becomes more confident to launch visible actions, given the fact that the rival lacks of capability to carry out retaliations (Chen et al. 2002). It is the major rationale for market leaders’ deterrent actions (Grimm et al. 2006). High capability level is an important means for leaders to utilize in the competition.

Formally,

_Hypothesis 5. The negative impact of action visibility on the firm’s performance is negatively moderated by the capability of the firm._

We provide an overall framework to illustrate the proposed relationships in Hypotheses 1 to 5, shown in Figure 3.

**FIGURE 3**
The Effects of Aspirations
5. The Model

Our goal is to better understand how a firm set and adjust its aspiration for improved performance in a competitive environment. By investigating the developed formal model we can identify the key determinants of affecting rivals’ aspiration level and the associated likelihood of responses in competition (see, e.g., Davis et al. 2007, Harrison et al. 2007). The model presented discusses firms competing against one another in a common market. We begin by describing the market condition and firm’s relative position in industry. Next, the firms process available market information and then set aspiration level individually. Later they make corresponding search action decisions. These decisions lead to an adjustment of its previous market position. In short, the competition between firms is portrayed as a series of action-reaction exchanges triggered by a nonstop modification of aspiration levels. The model is formulated in continuous time as a set of nonlinear differential equations. We consider a dyad-level analysis to explore this competitive
dynamics. In other words, a behavioral game-theoretical model is developed here for better understanding how competition impacts the aspiration adjustment process and vice versa (Gary et al. 2008, Sterman et al. 2007).

Specifically, the model consists of two levels of analysis: individual firm level and competition level (see Figure 4\(^4\)). There are four sectors for individual firm’s decision-making process. It begins with a critical evaluation of pre-battle relationship in the market condition sector. That is, firms assess both internal capabilities and external competition. Next, the sensory system sector models the goal-setting process based on the interpretation. The firms would set respective aspiration level to reflect a realistic estimation of their market position in the future. Accordingly, the firms are able to be aware of the resulting discrepancy between their aspiration level and actual performance (Lant 1992). Next, they translate the performance discrepancy into motivation to take competitive moves. The competitive move sector models the threshold of launching actions based on the firm’s competitive aggressiveness level, as well as the attached internal and public commitments.

\(^4\) Figure 4 actually models the identical process described in Figure 2, but using a different structure. It visualized the relationships and parameters/variables that are used in the model formalization.
The resource sector measures the outcomes of the specified attack/response, i.e. resource accumulation (see Dierickx and Cool 1989).

At the competition level, we focus on the interface between the two firms i.e. market condition sector. The competitive moves initiated by either firm contribute to the dynamic market performance, such as market share and market size following Schumpeter (1934) and the Austrian School (Young et al. 1996). Note that by deciding the level of visibility of
competitive moves, one firm could effectively distort the other’s estimation of the prospect of performance (see Chen et al. 2002).

5.1. Market Condition

There are two firms indexed by \( i \) and \( j \), where \( i = 1, 2 \) and \( j = 3 - i \). Firm \( i \)’s market share, \( p_i \), is influenced by its capability level of \( R_i \). It shifts gradually along with the changes in the relative capability level between the rivals (Ferrier et al. 1999). For example, industry challengers are able to erode leaders’ dominant market share through creating internal organizational assets (e.g., Smith et al. 2001, Young et al. 1996). Consistent with the strategy and marketing literature, we model the relationship between market share and capability level by a logit model (e.g., Sterman et al. 2007). Logit model is widely used to study customer preference of brand choice (e.g., Agewal and Schorlinc 1996). The logit formulation recognizes inertia in competition; as a result, a small disadvantage in capability will not lead to a huge loss in market share (see Scott 2001). The logit model used in this study is given by:

\[
p_i = \frac{W_i}{\sum_j W_j},
\]

(1)

\[
W_i = \exp(d_i \cdot R_i),
\]

(2)

where \( d_i \) is the resource commitment of firm \( i \) that reflects its ability to translate the capabilities into the substantial market power of \( W_i \) according to MaGrath et al. (1998). This parameter setting can relax the limitation of studying one single market in our model.

In reality, firms may diversify their resources into different markets, i.e. strategic resource diversion (MaGrath et al. 1998) to build mutual forbearance (Young et al. 1996). Therefore,
it is reasonable to assume that competing firms treat a common market with diverse strategic importance. Resource commitment is a relative measurement, ranging from 0 to 1, where 0 indicates that a firm has no intention to devote resources into the common market and 1 indicates that a firm is dedicated to this market. So, our model is applicable to study competitive dynamics between firms against one another in multiple markets as well.

Although the rivals are competing in a common market, the market size varies depending on their accumulated resources. Market size, $Z$, is positively associated with the individual firm capability level of $R$. Supported by solid capability levels, firms are able to further explore new opportunities to expand the market size. For instance, firms can invest aggressively in product/process/market innovation and development. They are then able to create more values from an even larger potential market (e.g., Acemoglu and Linn 2004). Noted that no matter which firm takes the initiative in exploring market size, in fact the other firm can also get access to the additional potential customers. Therefore, both firms contribute to the expansion of current market size. Formally,

$$Z = \sqrt{\sum_i \exp\left(a \cdot r_i \right) \cdot R_i^2}, \quad (3)$$

where $r_i \in (0,1)$ is the innovation commitment of firm $i$ and $a$ is a scaling factor to adjust the contribution of innovation commitment to the market size. In fact, firms will not risk all the existing resources into a new product/process/market development. Besides, firms differentiate from their commitments to R&D investment. According to Miles and Snow’s

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5 For simplicity, $a = 1$ is assumed in our analysis. Note that the value of $Z$ is limited in a reasonable range due to $\exp(r) \in (1, 2.72)$ and $Z$ is strictly concave in $R_i$. That is, the marginal contribution of firm resources to its market size is strictly decreasing, a common assumption in microeconomics and industrial organization.
(1978) typology, firms may adopt one of the three strategic orientations, namely “prospector”, “defender”, and “analyzer”. The key dimension underlying the typology is the rate at which a firm changes its products/processes/markets. Prospectors (with large \( r \)) attempt to be the pioneer in new market/product development. Defenders (with small \( r \)) only engage in little or no innovation. Analyzers (with medium \( r \)) are in between. A defender is likely to contribute less to market expansion than a prospector and an analyzer (Hambrick 1983).

The individual market share, together with the market size, represents each firm’s actual performance \( (P) \) in the competition:

\[
P_i = p_i \cdot Z.
\]  

Subjective (competitive) tension is a perceptual concept to study the intensity of rivalry. The term indicates the identification of major competitors in the common market (Chen et al. 2007). While the focal firm can manage its own competitive moves, the source of uncertainty mainly comes from the rival’s response towards it (Smith et al. 2001). This type of uncertainty is called “strategic uncertainty” (see Porter 1980). In particular, the level of subjective tension would be raised when the rival sends clear public signals showing ready for extensive competition (e.g., Chen et al. 2002, Chen et al. 2007). The signals are measured by public commitment, \( M^c \), in our model (according to Chen et al. (2002), explained later in Competitive Move sector). \( T_{ij}^* \) presents the subjective tension perceived by firm \( i \) according to the visibility of firm \( j \). Formally,

\[
dT_{ij}^*/dt = \left( M_j^c - T_{ij}^* \right)/r_i^T,
\]
where $M_j^p$ indicates the public commitment of firm $j$ and $\tau_i^T$ is the adjustment time for firm $i$ to comprehend such public commitment and then organize responses.

### 5.2. Sensory System

With the knowledge on market conditions, individual firm next moves on to decode the market information for adjusting aspiration through the sensory system. The sensory system includes two major steps: firms set their aspiration level and diagnose the resulting discrepancy with actual performance; next, they decide the corresponding motivation towards closing the performance gap.

Aspiration level, $L$, is an organizational target (Cyert and March 1963). It is flexible to reflect the ever-changing competitive market condition and internal capability levels. This is consistent with the conventional two sources of aspirations: historical and social information. On one hand, the firm manages its historical aspiration level with an additional consideration on market growth. On the other hand, social aspiration is complemented by the information on competitive tension. Public information sent by rivals is a vital message to understand the tension. Therefore, market growth is an indicator how well the firm can possibly perform, while competitive tension adjusts this estimation by taking account of rivals’ ambition. The firm sets its aspiration level according to the dynamics between historical and social information.

Indeed, not all firms aim for the leader position but they may boost their expectation after experiencing continuous low competitive tension from the rival (Chen et al. 2007). More specifically, when the competitive relationship is less intensive, i.e. low $T^*$, the firm may raise its aspiration level since a greater opportunity is perceived to improve its performance.
Additionally, an increasing market size, with massive potential customers, always indicates high market attractiveness that inspires firms to achieve a higher performance objective. However, an initial aspiration to dominate the market may be eroded after a series of fruitless attempts. Normally, when a targeted aspiration has not been fulfilled for some time, firms may experience extensive pressure to adjust goals (Bromiley 1991). Therefore, aspiration level is indeed aligned with both internal capabilities and external competitive relationship: It increases with higher market size and decreases with higher subjective tension. Formally,

\[ L_i = \frac{Z \cdot g_i}{T_{ij}^{\varphi}}, \]  

(6)

\[ g_i = \left(1 + br_i\right)^{\omega_i}, \]  

(7)

where the market size, \( Z \), is adjusted by individual firm’s perceived market growth rate of \( g \) and \( b \) is a scaling factor to adjust the contribution of innovation commitment to the perceived market growth rate. The innovation commitment, \( r \), together with the annual index, \( j \), influences the growth rate. The rationale for Equation 7 is that since aspiration level is an expectation towards the future development, it shall also reflect the expected growth in addition to the existing market size. However, different firms may maintain their own estimation based on firm strategy and optimistic level. For example, a prospector (with large \( r \)) tends to be more positive about market growth than a defender (with small \( r \)) as itself will spend great efforts on new market/product/process development. In addition, a firm is quite optimistic about the future performance, i.e. high aspiration level, if it is assigned to a higher \( \varphi \) value. For example, if \( \varphi = 2 \) is assigned to the firm, then it expects

\[ 6 \]  For simplicity, \( b = 1 \) is assumed in our analysis.
that the market growth rate would double the existing trend in the subsequent time period. And if \( \phi = 0 \) is assigned to the firm, then it expects that the future market size would maintain the same as the past time period. In other words, the innovation commitment of \( r \) reflects the scale of a firm’s perception on market growth rate and the annual index of \( \phi \) reflects its speed.

As a result of the aspiration setting, normally a performance discrepancy of \( G \) is diagnosed as the difference with actual performance \( P \) (Lant 1992). Formally,

\[
G_t = P_t - L_t.
\]  

(8)

Being aware of the performance discrepancy, firms will decide their corresponding motivation level, \( M \), in order to minimize the gap (Cyert and March 1963, March and Shapira 1992). According to the behavioral literature, a strong position, \( G > 0 \), (i.e. favorable performance discrepancy where \( P > L \), denoted as \( G^+ \)) leads to conservative behaviour towards competitive moves. The motivation level is denoted as \( M_{G^+} \), which refers to the motivation for a gain. On the contrary, performance below a target, \( G < 0 \), (i.e. unfavourable performance discrepancy where \( P < L \), denoted as \( G^- \)) leads to greater willingness to take competitive moves, in order to raise the chance of reaching the target (e.g., Chen and Miller 2007, March and Shapira 1987). \( M_{G^-} \) refers to the motivation for a loss. Accordingly, as illustrated in Figure 1, for a similar scale of \( G^+ \) (e.g., the positive gap between performance C and reference point A) and \( G^- \) (e.g., the negative gap between performance B and reference point A), a relationship of \( M_{G^+} > M_{G^-} \) is expected.
The poorer the position, the greater the risk reflected in the negative side of performance discrepancy. Hence firms are less motivated to move. Rather, firms may perceive the initial expectation as unattainable at the current stage. They will adjust the aspiration to an achievable level because firms operate in a competitive environment (e.g., Bromiley 1991). When they become reluctant to take actions due to the overwhelmed goals, they might lose opportunities to maintain desirable positions in the market. Accordingly, the firm tends to lower its aspiration level to reflect the credible threats from the rival. It will lead to a smaller performance gap. In this way, the firm could proactively adjust its own aspiration level in order to maintain high motivation for taking re/actions.

According to the behavioral literature, we model the performance value function, \( f_i \), as an asymmetric S-shaped curve and motivation, \( M_i \), as the first derivative of the value function (see Bromiley 2009, Lant 1992), as illustrated in Figure 1. Formally,

\[
M_i = \frac{df_i}{dG_i},
\]

(9)

\[
f_i(G_i) = \begin{cases} 
G_i, & \text{if } G_i \geq 0 \\
\alpha_i G_i, & \text{if } G_i < 0,
\end{cases}
\]

(10)

where \( \alpha_i \) and \( \beta_i \) determine the curvature of the performance value function for firm \( i \). \( \lambda_i (>0) \), the loss aversion parameter, determines how much firm \( i \) is motivated to take competitive moves under losses (\( G^- \)) than gains (\( G^+ \)). Empirically, the median values for both \( \alpha_i \) and \( \beta_i \) are 0.88; the median value for \( \lambda_i \) is 2.25 (see Bromiley 2009). Following the empirical observations, we adopt those values in the base case setting of our model.

The motivation, \( M \), could be further expressed explicitly as follow:
Notice that we set $M = 1.53$ for $G = 0$, where the value of 1.53 is the motivation level at which $G = 0.01$ given $\alpha = \beta = 0.88$. Because of the discontinuousness of function $f$, its first derivative approaches to infinity at $G = 0$. In the model, we find that within 1% performance discrepancy there is no significant value difference\(^7\); hence, the difference between the motivation level at $G = 0.01$ and $G = 0$ is ignored.

In sum, firms constantly adjust their aspiration levels through sensing both internal and external environments. Along with these aspiration adjustments, the firms would be motive to realign their efforts with new goals, leading to differentiate competitive move decisions (Koszegi and Rabin 2006).

### 5.3. Competitive Move

With the extensive motivation obtained to close the gap between the aspiration level and actual performance, the next step for firms is to make the attack/response decision. As discussed in the previous section, the decision logics for attack and response are identical: firms will take competitive moves if and only if the motivation exceeds a predefined action threshold, $\eta$. In our model, we set $\eta = 1.16$ as the base case according Bromiley’s (2009) work\(^8\).

---

\(^7\) We conducted sensitivity analysis later with various values at $G = 0$. The simulation results show that the difference is not significant for a larger value than 1.53. Therefore, the assumption is reasonable.

\(^8\) In his study, the first derivative of the function approaches to zero when the discrepancy reaches $\pm 10\%$. So we set the critical value of $\eta = \min M_{G_i}, M_{G_{i-1}}$, which equals to 1.16 in the base case (i.e. for
Apart from the threshold, it is also vital for firms to decide the visibility of the actions. According to Chen et al. (2002), competitive moves consist with both internal commitment component, \( M^I \), and public commitment component, \( M^p \). Accordingly, our model divides the specified motivation, \( M \), into two parts. One is translated into internal commitment that focuses on developing sustainable capabilities. The other is translated into public commitment that sends deterrent signals to rivals. Formally:

\[
M_i = \delta_i \left( M^I_i + M^p_i \right),
\]

\[
M^I_i = \begin{cases} 
M_i \cdot s_i / \delta_i & \text{if } M_i \geq \eta_i \\
0 & \text{if } M_i < \eta_i, 
\end{cases}
\]

\[
M^p_i = \begin{cases} 
M_i \cdot (1 + s_i) / \delta_i & \text{if } M_i \geq \eta_i \\
0 & \text{if } M_i < \eta_i, 
\end{cases}
\]

where \( \delta_i \) is a scaling faction to present the motivation parameter for firm \( i \). Its estimation here is based on two sequential empirical studies in action irreversibility (Chen and MacMillan 1992, Chen et al. 2002). Chen and his colleagues (1992, 2002) identify twelve common competitive moves. In 1992, they studied the irreversibility of each competitive move as a whole. In 2002, they further explored the individual effect of each commitment component on response. The summary of their empirical study is listed in Table 1.

\hspace{1cm} \alpha = \beta = 0.88 \). We later conduct experimental design to test the impact of different \( \eta \) values on firm performance to check the robustness of the base case outcome. For simplicity, we assume that both firms’ \( \eta \) is identical, i.e. \( \eta_i = \eta_j \).
## TABLE 1

<table>
<thead>
<tr>
<th>Competitive Move</th>
<th>Action Irreversibility in 1992</th>
<th>Internal Commitment in 2002</th>
<th>Public Commitment in 2002</th>
<th>Motivation Factor ( \delta ) (^9)</th>
<th>Action Visibility ( s ) (^{10})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Cut</td>
<td>2.66</td>
<td>1.954</td>
<td>3.948</td>
<td>0.451</td>
<td>0.669</td>
</tr>
<tr>
<td>Promotion</td>
<td>2.067</td>
<td>1.733</td>
<td>2.714</td>
<td>0.465</td>
<td>0.610</td>
</tr>
<tr>
<td>Service Improvement</td>
<td>2.276</td>
<td>2.062</td>
<td>2.846</td>
<td>0.464</td>
<td>0.580</td>
</tr>
<tr>
<td>Commission</td>
<td>2.464</td>
<td>1.875</td>
<td>3.451</td>
<td>0.463</td>
<td>0.648</td>
</tr>
<tr>
<td>Alliance</td>
<td>3.078</td>
<td>2.864</td>
<td>3.732</td>
<td>0.467</td>
<td>0.566</td>
</tr>
<tr>
<td>M&amp;A</td>
<td>4.528</td>
<td>4.369</td>
<td>4.472</td>
<td>0.512</td>
<td>0.506</td>
</tr>
<tr>
<td>Copromotion</td>
<td>2.016</td>
<td>1.658</td>
<td>2.714</td>
<td>0.461</td>
<td>0.621</td>
</tr>
<tr>
<td>Increase in daily departures</td>
<td>2.869</td>
<td>2.668</td>
<td>3.34</td>
<td>0.478</td>
<td>0.556</td>
</tr>
<tr>
<td>Exit from a route</td>
<td>2.249</td>
<td>2.322</td>
<td>2.491</td>
<td>0.467</td>
<td>0.518</td>
</tr>
<tr>
<td>Entry into a route</td>
<td>2.791</td>
<td>2.577</td>
<td>2.205</td>
<td>0.584</td>
<td>0.461</td>
</tr>
<tr>
<td>Cooperate with another airline</td>
<td>3.078</td>
<td>2.864</td>
<td>3.732</td>
<td>0.467</td>
<td>0.566</td>
</tr>
<tr>
<td>Hub creation</td>
<td>3.934</td>
<td>3.811</td>
<td>2.911</td>
<td>0.585</td>
<td>0.433</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>2.834</strong></td>
<td><strong>2.563</strong></td>
<td><strong>3.213</strong></td>
<td><strong>0.489</strong></td>
<td><strong>0.561</strong></td>
</tr>
</tbody>
</table>

## TABLE 2
Descriptive Summary of Action Visibility

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td><strong>0.561</strong></td>
<td><strong>Mean</strong></td>
<td><strong>0.561</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td>0.0719</td>
<td><strong>Minimum</strong></td>
<td>0.433</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Maximum</strong></td>
<td>0.669</td>
<td></td>
</tr>
<tr>
<td><strong>Confidence Level (95.0%)</strong></td>
<td>0.0457</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^9\) For each competitive move, motivation factor \( \delta \) = Action Irreversibility/(Internal commitment + Public commitment). Given the fact that action irreversibility could be further divided into two parts, internal and public commitments, this formula presents how to translate a particular rating of action irreversibility into the two components. That is, for one unit of action irreversibility, we could calculate the corresponding value for the corresponding internal and public commitments, respectively.

\(^{10}\) For each competitive move, action visibility \( s \) = Public commitment / (Internal Commitment + Public Commitment). This formula presents the ratio of public commitment attached to a particular competitive move.

\(^{11}\) Different values of action visibility will be considered later for experimental design.
We use the average value of their study results to estimate the motivation parameter, $\delta_i = \delta_j = 0.489$ (see Table 1). Our setting represents the relationship between the single measurement in 1992 and the dual measurement in 2002. Additionally, in Equations 13 and 14, $s_i$ is the visibility level attached to one competitive move for firm $i$. We calculate the division between internal and public commitment for each competitive move. Then we use the mean value as the base case of action visibility, where $s_i = s_j = 0.561$ (see Table 1). That is, public commitment accounts for 56.1% of one competitive move and internal commitment is allocated for 43.9%. The descriptive summary is presented in Table 2 to illustrate the deviation between competitive moves.

5.4. Resource

The fundamental objective for firms is to achieve superior performance in the market. The resource accumulation, $C_R^i$, is essential to achieve that goal (e.g., Dierickx and Cool 1989). Competitive moves with either internal commitment, $M^I_i$, or public commitment, $M^p_i$, could contribute to the resource accumulation. Take the airline industry as an example, competitive moves with high internal commitment, such as hub creation and merger & acquisition, could effectively construct firm-specific capabilities in building learning barriers (e.g., Barney 1991; Chen and MacMillan 1992, Chen et al. 2002). Comparably, competitive moves with high public commitment, such as service improvement and promotion with travel agents, would also contribute to the development of capabilities, though in a less significant way. Formally,

$$
\frac{dR_i}{dt} = \left( C_R^i - R_i \right) / \tau_i^R,
$$

$$
C_R^i = \epsilon_i^I M^I_i + \epsilon_i^p M^p_i,
$$

where $\tau_i^R$ is the adjustment time to accumulate capabilities for firm $i$; and, $\epsilon_i^I$ and $\epsilon_i^p$ are firm
### TABLE 3
Parameters and Initial Conditions for the Base Case

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Market Condition</th>
<th>Sensory System</th>
<th>Competitive Move</th>
<th>Resources</th>
<th>Initial Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market Condition</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Scaling factor (dimensionless (dmnl))</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Resource commitment (1/units)</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r</td>
<td>Innovation commitment (1/units)</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>φ</td>
<td>Annual Index (dmnl)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>𝛿̅</td>
<td>Adjustment time for subjective tension (months)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sensory System</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Scaling factor (dmnl)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>α</td>
<td>Curvature of gain function (dmnl)</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>β</td>
<td>Curvature of loss function (dmnl)</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>λ</td>
<td>Loss aversion parameter (dmnl)</td>
<td>2.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Competitive Move</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>√η</td>
<td>Action threshold (dmnl)</td>
<td>1.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>δ</td>
<td>Motivation parameter (dmnl)</td>
<td>0.489</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>√s</td>
<td>Action visibility (dmnl)</td>
<td>0.561</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ε₁</td>
<td>Accumulation effectiveness of internal commitment (1/unit)</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ε₂</td>
<td>Accumulation effectiveness of public commitment (1/unit)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>τᵣ</td>
<td>Adjustment time for resource accumulation (months)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Initial Conditions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>√Rᵢ₀</td>
<td>Initial capability level of firm i (units)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tᵢ₀</td>
<td>Initial subjective tension level of firm i (dmnl)</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The parameters with a tick at the front are tested under different values in the experimental design, see Section 6. Those parameters are chosen to examine since they directly contribute to the hypothesis testing. The details about experimental design are explained later.
i’s resource accumulation effectiveness of internal commitment and public commitment, respectively. As discussed, internal commitment tends to be more effective in accumulating capabilities (i.e. $\varepsilon_i^I > \varepsilon_i^P \ \forall i$).

The base case setting of all the parameters is summarised in Table 3.

6. Model Validation

Although the proposed model describes relationships that have been documented in the literature, the concentration so far is fragmented to the immediate relationships within the scope of individual firms. To test and build confidence in the model as a whole, it is necessary to fully explore all the simultaneous interactions among different factors at the competition level. In this section, we will integrate the fragmented relationships in our formal model, to assess whether those relationships operate simultaneously in a wide range of rivalry settings.

With two rivals competing in one market, action sensory, competitive move, the associated resource, and market conditions form a closed feedback loop, contributing to various firm performances. In order to surpass rivals, firms are expected to create and capture the opportunities for proper competitive moves based on an accurate understanding about the market environment. Consequently, they are able to affect the competition in a desirable way to reduce the response likelihood.

In particular, at the competition level, the creation of opportunities heavily relied on the two factors in a competitive relationship, i.e. 1) actors’ action visibility and 2) reactors’ aspiration level. The consideration of reactors’ aspiration level is a missing piece to explore competition in the existing behavioral literature. Hence, little insights have been attained in the dynamic interaction between the internal and external information. The model presented in the study fills this gap.
The reactor in our model follows an identical decision-making logic as the actor. Therefore, its high aspiration level normally leads to a negative performance discrepancy, while a low aspiration level results in a positive performance discrepancy. The reactor generates quite different response patterns based on its performance framing. In this section, we will present the four possible combinations of actor’s action visibility and rival’s performance discrepancy. Then we will assess the different impact of search actions on the rival’s response likelihood to validate the proposed model, as illustrated in Figures 5 and 6.

6.1. The Effect of High Action Visibility at Competition Level

When actions are highly visible, the effect of public commitment will dominate that of internal commitment. Under such circumstance, reactors mainly feel that the public are watching them being assaulted and will be forced to take necessary responses to protect firm reputation (Chen and Miller 1994). A common example of such actions is price cut. In Chen et al.’s (2002) study, the visibility of price cut reaches 0.669\(^{13}\), which is much higher than the average value of 0.561. Due to such significant impact of such attacks, most competitive dynamics studies treat price moves as a special case of estimating responses and associated payoffs (Chen and MacMillan 1992).

The public commitment attached to an action could affect reactors’ performance discrepancy by lowering their aspiration level for the next round. According to Equations 5 and 6, public commitment could sharply increase the perceived competitive tension in interfirm rivalry (Equation 5), hence negatively influencing the reactors’ aspiration level for the next period (Equation 6). For example, when rivals engage in continuous price cut campaign, they are indeed

\(^{13}\) In their study, the internal commitment score of price cut is 1.954; and the public commitment score is 3.948. Therefore, the visibility level equals to 0.669 since \( s=3.948/(1.954+3.948)=0.669 \).
5a Public commitment vs. loss

5b Public commitment vs. gain

5c Public commitment from loss to gain

6a Internal commitment vs. loss

6b Internal commitment vs. gain

6c Internal commitment from gain to loss
ready for a decreased expectation of the future performance (Chen and Miller 1994). In the following two sections, given reactors’ divergent types of performance discrepancy, we will test the major effect of public commitment on reactors’ motivation to take responses.

6.2. Actors’ High Action Visibility vs. Reactors’ Unfavorable Gap

We first analyze the impact of public committed actions on reactors’ negative framing of performance discrepancy, i.e. the aspiration level of the reactor is higher than its actual performance ($L_1 > P$ as illustrated in Figure 5a). The reactor has not completely fulfilled the desired performance level. Consequently, any move initiated by the actor will be treated as an absolute loss, as it could enlarge the distance between the initial aspiration level and the reactor’s actual performance. Thus the reactor is quite sensitive to such actions. It is consistent with the fundamental assumption of competitive dynamic research. According to Chen et al. (2002), public commitment is expected to provoke greater response likelihood from the reactor.

In Figure 5a, when the focal firm announces its public commitment, the rival would reduce its aspiration level from $L_1$ to $L_2$. Then the corresponding motivation level would be modified from $M_1$ to $M_2$. Apparently, due to the convexity of the rival’s negative framing effect (Equation 10), the rival would exhibit higher motivation to take responses with a closer unfavorable performance gap, i.e. $M_1 < M_2$. Hence the likelihood of responses increases associated with actor’s public committed attacks, all else being equal. The model could effectively reflect the findings in competitive dynamic literature that an action with higher public commitment will increase the likelihood of response (Chen et al. 2002).
6.3. Actors’ High Action Visibility vs. Reactors’ Favorable Gap

In this case, we assume the reactor is experiencing positive framing of performance discrepancy, i.e. $L_1 < P$. The positive gap would be translated into a sense of success. The enjoyable experience could, however, lead to higher inertia in adaptation (Miller and Friesen 1984). Thus it may be more reluctant to respond to external changes in market conditions. The outcome could be specified in the following two conditions. First, the reactor is of relatively large size in the competition. Given the actor’s public commitment, the reactor may perceive it as an exaggeration of the actor’s capability to implement attacks, i.e. competitive bluffing (Carr 1968, Moore 1992). For example, market leaders, even if they are aware of the public announcement from entrepreneurs, may not necessarily engage in retaliation moves, i.e. the effect of competitive uncertainty (Grimm et al. 2006). Second, the reactor is of relatively small size in the competition. It is common to observe deterrent attacks from market leaders. Although the reactor may experience favorable performance gap at first, it may reframe its aspiration level when the focal firm sends strong public signals to deter rivals (Grimm et al. 2006). Thus, the increased competitive tension imposes a more realistic aspiration to the reactor ( $L_2 < P$ as illustrated in Figures 5b and 5c). So, its corresponding likelihood of response would be sharply decreased.

It is notable that under a favorable performance gap, the reactor is less likely to take retaliation move towards the attacks. In Figure 6b, the reactor’s aspiration level decreases from $L_1$ to $L_2$, where it becomes more grateful to the current achievement. The motivation level is followed to a reduced level, $M_2$ (< $M_1$). It is because of the concavity of the rival’s positive framing effect (Equation 10). Additionally, in Figure 6c, the reactor experiences a transition from negative framing to positive framing effect, i.e.
$L_2 < P < L_1$. That is, the rival experiences a negative gap initially ($G_1^- = P - L_1 < 0$) and a positive gap afterward ($G_2^+ = P - L_2 > 0$). According to Equation 11, for a similar absolute distance to the aspiration level where $|G_1^-| \approx |G_2^+|$, the motivation level at $L_1$ (loss) is greater than that at $L_2$ (gain), i.e. $M_1 > M_2$, all else being equal. Likewise, the reactor is less likely to take responses. Hence the model, again, could effectively reflect the fact that an action with higher public commitment could decrease the likelihood of response when the rival enjoys a favorable position.

In mathematics, there is one critical point that could yield the same motivation level as the pre-battle condition, i.e. $M_1 = M_2$. That is, the motivation generated from the initial loss is identical to that derived from the latter gain in Figure 6c. Graphically, it might happen when $|G_1^-| \gg |G_2^+|^{14}$. In theory, it reflects the tipping point where the deterrent attack starts to exercise its effects on the rival.

The existing literature has just started to explore the conditional factors for deterrent action such as the market position of the actor (e.g., Grimm et al. 2006). We complement this perspective by considering the performance framing of the reactor. An effective deterrent action could successfully lower rivals’ motivation to take responses, i.e. $M_1 \gg M_2$. On the contrary, an ineffective deterrent action fails to achieve the specified motivation outcome, where $M_1 \leq M_2$. Our model could easily capture this shift by explicating the adjustment of rivals’ aspiration levels.

---

14 The estimated relationship between them is $|G_2^+|/|G_1^-| = 0.0012$ given $\alpha = \beta = 0.88$ and $\lambda = 2.25$ (see the Appendix for a detailed analysis).
6.4. The Effect of Mild Action Visibility at Competition Level

When an action is mildly visible, internal commitment will generate the dominant effect. The actor dedicates firm resources to long-term development, which deters the reactor’s immediate responses. The expectation of the reactor to be beneficial from the responses is relatively low (Chen and Miller 1994). According to Chen et al. (2002), hub creation in U.S. airline industry is a typical example. The visibility of this particular attack is 0.433\(^{15}\), which is much lower than the average value of 0.561. Consequently, reactors are inclined to take delayed or no responses towards such actions.

Internal commitment of an action influences reactors’ performance discrepancy by lowering their actual performance level. According to Equations 15 and 16, internal commitment could effectively contribute to resource accumulation. It then leads to a higher market position of the actor, such as a higher market share (Equations 1 and 2). On contrast, the reactor’s market share would be negatively influenced, hence leading to a worse actual performance level (Equation 4). For instance, when rivals effectively launch a new product, the performance of the focal firm would definitely be eroded as a result. In the following two sections, given reactors’ divergent types of performance discrepancy, we will test the major effect of internal commitment on reactors’ motivation to take responses.

6.5. Actors’ Mild Action Visibility vs. Reactors’ Unfavorable Gap

We first analyze the impact of internal committed attack when reactors experience a negative framing of performance discrepancy, i.e. actual performance is lower than the aspiration level (\(L > P_1\) as illustrated in Figure 6a). Figure 6a illustrates this effect on

\(^{15}\) In Chen et al.’s (2002) study, the internal commitment score of hub creation is 3.811; and the public commitment score is 2.911. Therefore, the visibility level equals to 0.433, i.e. \(s=2.911/(3.811+2.911)=0.433\).
rival’s motivation level. As described in Equation 16, the attacker effectively improves its market share in response to an increased resource accumulation. Correspondingly, the rival’s performance will decrease from $P_1$ to $P_2$. Then, the negative gap between its actual performance and the initial aspiration level would be even larger. As a result, the efforts required to close the gap become greater. For example, when the rival is only 3% less than the focal firm in terms of market share, it is reasonable to believe that the rival is highly motivated to catch up soon. However, if the gap enlarges to 30%, commonly supposed that the rival can hardly close the gap in a short run. In other words, given the limited resources currently obtained by the rival, the opportunity to catch up with the focal firm in competition turn out to be relatively small. It is reflected by the convexity of the negative framing effect in Equation 10. Therefore, the associated motivation level would decrease from $M_1$ to $M_2$ (as illustrated in Figure 7a, where $M_1 > M_2$). This is consistent with the finding in the competitive dynamic literature that an attack with higher internal commitment will decrease the likelihood of response (Chen et al. 2002).

6.6. Actors’ Mild Action Visibility vs. Reactors’ Favorable Gap

As discussed in section 3, when the rival currently enjoys a favorable gap that it outperforms the aspiration level, i.e. $L < P_1$, it would be able to build up the excess capabilities, i.e. slack resources (Levinthal and March 1981). Slack provides the ability to deal with setbacks (Bromiley 2005) and to cope with uncertainty (Bourgeois 1981). Therefore, the rival itself will be keen to invest in innovative activities (Greve 2003, Nohria and Gulati 1996). Such engagement will facilitate active responses towards internally committed attacks. It is since the main threat of the internal commitment is the attacker’s determination in not backing down (Chen et al. 2002, Staw and Ross 1987). Without doubt, this escalation of commitment would require excess resources to
support. Yet slack serves a positive function to overcome the barrier. Consequently, slack ensures the rival be able to engage in brutal competition with high resource commitment. Therefore, we are looking for a greater likelihood of response to internally committed attacks when rivals with a favorable gap. In Figure 6b, we can observe that the rival’s actual performance drops from $P_1$ to $P_2$ due to the attack. The competitive moves initiated by the actor make the rival’s performance worse. Supported by slacks, the rival is inclined to be more motivated to take responses, i.e. $M_2 > M_1$. In particular, an extensive attack may push the perceived performance discrepancy from gain ($P_1$) to loss ($P_2$), i.e. $P_2 < L < P_1$ in Figure 6c. Therefore, according to Equation 11, the motivation level of a positive framing ($M_1$) is less than the motivation level of a negative framing ($M_2$), all else being equal.

With a low aspiration level, rivals experiencing a favorable gap generally tend to be more likely to respond to internally committed attacks. And it would be much more difficult for the attacker to achieve the expected performance. Therefore, we can truthfully model the scenario that positively framed rivals would be more likely to respond to the actor’s internal commitment.

There is a critical point where the motivation keeps unchanged after the action, i.e. $M_1 = M_2$. It is the situation that actions would not stimulate the rival’s motivation to take reaction. That is, the actor can make substantial investment without triggering any response. The model suggests practical tactics of initiating an effective attack. Overall, our model is consistent with the competitive dynamics literature following Bromiley’s (2005) suggestion. According to the proposed formal model, we start to conduct simulation experiments.
7. Simulation Experiments and Analysis

To characterize the range of interfirm rivalry the model produces and to understand the impact of each parameter, the model has been extensively analyzed under a variety of designs. Specifically, at one individual firm level, we vary four parameters. They are one organizational characteristic parameter, i.e. initial capability level: leading position or challenging position (2); and three organizational decision-making parameters, aspiration level: aggressive or conservative (2); competitive aggressiveness level: active or inactive (2); action visibility level: internal-oriented commitment or public-oriented commitment (2). There are 8 factors considered at the dyad competition level. As a result, \(2^8 = 256\) sub-experiments are expected for a complete replicate of a two-level factorial design. While completing the full experimentation is exhaustive, Montgomery (1991) provides design resolutions to balance the need for realism against computational complexity and tractability. We hence adopt two-level fractional factorial design in the study. In such a way, the simulation experiments enable us to capture the essential characteristics of the interfirm rivalry without being overwhelmed by the model details.

7.1. Experimental Settings

According to Montgomery (1991), the successful use of fractional factorial design is based on one of the key ideas that higher-order interactions (i.e. interactions between more than three variables) play a less significant role in explaining the causal system. In other words, among several variables, the system is likely to driven primarily by some of the main effects and lower-order interactions. Our study mainly concentrates on the impacts of the single variable, i.e. aspiration level (H1), as well as two-factor interactions such as competitive aggressiveness and aspiration level (H2). In other
words, “design of resolution IV” is adopted (see Montgomery 1991), where the main
effects and two-factor interactions are particularly important in explaining competitive
outcomes. As a result, the number of sub-experiments decreases to $2^{8-3} (= 32)$. We
conduct 40 runs per sub-experiment. The experimental settings for the eight parameters
are reported in Table 4.

TABLE 4
Parameters for Experimental Design

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Level 1 (High)</th>
<th>Level 2 (Low)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own aspiration level</td>
<td>$L_1$</td>
<td>$L^H = Z \cdot g_y / T_y^y$</td>
<td>$L^L = Z \cdot g_y / \exp(T_y^y)$</td>
</tr>
<tr>
<td>Rival’s aspiration level</td>
<td>$L_2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own competitive aggressiveness</td>
<td>$\eta_1$</td>
<td>$\eta^H \sim U [1, 1.16]$</td>
<td>$\eta^L \sim U [1.53, 1.7]$</td>
</tr>
<tr>
<td>Rival’s competitive aggressiveness</td>
<td>$\eta_2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own action visibility</td>
<td>$s_1$</td>
<td>$s^H \sim U [0.61, 0.669]$</td>
<td>$s^L \sim U [0.443, 0.466]$</td>
</tr>
<tr>
<td>Rival’s action visibility</td>
<td>$s_2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own capability level</td>
<td>$R_1$</td>
<td>$R^H \sim U [6, 10]$</td>
<td>$R^L \sim U [1, 5]$</td>
</tr>
<tr>
<td>Rival’s capability level</td>
<td>$R_2$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For each parameter, we assign two levels: high and low. To differentiate the effects
between the two levels, we further assign each a distinct value distribution based on the
empirical results, as reported in Table 416. As the competing firms employ the same

16 The rationale of experimental design settings are as follow:

1) **Aspiration level:** we distinguish the two levels of aspiration by considering the firm’s attitude
towards the imposed competitive tension. We adopt Equation 6 as a high setting where the firm
tends to overlook the visible attacks. Comparably, if the firm exaggerates the public information
sent by the rival, it tends to be more conservative in setting its own aspirations. We apply an
exponential function in interpreting the competitive tension, which leads to a low aspiration level.

2) **Competitive aggressiveness level:** a firm is considered being aggressive when it continuously
improves itself. Based on Bromiley’s (2009) work, we assign a uniform distribution between 1
and 1.16 to represent firms with strong competitive aggressiveness. Otherwise, a conservative
firm seems being easily satisfied with the current achievement. Given that we assign $M = 1.53$ to
the reference point in Equation 13’, we model a conservative firm by a uniform distribution
between 1.53 and 1.7. Under this condition, the firm only initiates actions when it experiences
performance loss (threat), and reluctant to take actions under performance gain (opportunity).
mental model, the distribution is identical for the attacker and the defender. For example, we assign a uniform distribution between 0.61 and 0.669 to indicate a highly visible competitive move, no matter whether it is launched by the attacker or the defender. We adopt the attacker’s market share as the dependent variable. Market share has long been identified as one of the most important competitive outcomes reflecting a firm’s profitability (e.g., Chen and Hambrick 1995, Ferrier et al. 1999). In our model, the focal firm’s market share is reported as the average value of a five-year time period. By varying the values of parameters for each run, the overall results obtained for each sub-experiments are more robust to disregard the effects of noises (Montgomery 1991, Phelan and Lin 2001).

**TABLE 5**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Own aspiration</td>
<td>-.032</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Own aggressiveness</td>
<td>.057</td>
<td>.057</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Own action visibility</td>
<td>.025</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Own capability</td>
<td>.012</td>
<td>-.034</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Rival’s aspiration</td>
<td>.031</td>
<td>-.016</td>
<td>-.057</td>
<td>-.052</td>
<td>.027</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Rival’s aggressiveness</td>
<td>-.11</td>
<td>.075</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.090</td>
</tr>
<tr>
<td>7. Rival’s action visibility</td>
<td>.018</td>
<td>.056</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Rival’s capability</td>
<td>-.044</td>
<td>-.012</td>
<td>.029</td>
<td></td>
<td>.081</td>
<td></td>
<td></td>
<td>.046</td>
</tr>
</tbody>
</table>

Note: only the variables that have significant effects ($p < 0.05$) are included.

As shown in Table 5, the systematically generated results from the computer simulations have provided valuable insights to the issue of organizational decision-

3) **Visibility level**: we set the two levels based on Chen et al.’s (2002) study on the internal and public commitment. In order to examine the significant differences between high and mild action visibility, we adopt some extreme values in their study. For example, actions like market entry ($s=0.466$) and building new plant ($s=0.443$) are considered less visible; actions similar to price cut ($s=0.669$) and promotion ($s=0.61$) are pretty obvious to competitors.

4) **Capability level**: within a 1 to 10 scale, we adopt 1 to 5 to present a low capability level, whereas 6-10 to indicate a high level.
making under interfirm rivalry. To highlight its most interesting dynamics, in addition to the experimental design, we also provide specific numerical examples to visualize the tested results. Accordingly, the following sections can enhance our understanding about the underlying dynamics between the two competing firms.

7.2. The Main Effect of Aspiration Level in Action Sensory

According to Table 5, we could easily find the inconsistency between the experiment results and hypothesis 1. The result shows that the firm’s own aspiration level is negatively associated with its market performance ($\beta = -.032$). And the negative effect is significant ($p < .0001$). It does not support Hypothesis 1 that higher aspiration level leads to higher performance.

In addition to the negative impact of the firm’s own aspiration, the rival’s aspiration positively contributes to the firm’s market performance. The effect is quite significant ($\beta = .031; p < .0001$). This is largely due to the symmetric dyad-level simulation design: the two competing firms share the identical decision logic and divide the whole market exclusively. The rival’s aspiration is negatively associated with its own performance as well. Therefore, when the rival sets high aspirations, its market share will be eroded by the focal firm, hence directly proportionating to the focal firm’s better performance.

The above finding suggests that the impact of aspiration level on market share may be moderated by several other variables, such as its own aggressiveness and the rival’s action visibility. The interactive effects are explored in the following analysis.

7.3. The Moderating Effect of Competitive Aggressiveness

Hypothesis 2 addresses the extent to which the magnitude of competitive aggressiveness moderates the influence of the firm aspiration on its performance. Aggressive firms
would launch frequent and speedy actions. Thus high aspirations can proactively pursue the perceived opportunities and cope with threats to achieve improved market share. Our results support the proposed positive interaction. As illustrated in Figure 7, when the focal firm intends to play tough (▲B+), its high aspiration would lead to improved market share. When the attacker is less aggressive (■B-), its aspiration negatively contributes to less market share. That is, competitive aggressiveness will reinforce the effect of aspirations on firm performance.

FIGURE 7
The Interactive Effect of Aspiration and Competitive Aggressiveness on Market Share

We can model the firm’s behavior in specific simulation settings to further illustrate the impact of aggressiveness on competitive outcome. In Figure 8a, by controlling aggressiveness at a high level (\(\eta = 1\)), firm with low aspiration tends to perform much worse than one with high aspiration. We observe a disparity of 30 percent between their market shares. When we set aggressiveness at a low level (\(\eta = 1.7\)) in Figure 8b, low aspiration performs better. Given the fact that it is reluctant to take actions, the firm might soon lose the whole market if it keeps inattentive to competitive environment.

It is remarkable that strong competitive aggressiveness seems being a dominant strategy for the firm. Apparently, high aspirations guide the firm to behave aggressively in order not to retreat from the market. Moreover, aggressive attacks leave a firm with
low aspiration no worse off than being conservative (see Figure 9). It seems that a large number of rapid actions, in comparison to a small number of actions, facilitates marginally better performance. This is also supported by the experiment result in Figure 7, where strong aggressiveness (the upper line) generally leads to higher market share than weak aggressiveness (the bottom line). Therefore, the launch of aggressive actions is a dominant strategy for the firm.

7.4. The Moderating Effect of Action Visibility

There are two possible types of commitment a firm can attach to an action, public and internal commitments. The visibility represents the portion of public commitment attached to a competitive move. A highly visible re/action tends to be easily captured by the rival. Hypothesis 3 proposed that visible attacks would weaken the positive impact
of aspiration on firm performance. Contrary to our expectation, when the firm initiates highly visible actions, it does not significantly moderate the effect of aspirations on firm performance. Instead, the rival’s aspiration is negatively related to the firm’s improved market share.

**FIGURE 10**
The Interactive Effects of Action Visibility and Rival’s Aspiration

![Interaction Graph](image)

**FIGURE 11**
The Moderating Effect of Action Visibility on Market Share

11a Mild Attack Visibility  
11b High Attack Visibility

In Figure 10, we find that when the firm relies on mildly visible actions (i.e. □ C-), it can achieve the best possible market share if the rival sets high aspirations. That is, the rival overlooks the focal firm and its response lag is beneficial to the firm’s performance (see Figure 11a). However, visible actions (i.e. ▲ C+) are desired when the rival actively engages in risky search activities (see Figure 11b). It is quite against our
expectation that visible attacks lead to poor performance due to the elicited retaliation. Hence, we conclude that our analysis provides no support for Hypothesis 3.

In short, public-commitment dominated actions are quite effective to deter conservative rivals of low aspirations. In contrast, when the focal firm takes actions with low visibility, an ambitious rival with high aspirations is least able to take successful responses. Accordingly, the focal firm could take the most advantages from such internally committed actions.

7.5. The Dominant Effect of Competitive Aggressiveness and Action Visibility

According to the previous analysis, both competitive aggressiveness and action visibility significantly moderate the variance in market share through the focal firm’s and the rival’s aspiration respectively. The experiment results in Table 5 further show that competitive aggressiveness plays a dominant role in explaining the variance. Thus, Hypothesis 4 is supported.

7.6. The Moderating Effect of Asymmetric Firm Capability

The asymmetric pre-battle capability is expected to moderate the negative effect of action visibility on firm performance. For example, although deterrent actions are characterized by strong visibility, large firms could benefit from such moves: They are able to attach high public commitment to signal its leader position and deter rivals (Grimm et al. 2006). However, we could not find support for Hypothesis 5. That is, the impact of the interaction between initial capability level and action visibility does not play a significant role in predicting the average firm performance ( \( p > .05 \), see Table 5).

A parametric setting of simulation could depict the rationale. As illustrated in Figure 12, we compare the market performance of rivals of similar capabilities with those of asymmetric capabilities. First, we assign a low initial capability to both firms in Figure
12a. As examined in section 7.3, when the firm sets high aspirations, its performance deteriorates due to a series of visible actions. Consequently, the focal firm maintains lower market share for the entire five-year competition (see Figure 12a). If we assign a high initial capability to the focal firm (f1), where \( R = 10 \), the expected sustainable advantage is not observed. In Figure 12b, although the superior capability enable the focal firm to dominate the market at the beginning, the market share still gets eroded by the rival due to its strong action visibility.

**FIGURE 12**

The Effects of Firm Capability on Market share

12a Similar Capabilities between rivals  
12b Asymmetric Capabilities between rivals

**FIGURE 13**

The Interactive Effect of Aspiration and Initial Capability on Market Share
On the other hand, the initial capability of the firm indeed significantly moderates the effect of its aspiration level. In Figure 13, as a follower (i.e. D-), a higher aspiration could generate a better performance. However, as a leader (i.e. D+), aspiration is negatively associated with its market share. It would be quite dangerous for a dominant firm to underestimate the rival’s visible actions.

8. Theory Development

According to the experiment results, we offer a series of revised propositions on the effects of aspirations in competition (see Figure 14). In particular, we emphasize that competition provides greater challenges as well as opportunities in managing aspirations for improved performance. A firm cannot achieve the expected performance solely considering its own aspiration. It is far from enough to be aware of one’s own decision process. Virtually, rivals are also important to be considered when making

**FIGURE 14**

The Revised Effects of Aspirations

![Diagram of the Revised Effects of Aspirations]

- Firm Capability
- Competitive Aggressiveness
- Aspiration Level
- Rival’s Aspiration Level
- Action Visibility
- Firm Performance
- P1a
- P1b
- P2
- P3
- P4
aspiration decisions. The competitive characteristics can generate direct impact both on itself (i.e. aggressiveness) and on the rival (i.e. action visibility). By integrating the rival’s aspiration into the framework, the firm may effectively utilize both decoding and encoding mechanisms for higher performance.

Compared with the single-factor (i.e. the focal firm’s aspiration only) framework in Figure 3, the decoding and encoding process of aspirations to firm performance are better clarified in the two-factors (i.e. both the focal firm and the rival’s aspirations) framework in Figure 15. Also, the revised structure could clearly explain the opening example of the New Coke campaign. The propositions are explained below.

Fundamentally, aspiration is estimation about future based on current available information. It requires an accurate understanding about the firm itself and the outside environment (Cyert and March 1963). Also, it reflects the firm’s confidence to cope with any current challenge. In a competitive environment, the challenges mainly come from rivals. When the firm believes that it is able to achieve the target, it would not influenced much by the rivals’ signals. It would set higher aspirations. However, a number of lessons have demonstrated the limitation of such decision logic.

For example, competitors overlooking the capability of Wal-Mart contributed to its business success. Wal-Mart initially operated in small towns. However, larger rivals, including Kmart, Target, and Sears just viewed such territories as incapable of supporting a large discount operation. When the rivals finally started to take reactions, Wal-Mart had already accumulated experiences and capabilities necessary to compete in big cities (Grimm et al. 2006). Actually, a number of entrepreneurial firms achieve their success due to low interests of large rivals at early stage (i.e. competitive uncertainty, see Grimm et al. 2006). Therefore, it would be necessary for firms to be
sensitive to interfirm rivalry, especially the threats of new entrants. The sooner they could effectively detect the rivals and take them into account in aspiration settings, the better sustainable performance could be ultimately expected.

Additionally, aspirations have positive bias (Greve 2003). Firms aspire to achieve higher performance than past performance and other comparable firms in competition. This positive bias keeps firm from being completely stable and satisfied in the long run (Bromiley 2005). Therefore, firms commonly have more than one high aspiration that is above actual performance. They would accordingly result in different senses of loss (i.e. negative performance discrepancies). Due to the convexity of the value function at the loss side (see Figure 1), the larger the gap is, the lower the firm is motivated to take search actions. If the target is too high, the firm may be overwhelmed and thus

**FIGURE 15**
Comparison of Aspirations
unenthusiastic to achieve it (Bromiley 1991). The intended inspiring effect of a high aspiration could be hardly realized. As a result, the performance is unlikely to be improved.

In Figure 15, there are two potential aspirations, A and B, for the firm to choose, where $A < B$. Both aspirations exceed the actual performance, C. The firm perceives aspiration B is more difficult to attain. In other words, aspiration B requires the firm to take greater risks than aspiration A (March and Shapira, 1992). Therefore, the motivation ($C'_B$) of aspiration B to take search actions is much less than that ($C'_A$) of aspiration A. If the firm adopts the higher aspiration B, its performance would be negatively affected as it lacks necessary actions. Formally,

*Proposition 1a. Aspiration level is negatively proportional to firm performance in competition.*

Notice that the decision-making process illustrated in Figure 1 is a generic logic to achieve the performance target (Cyert and March 1963). Such logic could be applied to most players in competition. Therefore, we could argue that the rival’s aspiration is negatively associated with its performance. Also, in a competitive relationship, one firm’s loss is equivalent to another firm’s gain (e.g., Smith et al. 2001). It is particular true when we adopt market share as the measurement. The market share obtained by one firm must be the equal to the market share lost by another. Therefore, the rival’s high aspiration leads to poor performance for its own, but high performance for the focal firm. Formally,

*Proposition 1b. Rival’s aspiration level is positively proportional to the focal firm’s performance in competition.*
In fact, Proposition 1a is more relevant to large firms, such as the rivals mentioned in Wal-Mart example. For smaller firms, on the other hand, neglecting the signals from rivals may cause less damage. For example, when market leaders initiate deterrent actions, followers still have to be confident to take necessary reactions. Without reactions, followers’ performance could just be even worse in the future. Being ambitious to achieve challenging aspirations is vital for growing firms. This could be strongly supported by the development of Pepsi. In 1950, Pepsi was near bankrupt and Coca-Cola commanded 70 percent of the soft drink market. However, the CEO Alfred Steele advocated firm strategy as “Beat Coke” (Grimm et al. 2006). It is this aspiration that inspired Pepsi to aggressively explore supermarket segment and advertise “the Pepsi generation”. Slowly and ultimately, Pepsi caught up with Coca-Cola after the New Coke campaign. Therefore, high aspirations are less detrimental to small firms than large firms. Formally,

**Proposition 2.** Firm capability strengthens the negative relationship between aspiration level and firm performance in competition.

Competitive aggressiveness also significantly moderates the effect of aspirations on competitive outcomes. It is recognized that the motivation level decreases along with the magnitude of performance discrepancy (e.g., Lant and Montgomery 1987). Back to Figure 15, if the unfavorable gap between A and C is relatively small, the firm thinks that it is able to seek ways to reach the target. Yet if the aspiration is too high to achieve (i.e. gap between B and C), the firm will have a quite low incentive to initiate actions to improve itself (Bromiley 1991). However, a strong aggressiveness level means that the firm is still motivated by the low incentive, hence willing to take the risk for search
actions. Therefore, it could alleviate the insensitivity to an exceptionally large performance gap due to an overwhelming aspiration level. Formally,

Proposition 3. Competitive aggressiveness weakens the negative relationship between aspiration level and firm performance in competition.

Finally, public commitment indicates the credibility and visibility of the focal firm’s action, as well as the commitment to retaliate any reaction (Chen et al. 2002, Moore 1992). It influences the effectiveness of the rival’s aspirations to improve its own performance. When the focal firm’s action is less visible, the rival with high aspiration is likely to overlook the threats and concentrate on its original plan. The proposed negative relationship between aspiration and performance retains. On the other hand, an highly visible action imposes intensive competitive tension between firms (Chen et al. 2007). Such tension would interrupt the achievement of the rival’s pre-defined target. Even if the rival sets a high aspiration, the public attention would force it to take reactions (Chen et al. 2002).

There would be two possible outcomes. First, the signals are actually truthful. Then the rival’s expected return would be eroded during the action-reaction exchanges. In turn, the focal firm could exploit the opportunity to improve its performance. Second, the signals are bluffs to bewilder the rival. They seduce the rival to take inappropriate reactions, which are detrimental to its performance. The focal firm then could take the chance to gain advantages.

This provides a plausible explanation on the New Coke example. Coke highly aspired by its self-image as invincible and the guardian of the soft drink industry. The executives were even prohibited from using the work “Pepsi” in corporate headquarters (Grimm et al. 2006). Yet in the New Coke campaign, Pepsi’s visible action on flavor
tastes were quite strong and heavily attracted public attention. It imposed extensive tension that Coke had to respond. Moreover, Pepsi tricked Coke to believe that the signals were truthful: customers’ purchase decision was only affected by the flavor. The misleading signals triggered Coke’s large investment on the New Coke, which turned out to be a big failure. Pepsi was vastly beneficial from its effective utilization of visible actions. Formally,

Proposition 4. Action visibility strengthens the positive relationship between rival’s aspiration and the focal firm’s performance in competition.

9. Discussion and Implication

Aspiration plays a vital role in achieving superior performance. The growing behavioral literature has greatly investigated the two sources of aspiration information as well as the corresponding search actions to attain the specified target (Cyert and March 1963, Greve 2003). The effectiveness of aspirations is dependent on a firm’s interpretation on historical and social performance feedback (Greve 1998, 2003). However, the existing behavioral literature has not fully explored how to set aspirations in competition (Argote and Greve 2007, Bromiley 2005). Following Bromiley’s (2005) suggestion, our paper fills this gap by providing a competitive perspective on a firm’s aspiration setting according to the competitive dynamics literature (Chen 1996, Chen et al. 2002, Chen et al. 2007): 1) decoding process to internalize the aspiration information from past performance and other competitors; and 2) encoding process to externalize its information to affect rivals’ aspiration.

In order to surpass rivals, the firm apparently needs to be sensitive to aspiration information and audacious to take necessary actions. Yet it is far from enough to just collect aspiration information and decode it accurately. The firm needs to actively send
public signals through visible actions to disturb rivals’ aspiration setting and attainment as well. As a social reference to rivals, the firm could encode the information to exercise its influence through the social comparison process. The joint consideration of the specified encoding and decoding processes sheds light on aspiration setting in competition.

The results demonstrate that visible actions can generate positive impacts on firm performance on some occasion. Specifically, when rivals are rather pessimistic to set low aspirations, the firm the attacker can purposefully encode misleading information and take visible actions to improve its performance. Those rivals are more likely to be threatened by the public impact and take corresponding reactions (Smith et al. 1991). This is consistent with McGrath et al.’s (1998) findings on resource diversion strategies in multi-market competition. They consider two firms competing in two markets. One firm, in order to enhance its performance in the targeted market X, may publicly attack its rival in market Y, which is the rival’s target. In response to the visible competitive move, the less ambitious rival tends to take the attack seriously and divert resources from market X to market Y (McGrath et al. 1998). The firm’s attack clearly signals the commitment to market B, whereas its true intention is to protect market A. Therefore, the rival’s response is indeed favorable to the firm to dominate market X. In other words, while the likelihood of countermove towards a visible action is quite high (e.g., MacMillan et al. 1985, Smith et al. 1991), the retaliation misled by the firm would not contribute to rivals’ performance improvement but more likely to make it worse. In short, the firm can take advantage of it to fulfil its strategic intention by sending out distorted information.
For example, many leading firms like Toyota and Motorola are willing to popularize their innovative process methodology, the Toyota production system and the six sigma, to the public and even rivals. While the extant literature cannot fully rationalize such behavior (e.g., Diericks and Cool 1989), our analysis sheds lights on this unexplained puzzle. We can interpret their actions as deliberately eliciting imitative behaviors and draining rivals’ resources from innovation. As a result, the followers heavily rely on them as social reference; their leading position becomes difficult to be dethroned by rivals in the long run.

One other plausible explanation for the positive impacts may be that visible attacks force the rival into a ‘reaction dilemma’. That it, the rival seems being disadvantaged no matter it takes speedy countermoves or not. On one hand, its non-response is always preferred to the firm (e.g., Young et al. 1996, Smith et al. 2001). The firm may receive the substantial benefits derived from the actions without being challenged (Porter 1980), such as first-mover advantage (Lieberman and Montgomery 1988), reinforced organizational identity (Livergood and Reger 2010), and improved market position (Ferrier et al. 1999). On the other hand, the rival’s reputation may be greatly challenged by the visible action (Chen et al. 2002). Thus, it is inclined to take response to defend its reputation. However, as the attacker intends to mislead the rival to make illusory causal inference, its immediate response can be just what the firm wishes. Therefore, a well-developed visible action can facilitate the achievement of better performance without being disrupted by the rival.

Our experimental results suggest that constantly overlooking rivals to set high aspirations could not lead to high performance. It is especially true for large firms in competition. Their blindness leaves great opportunities for entrepreneurs to erode their
leading positions (Grimm et al. 2006). This is greatly due to the asymmetric relationship between competing firms (Chen 1996). For example, Firm A may view Firm B as its major competitor, thus being sensitive towards Firm B’s actions. On the other hand, Firm B may not consider Firm A as a comparable rival, hence likely to overlook Firm A’s actions. This asymmetric relationship could be observed between Pepsi and Coke in 1970s, where Pepsi’s strategy was to “Beat Coke” yet Coke’s executives were prohibited from using the word “Pepsi” (Grimm et al. 2006). Such asymmetric relationship further influences the way that firms interpret the aspiration information in competition.

Nonetheless, if those market leaders are aggressive to take search actions, the specified negative outcomes could be alleviated. Ferrier et al.’s (1999) work also provides strong support. They find that market leaders could protect their superior position only if they are active in taking re/actions. Strong competitive aggressiveness just enables firms to take actions even towards a large performance gap. Therefore, when firms decode aspiration information and set corresponding aspiration to guide search actions, they need take advantage of asymmetric relationship to seize opportunities. That is, they shall utilize the strengths (such as strong competitive aggressiveness) and leverage the vulnerabilities (such as scare capabilities) in order to always prepare themselves to outperform rivals.

9.1. Limitation

It is essential to recognize the boundary of our model since all the models necessarily omit many aspects of the real world. Our study is the first attempt to explore the significant role of competition in setting aspiration. Therefore, we do not adopt the conventional formula to calculate aspirations like Greve (2003). It is because we believe
the traditional measurement could not emphasize the impact of competition. Rather, retaining the legacy of aspiration setting from historical and social comparison, we explicitly take subjective (competitive) tension into account to illustrate the importance of competition (see Equation 4). Further empirical test through discrete choice modeling could validate the proposed equation.

In addition, strategy scholars have frequently integrated organizational decision-making process (see asymmetric S-curve in Figure 1) to predict risk-taking behaviors (e.g., Bromiley 1991, 2005, 2009). While we follow this research stream, it is admitted that we simplify the value function to ignore the probability weighting function (Bromiley 2010). This is a common problem in the strategy literature (see Bromiley 2010). To the best of our knowledge, our paper is the first attempt to respond Bromiely’s (2005) work to study competitive aspiration settings at a micro-dynamics level. Undoubtedly, the action-reaction dynamics is rather complex. We intend to capture the fundamental conclusions through a simple stylized model. Of course, future research could further work on adding the probability weighting function into our framework.

Besides, according to experimental results in Table 4, there are more interactive effects than we discussed. The large number of interaction is mainly due to the application of system thinking (see Sterman 2000). According to Figure 2, it is apparent that most variables are linked with each other in the closed feedback loops, either directly or indirectly (Davis et al. 2007). Therefore, it is easy to expect larger number of interactive effects than empirical studies. Future studies could further test our simulation results through empirical studies.
9.2. Empirical Implication for Future Research – Multilevel Analysis

Our experimental results show that in addition to the two-factor interaction, as reported in Table 2, there are also three-factor interactions captured in our feedback model. For example, competitive aggressiveness also plays a vital role in a three-factor interaction: when the firm sets high aspirations, it can act aggressively to strengthen the positive impact of rivals’ aspiration on its performance ($\beta = -.060$, $p < .001$). In other words, when both competing firms set high aspirations, the intensity of rivalry increases sharply. It would then detrimental to the attacker’s performance ($\beta = -.016$, $p < .0001$). Under this condition, the firm is difficult to achieve the expected outcome through aggressive actions. In other words, the aggressive attacks provoke too much unanticipated retaliation that the firm performance is adversely influenced.

The three-factor interaction indicates the necessity of conducting multilevel analysis in competitive dynamics studies (e.g., Singer and Willett 2003, Gelman and Hill 2009). Consistent with the fundamental assumption in the literature, responses are a result of certain action characteristics (Smith et al. 1991, Chen et al. 1992, Smith et al. 2001). Compared to linear regression models, where predictors like attacks, responses, and firm performance are analyzed at the same level (e.g., Chen and Miller 1994, Derfus et al. 2008), multilevel analysis has several advantages.

Multilevel analysis provides a coherent model that simultaneously incorporates both individual-level model (i.e. action characteristics) and group-level model (i.e. actor characteristics) (Singer and Willett 2003, Gelman and Hill 2009). The extant literature applies linear regression that is less able to explain the varying effects among groups.
The overlook of group indicators can be misleading in ignoring inter-group variation. This flaw partially contributes to the under-exploration of anticipated responses.

Figure 16 The Multi-Level Model Structure

According to our formal analysis, we suggest a multilevel framework for future empirical studies on competitive dynamics. The overall framework is shown in Figure 16. In the future study, firms shape their aspirations to make action decisions in pursuit of profits. The decision is further moderated by the group indicators, such as competitive aggressiveness and action visibility. Consequently, multilevel modeling is quite valuable to provide a holistic view on interfirm rivalry.

9.3. Managerial Implications

Whereas researchers have previously conduct substantial investigation to guide the firm’s aspirations in order to attain sustainable performance, competitive relationship with other rivals is remarkable in influencing the aspiration settings. We suggest a dynamic framework for decision makers to further recognize both internal and external effects. The two constructs of the framework – competitive aggressiveness and action visibility – are guidelines for managers to pay attention to the competitive relationship
and manage the associated encoding and decoding processes in competition. Our analysis shows that one firm, in pursuit of improved performance (market share), can set realistic aspirations. Additionally, it may act aggressively and deliberately launch visible attacks for the sake of seducing rivals. Considering an attacker who initiates actions is also a defender who takes reactions in competition, we propose that the firm shall cautiously counteract to public cues from rivals in order not to be misled by them.

10. Reference


The great Cola war goes global: Pepsi introduces ‘New Coke’ in foreign-market taste tests. Retrieved at 20 Nov 2010 from:


11. Appendix

As $M_2 = M_1$,
therefore $\frac{df_s}{dG_2} = \frac{df_s}{dG_1}$
i.e. $G_2^{(1)} = \phi(G_1)^{(1)}$.

Given $= 0.88$,
then $\frac{G_2}{G_1} = \exp \left( \frac{\ln( )}{1} \right)$
where $= 2.25$, $= 0.88$,
then $\frac{G_2}{G_1} = \exp \left[ \frac{\ln(2.25)}{0.88-1} \right] = 0.0012$. 

As $M_2 = M_1$,