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COMPETITIVE DYNAMICS IN TRIADIC STRUCTURES: A STUDY GLOBAL SEMICONDUCTOR FIRMS

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Abstract

This paper explores competitive balance and the factors influencing a firm's decision to adopt competitive or cooperative actions to maintain equilibrium within a triadic structure. Drawing upon the competitive dynamics theory and structural balance theory, we empirically tested our hypotheses using data collected from global semiconductor firms. We predicted how a firm's actions are shaped by its perception of balance, influenced by the current competitive and cooperative situation within a triad relationship. Our findings indicate that when a focal firm perceives lower competitive tension within the triadic structure, it tends to engage in cooperative actions with its partner's partner and competitor's competitor in the future. Conversely, when a focal firm perceives higher competitive tension, it is more likely to adopt competitive actions, such as competing with its partner's competitor and competitor's partner in the future. Our results provided a new avenue for studying the formation of competitive and cooperative relationship.

Keywords

Competitive Dynamics, Structure Balance, Cooperation and Competition

Introduction

The field competitive dynamics had flourished in recent years (Baum & Korn, 1996; Smith, Ferrier, & Ndofor, 2001). In this stream of research, Miller and Chen's (1994) awareness-motivation-capability (AMC) structure was usually treated as the major guide for exploring competitive tension and interfirm rivalry through the dyadic lens and for predicting competitive responses (Chen, Su, & Tsai, 2007). Important contributions had been made in connecting competitor analysis and interfirm rivalry. Less considered and discussed, however, dyadic relation probably was not adequate to understand competitive tension. The evaluation of the competitive tension was constrained by an approach that centered focal firm in firm-dyad level. Since dyadic ties were embedded in triads, each firm in triadic structure perceived competitive tension through direct and indirect ties which eventually determinate future actions included not only competition but also cooperation. As Chen and Miller (2012) suggested, researchers studying competitive dynamics should attempt to link macro and micro research and competition and cooperation.

Recent research had suggested that triadic analysis was more comprehensive than dyadic analysis (Choi & Wu, 2009). Similarly, because of the unstable relationship in a dyadic strategic alliance, firms in strategic alliance seek out new alliances and tend to form a triadic alliance (Madhavan, Gnyawali, & He, 2004). Indeed, a firm needed to perceive competitive tension not only in dyadic relationship but also in triadic structure. For example, when Apple formulated its strategy to compete against Google, Apple's decision to sue HTC patent infringements to undercut Google was a result of its recognition that HTC was Google's partner. Similarly, when Apple formulated its strategy to compete with Google, comprehending Google's perception of Microsoft as a main rival enhanced Apple's ability to determine an opportune time to attack Google. In this perspective, cooperation and competition between firms were not decided by a single firm, or two dyadic-linking firms, but the relation between them and other third parties.

To evaluate the competitive tension furtherly, we adopted structural balance theory to address "awareness-to-actions" in the triadic co-opetition structure. The initial idea behind balance theory was proposed in Heider's (1946) paper in behavioral psychology to study the triadic interpersonal relationships (Cartwright & Harary, 1956; Theodore Mead Newcomb, 1961). Specially, structural balance theory was applied not merely in individual level (Heider, 1946; Horowitz, Lyons, & Perlmutter, 1951; Theodore M. Newcomb, 1953; Rodrigues, 1967) but in

organization level (Wu & Choi, 2005). Heider (1946) also suggested that either balanced or imbalanced configuration existed and advanced a tendency toward balance. For example, HTC cooperated with both Microsoft and Google, but Microsoft and Google competed each other. Such triadic structure was imbalanced and the members in this imbalanced structure would try to change their relationship, such as Microsoft sued HTC to form a competitive relationship. So far, not much effort had been made to put structural balance theory in competitive analysis.

Based on competitive dynamics theory, we extended the construct of competitive tension (Chen, 1996; Chen et al., 2007) from firm-dyad level to firm-triad level. By introducing the notion of tendency toward balanced structure, we reconceptualized the competitive tension, redefined as the strain between a focal firm and two other firms that was likely to result in the firm taking either competitive or cooperative action. Through the empirical examination of the competitive tension, and by exploring the future relationship between a focal firm and its indirected related party, we enriched, extended, and bridged two theories to link macro and micro research as well as competition and cooperation.

We first reviewed the literatures of competitive dynamic theory and structure balance theory. Given these two theories, we then developed our hypotheses to show how a focal firm perceived competitive tension in triadic structure and how will it take future action. Next, we then discussed how we collected data and made our analysis. Following the analysis, we presented the results and conclude with a discussion.

Theoretical Background

Competitive Dynamics

Competitive moves were at the heart of competitive dynamics research. Competitive dynamics researchers had shown that various factors shape competitive moves, including organizational size (Chen & Hambrick, 1995), multi-market competition (Young, Smith, Grimm, & Simon, 2000), past performance (Hambrick, Cho, & Chen, 1996; Miller & Chen, 1996), and top management team characteristics (Hambrick et al., 1996). Still, the main theme concerned drivers that triggered competitive moves through predicting and sense-making rivals' actions.

Competitive dynamics researchers had found that the linkage between competitor analysis and interfirm rivalry was consequential (Chen, 1996). Underpinning the linkage were three drivers of competitive behavior: *awareness* of a competitive relationship and/or competitors' initiative, *motivation* to act (or respond), and the *capability* to do so (Smith et al., 2001), an effort initiated by organizational researchers (Dutton & Jackson, 1987; Kiesler & Sproull, 1982; Lant, Milliken, & Batra, 1992). These three awareness-motivation-capability (AMC) variables were key antecedents of competitive tension (Chen et al., 2007). Recent competitive dynamics research had engaged using the action/response dyad and AMC to examine interfirm rivalry and assess competitive tension between firms (Chen, 1996; Chen & MacMillan, 1992; Chen et al., 2007). The notion of competitive tension began to shed light on why certain events caused some firms to act and react forcefully, whereas other firms in the same industry did not.

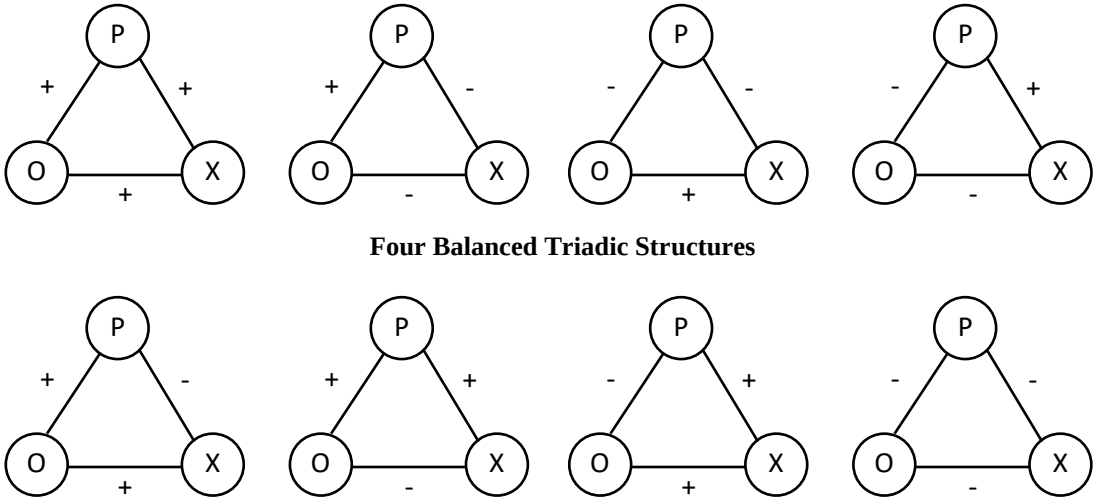
Despite these advances, however, competitive dynamics research had mostly centered on the focal firm and firm dyad level. It therefore leaves unexplored some critical issues concerning rival's viewpoints and considerations (Tsai, Su, & Chen, 2011). A few scholars had begun to stress that it was necessary to understand rival's intentions and perceptions (Montgomery & Weinberg, 1979) by constructing competitor acumen defined as the extent to which a focal firm's assessment of a given rival's prioritization of competitors (Tsai et al., 2011). Such research efforts in fact consider perceived competitive tension in a firm triadic level. Furthermore, as competitors in many industries form more and more cooperative relationships with each other while continuing to compete (Harbison & Pekar, 1998), such "co-opetition" (Brandenburger & Nalebuff, 1996) obviously happened beyond the dyads, but much more in the triads. Disappointedly, no study thus far had systematically examined the competitive tension in a firm triad level and cooperative action.

Structural Balance

To extend the AMC perspective to competitor analysis at the firm-triad level, we turned to structural balance theory as our theoretical framework. The seminal idea behind balance theory was expressed in Heider's (1946) paper in which he suggested that a balanced configuration exists by understanding positive or negative relationship between P-O-X unit. Based on the source ideas of Heider, further research of structural balance theory was developed mainly by Cartwright and Harary (1956) who formalized and extended to group level, Newcomb (1953; 1961) who applied A-B-X model in interpersonal communication and attraction, and Davis (1963) who proposed fifty-six hypotheses. Structural balance theory was the only theory from an established academic genre of literature that addresses triads explicitly (Choi & Wu, 2009).

In Heider's (1946) P-O-X unit, consisting of an actor (P), another actor (O), and an impersonal entity (X), was a triad that showed in Figure 1. Those in the top row were displayed the balanced triads while in the bottom row were displayed the imbalanced triads. A plus (+) sign represented positive (cooperative) relationship and a minus (-) sign represented negative (competitive) relationship between two actors. Typically, a balanced structure

had three plus signs or two minus signs and one plus sign, and an unbalanced structure had two plus signs and one minus sign or three minus signs (Choi & Wu, 2009). For example, if P liked O, O liked X, and P liked X, the structure was balanced; if P liked O, O liked X, but P disliked X, the structure was imbalanced. It was understandable in algebra, with the two positives or two negatives being positive and the mix of a positive and a negative being negative (Wasserman & Faust, 1994).



Four Balanced Triadic Structures

Four Imbalanced Triadic Structures

Figure 1. Balanced and Imbalanced Triadic Structures

The popularity of structural balance theory was explainable in part by their theoretical elegance and simplicity, but also by their obvious and wide applicability to studies in sociology and social psychology (Curry & Emerson, 1970). Therefore, structural balance theory was not only applied to cognition, but also to social exchange theory (Alessio, 1990) and problem solving (Adejumo, Duimering, & Zhong, 2008). Except of psychological field, recently, structural balance theory was extended to supply chain management (Choi & Wu, 2009) and social network field (Brusco, Doreian, Mrvar, & Steinley, 2011; Doreian & Mrvar, 2009; Hummon & Doreian, 2003). Though structural balance theory was first developed and was widely used between individual units (Heider, 1946; Horowitz et al., 1951; Morrissette, 1958; Theodore M. Newcomb, 1953; Rodrigues, 1967), this theory could be applied to larger entities such as groups (Adejumo et al., 2008; Hummon & Doreian, 2003), political parties and states (Moore, 1978) and organizations (Wu & Choi, 2005).

Structural balance theory provided an alternative argument of "awareness" compared with AMC framework. In AMC framework, a firm is aware of others' moves through market commonality and resource similarity (Hitt, Ireland, & Hoskisson, 2009). For example, Samsung and Sony watched each other's actions since they used similar resources to compete in overlapped markets. However, a firm not only concerned his similar competitor's actions, but also looked competitor's competitors and/or partners. Also, a firm might monitor his partner's competitors and/or partners. The competitive dynamics between Samsung and Sony in electronic devices market over past ten years had shown that they not only cooperate and compete with each other (ex. LCD TV market), but also extended cooperative competition relationship to third-party firms. Firm actually drew a cognitive map based on a triadic relationship. Hence, structural balance theory argued that whether actor perceived tensions depended on the types of relationship and existence of balance within triad.

The Competitive Tension in Triadic Structure

How would a firm perceive competitive tension in a firm triadic level? To capture the perception of competitive tension in triadic structure, we extended the construct of competitive tension. Originally, Chen and his companions defined that competitive tension is the extent to which a focal firm would consider a given rival as a primary competitor, and the possibility to take actions against the rival (Chen, 1996; Chen et al., 2007). In contrast to Chen et al.'s definition in dyadic structure, the redefinition of competitive tension in triadic structure was the strain between a focal firm and two other firms that was likely to result in the firm taking either competitive or cooperative action.

Our conceptualization of competitive tension in triadic structure included two sources. First, a firm perceives the competitive tension through its direct and indirect ties and positive and/or negative ties which we named "structural relationship". Triadic analysis provided a more holistic view of interfirm actions than that of dyadic analysis. As Choi and Wu (2009) argued, that analysis of dyadic structure did not capture the essence of a network. In other words, the dyadic analysis offered a parsimonious abstraction of the interfirm relationship. For

examples, if we only concerned dyadic relationship between buyers and suppliers, then the buyer-supplier and supplier-supplier had to be individually discussed. We lost the chance to explore rich interactions among a group of buyers and supplier, said buyer-supplier-supplier or supplier-buyer-buyer interactions. In triad, we could study both relationships of node-node and relationships of link-link, while the later one could not be studied in dyad.

Second, based on Heider's (1946) assumption, balanced triadic structures were stable, while imbalanced triadic structures would generate tension and force towards balance. Much research had examined and supported this tendency toward balance (Aronson & Cope, 1968; Deutsch & Solomon, 1959; Theodore Mead Newcomb, 1961; Price, Harburg, & Newcomb, 1966). The way to reduce tension and achieve balance was to change the signs on one of the P-O, P-X, and O-X relationship. For example, in a friendship triad, when a friend of a friend was an enemy, then either the enemy would become a friend or one of the friends would become an enemy, to resolve tension in relations(Aronson & Cope, 1968). Thus, this tension would also affect the competitive tension in triadic structure.

Indeed, moving from a dyadic relationship to a triadic relationship implied a quantum change (Caplow, 1956). Therefore, we expected that triadic structure performs better in explaining competitive tensions and predicting interfirm interactions than dyadic structure did.

Hypotheses

This section applied the structural balance theory to an examination of how competitive tension in triadic structure to influence firm's future action. A framework of our research, based on two dimensions, was proposed in Figure 2.

Partner / Directed Relationship / Competitor	Competitor	Partner
	State 3 Competitive tension: High Future action: Competition	State 1 Competitive tension: Low Future action: Cooperation
	State 2 Competitive tension: Low Future action: Cooperation	State 4 Competitive Tension: High Future action: Competition

Indirected Relationship

Figure 2. A Framework of Competitive Tension in Triadic Structures

Cooperative Actions

Balanced State 1. In this state, a focal firm I had a cooperative relationship with firm J and then firm J also had a cooperative relationship with firm K at T time period. As depicted in Figure 3, a set of firm I, J, and K had two pluses among them which induced lower competitive tension. Such a relational structure would be found easily in friendship group. Due to you were my friend, it was very natural to build a friendship with you friend. Similarly, such a relational structure would be found in semiconductor industry with the characteristic of vertical disintegration. Firms put different positions in value chain are viewed as partners because they possess different capabilities and strived to enter a coalition which was stronger than isolated (Caplow, 1956). Moreover, Dyer and Nobeoka (2000) found such triadic cooperative relationships among Toyota and its supplies in Toyota's supplier association. Thus, we propose that:

Hypothesis 1. The lower the perceived competitive tension in triadic structure, the greater a focal firm's possibility of establishment of cooperative relationship with its partner's partner.

Balanced State 2. In this state, a focal firm I had a competitive relationship with firm J and then firm J also had a competitive relationship with firm K at T time period. As depicted in Figure 3, a set of firm I, J, and K had two minus among them which induced lower competitive tension. Aronson and Cope (1968) assumed that if someone had no idea about the reason why other person disliked his enemy, he might assume that they disliked this guy for the same reasons and, therefore, their mutual attractiveness would increase. Thus, my enemy's enemy was my friend. In some industry, there might be a common competitor between others. For example, LG set up an alliance with Philips to compete with Samsung in LCD industry from 1999 to 2008. This was particularly true if a firm had stronger market power than other two competitors, but not much stronger, then this firm would become the public enemy (Dyer & Nobeoka, 2000). Therefore, through the lens of structural balance, we might find that:

Hypothesis 2. The lower the perceived competitive tension in triadic structure, the greater a focal firm's possibility of establishment of cooperative relationship with its competitor's competitor.

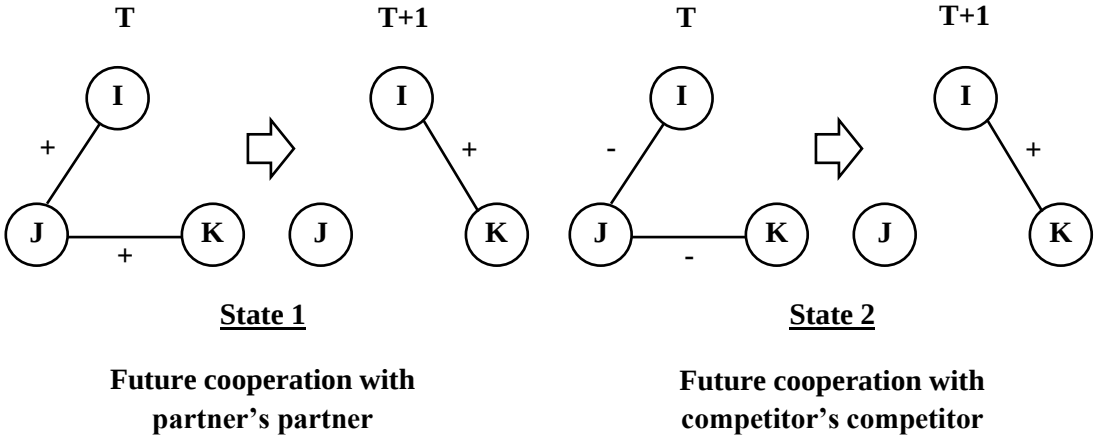


Figure 3. Future Cooperative Action in Balanced Triadic Structures

Competitive Actions

Competitive action had been a significant concern in researches of competitive dynamics theory (Chen et al., 2007).

Balanced State 3. In this state, a focal firm I had a cooperative relationship with firm J and then firm J had a competitive relationship with firm K at T time period. As depicted in Figure 4, a set of firm I, J, and K had one plus and one minus among them which induced greater competitive tension. It was also very natural that I dislike your enemy because I was your friend. Due to you were my friend, it was very natural to build a friendship with you friend. In the market, for example, the Micro Four Thirds system (MFT) is a standard created by Olympus and Panasonic, and announced on August 5, 2008, for mirrorless interchangeable lens digital cameras and camcorders design and development. Over past 5 years, Sony, Samsung, Pentax, Nikon, and Sigma all released their proprietary mirrorless system to compete with MFT. Thus, we predicted that focal actor will compete with partner's competitor for keeping balance. We proposed:

Hypothesis 3. The greater the perceived competitive tension in triadic structure, the greater a focal firm's possibility of establishment of competitive relationship with its partner's competitor.

Balanced State 4. In this state, a focal firm I had a competitive relationship with firm J and then firm J had a cooperative relationship with firm K at T time period. As depicted in Figure 4, a set of firm I, J, and K had one plus and one minus among them which induced greater competitive tension. It was almost impossible that someone might like his/her enemy's friend. Similar circumstances could draw in semiconductor industry. For example, an IC design firm (ex. Faraday Technology Corp.) competed with another IC design firm (ex. Global Unichip Corp.) because they not only owned similar capability but also belonged to different IC foundries (ex. TSMC and UMC). Therefore, they would build competitive relationship with competitor's partner. Thus, through the lens of structural balance, we might propose following arguments:

Hypothesis 4. The greater the perceived competitive tension in triadic structure, the greater a focal firm's possibility of establishment of competitive relationship with its competitor's partner.

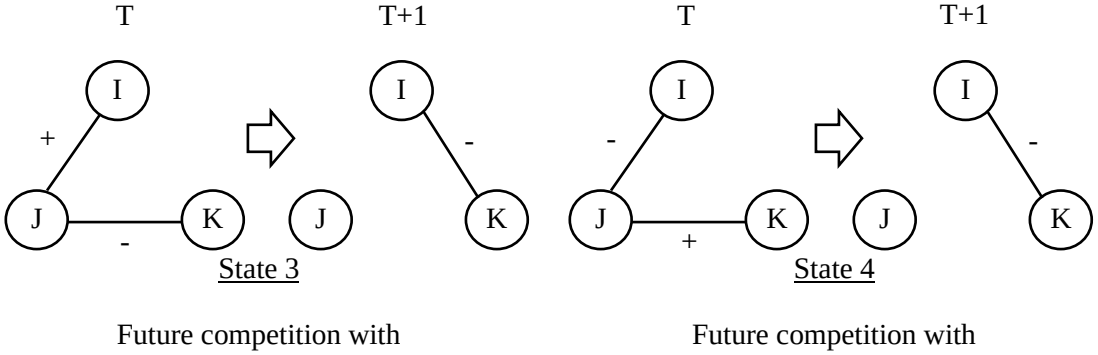


Figure 4. Future Competitive Action in Balanced Triadic Structures

Methods

Sample and Data Collection

We obtained data from the global semiconductor industry firms listed in the Asia Pacific Equity Research – Tech Hardware Supply Chain published by JP Morgan and Tech Files: Global Supply Chain published by Citigroup. After reconfirming with the industry experts, including general managers of the firms of security investment trust, purchasing and R&D managers, and product managers of IC assembly and test, IC design, IC manufacturing firms, and firms with end product, we used 30 active global semiconductor industry firms for our research. As depicted in Figure 5, these firms mainly operated in value chain sectors including Fabless (IC design), Foundry (IC manufacturing), IDM (Integrated Device Manufacturer, those with IC design and manufacturing capability), ODM and OEM of notebook and PC (the buyers).

The cooperative and competitive actions between firms were frequently happened in semiconductor industry, and this was why we chose this industry to examine our hypothesis. Moreover, firms changed their relationships with each other frequently based on their strategic consideration. Previous partners might become today's competitor, even the later may become a partner in the future. Therefore, we then got the data of strategic alliance events of our sample from the data base of Securities Data Company, SDC, and the longitudinal data ranges from 1998 to 2006.

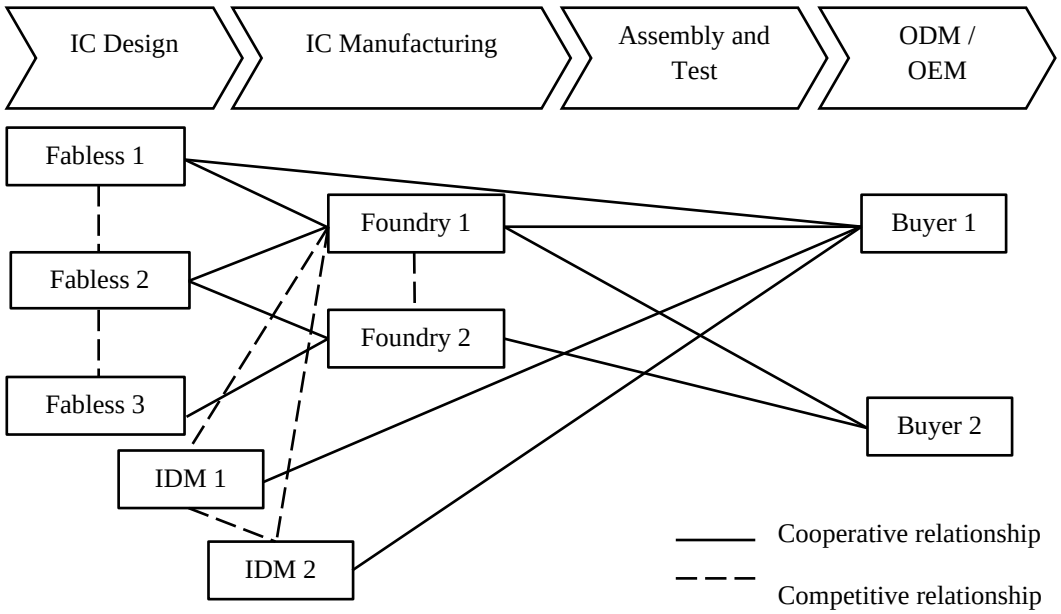


Figure 5. Illustration of Inter-firm Relationships in Semiconductor Industry

Definition of Inter-firm Relations

Cooperative relationship. We defined cooperative relationship as an alliance event(s) formed by two firms.

Competitive relationship. In general, competitive relationship existed when firms operated and provided products and services in same niche markets because they had similar resources or capabilities and targeted to similar markets or customers (Gimeno, 2004; McPherson, 1983). As above, we defined competitive relationship to which two firms were in the same value chain sector and alliance with a common third party. Figure 4 represented samples of cooperative relationship and competitive relationship.

Data Analyses

To testify our hypotheses, we generated six types of matrixes of sampled firms in each year. The first type of matrix was the original cooperation matrix where firms have alliance events with other firms, the Cooperation matrix (M1). The second one was the Real Competition matrix (M2), where firms were in the same value chain sector and alliance with a common third party. The third one is the Indirect Cooperation Matrix (M3), where firms had an indirect alliance relationship with a third party which had no any direct relationship with each other; a partner's partner had no direct relationship with a focal firm. The fourth one was the Indirect Competition Matrix (M4), where firms had an indirect competition relationship with a third party who had no any direct relationship with each other; a competitor's competitor had no direct relationship with a focal firm. The fifth one was the

Cooperation-Competition Matrix (M5), where a focal firm I had an alliance with firm J and firm J has a competition relationship with firm k, but no any other relationship between firm I and firm K; a partner's competitor had no direct relationship with a focal firm. The last one was Competition-Cooperation Matrix (M6), where a focal, firm I had a competition relationship with firm J and firm J has an alliance with firm K, but no any other relationship between firm I and firm K; a competitor's partner had no direct relationship with the focal firm. Next, we constructed each type of matrix separately from 1998 to 2006. Then, we used the software, MATLAB to simulate all the matrixes for 1,000 times.

The logic we adopted to simulate is as following. Firstly, we got a true value of hit ratio, the probability of predicting matrix matching the predicted one[1]. Secondly, we randomized the predicting matrix to match the predicted one for 1,000 times which generated a distribution of the randomized hit ratio, including the values of probability in maximum and minimum in 95% confidence interval. Then we compared the hit ratio of the true value and the randomized maximum value. If the hit ratio of the true value was greater than the randomized maximum one, we could be sure that the predicting matrix significantly predicted or matched the predicted one, not any randomized matrix could predict.

To testify the Hypothesis 1, first we predicted M3 of T time period on M1 of T+1 time period, Probability 1 (P1), and then predicted M3 of T time period on M2 of T+1 time period, Probability 2 (P2). Then, we used T test to examine the significance of mean difference between P1 and P2.

To testify the Hypothesis 2, first we predicted M4 of T time period on M1 of T+1 time period, Probability 3 (P3), and then predicted M4 of T time period on M2 of T+1 time period, Probability 4 (P4). Then, we used T test to examine the significance of mean difference between P3 and P4.

To testify the Hypothesis 3, first we predicted M5 of T time period on M1 of T+1 time period, Probability 5 (P5), and then predicted M5 of T time period on M2 of T+1 time period, Probability 6 (P6). Then, we used T test to examine the significance of mean difference between P5 and P6.

Finally, to testify the Hypothesis 4, first we predicted M6 of T time period on M1 of T+1 time period, Probability 7 (P7), and then predicted M6 of T time period on M2 of T+1 time period, Probability 8 (P8). Then, we used T test to examine the significance of mean difference between P7 and P8.

Results

Table 1 showed the results from the T test that used firm triadic relationships to predict competitive tension and cooperative or competitive active in the future. As shown in state 1 in the table, we testified the probability of cooperation formation by cooperation-cooperation triadic relationship at T time period. The result showed that prior state predicted 22.71 percent of cooperation formation which was statistically significantly ($p<.10$). Thus, Hypothesis 1 was supported. In state 2, we testify the probability of cooperation formation by competition-competition triadic relationship at T time period. The result showed that prior state predicted 21.3 percent of cooperation formation which was statistically significantly ($p<.05$). Therefore, Hypothesis 2 was supported. In state 3, we testified the probability of competition formation by cooperation-competition triadic relationship at T time period. The result shows that prior state predicts 28.5 percent of cooperation formation which was statistically significantly ($p<.05$). Therefore, Hypothesis 3 was supported. Finally, in state 4, we testified the probability of competition formation by competition–cooperation triadic relationship at T time period. The result shows that prior state predicts 29 percent of cooperation formation which was statistically significantly ($p<.10$). Therefore, Hypothesis 4 was also supported.

T time period	I-K Relationship of T+1 time period		Significant Difference
	Cooperation	Competition	
State 1	0.2271*	0.29*	-0.0629**
State 2	0.213**	0.2877	-0.0747**
State 3	0.2118**	0.285**	-0.0732**
State 4	0.2145*	0.29*	-0.0755**

***P< .01 **P< .05 *P< .10

Table 1. Results of Prediction of Cooperation and Competition Formation

[1] The hit ratio measured how correctly the cells in predicting matrix match those in predicted one. More specific, we only counted the cells coded as 1 in the predicting matrix which matched the cell coded as 1 in the predicted one. Those cells code as 0 as in the predicting matrix which match the cell code as 0 in the predicted one were excluded. Therefore, the hit ratio only measured the "predicting 1 on 1" cells, others including "predicting 0 on 0", "predicting 1 on 0", and "predicting 0 on 1" were excluded, not matching.

Discussion

In this paper, we predicted the relationship between a focal firm and the third (indirected) firm in the future. Through our results, we found that, if a focal firm perceived lower competitive tension in triadic structure, it would cooperate with partner's partner and competitor's competitor in the future. Moreover, if a focal firm perceived greater competitive tension in triadic structure, it would compete with its partner's competitor and competitor's partner in the future.

These findings were in line with previous studies, although no previous study had made this integration in detail. We could conclude with certainty that both competitive dynamic theory and structure balance theory were able to explain significant competitive tension between firms as well as to predict future relationship.

Implications

The study had both theoretical and practical implications. First, anchored in the competitive dynamics theory, our research extended competitive tension, a construct intended to find a significant linkage between competitor analysis and interfirm rivalry (Chen & MacMillan, 1992; Chen et al., 2007), to firm-triad level. Our findings showed that not only competitive relationship in perceived different degree of competitive tension, but also cooperative relationship. The issues might help advance research on interfirm relationship, establishment of relationship, and prediction of relationship.

Seconds, our research integrates structure balance theory, focused on studying the triads, and competitive dynamics, focused on studying the dyads. This integration highlighted the importance of studying the triads while pointing out the inadequacies of the dyads. Following Bloodgood and Bauerschmidt's (2002) suggestion, researchers studying a firm's strategy should allocate additional effort toward determining the accuracy of the firm's assumptions about its competitors. This integration also contributed to the accuracy of the firm's assumptions.

Third, both the competitive tension in firm-dyad level and in firm-triad level pointed to a dynamic relationship between firms. Indeed, as Austrian economics argued that markets never reach equilibrium because the profit forced for action will disrupt the stable state or status quo (Scherer & Ross, 1990). In other words, market equilibrium occurred only in the absence of competition. The results of this study clearly supported the notion.

Limitations and Future Directions

This study had four primary limitations. The first limitation concerned the types of structures used in the current study. Other types of structures including balanced and imbalanced structures would be insightful. Synthesis and competitive tension might be different from the scenarios in our study.

The second limitation was the assessment in competitive tension. Although the assessment of the competitive tension lends itself to both objective considerations (e.g., industry growth, industry concentration, and barriers to entry) (Ang, 2008; Baum & Korn, 1996; Scherer & Ross, 1990) and subjective considerations (Chen et al., 2007; Tsai et al., 2011), the empirical focus of this study was objective tension. It might be of interest for future research that the perceptive tension in firm triad level affects future relationship.

The third limitation was the heterogeneous of firm and relationship in triadic structure. Members and their relationships in triadic structure might differ in strength (Caplow, 1956; Price et al., 1966). A network could be signed-balanced but not balanced if, for example, I like J more than likes K. An additional interesting avenue of investigation might be to consider whether competitive tension might be considered units of more than three entities.

The final limitation was the dynamics of firm's relationship. The dynamics of firm's relationship might include establishment, transform, maintain, and even a change of the whole structure. Future research could examine such dynamics at T+2, T+3, even much longer to make sure the probability of prediction.

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