

## Cooperative Exchange with Substitutable Ties and Its Competitive Outcomes\*

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### Abstract

With a model of tie substitution, a construct that reflects each actor's evaluation of his or her social relations or networks, this study proposes that each actor's subjective evaluation of objective structural constraints may facilitate or delay the realization of structural constraints in general and the division of cooperative benefits in particular. It shows the following: first, ego with few (perceived) substitutable ties is likely to accept the unequal allocation of cooperative benefits; second, symmetry in tie-substitution at the global network suppresses (aggravates) competition for the division of cooperative outcomes when individual tie-substitution is low (high).

Keywords: Social Capital, Tie Substitution, Cooperation

### INTRODUCTION

Does inter-firm cooperation, such as joint ventures and long-term supply chains, lead to the fair allocation of cooperative outcomes among its participants? While the formation of cooperation indicates the presence of cooperative outcomes (e.g., Anderson 1990; Gomes-Casseres 1994; Hennart 1988; Kogut 1988), its formation does

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not necessarily guarantee that parties to cooperative exchanges may benefit in proportion to their contributions or productivities. Partners may free-ride on the cooperation of others so that they benefit from cooperation more than what they contribute. They may also compete for a larger share of cooperative benefits by exerting their negotiation power over the other partners (e.g., Castellucci and Ertug 2010). The learning race view of the alliance, for example, suggests that alliance partners covertly compete to learn from each other while devoting minimally required resources to an alliance (Hamel 1991; Hamel, Doz, and Prahalad 1989; Khanna, Gulati, and Nohria 1998; Kale, Singh, and Perlmutter 2000). In this regard, inter-firm cooperation is an implicit form of competition where each party is motivated to use cooperation as a platform for its own interests.

Although researchers widely acknowledge conflicts of interests inherent in interfirm cooperation, the process of dividing cooperative benefits receives relatively little attention from the literature with a notable exception of network exchange theory (e.g., Willer 1999), a series of experimental studies on the effects of network structure on the allocation of cooperative outcomes. This stream of research presumes that the structural constraint of social relations leaves little room for trading parties' ability to adapt themselves to either favorable or unfavorable relational constraints. However, it is likely that the effects of structural constraints are asymmetric, i.e., these effects vary with how each actor copes with such constraints. Those correctly anticipating these structural effects are more likely than those unaware of these effects to either capture possible benefits or mitigate potential costs. This in turn implies that the realization of structural constraints depends on actions made by each actor embedded in social relations, a case that is dubbed as the duality of structure and agency by Giddens (1979).

On the basis of the duality of structure, this study modifies network exchange theory by employing tie substitution, a construct that reflects each actor's evaluation of his or her social relations or networks. In doing so, this study assumes that each actor's evaluation of and response to structural constraints contributes to facilitate or delay the realization of structural constraints. With this assumption, this study seeks to understand the mechanism of how the structure of cooperative networks affects the division of cooperative benefits among partners of those relations, i.e., who

gets more from a given cooperation. Cooperative networks refer to a collection of dyadic cooperative exchanges. Note also that this paper is not about competitive behavior outside the domain of cooperation. For example, Gnyawali and Madhavan (2001) propose a model of competitive dynamics, which is affected by the configuration of cooperative exchanges among firms. In contrast, this paper provides no prediction as to how cooperation in a certain domain is transferred to competition in another domain. Rather, it shows how firms compete inside their cooperative networks when dividing the benefits resulting from their cooperation.

## THE ELEMENTS OF THE MODEL

### The Degree of Tie Substitution

A tie is defined as any kind of interfirm cooperation or cooperative exchange, whose purpose is to voluntarily exchange goods or services among independent organizations and is organized by explicit or implicit contracts to varying degrees. In other words, this study understands an exchange based on *voluntary contracting* as a *tie* between parties to this contracting. Note that an arm's length transaction in the market is also viewed, by this definition, as a tie. All economic transactions or exchanges in the market can be conceived as ties. This definition of 'ties' even includes the atomistic price systems, i.e., the market. In this regard, there are two governance modes available to a transaction: tie(s) and hierarchy. A basic assumption thus here is that all the exchanges are accompanied by social relations, i.e., exchange is mirrored by relations. Accordingly, this definition of a tie is compatible with a theoretical underpinning of neo-institutionalism: a market is one instance of institutions sustained and developed by a specific cognitive community (e.g., Powell 1991; Zuckerman 1999).

One may argue that our definition of a tie is too broad so that it mistakenly ignores the variation in the type of exchanges or relations. In particular, ties including the atomistic price systems, i.e., market ties, may differ from those circumventing the systems, i.e., nonmarket ties. For example, Baker, Faulkner and Fisher (1998) classified alliances, mergers, interlocking directorates, and political activities as nonmarket ties, hinting that these ties should differ

qualitatively from *pure* market ties. Their rationale was that these nonmarket ties are devices to go around the market activities and that these devices are “instances of market *failure* (p.148).” However, for the following reasons, this study does not distinguish between market and nonmarket ties.

First, what is common between market and non-market ties is that they are a form of exchange. When it comes to mergers, two or more independent parties sell or buy corporate control rights through the capital market. Joint venture is also an exchange where multiple independent firms buy corporate control rights collectively in return for the provision of financial resources. While parties to a market tie buy or sell products or services on the product market, those to a non-market tie exchange capital on the capital market. In this regard, they all are market-based exchanges. Even without activating either the product or the capital market, social actors can still exchange resources in various forms. Indeed, as anthropologists noted (Mauss 1990; Sahlins 1972), exchanges are also present in non-economic activities outside the market. The literature on social exchange is a case in point (e.g., Homans 1958, 1961).

Second, from the efficiency perspective, market ties are not qualitatively different from non-market ties. In other words, market ties are frequently the source of market failure, which means that the concept of market failure does not help distinguish between market and nonmarket ties. When actors seek to trade public goods, the exchange of goods involves externalities, or some actors have private information about exchanges and their consequences, (e.g., Mas-Colell, Whinston, and Green 1995: 350-351), thus underlying the failure of the market system. Note also that the economic literature, esp., in the domain of agency theory, considers M&A a device to correct market failure caused by agency problems, not the instances of market failure per se.

Third, non-equity alliances are not nonmarket activities. Rather they are based on voluntary and explicit contracting, where independent parties exchange their investments (Baker, Gibbons, and Murphy 2002, 2008). In this regard, Shapiro (1985) suggested that R&D alliances — including joint ventures — are a type of *ex ante* licensing, i.e., a market contract. Moreover, the effects of alliances on competitive efficiency vary with market structure and the content of alliances, meaning that non-equity alliances are not distinguishable from market ties with respect to efficiency (Goyal

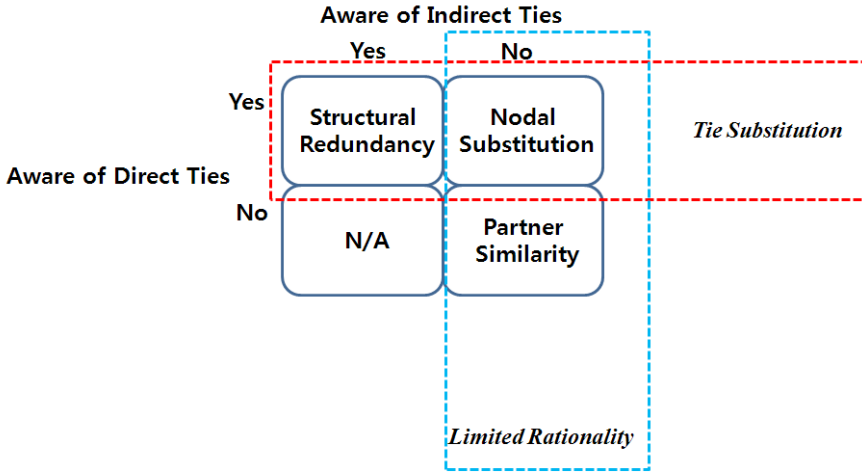
2007; Goyal and Moraga-Conzalez 2001).

Lastly, the concept of nonmarket ties may subscribe to a classical economics' narrow view of the market, i.e., a vacuum (or relational-free) marketplace of perfect competition. The separation of nonmarket ties from market ties implicitly suggests that activities remote from perfect competition conceived by classical economists are abnormal or 'not rational', a situation where sociologists unwittingly follow what economists ardently support. As long as the relevance of sociological approach to the market lies in its criticism against economists' over-reliance upon rationality, the following would unearth the unique contribution of sociological approach to the market such as Granovetter's (1985) embeddedness hypothesis: the perfectly competitive market is not *normal* but ready to melt into air, i.e., social relations.

Against this background, this study treats all the exchanges as the instances of ties.

*Tie substitution* refers to the extent to which ego's direct ties yield identical or comparable economic benefits from the ego's perspective. That is, it is a construct defined at the ego level. Let a tie between two firms,  $i$  and  $j$ , be  $X_{ij}$ . Suppose there is another tie,  $X_{ik}$ , where firm  $i$  has a distinct transaction with firm  $k$ . Then, ties  $X_{ij}$  and  $X_{ik}$  are said to be substitutable for  $i$  if both  $X_{ij}$  and  $X_{ik}$  are available to  $i$  and yield comparably good outcomes. The fact that ties  $X_{ij}$  and  $X_{ik}$  are substitutable for  $i$  does not necessarily mean that these ties are also substitutable for  $j$  or  $k$ . Since tie substitution is judged from ego's perspective, there is 'asymmetry' possible across firms with respect to tie substitution. That is, an exchange with firm  $j$ , which is substitutable for firm  $i$ , will be not substitutable for firm  $j$  if firm  $j$  has an unsatisfactory transaction with firm  $k$ .

It should be noted that ties differ in quality. For example, embedded ties should exhibit structural qualities different from those of arm's length ties. In this study, however, these differences are examined with respect to their impacts on tie substitution, i.e., differences in social capital perceived by ego. What I do emphasize with this approach is that as is the case with Durkheim's suicide, the proposed efficiency of competition (or cooperation) is not independent of social relations that actually constitute that competition. In other words, competition may not maximize social benefits if the competition (or cooperation) undermines the well-performing functions of social relations embedding actors of limited



**Figure 1. Actor Rationality, Structural Redundancy, and Nodal Substitution**

rationality and, more importantly, diverse values and preferences.

Tie substitution takes the following two distinct forms, depending on whether ego considers indirect ties, i.e., ties among her direct partners, while computing such economic benefits: structural redundancy (or substitution) and nodal substitution. When ego assesses resources flowing through direct and indirect ties, the potential and actual economic benefits of ego network — i.e., ego's social capital — is reflected into structural redundancy, i.e., the comparability of ego's direct ties with respect to economic benefits contingent upon the indirect ties. The social network literature has long suggested that the economic values or benefits of ego network vary with the structure of ego network, which in turn depends on direct and indirect ties (e.g., Ahuja 2000; Coleman 1988; Marsden 1983). For example, Burt (1992) suggested that two partners mutually connected are structurally redundant whenever ego seeks to obtain resources or information from these partners.

In comparison, nodal substitution refers to the economic comparability of ego's direct ties only. Because it ignores the benefits from indirect ties, nodal substitution is not sufficiently structural: i.e., it may capture partially social capital available to ego. This does not mean that nodal substitutions concern only the attributes of partners directly connected to ego, such as organizational size and

the quality of internal resources, attributes that attract attention from the strategic management scholars (Gulati, Nohria, and Zaheer 2000; Kougat 1988; Stuart 2000). Rather, both structural and nodal substitution delineates resources flowing through social relations, thus unveiling the qualities of relationships *as well as* resources held by partners. In other words, nodal substitution weighs the qualities of direct ties against those of partners' resources.

This study distinguishes between structural and nodal substitutions, two forms of tie substitution, in order to consider endogenously the ability to compute social capital on the ego's side, i.e., ego's rationality. The literature on social capital often presumes that ego recognizes and leverages social capital present in her social relations (e.g., Bae 2010; Burt 1992; Ryall and Sorenson 2007). Burt's (1992) redundant contacts draw on structural substitution, which a rational ego constantly monitors.

A general approach to structural substitution is the following. Assume that two partners exchange their resources at a completion rate of  $\theta$  such that  $\theta \in [0,1]$  and that these resources flow through indirect ties yet decay with the number of actors involved in the indirect ties. For ego 'i' that has L different partners, structural substitution is then defined as the squared sum of each direct tie's structural substitution:

$$\frac{\sum_j (\Delta_{ij} - \Delta_{i\bullet})^2}{L} \dots (1)$$

where  $\Delta_{ij} = \delta_{ij}[\theta_{ij}, \sum_k \delta_{jk}(d_{jk}, \theta_{jk})] - c_{ij}$ ,  $\Delta_{ij}$  and  $\delta_{ij}$  are the net and the total values of direct tie to  $j$ ,  $c_{ij}$  is the cost of forming a tie between  $i$  and  $j$ ,  $d_{jk}$  is geodesic distance between actors  $j$  and  $k$ , and  $j \in L$  and  $k \in M$ , which is the set of  $j$ 's direct or indirect partners. The higher value of equation (1) indicates that ego has few, structurally substitutable ties in her network.

As Krackhardt (1987) noted, however, ego is neither fully nor precisely aware of her social capital: ego is not perfectly rational. It is likely that ego may have insufficient information on either social relations or resources available from such relations. This consideration leads to nodal substitution, whose evaluation does not call for perfect rationality on the ego's side: ego arguably assesses her direct ties as long as tie formation is consciously managed. Of course, such assessment may not always be perfect, meaning that

nodal substitution is a subjective assessment of ego's social capital, whose value the third party may judge in a different way.

The introduction of nodal substitution serves the following theoretical purpose: the integration of local action with network structure. Although the social network perspective places the effects of network structure before the actions of individual actors, it is also undeniable that every relation is an outcome — byproduct at least — of actions intended by actors and that such intended actions are locally effective, i.e., contribute *partially* to the formation of social relations. The concept of nodal substitution is introduced to model ego's understanding of her social world, i.e., relations, which in turn constitute her *locally effective* action.

The qualifier, 'locally effective', merits further discussions. One theoretical motivation behind nodal substitution is that ego's subjective evaluation of her relations is not perfect. Accordingly, she may materialize potential benefits from her social capital, yet in a limited (thus locally effective) way. In other words, she often fails to realize what she intends to obtain. Another motivation is that each actor's nodal substitution — albeit locally ineffective — may interact with one another to constitute aggregate actions — i.e., social facts — in cooperative exchange networks. In other words, the model of nodal substitution seeks to examine emergent properties at the group level through mutually interacting nodal substitutions held by each actor: the question of how subjective evaluations collectively constitute the division of cooperative outcomes at the exchange network level. To this end, as discussed below, this paper looks into one structural condition, i.e., fully overlapping evaluations or symmetric nodal substitution. At the same time, our sole focus on a single structural condition is the limitation of this paper. As John Stuart Mills suggested (Nagel 1950: 221-223), the residues of this paper are thus the evidence for structural constraints imposed on ego.

It should be also noted that tie-substitution is not equivalent to tie-dissolution (tie longevity). The former concerns a state of *social capital* available to ego, whereas the latter pertains to a state of *social relations* embedding ego. As is the case with product substitution in economics, the concept of substitution only states that ego's direct ties yield comparable benefits, not that ego is willing to terminate one of her direct ties.

In contrast, tie dissolution is a state of social relations between



ego and her partners. Moreover, the nature of tie-dissolution is still open to debates. Economic approach for example emphasizes that interfirm relations, especially horizontal cooperation, are not long-lasting (e.g., Dussauge, Garrette, and Mitchell 2000; Kogut 1989; Park and Russo 1996; Reuer and Zollo 2005). By contrast, an institutional approach suggests that relations are difficult to modify and serve as structural constraints on actors' decisions and behaviors (e.g., Baker et al. 1998). Network inertia model (Kim et al. 2006) represents this approach, which makes a sharp contrast to Greve et al. (2010). Accordingly, it is not certain whether tie dissolution reveals the presence or absence of social capital among partners, i.e., whether partners of dissolute ties find alternative ties that can substitute for a current tie, for a tie can be dissolved either because participants in a tie successfully complete an intended exchange or because they are dissatisfied with the process or outcomes of an exchange.

### **Antecedents to Substitutable Ties**

Why are some ties substitutable and others not substitutable? Three different antecedents to tie-substitution are derived from the literature on interfirm exchanges such as the structural hole theory (Burt 1992), the network closure theory (Coleman 1988), and transaction cost economics (Williamson 1985).

As long as the actor maximizes the novelty of information obtained from others, redundant ties are substitutable because they provide similar information. Burt (1992) suggests that redundant ties provide similar information because of homophily effects (Lazarsfeld and Merton 1954; Lawler and Yoon 1998). Homophily effects occur if partners get to know one another because their *ex-ante* attitudes or their task-related knowledge is similar. Furthermore, if frequent interaction serves as a conduit for homophily, partners become more homogeneous after interacting with each other. Hence, whether redundant ties are an outcome of *ex ante* similarity in information or a driver for *ex post* similarity in information, they become substitutable from ego's perspective.

A competing model for inter-firm exchanges, the network closure theory (Coleman, 1988) posits that a densely connected network leads to a rich flow of information and the emergence of social norm constraining opportunistic behavior, and is thus more

favorable to actors. This densely connected network is also known as embedded ties, a reservoir of social capital with reciprocal transaction and enforceable trust (Portes and Sensenbrenner 1993; Granovetter 1985; DiMaggio and Louch 1998). From the perspective of information benefits, embedded ties are less substitutable than arm's length ties.

First, they provide rich information (Bae and Koo 2008; Hansen 1999; Saxenian 1996). Embedded ties set the ground for shared value and reciprocity between partners (Portes and Sensenbrenner 1993), which in turn gives each partner a strong incentive to make additional investments in a bid to optimize the exchange of information between partners. These investments include the development of routines dedicated to a given exchange and the access to each other's IT system relevant to the exchange. Toyota's Just-In-Time production system is a case in point. Second, they provide reliable information. People are more likely to disclose sensitive and intimate information to their close friends. Information obtained from embedded ties is more trustworthy and rich in its content, compared with arm's length ties, whose contacts are strangers at best. Taken together, the quality of information varies with the trustworthiness of the source as well as its content. This in turn suggests that embedded ties are less substitutable than arm's length ties.

Of course, embedded ties are not without costs. The opportunity cost of embedded ties is to sacrifice the diversity of information. For example, Uzzi (1996) shows that firms with heavy dependence on embedded ties tend to perform poorly, compared with those having a mix of embedded ties and arm's length ties. Nonetheless, Gulati (1995) demonstrates that firms tend to enter alliances with specific partners repeatedly, indicating that embedded ties persist over time. This persistence of embedded ties however implies that there must be other compensating benefits from embedded ties that alleviate the opportunity cost of information diversity. Social exchange theory, which originates from operant psychology (Homans 1961), suggests that such compensating benefits may include an obligation, which results from prior favorable exchanges and anticipates future profitable exchanges: reciprocity (Blau 1964; Emerson 1976). In other words, embedded ties will be repeated because the current exchange not only provides valuable outcomes *per se*, but also anticipates valuable future exchanges or discharges

social obligations from valuable past exchanges. As a result, embedded ties become less substitutable.

Finally, an efficiency-driven approach, transaction cost economics (TCE) deals mainly with the formation of a firm, and not about the formation of a tie (Williamson 1975, 1985). Williamson (1985), however, attempts to embrace a range of governance modes, including relational contracts (Baker, Gibbons, and Murphy 2002), by reducing the issues of transaction costs to those of contractual practices. According to Williamson (1985: 41), “any problem that can be posed ... as a contracting problem is usefully investigated in transaction cost economizing terms.” This means that in a network term, TCE deals with the ways to govern or organize transactions or exchanges, which are “ties” in this study. Ties occur through either of two governance modes, market governance and bilateral governance. Market governance is another name for the price mechanism and bilateral governance is synonymous with hybrid transactions such as franchising and alliances.

Ties under bilateral governance become less substitutable. Transactions for bilateral governance recur among a limited number of partners and are supported by transaction specific investments, a tendency that values the continuity of a pre-existing trading relation (Williamson 1985: 75). Due to transaction specific investments made by both parties, few alternative transactions of comparable value are available other than current exchanges, which will increase *ex post* transaction costs such as haggling costs. Hence, keeping hybrid transactions inside, i.e., crafting hierarchy, is preferred to forfeiting them, i.e., using the market. Because of this tendency, bilateral governance often transforms into unilateral governance, i.e., the hierarchy (Williamson 1985: 115). This lack of alternatives on the market suggests that hybrid ties are less substitutable.

As is the case with reciprocity mentioned above, hybrid ties rely on credible commitments, which are irreversible, specialized investments to safeguard trading relations. For example, each partner to an exchange may make capital investments intended only for her trading partners and whose redeployment is not possible without incurring significant costs. In this case, fundamental transformation eventually follows, where *ex ante* competition is larger than *ex post* competition and one of the trading parties has monopoly power over the other. To avoid *ex post* rent-seeking behavior or opportunism by the others, each party in exchange

may voluntarily choose to collectively increase transaction-specific investments. Such a reciprocal exposure of specialized assets, i.e., bilateral commitments, is rationally designed to reduce the hazards of opportunism, which leads their trading relations to be less substitutable ties over time.

In summary, three antecedents to tie substitution are homophily effects, reciprocity, and bilateral commitments. That is, homophily effects induce redundant ties to be more substitutable, reciprocity renders embedded ties to be *less* substitutable, and bilateral commitments makes hybrid ties less substitutable. It should be noted that both homophily and reciprocity may lead to conflicting predictions on a given tie with respect to tie substitution. For example, a redundant tie is ready to be substituted in terms of the structural hole theory. In contrast, it could be less substitutable in terms of the network closure theory. However, a direct comparison is infeasible because redundant ties concern the diversity of information, whereas embedded ties focus on the richness of information or information loss.

Nonetheless, these three antecedents should be jointly compared to assess tie substitution — especially, the quality of ties — for the following reasons.

First, the qualitative difference between ties is jointly determined by three independent antecedents, i.e., homophily, reciprocity, and bilateral commitments. Each antecedent alone accounts partially for tie substitution. It is possible that non-redundant ties are based on a strong social norm and reciprocity. CEOs of a company may have embedded ties with their managers of different departments, each of whom is disconnected. As Burt (1992) observes, the strength of a tie, which addresses one qualitative aspect of cohesive ties, may or may not be related to a structural hole. These antecedents are independent of one another.

Second, the relative contribution of each antecedent will vary across the nature of exchange. For example, brokerage positions such as structural holes are more likely to come into play when exchange partners are equally attractive and the multiple choices or memberships are available to the focal firm, i.e., broker. If one exchange party offers by far better terms of trade than the others, the choice of non-redundant ties become trivial because a focal firm has a single best solution to the design of its exchange networks.

Third, the relative contribution of each antecedent will vary across

firms. Firms differ in the number of alternative ties available to them. A central actor, by definition, is one with many alternative ties. In particular, a central actor with structural holes is able to increase its negotiation power since partners in alternative ties are not involved with one another and a central actor is the only exchange partner available to them. Since these partners occupy disadvantage positions, i.e., peripheral positions in exchange networks, it is likely that a central actor wants its partners more dependent on current relationships, yet peripheral actors attempt to avoid too much dependence on current relationships. On the one hand, tie substitution for a central actor depends on how successful the central actor induces its peripheral actors to form cohesive ties with her. Hence, reciprocity will become critical. On the other hand, tie substitution for peripheral actors depends on how they obtain bilateral commitments from a central actor and reduce anticipated transaction costs.

**P1:** The degree of tie substitution varies with three antecedents, homophily, reciprocity, and bilateral commitments. a) It is an increasing function of homophily. b) It is a decreasing function of reciprocity and bilateral commitments.

### **Exclusion as a Mechanism**

How does tie-substitution — ego's evaluation of her direct ties — relate to the division of cooperative outcomes? This paper draws on network exchange theory and proceeds with the following two related assumptions. First, competition for a cooperative exchange increases with the likelihood of exclusion from proposed exchanges. Second, competition for exchange accompanies competition for the division of cooperative outcomes. Third, the likelihood of exclusion from exchanges increases with ego's tie-substitution. In what follows, I will examine each assumption.

Cooperative exchange involves a process of competition where parties to an exchange compete to obtain better terms of trade, while realizing more gains in return for goods and services. Such competition is also reflected into each party's way of 'securing productive relationships' (Burt 1992: 4), i.e., how to select and complete more profitable transactions with other firms while sifting out and terminating less profitable transactions. If all the parties to

an exchange are guaranteed to enjoy fair gains from the exchange, they may have no incentive to vie for the division of cooperative outcomes. Whenever their fair gains from cooperative exchange are threatened, competition among partners will ensue.

Experimental studies on network exchange theory (Patton and Willer 1990; Markovsky, Willer, and Patton 1988; Willer 1999) offer a general model for competition inside cooperative exchange by employing the notion of *exclusion*. If there are  $N$  possible exchanges available and  $M$  firms competing for the exchanges such that  $M$  is larger than  $N$ , then there are always  $M - N$  firms which fail to win any exchange. As  $M$  increases,  $M - N$  increases as well. These  $M - N$  firms are the ones that are 'excluded' from economic exchanges that occur. This discussion also suggests that a firm more susceptible to exclusion threat will have relatively less negotiation power than does its otherwise identical counterpart.

This model is well compatible with the density-based view of competition. For example, economic literature traditionally assumes that competition to acquire better gains in exchange increases with the number of 'similar' firms in the market. Population ecologists also model the intensity of competition as an increasing function of the density of a population, which is the number of firms with a similar structure (Hannan and Carroll 1992). The implicit mechanism behind these approaches is that, for a given cooperative exchange, the likelihood of one firm winning this exchange will decrease if the number of its competitors gets larger. However, competition under network exchange theory differs substantially from a density-based view of competition:

Competition by network exchange theory is constrained by each firm's exchange network. In contrast, a density-based competition presumes that firms in the same niche face the same environmental pressure or constraints. Suppose a producer, which relies on outsourcing the key components of its product, each of which is produced by a single vendor. The failure to buy any of the components will prevent this producer from making its final products. The number of trading parties needed for the focal firm is then equal to the number of key components needed. In this regard, network exchange theory concerns the design of all the exchanges needed for the focal firm to achieve its economic interests.

Regarding the division of cooperative outcomes, network exchange theory concerns a focal firm's ability to exclude trading partners

from a given cooperative exchange. The basic assumption behind this approach is that ego or the focal firm's share of cooperative outcomes increases with her ability to exclude partners from a given exchange. The reason is that those facing the threat of exclusion may offer a better terms of trade to ego so that they secure cooperative exchanges with ego. From ego's perspective, this means that as her likelihood of exchange exclusion increases, ego may compete for a cooperative exchange by conceding competitively her share of cooperative outcomes to potential partners.

This study further extends the above implications of network exchange theory by introducing tie-substitution. In particular, this study suggests that the likelihood of exclusion varies with the number of trading partners with comparable quality, i.e., substitutable ties, as well as the number of minimally required partners for this exchange. Indeed, Hirschman (1970) shows that actors in the market have two options to express their dissatisfaction with a currently deteriorating service: voice and exit. The exit option, which is widely discussed in economic literature, includes dissolution of ties, divestiture, and switching into alternative services. In contrast, the voice option refers to non-market procedure such as making complaints directly to a producer. In discussing the relative effectiveness of these options, he argues that the voice option will work better if the exit option is used as a credible threat. Put it differently, one's negotiation power over the allocation of cooperative benefits will increase if he or she maintains more substitutable ties to switch into.

With regard to negotiation power, the prior literature on a network structure assumes that a central actor or broker is in a better position to maximize its negotiation power thanks to its network position (Friedkin and Johnsen 1997; Ibarra and Andrews 1993; Burt 1992). Yet, the model developed here suggests that even a central actor may lose its negotiation power if its ties are less substitutable. For example, Willer (1999) clearly shows that the mechanism of exclusion may undermine the dominant position of a central actor if the minimally required number of partners for a central actor is equal to the number of its current partners. In this case, there are no substitutable ties left for the central actor. As a result, it is vital to examine tie-substitution before making any prediction about the negotiation power of an actor in a network.

The following case illustrates the role of tie-substitution. Suppose

that each firm in the market is allowed to conduct only one exchange within a certain period. A focal firm with many substitutable ties can choose any of them and exclude the rest without loss of gains. If trading partners in these substitutable ties do not have additional exchanges other than one with the focal firm, they will compete with one another by offering better terms of trade to the focal firm to the extent that they successfully complete an exchange. Hence, the focal firm with multiple substitutable ties will benefit more from competition among its partners that have no substitutable ties.

### **Actor Rationality and Nodal Substitution**

The extension of network exchange theory by tie-substitution however poses an important theoretical question of whether network exchange theory is compatible with the model of tie-substitution. The reason is that network exchange theory draws on structuralism, which does not allow for any level of actor rationality, i.e., social structure always comes before agency. In contrast, the model of tie-substitution presumes that each actor seeks to evaluate his or her social relations and manage them accordingly. Given that every relation is an outcome — byproduct at least — of actions by actors, the better understanding of structural effects calls for the analysis of how structurally constrained actions contribute to reproducing or modifying structural constraints. In this regard, the structuralist account of network exchange theory is compatible with that of tie-substitution once the concept of nodal substitution, not structural substitution, is introduced to model ego's understanding of her social world, i.e., relations.

Against this background, this study re-interprets the structural implications of network exchange theory *from ego's perspective*. With nodal substitution, the likelihood of exclusion is recast as ego's subjective likelihood of exclusion. This means that different actors may expect different likelihoods of exclusion for the same structure of social relations. In the similar vein, competition for exchange is viewed as ego's willingness to compete for a better term of trade. Competition appears to be intense when ego feels little negotiation power over her potential and current partners because her rivals vie for offering a better term of trade to her partners. Ego's subjective evaluation of competitive intensity and thus her negotiation power should affect ego's actual decision for the term of trade. In



particular, as ego seeks to make a tie to her partner, ego lack of perceived negotiation power will make ego voluntarily concede her term of trade with the partner, eventually undermining her share of cooperative outcomes in the course of negotiation. Given that nodal substitution is ego's subjective evaluation of relations, one may question why ego does not try to keep her interest in the exchange that she values highly. The above discussion does not imply that ego gives up maximizing her interest. Rather, it simply shows that one who loves more will lose more.

This discussion leads to the following conclusions. First, as is shown in network exchange theory, ego has more negotiation power over her partners when her ties to these partners are nodal-substitutable. Second, ego expects that their partners have little power to exclude ego from their exchanges as her ties to them are nodal-substitutable. In short, the following propositions will hold.

**P2:** Ego's subjective likelihood of exclusion decreases with ego's nodal substitution.

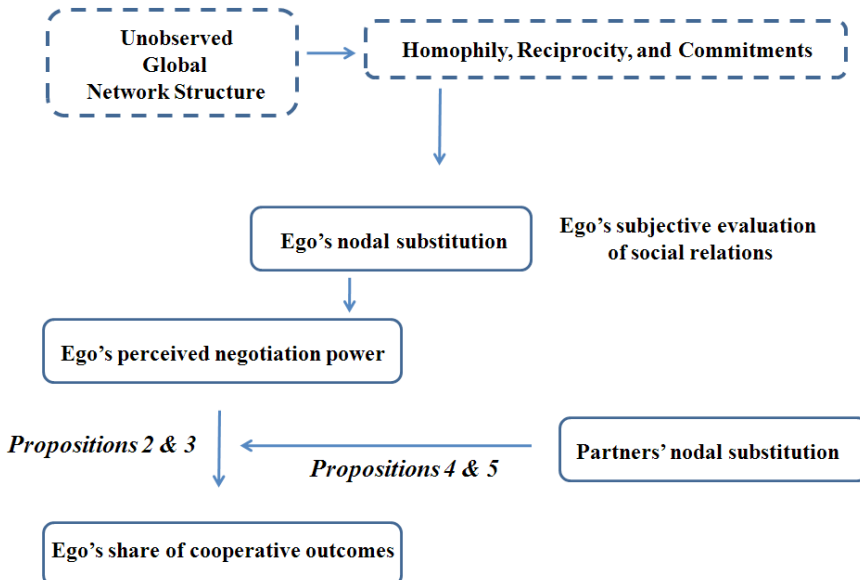
**P3:** Ego's share of cooperative outcomes increases with ego's nodal substitution.

The above discussion has so far assumed that ego's decision depends on ego's subjective evaluation of her social relations and that neither partners' evaluation of her relations nor their evaluation of ego's evaluation affects ego's decision. Once partners' evaluations are brought in, the current discussion calls for the dyadic or network level analysis, which is made in the subsequent sections. This study however precludes the following two possibilities: common knowledge and illusory knowledge. Common knowledge refers to a case in which everybody knows what everybody else knows. This case however allows for too much rationality to actors, which is incompatible with the model of nodal substitution. The latter indicates that what each actor knows has nothing to do with the reality or actual economic gains. This case is again too restrictive because it does not leave any room for actor rationality. The realistic and thus representative description of actual decision-making should fall between these two extreme possibilities. With limited rationality by nodal substitution, this study thus assumes that each actor's evaluation of her social relations is private information in the course of negotiation with other partners.

### Correlated Evaluations and Symmetric Substitution

Cooperative exchange networks involve multiple actors with their own interests to satisfy. A structuralist account of these networks is typically that the structural constraints of these networks are 'foreign' to each actor embedded into them, i.e., they are social facts in a Durkheim's sense (Durkheim 1952: 318). However, this study acknowledges that these structural constraints cannot be perfect and that they take their effects through actions by each actor. This structuration approach (Giddens 1979) to social networks makes the room for nodal substitution.

This introduction of nodal substitution necessitates the following analysis of structuration: how each actor's nodal substitution interacts with one another to constitute aggregate actions — i.e., social facts — in cooperative exchange networks? Given that nodal substitution is ego's subjective evaluation of her social relations, this study rephrases such analysis as the question of how subjective evaluations collectively constitute the division of cooperative outcomes at the exchange network level. Nodal substitution ranges



**Figure 2. Substitutable Ties and Cooperative Outcomes**

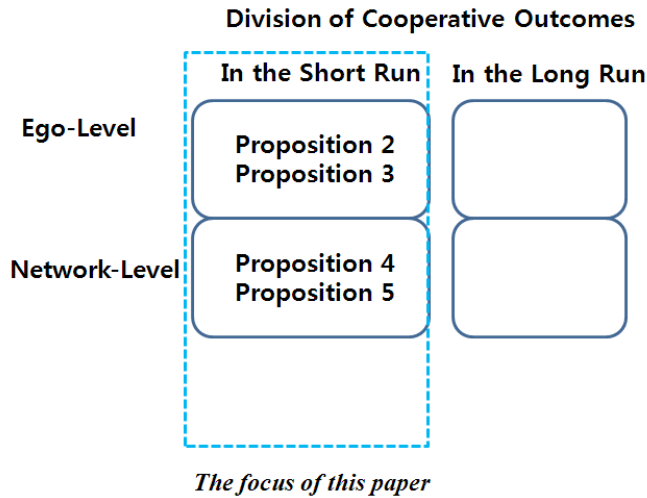
theoretically from no overlapping evaluations to fully overlapping evaluations (i.e., symmetric nodal substitution). Out of these two theoretical bounds at hand, this study looks into the case of fully overlapping evaluations because the other bound includes a variety of cases that cannot be summarized in one way or another. In sum, the above discussion is summarized in figure 2.

Note that overlapping evaluations differ from overlapping relations. Each actor may have different social relations even when each actor's evaluation of social relations overlaps fully with the others'. Overlapping evaluations hence only suggest that actors have correlated or identical evaluations of structural constraints imposed on them. For example, correlated evaluations refer to what actors believe, such as their partners' power over cooperative networks. Such correlated evaluations again vary between the following two forms: every actor in a network feels that her direct ties are fully substitutable or every actor in a network feels that the direct ties are not substitutable at all.

Because the subjective likelihood of exclusion depends on nodal substitution, correlated evaluations over social relations will lead each actor's exclusion likelihood to converge. This in turn affects actors' willingness to compete for a better term of trade. In particular, the following results are expected at the network level. When nodal substitution by each actor is low, symmetric nodal substitution suppresses competition for the division of cooperative outcomes: actors' perceived negotiation powers over their partners are low so that their subjective exclusion likelihoods are high. Accordingly, none of them vie for a more share of cooperative outcomes. The lack of competition culminates in the equal division of cooperative outcomes at the network level.

**P4:** The division of cooperative outcomes among network members is symmetric (i.e., equal) when each member's nodal substitution is symmetric and low.

In contrast, when nodal substitution by each actor is high, symmetric nodal substitution aggravates competition for the division of cooperative outcomes. When two parties all believe that they have more negotiation powers over the other, competition continues until either of them runs out of resources and subscribe to the term of trade offered by the other. That is, when all the parties are confident



**Figure 3. Nodal Substitution and Effects across Levels**

about winning the negotiation, only resource constraints faced by each party will drive the evolution of competition. Accordingly, those with relatively large amount of resources will claim for a larger share of cooperative outcomes.

**P5:** The division of cooperative outcomes among network members is in proportion to the relative difference in resource endowments by network members when each member's nodal substitution is symmetric and high.

Do the above propositions imply that the division of cooperative outcomes is in equilibrium? In the short run, the division should be stable, yet it may not remain so when the objective social relations differ substantially from actors' subjective evaluation of the relations. Whether the objective social structure eventually overshadows the effects of nodal substitution is a new research question, which is beyond the scope of the current inquiry. Network inertia model (Kim, Oh, and Swaminathan 2006) however implies that subjective evaluations may not diverge from persistent social relations. That is, ego with incorrect nodal substitution may either undervalue or overvalue the constraints and supports from her social relations, but she may adjust her evaluation in the long run when she receives consistent feedbacks from persistent social

relations. The above-discussion is summarized in figure 3.

### **Horizontal and Vertical Cooperation with Tie-Substitution**

As mentioned above, exclusion likelihood with both nodal substitution and the number of minimally required partners for this exchange. The latter captures the nature of cooperative exchange, i.e., what to complete through a given exchange. While the nature of an exchange could be diverse, a frequent and important way of classifying exchanges is whether they involve horizontal cooperation, i.e., exchange among direct rivals, or vertical cooperation, i.e., exchange among different value chain participants.

Other things being equal, nodal substitution is likely to be high for ego's horizontal cooperation than vertical cooperation. First of all, empirical findings on the duration of cooperation, which is partly related to the quality of relations, suggest that horizontal cooperation would be less durable and thus less valuable to ego, compared with vertical cooperation. Alliances among direct competitors are found to last for a short period (Kogut 1989; Park and Russo 1996; Dussauge, Garrette, and Mitchell 2000), yet supplier-buyer relationships tend to be stable over time (Dyer 1996). Second, vertical cooperation is more likely than horizontal relationships to make transaction-specific investments (Freeland 2000; Teece 1986; Monteverde and Teece 1982). Few firms make every component required for their final products since fast technological advancements prevent them from being efficient and advanced in every phase of their value chains. Hence, downstream manufacturers choose quality suppliers, which are willing to invest in transaction-specific equipment, and rely on them for a variety of components. The automobile and telecommunications industries all illustrate this case. Finally, partners in horizontal cooperation are more likely to possess similar resources since they compete for the same niche in economic and social environments (Hannan and Freeman 1977). Such resource similarity indicates that partners are comparable in quality and likely to be substitutable.

**P6:** From ego's perspective, vertical cooperation is less nodal-substitutable than horizontal cooperation.

Vertical cooperation emerges out of the division of labor in

the value chains. The finished good producer for example is one that relies on multiple suppliers for its final product. If one of its suppliers fails to deliver key components for its final product, this firm, too, cannot run its production process. Therefore, this firm is widely open to the unexpected performance of its suppliers if it cannot find alternative suppliers of a comparable quality. The reverse is true to the upstream suppliers. This explains why transaction cost economics (Williamson 1975, 1985) predicts the integration of upstream suppliers by downstream producers. Accordingly, exclusion likelihood in vertical cooperation is more critical to ego's performance than in horizontal cooperation. In other words, the effects of nodal substitution should be more salient for vertical cooperation than horizontal cooperation.

**P7:** Compared with horizontal cooperative outcomes, the reduction in ego's share of vertical cooperative outcomes is larger as ego's nodal substitution decreases.

### **Substitution with or without Potential Partners**

The concept of nodal substitution draws on limited actor rationality; i.e., actors consider their direct partners only when evaluating their cooperative networks. This assumed rationality becomes subtle when one needs to judge whether ego compares her direct partners with potential ones, a case that is likely to occur in reality. Romo and Schwartz (1993) illustrate the role of potential partners on nodal substitution. They show that for large, central firms the potential partners are readily available so that they relatively easily migrate to other manufacturing districts. But many smaller suppliers that lack in potential partners face all the costs of tie dissolution. This implies that the availability of potential partners should influence ego's nodal substitution.

Two main sources of potential partners are those exclusively trading with each other, i.e., clique members, and those never trading at all, i.e., isolates (Nohria and Garcia-Pont 1991; Rosenkopf and Tushman 1998). Cliques in a network are by definition cohesive inside and not accessible to ego outside the cliques. In comparison, isolates are easily accessible to ego. As long as nodal substitution increases with the availability of potential partners, it follows that:

**P8:** Ego's nodal substitution increases with isolates in a network, yet decreases with the number of cliques in a network.

The analysis of potential partners raises the following question: does the effect of dyadic tie-substitution (i.e., with a specific partner) depend on nodal substitution at the ego network level (i.e., with other partners)? In other words, does ego enjoy more benefits by cooperating with a partner when her exchange with the partner is not substitutable yet her nodal substitution at the ego level is high? To address this question, it is necessary to re-examine the definition of nodal substitution. As noted above, nodal substitution is ego's evaluation of her social relations, i.e., cooperative exchanges with her partners. This means that nodal substitution is not defined when ego has only one cooperative partner. For ego with more than one partner, nodal substitution is based on pair-wise comparison of dyadic exchanges. Equation 1 on page 8 illustrates this logic although the term for indirect ties should be dropped when computing nodal substitution. Hence, the relationship between dyadic tie-substitution and nodal substitution is equivalent to that of an observation and the mean from a group of observations.

For example, an outlier should influence critically the mean of observations. For ego with a lower level of nodal substitution, a non-substitutable exchange will be present. In contrast, ego with a higher level of nodal substitution is likely to enter a highly substitutable exchange. Either way, the value of a given exchange is weighed against the mean value of all the direct ties, i.e., nodal substitution. This means that ego seeks to extract a better terms of trade from her partner when the value of a given exchange is perceived to be lower than the mean value of her other exchanges. Other things being equal, this should be reflected into ego's more share of cooperative outcomes with the partner.

### AN ILLUSTRATION

In this section, I illustrate one empirical strategy to uncover the proposed theoretical mechanism for nodal substitution. Note that nodal substitution does not measure social capital available to ego. Rather, it measures ego's subjective evaluation of social capital whose presence is not fully known to ego.

One way to measure nodal substitution is to employ self-report surveys such that the subject is asked to name and assess her firm's direct ties. Apart from measurement errors, an issue yet to be solved is to judge whose evaluations are representative of the firm under study. As is the case with organizational goal (e.g., Cyert and March 1963), consistent and stable evaluations over a firm's social relations are difficult to obtain. This is more likely so when the top management team, key decision-makers of the firm, belong to multiple, competing coalitions of managers. Alternatively, one may consider a variant of Blau's (1977) heterogeneity index, which captures the similarity (or comparability) in the size (or content) of cooperative exchanges with a focal firm's partners. This option assumes that the subjective evaluations of a given social relation are related to the relative size (or content) of these exchanges. This assumption is relatively realistic, yet leaving little from the role of perceptions by managers and often demanding detailed information concerning exchanges.

The other way to operationalize nodal substitution is to build on the study of repeated ties (Gulati 1995; Cook and Emerson 1978) at the ego network level. Although nodal substitution is based on the subjective preference over a given tie, only the choice of a given tie — which is governed by nodal substitution and arises from a bargaining process among coalitions of managers — is observable and objective. Hence, one may use this pattern as a proxy for nodal substitution. The degree of nodal substitution,  $\lambda$ , for firm  $i$  in year  $t$  is defined as follows:

$$\lambda = - \frac{\sum_j R(t)_{ij}}{\sum_j Z(t)_{ij}},$$

where  $i \neq j$  and  $Z(t)_{ij} = 1$  if organizations  $i$  and  $j$  entered an alliance with each other in year  $t$ , and  $R(t)_{it} = Z(t)_{ij} - 1$ .

$\lambda$  varies from  $-1$  to  $0$ . Hence, the larger value of this measure indicates that ties in ego network are more substitutable. In particular, this measure examines the degree of nodal substitution at a firm level, not at a dyad level so that  $\lambda$  measures the proportion of substitutable ties out of total relationships a firm has.

With this definition, I estimated the following performance



specification to see the effects of nodal-substitution on firm profitability. Specifically, I chose the following models:

$$\Delta \text{ROI}_{it} = \beta_0 + \beta_1 \times \Delta \text{ROI}_{it-1} + \beta_2 \times \text{Tie Substitution}_{it} + \beta_3 \times \text{Weak Components}_{it} + \beta_4 \times \text{Tie Substitution}_{it} \times \text{Weak Components}_{it} + X\beta + e_{1it}$$

where  $X$  is a matrix of control variables,  $\beta$  are vectors of parameters, and  $e_{it}$  is the error term.

A change in firm performance at year  $t$ ,  $\Delta Y(t)$ , is defined as the first difference of the dependent variable:  $\Delta Y(t) = Y(t) - Y(t-1)$ . ROI was obtained from yearly net income divided by invested capital that is the sum of common equity, long-term debt, and preferred stock. I also measured ego's network structure as the number of weak component cliques in ego network. A set of control variables included in the analyses were: market capitalization, current ratio, and debt ratio of a firm as proxies for operating efficiency and the market share of a firm as a proxy for each organization's market power.

The data used for this illustration were the strategic alliances occurring among public firms in the US communication service industry from 1991 to 1998. Since the specified model included lagged dependent variables, ordinary least square (OLS) estimator would be inconsistent if the error term was serially autocorrelated. To model empirically firm heterogeneity, I constructed multiplicative heteroscedasticity errors by decomposing  $e_{it}$  into a homosecastic error term, i.e.,  $\mu_t$ , and an unknown scale function of explanatory regressors:  $e_{it} = \sigma(X_{it})\mu_t$ . I used an identity function as a scale function of explanatory regressors to fit the data. The parameter estimator was the feasible generalized least squares (FGLS) estimator with the correction of heteroscedasticity. It is asymptotically equivalent to the maximum likelihood estimator (MLE). Parameters were estimated by using PROC MODEL procedure of SAS.

Table a1 gives FGLS estimates for the dynamic process, where competition among alliance partners affects the negotiation power of a focal organization and accordingly its share of cooperative benefits. As shown in the table, firm profitability is negatively correlated with Tie Substitution even after controlling for alternative factors. That is, an organization loses its negotiation power over its partners as its ties become substitutable.

**Table A1. Tie Substitution and Firm Performance<sup>a, b</sup>**

Variables	Changes in Profitability
<b>Mean</b>	
Tie Substitution ( $\lambda$ )	0.76 (0.21)**
Weak Components	0.20 (0.07)**
Tie Substitution $\times$ Weak Components	-0.56 (0.17)**
Constant	-0.15 (0.13)
Lagged $\Delta$ ROI	-0.16 (0.05)**
Debt Ratio	-0.15 (0.01)**
Current Ratio	0.02 (0.02)
Market Capitalization/ $10^6$	-0.38 (0.67)
Market Share	0.08 (0.15)
<b>Log variance</b>	
Tie Substitution ( $\lambda$ )	-3.00 (1.02)**
Weak Components	-1.24 (1.02)
Tie Substitution $\times$ Weak Components	-3.64 (1.02)**
Constant	29.03 (1.03)**
Lagged $\Delta$ ROI	-0.27 (1.04)
Debt Ratio	-0.08 (1.02)
Current Ratio	-0.70 (1.03)
Market Capitalization/ $10^6$	-11.22 (1.02)**
Market Share	-6.36 (1.03)**
<b>R-squared</b>	0.537

a) \*  $p < .05$ ; \*\*  $p < .01$  (one-sided tests). Standard errors in parentheses. b) Parameters obtained through FGLS with multiplicative heteroscedasticity errors.

## CONCLUSION AND IMPLICATIONS

This study proposes a model of nodal substitution in cooperative networks in a bid to examine the division of cooperative outcomes. In particular, this study draws on exclusion likelihood to hypothesize the effects of nodal substitution on the division of cooperative outcomes. Nodal substitution is ego's subjective evaluation of her social relations, which presumes that not all ties are equal in quality. Rather than analyzing context-free structural properties of a tie such as brokerage and cohesion, this model directly incorporates the qualitative difference in ties into the process of cooperative exchange among firms. That way, this study seeks to relate the effects of tie structure to each actor's subjective understanding of his or her social relations.

What constitutes the structural effects of social relations is a long-lasting and arguably inconclusive debate on structuralism (e.g., Piaget 1970). Regarding social relations, this debate is rephrased as a question of whether the effects of tie structure are distinct from those of resources held by each actor involved in social relations. Three theoretical stances are available. One is that the effects of tie structure — what the structure can do — are a mere reflection of what resources flowing through social relations. Giddens (1979) in this regard proposes that structure exists as resources (p.64). One reason why Giddens (1979) treats resources as structure, more precisely, structuring property, is related to his attempt to integrate structure into agency, i.e., a model of structuration (see p.69 and p.71). Without knowing the type of individually-held resources, one cannot uniquely discern the effects of tie structure. For example, redundant contacts are otiose only when resources carried by redundant contacts are excessive. Indeed, Granovetter (1990) complained that a network analysis tended to be biased toward reductionism, saying that “it is methodologically more individualist than some other sociological traditions (p.95).” Another stance is that tie structure fully determine resources flowing through social relations. In this case, tie structure manifests itself by shaping resources. Cognitive embeddedness (Zuckin and DiMaggio 1990), field (Martin 2003) and habitus (Bourdieu 1977) are some examples. The other is that the structure and resources of ties are distinct yet the former constrains the latter partially. In this case, tie structure guides the pattern of social interactions (or exchanges) among actors, which in turn affects the accumulation of resources by these actors (e.g., Entwisle et al. 2007).

The key difference between the second and third stances lies in the ability of structure to generate social practice. The second stance regards structure fully responsible for every social practice, thus rendering individually-held resources an outcome of structural constraints. One weakness of this stance is its unavoidable tendency to over-socialize the effects of structure. In contrast, the third stance understands structure as the potential for social practice, i.e., setting a limit on practices and thus the actual distribution of resources among actors. The drawback of this stance is to necessitate a theory of agency that materializes the potential for practice.

With nodal substitution, this study seeks to unveil the medium of

structural effects along the third theoretical stance of structuralism. First, this study views the structure of ties as governing exchanges or social interactions among actors. Second, the channeling of interactions draws on limitedly rational actors' perceptions of their social relations, which is captured by nodal substitution. Third, as a result, the effects of tie structure emerge only after such perceptions, often mistaken, emanate decisions and behaviors by actors. That is, structure cannot reveal itself independently.

Against this backdrop, the present study has the following theoretical implications. First, a subjective comparability of ties is one important way of uncovering the sources of network effects. A structuralist account of social action invokes the structure and strength of ties as the sources of network effects. Yet, social structure is a meaningful constraint on social action to the extent that the structure is reproducible, i.e., not transient. This study presumes that a reproducible structure is one that is stable. In this regard, this study addresses the stability of tie structure by bringing in the concept of tie substitution, particularly, nodal substitution — a subjective comparability of ties. Second, given the subjective comparability of ties, the sources of network effects are not separated from the very act of valuing the outcomes of exchanges among social actors. That is, valuation — a perception that does not necessarily correspond to social structure, which is not fully observable — constitutes critically the emergence of social structure, i.e., network effects. Without specifying the process of valuation, a structuralist account of network effects is likely to yield a black-box explanation where the outcomes of exchanges occur in a certain way and is independent of ego's intention because structure — “unspecified” residuals — dictates that way. Lastly, because valuations are not perfect in nature, self-reported social capital may not in this regard reflect network effects fully, which means that ego and her partners' valuations should be correlated before generating any tangible outcomes in the course of exchanges.

This study has its own limitations and thus presents additional avenues for examining the effects of social relations. First, when nodal substitution, a perceived state of social capital, is not compatible with the true value of ego's social capital, does the effects of social relations overshadow those of mistaken nodal substitution? To address this question, the following analyses should be further made: whether nodal substitution by ego leads to actual changes

in the structure of ego network. Normally the cost of forming a tie reduces the incentive to add a new tie, yet the ineffective transfer of resources increases the incentive to add a new one. As equation 1 shows, the cost of a tie as well as the degree of transfer effectiveness shapes ego's nodal substitution. Such relationships imply that nodal substitution should have implication for the addition or deletion of ties. It is uncertain however whether increasing nodal substitution may readily undermine the ground for tie deletion. It is also likely that ego wants to keep highly substitutable ties while preserving her negotiation power (e.g. Thompson 1967: 32). For example, a firm considering second sourcing partners may keep the exchanges with them to be substitutable in a bid to secure its negotiation power over suppliers. A further analysis is necessary.

Second, it is also important to examine whether the correspondence between nodal and structural substitutions varies with the structure of ego network. As noted above, structural substitution perceived by rational actors should correspond to the true structure of ego network. Hence, the correspondence between nodal and structural substitutions begs the question of when nodal substitution precisely captures the true state of ego network. Among possible conditions, network scholars would be interested in whether ego assesses her network when the tie structure is full or void of brokerage opportunities. If information flows effectively through cohesive ties, ego is less likely to err as her network loses brokerage opportunities.

Moreover, one important limitation of this study is that it does not offer a criterion for judging whether a given share of cooperative outcomes is competitively efficient, i.e., fair. While some efforts are made in the analysis of network-level effects (see section on correlated evaluations and symmetric substitution), a proper analysis requests the discourse of moral economy of a kind (e.g., Knight 1923). However, any attempt to design social relations will solicit the act of placing one network over the other. A normative examination of the cooperative outcomes merits surely further attention.

Practically, this model has the following implications. First, managers may pay attention to their nodal substitution when designing their alliance portfolio. If an alliance portfolio consists of mainly less substitutable ties, a firm is expected to enter non-redundant relationships so as to avoid the possible hold-up problem

or to induce bilateral commitments from its partners. Simple expansion strategy with multiple alliances will not bring expected benefits without carefully planning for tie substitution. Second, nodal substitution also suggests a possible governance or control devices for alliances. For example, firms with substitutable ties may rely on the price mechanism for coordinating exchanges among partners, whereas firms with less substitutable ties may develop more hierarchy-based control systems for organizing transactions.

Cooperative exchanges are open to competition among trading parties, actual and potential, because interfirm cooperation is a way of developing one's business, and thus an implicit form of competition. The way that each party perceives social relations may shape the allocation of cooperative outcomes at least in the short run. Accordingly, nodal substitution, a form of cognition, may facilitate or delay the manifestation of structural constraints by social relations.

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