ECONOMIC MULTIPLEXITY: 
THE STRUCTURAL EMBEDDEDNESS OF COOPERATION 
IN MULTIPLE RELATIONS OF INTERDEPENDENCE

by

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ABSTRACT

The structural embeddedness argument (Granovetter, 1985) suggests that action in an economic relation is embedded in a network of other economic and social relations. In this paper, we focus on relations of economic interdependence that are embedded in a larger set of relations between the same parties: a medium-range construct that we term economic multiplexity. It includes, among others, instances of multimarket competition, multiple cooperative alliances, multiple buyer-supplier relations, cooperative ties between product-market competitors, etc. The paper first outlines the scope of economic multiplexity by reviewing different existing literature streams dealing with multiple relations of interdependence among organizations. The review is followed by a game theoretical development of the consequences of economic multiplexity for interfirm cooperation. General propositions and specific corollaries are derived from this theoretical development. Finally, the paper discusses the implications of this cooperative theory for explaining the evolutionary dynamics of multiplexity among firms.
In January 1994, baseball teams were in a stalemate over a revenue-sharing proposal which was staunchly opposed by St. Louis Cardinals' chairman and Anheuser-Busch's CEO, August A. Busch III. Mr. Busch suddenly changed his mind and stopped blocking the proposal after receiving phone calls from the chief executives of the Kansas City Royals, the San Francisco Giants and the Houston Astros. Interestingly, the Royals' chairman was David Glass, CEO of Wal-Mart, the largest customer of the Cardinal's parent, Anheuser-Busch; the owner of the Astros, Drayton McLane, was Wal-Mart's second biggest shareholder; and the Giants' owner, Peter Magowan, was chairman of Safeway, the nation's third-largest supermarket chain. While, according to insiders, these calls were not threatening or intimidating whatsoever, they were nevertheless a reminder of the Cardinals' parent's bigger interests: selling beer. (Helyar, 1994).

For some researchers, the essence of strategic behavior lies in the interdependence of decisions and actions with those of external actors (Schelling, 1960; Dixit & Nalebuff, 1991). Organizational actions interact with those of its competitors, buyers and suppliers, partners, etc. (Brandenburger & Nalebuff, 1995). It is thus not strange that the phenomenon of interorganizational (or strategic) interdependence has been at the core of the research agenda of strategic management (Porter, 1980; Harrigan, 1985; Williamson, 1985; Contractor & Lorange, 1988; Parkhe, 1993; Brandenburger & Nalebuff, 1995) as well as organization theory (Pfeffer and Salancik, 1978; Pennings, 1981; Oliver, 1990). This paper makes a contribution to that extensive literature by focusing on situations in which organizations are interdependent through multiple simultaneous relations of interdependence, a situation which we term economic multiplexity. In those situations, each individual relation is embedded in a web of other relations among the same parties. The same parties can simultaneously play the roles of rivals, partners, buyers or suppliers to each other. The purpose of this paper is to define the scope of the construct of economic multiplexity, and provide a game theoretical explanation of its effects on cooperative behavior.

INTRODUCTION

In a comprehensive review of the economic and organizational literatures of interorganizational dependence, Pennings (1981) distinguished among three types of interdependence relations among organization: interdependence with oligopolistic competitors (horizontal interdependence), with buyers and suppliers (vertical interdependence) and with cooperative partners and complementary firms (symbiotic interdependence). Over the years, an extensive literature has accumulated which studies patterns of horizontal interdependence and competitive interaction (Porter, 1980, 1981, 1985; Chen & McMillan, 1992; Smith, Grimm, & Gannon, 1992; Porac, et al., 1995; Baum & Korn, 1996; Chen, 1996; Gimeno & Woo, 1996), interdependence in vertical transactions (Dwyer, Schurr & Oh, 1987; Provan & Skinner, 1989; Masten, Meehan & Snyder, 1991; Heide & Miner, 1992; Provan, 1993; Dyer & Ouchi, 1993; Dyer, 1994; Heide, 1994; Zaheer & Venkatraman, 1995) and interdependence in cooperative relations (Harrigan, 1985; Kogut, 1988; Contractor & Lorange, 1988; Parkhe, 1993a, 1993b; Gulati, 1995a, 1995b).1

Despite this extensive literature, theoretical and empirical analyses of interdependence relations have used, for the most part, a “relational reductionist” approach. These relations are studied in isolation, with the outcome of a relation expected to
depend on the conditions or characteristics of that relation, rather than on factors outside it. Thus, research on relations of interorganizational dependence have generally ignored the embeddedness of those relations within their context of cognition, culture, social structure, and institutions (Zukin & DiMaggio, 1990).

In this paper, we are interested in the structural embeddedness of relations of interdependence (Granovetter, 1985; Zukin & DiMaggio. 1990). The structural embeddedness argument suggests that the cooperative or opportunistic outcome of an economic relation is influenced by the position of that relation within a network of other economic and social relations (Granovetter, 1985). This structural embeddedness was illustrated in the opening anecdote, which reflected how the cooperative resolution of a relation of interdependence (cooperation with the baseball revenue-sharing proposal) is influenced by other simultaneous relations among the actors (vertical relations in beer sale and distribution), particularly if these relations affect the actors' “bigger interests”. Thus, the structural embeddedness argument, as developed in this paper, suggests that the behavior of corporate actors in a network of economic and social relations is not only determined by the narrow gains or losses in that relation, but also by the implications that their behavior may have in the broad portfolio of relations (their “bigger interests”).

A focus on the structural embeddedness of economic relations thus requires direct attention to the structure of the network of economic and social relations in which a particular relation is embedded. The structure of networks, while studied extensively by sociologists using network analysis (Knoke & Kuklinski, 1982; Burt, 1983; Mizruchi & Schwartz, 1987; Zukin & DiMaggio, 1990; Baker, 1990), has received only limited attention in strategic management (Nohria & Garcia-Pont, 1992; Nohria & Eccles, 1992; Provan, 1993; Lorenzoni & Baden-Fuller, 1995; Zaheer & Venkatraman, 1995). Prior research has focused on some critical structural dimensions of these intercorporate networks, such as the number and range of ties (Kogut, Shan, & Walker, 1992; Powell & Brantley, 1992), the density of the relations in a firm's network (Kogut, Shan, & Walker, 1992; Provan, 1993), or the centrality of a firm's position in a network (Barley, Freeman, Hybels, 1992; Lorenzoni & Baden-Fuller, 1995). All of these dimensions are expected to influence the embeddedness of individual relations within the network.

As the opening anecdote suggests, however, the embedding role of the network of relations may be most critical when it includes other economic relations linking the same parties. Our paper focuses on the type of structural embeddedness which occurs when the actors of an economic relation \( x \) are also simultaneously linked to each other through other economic relations of interdependence \( y, w, z \). To paraphrase the terminology of network analysis (Minor, 1983), we define such a situation as economic multiplexity. Economic multiplexity is thus present in the following situations:

1. multiple instances of horizontal interdependence (i.e., firms engaged in competition in multiple niches, geographical markets or industries, such as American Airlines and United Airlines, Goodyear and Michelin, or GE and Westinghouse),
2. multiple instances of vertical interdependence (i.e., firms engaged in multiple vertical transactions with each other, such as Toyota and many of its first-tier suppliers),
3. multiple instances of *symbiotic* interdependence (i.e., firms engaged in multiple cooperative arrangements with each other, such as Corning’s relations with Siemens or Asahi), and

4. multiple instances of interdependence of *mixed* types, such as when firms experience simultaneously vertical and horizontal interdependence (for instance, AT&T supplying equipment to some of its product-market competitors) or horizontal and symbiotic interdependence (such as joint ventures among product-market rivals).

Economic multiplexity, as defined here, appears to be a relatively frequent phenomenon, especially among large multimarket/multiproduct firms. As Hamel and Prahalad (1994) emphasize, “on any given day... AT&T might find Motorola to be a supplier, a buyer, a competitor, and a partner”. The complexities of those multiple relations, however, have remained largely unexplored in strategic management. It is the purpose of this paper to redirect research attention towards this interesting phenomenon. To that end, we first review several literature streams which have dealt with aspects of economic multiplexity. This review promotes mutual awareness and cross-fertilization across previously independent lines of research. We then use the tools of game theory (Camerer, 1991; Saloner, 1991) to analyze the effects of economic multiplexity for interfirm cooperation and forbearance. The contribution of game theory to this quest is important, since it allows us to focus on the theoretical “skeleton” of the problem. This theoretical analysis provides abstract theoretical propositions that have implications across a wide range of applications. Finally, we draw from this theoretical development to discuss the primary forces underlying the evolutionary dynamics of multiplexity.

**ECONOMIC MULTIPLEXITY IN ECONOMICS AND MANAGEMENT**

Situations of economic multiplexity have received very limited attention in the strategic management literature. This, in part, reflects a reductionist bias in the paradigms which inform strategic management research. For instance, the structure-conduct-performance paradigm of Industrial Organization Economics, which has informed research on horizontal interdependence (Porter, 1980; Pennings, 1981), has focused mainly on the structural characteristics of the market as the determinant of competition, rather than looking outside the market to other relations tying the market players together. This single-market reductionism in analyzing horizontal interdependence has slowed attention by IO economists (and, indirectly, strategists) to the study of competition among multiproduct or multimarket firms, which is only recently developing (Baumol, Panzar & Willig, 1982; Brander & Eaton, 1984; Katz, 1984; Bulow, Geanakoplos & Klemperer, 1985; Bernheim & Whinston, 1990; Kesteloot, 1992; Klemperer, 1992).

A similar reductionist bias is present in Transaction Cost Economics (TCE), which defines the individual transaction as the unit of analysis (Williamson, 1991). The agenda of TCE has thus focused on those transaction characteristics that influence the successful resolution of the transaction. This ignores the possibility that the resolution of the transaction is determined by contextual conditions of the transaction (such as other social or economic ties between the parties to the transaction) ra-
ther than the internal characteristics of the transaction (Granovetter, 1985). This reductionist emphasis of TCE on single, narrowly defined, transactions has been widely criticized in the literature on interorganizational networks (Powell, 1990; Doz & Prahalad, 1991; Nohria & Eccles, 1992; Provan, 1993; Lorenzoni & Baden-Fuller, 1995), relational contracting (Dwyer, Schurr, & Oh, 1987; Heide, 1994) and cooperation (Hill, 1990; Ring & Van de Ven, 1992, 1994).

While economic multiplexity has not been a central theme in the strategic management literature, there are some independent streams of research that have investigated some situations of multiplexity. We review those isolated literature streams in this section. Table 1 summarizes those research streams that we identified as pursuing research on economic multiplexity phenomena. Table 1 classifies existing work according to the types of interdependence considered. Cells 1, 2 and 3, in the main diagonal of the table, consider situations of multiple instances of horizontal, vertical and symbiotic interdependence, respectively, while cells 4 to 6 explore situations which combine mixed forms of interdependence.

**INSERT TABLE 1 ABOUT HERE**


A central question in this research is how multipoint competition influences the intensity of rivalry (Gimeno, 1994) and the tactics of competitive interactions (Karnani & Wernerfelt, 1985; smith & Wilson, 1995; Chen, 1996; Baum & Korn, 1996). A long-established theory in this area proposes that multimarket contact should reduce the intensity of rivalry (“mutual forbearance”) due to the possibility of multimarket retaliation (Edwards, 1955; Bernheim & Whinston, 1990). While the empirical findings with respect to mutual forbearance have not been very consistent (Gimeno, 1994), it appears that the lack of consistency may reflect differences in empirical approaches. Those studies using more controlled settings (either through controlled experimentation, exhaustive control variables, or longitudinal data) have been more successful in finding evidence in agreement with mutual forbearance (Gelfand & Spiller, 1987; Phillips & Mason, 1992; Evans & Kessides, 1994; Gimeno & Woo, 1996).

Other studies have focused on the influence that multiple existing relations of horizontal interdependence have on the incentives to enter markets of the rival. The precursor of these studies is Knickerbocker's (1973) dissertation on international “follow-the-leader” behavior, followed by other studies (Flowers, 1976; Baer, 1984; Yu & Ito, 1988). Their findings suggest that firms that are already horizontally inter-
dependent have a higher incentive to imitate foreign direct investment moves of their rivals, thus expanding their horizontal interdependence even more. Ecological studies have also found that multipoint competition influences the patterns of entry and exit (Barnett, 1993; Barnett, Greve & Park, 1994; Baum & Korn, 1996). As a consequence of reduced rivalry, firms are less likely to exit markets in which they encounter multipoint competitors (Barnett, 1993; Barnett, Greve & Park, 1994; Baum & Korn, 1996). Interestingly, Baum & Korn (1996) also found firms to be less likely to enter markets of multipoint competitors, a tendency which contrasts with the “follow-the-leader” behavior of firms diversifying internationally. In general, these findings provide additional evidence that multipoint competitors are more cautious in their competitive interactions, as these interactions can easily escalate over their multiple markets and lead to total war (Karnani & Wernerfelt, 1985).

Overall, the multipoint competition literature suggests that the resolution of a situation of horizontal interdependence among rivals in one market is not only determined by the conditions in that market (concentration, sales growth, entry barriers, etc) as the S-C-P paradigm and Porter's 5-forces would predict, it is also determined by whether those same rivals also encounter each other in other markets. According to estimates from our research (Gimeno & Woo, 1996), the intensity of rivalry between a set of competitors in a city-pair market of the U.S. airline industry is more strongly determined by their multimarket contact outside that market than by the structural characteristics of the market (such as concentration, presence of potential entrants, etc).

Cell 2 presents research on situations of economic multiplexity characterized by multiple vertical relations between corporate actors. It is helpful to differentiate between two forms of vertical multiplexity: parallel (when actors retain the same role as buyer or seller in the multiple transactions) and reciprocal (when the buyer in one relation is the seller in another). While parallel multiplex relations are probably more common, reciprocal relations have captured more theoretical interest (Pfeffer & Salancick, 1978; Williamson, 1983).

Economic multiplexity by parallel vertical ties is a common characteristic in long-term manufacturing-supplier agreements, industrial marketing channels, and relationship contracting (Macneil, 1978, 1980; Dwyer, Schurr & Oh, 1987; Ring & Van de Ven, 1992; Dyer & Ouchi, 1993; Heide, 1994; Ganesan, 1994; Dyer, 1994; Kalwani & Narayandas, 1995; Zaheer & Venkatraman, 1995). Multiplexity is increasingly common in relational contracts between manufacturers and their first-tier suppliers. Some Japanese manufacturers, for instance, are known to encourage their first-tier suppliers to take responsibility for manufacturing multiple and more complex supplies and assemblies (Clark, Chew & Fujimoto, 1987; Lyons, Krachanberg & Henke, 1990; Dyer, 1994). Thus, the interdependence between the supplier and manufacturer becomes multiplex, which serves to stabilize the relationship. Buyer-supplier relationships also are replicated (thus becoming multiplex) when the manufacturers expand abroad and their first-tier suppliers follow them to the new location, a practice known in international business as “follow the customer” (Aharoni, 1966; Encarnation, 1987; Martin, 1994; Martin, Mitchell, & Swaminathan, 1995). Similarly, sellers often seek multiplexity with their buyers by such marketing practices as “bundling”, tie-in agreements, etc. While these tactics may result in important efficiency gains, they could also stabilize the trading relationship.

Situations of multiple reciprocal vertical relationships have received more theo-
retical attention in the literature. In the antitrust literature of the 1960s, for instance, reciprocal trade relationships were looked upon as evidence of unlawful use of market power (Stocking & Mueller, 1957; FTC, 1969). Studies carried out at that time showed that reciprocity was often sought in trade relationships among large companies, and that organizational coordination mechanisms were implemented to facilitate the intra-firm coordination necessary for the firm to use its power as a buyer in obtaining sales from its suppliers (FTC, 1969). The view that this practice is anticompetitive has since receded (Bork, 1978). Current theoretical views of reciprocal dealings focus on its “advantageous governance structure benefits” as an “exchange of hostages” agreement (Williamson, 1983: 351). High but symmetric mutual dependence may lead to joint action by the transaction parties (Zaheer & Venkatraman, 1995) and more flexible mutual adjustment processes (Heide, 1994), compared to situations of unilateral (or asymmetric) dependence that undermine flexibility in negotiation. Therefore, it is quite likely that reciprocity is sought by the more dependent party of an exchange as a mechanism for balancing power (Pfeffer & Salancik, 1978: 149; Heide & John, 1988), rather than by the powerful party as the anticompetitive views suggested.

The prevalence and importance of reciprocal dealings has not been broadly studied. In a network analysis of intercorporate (keiretsu) ties in Japan, Lincoln, Gerlach, & Takahashi (1992) found significant reciprocity in trading relationships among top industrial firms (12.4 percent of trade ties were reciprocated). As far as we know, a comparable U.S. study has not yet been carried out.

Another important area of economic multiplexity by multiple (parallel or reciprocal) vertical ties occurs when capital supply relations overlay vertical trade relations (Burt, 1983). The practice of manufacturers investing in their suppliers (and thus gain some corporate control) has been reported as a characteristic of relational contracts (Pisano, 1989; Bogert, 1996). The reciprocity of these ties may by used by manufacturers to coopt suppliers and thus reduce opportunistic incentives (Burt, 1983). Conversely, Kochar & David (1996) found that institutional investor owners who also supply services (insurance, banking, pension fund management...) to corporations (i.e., with parallel vertical relations) were less able to exercise their governance role than institutional investor owners without such trade relations. Thus, the role of ownership relations as a tool for balancing dependence in trade relations and/or exercising power over buyers and suppliers needs to be examined in greater detail.

Cell 3 describes studies of economic multiplexity by means of multiple cooperative agreements. In practice, this form of multiplexity may be difficult to observe by the researcher, since firms may opt to broaden the scope of existing agreements to include new cooperative arrangements, rather than establish multiple cooperative arrangements with the same partners. Telser’s (1980) theoretical study of “self-enforcing agreements” suggested that pooling multiple cooperative agreements (so that a violation of cooperation in one of them may be punished by withdrawing cooperation across the board) may have a positive effect on the stability of cooperation. Kogut (1989) found support for that proposition in a sample of cooperative arrangements by 93 U.S. manufacturing firms. A joint venture is more likely to survive if the same partners are linked by other licensing and joint venture relationships. The importance of multiple cooperative ties has also been stressed by Gulati (1995a, 1995b), by showing that repeated cooperative ties between two firms a) increased the
likelihood of additional cooperative alliances (Gulati, 1995b), and b) decreased the contractual safeguards in new relations (operationalized by the use of non-equity alliances) (Gulati, 1995a). Taken together, these results indicate that multiplexity in symbiotic relations enhances cooperative incentives and reduces the need for strong governance (equity), thus relying more heavily on the self-enforcing qualities of multiplex relations.

Cells 4, 5 and 6 review literature discussing economic multiplexity composed by different types of relations of interdependence. As can be seen from our review, this literature is currently underdeveloped. We thus concur with previous authors (Pennings, 1981; Parkhe, 1993a; Khanna, 1995) in calling for greater understanding of the interaction of different types of interdependence (vertical, symbiotic, horizontal) as a fundamental direction for theory development.

Cell 4 reviews the literature on multiplexity by simultaneous horizontal and vertical relations. The literature on “conglomerate power” (Edwards, 1955; Mueller, 1969) had hypothesized that vertical contacts among competing firms might reduce the intensity of rivalry in jointly contested markets. Little systematic support for this proposition has been found (Strickland, 1976). Individual cases involving conflict between vertically related firms that are also competitors have also been studied in the antitrust literature (Scherer, 1970; Bork, 1978). These conflicts are possible, for instance, when a supplier decides to partially integrate forward into retailing, thus competing with some of its own distributors and retailers. In those cases, retailers may use their vertical buyer power to respond to competitive attacks in the retailing market (see the Consolidated Foods - National Tea Co. case study, in FTC, 1969). The 1995 AT&T break-up also highlights some negative effects of combining horizontal and vertical interdependence relations (The Economist, 1995). The lack of systematic empirical research in this area is a drawback, given Pennings’ assertion that “the interaction between horizontal and vertical interdependence creates thorny problems but also provides further insights into organizational strategies” (1981: 434).

Cell 5 captures research on the interaction between horizontal and symbiotic interdependence. This is an important form of multiplexity, since cooperative agreements are most likely to occur among rivals (Hergert & Morris, 1988). A long-established line of research in IO economics and organization theory has argued that joint ventures and cooperative arrangements can be used to overcome some of the negative effects of competition (Kahn, 1950; Mead, 1967; Pate, 1969; Pfeffer & Novack, 1976). This suggests that cooperative arrangements and joint ventures may be used to reduce the rivalry effects of horizontal interdependence (i.e., increasing cooperation in horizontal relations). Conversely, cooperative behavior in a symbiotic relation may be hindered by horizontal interdependence if the firms can use their learning from their cooperative relation to improve their competitive position towards one another (Khanna, 1995; Khanna, Gulati & Nohria, 1995). These distorted incentives due to market overlap may explain Bleeke & Ernst's (1991) findings that joint ventures among partners with geographically overlapping businesses tend to fail more frequently. On the other hand, Sohn's (1993) findings that joint ventures of Korean chaebols with Japanese keiretzus used reduced equity safeguards was interpreted as suggesting that their multiple areas of horizontal interdependence may serve as a governance safeguard of their cooperative relations. These interesting but apparently conflicting interpretations of findings make the study of multiplexity by
simultaneous symbiotic and horizontal interdependence a fundamental question for theory development in cooperative strategies in general, and international strategies in particular (Parkhe, 1993a; Khanna, 1995).

Cell 6 describes research examining economic multiplexity of mixed vertical and symbiotic relations of interdependence. Pfeffer & Novack (1976) found that patterns of inter-industry joint ventures followed in part patterns of vertical interdependence among those industries. The current trends towards relational contracting and “value-added partnerships” are probably making this type of multiplexity even more likely today (Johnston & Lawrence, 1988). The cooperative effects of this multiplexity, however, is not as clear. For instance, Kogut (1988) found that other supply contracts between joint venture partners did not increase the sustainability of the venture. However, his sample of U.S. joint ventures between 1975 and 1983 may reflect more adversarial vertical relations than are common today.

In summary, this literature review highlights existing areas of research on economic multiplexity and underscores three opportunities for future contributions. First, the review shows that several currently active streams of research in strategic management can be linked by the mid-range construct of economic multiplexity which may provide opportunities for future theoretical cross-fertilization. For instance, the current advances in multipoint competition research (Baum & Korn, 1996; Chen, 1996; Gimeno & Woo, 1996) may provide valuable guidance for analyzing multiple vertical or symbiotic relations of interdependence. Second, the review highlighted several critical areas of research for furthering our understanding of the construct of economic multiplexity. For instance, the interaction of different types of interdependence should become a pressing area of extension of this research. Third, the literature review found some similarity in the theoretical arguments across the different forms of multiplexity. A common theme running through this literature indicates that, in some cases, economic multiplexity enhances cooperation and mutual forbearance. This suggests an opportunity for developing a theory of cooperation at this broader mid-range level, which could then illuminate future research in such diverse and important areas as competitive strategy, cooperative strategies and vertical relations. The next section presents a first step towards the development of this mid-range theory of economic multiplexity as a restraint on opportunistic behavior.

**ECONOMIC MULTIPLEXITY AND MUTUAL FORBEARANCE**

This section provides a game theoretical exposition of the role of economic multiplexity in influencing the incentives for refraining from opportunism (mutual forbearance) in situations of interdependence. We initiate this theoretical development by characterizing situations of interdependence as having the general structure of a prisoner's dilemma (PD) game. We then review some existing theoretical perspectives on cooperation in a prisoner's dilemma, and discuss how economic multiplexity fits in among these existing theories. The discussion is followed by a theoretical development of the forbearance effects of economic multiplexity.

**Relations of interdependence as prisoner's dilemmas**
Relations of interdependence are characterized by outcome dependence of one party on another’s actions, whose behavior is not under the direct control of the first. While interdependence per se does not negate the incentives to cooperate, cooperation becomes a problem when mutual interdependence is coupled with individual incentives to unilaterally defect from a cooperative agreement at the expense of the other party. In such situations, there is a collectively rational strategy of mutual cooperation (win-win), yet the presence of opportunistic incentives (win-lose) leads to an individually rational strategy of mutual defection. The prisoner’s dilemma (PD) game (Luce & Raiffa, 1957; Axelrod, 1984; Hill, 1990; Parkhe, 1993b) epitomizes this conflict between individual rationality and collective rationality. See Figure 1 for the payoff structure of the PD game.

The PD game can serve as an abstraction of the payoff structures of all three types of relations of economic interdependence (horizontal, vertical and symbiotic), since all three are characterized by simultaneous cooperative (win-win) and opportunistic (win-lose) incentives (Brandenburger & Nalebuff, 1995). Table 2 summarizes the incentives to cooperate and defect in the three types of relations of interdependence described here, together with some relevant literature. Interestingly, these literatures have coined similar terminology independently of one another. Thus, in vertical and symbiotic relations, “mutual forbearance” indicates that parties refrain from opportunistically pursuing their own interests in the transaction at the expense of others (Buckley & Casson, 1988), while in the horizontal interdependence literature, “mutual forbearance” (Edwards, 1955; Gimeno, 1994) refers to the incentives to refrain from initiating aggressive competitive moves towards rivals.

Supporting cooperation in a relation through extra-relational enforcement

Our purpose, in agreement with Granovetter’s (1985) structural embeddedness argument, is to show that other relations among the parties can influence cooperation in a given relation. It is thus helpful to theoretically draw the boundary between internally sustained cooperation within a single relation (intra-relational), and cooperation which is sustained by other different relations (extra-relational). Table 3 provides different theoretical models explaining cooperation in a PD game. The first column in table 3 presents our definition of internally sustained cooperation (single “self-enforced” relations), while the remaining columns present different theoretical models which can explain cooperation even in relations which are not “self-enforced”, by drawing on the enforcement power of other different relations. These different theoretical models include our model of economic multiplexity (Telser, 1980; Feinberg, 1984; Bernheim & Whinston, 1990; Kesteloot, 1992), models of cooperation within informational networks (Granovetter, 1985; Provan, 1993), and models of generalized reputation (Klein & Leffler, 1981; Kreps, Milgrom, Roberts, & Wilson, 1982; Kreps, 1990).
The simplest explanation of cooperation in a relation of interdependence is that future instances of the same relation will enforce present cooperation by providing negative reactions to defection events. This is the essence of Telser’s (1980) “self-enforcing agreement” concept: a relation in which the “shadow of the future” (Friedman, 1971; Axelrod, 1984; Heide & Miner, 1992) is enough to keep the parties from defecting. A relation is self-enforced if the present value of cooperation in the relation is greater than the present value of opportunism, given that opportunism would lead to retaliation within the relation. For a corporate actor with an internal rate of discount of $\alpha_i$, which represents the actor’s preferences between a payoff now and in the future, and a PD game with payoffs of $mc_i$ (for the mutual cooperation outcome), $md_i$ (for the mutual defection outcome), and $ud_i$ (when the player unilaterally defects), the condition of rational unilateral cooperation becomes (See Figure 1):

$$\alpha_i^* = \frac{mc_i - md_i}{ud_i - md_i} \geq \alpha_i$$ (1)

Equation 1 represents the boundary condition of “self-enforced” cooperation. It predicts that cooperation depends on both the payoff structure of the game and the personal characteristics of the player (as represented by the player's internal discount rate, $\alpha_i$). With respect to the structure of the game, the relevant information is captured in the ratio $\alpha_i^*$, which is a function of the payoffs of the game. This single number, which is between 0 and 1 for every PD game, can be used to represent the strength of cooperative or opportunistic incentives implicit in the payoff structure of a particular relation of interdependence. Thus, we label this important ratio the “index of structural self-enforcement” (ISS) of a relation. Lower values of ISS represent a relation with strong structural incentives towards opportunism, and vice versa. In addition to ISS, cooperation depends on the internal discount rate of the parties. Games with low ISS may still lead to cooperation if played by actors with even lower discount rates. Thus, a relation of cooperation can be “self-enforced” when the ISS for all parties of that relation is above their own internal discount rates.

However, cooperation may still be possible in those relations that are not “self-enforced” within the focal relation, as long as they are embedded in a network of other relations (Granovetter, 1985; Hill, 1990; Powell, 1990; Provan, 1993). For that “extra-relational” enforcement to be in agreement with the principles of game theory, three conditions are necessary: a) efficient information transfer from the focal relation to other relations (i.e., decision-makers managing the other relations quickly become aware of prior episodes of defection, so that they can punish the defector), b) incentive by decision-makers of other relations to make their behavior contingent on the resolution in the focal relation (i.e., they will defect if and only if the other party defected before in some other relations), and c) lack of incentive by any firm to carry out massive unilateral defection (simultaneous defection in all relations at the same time, trying to get the most out of defection before the penalty stage begins). We now discuss these three conditions of extra-relational enforcement, and compare the different models in those dimensions.

Effective information transfer about prior defections (reputational information) across relations is a necessary condition for extra-relational enforcement of coopera-
tion. Generalized reputation specifications have substantially ignored this condition, simply assuming that “reputational” information is clearly visible and/or easily transferred to other relations. This assumption is problematic in situations in which defection may be difficult to observe and verify by outsiders to the relation. Even if an agreement fails, an outsider may find it difficult to assign responsibility of the failure to any of the parties or to environmental effects. This problem is somewhat minimized in informational embeddedness specifications (Granovetter, 1985; Provan, 1993) if the relations are embedded in a dense informational network (Granovetter, 1985; Powell, 1990; Provan, 1993), which allows the transfer of richer, non-verifiable, information. Even in those cases, however, information from one's own dealings with another party will always be cheaper, richer and more reliable than those acquired through an information network (Granovetter, 1985: 190). Thus, the internalization of the information transfer to other relations afforded by economic multiplexity creates value added over simply relying on external networks and external reputations.

The second condition for extra-relational enforcement is that the incentives for the parties in the external “enforcing” relations are such that they will defect if and only if the other party defected earlier in another relation. Behavioral enforcement requires self-discipline to act differently from the actor’s narrow incentives (Schelling, 1960). It requires self-discipline in cooperating when the other party cooperated in other relations, even though this may be against the incentives to defect of the actor (otherwise the threat is empty). It also requires self-discipline to defect when a defection occurred in another relation, even though it may be against the interests in that relation to escalate conflict (otherwise the threat is not credible). In economic multiplexity, enforcement becomes credible by its being internalized within the firm, since the firm directly benefits in other relations from its enforcement. The incentive of external relations to enforce reputations, however, is more problematic. Models of generalized reputation (Klein & Leffler, 1981; Kreps, 1990) simply avoid this problem by assuming a one-sided PD structure, which ignores the incentives to unilaterally defect by the enforcing actor. Even in models of informational embeddedness, the willingness of network actors to enforce the relations of other actors may not be assured (since the private costs of enforcing the relations of other actors may outweigh its private benefits). On the other hand, collective action and social norms may evolve within the network, which make mutual enforcement possible and credible. While we do not explore this possibility in this paper, it is apparent from our analysis that the mutual provision of enforcement might be at the root of the alleged cooperation-enhancing incentives within networks of relations.

Finally, any model that relies on extra-relational enforcement must recognize the possibility of massive defection, that is, the defection in all relations at the same time. With multiple relations, defection in one relation is punished by retaliation in many other relations. However, in that case, the strategy of defecting in only one relation will always be inferior to defecting in all relations at once (punishment will be the same, yet the payoff from defection is higher). Thus, when multiple relations are being used to sustain cooperation, the cost-benefit analysis should be between not defecting and defecting in all relations and suffering the consequences. This critical insight is at the heart of formal modeling of economic multiplexity (Bernheim & Whinston, 1990), but has been implicitly ignored in generalized reputation models (which assume sequential, rather than overlapping, multiple relations), informational
embeddedness models, and even some formal models of multiplexity (Feinberg, 1984).

In summary, there are a variety of models to explain the structural embeddedness of a relation in a network of other relations and how this affects cooperation. Game theory suggests three important dimensions for those multiple relations to enforce cooperation: efficient information transfer, incentives to enforce punishments of defections by others, and incentives to avoid massive defection. The model of economic multiplexity internalizes information transfer and retaliation, and deals explicitly with the possibility of massive defection. It is thus a relatively conservative yet theoretically rigorous model of extra-relational enforcement of cooperation. The next section develops the cooperative logic of economic multiplexity in detail.

**Analysis of forbearance incentives under economic multiplexity**

It is helpful to distinguish between two types of effects of economic multiplexity on cooperation: general pooling effects and idiosyncratic pooling effects. General pooling effects occur from the pooling of relations that are independent (where the payoffs in one relation are independent of the actions in the other relation). The two relations are linked only behaviorally, by the decision of the actors to react in one relation to actions in another. Idiosyncratic pooling effects occur when the payoff structure of relations are directly influenced by actions in other relations. In practical terms, idiosyncratic pooling effects obtain when the relations have a direct cost or demand effect on one another that changes the payoff structure, so that the actions taken in one relation have a material impact on the payoffs in the other relation.

**General Pooling Effects**

Cooperation implies two separate but interdependent processes: interfirm coordination in developing a cooperative solution, and enforcement of the cooperative solution by credible deterrence of deviations from that cooperative solution (Schelling, 1960). These processes are different but deeply interrelated, since coordination among players with divergent interests becomes strategic bargaining (Schelling, 1960; Spence, 1978; Knez & Camerer, 1994), which in turn is influenced by bargaining power and enforceability considerations.

Interfirm coordination is particularly difficult when firms have diverging interest (as in the PD game), since the parties have an incentive to misrepresent their position in order to increase their own gains, even though this behavior may indirectly lead to less efficient collective solutions (Schelling, 1960). Economic multiplexity can facilitate interfirm coordination in at least two ways: a) by increasing the accumulated stock of interactions among the actors from other relations, and thus allowing mutual learning by trial and error (Scott, 1993) and the development of institutionalized norms of equity (Shapiro, Sheppard & Cheraskin, 1992), and b) by relaxing the rule of symmetry from each discrete area of interdependence, while still maintaining symmetry over the set of relations (Schelling, 1960; Porter, 1980; Raiffa, 1982).

The first effect, tacit coordination enhancement through accumulated contacts through multiple relations, is in agreement with the sociological explanations of cooperation as a function of prior mutual experience (Good, 1988; Levinthal & Fich-
man, 1988; Gulati, 1995a). Multiple relations multiply the past experience by the number of relations, thus providing better knowledge and more accurate expectations about the characteristics of the other party. The second effect, based on the ability to break away from strict rules of symmetry in bargaining, is more unique to multiplexity. As it is well known in bargaining theory (Raiffa, 1982), negotiating simultaneously across multiple issues (or integrative bargaining) provides greater negotiation flexibility and allows mutual adjustment, two dimensions which are critical for the endurance of cooperative relations in dynamic environments (Heide, 1994). Negotiation across multiple relations, for instance, may allow firms to negotiate relations for which outcomes are not perfectly divisible, or when the parties have different private assessments of the possible outcomes. Moreover, multiplexity may also allow coordination through delegation of leadership in each relation, through mutual superordination and subordination to each other in different relations (Simmel, 1950). The expected effects of multiplexity in interfirm coordination leads to these propositions:

**Proposition 1:** The ability of firms to coordinate in a relation of interdependence will be influenced by the past interactions in that relation as well as past interactions in other relations in common.

**Proposition 2:** Firms engaged in economic multiplexity are more likely to coordinate in ways which allow asymmetric payoffs and leadership in specific relations while still maintaining overall symmetry.

The second aspect of cooperation is the enforcement of the cooperative agreement in situations including multiple relations of interdependence. It is in this area that game theory has made the greatest contribution (Telser, 1980; Bernheim & Whinston, 1990; Kesteloot, 1992; Mester, 1993). Much of this literature has been developed for the case of multimarket competition, but, through abstraction, it can be readily applied to other cases of economic multiplexity.

Perhaps the most critical insight in the game theoretical literature of economic multiplexity is the realization by Bernheim & Whinston (1990) that the agglomeration of relations, while increasing the potential for retaliation, may also increase the incentives for massive defection. Thus, in economic multiplexity, the critical condition for a positive cooperative effect is not that massive retaliation can deter isolated defections, but rather that massive retaliation can deter massive defection. If MD, UD, and MC are the joint payoffs of massive mutual defection, massive unilateral defection, and massive cooperation, respectively, the condition can be written as:

\[
A_i^* = \frac{MC_i - MD_i}{UD_i - MD_i} \geq \alpha_i
\]

Which, in the case of general pooling effects, given the independence of the payoffs, equals:

\[
A_i^* = \frac{\sum_k mc_i - \sum_k md_i}{\sum_k ud_i - \sum_k md_i} \geq \alpha_i
\]
which, with some mathematical manipulation, leads to:

\[ A_i^* = \sum_k \lambda_{ik} \cdot \alpha_{ki} \geq \alpha_i \]

where \( \lambda_{ik} = \left( \frac{ud_{ik} - md_{ik}}{\sum_k ud_{ik} - \sum_k md_{ik}} \right) \), so that \( \sum_k \lambda_{ik} = 1 \).

Equation (4) is a fundamental equation that suggests that the joint self-enforcement of a set of multiple relations is determined by the weighted-average of the indexes of structural self-enforcement of the individual equations (ISS). The implications of this result are far-reaching. Firstly, it shows that there is no “free lunch” from agglomerating relations of interdependence. Agglomerating relations that are all highly competitive (low ISSs) will not lead to reduced competition. In fact, agglomeration of relations with equal ISSs should have no material effect on the cooperative behavior in those relations of interdependence. This is the essence of Bernheim & Whinston’s (1990) “irrelevance result”.

The “irrelevance result” presents a boundary condition to cooperative effects of economic multiplexity. On the one hand, it predicts that economic multiplexity per se does not create new enforcement power to sustain rational cooperation. At the same time, it directs the researcher’s attention to those conditions in which economic multiplexity should have an observable effect, namely relations that are not self-enforced (\( \alpha_i^* < \alpha_i \)) but which are embedded in a case of multiplexity with other strongly self-enforced relations (\( \alpha_i^* > \alpha_i \)).

**Proposition 3:** The mere agglomeration of independent relations with equal ISS has no effect on the cooperative outcome of those relations.

**Proposition 4:** An economic relation which is not self-enforced (\( \alpha_i^* < \alpha_i \)) will still be resolved cooperatively if it is embedded in other relations which are strongly self-enforced (\( \alpha_i^* > \alpha_i \)).

This central proposition leads to several important propositions and corollaries about the effects of portfolios of relations. We consider two applications. The first focuses on managing portfolios of relations that have different ISSs due to the characteristic of the relation, but with ISSs symmetric for both parties. The second focuses on managing portfolios of relations with asymmetric ISSs for the different parties.

**Multiple relations with symmetric ISSs that vary across relations**

There are situations in which the structural self-enforcement of a relation may be a characteristic of the relation, and is thus symmetric for the parties of the relation but different from relation to relation. For instance, a joint venture with very uncertain future prospects may have low self-enforcement for both partners, since they
both view the future payoffs as less valuable than present returns from defection. Similarly, firms competing in a low growth market may have a hard time sustaining collusion, since the shadow of the future is smaller. Thus, in absence of economic multiplexity, mutual defection is likely for those relations that are characterized by symmetrically low indexes of structural self-enforcement (ISSs) for both parties. These relations, however, can be carried out cooperatively within the context of a multiplex relationship, if the remaining relations have symmetrically high ISSs. The different effect should not be present for high ISS relations.

**Proposition 5:** An economic relation which has low symmetric self-enforcement for the parties of the relation will be resolved more cooperatively if the same parties have additional economic relations in common which are characterized by higher symmetric self-enforcement.

**Proposition 6:** An economic relation which has high symmetric self-enforcement for the parties of the relation will not be resolved more cooperatively if the same parties have additional economic relations in common which are characterized by lower symmetric self-enforcement.

While these propositions are broad and abstract, the following corollaries provide more tangible implications:

- **Differences in time horizons across relations:** Relations with short time horizons have accordingly low indexes of structural self-enforcement. While these relations may be difficult to manage cooperatively in isolation, they could be managed more cooperatively if pooled with other relations with longer time horizons (and thus higher ISSs). Thus,

  **Corollary 1:** Relations with a short time horizon will be managed more cooperatively if embedded with other relations with longer time horizons.

- **Differences in lags of observation across relations:** If the actions of the other party in a relation can only be clearly observed with a time lag (either directly or through its effect on the payoffs), then retaliation is delayed, giving enhanced incentives to the other party to behave opportunistically. This is why long lags between defection and detection hinder tacit collusion (Stigler, 1964), or why joint ventures with low behavioral transparency are more likely to require contractual safeguards (Parkhe, 1993b). Thus,

  **Corollary 2:** Relations with long detection lags will be managed more cooperatively if embedded with other relations with shorter detection lags.
Corollary 3: Relations with low behavioral transparency will be managed more cooperatively if embedded with other relations with higher behavioral transparency.

- Difference in governance safeguards across relations: Parties to a relation can structure the relation so that the ISS of the relation is increased (Parkhe, 1993b; Gulati, Khanna, & Nohria, 1994) by investing in governance safeguards, such as legal restraints, unilateral asset commitments, pooled patent agreements, profit divisions clauses, etc. In essence, these safeguards serve to modify the payoffs of the relation, thus leading to increased ISSs. Yet, these governance mechanisms have a cost for the organizations (Williamson, 1985; Hill, 1990). Thus, we expect that relations with low governance safeguards (with low ISSs) will be managed cooperatively if the parties have simultaneously high governance relations in common.

Corollary 4: Relations with low governance safeguards will be managed more cooperatively if embedded with other relations with higher governance safeguards.

- Portfolio of relations in different stages of their life cycles: The index of structural self-enforcement of a relation is likely to be influenced by life-cycle effects. For instance, ISSs of competitive relations decrease as the growth rate in the market slows towards maturity (the present value of future cooperation decreases). Similarly, ISSs of knowledge-link alliances (Doz, Hamel & Prahalad, 1989; Badaracco, 1990; Hamel, 1991) decrease with the life of the venture, as more and more knowledge is acquired. In the absence of multiplexity, these relations would lead to intense end-game defection. Yet, with multiplexity, these relations can be maintained cooperatively despite their low ISSs.

Corollary 5: Firms that meet as competitors in low growth markets are more likely to avoid intense competition if they also meet as competitors in other high growth markets (Bernheim & Whinston, 1990)

Corollary 6: Knowledge-link alliances at a late stage in the learning process will be managed more cooperatively if embedded with other knowledge-link alliances at early stage of learning.

Multiple relations with asymmetric ISSs for the parties to the relations.

Economic multiplexity can also have a critical role in balancing relationships that present asymmetric indexes of structural self-enforcement. That is, the payoffs are such that while one party (that with high ISS) would be willing to refrain from opportunism if the other party cooperated, the party with low ISS has a net preference for unilateral defection. This condition, for instance, describes vertical relations
characterized by unilateral dependence due to asymmetric relation-specific investments (Heide, 1994). One possibility that has been recognized in the literature is for the parties to implement some governance safeguards ("hostages") to balance the incentives of the relationship (Williamson, 1983). However, this is likely to be expensive and reduce flexibility. Alternatively, the parties can pool the relation with other external relations that are asymmetric in a reciprocal way. This leads to a new proposition:

**Proposition 7:** An economic relation which has asymmetric self-enforcement for the parties of the relation (low ISS for ego, high ISS for alter) will be resolved cooperatively if the same parties have additional economic relations in common which are characterized by asymmetric self-enforcement in a reciprocal way (high ISS for ego, low ISS for alter).

Again, this abstract proposition can be substantiated by some tangible corollaries:

- **Relations with asymmetric relation-specific investments.** As developed by Klein, Crawford and Alchian (1978), Williamson (1983, 1985), and Hill (1990), asymmetric relation-specific investments (i.e., asset specific investments), while creating a composite quasi-rent for the relation, invite expropriation by the opposing party. This incentive would be reduced if another relation between the parties existed with asymmetrically reciprocal investments.

  **Corollary 7:** Relations with asymmetric relation-specific investments will be managed more cooperatively if embedded with other relations with asymmetric relation-specific investments of reciprocal nature.

- **Relations with asymmetric private costs and benefits.** The payoffs of a relation for each party is composed of both shared and private costs and benefits (Khanna, Gulati, & Nohria, 1995). For instance, a partner in an alliance may be gaining substantial know-how from the other which has great value in combination with its other businesses. Alternatively, it may carry a more than proportional share of the management burden of the alliance. In competition, a firm’s willingness to forbear may be determined by the interrelationships of that business with others in its portfolio (Porter, 1985). These situations make the ISSs of the parties differ due to private costs and benefits. In isolation, these conditions could lead to deviations from cooperative behavior by the party with lower ISS. Yet, if the relation is embedded with other relations with reciprocal incentives, the incentive for defection diminishes. For instance, the two alliances between Corning and Siemens (one using Corning technology and Siemens management, the other with an opposite arrangement) appear to be specifically designed as reciprocal mirrors of one another.
Corollary 8: Relations with asymmetric private costs and benefits will be managed more cooperatively if embedded with other relations with private costs and benefits of reciprocal nature.

* Relations with asymmetric payoffs due to non-divisible payoffs, specialization advantages or different current positions. In some situations, payoffs are hard to divide equally due to technical considerations, such as the non-divisibility of the payoff (a patent, a brand name) or cost considerations that lead to specialization. In the airline industry, for instance, a small city-pair market may be profitably exploited by one rival, but would lead to losses if two firms tried to jointly exploit it (natural monopoly). While those situations would ideally call for an asymmetric agreement, such an agreement would lead to payoff asymmetry and therefore asymmetry of ISSs. Payoff asymmetry can also obtain from different current positions. The payoff structure of cartel arrangements for firms with different market shares is such that the small firms have an incentive to defect from the cartel (Jacquemin & Slade, 1989). With multiplexity, these problems can be solved by internally allocating leadership of those relations among parties in a way which maintains global symmetry. In multipoint competition, for instance, firms can develop “spheres of influence” (Bernheim & Whinston, 1990; Ma & Jemison, 1994; Baum & Korn, 1996) by mutual subordination to the rival’s market leadership in the markets that are important to the rival. Georg Simmel suggested that this strategy of simultaneous superordination in one relation and subordination in another relation is a fundamental principle of societal coordination (Simmel, 1950).

Corollary 9: Relations with asymmetric payoffs due to non-divisibilities, specialization advantages or different current positions will be managed more cooperatively if embedded with other relations with similar characteristics but offering reciprocal incentives.

Idiosyncratic Pooling Effects

In addition to the general effects from pooling otherwise independent relations, economic multiplexity may have a more subtle effect on cooperation if the relations are linked by cost conditions (such as economies of scope) or demand conditions (such as demand complementarity or substitution). When those subtle links between relations exist, the payoffs of broad mutual cooperation (MC), broad mutual defection (MD), and broad unilateral defection (UD) will not equal the sum of the individual payoffs from each independent relation, as stated in equation (3), and therefore equation (4) does not hold. In order to predict the cooperative effect of multiplexity in situations of interdependent relations, an understanding must be gained of the joint payoffs. In general, from equation (2), the following proposition can be stated.
Proposition 8: The cooperative effect of economic multiplexity is modified by idiosyncratic interdependencies among relations (when the payoff in one relation depends on the behavior in the other relations). Taking the general pooling effect as a baseline, cooperation will be enhanced if the interdependencies lead to the following effects of pooling: a) the payoffs of mutual cooperation increase more than proportionally, b) the payoffs of unilateral defection increase less than proportionally, and c) the payoffs of mutual defection increase less than proportionally.

Determination of the factors and situations that have such effects on payoff is hard to generalize a priori, and requires attention to the individual interaction between relations. First, consider a situation in which a set of vertical relations share the same sunk relation-specific investment, which is independent of the number of relations or the volume of trade (Klemperer, 1992). This could be due, for instance, to procedural asset specificity (Zaheer & Venkatraman, 1995) in workflow coordination needed to do business with a party. If only one relation is carried out in this way, the non-investing party may have a strong incentive to appropriate the quasi-rents from such an investment, since the amount that could potentially be appropriated is large in comparison with the cooperative profits from just one relation. If multiple vertical relations are pooled, however, the benefits from cooperation increase as the number of relations increase, yet the ability of the non-investing party to appropriate the other, which is bound by the amount of the sunk investment, remains constant, thus leading to a net increase in the incentives to cooperate.

Consider also a situation in which multimarket contact occurs over a set of markets that are demand substitutes (Kesteloot, 1992), so that increase in sales in one market decreases demand for the other market (such as coffee and tea). This situation has been predicted to increase the incentives to tacitly cooperate with a competitor (Kesteloot, 1992), since it will increase the broad profits from defection and opportunism less than proportionally (i.e., less than if the markets were independent). This is because defecting in one market would immediately decrease the demand available to the other market (and therefore the profits from defection in the other market). Thus, firms that experience multimarket contact across a set of substitute markets may actually find it easier to sustain tacit cooperation (collusion). The opposite is true for demand of complementary products.

Finally, consider the common situation in which one firm, through forward or backward integration, becomes a competitor of an existing buyer or supplier. In this case, well studied in the vertical foreclosure literature in antitrust and IO Economics (FTC, 1969; Bork, 1978), the firms are simultaneously engaged in a competitive relation and a buyer-supplier relation. This situation sets up a wide range of strategic incentives to use one relation to leverage one's position in the other. If the un-integrated firm has vertical bargaining power, it may use it to force the integrated rival to reduce the intensity of competition, or even to pull out of the market (see the case on Consolidated Foods and National Tea Co. in FTC, 1969: 469). On the other hand, if the integrated firm has the bargaining power, it may use it to leverage its position in the competing markets. Unraveling the complexities of the vertical foreclosure problem cannot be undertaken here; yet it is apparent that the payoffs of one relation
would be deeply influenced by the behavior of the parties in the other. A similar problem in cooperative alliances between rivals (Khanna, Gulati & Nohria, 1995; Khanna, 1995) may also hinder cooperation.

**Caveat: Intrafirm Coordination**

While the focus in this paper is on the effects that a particular configuration of external relations can have for the cooperative behavior of the firm, the critical internal processes (Ring & Van de Ven, 1994) that are necessary for obtaining this benefit must be recognized. In particular, intrafirm coordination and incentives of the organizational actors with decision-making responsibilities in the different relations are critical for obtaining the benefits of economic multiplexity.

One could think of a firm as an internalized information and control network. If so, the same problems that hinder cooperation when relying on external relations can be applied here. The transfer of reputational information within the firm may not be perfect, and the incentives for organizational participants to retaliate against opportunistic moves affecting other relations of the firm outside their immediate control may be weaker than we assumed. On the other hand, managers can create incentives and coordinating roles to change this. Ammer (1962) discussed the complex organizational innovations developed in the 1950s and 1960s to manage buyer-supplier reciprocity relations. Gulati, Khanna & Nohria (1994) also report the creation of organizational liaison roles which serve to integrate and balance multiple relations. For instance, they report the role of the “relationship managers” in DEC “who are responsible for all aspects of the firm's relationship with specific partners”. Thus, intrafirm coordination across relations is an important and necessary condition for forbearance.

**THE EVOLUTIONARY DYNAMICS OF ECONOMIC MULTIPLEXITY**

Our theoretical model so far has only tried to explain the consequences of economic multiplexity. If purposeful firms are aware of the cooperation-enhancing effects of multiplexity, they may actively seek multiplexity (Pfeffer & Salancick, 1978; Williamson, 1983) to enhance cooperation. This view would thus partially predict the evolutionary dynamics of multiplexity among purposeful organizations. Other explanations for firms developing economic multiplexity range from efficiency-seeking reasons, such as economies of scale and scope, sunk costs and partner-specific investments, through social learning and mimicry (Knickerbocker, 1973; Haveman, 1993) to simple randomness (Scott, 1993). We offer cooperation enhancement as an additional, rather than an alternative, explanation.

The rational, cooperation-enhancing, view of temporal extension of relations contrasts markedly with the familiarity-based view, based on social psychology (Deutsch, 1973), which has been more popular in strategy research (Parkhe, 1993b; Gulati, 1995a, 1995b). In essence, these researchers suggest that mutual experience engenders mutual trust, and leads to extension of relations and relaxation of governance safeguards (Parkhe, 1993b; Gulati, 1995a, 1995b). However, this view challenges rational behavior by the parties to an agreement, which “requires that the probability of continuing their relation does not depend on their past experience with
each other” (Telser, 1980: 36). Indeed, in a world of rational actors, “the foundation of cooperation is not really trust, but the durability of the relationship” (Axelrod, 1984: 182). In the absence of improvements in the “shadow of the future”, familiarity-based trust would “stand as a temptation to the seller to cheat the buyers and convert their goodwill into ready cash” (Telser, 1980: 36). In the absence of enhanced rational bases for cooperation under multiplexity, familiarity-based extension of relations would lead to “confidence” rackets “that simulate certain relationships, sometimes for long periods, for concealed purposes” (Granovetter, 1985: 491). We thus offer a view of relation extension which is in agreement with rational behavior.

According to proposition 4, the benefit of economic multiplexity is that of balancing the incentives to defect across a set of relations. In this view, economic multiplexity allows firms to carry a relation in cooperation even though the same relation would result in defection if carried out in isolation (i.e., with low ISSs). This, for instance, could directly benefit the firm by being able to minimize governance safeguards on relations that are governed by multiplexity.

The cooperative-enhancing effects of economic multiplexity suggest that firms would purposefully increase their relations with other actors in their environment with whom they are already interdependent. Drawing on propositions 4, 5 and 6, we suggest that this purposeful extension of relations may have two forbearance-related purposes: a) use of already established high ISS (strongly cooperative) relations in order to enter into lower ISS relations, and b) preemptive creation of high ISS relations in order to balance out other low ISS interdependencies. The first type of extension of relation, which we term *exploitative extension*, serves to take advantage of already existing enforcement power and use it in supporting a new relation which would otherwise fail without such external enforcement. The second mode of expansion, *preemptive extension*, serves to create excess enforcement power in a new relation which could spill over to other pre-existing relations. Figure 2 depicts both forms of relation extension.

**EXPLOITATIVE EXTENSION** has been widely described in the literature. Gulati's (1995a) finding that prior equity joint ventures would generate future non-equity alliances provides an ideal illustration of the exploitation of high-ISS relations to support low-ISS ones. The phenomenon of “follow the buyer” (Martin, Mitchell, & Swaminathan, 1995) provides another illustration. Japanese first-tier suppliers making investments in the U.S. have been making very risky transaction-specific investments apparently without many governance safeguards. Yet, these low-ISS relations were enforced by long-standing high-ISS relations in Japan. This form of extension thus leads to the appearance that “familiarity breeds trust” (Gulati, 1995a), since it predicts that an organization wanting to carry out a relation which involves strong incentives to defect would prefer to rely on those organizations with which it is tightly bound by existing cooperative relations (examples 1 and 2 in Figure 2). If relations are such that ISS increases with the life of the relation, then we should expect an observable pattern of “familiarity-based trust”, in that these firms will engage in new relations and cooperate despite low ISSs (example 2). Exploitative extension
may also be empirically reflected in a propensity to take advantage of prior strong
governance in pre-existing relations to relax governance safeguards (and thus reduce
governance costs) in the new relation. Thus, this explanation provides a game-
theoretical logic for two phenomena: a) evolving economic multiplexity (new relations
follow established relations), and b) repeated relations becoming increasingly
informal (less governed).

**Proposition 9:** Firms already engaged in relations characterized
by high structural self-enforcement will be likely to extend their rela-
tions with new additional relations characterized by lower structural self-enforcement.

As compared to exploitative extension, in which case new relations are the result
of prior high ISS relations, preemptive extension represents new relations as in-
vestments in cooperation. Preemptive extension would thus be engaged by firms that
currently have relations characterized by low ISS, marked by potential or actual de-
fection/competition. One example would be situations in which actors face asymmet-
ric structural self-enforcement incentives due to relation-specific investment, asym-
metric market positions, etc. In such situations, the more dependent party may re-
quire the development of a reciprocal relationship in order to reduce the incentives to
defect by the party with lower ISS (Pfeffer & Salancik, 1978; Williamson, 1983). The
same principle underlies the competitive practice of “exchange-of-threats” in in-
which a firm faced by entry by a foreign rival decides to engage in cross-entry and
establish a foothold in the home market of that rival (Karnani & Wernerfelt, 1985; Casson, 1987) to stabilize the relationship and enforce forbearance (Casson, 1987).
Another illustration of preemptive expansion, illustrated in example 4 in Figure 2,
may be seen in a tendency in knowledge-link alliances (which usually have a finite
time span, and therefore face lower ISSs at the end of the alliance) to concatenate al-
liances, so that the beginnings of new collaborative ventures (high ISS) overlap with
the “end-stages” of other alliances (low ISS). Thus, we expect preemptive expansion
to also be an important dimension of the extension of economic multiplexity. How-
ever, it must be recognized that, instead of exercising voice through preemptive in-
crease of relations of interdependence, firms may opt for exit when exit from exist-
ing relations is easy and viable (Hirschman, 1970). We thus expect to see preemptive
relation extension in situations characterized by high relation exit costs.

**Proposition 10:** Firms already engaged in relations characterized
by low structural self-enforcement and high exit barriers from those relations will be likely to extend their relations with new ad-
ditional relations characterized by high structural self-
enforcement.

These propositions describe a strongly path-dependent process of economic mul-
tiplexity, with past relations influencing the creation of new relations. A empiri-
cal application of how existing multiplexity influences the extension of additional re-
lations of interdependence is presented in Baum & Korn (1996). The idea of economic multiplexity, and the propositions derived from it, can increase our understanding of the evolutionary dynamics of interdependence among organizations.

CONCLUSION

The embeddedness argument, which serves as the theme for this book, suggests that economic action is dependent on contextual structures of social and economic relations. More research is needed to flesh out the implications of embeddedness into testable propositions that inform research and practice about the effects and the limits of embeddedness. This research presents an attempt to look through the lenses of game theory to understand in depth the predicted effects and limits of economic multiplexity (a form of structural embeddedness) in cooperative behavior.

The paper has presented a medium-range construct, economic multiplexity, which can become valuable for researchers studying situations in which firms are tied together by multiple simultaneous relations of interdependence. We believe that many of the theoretical arguments that inform research in multipoint competition, repeated alliances, buyer-supplier link extension, etc. can be abstracted and generalized at this medium-range level, thus enabling cross-fertilization across those previously independent research streams. While this makes theoretical exposition somewhat abstract and difficult, the benefit is the development of propositions and principles with broader applicability.

The contribution of game theory to this quest is important. Game theory modeling allowed us to focus on the theoretical “skeleton” of the problem at hand (the maximum level of abstraction which maintains the desired characteristics of the phenomenon being modeled). We found that the game-theoretical “skeletons” of widely different problems, such as multipoint competition, multiple alliances, multiple buyer-supplier relations, reciprocal relations, etc. are actually quite similar. In essence, these situations represent multiple simultaneous repeated prisoner’s dilemmas (Telser, 1980; Bernheim & Whinston, 1990). As these theoretical similarities are recognized, we expect future work in these areas to experience substantial cross-fertilization.

More importantly, this paper calls for an increase in awareness and research in the most theoretically interesting but difficult issues of economic multiplexity: the combination of mixed types of relations of interdependence. As briefly developed in the section on idiosyncratic pooling effects, some multiple relations of mixed nature may have cross-relation interdependencies such that pooling may lead to less rather than more forbearance. This area of research could be helpful in developing the mixed cooperative and competitive motives in joint ventures with competitors (Parkhe, 1993b; Khanna, 1995).

Finally, another interesting line of extension of this research should consider the long-term implications of economic multiplexity in different dynamic environments. While multiplexity may increase cooperation due to the retaliation potential in other relations, it can also lead to relational rigidities and inertia, since firms may fear to break an inefficient relation because of the implications in other relations. Thus, economic multiplexity may be a mixed blessing in fast-moving environments. On the one hand, it makes cooperation possible in environments characterized by
shorter “shadows of the future” due to fast technological trajectories and obsolescence. On the other hand, the concentration of massive retaliation opportunities may decrease the adaptive flexibility of those relations in turbulent environments. The combined dynamics of those effects seem to lead inexorably to punctuated equilibrium. Thus, a more long-sighted exploration of the benefits and drawbacks of economic multiplexity offers many opportunities for contributions to the fundamental questions of strategic management.

ENDNOTES

1 A review of the extensive literatures on horizontal, vertical and symbiotic interdependence is outside the scope of this paper.

2 It is important to note that structural embeddedness does not contradict rational action, and is in fact quite in agreement with a broad definition of rational action as self-interested purposeful action within the constraint of existing network constraints. Granovetter (1985: 506) states that “what looks to the analyst like nonrational behavior may be quite sensible when situational constraints, including those of embeddedness, are fully appreciated”. Thus, the embeddedness of economic action implies that the actors take into account not only the direct effects of their behavior within the relation, but also consider the indirect effect through other relations between the actors.

3 We exclude from our definition those social relations among organizations that are not based on economic interdependence. While this is a shortcoming for a paper dealing with embeddedness, we require this simplification to limit the types of relations to consider. Moreover, the definition of social ties carries more meaning for individual actors than for corporate actors. We chose not to pursue that avenue here.

4 A lot of current work in game theory is trying to understand the conditions which may lead to cooperation by short-lived players, including overlapping generations, games with boundedly rational players, unilateral commitments by short-lived players, randomly matched opponents, etc (see chapters 5 and 9 in Fudenberg & Tirole, 1992).

5 The fact that these “confidence” rackets exist may mean that in fact the heuristics used by people to evaluate when to trust and extend relations may not be too calculative, and may suffer from biases. For a discussion of the calculative view of trust formation see Coleman (1990) and Williamson (1993). If that is the case, our research may have normative implications.
REFERENCES

Aharoni, Y. 1966. *The foreign investment decision process*. Boston, Division of Research, Graduate School of Business Administration, Harvard University.


<table>
<thead>
<tr>
<th>Combinations of multiple types of interdependence</th>
<th>Horizontal interdependence</th>
<th>Vertical interdependence</th>
<th>Symbiotic interdependence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Horizontal interdependence</strong></td>
<td><strong>Cell 1</strong></td>
<td><strong>Cell 4</strong></td>
<td><strong>Cell 5</strong></td>
</tr>
<tr>
<td><strong>Vertical interdependence</strong></td>
<td><strong>Cell 2</strong></td>
<td><strong>Cell 6</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Symbiotic interdependence</strong></td>
<td><strong>Cell 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple strategic alliances or joint ventures: Telser, 198; Kogut, 1989; Gulati, 1995a, 1995b.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2
Interpretations of different types of relations of interdependence as Prisoner’s Dilemma games

<table>
<thead>
<tr>
<th>Precedents in the literature</th>
<th>Relations of horizontal interdependence as PD games</th>
<th>Relations of vertical interdependence as PD games</th>
<th>Relations of symbiotic interdependence as PD games</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamberlin, 1933</td>
<td>Telser, 1980</td>
<td>Telser, 1980</td>
<td></td>
</tr>
<tr>
<td>Shapiro, 1989;</td>
<td>Hill, 1990</td>
<td>Parkhe, 1993b</td>
<td></td>
</tr>
<tr>
<td>Bernheim &amp; Whinston, 1990</td>
<td></td>
<td>Gulati, Khanna &amp; Nohria, 1994</td>
<td></td>
</tr>
<tr>
<td>Tirole, 1990</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Incentives to cooperate

- For sufficiently inelastic demand, rivals may reduce rivalry / increase prices / reduce outputs and increase joint profits by doing so.
- Cooperation allows specialization in one task, and thus may create value over mutual distrust or defection. Value created may be shared among firms.
- Value created through joint development of business. Also, benefits from combining complementary competences, sharing risks and developing new opportunities.

Relation-specific factors associated with cooperation

- Fewness of competitors.
- High expected growth in demand.
- Long-term bilateral dependence.
- Legal enforcement of contract or endogenous governance safeguards.
- Expectation of long-term benefits from relation.
- Symmetric relation-specific assets
- Symmetric equity ownership.

Incentive to defect

- Benefit from temporary advantage by unilaterally increasing competitive rivalry / reducing price / increasing output.
- Lower cost of compliance with contract while maintaining the economic rewards.
- Increased economic rewards for same product by ex-post haggling over price.
- Lower costs due to underprovision of effort, competences, managerial talent, while maintaining equal share of results.
- Benefit from appropriating partner’s technology or ex-post haggling over distribution of results.
Table 3
Theories of extra-relational enforcement mechanism of cooperation in the Prisoner’s Dilemma game

<table>
<thead>
<tr>
<th>Type of enforcement</th>
<th>“Self-enforced” relations</th>
<th>Economic multiplexity</th>
<th>Informational embeddedness</th>
<th>Generalized reputation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical foundations</td>
<td>Intra-relational</td>
<td>Extra-relational</td>
<td>Extra-relational</td>
<td>Extra-relational</td>
</tr>
<tr>
<td>Definition &amp; Scope</td>
<td>Relation is enforced by the penalty in future stages of the same relation (“shadow of the future”).</td>
<td>Relation is enforced by the penalty in future stages of this and other relations between the same parties.</td>
<td>Relation is enforced by the penalty in future stages of this and other relations with parties within the informational network.</td>
<td>Relation is enforced by the penalty in future stages of this relation and all other relations engaged by the defector.</td>
</tr>
<tr>
<td>Information transfer between relation and “enforcing” relations</td>
<td>Not relevant, they are the same relation.</td>
<td>Internalized information transfer (“within firm”) across relations</td>
<td>Network-based information transfer across relations</td>
<td>Spontaneous information transfer across relations (not specified in model).</td>
</tr>
<tr>
<td>Incentives to enforce by “enforcing” relations</td>
<td>Most credible. Current cooperation on this relation relies on it.</td>
<td>Quite credible. Enforcement benefits other relations within firm.</td>
<td>Somewhat credible. Lack of incentives to enforce, unless “socialized” into network.</td>
<td>Not credible. Lack of incentives to enforce. Must rely on asymmetric incentives (one-sided PD or precommitment).</td>
</tr>
<tr>
<td>Incentives to forbear from massive defection</td>
<td>Not relevant for this case.</td>
<td>Acknowledged as critical consideration (Bernheim &amp; Whinston, 1990)</td>
<td>Important consideration, but not considered explicitly in theory development.</td>
<td>Important consideration, but not considered explicitly in theory development.</td>
</tr>
<tr>
<td>Breadth of enforcement mechanism</td>
<td>Narrowest</td>
<td>Narrow</td>
<td>Broad</td>
<td>Broadest</td>
</tr>
<tr>
<td>Reliability of enforcement mechanism</td>
<td>Most reliable</td>
<td>Quite reliable</td>
<td>Somewhat reliable</td>
<td>Somewhat unreliable</td>
</tr>
</tbody>
</table>
Figure 1
The Prisoner’s Dilemma game

<table>
<thead>
<tr>
<th>Payoff for i, payoff for j</th>
<th>j cooperates</th>
<th>j defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>i cooperates</td>
<td>(mc_i=3, mc_j=3)</td>
<td>(uc_i=0, ud_j=5)</td>
</tr>
<tr>
<td>i defects</td>
<td>(ud_i=5, uc_j=0)</td>
<td>(md_i=1, md_j=1)</td>
</tr>
</tbody>
</table>

Payoff structure of a Prisoner’s Dilemma game

\[ ud_k > mc_k > md_k > uc_k \]

Condition for rational cooperation by player \( k \) under most unforgiving enforcement (grim strategies)

\[
NPV (\text{cooperation forever}) > NPV (\text{defect now and suffer the consequences forever})
\]

\[
mc_k + \frac{mc_k}{(1 + \alpha_k)} + \frac{mc_k}{(1 + \alpha_k)^2} + \frac{mc_k}{(1 + \alpha_k)^3} + \frac{mc_k}{(1 + \alpha_k)^4} + \ldots > ud_k + \frac{md_k}{(1 + \alpha_k)} + \frac{md_k}{(1 + \alpha_k)^2} + \frac{md_k}{(1 + \alpha_k)^3} + \frac{md_k}{(1 + \alpha_k)^4} + \ldots
\]

which is equivalent to \( \frac{mc_k - md_k}{ud_k - md_k} > \alpha_k \) for each player \( k \).

(Where \( \alpha_k = \text{intertemporal discount rate used by player } k \)).
Figure 2
Paths of evolutionary dynamics of economic multiplexity

Illustrations of exploitative extension of relations

Example 1: Constant ISSs over time.

Example 2: Increasing ISSs over time.

Illustrations of pre-emptive extension of relations

Example 3: Constant ISSs over time.

Example 4: Decreasing ISSs over time.