

## THE EVOLUTION AND PERSISTENCE OF DOMINANT ROLES IN INTERORGANIZATIONAL RELATIONSHIPS

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### ABSTRACT

Recent application of role theory to economic behavior (Montgomery 1998) has provided new insights into interorganizational relationships (Heide and Wathne 2006). In particular, role theory offers a framework for investigating the source of seemingly contradictory accounts of economic exchange, including Uzzi's (1997; 1996) finding that embeddedness enhances firm survival in the apparel industry and Wathne, et al.'s (2001) discovery that embeddedness does not insulate a firm from price competition in the commercial banking industry. The key to understanding these discrepancies lies in the divergent evolution of dominant relationship roles. This paper investigates the evolution and persistence of roles in interorganizational relationships from a role-theoretic perspective using agent-based modeling.

**Keywords:** interorganizational relationships, role theory, economic behavior, agent-based modeling

### INTRODUCTION

According to the classical and neoclassical schools of thought, economic transactions are coordinated through the mechanism of price; that is, the totality of information necessary for exchange is communicated by the price associated with the transaction. Moreover, economic actors are rational, utility maximizing, and self-interested. Granovetter (1985) criticizes this view of economics as “undersocialized,” in that it “disallow[s] by hypothesis any impact of social structure and social relations on production, distribution, or consumption.” He contends that economic behavior is “embedded” in social relations and that these relations have a significant impact on how actors behave. This, then, is the “problem of embeddedness”: that “behavior and institutions to be analyzed are so constrained by ongoing social relations that to construe them as independent is a grievous misunderstanding” (Granovetter 1985).

Granovetter's hypothesis is supported by empirical research in the apparel industry. Uzzi (1997; 1996) found that firms that rely on arm's length market transactions are more likely to fail than are firms that leverage social relations. He attributes this outcome to three features of embedded transactions: trust, information sharing, and joint problem solving. More recently, however, Wathne, Biong, and Heide (2001) uncovered evidence to the opposite effect: in the commercial banking industry, social relations are ineffective at protecting firms from price and product competition. Although social relations can create a barrier to switching, they are outweighed by firm-level switching costs and competitor superiority in price or product breadth.

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Montgomery (1998) offers a role-theoretic conception of embeddedness that may help resolve this apparent contradiction. He attributes discrepancies in economic behavior to the roles elicited by relationships: (1) the role of “businessperson,” who maximizes profit, and (2) the role of “friend,” who cooperates out of principle. Which role is invoked in a particular transaction depends on the history of the relationship. Heide and Wathne (2006) extend this role-theoretic perspective to the governance of interorganizational relationships, proposing a conceptual framework that links governance strategies to roles and role activation. They identify two specific areas for future research: (1) the connection between roles and profitability, and (2) the sources of “stickiness” of roles.

The purpose of this research is to explore the consequences of embeddedness from a role-theoretic perspective. In particular, we seek to explain why certain industries exhibit a high level of embeddedness, whereas others favor arm’s length market transactions. To this end, we investigate how roles can become dominant in an industry and, once established, influence the profitability of industry players. Greater understanding of how roles evolve within industries and the implications of an established, dominant role will help inform the governance decisions for firms entering or competing in such industries.

In the following section, we expand on our discussion of the role-theoretic perspective of economic behavior and introduce hypotheses on the evolution and persistence of roles in interorganizational relationships. We then propose an agent-based model for testing the hypotheses. Finally, we present our findings and discuss their implications and limitations.

## **CONCEPTUAL FRAMEWORK**

Uzzi (1997) classifies business relationships as either “arm’s length” or “embedded.” Arm’s length relationships are characterized by non-repeated transactions where the emphasis is on price. Performance is assured through contracts and monitoring, and problems are solved by switching suppliers. In contrast, embedded relationships are characterized by repeated transactions where price is but one consideration. Personal relations play a key role in business decisions, and relationships are governed by trust and reciprocity. As a result, embedded relationships benefit from higher levels of information sharing and joint problem solving. In other words, embedded relationships encourage cooperation, whereas arm’s length relationships discourage it.

In role-theoretic terms, arm’s length and embedded relationships are the result of firms assuming the roles of “businessperson” and “friend,” respectively (Montgomery 1998). The businessperson follows the “logic of consequences” and seeks to maximize utility, while the friend follows the “logic of appropriateness” and behaves according to rules and norms (March 1994). Thus a friend favors cooperation even if it results in short-term loss, while the businessperson defects if doing so results in the highest gain. Different roles may be invoked at different times in different relationships.

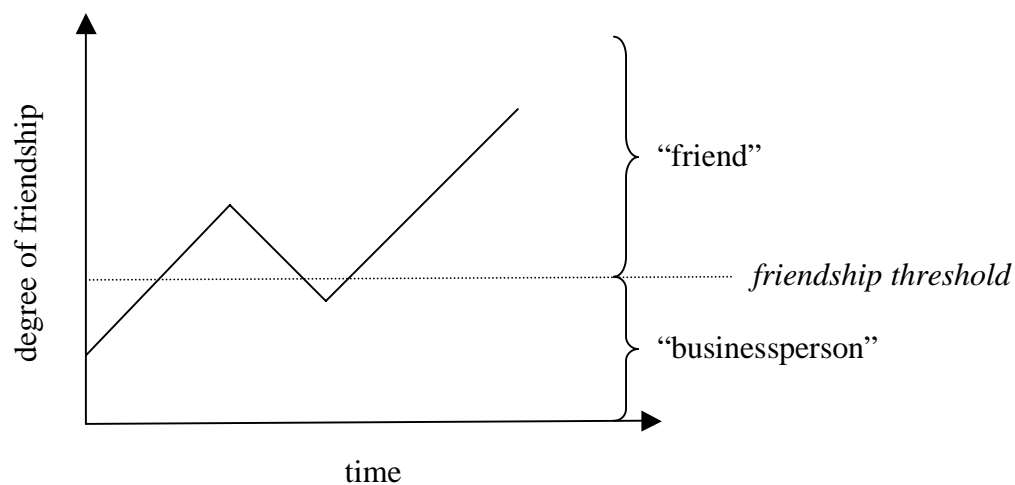
Which role an actor assumes in a relationship depends on the disposition of the actor and the history of interactions between the actor and the other party (Heide and Wathne 2006). Montgomery (1998) conceptualizes this as a threshold model: for each party an actor interacts with, the actor maintains a mental record of “degree of friendship” (see Figure 1). When the actor interacts with another party, his degree of friendship with the other party increases or decreases depending on the characteristics of the interaction. For example, if the other party

goes above and beyond the letter of a contract to help the actor, the degree of friendship will increase. If, on the other hand, the other party insists on compliance with the terms of a contract despite unforeseen difficulties, the degree of friendship will decrease. When the degree of friendship exceeds a certain level, the “friendship threshold,” the actor assumes the role of friend. If the degree of friendship is beneath the friendship threshold, the actor assumes the role of businessperson.

The predisposition of an actor to assume the role of businessperson or friend is reflected in the actor’s friendship threshold. An actor who is quick to befriend others will have a low friendship threshold, whereas an actor who prefers to stay at arm’s length will have a high friendship threshold. The initial degree of friendship is determined by the mechanism through which the actors are first introduced. Consistent with Uzzi’s (1996) findings, if the actors are introduced by a mutual friend, the initial degree of friendship will be relatively high. If instead the actors meet through search in an anonymous market, the initial degree of friendship will be low.

This conceptualization of economic behavior as a series of roles can be extended to an industry of firms. An embedded market can be viewed as one in which the dominant relationship role—i.e., the role assumed by the greatest number of firms in the industry—is that of friend. An anonymous market, in contrast, is one in which the dominant relationship role is that of businessperson. Moreover, we can speculate as to the type of industry that will arise given an initial level of embeddedness. Based on Uzzi’s (1996) finding that “embedded ties can originate from anonymous market ties, but this source of embeddedness is uncommon in [the apparel] industry,” we hypothesize that:

- H<sub>1A</sub>:** The dominant relationship role that will evolve in an industry that is initially devoid of embeddedness (i.e., an anonymous market) will be that of businessperson.



**FIGURE 1** Threshold model of role determination

A market may be embedded from the outset when business relationships have been primed for embeddedness by third-party referrals or personal relationships (Uzzi 1996). As the initial level of embeddedness in an industry increases, we expect to see a greater number of firms adopting the role of friend. Moreover, we hypothesize that there is a critical initial level of embeddedness which, if exceeded, will lead to the evolution of an embedded industry. In other words:

**H<sub>1B</sub>:** The dominant relationship role that will evolve in an industry initially characterized by a level of embeddedness above a critical point will be that of friend.

Uzzi (1996) demonstrated that in the apparel industry, firms that preferred embedded relationships over arm's length relationships were more likely to survive. Since the apparel industry most closely resembles an embedded market, we can infer that, in embedded markets, firms that are predisposed to assume the role of friend will outperform firms that operate as businesspersons. On the other hand, in an anonymous market it is predicted that firms that are predisposed to the role of businessperson will outperform firms that prefer to act as friends, since in such markets friends will not realize gains due to cooperation and, moreover, are likely to be taken advantage of by businesspersons. Therefore, we predict that:

**H<sub>2A</sub>:** In an embedded market, firms that prefer the role of friend will outperform firms that prefer the role of businessperson.

**H<sub>2B</sub>:** In an anonymous market, firms that prefer the role of businessperson will outperform firms that prefer the role of friend.

## METHODOLOGY

Similar to Montgomery (1992), we model firm behavior as a repeated prisoner's dilemma. Rather than analyze the game mathematically, however, we employ agent-based modeling. This enables us to investigate emergent properties of the system (Axelrod and Tesfatsion 2006), which is essential in a model such as ours, where the behavior of actors is dependent on past experience and the actors continually adapt based on their interactions. Moreover, agent-based modeling permits experimentation with a heterogeneous population of actors (Axtell 2000), in this case a population of firms with different roles, predispositions, relationships, and histories.

Our model specification is presented below. This is followed by a description of how core aspects of the model are operationalized. Finally, the findings from simulations of our agent-based model are reported.

### Model Specification

Two types of firms are represented in the model: manufacturers and suppliers. Manufacturers purchase materials from suppliers to use in the manufacturing process, and suppliers sell these materials to manufacturers to earn a profit. Interactions between manufacturers and suppliers take the form of a repeated prisoner's dilemma (see Figure 2). Each period, the manufacturers choose the suppliers from whom to purchase materials. A supplier can either "cooperate" by delivering the product as expected or "defect" by shirking on product

quality or quantity. Similarly, a manufacturer can either “cooperate” by paying the full amount for the product or “defect” by demanding allowances from the supplier. Note that only the interactions of *principal* exchange partners are modeled. That is, the supplier selected by a manufacturer is assumed to be the one that supplies the most product to that manufacturer in that period. This does not preclude the possibility of a manufacturer obtaining materials from multiple suppliers; however, including secondary sources in the model could underestimate the effect of embeddedness (Uzzi 1996).

The interaction history between a manufacturer and a supplier is encapsulated in their “degree of friendship” (Montgomery 1992). When a manufacturer’s degree of friendship with a supplier exceeds the manufacturer’s “friendship threshold” (see Figure 1), it will assume the role of “friend” when interacting with the supplier. If, on the other hand, the manufacturer’s degree of friendship is less than or equal to its friendship threshold, it will assume the role of “businessperson.” Likewise, each supplier has a degree of friendship with each manufacturer. When the supplier’s degree of friendship with a manufacturer exceeds the supplier’s friendship threshold, it will assume the role of “friend” when interacting with the manufacturer. When the supplier’s degree of friendship is less than or equal to the supplier’s friendship threshold, it will assume the role of “businessperson.” After each exchange, the firms update their respective degrees of friendship to reflect the outcome of the transaction. If the other party cooperated, the firm increases its degree of friendship with the other party. If instead the other party defected, the firm decreases its degree of friendship with the other party. Thus firms are capable of role switching (Heide and Wathne 2006; Montgomery 1992) based on their interaction histories.

		<i>Supplier</i>	
		C <sub>2</sub> (“delivers as promised”)	D <sub>2</sub> (“shirks on quality or quantity”)
<i>Manufacturer</i>	C <sub>1</sub> (“pays in full”)	5, 5	3, 6
	D <sub>1</sub> (“demands allowances”)	6, 3	4, 4

**FIGURE 2** Payoff matrix for manufacturer and supplier in two-sided prisoner’s dilemma

How the parties to a transaction behave (i.e., whether they cooperate or defect) determines the payoffs each receives from the transaction (see Figure 2). The firms’ behavior, in turn, is a function of the role assumed: a “friend” cooperates out of principle, while a “businessperson” opts for short-term gain and defects (Montgomery 1992). If both manufacturer and supplier cooperate, the manufacturer receives the full value of its purchase ( $U_1(C_1, C_2) = 5$ ) and the supplier receives full payment ( $U_2(C_1, C_2) = 5$ ). If the manufacturer cooperates and the supplier defects, the manufacturer receives less than the full value of the purchase ( $U_1(C_1, D_2) = 3$ ) due to the supplier’s shirking on quality or quantity, and the supplier receives more than fair

compensation ( $U_2(C_1, D_2) = 6$ ) due to savings on materials and labor. If, instead, the manufacturer defects and the supplier cooperates, the manufacturer receives more than the full value of the purchase ( $U_1(D_1, C_2) = 6$ ) by demanding allowances for defective merchandise when the product is in fact satisfactory, while the supplier receives less than fair compensation ( $U_2(D_1, C_2) = 3$ ). Finally, if both manufacturer and supplier defect, the manufacturer receives less than the full value of the purchase ( $U_1(D_1, D_2) = 4$ ) due to the opportunity cost of not having necessary supplies on hand, and the supplier loses potential revenue ( $U_2(D_1, D_2) = 4$ ) due to allowances granted the manufacturer. Note that the payoff matrix satisfies the requirements for a two-sided prisoner's dilemma (Axelrod 1984), since  $U_1(D_1, C_2) > U_1(C_1, C_2) > U_1(D_1, D_2) > U_1(C_1, D_2)$ ,  $U_2(C_1, D_2) > U_2(C_1, C_2) > U_2(D_1, D_2) > U_2(D_1, C_2)$ , and  $U_1(C_1, C_2) > (U_1(D_1, C_2) + U_1(C_1, D_2))/2$ .

To decide which supplier to purchase materials from, a manufacturer starts by ranking its suppliers by degree of friendship. If the manufacturer is friends with one or more suppliers (i.e., the manufacturer's degree of friendship with the supplier exceeds the manufacturer's friendship threshold), the manufacturer will choose the supplier with which it has the highest degree of friendship. If several suppliers have equally high degrees of friendship, the manufacturer will randomly select one. If the manufacturer is not friends with any suppliers (i.e., the manufacturer's degree of friendship is below its friendship threshold for all suppliers), the manufacturer will randomly select a supplier. This corresponds to a businessperson choosing the supplier with the lowest price.

## Operationalization

Three aspects of the model require further elaboration with respect to how they are operationalized: (1) role activation, (2) role preference, and (3) market embeddedness.

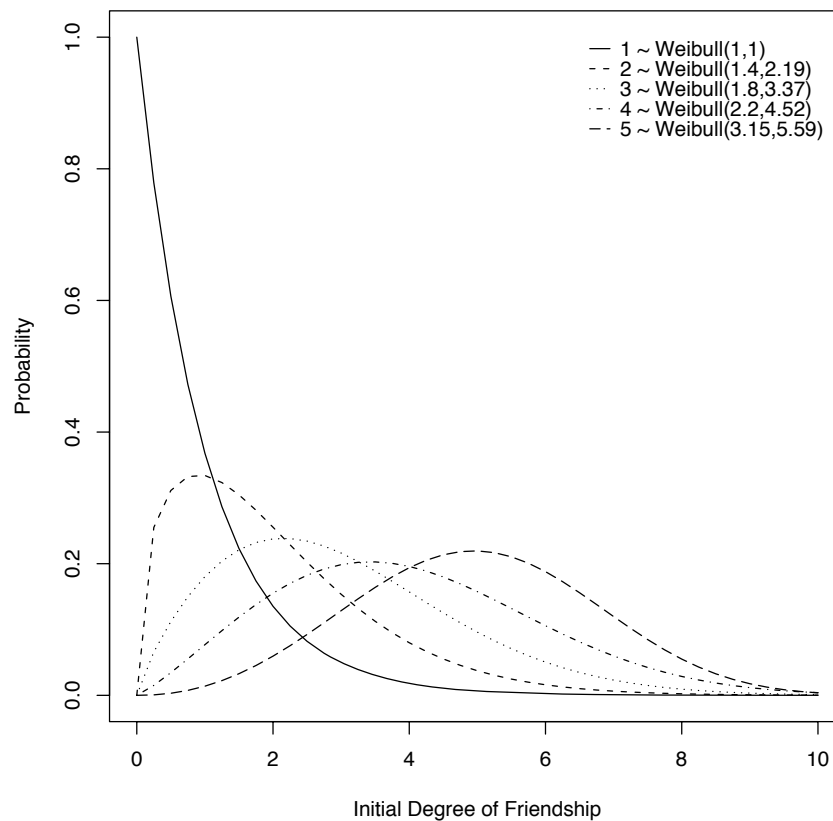
*Role activation.* The degree of friendship between two firms (see Figure 1) is expressed as an integer from zero to ten, with zero corresponding to the absence of friendship and ten representing the highest possible level of friendship. Likewise, the friendship threshold is also expressed as an integer from zero to ten. When degree of friendship exceeds a firm's friendship threshold, the firm assumes the role of "friend." When degree of friendship is less than or equal to a firm's friendship threshold, the firm assumes the role of "businessperson." Note that friendship can be asymmetric, in that a manufacturer's degree of friendship with a supplier may differ from the supplier's degree of friendship with the manufacturer; moreover, the two firms may have different friendship thresholds. Thus a manufacturer may assume the role of friend with a supplier who assumes the role of businessperson or vice versa.

*Role preference.* The preference of a firm for the role of friend or businessperson is indicated by the firm's friendship threshold. A high friendship threshold indicates a firm that prefers the role of businessperson, since the firm requires a higher degree of friendship with another firm before it will assume the role of friend. In contrast, a firm with a low friendship threshold is characterized as preferring the role of friend, since a lower degree of friendship with another firm is needed for it to assume the role of friend. Friendship thresholds are presumed to be normally distributed in the population, and thus are randomly assigned to firms from a normal distribution with  $\mu = 5$  and  $\sigma = 1$ .

*Market embeddedness.* The embeddedness of a market refers to the extent to which economic behavior is influenced by social relations (Uzzi 1996). In an anonymous, arm's length

market, economic behavior is completely unaffected by social relations. In contrast, in a wholly embedded market, economic behavior is completely determined by social relations. Although neither of these may be plausible *per se*, they are valuable from a theoretic standpoint as the endpoints of a continuum of markets, from the anonymous to the wholly embedded; as the level of embeddedness increases, so does the influence of social relations on economic behavior within the market.

In this study, the level of embeddedness of a market is specified on a scale of zero to ten, where zero represents an anonymous market and ten corresponds to a wholly embedded market. To simulate an anonymous market, the initial degrees of friendship of all firms are set to zero. Similarly, to create a wholly embedded market, the initial degrees of friendship are set to ten. Between the two extremes, the initial degrees of friendship are randomly assigned from a Weibull distribution, where the parameterization of the distribution depends on the level of embeddedness (see Figure 3). Thus as the level of embeddedness increases, so does the probability of a firm being assigned a high initial degree of friendship with another firm. (For embeddedness greater than five, the mirror image of the distributions shown in Figure 3 are utilized. For instance, a market with a level of embeddedness equal to seven is generated from the mirror image of the Weibull distribution for embeddedness level three.) Note that each of the Weibull distributions has a mean equal to the level of embeddedness. For example, the expected value of a random variable distributed as Weibull(2.2, 4.52) is four, the same as the level of embeddedness represented by that distribution.

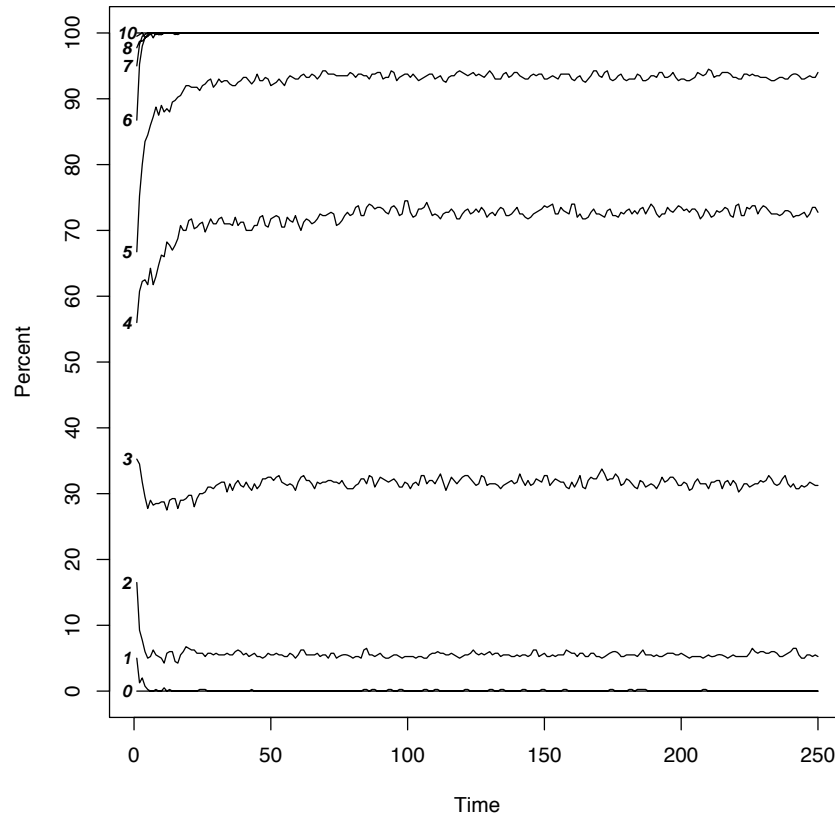


**FIGURE 3** Market embeddedness probability distributions

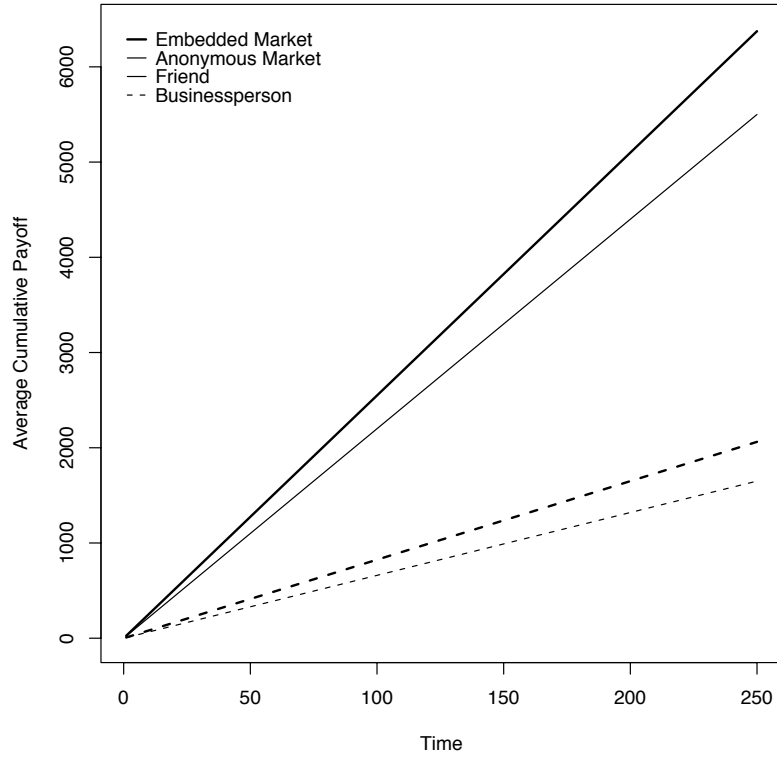
## Results

The model was programmed in Java and simulated with REPAST, an open source agent-based modeling environment (North et al. 2006). Model parameters were determined by the hypothesis being tested, as discussed below. For each set of parameters, the model was run twenty times, and results from batches of runs were aggregated for analysis. In each run, a market comprised of twenty manufacturers and twenty suppliers was simulated for 250 periods.

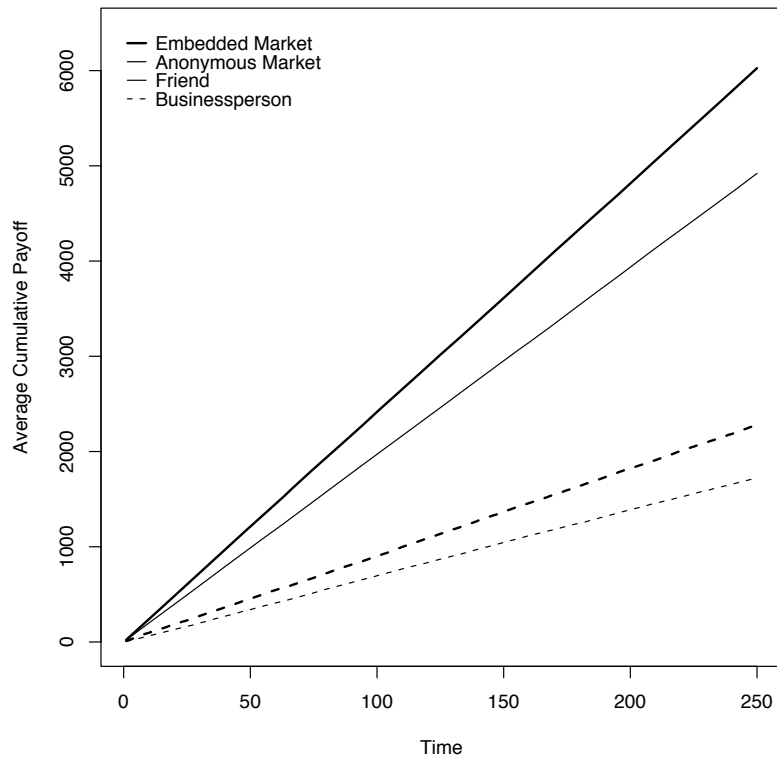
To test Hypotheses 1A and 1B, markets with initial levels of embeddedness from zero to ten were simulated. Each period, the number of firms that assumed the role of “friend” in a transaction was recorded; these data are graphed as percentages in Figure 4 (the numbers in italics indicate the level of embeddedness of the market at outset). In support of Hypothesis 1A, firms that start in an anonymous market assume the role of businessperson throughout the simulation. Similarly, firms that assume the role of businessperson in markets with initial levels of embeddedness equal to 1, 2, and 3 are consistently in the majority. Averaged over the last fifty periods, they account for 100%, 94.5%, and 68.5% of the firms participating in transactions, respectively. In contrast, firms assuming the role of friend in markets with an initial level of embeddedness greater than or equal to 4 quickly become the majority. Averaged over the last fifty periods, they account for 72.8%, 93.4%, and 100% of the firms participating in transactions, respectively. Thus Hypothesis 1B is supported.



**FIGURE 4** Percent active firms in friend role



**FIGURE 5** Manufacturer payoffs



**FIGURE 6** Supplier payoffs

To test Hypotheses 2A and 2B, two types of markets were simulated: an anonymous market and an embedded market (level of embeddedness = 8). Each period, the cumulative payoffs for firms with friendship thresholds greater than five (i.e., firms that prefer the role of “businessperson”) and for firms with friendship thresholds less than five (i.e., firms that prefer the role of “friend”) were recorded. The data for manufacturers are graphed in Figure 5 and the data for suppliers are graphed in Figure 6. Surprisingly, firms that assume the role of “friend” outperform firms that assume the role of “businessperson” in *both* anonymous and embedded markets, supporting Hypothesis 2A and disconfirming Hypothesis 2B. In the embedded market, manufacturer “friends” realize an average final payoff of \$6,374, compared to \$2,062 for “businesspersons.” Similarly, in the anonymous market, manufacturer “friends” earn a total of \$5,500, while manufacturer “businesspersons” earn only \$1,650. For suppliers, “friends” in the embedded market receive \$6,026, compared to \$2,278 for “businesspersons”. In the anonymous market, “friends” receive \$4,921, compared to \$1,724 for “businesspersons.”

It is informative to consider the relative increases in profitability that are achieved by adopting the role of “friend” versus “businessperson” or by functioning in an embedded versus anonymous market. Manufacturers are over three times as profitable (3.1 in the embedded market and 3.3 in the anonymous market) when they assume the role of friend instead of the role of businessperson, while suppliers are between 2.6 and 2.9 times as profitable. With respect to market type, manufacturer “friends” realize a 16% gain by operating in an embedded market instead of an anonymous market, and manufacturer “businesspersons” achieve a 25% gain. Suppliers do even better in embedded markets; they realize a 22% gain when in the role of “friend” and a 32% gain when in the role of “businessperson.”

## DISCUSSION

Our model shows that the conditions surrounding the development of a market have a powerful influence on the ultimate characteristics of the market. Namely, a market primed for embedded relations will tend to evolve into a market dominated by “friends,” whereas a market without such priming will be dominated by “businesspersons.” These dominant relationship roles in turn determine the form of the market. When the majority of the firms assume the role of “friend,” the market is highly embedded. When the majority assume the role of “businessperson,” however, the market is more accurately portrayed as “anonymous” or “arm’s length.”

Beyond providing insight into why markets differ in embeddedness, our model suggests that certain relationship roles are superior from a profitability standpoint regardless of the level of embeddedness. Assuming the role of “friend” not only results in greater profit in embedded markets, it benefits firms in anonymous markets, too. In fact, firms in anonymous markets realize a larger increase in profitability by assuming the role of “friend” than do firms in embedded markets. This runs counter to the popular notion that a business in a cutthroat industry must itself behave in a cutthroat manner. On the contrary, the business may achieve superior returns by adopting the role of “friend.”

Our agent-based model offers insights into the evolution and persistence of interorganizational relationship roles. Empirical verification of the predictions of the model are important for providing support for the model’s external validity. This may prove difficult, however, since data on the initial conditions of markets, particularly with respect to embeddedness, is not easily obtained.

Two additional aspects of the model deserve further attention. First, the model focuses on the impact of initial market characteristics. It is conceivable, though, that shocks to the system that occur at a later time may also have a significant impact on the dominance of relationship roles. Second, the model is built on the assumption that embeddedness discourages opportunism. However, it has been suggested that firms may expose themselves to increased opportunism if they become overembedded (Granovetter 1985; Uzzi 1997; Uzzi 1996). The model could be extended to explore the impact of overembeddedness on firm performance.

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