Stability and Change in Embedded Relationships:
Broken Ties in Japanese Automotive Keiretsu

Christina L. Ahmadjian[*]

Hitotsubashi University

Graduate School of

International Corporate Strategy

National Center of Sciences

2-1-2 Hitotsubashi Chiyoda-ku

Tokyo 101-8439, Japan

Phone: 813-5726-2180

Fax: 813-4212-3069

email: cahmadjian@ics.hit-u.ac.jp

Gregory E. Robbins

Goizueta Business School

Emory University

email: Greg_Robbins@bus.emory.edu

[*] Corresponding author.

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ABSTRACT

This study examines how destabilizing pressures interact with embedded exchange relationships in an analysis of broken ties between Japanese auto manufacturers and their suppliers. While functional, political and social pressures all led to broken ties, their effect differed depending on the nature of the tie. We define two types of embeddedness, relational and normative, and argue that while political and social pressures lead to breakage of normatively embedded ties, relationally embedded ties are robust to these pressures. In contrast, functional pressures, specifically, performance, lead to breakage of relationally embedded ties. Our theory and empirical findings have implications for the study of networks and embeddedness and for research on institutional change in business systems.

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Exchange relationships between buyers and sellers are a fundamental component of

economic organization (Burt, 1983; Williamson, 1985; Whitley, 1992). A large and influential

body of literature illuminates how this economic activity is embedded in social relationships: how

it is shaped by norms around appropriate ways to conduct business transactions, supported by

existing patterns of social relationships, and reinforced as social ties evolve through shared history

and repeated transactions (Granovetter, 1985; Gulati, 1995; Uzzi, 1997).

Researchers have acknowledged that exchange relationships form constantly evolving

systems and argue that ties should be examined in a demographic context as a longitudinal process

of formation and breakage (Baker, Faulkner and Fisher, 1998). Yet while much research has

studied the formation and deepening of ties (Gulati, 1995; Gulati and Gargiulo, 1999), few studies

have examined their dissolution (but, see Levinthal and Fichman, 1988; Seabright, Levinthal and

Fichman, 1992; Baker et al., 1998 for exceptions).

A better understanding of the dissolution of exchange ties is significant not only to

understanding embeddedness and interorganization ties per se, but is also relevant to theorizing

institutional change across business systems. Comparative research on business systems around

the globe indicates that business systems may be distinguished in part by their characteristic

patterns of exchange relationships. These patterns vary in the degree to which typical ties are arms

length rather than embedded in rich social relationships, in the norms around the value of long term

ties versus transactions of shorter duration, and in the typical network structures formed by

configurations of closely tied exchange partners (Whitley, 1992; Biggart and Guillen, 1999; Hall

and Soskice, 2001). While researchers argue that the interaction of global forces with these

existing systems leads to distinct trajectories of change that will maintain diverse business systems

(Guillen, 2001), very little theory or research has attempted to consider the mechanisms by which

these destabilizing influences interact with existing relationship patterns. Understanding the forces

that lead to the breakage of exchange relationships and how the patterns of breakage differ across

different types of tie is critical to understanding how industries and economies evolve and the

pressures that lead to change.

The Japanese automotive industry of the 1990's provides a particularly interesting setting

in which to examine dissolution of exchange relationships and how this leads to changes in

business systems. In the 1980's and early 1990's, relationships between Japanese auto

manufacturers and their suppliers received much attention as a new paradigm for exchange

relationships (Smitka, 1991; Clark and Fujimoto, 1991). Auto manufacturers and suppliers

maintained high levels of interdependence, partial ownership stakes, long histories of relationships,

and personal ties at various levels. These configurations of buyers and their core suppliers, linked

by equity ties, were often referred to as "keiretsu," and researchers argued that the benefits of these keiretsu relationships for learning and governance were key to the success of the Japanese auto industry (Dyer, 1996).

In the 1990's, however, the industry faced a number of internally and externally generated threats. With the burst of the asset and real estate bubbles in the early 1990's and declining domestic demand in Japan, the performance of many firms declined drastically, and the auto industry was no exception. An influx of foreign investors in Japanese equity transformed the ownership structure of many firms, replacing Japanese financial institutions with their long-term perspectives with foreign investors demanding return on their investment. The 1990's also showed a reduced confidence among Japanese themselves in postwar economic institutions such as permanent employment and keiretsu.

In this paper, we develop a theoretical framework to explain how various types of destabilizing pressures interact with embedded ties. We use this framework to analyze the dissolution of network ties in exchange relationships between Japanese auto manufacturers and suppliers between 1987 and 1996. Our argument revolves around the notion that the effect of various destabilizing pressures on an exchange relationship depends on the interaction between the nature of the destabilizing pressure and the type of tie. We argue that two types of embeddedness characterize exchange relationships between Japanese auto manufacturers and suppliers. One,

which we refer to as "relational embeddedness," consists of interpersonal relationships, shared

routines and language, and trust—in other words, the deepening social relationships that are

intertwined with exchange relationships. The other, which we term "normative embeddedness,"

refers to the prevailing social norms concerning how easily exchange relationships can be broken.[2]

Following Oliver (1992), we identify three types of destabilizing pressures: functional, political

and social. We argue that each of these pressures exerts its influence through a different

mechanism and that these mechanisms have different effects on relationally versus normatively

embedded ties. Taken together, this line of argument provides a plausible account of how the path,

and thus the outcome, of change depend as much on the preexisting patterns of relationships as on

the destabilizing pressures.

In the following section, we provide an overview of different concepts of embeddedness,

the different types of destabilizing pressures, and the mechanisms through which they are likely to

influence different types of ties. We generate a set of propositions based on this framework. We

then examine the empirical case of the Japanese automotive industry, and develop specific,

testable hypotheses based on the propositions generated earlier. We test these hypotheses on a data

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[2] Greenwood and Hinings (1996) also use the term "normative embeddedness" to describe
practices that are defined and maintained in a normative context, though they do not use the term
to specifically refer to types of exchange relationships.

set of purchase-supply transactions between 1987 and 1996 among the 11 Japanese auto

manufacturers and 380 suppliers across 103 parts.

THEORETICAL BACKGROUND

Concepts of embeddedness

Our theoretical starting point is that economic transactions are not sealed off from the rest

of society, but are rather permeated by social influences. While this embeddedness perspective can

be traced back to the work of Karl Polanyi (1957), its major contemporary influence derives from

Granovetter's 1985 article, in which he argued that economic behavior and institutions "are so

constrained by ongoing social relations that to construe them as independent is a grievous

misunderstanding" (Granovetter, 1985). While Granovetter concentrated primarily on "ongoing

social relations" as viewed through social network theory, other researchers viewed

"embeddedness" more broadly as including cultural, cognitive, and normative influences. Zukin

and DiMaggio (1990), for example, categorized embeddedness into four types: cognitive, cultural,

structural, and political, while Swedberg (1997) identified influences deriving from networks

theory, cultural sociology, and organization theory, especially institutional theory. Institutional

theory in turn recognizes various categories of social influence, such as DiMaggio and Powell's

(1983) coercive, mimetic, and normative isomorphic processes and Scott's (2001) schema of

regulatory, normative, and cognitive "pillars" of institutionalization. Even Granovetter's (1985)

more restricted view of embeddedness as deriving from concrete social relations (rather than

general societal values) was ambiguous as to whether the important factor was the topology of the

overall pattern of ties in which an actor was embedded, or rather the norms and personal

expectations that accompanied such relations. Consequently, subsequent work on embeddedness

has drawn from a wide variety of formulations. Yet despite this variety there are several broad

themes that repeatedly appear. One is that ongoing exchange with a given partner tends to make the

partner's unique identity increasingly salient, thus "personalizing" the tie. We refer to this as

relational embeddedness and describe it in detail in the next paragraph. Another theme is that

societal norms from outside (or predating) the tie influence the expectations that partners have for

each other and the range of behaviors that they will seriously consider. We refer to this as

normative embeddedness and elaborate on its definition and characteristics after our description of

relational embeddedness.

Relational embeddedness refers to exchanges in which the specific identity of the

exchange partners carries significant weight: through shared history and relationship-specific

investments, including the development of private procedures and routines, the exchange partners

develop a bilateral dependence and a sense of partner-specific obligation and reciprocity. The

specificity of these relationships has been shown to enhance the flow of information, promote trust

and provide an alternative governance structure for transactions (Granovetter, 1985; Uzzi, 1997; Dyer and Singh, 1998; Gulati, 1995).

While relational embeddedness is built on the specificity of partners' identities and is by definition a property of each individual tie, normative embeddedness refers to standards for appropriate behavior that apply to all ties of a given type within a particular field. These normative elements provide rules for how transactions are to be conducted across organizational fields (Biggart and Guillen, 1999; Fligstein, 1996; Greenwood and Hinings, 1996), and they vary across organizational fields. The existence of such standards is most easily seen in research on comparative business systems, where configurations of interorganizational networks and norms for conducting exchange relationships, such as the degree to which transactions are conducted at arms length, vary substantially across nations (Whitley, 1992; Hamilton and Biggart, 1988; Sako 1992). These norms may arise as a response to specific patterns of historical development (Hamilton and Biggart, 1988), from underlying cultural factors (Dore, 1987) or through efforts of powerful actors to promote norms, or "rules of exchange," that advance their own interests and positions (Fligstein, 1990, 1996).

Embedded ties and destabilizing pressures

Research to date has primarily focused on the processes by which embedded ties are

established (Gulati and Gargiulo, 1999) and the effect of embeddedness on outcomes such as

mutual learning, acquisition of information, and survival (Uzzi, 1997). There has been little

research on the dissolution of ties, though several papers study the complementary question of the

persistence of network ties in the face of destabilizing pressures. Levinthal and Fichman (1988), in

their research on client auditor relationships, found that long-lasting, embedded ties were less

likely to be broken in the face of changing resource dependencies. Similarly, Baker, Faulkner and

Fisher (1998) found that long-lasting ties between firms and advertising agencies were more

persistent and less likely to be broken over time. Romo and Schwartz (1995) found that

manufacturers considering moves to lower cost regions were less willing to sever embedded ties

even in the face of immediate cost savings.

These studies contrast embedded ties to non-embedded ties, but do not distinguish among

types of embeddedness. If there is more than one type of embedded tie then they may behave

differently from each other, even while collectively changing more slowly than non-embedded ties.

Different types of embedded ties may respond to different pressures for change. It is also unclear

whether being resistant to change merely means changing more slowly along the same trajectory

as more rapidly changing ties or whether such embedded ties have a different arc of response.

We argue that the degree to which embedded ties respond to destabilizing pressures

depends on both the type of embeddedness and the nature of the pressure. Normatively and

relationally embedded ties respond very differently depending on the source of the destabilizing pressure. In other words, ties are responsive to some pressures for change, but not to others, and therefore, it is necessarily to consider the different types of destabilizing pressures and the mechanisms through which they lead to the breakage of ties separately.

An extensive body of literature documents the processes by which institutional fields are destabilized and give way to broad changes (Greenwood and Hinings, 1996; Tushman and Romanelli, 1985; Fligstein, 1990). Oliver (1992) classifies these destabilizing influences as functional, political, and social pressures. Following this framework, we examine each type of pressure, specify the different mechanisms through which it fosters change, and derive propositions based how susceptible each form of embeddedness is to those mechanisms.

Functional pressures: Oliver (1992: 572) defines functional pressures as the conflict between "economic criteria of efficiency or effectiveness" and institutionalized practices. A long tradition in research in organization theory has documented how these functional pressures lead to organizational change. Firms rethink once effective practices to adapt to new environmental contingencies (Thompson, 1967; Chandler, 1977). Declining performance is a strong signal of maladaptation and triggers the need to search for more effective practices (March and Simon, 1958; Cyert and March, 1963).

Relationships between buyers and suppliers may be particularly susceptible to

reconsideration under times of economic stress. As Tushman and Romanelli (1985: 177) note: "As

webs of interdependent relationships with buyers, suppliers and financial backers strengthen, and

as commitments to internal participants and external evaluating agents are elaborated into

institutionalized patterns of culture, norms and ideologies, the organization develops inertia, a

resistance to all but incremental change." Functional pressures are likely to lead to a crisis that in

turn sparks disruptive change, and leads firms to reconsider these existing routines and patterns of

operation. While such reconsideration could implicate both normatively and relationally

embedded ties, these existing routines and patterns are some of the particular elements that

stabilize relationally embedded ties and support their performance advantages. We therefore

expect functional pressures to have a particularly strong destabilizing effect on relationally

embedded ties.

Proposition 1: Functional pressures will have a greater effect on the breakage of relationally

embedded ties than on normatively embedded ties.

Political pressures In Oliver's (1992: 570) framework, political pressures for change

occur as organizations seek to resolve conflict with external actors who question the value of an

institutionalized practice. Organizations are particularly likely to respond to demands of external

actors on which they are dependent for critical and non-substitutable resources (Pfeffer and

Salancik, 1978). Such actors include buyers and suppliers, providers of financial capital, and the

state. Changes in the identities, relative power, or nature of the demands of these actors are likely

to pressure firms to abandon existing routines and relationships.

Organizations respond to political pressures not only by actually making the changes that

are demanded, but also by coopting the source of pressure, avoiding situations of influence, and

responding symbolically rather than substantively to these demands (Pfeffer and Salancik, 1978;

Meyer and Rowan, 1977). Westphal and Zajac (1998) show this divergence between actual

technical demands and managing the expectations and needs of external constituencies in

adoptions of, and investor response to, corporate governance practices. They find that firms

manage expectations of investors symbolically by announcing long-term incentive plans but not

implementing them. Investors respond to both the symbolic and real, driving up share price even

when the plan is not implemented. For institutional investors, one step removed from the

operations of the firm and unable to evaluate the substance of a reform, such symbols may be

enough.

Because political actors are likely to be at a distance from the inner workings of a firm,

they are unable to evaluate whether changes are real or not, and thus may be satisfied by symbolic

changes. Consequently, we expect political pressures will lead firms to change behaviors that are

less closely tied to core operations. To translate this into our schema of relationally and normatively embedded ties, we predict that political pressures will be more likely to lead to the breakage of normatively embedded ties than relationally embedded ones as a way of demonstrating compliance to these external constituencies. This is because the rationale for normative ties is oriented outward to external legitimacy while the relational ties are oriented to the other partner and thus more directly to the content and purpose of the tie and associated transactions. By severing normatively embedded ties, a firm can signal its compliance while maintaining its more valuable relationally embedded ties.

Firms may also respond to political pressure by breaking the normatively embedded ties because relationally embedded ties are intrinsically harder to break, since they have become intertwined with reciprocity, implicit agreements, mutual investments, and social relationships. A relationally embedded tie is likely to be accompanied by relationship-specific investments, such as production facilities located in close proximity, closely interlinked systems for information exchange or parts procurement (Dyer, 1996; Williamson, 1985). Relationally embedded partners are likely to have developed shared language, shared routines—familiar and certain ways of doing things. While the economic viability of these ties may have waned, they may be costly and difficult to break in the short term (Romo and Schwartz, 1995) and absent necessity, firms are likely to first dissolve the normatively embedded ties. We will come back to this issue of whether embedded ties

are difficult to break for economic or for more social reasons in the discussion section and consider

it in light of some of our empirical results.

Proposition 2: Political pressures will have a greater effect on the breakage of normatively

embedded ties than relationally embedded ties.

Social pressures: Changing behaviors can also occur through changes in socially

constructed norms of legitimate, taken-for-granted behavior. This can occur as new norms of

appropriate behavior sweep through an organizational field. Researchers have documented

numerous cases of such sweeping changes. Fligstein (1990) documents abrupt changes in notions

of legitimate goals and behavior for firms, or what he calls "conceptions of control" throughout the

history of industrial development in the US. In a study of the publishing industry, Thornton (2002),

documents changing "institutional logics," as the emphasis switched from an editorial to a market

logic. Haveman and Rao (1997) document changing institutional logics in the U.S. savings and

loan industry, and their association with changes in organizational forms.

Norms around appropriate behavior in exchange transactions may also change through a

process of deinstitutionalization, or a degrading of legitimacy constraints that hold these

relationships together. This can occur through a process of dissipation (Oliver, 1992), in which

notions of legitimacy of a practice simply decline when denied of ongoing support. It can also

occur through a process of safety in numbers, in which increasing rejections of a practice (such as

rejections of permanent employment) relax the legitimacy constraints that supported that practice

(Ahmadjian and Robinson, 2001). In both of these cases, the effect is a wearing down of the

legitimacy constraints that lead to normative embeddedness, leading to a greater propensity of

breakage.

Proposition 3: Social pressures due to weakening of legitimacy constraints will have a greater

effect on the breakage of normatively embedded ties than relationally embedded ties.

The context: The Japanese auto industry

We apply this framework to the process of dissolution of network ties in the Japanese auto

industry in the 1990's. In the 1980's and early 1990's, relationships between Japanese auto

manufacturers and their suppliers received much attention as a new paradigm for exchange

relationships (Smitka, 1991; Clark and Fujimoto, 1991; Nishiguchi, 1994). Auto manufacturers

and suppliers were found to maintain high levels of interdependence, partial ownership stakes,

long-histories of relationships, and personal ties at various levels. These configurations of buyers

and their core suppliers, linked by equity ties, were often referred to as keiretsu, and researchers

argued that the benefits of these keiretsu relationships for learning and governance were key to the success of the Japanese auto industry (Dyer, 1996).

In the Japanese auto industry, normative and relational embeddedness were particularly significant. Compared to other organizational fields (for example, the US auto industry), all of the ties in the Japanese auto industry were normatively embedded, that is, there were strong normative pressures against breaking ties (and thus tie breakage was extremely rare across all types of ties). Scholars comparing Japanese supply relationships and those of western economies noted that there was a general sense in these relationships of what Dore (1987) referred to as "goodwill" and Sako (1992) referred to as "obligational" contracting, which included a strong tendency towards long-term relationships with business partners. Sako (1992), in her study of contracting relationships in Japan and Great Britain, found that Japanese manufacturers and suppliers generally had greater expectations of the long-term durability of a relationship regardless of the specific details, such as degree of asset specificity, of that transaction. Dore (1987) argued that normative expectations towards exchange relationships in Japan stemmed from Confucian roots of reciprocal obligations.

Within this general normative context encouraging long-term relationships, there was a smaller subset of relationally embedded ties. These relationships encompassed a greater amount of communication, trust, long-term outlook, shared research and development, and ongoing

collaboration in manufacturing. These most deeply embedded relationships tended to be overlaid

by equity ties. Ahmadjian and Oxley (2006) showed that in the Japanese auto industry, auto

manufacturers tend to hold shares in those suppliers that dedicate a large percentage of their sales

to them. Lincoln and Ahmadjian (2000) showed how equity ties accompany dispatch of both

senior executives and employees, and thus provide a structure for personnel exchange. In their

study of Japanese business groups, Lincoln, Gerlach, and Takahashi (1992) found that equity ties

overlaid purchase-supply and financial transactions. In Japanese, the term keiretsu commonly

refers to firms that are tied through equity stakes, and the presence of an equity tie delineates the

supplier's membership in an auto manufacturer's closest circle of relationships.

It is important, in the Japanese context, to understand these ties not simply as ownership

ties, or financial investments for capital gain, but rather, as specific governance mechanisms

through which to manage relationships. There has been some debate as to the specific role of

these ties—and whether they should be seen largely as symbols of commitment (e.g. Gerlach,

1992) or more specific governance mechanisms such as hostages (e.g. Ahmadjian and Oxley,

2004; Flath, 1993; Gilson and Roe, 1993). Regardless of the specific mechanism by which they

operate, however, these ties are important as delineating relationships between suppliers, and

drawing the lines around an inner set of core relationships. In this paper, we use equity ties as a

way to distinguish the relationally embedded from the normatively embedded relationships.

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Destabilizing forces in the Japanese auto industry: In the 1990's, the Japanese auto

industry encountered a variety of destabilizing forces, functional, political, and social in nature.

During the 1990's, many Japanese firms were hit hard by declining asset prices, declining demand,

and burdens of over-expansion during the 1980's boom. These performance pressures were likely

to cause auto manufacturers to rethink the ways that they have been doing business. They gave

auto manufacturers a justification to break long-standing ties, and made them more willing to incur

the costs of breaking familiar routines and relationships. However, not all auto manufacturers were

affected equally. While Nissan was virtually bankrupt in the 1990's, Toyota and Honda reported

some of their best years ever.

H1: Performance will have a greater effect on the breakage of relationally embedded (equity) ties

than normatively embedded (non-equity) ties.

An alternative argument to H1 is that performance pressures will lead to greater breakage

of normatively embedded ties as firms work even more closely with relationally embedded

suppliers. We believe that while this may be the case when a crisis is seen as a short-term

phenomenon that can be overcome, dropping corporate profits in Japan in the 1990's were due to

decreased domestic demand, excess capacity, and unproductive deployment of human and

physical assets, and required more than a temporary adjustment. While this crisis may have driven

firms more closely into the arms of some relationally embedded suppliers, it also gave them an

opportunity to sever or decrease relationships with relationally embedded suppliers that were

somehow misaligned with current corporate goals and had lost their value.

The Japanese auto industry also faced political pressures in the form of an upsurge in

foreign ownership of shares. These foreigners included both institutional investors investing for

their portfolios and foreign auto manufacturers trying to increase their global reach through stakes

in Japanese auto makers. By the end of the 1990's, after our analysis ends, a number of foreign

auto manufacturers had taken controlling stakes in Japanese firms—Renault in Nissan, Ford in

Mazda, GM in Isuzu. During the period covered in this paper, however, foreign shareholders held

large minority stakes, which did not afford them direct control.

These foreign investors tended to bring their own standards of "appropriate" business

practices. Interestingly, while the embedded purchase-supply relationships of Japanese auto

makers had once received international attention and praise, foreign investors tended to see them

as outdated and inefficient. When Renault completed its takeover of Nissan in the late 1990's, for

example, one of its first acts was to dismantle Nissan's keiretsu of suppliers.

Since foreigners did not hold controlling stakes in the Japanese automakers during the

period we study, they were not able to dictate how supplier relationships were to be managed and

hence their pressure was largely political. These foreign shareholders could influence the automakers through exercising voice, by speaking up about how they thought the firm should be run, or by threatening exit through selling their shares. We predict that auto manufacturers responded to this political pressure through symbolic behavior that placated external pressures but did not affect core relationships.

H2: Foreign shareholders have a stronger influence on normatively embedded (non-equity) ties than relationally embedded (equity) ties.

Finally, the exchange relationships in the Japanese auto industry during this period experienced social pressures as Japan experienced a shift in attitudes towards the value of long-term relationships. One reflection of this was the increased propensity of Japanese firms to downsize as the 1990's progressed, reflecting declining normative constraints on severing implicit long-term contracts with employees (Ahmadjian and Robinson, 2001).

We predict that this change in attitudes from the more relational 1980's to the decreasingly relational 1990's led to breakage of normatively embedded ties. As an example of this tendency, consider the end of the relationship between Nissan Motors and Nissan Life Insurance. Nissan Motors and Nissan Life were linked through long-term historical ties. Nissan

Motors did not own shares of Nissan Life, but sent directors to its board. When Nissan Life faced

financial disaster, it approached Nissan Motors (and Hitachi, another firm with long-term

historical ties) for help. Both firms said no, arguing that there was no reason to maintain the

relationship since Nissan Life had no ongoing business value to them (though Nissan Life sold

insurance to their employees). In other words, Nissan Motors' tie with Nissan Life was

normatively embedded, and was severed. This episode received substantial media attention as an

example of changing attitudes towards long-term obligations. Underlying this attention was the

implication that this sort of tie would not have been broken in an earlier period.

These declining legitimacy constraints picked up momentum in the mid-1990's.

Downsizing, for example, began to accelerate from 1993, reaching a peak in 1996 (Ahmadjian and

Robinson, 2001). For this reason, we expect to see the effect of declining legitimacy constraints

only in the period between 1993 and 1996.

H3: The decline of legitimacy constraints led to greater breakage of normatively (non-equity)

embedded ties than relationally (equity) embedded ties between 1993 and 1996.

DATA AND METHODS

Sample: The sample encompasses supply transactions for all major automobile

manufacturers in Japan in 1987, 1990, 1993 and 1996. We obtained information for these

transactions from two reports published by IRC, a Japanese business information firm. One,

Jidōsha Buhin no 160 Hinmei no Seisan Ryūtsū Chōsa ("A Survey of Manufacture and

Distribution of 160 Auto Parts"), was published in 1987 (IRC, 1987; 1996). We used the follow-up

report, on 200 auto parts, to update the transactions for 1990, 1993, and 1996. These reports cover

most of the major parts categories, except for steel and body parts. For each part, the IRC reports

the name of each supplier and the number of units it sold in each year to each auto manufacturer.

There is some difference in the parts covered for each year. We limited our sample to only parts

that IRC reports transactions for all 4 years, 1987, 1990, 1993, and 1996 (although analyses with

an unbalanced panel, of any part reported in any year provide very similar results). Because we

analyzed change in ties, the data set contained observations for three years: changes in ties from

1987-1990, from 1990-1993, and from 1993-1996.

The initial sample contained a total of 11 auto manufacturers, 380 of a total of the 483

suppliers that appeared in any of these 4 years, and 103 parts categories, for a total of 5123 of the

6987 transactions reported across the 4 years. (After removing 3 outliers, as described below, the

final sample had 5120 observations). Each observation is an auto manufacturer/supplier/part triad, and there is a separate observation for each transaction between an auto manufacturer with a given supplier for a given part.

Dependent variables: The dependent variable is a binary variable representing the existence of a broken tie. We define broken ties in several ways. First, and most obviously, a broken tie occurs when a buyer does not purchase a part from a supplier from which it purchased parts the previous period (recall that our data source reports transactions at 3 year intervals). We call this a 100% broken tie. Broken ties of this nature were relatively rare. We believe that though completely broken ties are an important measure of dissolution of relationships, large decreases in purchases should also be considered as broken ties since they represent significant downgrades of exchange relationships. For example, in the 1990's, one of the authors interviewed the head of procurement at the factory of a major auto manufacturer that had just announced that it was breaking its exchange relationship with a supplier. This news had received prominent attention in the media as demonstrating that long-term purchase supply relationships were breaking down. It turned out that while the buyer cut its purchases from the supplier dramatically, it still intended to maintain a lower volume of orders.

In order to capture relationships that were reduced but not completely severed, we defined the dependent variable as different levels of reductions in transactions. Broken ties of 50% or more occurred when a buyer reduced its purchases from a supplier by 50% or more from period t-1 to period t. We calculated broken ties of 70% and 30% in a similar fashion.

One concern with this measurement of broken ties is that they may have represented a temporary decrease in transactions rather than a permanent break. To examine this possibility, we looked at the number of times a tie decrease was followed by an increase. For the 100% break, we found that of 25 ties that were broken between two periods, in only 1 case did the transaction resume in the following period (we looked at the periods 1987-1990, 1990-1993, and 1993-1996 since we do not have data after 1996). For a 70% break, only 4 of 72 breaks resumed, for 50%, 10 of 170 breaks resumed, and for 30%, 35 of 357 breaks resumed (and those that resumed tended to do so at a very low level). This indicates that the larger breaks tended to be permanent, while smaller breaks were more likely to be fluctuations in trading volume.

Independent variables: Our primary measure of relational embeddedness is whether an auto manufacturer held an equity stake in a supplier. As we noted above, in Japan, equity ties tend to overlay relationally embedded exchange relationships. An examination of equity ties in our data set demonstrates the close relationship between equity ties from buyer and supplier and other

connections. For example, an equity tie is more likely to be associated with the dispatch of

directors to sit on a board (correlation .69), as well as with the use of at least one of the same main

banks (correlation .40). Equity stakes are correlated with the dependence of a buyer on a supplier

(.21), and a supplier on a buyer (.51).

Data for equity ties for listed suppliers came from *Kaisha Nenkan* (Nikkei, various years),

annual corporate reports for 1989 and 1998 (reporting equity ties for 1987 and 1996). For unlisted

suppliers, we obtained a binary measure from the IRC report. Since use of a continuous measure of

equity stake would have limited our sample to only listed suppliers, we used the binary variable

(equity stake or not) for all suppliers. Equity ties were remarkably stable between 1987 and 1996

with none broken during this period.

We included one measure of performance of auto manufacturers: return on assets in

between year t-1 and year t (measured as ordinary income, *keijyō rieki*, divided by total assets). We

also conducted analyses using change in sales between these two years and found the results were

similar to those for ROA. These data came from the Nikkei NEEDS database. To measure the

degree of competition from newly entered foreign suppliers, we counted the number of newly

entered foreign suppliers of a part between period t and period t-1. Foreign suppliers were nearly

non-existent prior to 1990. We also included the total number of suppliers for a given part,

calculated from the IRC reports. Foreign ownership was the percent of a firm's shares held by foreign investors in the year t-1 and was obtained from Nikkei NEEDS. Table 1a summarizes how the variables map onto our hypotheses.

We controlled for the total share of an auto manufacturer's purchases of the part from a given supplier (in the previous period), since breakage of 50% or more is likely to be affected by the size of the share initially. Other controls included the total share of a supplier's sales of a given part that went to the auto manufacturer in the previous period, the number of different parts transacted between a given auto manufacturer and supplier, and the size of the auto manufacturer (log of total assets). We were unable to control for supplier size, because this information was available only for listed suppliers, but we included a binary variable equal to one if a supplier was publicly listed as a proxy for size.

Analytical approach: The unit of analysis was the automaker/supplier/part triad, across each of three years (1987-1990, 1990-1993, 1993-1996). The dependent variable was a broken tie (of 30%, 50%, 70% and 100%). Our hypotheses consider the effects of various destabilizing pressures on exchange relationships overlaid by equity, and those without equity ties. Our analyses, then, involve comparing the effect of the different explanatory variables in these equity and non-equity sub-samples.

The unit of analysis is the auto manufacturer/supplier/part triad, and thus, there is a

separate observation for each transaction between an automaker with a given supplier for a given

part. Each dyad is observed over 3 years. While researchers have addressed the issue of

interdependence between dyads (Lincoln, 1984), triads make for a particularly complex data

structure. We have dealt with the problem of interdependence between triads in several ways. First,

we used a probit procedure with robust standard errors adjusted for clustering on supplier (White,

1980). We also estimated models with clustering on automaker and part and the results are similar.

The robust estimator obtains consistent standard errors even when the correlation structure

assumed by a probit model is violated, and allows us to relax the assumption that observations of

the same firm are uncorrelated across time. We included fixed effects for years. In supplementary

models (available from the authors) we included fixed effects for auto manufacturers, and found

that the results were virtually unchanged.

We also included in our models a modified version of Lincoln's (1984) auto-regression

term. We calculated three auto regression terms: the mean of the dependent variable across all

triads (except for the focal triad) that contain $part_i$, the mean of the dependent variable across all

triads (except the focal triad) that contain $automaker_j$, and the mean of the dependent variable

across all triads (except the focal triad) that contain $supplier_k$.

We first analyzed the pooled sample, combining transactions overlaid by equity and those without equity (see for example, Column 1 of Table 3). Next, we constructed a set of variables that broke down each independent variable into two variables: one that took the value of the variable when equity=0, and 0 when equity=1 and the other that took the value of the variable when equity=1, and 0 when equity =0. For example, we created two variables for profit, ROA_0 and ROA_1. ROA_0 was equal to ROA when equity=0, and equal to 0 when equity =1, while ROA_1 was equal to 0 when equity =1 and equal to ROA when equity =0. Column 2 of Table 3 shows the estimates for all independent variables when equity=0, while Column 3 shows the estimates for all independent variables when equity=1. These estimates are all from a pooled model, in which the variables for the equity=0 and the equity=1 conditions are combined and the constant suppressed. To test whether the variables of interest (return on assets, foreign ownership, and year) had different effects on broken ties in the equity and non-equity sub-samples, we conducted Wald tests. Column 4 reports the chi-squared and significance levels for these tests for the hypothesized variables.

We conducted diagnostic tests for model fit, using Pregibon's dbeta (1981), which measures the degree to which coefficients change when one observation is deleted, in order to detect observations that have inordinately large patterns of influence. We removed 3 observations with dbeta of greater than 1 and therefore our analyses are on 5120 observations.

RESULTS

Table 1b shows that an increasing percentage of exchange relationships were broken across the three periods. Interestingly, the propensity to break ties decreased slightly in the 1990-1993 period, and then increased considerably in 1993-1996. Tables 4-7 report results of probit analyses for different levels of tie breakage.

Table 4 presents analyses of 100% breakage of ties. As Table 1b shows, completely broken ties were quite rare, even as the rate of breakage increased between 1993 and 1996. Consistent with H1, profitability, as measured by return on assets, had a significantly different effect in the equity and non-equity samples. Tie breakage was more sensitive to performance in relationally embedded (equity) relationships than in the normatively embedded relationships (non-equity). Contrary to H2, foreign ownership did not have any effect on 100% tie breakage. Supporting H3, the increased propensity to break ties between 1993 and 1996 was apparent only in normatively embedded ties.

Table 5 shows analyses of broken ties of over 70%. As for 100% ties, the functional pressure of profitability was significantly related to broken ties in the equity sample, while social pressure, measured by the year 1996, led to breakage of non-equity ties. The difference in the effect of foreign ownership in the two groups was still not significant, although it was positive and

significant in the non-equity group, and negative and non -significant in the equity group. Table 6, with breaks of 50%, further confirms this pattern, with significant differences in coefficient estimates for performance in 1996, and insignificant differences for foreign ownership, though in a direction consistent with our predictions. Results for breakage of 30% or more are weaker, though they follow the predicted pattern.

Although these results are generally consistent with our hypotheses, they pose several puzzles. The first is the relatively low significance levels of foreign ownership. One explanation is that the variance is relatively low, and levels of significance would be higher in a sample with higher variance on the dimension of foreign ownership. Because the effect of foreign ownership forms a consistent pattern across the analyses of different levels of breakage (except for 30%), and because foreign ownership does have a significant effect on breakage in the sample of equity ties, we conclude that there is evidence consistent with our prediction that foreign ownership is more likely to lead to breakage in normatively embedded ties.

Another puzzle is the decline in the propensity to break ties between 1990 and 1993. As we noted earlier, the loosening of normative constraints against breaking of ties accelerated between 1993 and 1996, and therefore normative constraints against tie breakage were still strong between 1990 and 1993. Therefore, while we cannot explain the decline in tie breakage, this period of decreased tie breakage did not coincide with weakening normative constraints, and thus, is not

evidence to disprove our assertion that weakening normative constraints led to tie breakage.

While our primary focus is not on the establishment of new ties, it is nevertheless interesting to consider how (and whether) broken ties were replaced. Table 8 shows the changing propensity to extend new ties over the three periods in our sample. The increasing propensity to add new ties between 1993 and 1996 suggested that new ties replaced broken ties. However, Table 9 shows that manufacturers were more likely to establish new ties with suppliers in which they already had an equity stake and in suppliers from which they already purchased multiple parts. In other words, new ties were more likely to be extended to relationally embedded suppliers.

DISCUSSION

In this paper, we developed a framework to explain the dissolution of embedded ties as an interaction between different types of destabilizing pressures and different natures of embeddedness. We argued that different pressures for change act through different mechanisms and therefore, while functional, political, and social pressures all lead to the breakage of network ties, they do so in different ways. The influence of these three types of destabilizing forces depends on whether a tie is relationally or normatively embedded. Relationally embedded ties are overlaid by strong social relationships, high degrees of collaboration and interaction, and investments in relationship-specific assets. Normatively embedded ties, on the other hand, have a lower level of

this sort of relational intensity, but are embedded in a more general set of norms surrounding the duration of exchange relationships.

We applied this framework to the Japanese auto industry from 1987 to 1996, and found that functional pressures led to the breakage of relationally embedded ties, while political and social pressures led to breakage of normatively embedded ties. We further found that auto manufacturers tended to establish new ties with suppliers with which they already had a relationship.

This research extends theory on interorganizational relationships and their response to destabilizing forces in several ways. First, while researchers have identified different pressures for change and noted that these pressures can come from functional, political, and social sources, our framework goes one step further in highlighting that these different types of pressures may have very different outcomes. Second, our paper contributes to research on embeddedness and interorganizational networks by providing a framework for understanding de-embeddedness, or dissolution of ties. Furthermore, we extend research on embeddedness by distinguishing between different types of embedded relationships and their implications of the evolution of networks.

Our findings that political and social pressures lead to dissolution of normatively embedded ties, that the increasing propensity to dissolve ties has not been matched by a greater rate of tie formation, and that new ties tend to be formed along the lines of existing relationships

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suggest a "paradox of de-embeddedness."[3] The dissolution of ties does not necessarily mean a

greater propensity towards arms-length transactions. In fact, the combination of breakage of

normatively embedded ties and replacement of broken ties with new ties based on existing

relationships suggests a trend towards even higher levels of relational embeddedness. The

"paradox of de-embeddedness" is that breaking of embedded ties may lead to greater

embeddedness as relationally embedded ties replace normatively embedded ones.

This "paradox of de-embeddedness" adds some insight into the debate over changes in

Japanese economy. While some observers have argued that there have been dramatic changes in

business practices such as buyer-supplier relationships, others see far more continuity (see Dore,

2000, and Yamamura, 1997, for views that emphasize continuity and the business press, especially

The Economist, *Financial Times* and *Nikkei*, for accounts of change). Our research suggests that

change and continuity co-exist, but occur in very different circumstances. As normative

constraints against breaking long-standing relationships fade, relationally embedded ties persist

and even strengthen.

One of the important questions remaining is why firms maintain relationally embedded

ties. Is it because they are useful and productive? Or, is it because they are the most difficult to

break, being overlaid by social relationships, implicit agreements and sunk costs in

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[3] Uzzi (1997) used "the paradox of embeddedness" to contrast the advantages of moderate levels
of embeddedness with the problems at high levels.

relationship-specific investments? Other researchers have noted this dilemma. Seabright et al.

(1992:154) note: "Empirically, it is difficult to distinguish between attachments that reflect

transaction efficiency and those that reflect the embeddedness of a relationship, as the two

properties are likely to covary. Indeed, it is hard to imagine the development of highly specific

relationship capital that does not engender some element of social ties." The fact that

low-performing firms do break relationally embedded ties, however, suggests that at least some of

these ties may be less than optimal, and there are performance advantages to breaking them. On the

other hand, the propensity of successful firms to maintain their group of relationally embedded

suppliers suggests that the benefits of relationally embedded exchange relationships remain.

Our research did not extend past 1996, but developments after 1996 suggest that the

process we document here continued. Toyota, a steadily high performer, remained committed to

its existing patterns of close, relationally embedded purchase supply relationships, while troubled

(and, eventually, foreign-owned) Nissan increasingly pushed both normatively and relationally

embedded suppliers aside. As foreign manufacturers took controlling stakes in Japanese

automakers, including Mazda and Isuzu, keiretsu relationships increasingly broke down in favor of

larger suppliers with greater volume and global scope. One of the biggest changes after 1996 was

that auto manufacturers such as Nissan not only decreased their dependence on many suppliers,

but began to sell their equity stakes in suppliers, something not yet seen in 1996.

Limitations and opportunities for future research: There are a number of limitations in

this study. Some of them are difficult to surmount due to data, while others open up promising

areas for future research. While we believe that, based on our knowledge of the Japanese auto

industry and interorganizational relationships in Japan, equity is a good proxy for relational

embeddedness, finer-grained measures of embeddedness would be useful. However, although in

theory it is possible to collect finer-grained measures of embeddedness through surveys, there are

problems with this approach besides the usual ones of cost, response rates, and reliability of

self-reports. The question of buyer-supplier relationships has become politically charged in Japan,

with firms balancing external demands to unwind old relationships to increase profits with

maintaining obligations to existing suppliers. Automakers seem less willing today to discuss

purchase-supply relationships with outsiders than they were 10 or 15 years ago, when the question

was how other countries could duplicate Japan's success, rather than how Japanese companies are

dealing with financial distress and a difficult external environment. We think that the best approach

to further advancing this framework may be to apply it to other industries where alternative

measures of relational embeddedness are more readily available.

Future development of our theoretical framework would benefit from research in settings

that provide better measures of social pressures for change. Because we only have measures of

broken ties in four years (over a ten year period) and because normative pressures for change only

became apparent between 1993 and 1996, the best we can do is to measure the effect of the year

1996 on changes. It is possible to obtain more detailed measures of attitudinal changes through

rhetoric in the press and by the government, as well as measures of the spread of practices that

reflect attitudinal change, such as downsizing. Research that more closely correlates these

measures with annual measures of broken ties, perhaps from another industry, would be useful.

Our framework could also be extended to consider in more detail the characteristics of the

supplier—for example, size, global reach, and technical capabilities. Particularly interesting would

be a study of the factors that lead a buyer to break ties with a poor performing or less than capable

supplier with which it has a strong, relationally embedded tie.

Finally, this research has implications for the study of business systems and change.

While there is a general understanding that local institutions shape the process by which business

systems evolve, much less has been said on how this actually happens. This paper offers an

example in which destabilizing pressures affect different types of relationships in different ways,

leading to an outcome that is neither complete transformation nor inertia; rather, different elements

change at different paces and for different reasons. We believe that further development of theory

on business systems will benefit from a closer look at exactly how local institutions, be they

interorganizational linkages or other sorts of practices, policies or norms, interact with different

pressures for change.

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Table 1a: Hypothesized relationships

Destabilizing pressure	Independent Variables	Hypothesized effect
Functional (H1)	ROA_{t-1}	Greater for relationally embedded tie (equity) than normatively embedded tie (non-equity)
Political (H2)	Percentage foreign ownership	Greater for normatively embedded tie (non-equity) than relationally embedded tie (equity)
Social (H3)	Time (dummy for '96)	Greater for normatively embedded tie (non-equity) than relationally embedded tie (equity)

Table 1b: Broken ties over time

(Broken ties as a percentage of all buyer-supplier transactions for a given part)

	1987-1990	1990-1993	1993-1996
Broken ties (100%)	.015	.001	.061
70%	.035	.022	.099
50%	.057	.048	.134
30%	.110	.108	.193

Table 2: Descriptive statistics (n=5120)

	mean	Standard deviation	minimum	maximum
Breakage of 50% or more	.081	.273	0	1
Breakage of 30% or more	.139	.346	0	1
Breakage of 70% or more	.053	.224	0	1
Breakage of 100%	.026	.161	0	1
Log assets	13.97	.905	12.65	15.77
Roa t-1	.029	.026	-.027	.107
Total number of suppliers for part	7.57	3.75	2	20
Foreign ownership t-1	.124	.127	.004	.433
Year=93	.332	.471	0	1
Year==96	.357	.479	0	1
1=equity stake in supplier	.203	.402	0	1
% buyer's inputs from supplier (t-1)	.491	.345	0	1
% supplier's inputs from buyer	.384	.383	0	1
Total number of different parts transacted	3.46	4.69	1	26

Table 3:   Correlations

		1	2	3	4	5	6	7	8	9	10	11
1	Breakage of 50% or more	1.00										
2	Log assets	-0.02	1.00									
3	Roa t-1	-0.03	0.46	1.00								
4	Foreign ownership t-1	0.08	-0.06	-0.17	1.00							
5	Total number of suppliers for part	0.08	0.05	-0.01	0.02	1.00						
6	% buyer's inputs from supplier (t-1)	-0.18	-0.13	-0.02	-0.07	-0.11	1.00					
7	% supplier's inputs from buyer	0.01	0.38	0.18	-0.03	0.42	0.15	1.00				
8	Year=93	-0.08	0.00	-0.41	-0.06	0.00	0.01	0.00	1.00			
9	Year=96	0.13	0.02	-0.01	0.21	0.08	-0.06	0.00	-0.53	1.00		
10	1=equity stake in supplier	-0.06	0.37	0.20	-0.09	0.13	0.21	0.51	0.00	-0.02	1.00	
11	Total number of different parts transacted by buyer and supplier	-0.04	0.16	0.15	-0.10	-0.11	0.19	0.04	0.02	-0.03	0.25	1.00

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Table 4: Broken ties of 100% (probit with robust standard errors, 5120 customer/supplier/part triads)

	Broken ties, pooled sample	Broken ties, with equity	Without equity	Significance of difference* (Wald test)
Log assets	-.291***	-.157	-.324***	
	(.063)	(.215)	(.064)	
Roa t-1	1.791	-18.924*	3.944	6.41**
	(3.203)	(8.870)	(3.474)	
Total number of suppliers for part	-.004	-.043	.0001	
	(.015)	(.044)	(.015)	
Foreign ownership t-1	-.104	-1.045	.182	.78
	(.579)	(1.228)	(.622)	
Year=93	-.973***	n.a.	-.834**	
	(.272)		(.267)	
Year==96	.657***	-.086	.731***	7.88**
	(.132)	(.299)	(.134)	
1=equity stake in supplier	-.017			
	(.151)			
1=listed supplier	.107	-.064	.119	
	(.125)	(.378)	(.122)	
% buyer's inputs from supplier (t-1)	-1.592***	-2.117***	-1.518***	
	(.242)	(.478)	(.259)	
% supplier's sales to buyer	.379**	.548	.361*	
	(.151)	(.466)	(.159)	
Total number of different parts transacted by buyer and supplier	-.039*	-.008	-.048**	
	(.019)	(.028)	(.019)	
Constant	.823*			
	(1.010)			
N	5120	1039	4081	
Log likelihood	-471.21			

(*p<.05; ** p < .01; ***p < .001, one-tailed tests; auto-regression term included in regression but not reported)

* Chi-square and significance level

Table 5: Broken ties of >70% (probit with robust standard errors, 5120 customer/supplier/part triad)

	Broken ties, pooled sample	Broken ties, with equity	Without equity	Significance of difference* (Wald test)
Log assets	-.169*** (.045)	-.035 (.199)	-.203*** (.048)	
Roa t-1	-2.689 (1.948)	-25.204*** (6.565)	-.921 (2.092)	13.11***
Total number of suppliers for part	.005 (.009)	-.059 (.038)	.010 (.009)	
Foreign ownership t-1	.510 (.430)	-.881 (1.316)	.779* (.461)	1.34
Year=93	-.347** (.138)	-1.791*** (.489)	-.263* (.140)	
Year==96	.419*** (.099)	-.140 (.246)	.439*** (.103)	5.23*
1=equity stake in supplier	-.330** (.115)			
1=listed supplier	.216** (.081)	.079 (.285)	.209** (.080)	
% buyer's inputs from supplier (t-1)	-1.047*** (.128)	-2.547*** (.481)	-.905*** (.130)	
% supplier's sales to buyer	.350** (.119)	.828* (.458)	.306** (.120)	
Total number of different parts transacted by buyer and supplier	-.011 (.010)	.010 (.016)	-.018 (.014)	
Constant	.831 (.700)			
N	5120	1039	4081	
Log likelihood	-908.25			

(*p<.05; ** p < .01; ***p < .001, one-tailed tests; autoregression term included in regression but not reported) * Chi-square and significance level

Table 6: Broken ties of >50% (probit with robust standard errors, 5120 customer/supplier/part triad)

	Broken ties, pooled sample	Broken ties, with equity	Without equity	Significance of difference* (Wald test)
Log assets	-.125**	-.099	-.163***	
	(.041)	(.146)	(.044)	
Roa t-1	-3.556*	-15.101***	-1.687	9.62***
	(1.786)	(4.321)	(1.870)	
Total number of suppliers for part	.012	-.002	.014*	
	(.008)	(.029)	(.008)	
Foreign ownership t-1	.728*	-.157	.932**	1.69
	(.344)	(.783)	(.375)	
Year=93	-.248*	-.413	-.229*	
	(.118)	(.306)	(.102)	
Year==96	.355***	.049	.353***	1.63
	(.098)	(.216)	(.081)	
1=equity stake in supplier	-.263*			
	(.117)			
1=listed supplier	.246***	.007	.249***	
	(.068)	(.238)	(.069)	
% buyer's inputs from supplier (t-1)	-.896***	-1.471***	-.811***	
	(.099)	(.309)	(.103)	
% supplier's sales to buyer	.350***	.389	.360***	
	(.098)	(.312)	(.098)	
Total number of different parts transacted by buyer and supplier	-.004	-.015	-.001	
	(.007)	(.014)	(.010)	
Constant	.336			
	(.626)			
N	5120	1039	4081	
Wald chi2	249.86			
Log likelihood	-1264.90			

(*p<.05; ** p <.01; ***p < .001, one-tailed tests; autoregression term included in regression but not reported) * Chi-square and significance level

Table 7: Broken ties of   >30% (probit with robust standard errors, 5120 customer/supplier/part triad)

	Broken ties, pooled sample	Broken ties, with equity	Without equity	Significance of difference* (Wald test)
Log assets	-.058*	.040	-.073*	.
	(.034)	(.093)	(.037)	
Roa t-1	-2.690*	-7.712**	-1.942	2.55
	(1.415)	(3.258)	(1.569)	
Total number of suppliers for part	.007	-.015	.012	
	(.007)	(.017)	(.007)	
Foreign ownership t-1	.468	.992	.529	.51
	(.300)	(.603)	(.322)	
Year=93	-.147	-.293	-.138	
	(.098)	(.193)	(.110)	
Year==96	.237**	-.048	.261***	2.63
	(.086)	(.165)	(.094)	
1=equity stake in supplier	-.278***			
	(.076)			
1=listed supplier	.210***	.323*	.181**	
	(.059)	(.167)	(.063)	
% buyer's inputs from supplier (t-1)	-.829***	-1.296***	-.732***	
	(.074)	(.222)	(.078)	
% supplier's sales to buyer	.319***	.674**	.275**	
	(.085)	(.237)	(.087)	
Total number of different parts transacted by buyer and supplier	.002	-.002	.004	
	(.005)	(.010)	(.006)	
Constant	-.524			
	(.535)			
N	5120	1039	4081	
Log likelihood	-1878.54			

  (*p<.05; ** p < .01; ***p < .001, one-tailed tests; auto-regression term included in regression but not reported)

* Chi-square and significance level

Table 8: New ties

(New ties as a percentage of 16,537 possible buyer-supplier ties for a given part)

	1987-1990	1990-1993	1993-1996
New ties	.023	.024	.032

Table 9: Determinants of new ties (probit with robust standard errors, 16537 customer/supplier/part triads)

	New ties
Log assets	.041
	(.025)
Roa t-1	.201
	(1.175)
Total number of suppliers for part	-.023***
	(.006)
Foreign ownership t-1	.534**
	(.172)
Year=93	.022
	(.072)
Year==96	.146*
	(.067)
1=equity stake in supplier	.620***
	(.123)
1=listed supplier	-.014
	(.064)
Total number of different parts transacted by buyer and supplier	.065***
	(.018)
Constant	-2.484***
	(.342)
N	16537
Log likelihood	-1942.19

(*p<=.05; ** p <= .01; ***p <= .001, one-tailed tests; auto-regression term included in regression but not reported)