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Source: *Strategic Management Journal*, Vol. 16, No. 8, (Nov., 1995), pp. 589-619

Published by: John Wiley & Sons

Stable URL: <http://www.jstor.org/stable/2486981>

Accessed: 29/04/2008 05:01

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## RECREATING AND EXTENDING JAPANESE AUTOMOBILE BUYER–SUPPLIER LINKS IN NORTH AMERICA

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*We compare buyer–supplier links established by pairs of Japanese-owned automobile assemblers and component manufacturers operating in Japan and in North America during 1989–90. Eight assemblers and more than 170 Japanese component manufacturers had established North American manufacturing facilities. In total, Japanese automobile assembly organizations operating in North America had recreated about a quarter of their Japanese supply links. The suppliers that set up North American facilities had recreated almost 60 percent of their links with traditional buyers and formed more than 16 percent of the possible extension links with new assembler partners. We identify several economic and organizational factors that influence whether an existing buyer–supplier link will be recreated in a new location and whether firms that do not have a buyer–supplier relationship at home will form an extension link in the new location. We find that the presence of a long-term buyer–supplier relationship, buyer and supplier entry timing to the new location, the joint venture status of the buyer, supplier size, and the breadth of a supplier's sales base in the home market influence the likelihood that links will be recreated and extension links will be formed.*

Companies that set up business operations outside their domestic market often form supply links with home-country suppliers that also have established foreign facilities (Vernon, 1971; Grubel, 1977; Terpstra and Yu, 1988). The suppliers frequently make major contributions to the success of an assembler's international facilities (Lamming, 1990; Blenkhorn and Banting, 1991; Florida and Kenney, 1991). Indeed, close links with home-country suppliers might provide an assembler some of the intangible firm-specific advantages that internalization theorists and international strategists argue are needed to support a firm's international expansion. It is unlikely, however, that any expanding firm will establish links in the new location with all

possible home-country suppliers. We understand little about the firm-level factors that determine which links between home-country buyers and suppliers will be formed in the new location, because most research concerning buyer–supplier ties in international expansion either focuses on a few cases or studies the empirical issue as an aggregate industry-level phenomenon.

In this study, we identify incentives that might lead assemblers that have expanded internationally to establish links in the foreign location with suppliers from the assemblers' home country. Empirically, we examine the buyer–supplier links of Japanese-owned automobile assemblers and first-tier component manufacturers operating in North America during 1989–90. We define a supplier as a company that produces components and an assembler as a company that combines components into an end-product. (In our context, the terms buyer and assembler are synonyms.)

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Key words: interfirm relationships; buyer–supplier strategy; global strategy; automobile industry

In the automobile industry, the assemblers are the motor vehicle manufacturers such as Toyota and Mitsubishi, while the suppliers are firms that manufacture components such as brakes and door latches. In turn, we define a buyer-supplier link as a case in which an assembler purchases components manufactured by a legally separate supplier. We refer to cases in which traditional suppliers and assemblers establish manufacturing facilities in a new location and establish supply relationships as 'recreating' buyer-supplier links. We refer to cases in which firms that do not supply an assembler in the home country establish manufacturing facilities and become suppliers in the new location as 'extending' buyer-supplier links. We identify several economic and organizational factors that influence which home-country links will be recreated and which extension links will be formed.

This research has both topical and general interest. The issue of automobile component supply is generating substantial competitive and political controversy (e.g. Haglund, 1991; *Economist*, 1992-93). A major goal of recent American trade missions has been to force Japanese manufacturers to purchase auto parts from American firms. Political pressure, the changing yen-dollar exchange rate, and improvements in quality and delivery of components have led Japanese buyers to increase their purchases in the U.S.A. Nonetheless, Japanese and American automobile manufacturers now purchase components from many Japanese-owned suppliers owing to lower cost, higher quality, or superior service for some products, and American buyers are likely to increase their purchases from Japanese-owned firms in the future (Davies, 1989). Some argue that continued competition from Japanese suppliers might be needed to strengthen the American automobile assembly and parts-manufacturing sectors (e.g., Gelsanliter, 1990). A more detailed empirical understanding of which buyer-supplier links are being recreated and extended is needed to clarify the discussion. In addition, the general issue of buyer-supplier links in global industries is important to competition throughout the economy. Our arguments and analysis apply to buyer-supplier relations in many manufacturing and service industries and help place the political and competitive issues of buyer-supplier relationships in an accurate context.

The paper proceeds as follows. The following section outlines the importance of long-term interfirm supply relationships and reviews previous analyses of link recreation and extension in foreign locations. We next identify several firm-level factors that might influence link recreation and extension. We then describe the empirical case of Japanese auto industry firms. The subsequent section reports logistic regression estimates of influences on link recreation and extension. The conclusion summarizes the results and raises issues for future research.

### **BACKGROUND: BUYER-SUPPLIER LINKS**

Buyer-supplier link recreation and extension arise as issues owing to the importance of long-term interfirm supply relationships in many industries (Martin, Mitchell, and Swaminathan, 1994). Although strategists once tended to view suppliers and buyers primarily as antagonists seeking to appropriate the profits of existing business activity in an industry chain, we now recognize that effective supply relationships connect the specialized capabilities of several firms and so contribute to the development of new business opportunities (Porter, 1985; Richardson, 1993a). Long-term interfirm supply relationships provide an alternative to the simple make-or-buy choice in which transaction-specific assets are employed internally and general assets are governed through short-term contracts (Williamson, 1975). Even for components that require transaction-specific investment, long-term relationships with suppliers are often superior to internal sourcing when suppliers can produce higher-quality or lower-cost goods than an internal operation (Nishiguchi, 1994). Long-term supply relationships tend to be superior to short-term relationships when products are complex, technology is changing, there are complicated interactions among components, information transfer is difficult and uncertain, or when a trading relationship requires specialized human skills (Monteverde and Teece, 1982; Helper, 1987; Masten, Meehan, and Snyder, 1989; Lyons, Krachenberg, and Henke, 1990).

Firms engaged in long-term supply relationships often shift product development responsibilities from the assembler to the supplier, exchange

technical and marketing personnel, or carry out other cooperative activities (Hayes and Wheelwright, 1984; Womack, Jones, and Roos, 1990; Clark and Fujimoto, 1991), so that the suppliers play integral roles in defining and achieving the assemblers' objectives (Blenkhorn and Banting, 1991). Interorganizational links such as long-term buyer–supplier relationships might also help firms develop the trust needed to secure an effective partnership (Cusumano, 1985; Heide and Miner, 1992), reduce the effects of environmental uncertainty (Pfeffer and Salancik, 1978), ensure a stable flow of resources in times of scarcity or environmental turbulence (Stearns, Hoffman, and Heide, 1987), and reduce risks (Contractor and Lorange, 1988). Because creating a set of effective buyer–supplier relationships tends to be a slow and difficult process (Eccles, 1981; Heide and John, 1990), firms that possess such relationships have advantages that competitors can not replicate quickly. Therefore, effective long-term supplier relationships contribute to the success of a firm's domestic operations and offer a potential source of advantage when a firm establishes foreign facilities.

When a firm establishes production facilities in a location outside its home country, the company will often benefit if it can draw on some of its existing ties with suppliers rather than undertake internal production or establish links with locally based suppliers for all components required in the new location. In-house production at the new location is not feasible for components for which an assembler lacks capabilities or volume. New locally based suppliers often lack the requisite technical skills to produce the desired components or the organizational skills required to establish suitable buyer–supplier links. To the extent that the foreign assembly facility is similar to the buyer's home country operations, some existing suppliers will possess technical and organizational skills suited to the new location. In many cases, therefore, an assembler will benefit by reestablishing some of its existing buyer–supplier links in the new location (Lamming, 1990; Blenkhorn and Banting, 1991). In part, the suppliers can serve the buyer's foreign facility by exporting components to it. Importing is often difficult and prohibitively expensive, however, because of transportation costs, trade laws, tariffs, political pressure to purchase components in the host

location, and the logistical requirements of just-in-time manufacturing processes (Encarnation, 1987; Turnbull, Oliver, and Wilkinson, 1992). Therefore, it sometimes will be necessary for the supplier to manufacture components in the foreign location.

The value of supplier expansion in concert with buyer expansion relates closely to current theories of international expansion and technical development. Internalization theorists argue that firms expand beyond their home markets in order to realize the value of intangible assets such as technical skills and organizational competence (Coase, 1937; Caves, 1971, 1982; Dunning, 1973; Buckley and Casson, 1976; Morck and Yeung, 1991). Similarly, international strategists argue that firms can increase and leverage the value of assets by expanding globally (Vernon, 1971; Hymer, 1976; Kogut, 1985; Porter, 1986; Prahalad and Doz, 1987; Bartlett and Ghoshal, 1989; Casson, 1990). From this point of view, established buyer–supplier relationships provide an additional intangible asset that might assist with international expansion (Grubel, 1977; Gray and Gray, 1981), because part of a buyer's technical skills and other capabilities will exist in the form of intangible interorganizational routines that link it with its suppliers. Moreover, existing suppliers may contribute to a buyer's absorptive capacity, which Cohen and Levinthal (1990: 129) define as a firm's ability to assimilate and apply new external information, by helping its partner scan the new environment and acquire needed capabilities to operate within it. Hence, expanding buyers often will benefit if some of their suppliers also expand.

Several studies have addressed supplier expansion following international expansion of the buyer. Some authors have argued that manufacturing and service-sector suppliers will often follow their customers abroad and several case studies describe examples (e.g., Brimmer and Dahl, 1975; Rangan, 1985; Burton and Saelens, 1986; Turnbull and Doherty-Wilson, 1989). Some North American auto component manufacturers made foreign direct investments when American car manufacturers expanded into Europe (Vernon, 1971), for example, and component companies such as Bendix are now major suppliers to American-owned automotive facilities in Europe. Similarly, European suppliers such as Philips are now establishing North

American manufacturing facilities to serve the new BMW automobile-manufacturing facility in South Carolina. Systematic empirical studies, mainly of banking and advertising companies (e.g., Safarian, 1966; Grubel, 1977; Gray and Gray, 1981; Terpstra and Yu, 1988; Goldberg and Johnson, 1990; Seth and Quijano, 1991), conclude that many service sector suppliers follow when their customers expand. However, most studies measure correlations between aggregate foreign direct investment by a customer industry and aggregate foreign direct investment by a supplier industry, rather than examine firm-level decisions. Therefore, the studies provide little information concerning which suppliers in an industry will expand and which buyers they will sell to after expanding.

Identifying influences on which buyer-supplier links will be recreated in the new location is a key strategic and organizational question. Although dealing with traditional suppliers after setting up new facilities offers important benefits for a new assembly operation, recreating existing links also poses substantial trade-offs relative to establishing links with new suppliers. New conditions in the foreign location will challenge the stability of interorganizational relationships (Leblebici and Salancik, 1982). On the one hand, existing suppliers contributed to past competitive success and often possess knowledge that is relevant to current competitive needs. Conversely, new suppliers might understand the new operating environment better than traditional suppliers, while the assembler's manufacturing facility in the new location might not provide sufficient volume for a traditional supplier to set up a new plant. Moreover, international expansion by a single firm creates difficulties that stem from complex organizational structures and cultural diversity (Hofstede, 1980; Caves, 1982; Kogut and Singh, 1988). Owing to the conflict of benefits and problems, an expanding assembler is likely to recreate only some of its existing buyer-supplier links in the new location. We need greater systematic understanding of which buyer-supplier links will be recreated.

Identifying influences on link extension also is an important issue. From an assembler's point of view, home country suppliers that serve a firm's home-country competitors sometimes become useful sources of supply in international markets when the assembler cannot recreate

links with traditional suppliers (Pastré, 1981). An extension relationship has advantages if there are systematic differences in buyer-supplier relations among firms based in different countries (see Kogut, 1991). In the automotive industry and in other industrial sectors, for example, firms based in a given country have long tended to adopt practices that resemble those of other firms from the same country more than they resemble practices of firms from other countries (Lamming, 1990; Lieberman, 1990; Cusumano and Takeishi, 1991; Florida and Kenney, 1993). If two expanding buyers from the same country follow similar practices with their suppliers, it often will be easier for one to deal with the other's supplier in the new location than to establish a link with a local supplier in the new location. Forming extension links might allow a buyer to avoid the potential of high switching costs created when a firm depends on a single supplier for a key component, especially if few of a buyer's traditional home-country suppliers for a particular component have established foreign facilities. In the U.S.A., firms frequently carry out internal production of goods for which switching costs would be high (Walker and Weber, 1984, 1987). As an alternative, an assembler that sets up international facilities might use new home-country suppliers to create multiple sourcing or parallel sourcing arrangements. Richardson (1993b) argues that parallel sourcing, which involves using different suppliers of similar goods for different projects, approaches the quality and scale benefits of sole sourcing while avoiding the potential hold-ups inherent in depending on a single supplier.

## RESEARCH ISSUES

We pose our queries concerning link recreation and extension as research issues owing to the exploratory nature of the study, but where appropriate the likely direction of relationships is identified. The discussion applies to recreation and extension incentives for pairs of suppliers and buyers. The theoretical motivation for the discussion draws from considerations of volume economies, interorganizational learning, and interorganizational power. Our choice of particular factors to study is affected by empirical availability in the auto industry, but the factors are applicable

to many other cases. The arguments address the perspective of buyers that have established international manufacturing facilities and all home-country suppliers, thereby treating a supplier’s decision to expand to the new location and the firm’s decision to sell to a particular buyer as joint decisions. The set of pairwise relationships involving these firms is defined as the all-supplier sample. The statistical analysis that follows will also examine a sample that includes recreation and extension links only for the suppliers that have expanded to the foreign location, which is defined as the transplant-supplier sample. (The term ‘transplant’ refers to automobile assembly and component-manufacturing facilities established in foreign locations.) The paper addresses characteristics of each potential buyer–supplier pair and characteristics of each individual buyer and supplier. Table 1 summarizes the expected influences on link recreation and extension in the all-supplier sample.

**Characteristics of buyer–supplier pairs**

The past experience of individual buyer–supplier pairs is likely to affect link recreation and extension incentives. Long-lasting economic

relationships often lead to valuable interorganizational partner-specific experience with administrative systems (Van de Ven, 1976), as well as relationship-specific assets and skills such as idiosyncratic information and specialized technology (Asanuma, 1989; Fichman and Levinthal, 1991). Long-lasting relationships also promote interorganizational trust that reduces fears of opportunism (Granovetter, 1985; Williamson, 1985: 120–123). The relationships create both interfirm capabilities and interfirm dependence (Weick, 1979; Aldrich and Whetten, 1981). Thus, we expect buyers and suppliers with long-established relationships in the home country to be particularly likely to recreate manufacturing links in the new location.

Firms that were once trading partners in the home country but no longer have a supply relationship face conflicting incentives to establish an extension link in the new location. Any negative experience that led to the breakdown of the home-country relationship might discourage attempts at establishing a link at foreign operations. On the other hand, the former supplier might retain buyer-specific experience that makes it a more likely choice than a completely unknown supplier for serving the assembly facility.

Table 1. Expected influences on the likelihood that a particular buyer–supplier link will be recreated or a potential extension link will be formed<sup>a</sup>

	Recreation	Extension
<i>Buyer–supplier characteristics</i>		
Long past experience	+	?
<i>Buyer characteristics</i>		
Production experience in new location	+	0
Production volume in the new location	+	+
Home-country production volume	?	?
Number of suppliers in home country	–	+
<i>Joint venture status</i>		
Venture with home-country buyer	–	+
Venture with local buyer	?	?
<i>Supplier characteristics</i>		
Supplier size	+	+
Supplier expanded before buyer	+	+
Number of buyers in home country	+	+
<i>Captive supplier</i>		
Captive of buyer that has expanded	?	–
Captive of buyer that has not expanded	n/a	–
Sell only to buyers that have not expanded	n/a	–

<sup>a</sup>The predictions address the all-supplier sample, which includes all home-country buyers that have established foreign facilities and all home-country suppliers.

## Buyer characteristics

### *Production experience in the new location*

We expect longer buyer production experience in the new location to be associated with greater likelihood that a buyer-supplier link will be recreated. Assemblers that are among the first to expand to a new location might choose to depend on local suppliers for components that cannot be imported or produced internally but, to the extent that local firms do not follow the same supply practices that the buyer is familiar with in its home country, the early-entrant firm is likely to encourage its home-country suppliers to establish foreign facilities in order to recreate relationships with them.

A factor that might oppose this prediction is that many early entrants to foreign markets fail (Hood and Young, 1979; Mitchell, Shaver, and Yeung, 1993, 1994). If there is high uncertainty concerning the success of an expanding buyer, suppliers might be reluctant to establish new manufacturing facilities to serve an early-entrant buyer's first production needs. If home country suppliers refuse to establish new facilities, early-entrant buyers might be forced to rely on local suppliers for their early production needs rather than recreate links with many traditional suppliers. Buyers that establish successful local supplier links during their early years in the new location then might be loath to disrupt their local supply relationships by recreating links once the buyer's survival is assured and home-country suppliers become more willing to establish new facilities for them. Nonetheless, we expect longer buyer experience in the new location to have a positive effect on link recreation in cases in which early-entrant buyers were credible firms with reasonable chance of expansion success.

We expect longer buyer production experience in the new location to have no overall association with link extension because both older and newer buyers will be extension targets for suppliers. Earlier-entrant buyers will have more time to form extension links with suppliers of which they did not have first-hand knowledge (see Dunning, 1986). At the same time, however, later-entrant buyers will often draw on earlier-entrants' suppliers. Therefore, we expect little difference in the likelihood that earlier and later-entrant buyers will establish extension links.

### *Production volume in the new location*

We expect a buyer's production volume in a new location, which often will be related to longer experience, to be positively related to the likelihood that any one link will be recreated or any one potential extension link will be formed. The greater the production volume, the greater the opportunity for a buyer's existing suppliers to achieve sufficient volume economies to justify facilities in the new locale. Also, the larger the buyer's volume in the new location, the more a home-country supplier stands to gain from establishing a link in the new location and the more the buyer stands to lose if it deals with an inefficient local supplier. In addition, larger organizations often have stronger administrative skills than smaller organizations (Penrose, 1959), so that buyers with greater production volume in the new location might be better able to manage the process of recreating partnerships and establishing extension links.

### *Home-country production volume*

Whether the level of buyer home-country production volume will affect link recreation is uncertain, because of conflicting influences of scale and interorganizational power. In the presence of scale economies, which are common in the automobile sector (Pratten, 1971; Scherer, 1980), the larger the buyer's home-country operations, the more likely existing suppliers will operate scale-intensive equipment in the home country. Buyers that expand internationally tend to produce substantially smaller volumes in the new location than in their home country at first (Kogut, 1983). In such cases, a supplier to a large home-country buyer that recreates the relationship in the new location will need to operate different production systems in the two locations or operate a supply facility below optimal scale in the new location; both options create disincentives for an incumbent supplier to set up foreign operations. From an interorganizational dependence perspective, however, a recreation incentive arises owing to the link between firm size and bargaining power. Other things being equal, a large buyer can exert more power over its trading partners than can a small buyer because the larger firm threatens greater harm to its partners should it withdraw its business

and offers greater potential benefits of increased future purchases (Pfeffer and Salancik, 1978). Insofar as buyers are larger than their suppliers, resource dependence theory would predict that larger home-country buyers will be more likely to recreate supplier links in the new location. The relative impact of the economic scale and power dependence influences on link recreation is an intriguing empirical question.

We have no prior expectations concerning the association between link extension and a buyer's home-country production volume. From the point of view of a supplier considering extension opportunities, serving a new customer in the new location might lead to later opportunities to sell goods to that customer in the home country (Grubel, 1977; Gray and Gray, 1981). Whether this potential opportunity will provide incentives for suppliers to establish extension links with buyers that have larger home-country operations is an empirical question.

#### *Number of home-country suppliers*

The number of suppliers that a buyer deals with in its home country might have opposite influences on the likelihood of recreation and extension. Buyers with many home-country suppliers might possess broader supplier management skills than buyers that deal with few suppliers, and so might find it easier to create any available extension links abroad while having less need to form recreation links.<sup>1</sup>

#### *Joint venture status*

Cases in which buyers operate in the new location as joint venture partners with other buyers also might affect link recreation and extension incentives. When a joint venture is established by two home-country competitors that do not have identical sets of suppliers in the home

country, the joint venture's pool of candidates for partnership recreation will be larger than if each buyer established an independent facility. Hence, any one supplier recreation relationship is less likely to be established by a buyer that is part of an assembly joint venture than by a buyer that operates a single-owner facility. Similarly, the pool of extension candidates will be smaller for the joint venture, so that any one supplier extension link might be more likely to be established by a buyer that is part of an assembly joint venture than by a buyer that operates a single-owner facility. Sharing each other's supplier base might also reduce the chance that one assembler can exert undue control over the joint venture (Harrigan, 1985).

When a joint venture is established by a home-country company and a local competitor (e.g., between a Japanese automobile assembler and a North American assembler), the joint venture might draw heavily on the local company's pool of local suppliers. If so, then such cross-national assembly joint ventures might be less likely than other buyers to recreate partnerships and establish extension links. Conversely, the strength of the expanding firm's suppliers and other suppliers from its home country might be part of the attraction of the joint venture for the local firm. Burgers, Hill, and Kim (1993) argue that firms sometimes use joint ventures or other alliances to gain access to their competitors' strategic capabilities. If the foreign firm's supply base is part of its attraction to the local company, recreation and extension will be at least as likely as for other buyer organizations.

#### **Supplier characteristics**

We next identify factors that make links with particular assemblers more or less desirable from a supplier's viewpoint. Although suppliers often realize less stability and lower profitability than assemblers (Caves and Uekusa, 1976), suppliers also might gain important benefits from long-term buyer–supplier relationships. Suppliers that enjoy long-term ties with one or more assemblers might have more predictable markets and better information for product development and production planning than suppliers that rely primarily on short-term relationships with customers. Both the supplier and the buyer might benefit from a long-term buyer–supplier relationship, therefore,

<sup>1</sup> A buyer with many suppliers in the home country has many recreation candidates and few extension candidates. For instance, a buyer that dealt with all but one supplier in the home country would have recreation opportunities with all those firms, but an extension opportunity with only one supplier. Because our focus is on buyer–supplier pairs, the variation in the number of candidates does not create a statistical dependency between the number of suppliers that a buyer deals with in the home country and the likelihood that the buyer will form any particular recreation or extension link in the new location.

and both firms must assess the benefits of recreating and extending supply relationships.

#### *Supplier size*

Large suppliers are more likely to recreate and extend links than small suppliers. As a supplier's size increases, the organizational and financial resources available to it also increase (March and Simon, 1958; Sharfman *et al.*, 1988). The literature on foreign direct investment suggests that large firms are more likely to possess resources for international expansion and can spread the costs of foreign operations over a large base of R&D and administration (e.g., Horst, 1972; Caves, 1982). In addition, large suppliers might be able to make a foreign plant benefit from large spillovers of home-country experience. Thus, larger suppliers are more likely to expand and are more likely to recreate links in the new location. Larger suppliers also are more likely to form extension links because greater size improves a supplier's power relative to any of its current buyers that are reluctant to allow their suppliers to form links with new buyers (Pfeffer and Salancik, 1978).

#### *Supplier expanded before buyer*

We often think of suppliers expanding after or at the same time that their buyers set up foreign facilities. However, there are two types of cases in which some suppliers establish facilities in the new location before their potential recreation and extension partners expand. First, some suppliers might expand before any home-country buyer sets up a foreign manufacturing facility, in order to sell components to foreign buyers. Second, a supplier might enter the foreign location after some home-country buyers expanded but before a particular recreation or extension candidate sets up its foreign facilities. In either situation, home-country suppliers that expanded before their potential partners from the home country are likely to be particularly desirable recreation and extension targets because of the suppliers' established local presence.

#### *Number of home-country buyers*

The number of buyers a supplier serves domestically creates positive incentives for link

recreation and extension. The more domestic buyers that have established foreign facilities, the more opportunities there will be to achieve minimum efficient scale as the partners expand, which raises the incentives for link recreation. Once the supplier expands in order to recreate a first link, the company will be available to recreate links with other assemblers in the new location. Moreover, a supplier with many home-country buyers possesses substantial interorganizational experience, whether or not the buyers have expanded, which will tend to make the supplier a desirable candidate for recreation and extension links in the new location.

The question of the number of home-country buyers addresses an underemphasized and important point. Discussions of buyer-supplier relationships in general and Japanese buyer-supplier relationships in particular often view buyers as the dominant and even exploitative partners in the relationships, with suppliers tending to be captive to a single buyer (see Lincoln and McBride, 1987). In practice, though, suppliers often deal with many customers and we are beginning to recognize that interfirm relationships in Japan and elsewhere often are mutually beneficial (Lincoln, 1990). Although customers might fear potential leakage of proprietary knowledge when a supplier also deals with competitors (Lamming, 1990), some suppliers possess sufficient skill or volume economies to outweigh proprietary concerns. In such cases, suppliers tend to have a substantial degree of autonomy from any one buyer. In this empirical case, some Japanese suppliers have very strong technical and financial resources and deal with many buyers. Firms such as NSK Bearing and Nippon Denso, for instance, exercise substantial independence in their choice of what new capabilities to develop, where to expand, and who to deal with. Similarly, U.S. auto component suppliers such as ITT, TRW, Johnson Controls, and many others do not depend on a single buyer. Such cases are more likely to involve bilateral dependence between buyer and supplier than unilateral dependence of a supplier on its customers. Indeed, suppliers might be the stronger partners in some relationships. Given current trends in the auto industry and other manufacturing sectors, in which out-sourcing of components and supplier-led design play

increasingly important roles, supplier power is likely to increase in the future.

One might question whether firm-specific advantages are a relevant issue when a supplier deals with more than one customer, because it might appear that any advantage that stems from buyer-supplier relationships could be imitated and would dissipate. However, firm-specific routines will tend to develop between a buyer and supplier even when the supplier deals with other customers. The routines will incorporate idiosyncratic characteristics of the buyer and supplier and thereby reflect the history of the relationship between the two firms. In addition, the customer might benefit from skills the supplier has learned from its other customers. Suppliers that have experience with several customers may then provide particularly valuable support to assemblers' foreign expansion.

#### *Captive suppliers*

The issue of buyer dominance does arise in the case of captive suppliers. The case in which a supplier has only one buyer is an extreme case of the number of buyers. A captive supplier of a buyer that has expanded faces conflicting incentives to recreate the buyer-supplier relationship in the new location. Such a captive supplier case is a monopsony situation that represents extreme small numbers bargaining (Williamson, 1985). Lamming (1990) discusses competitive advantages that might stem from especially tight relationships between a supplier and one assembler. A captive supplier and its buyer might develop particularly strong firm-specific interorganizational experience that is valuable in the buyer's new location. We expect captive suppliers that establish facilities in the foreign location to be very likely to recreate links if their traditional partner also has established a foreign facility, but the captive supplier might lack scale and organizational experience needed to support its own international expansion. Hence, when analyzed in terms of all possible recreation pairs, the likelihood that a captive supplier of a buyer that has expanded will recreate the relationship is an empirical question.

Captive suppliers might be particularly unlikely to form extension links. Captive suppliers that expand to the new location in order to serve their buyer's foreign operations might be sufficiently

dominated by their single partner that establishing a link with a new company is not possible even if the supplier views it as desirable. Captive suppliers of buyers that have not expanded are not candidates for link recreation, and often will lack the interorganizational experience needed to expand to the new location and establish links with new partners. The case where the buyer has not expanded generalizes to situations where the supplier has several domestic buyers, none of which has expanded. Such a supplier is not a candidate for link recreation and, we expect, will be unlikely to set up foreign facilities and form extension links.

The characteristics of individual buyers and suppliers and of buyer-supplier pairs that we have outlined in this section are especially relevant in the automobile industry. We next review the importance of buyer-supplier relationships in the industry and describe the data concerning buyer-supplier relationships among Japanese-owned automobile assemblers and component manufacturers operating in Japan and North America.

### **BUYER-SUPPLIER RELATIONSHIPS IN THE AUTO INDUSTRY**

Buyer-supplier relationships are particularly important in the automobile industry, where many components must be combined to create the final product and technological change is ongoing. Until recently, North American auto makers followed a short-term contracting approach with most external suppliers (Cusumano and Takeishi, 1991; Helper, 1991). The short-term approach worked well enough when all major competitors followed a similar strategy, but the practice created competitive disadvantages when new competitors based in Japan introduced more effective supplier strategies. Closeknit long-term buyer-supplier relationships are commonly held to be more prevalent in Japan than in North America. Japanese auto assemblers tend to establish in-depth relationships with a limited number of first-tier suppliers that subcontract part of the production to second-tier suppliers and, in turn, to third-tier suppliers that specialize in manufacturing processes such as pressing, cutting, welding, forging, and casting (McMillan, 1990; Ballon, 1992). Although esti-

mates vary somewhat, Turnbull, Oliver, and Wilkinson (1992) suggest that there are several hundred first-tier suppliers, about 900 second-tier suppliers, and as many as 10,000 third-tier suppliers in the Japanese auto sector. In recent years, Japanese assemblers as a group outsourced over 70 percent in value of their automotive components—substantially more than American or European mass producers (Cusumano, 1985; Odaka, Ono, and Adachi, 1988: 54). Although the length of individual contracts often is no longer in Japan than in the U.S.A. (Asanuma, 1989; Helper, 1991; Smitka, 1991), buyers and suppliers maintain longer time horizons because there tends to be a higher likelihood that contracts will be renewed. Cole and Yakushiji (1984) found that effective buyer–supplier links provided Japanese auto manufacturers with significant cost advantages relative to North American manufacturers during the early 1980s. Clark, Chew, and Fujimoto (1987), meanwhile, found that suppliers to Japanese automotive plants designed more than three times as many new parts as suppliers to North American plants and attributed part of the Japanese assemblers' technical superiority to supplier involvement in the design process. Long-term buyer–supplier relationships are integral parts of the firm groups that many authors argue provide Japanese firms with substantial competitive advantages relative to American and European competitors (e.g., Gerlach, 1987).

Many Japanese suppliers and assemblers are associated in groups that are often referred to as vertical *keiretsu* (Gerlach, 1992)—a term that also is used to describe bank-centered groups (Lincoln and McBride, 1987). The vertical *keiretsu* structure is sometimes held to promote close coordination of buyers' and suppliers' decisions in areas such as product design and plant investment, because communication is facilitated by formal suppliers' associations that promote information sharing (Cusumano, 1985; Smitka, 1991). However, evidence concerning the uniqueness and effect of vertical *keiretsu* is weak. Bensaou (1992) reported that visits between buyers and suppliers were at least as common among U.S. automotive firms as among Japanese companies. In a multiindustry sample, Hennart and Park (1994) found that simply knowing that a *keiretsu*-affiliated manufacturer had expanded to the U.S.A. did not help to

explain whether a supplier would expand by 1986. Further empirical research concerning link recreation and extension when Japanese firms expand internationally is warranted.

Many first-tier Japanese suppliers now operate North American manufacturing facilities. Just as Honda, Toyota, Mazda, and other automobile manufacturers have established assembly transplants in Canada, the U.S.A., and Mexico, so have component suppliers such as Nippon Denso and NSK set up component-manufacturing facilities on this continent. Therefore, the automotive industry provides an empirical setting to study factors that influence the recreation and extension of buyer–supplier links as assemblers and suppliers establish manufacturing operations outside their home country.

#### **Japanese assembly and supply transplants in North America**

We examined recreation and extension links established by Japanese automobile manufacturers operating in North America. Columns 1–5 of Table 2 summarize the following information. By 1990, eight of 11 Japanese automobile manufacturers set up manufacturing facilities in North America, either as wholly owned operations or as joint ventures. Honda was the first to enter, with an Ohio plant that went into production in 1982, and the company has since opened two new plants in Ohio and a facility in Ontario. The Nissan Motors plant in Tennessee began production in 1985 and the company has since established a plant in Cuernavaca, Mexico. A 50 : 50 joint venture between Toyota and General Motors in California (Nummi) also went into production during 1985. Toyota opened wholly owned plants in Ontario and Kentucky during 1988. Mazda set up a wholly owned plant in Michigan in 1987, where it produced cars for itself and for Ford. Ford took a partial ownership position in 1992. In 1988, Mitsubishi and Chrysler established the Diamond Star 50 : 50 joint venture in Illinois, which Mitsubishi recently began to take over as a wholly owned operation. During 1989, Subaru and Isuzu opened a 51 : 49 joint venture in Indiana (SIA) and Suzuki and General Motors set up a 50 : 50 joint venture in Ontario (CAMI). Among the Japanese motor vehicle manufacturers, only Daihatsu, Hino, and Nissan Diesel lacked North American manufac-

Table 2. Summary of Japanese auto assembler links with Japanese auto suppliers in North America, 1989-90

Assembler (1)	Production 1988-89 <sup>a</sup> (000 units)		Began North American production (year) (4)	Joint venture in North America (partner) (5)	Supplier links in Japan (no.) (6)	Total links (no.) (7)	Recreation links: buy from supplier in Japan		Extension links: do not buy from supplier in Japan (no.) (10)
	North America (2)	Japan (3)					(no.) (8)	(%) <sup>b</sup> (9)	
Honda	364	1328	1982		188	102	78	41	24
Nissan Motors	113	2293	1985		186	67	58	31	9
Toyota: Nummi	161	3972	1985	Nummi (General Motors)	166	35	27	16	8
Mazda	192	1245	1987		196	68	54	28	14
Mitsubishi	47	1255	1988	Diamond Star (Chrysler)	224	46	35	16	11
Toyota (Independent)	85	3972	1988		166	66	53	32	13
Isuzu	3	566	1989	SIA (Subaru)	167	66	40	24	26
Subaru	3	576	1989	SIA (Isuzu)	154	65	41	27	24
Suzuki	1	857	1989	CAMI (General Motors)	171	41	29	17	12
Daihatsu		643			143				
Hino		60			141				
Nissan Diesel		40			139				
Column totals						556	415		141
Column averages	108	1401			170	62	46	26	16
No. of distinct suppliers					670	159 <sup>c</sup>	152		68

<sup>a</sup>Unit production is 1988 and 1989 average (only 1989 for Isuzu, Subaru, and Suzuki in North America, and Daihatsu, Hino, and Nissan Diesel in Japan).

<sup>b</sup>Column 9 = column 8/column 6.

<sup>c</sup>An additional 14 suppliers had North American facilities but there was no record of any links with the assembler transplants in 1989-90.

Links with Japanese suppliers in North America

turing facilities in 1990. The assemblers' 2-year average annual 1988–89 North American automobile production ranged from fewer than 1000 to 364,000 vehicles. Their Japanese production volume during the same period ranged from fewer than 600,000 to almost 4 million vehicles.<sup>2</sup>

To analyze which recreation and extension links were formed required that we identify individual buyers and suppliers, determine whether they had home country relationships, and determine whether they established relationships in North America. We first used a study of the Japanese auto industry produced by Dodwell Marketing Consultants (1990) to identify buyer–supplier relationships in Japan. By our definition, a supplier–assembler link meant that the assembler sold at least one type of component directly to the assembler. From this source, we identified 670 first-tier Japanese-owned automobile component suppliers that supplied components to Japanese-based operations of the 11 Japanese automobile manufacturers during the 1989–90 period. Our set of first-tier suppliers is at least as comprehensive as that identified by others (e.g., Turnbull *et al.*, 1992). The range of components was vast, including brakes, carburetors, automatic transmissions, catalytic converters, windshields, air bags, headlamps, plastic trim, and many other goods. For almost all cases, we were able to determine whether each supplier sold components to each assembler. The number of supplier links ranged from 139 to 224 for the assemblers, with an average of 170 links (column 6 of Table 2). The incidence of supply relationships we identified for Toyota and Nissan are similar to those reported by Ikeda (1987: Table 2).

We then turned to a study of Japanese component suppliers that operate in North America prepared by ELM International, Inc. (1991). This guide reports supply links between Japanese-owned component suppliers based in

North America and auto manufacturers located in this continent, and provides the most comprehensive listing of automobile component manufacturers available. From this guide, we identified Japanese-owned component manufacturers based in North America that sold at least one type of component to a Japanese auto assembler located in Canada, the U.S.A., or Mexico.

To compare the data from the Dodwell and ELM sources, we examined the overlap among the identity of the suppliers and the products supplied by them. Because the two lists differ in level of detail for many components, we also tried to determine whether any components would be used only in a given market. Features such as catalytic converters, automatic transmissions and air bags until recently were used only in North America, but in each case there was at least one Japanese producer and the component was used in some Japan-made vehicles, so we concluded that all components included in ELM were part of the industry set. We included only manufacturing ventures, thereby omitting 38 companies listed in the ELM guide that had set up only sales offices on this continent. We excluded one product from the Dodwell list that we do not believe is used in North America—speed limit alarms—but no first-tier supplier was removed from the Japanese list because manufacturers of speed limit alarms also manufacture other vehicle components. We excluded 63 firms that appear in the ELM guide but do not appear in the Dodwell guide, most of which are likely to be first-tier suppliers in Japan that were omitted by the Dodwell study. Some of the firms that appear only in the ELM guide might be second-tier suppliers in Japan that act as first-tier suppliers in North America, but this practice is not common according to managers of Japanese auto component companies with whom we consulted because second-tier suppliers generally produce goods at such a subcomponent level that their products are not suited to first-tier supply.

We used industry-related publications such as *Chilton's Automotive Industries*, *Ward's Automotive Year Book*, and *Automotive News* to obtain industry statistics and cross-check the identity of suppliers. After eliminating noncomparable firms, we found that 173 of the 670 Japanese component manufacturers in the Dodwell (1990) source had established manufacturing facilities in North

<sup>2</sup> As predicted by the incremental expansion model of international activities (Kogut, 1983), the transplants operated at a substantially smaller scale than their parents. In each of its first 5 years of operations, each Japanese automotive assembly transplant produced less than 27 percent of its parent's Japanese unit volume. At the end of the study period, Honda had the largest ratio of transplant to domestic volume, but in the first 8 years of operations Honda's transplant production was less than 31 percent of its parent.

America by the beginning of 1991, and that 159 of the 173 were reported to be selling components to Japanese-owned assemblers. These numbers are similar to estimates reported in the business press (e.g., Rapoport, 1991: 76).

We next created a matrix of Japanese buyer-supplier relationships in North America. Column 7 of Table 2 reports the number of North American supply links with Japanese-owned suppliers that we found for each auto manufacturer, which ranged from 35 to 102. We report Toyota's joint venture with General Motors (Nummi) and Toyota's independent operations separately, in order to help determine whether joint ventures follow different supplier strategies. We report separate records for Subaru and Isuzu in North America, although their participation is through a single joint venture, in order to determine whether there are differences in the degree to which each company's Japanese suppliers entered North America.<sup>3</sup> Thus, we identified nine transplant assembler organizations controlled wholly or in part by the eight Japanese assemblers that had expanded into Canada or the U.S.A. On average, the nine assembler organizations had formed 62 links with Japanese-owned suppliers operating in North America.

We then differentiated between recreating relationships and establishing extension links. Column 8 of Table 2 reports the number of supply relationships that each assembler recreated with suppliers from which it bought components in Japan. The number of such recreated relation-

ships ranged from 27 to 78, with 152 distinct suppliers. Column 9 reports the proportion of each assembler's Japanese supply links that had been recreated in North America, which ranged from 16 percent to 41 percent. Column 10 then reports the number of North American supply relationships that each manufacturer had established with Japanese suppliers from which the assembler did not buy components in Japan. The number of such extension cases ranged from 8 to 26 links, with 68 distinct suppliers.

Several figures stand out in this summary. On average, assemblers had recreated about a quarter of their supplier links (26% in column 9 of Table 2) and formed 16 extension links by 1990 (column 10). Almost one-quarter of first-tier Japanese suppliers had set up manufacturing facilities in North America and were selling goods to Japanese-owned assemblers (159 of 670 firms in columns 6 and 7). Most suppliers appear to have set up North American manufacturing facilities in order to recreate existing links. In addition, though, more than 40 percent of the suppliers that established North American facilities also had formed extension links (68 of 159 suppliers in columns 7 and 10). Indeed, seven suppliers that formed extension links had established no recreation links by 1990 (the difference between the figures in the last row of columns 7 and 8). It is clear that the processes of buyer-supplier link recreation and extension were well under way by 1990.

The frequency with which extension links were formed suggests that many suppliers viewed North American expansion as a means of growing beyond existing relationships. The cases in which suppliers formed extension links without first having recreated links are particularly intriguing. One example of such a case is a small manufacturer of valve springs that sold components to five small assemblers in Japan. In response to slow growth of its domestic sales, the supplier opened a facility in Michigan in 1987. As of 1990, the firm sold valve springs to Honda's transplant in Ohio but had not recreated links with any of its three home-country partners that had expanded to North America during 1988 and 1989. A second example is a mid-sized manufacturer of air conditioners and compressors that sold goods to several of the smaller assemblers in Japan. The company opened a Texas plant in 1974 to serve North American companies, before

<sup>3</sup> Treating Subaru and Isuzu as two entities in North America raises methodological issues but we believe that the approach is superior to the principal alternative methodology, which would treat the two assemblers as a combined operation in Japan. The alternative approach would involve judgment about whether to take the average or the sum of the variables that measure home-country buyer characteristics and length of past buyer-supplier experience. Subaru and Isuzu follow independent supplier strategies (the two companies had 86 suppliers in common in Japan in 1990, but Subaru also had 68 suppliers that did not sell to Isuzu and Isuzu had 81 suppliers that did not sell to Subaru). We prefer to treat the parent companies as separate firms and employ an independent variable to denote that they are allied in North America. As sensitivity analysis, we calculated estimates in which we excluded the buyer-supplier pairs involving Subaru or Isuzu. The sensitivity analysis also excluded Toyota and Nummi, which raises complications stemming from Toyota's dual presence in North America. Although some levels of statistical significance change marginally in the sensitivity analysis, the estimates are materially equivalent to those obtained in the complete samples and the overall interpretation of the results does not change.

the Japanese auto assemblers entered North America, and then opened several additional facilities during the 1980s. By 1990, the company was selling goods to the Mazda and Honda assembly transplants but had no supply links with the transplants of its traditional Japanese customers. In this case, the company had a strong North American base and a relatively weak presence in its own domestic market. Both examples demonstrate that some suppliers have substantial independence in choosing the companies to which they will sell goods. The examples also suggest that link extension in a foreign market provides a means by which suppliers can grow beyond the scope of their home-country operations.

Such supplier independence stands in marked contrast to popular notions concerning the Japanese auto sector, which often view the assemblers as the dominant partners in buyer-supplier relationships. Our data conflict with the idea that most suppliers are captive to a single buyer. On average, the 670 first-tier suppliers that we identified sold goods to 2.8 buyers in the auto sector. Only slightly more than half (358) sold components to a single buyer in 1989, while 108 suppliers sold goods to at least six of the 11 assemblers operating in Japan. Clearly, many suppliers play important roles for many automotive assemblers.

### Sample selection and dependent variables

As we noted earlier, we created two samples for the analysis, both of which included all assemblers with North American manufacturing facilities. The first sample, which we refer to as the all-supplier sample, included all possible pairs of the assemblers and Japanese first-tier suppliers (6000 buyer-supplier pairs). The recreation and extension estimates obtained with the all-supplier sample jointly address two questions: whether a supplier will establish a North American facility and which assemblers a supplier will recreate and extend links with if the component manufacturer expands. By incorporating all suppliers, including those that have not expanded as well as those that have, the all-supplier sample avoids selection bias (Berk, 1983) that might arise if we focused only on suppliers that set up North American facilities. The all-supplier sample has a drawback, however, because it implicitly assumes that link recreation and extension decisions are made independently. Instead, most link extensions will occur after a

supplier has expanded to a foreign location and recreated at least one buyer-supplier link. Some link recreation decisions also will occur sequentially. Although potential opportunities for link extension and multiple link recreation might induce suppliers to expand, many link formation incentives will arise after a supplier sets up foreign facilities.

In order to focus attention more directly on link recreation and extension incentives facing suppliers that have expanded, we created a subset of the first sample that included only suppliers that had set up North American manufacturing facilities by 1990. We refer to this as the transplant-supplier sample, which includes 1556 buyer-supplier pairs. Comparing the results in the all-supplier and transplant-supplier samples helps us discriminate among factors that influence whether a supplier will expand to the new location and factors that influence which buyers and suppliers will form links in the new location once a supplier expands.

We divided each of the all-supplier and transplant-supplier samples into two complementary portions in order to form dependent variables for the study. In each sample, the first portion consisted of pairs of firms that had a supply relationship in Japan and so were candidates for link recreation in North America. The second portion of each sample consisted of pairs of firms that did not have a supply relationship in Japan and so were candidates for link extension in North America. The 6000 cases in the all-supplier sample consisted of 1618 recreation candidate pairs and 4382 extension candidate pairs. The 1556 cases in the transplant-supplier sample consisted of the 704 recreation candidate pairs and 852 extension candidate pairs. We then formed 0-1 dependent variables that took a value of 1 if a North American relationship recreation (415 cases) or extension link (141 cases) existed for each buyer-supplier pair.<sup>4</sup>

<sup>4</sup> In the all-supplier sample, the number 6000 equals nine transplant assembler organizations times 670 suppliers, minus 30 pairs that we omitted because we could not determine whether a supply link existed in Japan (the 30 pairs involved 15 suppliers and five assemblers). The 1618 potential cases of link recreation in the all-supplier sample equals the sum of the Japanese supply links lists for the nine assembly organizations that established North American transplants (from column 6 in Table 2). The transplant-supplier sample size of 1556 equals nine assembler organizations times 173 suppliers (the 159 suppliers that formed links with transplant assemblers plus the 14 suppliers that formed links only with North American firms), minus one case that we omitted because we could not determine whether a supply link

Row 1 in Parts A–D of Table 3 reports summary statistics for the recreation and extension dependent variables. In the all-supplier sample described in panel 1, the 415 recreation cases represented 25.6 percent of the potential links (0.256 in row 1 of part A of Table 2) and the 141 extension cases represented 3.2 percent of the potential links (part B). In the transplant-supplier sample described in panel 2, the 415 recreation cases represented 58.9 percent (part C) and the 141 extension cases represented 16.5 percent (part D) of the possible links. The transplant-supplier descriptive figures in panel 2 reinforce the conclusion that many recreation and extension opportunities are pursued by suppliers that set up foreign facilities.

### Independent variables

Table 3 also reports descriptive statistics for the independent variables used in the analysis (the appendices contain correlation tables). Two variables address buyer–supplier past history. We were able to determine whether buyer–supplier links existed in Japan during 1979 for most pairs of firms. Although we could not determine when most buyers and suppliers began their relationship in Japan, we judged that a relationship spanning at least 10 years is long enough to indicate a substantial history. We used 0–1 dummy variables to record whether a buyer–supplier pair had a purchase relationship in 1979 or if we could not determine whether a link existed in 1979 (rows 2 and 3 in Table 3).

Five variables in the table record buyer characteristics (rows 4–8 in Table 3). Production experience in the new location was defined as the calendar year that a buyer began automobile production in North America minus 1900, which associates later entry years with lesser experience. We also determined North American unit production volume in 1989–90, but found that greater production volume was highly correlated with earlier entry year ( $r > 0.90$ ) and so used only the entry year variable in the statistical analysis. Owing to the high correlation, statistical estimates associated with later entry year also can be

interpreted as associations with lesser North American production volume. We recorded each assembler's average annual 1988–89 vehicle unit home-country production volume and the number of suppliers from which each buyer purchased components in Japan. Two 0–1 dummy variables identified the North American joint venture between home-country buyers (Subaru and Isuzu) and the North American joint ventures between Japanese and North American firms (Nummi, Diamond Star, and CAMI). The figures used for the buyer characteristic variables are reported in Table 2, in which columns 2 and 4 note North American production and entry year, columns 3 and 6 report Japanese production volume and number of supplier links in Japan, and column 5 reports the identity of the joint venture partners.

We also defined several variables measuring supplier characteristics (rows 9–16 in Table 3). We recorded supplier size in billions of yen of annual sales.<sup>5</sup> For 66 suppliers (comprising 564 buyer–supplier pairs) where no supplier size data were available, we set supplier size to the average of the relevant sample and set an unknown size dummy variable equal to 1 to check for any bias this estimate might generate. We created two 0–1 dummy variables to address cases in which a supplier expanded before a buyer. We denoted suppliers that established North American manufacturing facilities before 1980, which we judged to be early enough that the entry was prior to any supplier expansion engendered by the assembly entry of Honda and Nissan in the early 1980s (see, for example, Tharp and Simpson, 1980). We also denoted cases in which the supplier in the buyer–supplier pair entered North America at least 3 years before the buyer, assuming that a 3-year lead was enough time to avoid picking up cases in which the supplier's entry was part of the buyer's entry planning. We recorded the number of automobile manufacturers to which the supplier sold components in

<sup>5</sup> We obtained supplier size data from the 1987 or 1988 fiscal year for 594 of 670 suppliers (comprising 5346 of the 6000 buyer–supplier pairs). For another 10 suppliers (90 buyer–supplier pairs), data could be obtained only for an earlier year (seven suppliers in 1986 or 1987; three suppliers in the 1982–85 period). To check for any biases that might result from including size data for different years, we added a variable recording the year for which supplier size data were measured to sensitivity analysis models, finding no significant influences.

existed in Japan. The 704 recreation candidates in the transplant-supplier sample equals the sum of the number of links that existed in Japan among the nine assembler organizations and 173 suppliers operating in North America.

Table 3. Summary statistics for buyer-supplier pairs: All-supplier and transplant-supplier samples

Variable	(1) All-supplier sample (6000 cases)				(2) Transplant-supplier sample (1556 cases)			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
	A. Recreation candidates (have link in Japan, $N = 1618$ )				C. Recreation candidates (have link in Japan, $N = 704$ )			
1 Recreation (dependent variable)	0.256	0.437	0	1	0.589	0.492	0	1
2 Long past buyer-supplier experience (link in 1979)	0.587	0.492	0	1	0.707	0.455	0	1
3 Unknown link in 1979	0.278	0.448	0	1	0.163	0.370	0	1
4 Production experience in new location (entry year)	86.83	2.28	82	89	86.68	2.39	82	89
5 Home-country production volume	1761	1222	566	3972	1766	1222	566	3972
6 Number of suppliers in home country	182.01	20.91	154	224	181.02	19.90	154	224
7 Joint venture with home-country buyer	0.198	0.399	0	1	0.203	0.403	0	1
8 Joint venture with local buyer	0.347	0.476	0	1	0.317	0.466	0	1
9 Supplier size	154.91	460.46	0	4075	244.99	585.66	2	4075
10 Unknown size	0.048	0.214	0	1	0.006	0.075	0	1
11 Supplier expanded before buyer: before 1980	0.078	0.269	0	1	0.180	0.385	0	1
12 Supplier expanded before buyer: after 1979	0.077	0.267	0	1	0.178	0.382	0	1
13 Number of buyers in home country	5.438	3.483	1	11	7.007	3.082	1	11
14 Captive supplier of buyer that has expanded	0.206	0.405	0	1	0.070	0.255	0	1
	B. Extension candidates (no link in Japan, $N = 4382$ )				D. Extension candidates (no link in Japan, $N = 852$ )			
1 Extension (dependent variable)	0.032	0.176	0	1	0.165	0.372	0	1
2 Long past buyer-supplier experience (link in 1979)	0.031	0.175	0	1	0.054	0.226	0	1
3 Unknown link in 1979	0.419	0.493	0	1	0.306	0.461	0	1
4 Production experience in new location (entry year)	86.92	2.27	82	89	87.06	2.18	82	89
5 Home-country production volume	1799	1284	566	3972	1802	1302	566	3972
6 Number of suppliers in home country	178.94	19.62	154	224	178.78	20.09	154	224
7 Joint venture with home-country buyer	0.231	0.421	0	1	0.237	0.426	0	1
8 Joint venture with local buyer	0.329	0.470	0	1	0.347	0.476	0	1
9 Supplier size	59.72	196.75	0	4075	119.92	306.39	2	4075
10 Unknown size	0.111	0.314	0	1	0.027	0.162	0	1
11 Supplier expanded before buyer: before 1980	0.020	0.141	0	1	0.104	0.306	0	1
12 Supplier expanded before buyer: after 1979	0.032	0.176	0	1	0.165	0.372	0	1
13 Number of buyers in home country	1.836	1.571	1	10	2.808	2.265	1	10
14 Captive supplier of buyer that has expanded	0.544	0.498	0	1	0.427	0.495	0	1
15 Captive supplier of buyer that has not expanded	0.109	0.311	0	1			0	0
16 Sell only to buyers that have not expanded	0.121	0.326	0	1			0	0

Japan. We also created two dummy variables denoting suppliers that sold to only one Japanese automobile manufacturer, distinguishing between captives of buyers that had expanded and captives of buyers that had not expanded. (We also disaggregated the number of home-country buyers variable, distinguishing between buyers that had expanded and those that had not, but the two resulting variables were too highly correlated to provide useful independent information.) In addition, we created a 0–1 dummy variable denoting suppliers that sold only to buyers that had not expanded to North America. The variables denoting suppliers that sold only to one or more buyers that had not expanded to North America were relevant for the extension analyses and, as can be seen in Table 3 (rows 15 and 16 in part D), no such suppliers established transplant facilities in North America.

### Statistical method

We calculated binomial logistic regressions in order to estimate influences on the likelihood that firms would establish recreation and extension buyer–supplier relationships in North America. The two models took the following form:

$$\ln [R_i/(1-R_i)] = \beta_1 X_i \quad (1)$$

$$\ln [E_i/(1-E_i)] = \beta_2 X_i \quad (2)$$

In Equation 1,  $R_i$  is the probability that a particular supplier–assembler pair (denoted by the index  $i$ ) will recreate a supply relationship in North America. In Equation 2,  $E_i$  is the probability that a particular supplier–assembler pair will form an extension link in North America. The log odds of each probability is tested for linear associations with a vector of covariates  $X_i$ , estimating coefficient vectors  $\beta_1$  and  $\beta_2$  (which include intercepts). The effect of a one-unit change of a covariate on the probability of pair  $i$  recreating a supply relationship is  $\beta_\nu R_i(1-R_i)$ , where the index  $\nu$  denotes a particular independent variable. The maximum likelihood logistic regression estimates were obtained using the SAS statistical package.

We calculated two complementary binomial logistic regression analyses for each sample. Using Model 1, we analyzed the 1618 cases of potential recreation in the all-supplier sample

and the 704 cases of potential recreation in the transplant–supplier sample. Using Model 2, we analyzed the 4382 cases of potential link extension in the all-supplier sample and the 852 cases of potential extension in the transplant–supplier sample.

## RESULTS

We present the results in two stages, first describing the analysis of the all-supplier sample, then comparing and contrasting the analysis of the transplant–supplier sample. Table 4 reports the results of the binomial logistic regression analyses of the all-supplier sample. Panel 1 reports recreation estimates (Equation 1), while panel 2 reports extension estimates (Equation 2). The coefficients and standard errors for home-country volume, number of suppliers in home country, and supplier size were scaled up by 1000 in order to report meaningful figures. Both models provided significant statistical fit according to tests based on the log likelihood  $\chi^2$  statistics shown at the foot of each table. The log likelihood  $\chi^2$  statistic, which is defined as  $-2$  times the difference between the log likelihood of the estimated model and the log likelihood of a model containing only a constant term, is distributed as a  $\chi^2$  with degrees of freedom equal to the number of covariates specified in the model.

### Link recreation in the all-supplier sample

#### *Buyer–supplier characteristics*

Longer buyer–supplier experience had the expected positive effect on link recreation (panel 1 of Table 4), as assemblers and suppliers that had Japanese ties in 1979 were more likely to recreate the links in North America than firms that had no links in 1979 (which was the omitted case in the statistical analysis). The result is consistent with the argument that long-term relationships facilitate interorganizational learning and lead to interorganizational interdependence, which then creates incentives for a buyer and supplier that have conducted a long-lasting relationship to recreate the link in a new location. Whether the recreation decision is dominated by the buyer, by the supplier, or shared can not be

Table 4. Logistic regression estimates of influences on link formation in the all-supplier sample

Variable	1. Recreation (1618 cases)				2. Extension (4382 cases)			
	Predicted	Coef.	S.E.	Prob.	Predicted	Coef.	S.E.	Prob.
<i>Buyer-supplier characteristics</i>								
Link in 1979	+	1.075	0.216	0.0001	?	0.615	0.365	0.09
Unknown link in 1979		0.192	0.251	0.44		-0.209	0.208	0.32
<i>Buyer characteristics</i>								
Later entry year	-	-0.155	0.035	0.0001	0	-0.077	0.054	0.15
Home-country volume ( $\times 1000$ )	?	-0.040	0.084	0.65	?	-0.160	0.123	0.20
No. of suppliers in home country ( $\times 1000$ )	-	-0.860	5.480	0.87	+	5.800	7.500	0.44
Joint venture with home-country buyer	-	-0.520	0.330	0.12	+	0.591	0.446	0.18
Joint venture with local buyer	?	-1.108	0.177	0.00	?	-0.423	0.278	0.13
<i>Supplier characteristics</i>								
Supplier size ( $\times 1000$ )	+	0.317	0.141	0.02	+	0.370	0.272	0.17
Unknown size		-1.741	0.732	0.02		-1.630	0.721	0.02
Expanded before buyer: before 1980	+	1.780	0.223	0.0001	+	2.948	0.276	0.0001
Expanded before buyer: after 1979	+	2.264	0.233	0.0001	+	1.546	0.297	0.0001
No. of buyers in home country	+	0.105	0.025	0.0001	+	0.246	0.052	0.0001
Captive of buyer that has expanded	?	-0.060	0.248	0.81	-	0.476	0.245	0.05
Intercept		11.224	3.110	0.0003		1.361	4.789	0.78
Model log likelihood		-715.9				-512.7		
Log likelihood $\chi^2$ (d.f. = 13)		410.6				221.2		
North American links		415				141		

The probability measures are based on two-tailed *t*-tests.

determined from this result, but it is clear that long-term partners often expand together.

#### *Buyer characteristics*

Among the buyer characteristics reported in panel 1 of Table 4, later entry year (and, by implication, lesser assembler North American production volume, which is strongly correlated with entry year) had the expected negative relationship with link recreation. Joint ventures with local buyers also were less likely to recreate supplier links, suggesting that the buyers tend to draw on their local partners' pools of suppliers. In part, this result might stem from the social pressures that existed during the 1980s for American-owned automobile manufacturers to support American suppliers. The number of home-country suppliers had no significant influence on recreation, which likely stems from the limited variation in that measure. (Column 6

of Table 2 shows that most Japanese auto manufacturers that set up North American manufacturing facilities use about the same number of suppliers: from 154 to 196 suppliers, except for Mitsubishi's 224.) Greater home-country production also had no significant impact, which might reflect conflicting influences of volume economies and interorganizational dependence. Suppliers that sell to particularly large manufacturers might operate at such a scale that they cannot easily replicate their operation in a new location and so are not willing to expand, but some large buyers might be able to encourage their suppliers to set up facilities in the new location owing to the potential for larger volume sales in the future.

#### *Supplier characteristics*

Several supplier characteristics affected the likelihood of link recreation. As expected, suppliers

that were present in the foreign market before the buyer in their buyer–supplier pair expanded were especially likely to be recreation partners. Larger suppliers also were more likely to recreate links, which is consistent with the notion that larger firms tend to have more slack resources and a larger stock of intangible assets necessary for expansion (March and Simon, 1958; Caves, 1982). The firms for which size information was unknown were unlikely to recreate links, which is consistent with the positive effect of greater known supplier size because most suppliers of unknown size appear to be small. Suppliers that dealt with many assemblers in Japan were particularly likely to recreate links in North America. The impact of the number of home-country buyers is consistent with interorganizational experience arguments concerning incentives for link recreation, and is distinct from the supplier size influence because the variables recording the number of home-country buyers are only weakly correlated with supplier size (Appendix 1a). Captive supplier status had little influence on recreation, which suggests that the number of buyers has a linear effect on link recreation.

### **Link extension in the all-supplier sample**

#### *Buyer–supplier characteristics*

Assemblers and suppliers with Japanese relationships in 1979 that no longer existed in 1989 were slightly more likely to form extension links in North America than were firms that had no ties in 1979 (panel 2 in Table 4). From the point of view of the assembler, this result suggests that familiarity and any positive remnants of the earlier trading relationship might favor dealing with a supplier that is somewhat known rather than an unknown supplier when a link recreation opportunity is not available. From the point of view of the supplier, it might be that partner-specific information that remains from the earlier domestic relationship is utilized when approaching the transplant buyer for business.

#### *Buyer characteristics*

No buyer characteristics had significant impact on link extension in the all-supplier sample, which suggests that differences among buyers do

not play large roles in determining which suppliers expand to a foreign location and establish supply links with new home-country firms. However, a model (not reported) that omitted the five buyer characteristic variables had statistically significantly less explanatory buyer than the reported model, based on a log likelihood  $\chi^2$  test, suggesting that buyer characteristics do have an overall impact.

#### *Supplier characteristics*

Several supplier characteristics affected link extension in the all-supplier sample. As in the recreation case, suppliers that were present in the foreign market before the potential customer in their buyer–supplier pair expanded were especially likely to be extension partners. Supplier size had no influence, although unknown size cases were unlikely to form extension links, but suppliers with greater numbers of home-country buyers were more likely to form extension links. These results suggest that greater interorganizational experience has a stronger influence on formation of links with new partners than revenue-based size alone. Somewhat surprisingly, captive suppliers of expanded buyers also were weakly more likely to form extension links, once the linear effects of the number of buyers was accounted for, which suggests that some captive suppliers might view extension opportunities in foreign locations as a means of reducing their dependence on a single buyer. No captive supplier of a buyer that had not expanded created an extension link, however, indicating that recreation is a prerequisite for the cases in which captives extended their sales base.

### **Link recreation and extension in the transplant-supplier sample**

Table 5 reports the results of the binomial logistic regression analyses of recreation and extension in the transplant-supplier sample. Both models had significant explanatory power. Most influences were similar to those found in the all-supplier sample analyses of recreation and extension, but a few key differences appeared. Table 6 summarizes the results found in the two samples.

Two principal differences stand out when comparing the recreation influences in the

Table 5. Logistic regression estimates of influences on link formation in the transplant-supplier sample

Variable	1. Recreation (704 cases)				2. Extension (852 cases)			
	Predicted	Coef.	S.E.	Prob.	Predicted	Coef.	S.E.	Prob.
<i>Buyer-supplier characteristics</i>								
Link in 1979	+	1.058	0.253	0.0001	?	0.626	0.377	0.10
Unknown link in 1979		0.537	0.309	0.08		0.040	0.226	0.86
<i>Buyer characteristics</i>								
Later entry year	-	-0.087	0.048	0.07	0	-0.100	0.057	0.08
Home-country volume ( $\times 1000$ )	?	-0.030	0.097	0.72	?	-0.220	0.124	0.07
No. of suppliers in home-country ( $\times 1000$ )	-	-0.010	5.880	0.999	+	1.120	7.740	0.89
Joint venture with home-country buyer	-	-0.626	0.371	0.09	+	0.580	0.454	0.20
Joint venture with local buyer	?	-1.391	0.212	0.0001	?	-0.436	0.277	0.12
<i>Supplier characteristics</i>								
Supplier size ( $\times 1000$ )	+	0.226	0.169	0.18	+	0.312	0.287	0.28
Unknown size		-0.210	1.105	0.85		-0.636	0.767	0.41
Expanded before buyer: before 1980	+	0.415	0.231	0.07	+	1.159	0.273	0.0001
Expanded before buyer: after 1979	+	0.874	0.246	0.0004	+	-0.209	0.295	0.48
No. of buyers in home country	+	0.040	0.033	0.22	+	0.079	0.057	0.17
Captive of buyer that has expanded	+	1.101	0.434	0.01	-	0.308	0.276	0.27
<i>Intercept</i>		7.095	4.229	0.09		6.625	5.083	0.19
Model log likelihood		-425.4				-352.7		
Log likelihood $\chi^2$ (d.f.=13)		102.5				59.1		
North American links		415				141		

The probability measures are based on two-tailed *t*-tests.

Other than the captive supplier recreation prediction, the predictions are the same as in the all-supplier sample.

transplant-supplier sample to those found in the all-supplier sample (columns 1 and 3 of Table 6). First, supplier size and number of home-country buyers did not significantly influence the transplant-supplier recreation analysis. This difference suggests that a supplier's size and the breadth of its buyer base influence the likelihood that the supplier will expand to a foreign location but that, once in the new location, greater size and breadth do not make a supplier more likely to recreate any given link. Second, the captive supplier result becomes positive in the transplant-supplier analysis, which suggests that captive suppliers might be no more likely than other suppliers to expand to a new location, but a captive supplier that does expand will recreate its link with the home-country buyer.

The principal difference in the statistical analysis of transplant-supplier extension when compared to all-supplier extension is that most

significant effects of supplier characteristics disappear (columns 2 and 4 of Table 6). Only the case in which the suppliers expanded before 1980 retains a significant influence on extension. As in the analysis of recreation, the comparison suggests that most supplier characteristics have more influence on which suppliers will expand than on which firms they will sell components to after they expand. Nonetheless, the fact that captive supplier status does not have a negative influence on link extension in the transplant-supplier sample is notable, because it again suggests that some captive suppliers seek new buyers once they have established a foreign facility to serve their domestic partner.

The transplant-supplier extension analysis also identified weakly significant negative influences of buyer entry year and home country production that were not significant in the all-supplier extension analysis. The expansion timing result

Table 6. Summary of influences on link recreation and extension

	All-supplier sample		Transplant-supplier sample	
	Recreation (1)	Extension (2)	Recreation (3)	Extension (4)
<i>Buyer-supplier characteristics</i>				
Link in 1979	+	+	+	+
Unknown link in 1979	+	-	+	+
<i>Buyer characteristics</i>				
Later entry year	-	-	-	-
Home-country volume	-	-	-	-
No. of suppliers in home country	-	+	-	+
Joint venture with home-country buyer	-	+	-	+
Joint venture with local buyer	-	-	-	-
<i>Supplier characteristics</i>				
Supplier size	+	+	+	+
Unknown size	-	-	-	-
Expanded before buyer: before 1980	+	+	+	+
Expanded before buyer: after 1979	+	+	+	-
No. of buyers in home country	+	+	+	+
Captive of buyer that has expanded	-	+	+	+
Captive of buyer that has not expanded		- <sup>a</sup>		
Sell only to buyers that have not expanded		- <sup>a</sup>		

\*\* $p < 0.05$ ; \* $p < 0.10$  (two-tailed  $t$ -tests)

<sup>a</sup>Qualitative rather than regression results, because no supplier that sold only to one or more buyers that had not expanded formed an extension link.

suggests that later-entrant assemblers had not yet had time to form as many supplier links as earlier entrants. The home-country volume influence suggests that transplanted suppliers might expect extension links with smaller buyers to provide more reliable avenues to future sales in the home country.

## DISCUSSION AND CONCLUSION

This study makes both intrinsic and general contributions. In the particular case, the research demonstrates that Japanese automobile component assemblers and suppliers are establishing many buyer-supplier recreation and extension links in North America. About one-quarter of first-tier suppliers had set up manufacturing facilities on this continent by 1990 and many Japanese auto manufacturers were drawing from those facilities. More generally, the study advances from earlier empirical analyses of

supplier expansion that examined industry aggregates. By examining the issues at the level of individual firms, the study contributes to our general understanding of the buyer characteristics, supplier characteristics, and characteristics of particular buyer-supplier pairs that influence link recreation and extension.

Three general conclusions stand out. First, buyers and suppliers with long-standing links in the home country tended to recreate the links in the new location. To a lesser extent, buyers and suppliers that once had supply links at home but no longer were allied tended to form extension links. These results demonstrate the strong impact of long-term supplier relationships on the international expansion activities of the buyers and suppliers involved in the relationships. An implication of the result is that the long-term partners are likely to possess a detailed understanding of the interfirm transactions that are needed to provide competitive advantages in the new location. The result is particularly

intriguing in the extension case because it suggests that knowledge gained in past relationships, even relationships that ended, might be useful in a new location.

Second, supplier characteristics had more influence on link formation than buyer characteristics. The buyer characteristics that we measured had relatively little influence on the likelihood that particular supplier links would be recreated or extended, which indicates that all expanding buyers undertake a similar process of link recreation and extension. Later entrants to the foreign market and assemblers that formed joint ventures with local buyers were somewhat less likely to recreate their links, but the other buyer characteristics had little consistent impact. By contrast, supplier characteristics had strong influences on which suppliers would expand. Larger suppliers and suppliers that sold goods to many buyers in the home country were particularly likely to expand. The results suggest that large and broad-based suppliers are most likely to possess the financial and organizational resources needed to support international expansion. The impact of the number of buyers is particularly striking, because it suggests that experience with dealing with several organizations contributes to a supplier's ability to undertake international expansion and establish supply links with firms in a foreign location. Such interaction with many organizations might increase a supplier's program management capabilities and enable it to manage diversity in buyer demands. The interorganizational experience might sometimes be more important than revenue-based size, especially in the case of forming extension links with new buyers.

The third general conclusion is that buyers tended to tap into the pool of home-country suppliers already present in the new location when the buyers entered. Suppliers that had long experience in the new location were common partners in both recreation and extension links. This outcome demonstrates that suppliers do not simply respond to buyer expansion, but also play partially independent roles in international activity.

Overall, the results help address the issue of when suppliers in Japan and elsewhere will tend to act independently of their existing buyers. Some analyses of buyer-supplier relationships in Japan view the relationships as vertical groups

in which the buyer is the dominant partner, acting as the leader of a group of subordinate suppliers (e.g., Hasegawa, 1991; also see Dore, 1973; Clark, 1979). If such dominance is the case, a supplier will expand internationally only when its buyer also expands and the supplier will be unlikely to form extension links after its expansion. Our results reject such a simple interpretation. Although we find that buyers and suppliers with long-term relationships tend to recreate links this, in itself, is not evidence of buyer dominance because suppliers also stand to benefit from recreating valuable links. Instead, we find that suppliers sometimes expand before their buyers and that larger suppliers, especially when size is defined as the number of buyers in the home country, undertake independent activity. We do find weak support for the buyer dominance notion to the extent that captive supplies expand only when their home-country partners expand, but the captive suppliers sometimes also form extension links after expanding. The analysis supports the premise that suppliers have incentives to undertake independent activity but also face constraints on their independence (Martin *et al.*, 1994), where the constraints include small size and having home-country links only with buyers that have not expanded.

The Japanese auto assembly industry also can be viewed in terms of horizontal groups of assemblers, in which some assemblers are partially linked through equity holdings and other forms of exchange. In particular, Toyota, Daihatsu, and Hino are sometimes viewed as one group, and Nissan Motors, Subaru, and Nissan Diesel as a second group. Such horizontal grouping might influence extension activity, such that a buyer would be more likely to form an extension link in the new location with a supplier that sold goods to a member of its group in the home country. We found no horizontal group influence on extension, however, when we conducted sensitivity analysis of the all-supplier and transplant-supplier samples.

It would be useful to examine other constraints on independent action. Lincoln and McBride (1987) argue that ties between large buyers and smaller, dependent subcontractors (i.e., suppliers) in Japan are reinforced by mutual stockholdings and interlocking directorates. Whether equity and directorship ties affect recreation and extension by Japanese firms

operating in foreign locations is beyond the scope of this paper, but discussions of dependence in which equity and directorship ties are expected to play a role tend to involve captive suppliers or, at least, suppliers that do business almost exclusively with one firm (Lincoln and McBride, 1987: 307). Our examination of captive suppliers, which shows that captive suppliers expand only when their home-country partners expand, intersects with the Japanese vertical groupings literature addressing smaller suppliers. Whether and how the existence of equity or directorship ties, in addition to purchasing links, affects the recreation and extension decisions of captive suppliers are interesting questions. We suspect that captive suppliers in which buyers hold equity or directorship ties will be more likely to expand and recreate links and less likely to form extension links than other captives. Among larger firms, by contrast, Lincoln, Gerlach, and Takahashi (1992: Table 3) find substantial reciprocity in trade and directorship relationships, which suggests that larger suppliers are not dependent on their customers and is consistent with our conclusion that suppliers with large sales revenue or many buyers exercise substantial independence. Whether equity and managerial holdings within Japanese vertical groups of buyers and suppliers affect link recreation and extension warrants further analysis.<sup>6</sup>

When viewed in a broader context, the analysis has implications for theories of interorganizational relations in complex networks of organizations. Some analysts have viewed such networks as nonintersecting entities in which competition takes place between constellations of buyers and suppliers (e.g., Fombrun, 1988). However, such a simple depiction of independent networks does not apply to many empirical cases and in our study we find that many auto suppliers sell goods to several automobile assemblers. Such multiple relationships might occur because suppliers seek to participate in several networks in order to reduce dependence on a single buyer and to gain volume economies. Indeed, buyers might even encourage some suppliers to sell goods to the

buyers' competitors, in order to increase the suppliers' scale and learning opportunities. In addition, strongly performing suppliers might be very desirable partners for assemblers and hence be invited to join several networks. Further research could fruitfully investigate whether supplier participation in more than one inter-organizational network contributes to performance differences among suppliers or assemblers.

Several other avenues for further research could fruitfully extend the study. First, other factors that are likely to affect the incentive to recreate and extend home-country supply links include the complexity and idiosyncrasy of the link between a component and the final assembly, the degree to which a product is designed for the new market, the degree of political turmoil created by establishing foreign-owned suppliers in the new location, the existence of alternative suppliers in the new location, the degree to which one firm holds an equity stake in another, and local industry characteristics such as concentration and geographic location. Second, it would be valuable to map the creation of the new links over time, starting with an assembler's entry to North America. Such temporal investigation could usefully incorporate Knickerbocker (1973) and Graham's (1978) insight that international expansion is often a response to a competitor's expansion. Third, it would be useful to examine variation in the intensity of the relationships in terms of sales volume and component differences. Examining links rather than volume is valuable, because even small initial sales might lead to greater sales in the future, but the issue warrants further analysis. Fourth, it would be useful to extend the analysis to instances in which expanding assemblers add local firms to their supplier base and transplant suppliers create links with local assemblers. Nonetheless, the existing study offers significant insights into an important strategic and policy issue.

Most or all operations management, marketing, and corporate strategy courses taught in North America and Europe now discuss the competitive importance of long-term buyer-supplier relationships. The analysis that we report in this study has direct implications for both our particular understanding of auto component supply and our general understanding of the recreation and extension of supply links following international expansion. Supply relationships provide

<sup>6</sup> Whether the expansion decisions of noncaptive suppliers are affected by equity and directorship ties with buyers also is an open question. We suspect that such suppliers will be particularly likely to expand and to recreate links, but will form fewer extension links than other noncaptives following expansion.

important sources of competitive advantage for final products assemblers, whether the products are manufactured goods or nonphysical services. As firms expand throughout the world, as many must today, the extent to which they prosper will be influenced by the effectiveness of their supplier strategies. Understanding the influences on supply link recreation and extension will help increase the effectiveness of these strategies.

### Acknowledgements

We are grateful for assistance provided by Marc Santucci of ELM International, Inc. in East Lansing, Michigan, and for financial support provided by the Center for International Business Education and the Japan Technology Management Program of the University of Michigan. We appreciate comments received from reviewers, from Bernard Yeung, and from participants of the Interdisciplinary Colloquium on Organization Studies at the University of Michigan.

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Appendix 1a: Correlation matrix of all-supplier sample, recreation subject (N = 1618)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Dependent variable	1.00	0.20	-0.17	-0.11	0.01	-0.03	-0.00	-0.16	0.17	-0.12	0.25	0.25	0.27	-0.17
<i>Buyer-supplier characteristics</i>														
2 Link in 1979	0.20	1.00	-0.74	0.04	0.07	-0.01	0.01	0.05	0.05	-0.13	0.09	0.05	0.17	-0.12
3 Unknown link in 1979	-0.17	-0.74	1.00	-0.06	0.00	0.05	-0.06	-0.01	-0.02	0.16	-0.09	-0.10	-0.23	0.24
<i>Buyer characteristics</i>														
4 Later entry year	-0.11	0.04	-0.06	1.00	-0.30	-0.16	0.47	0.19	-0.01	-0.01	0.01	0.20	0.06	-0.05
5 Home-country volume	0.01	0.07	0.00	-0.30	1.00	-0.20	-0.48	0.11	-0.01	-0.02	-0.01	-0.12	0.02	-0.03
6 No. of suppliers in home country	-0.03	-0.01	0.05	-0.16	-0.20	1.00	-0.51	0.30	-0.02	0.09	0.00	-0.09	-0.10	0.10
7 JV with home-country buyer	-0.00	0.01	-0.06	0.47	-0.48	-0.51	1.00	-0.36	0.02	-0.06	0.01	0.16	0.07	-0.07
8 JV with local buyer	-0.16	0.05	-0.01	0.19	0.11	0.30	-0.36	1.00	-0.02	0.03	-0.02	0.02	-0.02	0.03
<i>Supplier characteristics</i>														
9 Supplier size	0.17	0.05	-0.02	-0.01	-0.01	-0.02	0.02	-0.02	1.00	-0.03	0.19	0.08	0.20	-0.10
10 Unknown size	-0.12	-0.13	0.16	-0.01	-0.02	0.09	-0.06	0.03	-0.03	1.00	-0.07	-0.07	-0.19	0.24
11 Expanded before buyer: before 1980	0.25	0.09	-0.09	0.01	-0.01	0.00	0.01	-0.02	0.19	-0.07	1.00	-0.08	0.23	-0.13
12 Expanded before buyer: after 1979	0.25	0.05	-0.10	0.20	-0.12	-0.09	0.16	0.02	0.08	-0.07	-0.08	1.00	0.21	-0.14
13 No. of home-country buyers	0.27	0.17	-0.23	0.06	0.02	-0.10	0.07	-0.02	0.20	-0.19	0.23	0.21	1.00	-0.65
14 Captive of buyer that has expanded	-0.17	-0.12	0.24	-0.05	-0.03	0.10	-0.07	0.03	-0.10	0.24	-0.13	-0.14	-0.65	1.00

APPENDIX 1b: Correlation matrix of all-supplier sample, extension subset (N = 4382)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Dependent variable	1.00	0.06	-0.03	0.00	-0.05	-0.02	0.05	-0.04	0.08	-0.06	0.27	0.11	0.15	-0.05	-0.06	-0.07
2 <i>Buyer-supplier characteristics</i>		1.00	0.06	-0.03	0.00	-0.05	-0.02	0.05	-0.04	0.08	-0.06	0.27	0.11	0.15	-0.05	-0.06
3 Link in 1979	0.06	1.00	-0.15	0.01	-0.03	0.03	0.00	0.03	0.02	-0.03	0.04	0.03	0.15	-0.10	-0.02	0.01
4 Unknown link in 1979	-0.03	-0.15	1.00	0.02	0.00	-0.01	0.01	0.00	0.01	0.17	0.05	-0.08	-0.20	0.19	0.02	0.03
5 <i>Buyer characteristics</i>				1.00	0.02	0.00	-0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
6 Later entry year	0.00	0.01	0.02	1.00	-0.32	-0.24	0.50	0.12	0.01	0.00	-0.00	0.12	-0.03	0.01	-0.00	-0.00
7 Home-country volume	-0.05	-0.03	0.00	-0.32	1.00	-0.16	-0.52	0.15	0.01	0.00	0.01	-0.07	0.00	0.00	0.00	-0.00
8 No. of home-country suppliers	-0.02	0.03	-0.01	-0.24	-0.16	1.00	-0.52	0.23	-0.00	-0.01	-0.02	-0.05	-0.00	-0.00	0.01	0.01
9 JV with home-country buyer	0.05	0.00	0.01	0.50	-0.52	-0.52	1.00	-0.38	-0.00	0.01	0.00	0.09	-0.01	0.00	-0.01	-0.01
10 JV with local buyer	-0.04	0.03	0.00	0.12	0.15	0.23	-0.38	1.00	0.02	-0.00	0.01	0.01	-0.01	-0.01	0.00	0.00
11 <i>Supplier characteristics</i>																
12 Supplier size	0.08	0.02	0.01	0.01	0.01	-0.00	-0.00	0.02	1.00	0.05	0.08	0.12	0.16	-0.00	-0.07	-0.08
13 Unknown size	-0.06	-0.03	0.17	0.00	0.00	-0.01	0.01	-0.00	0.05	1.00	-0.05	-0.06	-0.15	0.15	0.00	0.01
14 Expanded before buyer: before 1980	0.27	0.04	0.05	-0.00	0.01	-0.02	0.00	0.01	0.08	-0.05	1.00	-0.03	0.14	-0.05	-0.05	-0.05
15 Expanded before buyer: after 1979	0.11	0.03	-0.08	0.12	-0.07	-0.05	0.09	0.01	0.12	-0.06	-0.03	1.00	0.12	-0.08	-0.06	-0.07
16 No. of home-country buyers	0.15	0.15	-0.20	-0.03	0.00	-0.00	-0.01	-0.01	0.16	-0.15	0.14	0.12	1.00	-0.58	-0.17	-0.19
17 Captive of buyer that has expanded	-0.05	-0.10	0.19	0.01	0.00	-0.00	0.00	-0.00	0.15	-0.05	-0.08	-0.58	1.00	-0.38	-0.41	-0.41
18 Captive of buyer that has not expanded	-0.06	-0.02	0.02	-0.00	0.00	0.01	-0.01	0.00	0.00	-0.07	0.00	-0.05	-0.06	-0.17	-0.38	1.00
19 Sell only to buyers that have not expanded	-0.07	0.01	0.03	-0.00	-0.00	0.01	-0.01	0.00	-0.08	0.01	-0.05	-0.07	-0.19	-0.41	0.94	1.00

APPENDIX 2a: Correlation matrix of transplant-supplier sample, recreation subset (N = 704)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Dependent variable	1.00	0.12	-0.04	-0.15	0.01	-0.00	-0.02	-0.25	0.08	-0.01	0.05	0.05	0.01	0.10
<i>Buyer-supplier characteristics</i>														
2 Link in 1979	0.12	1.00	-0.69	0.05	0.10	0.03	-0.04	0.10	0.14	-0.03	0.03	-0.03	0.20	-0.09
3 Unknown link in 1979	-0.04	-0.69	1.00	-0.08	-0.00	0.02	-0.06	-0.02	-0.12	0.07	-0.03	-0.04	-0.22	0.21
<i>Buyer characteristics</i>														
4 Later entry year	-0.15	0.05	-0.08	1.00	-0.27	-0.21	0.49	0.19	0.02	0.03	0.04	0.34	0.18	-0.19
5 Home-country volume	0.01	0.10	-0.00	-0.27	1.00	-0.18	-0.49	0.13	-0.03	-0.03	-0.02	-0.19	0.01	-0.04
6 No. of suppliers in home country	-0.00	0.03	0.02	-0.21	-0.18	1.00	-0.52	0.25	-0.00	0.11	0.02	-0.13	-0.08	0.08
7 JV with home-country buyer	-0.02	-0.04	-0.06	0.49	-0.49	-0.52	1.00	-0.34	0.03	-0.04	0.01	0.25	0.09	-0.08
8 JV with local buyer	-0.25	0.10	-0.02	0.19	0.13	0.25	-0.34	1.00	-0.01	0.03	-0.00	0.06	0.07	-0.08
<i>Supplier characteristics</i>														
9 Supplier size	0.08	0.14	-0.12	0.02	-0.03	-0.00	0.03	-0.01	1.00	-0.01	0.17	0.03	0.12	-0.07
10 Unknown size	-0.01	-0.03	0.07	0.03	-0.03	0.11	-0.04	0.03	-0.01	1.00	-0.04	-0.04	-0.14	0.13
11 Expanded before buyer: before 1980	0.05	0.03	-0.03	0.04	-0.02	0.02	0.01	-0.00	0.17	-0.04	1.00	-0.22	0.18	-0.07
12 Expanded before buyer: after 1979	0.05	-0.03	-0.04	0.34	-0.19	-0.13	0.25	0.06	0.03	-0.04	-0.22	1.00	0.15	-0.11
13 No. of home-country buyers	0.01	0.20	-0.22	0.18	0.01	-0.08	0.09	0.07	0.12	-0.14	0.18	0.15	1.00	-0.53
14 Captive of buyer that has expanded	0.10	-0.09	0.21	-0.19	-0.04	0.08	-0.08	-0.08	-0.07	0.13	-0.07	-0.11	-0.53	1.00

APPENDIX 2b: Correlation matrix of transplant-supplier sample, extension subset ( $N = 852$ )

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Dependent variable	1.00	0.08	0.03	-0.02	-0.12	-0.04	0.12	-0.12	0.05	-0.04	0.18	-0.04	0.07	-0.01
<i>Buyer-supplier characteristics</i>														
2 Link in 1979	0.08	1.00	-0.16	0.01	-0.06	-0.02	0.00	0.02	0.04	-0.04	0.04	0.02	0.16	-0.13
3 Unknown link in 1979	0.03	-0.16	1.00	0.04	-0.00	0.00	0.02	0.01	-0.04	0.14	0.22	-0.10	-0.18	0.23
<i>Buyer characteristics</i>														
4 Later entry year	-0.02	0.01	0.04	1.00	-0.36	-0.22	0.50	0.09	0.00	-0.02	-0.02	0.27	-0.07	0.03
5 Home-country volume	-0.12	-0.06	-0.00	-0.36	1.00	-0.16	-0.53	0.14	0.05	0.01	0.02	-0.16	0.01	0.01
6 No. of suppliers in home country	-0.04	-0.02	0.00	-0.22	-0.16	1.00	-0.51	0.26	-0.02	-0.04	-0.04	-0.12	-0.01	0.01
7 JV with home-country buyer	0.12	0.00	0.02	0.50	-0.53	-0.51	1.00	-0.41	-0.02	0.01	-0.00	0.20	-0.02	0.00
8 JV with local buyer	-0.12	0.02	0.01	0.09	0.14	0.26	-0.41	1.00	0.03	-0.02	0.01	0.00	-0.02	0.01
<i>Supplier characteristics</i>														
9 Supplier size	0.05	0.04	-0.04	0.00	0.05	-0.02	-0.02	0.03	1.00	0.03	0.05	0.10	0.24	-0.10
10 Unknown size	-0.04	-0.04	0.14	-0.02	0.01	-0.04	0.01	-0.02	0.03	1.00	-0.06	-0.07	-0.11	0.09
11 Expanded before buyer: before 1980	0.18	0.04	0.22	-0.02	0.02	-0.04	-0.00	0.01	0.05	-0.06	1.00	-0.15	0.09	-0.05
12 Expanded before buyer: after 1979	-0.04	0.02	-0.10	0.27	-0.16	-0.12	0.20	0.00	0.10	-0.07	-0.15	1.00	0.01	-0.10
13 No. of home-country buyers	0.07	0.16	-0.18	-0.07	0.01	-0.01	-0.02	-0.02	0.24	-0.11	0.09	0.01	1.00	-0.69
14 Captive of buyer that has expanded	-0.01	-0.13	0.23	0.03	0.01	0.01	0.00	0.01	-0.10	0.09	-0.05	-0.10	-0.69	1.00