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Abstract

This research examines how the vertical, competitor and community elements of the interorganizational environment influence the occurrence and timing of international expansion by supplier firms. We argue that information and market attractiveness constraints influence the outcome we study, the establishment by a supplier of a first plant in a foreign location. We develop a model that captures these two constraints through the prevalence and timing of prior expansion by current and potential buyers (vertical elements of the interorganizational environment), by rival suppliers (competitor elements), and by non-competing suppliers (community elements). An empirical analysis of expansion patterns among 547 Japanese automotive component suppliers into the United States and Canada between 1978 and 1990 generally supports the model. The results suggest further multilevel work on the interaction between the evolution of individual organizations and the interorganizational environment in which organizations operate.

Organizational Evolution in the Interorganizational Environment: Vertical, Competitor, and Community-Level Influences on Supplier Expansion to Foreign Markets

This study investigates how the interorganizational environment shapes organizational evolution. We focus on corporate expansion into new markets as one of the main forms of organizational evolution. The specific form of corporate expansion we study involves the establishment of a production facility in a foreign location. Existing theoretical work on how interorganizational factors affect organizational evolution deals primarily with the basic life events of organizational founding and death or with various forms of organizational performance (Astley and Fombrun, 1987). The actions that occur between birth and death, as an ongoing firm grows and declines, deserve attention in their own right (Nelson and Winter, 1982). The actions that affect a firm's long term operating efficiency, financial profitability, and survival often occur when the firm, rather than growing gradually within its initial environment, undertakes discrete corporate expansion that redefines its environment of reference (Caves, 1996).

Though corporate expansion into a new market is one of the fundamental forms of variation among business organizations (Aldrich, 1979: 24, 39), it is also among the least understood outcomes of the interorganizational environment. One can view corporate expansion as a form of constrained adaptation to growth opportunities. We assume that firms that undertake major, discrete expansion moves exert strategic choice, in the sense that managers have substantial influence in determining and selecting among multiple options regarding the occurrence, timing, and direction of organizational growth (Child, 1972). We further assume that firms expand in order to improve corporate performance. We do not specify a single corporate performance goal but derive hypotheses that are consistent with the search for profitability, survival, and business growth. Some combination of these goals plausibly describes the incentives for firms to expand into new markets (Penrose, 1959).

We also assume that firms face substantial constraints on corporate expansion. Our analysis highlights two such limits. The first limit is a market attractiveness constraint. A firm is more likely to enter a new market if it can identify a set of buyers from which it stands a reasonable chance of obtaining sales. In assessing the overall amount of business that it might obtain, we expect a supplier to consider which competitors, if any, are operating in the new market. Markets with more potential buyers and fewer rivals are more attractive, all other things equal. This first constraint is one of finite resources, and is common to all open-system models of organizations (Thompson, 1967: 26-27). The second limit on expansion is an information constraint. Before a firm considers expanding into a new market, it needs to be aware of opportunities in that market and to be able to assess the market potential. Bounded rationality restricts expansion into markets about which information is limited (Simon, 1976; Nelson and Winter, 1982). We assume that firms become more likely to expand once reliable information about a new market becomes available, partly through the observation of pioneering firms with which the focal organization is familiar (Klein, 1977: 68-791; March, 1991). Working through these market attractiveness and information constraints, we expect several levels of the interorganizational environment to influence corporate expansion. Specifically, we expect the vertical, competitor, and community levels of the interorganizational environment to influence supplier expansion to foreign markets.

In examining organizational evolution, researchers have become increasingly aware of the need to account for influences at multiple levels (Rousseau, 1985; Baum and Singh, 1994: 3-20; Drazin and Schoonhoven, 1996). Barnett and Carroll (1987), for example, showed that, among mutual and commercial telephone companies operating in Iowa during the 1900-1917 period, community and competitor factors influenced both corporate growth by addition of customers in an existing business and corporate expansion by entry into a new business. Miner, Amburgey and Stearns (1990), studying Finnish newspapers over a period of 200 years, showed that both the competitor environment and the vertical environment of political parties

with which newspapers may align themselves affected the rate of organizational transformation, which they defined as nine types of events including changes in newspaper content or geographic coverage.

We examine three levels of the interorganizational environment. The first level is the vertical environment, which consists of relationships that link a supplier firm with each of its current buyers and its potential buyers. The second level is the competitor environment, in which the actions of firms that compete with a given supplier influence that supplier's actions. The competitor environment consists of suppliers that sell goods similar in function to those of a focal supplier. The third level is the community environment, which encompasses the aggregate behavior of supplier firms that produce different components and therefore do not compete directly with a focal supplier. Together, the three levels of analysis allow us to account for three fundamental sources of interorganizational influence (Pennings, 1981): vertical interdependence between buyers and suppliers (vertical effects), horizontal competition between firms operating in the same product-market (competitor effects), and horizontal complementarity between suppliers that offer different products for the same buyers (community effects). To our knowledge, no empirical research has jointly investigated the influences of the vertical, competitor, and community environments on organizational expansion into new markets.

This paper contains six sections. The first section discusses basic issues in the study of corporate expansion. In the second section we develop hypotheses about the effects of vertical, competitor, and community interaction on supplier international expansion. The third section covers data and methodology and describes the study's variables. In the fourth and fifth sections we report and discuss the results. The sixth section summarizes the implications of the study. Below, we develop hypotheses in the case of international expansion. As our discussion indicates, some of these hypotheses parallel the literature on domestic product-market diversification.

SUPPLIER INTERNATIONAL EXPANSION: THEORY AND HYPOTHESES

The empirical outcome of interest in this paper is the establishment by a supplier of its first plant in a foreign location. This form of expansion is commonly referred to as foreign direct investment. Foreign direct investment shapes competition between firms in most industries and has important consequences for the welfare of nations (Caves, 1996). International expansion is also a discrete and highly visible form of corporate expansion that one can measure reliably. Thus, foreign direct investment represents a particularly useful context for assessing the vertical, competitor, and community influences on organizational expansion.

We draw on two main streams of literature to explain organizational evolution through international expansion. The foreign direct investment literature addresses how within-firm characteristics and macro-environments affect a corporation's propensity to expand internationally. The interorganizational relationships literature addresses organizational adaptation and change. Between them, these literatures yield eight hypotheses about corporate evolution through international expansion.

Vertical Effects On Expansion

Vertical relationships are an appropriate level of analysis wherever a fundamental transformation brought about by relation-specific investment and learning gives interorganizational relationships a partner-specific rather than a purely arm's length character (Becker and Stigler, 1977). Small-numbers bargaining situations are frequent in buyer-supplier relationships and often are long-lasting. The vertical aspect of interorganizational relationships is prominent not only in the context of the Japanese industrial enterprises that we study empirically, but also in other contexts wherever small numbers of buyers and suppliers exchange products or services that are complex or involve sensitive delivery systems (Phillips, 1960; Heide and Miner, 1992; DiMaggio, 1994). Phillips (1960) and Richardson (1972) argued that industries

featuring well-established links between buyer-supplier pairs are the rule rather the exception, while undifferentiated markets with large numbers of buyers and suppliers are comparatively rare. Examples of industries where buyers and suppliers often develop strong vertical links include railroad transportation (Macaulay, 1963), aerospace (Masten, 1984), financial auditing (Levinthal and Fichman, 1988), and shipbuilding (Masten, Meehan and Snyder, 1991), and apparel manufacturing (Uzzi, 1997).

Applying a vertical focus of analysis to international expansion allows us to analyze how a supplier will react when a current or potential buyer expands. The buyer's investment means that a well-identified and comparatively attractive component market is opening in the host location. Entry by a buyer provides a signal of the importance of the new market and may also imply threats to sales in the home market if the buyer eventually replaces domestic production capacity with foreign plants. The fact that the buyer is a new entrant to the foreign market indicates that its new operations must arrange supplier links where none existed before. Thus, buyer expansion directly addresses the information constraint on supplier expansion. Buyer expansion, however, does not intrinsically define how attractive that market will be. The market attractiveness constraint requires further analysis in light of the supplier's existing capabilities.

In considering supplier capabilities, much of the prior research that examines supplier reaction to buyer international expansion draws upon internalization theory (Buckley and Casson, 1976). Internalization theory identifies two conditions for foreign direct investment. First, the firm must possess products or technologies that are valuable enough in the host location to compensate for the costs and risks involved with investment in a foreign location (Dunning, 1973; Caves, 1996). Second, given that a foreign market warrants entry, the choice of the mode of entry will be based on the comparative costs of organization, in the tradition of Coase (1937). A firm will set up its own operations in a foreign market, rather than license or sell its technology outright to a firm already operating in the host location, if the costs of transferring knowledge across firm boundaries are substantially higher than the costs of transfer across subsidiaries of

the same firm. These costs include direct costs of transfer and latent costs associated with potential leakage to a licensee (Hennart, 1982).

The relative costs of transferring knowledge are likely to be highest where the assets supporting entry are intangible, meaning that they are embodied in knowledge dispersed throughout the organization rather than consisting of a discrete physical asset. Examples of such intangible assets include the R&D capabilities embodied in teams of researchers and technicians, the ability of marketing teams to style and promote products in distinctive ways, and the general management talents embodied throughout the corporate hierarchy (Buckley and Casson, 1976; Caves, 1996). The tacit character of intangible assets makes them hard to specify and therefore particularly expensive to transfer to a non-affiliate whose rules of internal organization do not match those of the source (Teece, 1977). Moreover, even if intangible knowledge can be made explicit to facilitate transfer to another firm, it then becomes hard to protect against imitation by those who can observe the knowledge first-hand (Arrow, 1962). Because assets that are intangible are both more difficult to transfer to a non-affiliated organization and more likely to be misappropriated by the non-affiliate, their transfer will be more likely to occur between subsidiaries of the same firm (Buckley and Casson, 1976; Caves, 1996). Thus, internalization theory predicts under which conditions firms will expand internationally by setting up their own subsidiaries in foreign locations.

Building on internalization theory, Grubel (1977) and Gray and Gray (1981) argued that a supplier would be likely to establish a foreign facility after one of its buyers expands internationally. Such follow the buyer expansion provides a means of exploiting and preserving the buyer-specific knowledge acquired through domestic exchange. Buyer-specific knowledge consists of idiosyncratic information about the requirements and capabilities of a buyer. The knowledge provides the current supplier with an advantage in serving the buyer's ongoing needs (Levinthal and Fichman, 1988; Asanuma, 1989; Martin, 1996). Intangible knowledge of this type is difficult to transfer to another company, and difficult to monitor should it

somehow be made available to a licensee or franchisee. Thus, when a buyer expands internationally, its current domestic suppliers will become more likely to set up foreign facilities of their own. Such behavior is likely driven by relation-specific knowledge that makes a supplier more efficient in serving the transplanted buyer's foreign subsidiary (Grubel, 1977; Gray and Gray, 1981). Furthermore, a supplier will feel a sense of urgency in expanding internationally following buyer expansion, lest the initial competitive advantage be lost to another firm. If the current supplier does not follow its domestic buyer in setting up foreign operations, then the transplanted buyer will be likely to establish a link with an alternate supplier that will eventually develop relation-specific knowledge of its own and could later threaten the current supplier in the domestic market (Grubel, 1977).

Starting with Goldberg and Saunders (1980), several empirical studies have sought to test the arguments of Grubel (1977) and Gray and Gray (1981) by examining whether there is a link between the international presence of firms in a supplier industry and the international presence of firms in client industries. Li and Guisinger (1992) and Sagari (1992) provide comprehensive reviews of these studies. This research shows a positive relationship between the investment by buyer firms from a particular home country in a given host country, and the investment level of supplier firms from the home country industry. This pattern of results holds whether one measures investment by the number of plants or branch offices established, or by the asset value of these units. Past empirical studies have focused largely on service suppliers, such as banks and advertising agencies.

These studies share two drawbacks related to the link between their research design and the underlying theory. First, the studies rely on pooled cross-sectional data or, in the most favorable case, on disjoint panels of data. Therefore, the studies do not establish a causal relationship between buyer expansion and supplier expansion, as hypothesized by Grubel (1977) and Gray and Gray (1981). Second, as Sagari (1992) notes, the studies rely on aggregate measures of investment in buyer industries to estimate

influences on supplier expansion. Therefore, the studies cannot compare the effect of expansion by current buyers with the effect of expansion by potential buyers. The motivations for supplier investment following expansion by a current buyer differ from those for investment following expansion by a potential buyer (Grubel, 1977). Studies that aggregate buyer expansion at the industry level may underestimate the impact of current-buyer expansion on supplier expansion, depending on the relative impact of expansion by current and potential buyers. As we discuss below, neither effect dominates intrinsically.

In contrast to previous studies, we explicitly attend to the distinction between current and potential buyers, both theoretically and empirically. We distinguish between the current-buyer effect and the potential-buyer effect and measure each after controlling for the other. We also use a longitudinal research design that allow us to examine the relative timing of events. This approach allows us to make the research design consistent with the underlying theoretical mechanisms.

The internalization logic of relation-specific knowledge suggests two sets of hypotheses that address the influence of the vertical relationship between suppliers and buyers on the international expansion of suppliers. First, the opportunity to exploit relation-specific knowledge will prompt a supplier to expand internationally after current domestic buyers expand. As the number of current buyers that have already expanded increases, however, the incremental effect of expansion by every successive buyer will become weaker because a supplier is unlikely to immediately recreate all home country links in the new country (a market attractiveness issue) and because the information contributed by observing later buyer entries is less novel (an information issue). Thus, we expect the likelihood of supplier expansion to increase monotonically but less than proportionately as the number of transplanted current buyers increases.

> Hypothesis 1: The likelihood that a supplier will establish a foreign production facility will increase at a decreasing rate with the number of its current domestic buyers that have entered the foreign market.

Second, the logic of internalization also leads to predictions about the effect of expansion by potential domestic buyers, that is, by firms in the home country industry to which the supplier does not sell goods. The opportunity to expand its buyer base can lead a supplier to follow potential buyers into foreign locations. Transplanted potential domestic buyers will be attractive because relation-specific knowledge acquired in the foreign location may eventually allow the new supplier to obtain business in the initial domestic location where both the buyer and the supplier operate their main facilities (Grubel, 1977; Gray and Gray, 1981). Thus, international expansion by a potential domestic buyer will have a positive effect on a supplier's propensity to establish foreign production facilities (Martin, Mitchell and Swaminathan, 1995). Again, we expect the vertical effect to increase less than proportionately for a given supplier as the number of transplanted potential buyers increases.

> Hypothesis 2: The likelihood that a supplier will establish a foreign production facility will increase at a decreasing rate with the number of potential domestic buyers that have entered the foreign market.

The existing literature does not allow us to make a definite prediction about the relative impact of cumulative entries by current and potential buyers. Martin, Mitchell and Swaminathan (1995) found that a transplanted supplier is more likely to establish a link in the host location with a given current buyer than with a given potential buyer. This informs us as to the chances of creating a link following supplier expansion. We know very little, however, about the relative benefits and risks involved in adding new links with current or potential buyers, whether in a domestic context (Blau, 1964: 161-162; Cook, 1977) or in a foreign location (Grubel, 1977). Furthermore, the literature is all but silent as to the relative costs of not following current or potential buyers into foreign markets (Vernon, 1971: 75). Because we have no unequivocal way to compare both the risks and the expected returns from following or not following a

current or potential buyer, we treat the relative impact of entry by current and potential buyers as an empirical research question.

Competitor Effects On Expansion

The analysis moves to a competitor level of analysis when considering how the aggregate behavior of similar firms influences a focal firm (Hawley, 1950; Hannan and Freeman, 1989). Firms offering similar products that expand from a given home country represent a distinct organizational population in the host location. The population exists as a distinct set because firms develop organizational forms influenced by routines that are specific to the location where their domestic development occurred (Kogut, 1991). In the automotive industry, which is the empirical context for this study, there is ample evidence of systematic and enduring differences among producers of a given product based on the home country of these producers (Lieberman, Lau and Williams, 1990; Clark and Fujimoto, 1991). A relevant reference competitive population for a transplanted supplier, therefore, consists of all other suppliers from the same home country that produce the same components. While nation-of-origin effects have received particular attention in the automotive industry, similar durable patterns have been documented in other industries, including machine tools, electrical machinery, electronics, rubber and chemicals, among countries from North America, Asia, and Europe over multiple decades (Chandler, 1990; Fuss and Waverman, 1992; Kogut, 1993).

Foreign expansion by one or more firms is likely to prompt matching foreign direct investment by some competitors because the expansion generates information about the target market while defining conditions under which a follower will find the host market attractive. The observation of current rivals that have entered a new market before is an important source of information about opportunities and threats in that potential market for later entrants. In the absence of detailed information about a host market, entry by known competitors may indicate that the market is more attractive than earlier thought (King, 1995). Such information effects figure prominently in models where similarity across firms in a population increases

because they undertake similar changes over time (DiMaggio and Powell, 1983; Mezias and Lant, 1994; Miner and Haunschild, 1995). Mimetic effects of this type are likely to be most common in highly uncertain contexts (Spender, 1989; Abrahamson and Rosenkopf, 1993). Empirically, Haveman (1994a) interprets follow-the-leader effects in the context of domestic product-line diversification as a case of mimetic behavior.

These arguments can be extended to the case of international corporate expansion. International expansion is a form of diversification, albeit in geographic markets rather than in product-markets as studied by Haveman (1994a, 1994b). In the international context, information gleaned from observing domestic rivals expanding should be more valuable than information about other entrants because it indicates how firms that possess comparatively similar technology and organizational structures, and whose domestic market experience is well known, can operate in the foreign location. There is also substantial uncertainty involved in establishing foreign operations (Aharoni, 1966: 92-99; Hawkins and Walter, 1981). This uncertainty will tend to encourage mimetic follow-the-leader behavior.

There is a market attractiveness constraint, however, to the number of firms that can expect to successfully imitate industry pioneers in expanding internationally. Again, our argument parallels the literature on domestic corporate expansion. Consistent with organizational ecologists' prediction that the number of entrants into a new market will eventually decline as the number of market participants increases (see Hannan and Carroll, 1992: 25-49), Haveman (1994b) finds that the number of firms that diversify into existing markets tends to decline beyond some threshold as the number of prior diversifying entrants increases.

Models of international expansion have similarly recognized the importance of competitive forces in shaping the market attractiveness constraint. Such models predict an initial impetus to follow early rival entrants into a foreign location, but only up to a point. The follow-the-leader behavior has been explained

as an effort to avoid leaving close rivals unchecked in foreign markets from which they might derive low-cost products or cash from profits that feed their competitive drives in the home market or elsewhere (Knickerbocker, 1973; Kamani and Wernerfelt, 1985; van Witteloosuijn and van Wegberg, 1992). As the number of competitors that invest in a host country increases, however, the level of competition among these firms increases. The competition causes the costs of international entry to increase and the gains from operating in the host location to decline (Hymer, 1976; Mitchell, Shaver and Yeung, 1994). Knickerbocker (1973) and Yu and Ito (1988) reported that foreign entry by domestic competitors tends to occur in a wave-like pattern, with the number of new entrants in a given time period first increasing and then decreasing as more domestic competitors expand. This pattern appears to characterize firm entry in many geographic regions and industries, especially those with intermediate levels of concentration (see also Graham and Krugman, 1991). As entry by rivals relieves the information constraint while tightening the market attractiveness constraint, we expect that the number of firms expanding internationally will first increase and then decrease as the number of competitors having already entered increases.

> Hypothesis 3: The likelihood that a supplier will establish a foreign production facility will first increase and then decrease in an inverted U-shaped form as the number of competitors having already entered increases.

Community Effects On Expansion

The community perspective emphasizes the interaction between sets of related organizations. At the community level of analysis, changes in one population can have a positive, neutral or negative effect on the other population (Astley and Fombrun, 1987; Brittain and Wholey, 1988). The direction of the effect reflects the extent to which the two competitors complement each other in generating mutually beneficial growth opportunities, draw on unrelated resources, or rely on the same finite pool of resources (Hawley,

1950; Carroll, 1984). The organizational community framework is useful when considering the effect of indirect interorganizational relationships on firm-level behavior (Astley and Fombrun, 1983, 1987).

From the perspective of a supplier, other firms operating in the same stage of the industry chain will belong to either of two distinct groups. One group, discussed above, consists of competitors that produce the same components as the focal supplier. The second group, which is relevant to community-level analysis, consists of non-competing suppliers. Non-competing suppliers have product lines that do not overlap with that of the focal supplier and, therefore, do not compete with the focal supplier even when serving the same buyers.

We expect populations of non-competing suppliers to have a mutually beneficial relationship in foreign locations, meaning that an increase in the number of transplants from one population will be favorable to the international expansion of firms in the other population. Theorists sometimes refer to this type of mutual complementarity as symbiosis or mutualism (Astley and Fombrun, 1987; Barnett and Carroll, 1987; Brittain and Wholey, 1988).

We expect a positive community effect on supplier expansion because entry by non-competing suppliers relaxes both the information constraint and the market attractiveness constraint. First, entry by a non-competing supplier makes the foreign presence of domestic suppliers more visible and provides industry-wide information about the host market (see Aharoni, 1966; Martin, Mitchell and Swaminathan, 1994). Second, as more non-competing suppliers expand to the new location, the transplanted buyer will have access to a more complete set of suppliers that have learned to operate under consistent, home-country-specific standards of buyer-supplier interaction (Kogut, 1991). The transplanted supply base will strengthen the transplanted buyer which, in turn, will make international expansion more attractive for later supplier entrants.

Thus, we expect that the propensity of a supplier to expand internationally will increase as more non-competing suppliers expand. As with buyer expansion, however, we expect this effect to decline as the size of the community grows. As the number of non-competing transplant suppliers increases, the incremental information and buyer stability contributed by each additional transplant will decrease.

> Hypothesis 4: The likelihood that a supplier will establish a foreign production facility will increase at a decreasing rate with the number of non-competing domestic suppliers that have entered the foreign market.

Vertical, Competitor, and Community Effects on Expansion Timing

Hypotheses 1 through 4 address the effect of several elements of the interorganizational environment as the numbers of transplanted current buyers, potential buyers, competitors, and non-competing suppliers increase. When viewed dynamically, however, corporate expansion involves an examination not only of whether change occurs, but also of when such change occurs (Mitchell, 1989). To the extent that the information that relieves a supplier's information constraint is public, the information contains the seeds of its own obsolescence. As buyers line up suppliers for their transplant operations, the information that each entering buyer contributes loses relevance. As multiple competing suppliers heed the initial market signal, the resulting competition threatens to negate the initial market promise. Studies of new product introduction in U.S. consumer goods industries show that, in addition to rank order of entry, the time elapsed since the first entrant started operations affects a firm's market performance (Brown and Lattin, 1994; Huff and Robinson, 1994). In a domestic context of product-market diversification, this means that an organization may respond not only to cumulative entry by competitors, but also to the time elapsed since a competitor first entered.

Building on the domestic product-market diversification research, we argue that time since entry by the first firm of each element of the interorganizational environment needs to be considered along with the cumulative number of prior entrants in each category. We expect that expansion by a pioneering organization will create a finite decision window for other organizations to expand. This timing effect may describe suppliers' responses to the expansion of competing suppliers (competitor effects), consistent with domestic studies. We argue that the timing effect will also apply to entry by pioneering buyers (vertical effects) and by non-competing suppliers (community effects).

In the case of buyer expansion, the need for a transplanted buyer to source components in the host location defines a window of opportunity. Suppliers can exploit relation-specific knowledge only after the buyer has expanded internationally (Gray and Gray, 1981). At that point, current and potential suppliers have a finite amount of time to expand as they seek to capture the transplant's business in the host location (Grubel, 1977). This window of opportunity closes as the transplanted buyer identifies a full complement of suppliers in the host location, raising the market attractiveness constraint again. In each case, the market attractiveness constraint will start rising as the information constraint declines. The window of opportunity is likely to be quite short for a transplanted buyer, for two reasons.

First, like other buyers, a transplanted buyer needs to identify suppliers for each component that is part of the final product before the buyer starts its own production operations on a commercial scale. In the auto industry, for instance, it is not practical to start mass-assembling cars if the assembler has not yet arranged supplies of piston rings or brake pads. Masten, Meehan and Snyder (1991) argue that the same requirement to have all components on hand before orderly production of a product or service commences exists in many industries. Other examples include shipping services (Pirrong, 1993) and construction (Slaughter, 1993). The buyer has a strong incentive to arrange suppliers for the components involved in its product range quickly, because the investment of setting up a new operation cannot start to pay back until

commercial production begins. The time involved in starting operations at new plants before they generate revenues is typically measured in months or years (Gilbert and Lieberman, 1987). All new plants face an economic incentive to finalize initial procurement quickly.

Second, the window of opportunity will be shorter for buyers that make a comparatively narrow range of end-products and, therefore, start with a shorter shopping list. A buyer's transplanted operations are generally small in scale and scope relative to the parent home-country operations (Johanson and Vahlne, 1977; Kogut, 1983). Thus, transplanted buyers tend to complete their supplier selection comparatively rapidly. If a supplier contemplates expanding into a foreign location to serve a transplanted buyer that has expanded into that location, it must act quickly or lose out on the opportunities at buyer startup (Grubel, 1977). After the initial decisions, years may pass before procurement is reopened, typically as the buyer introduces new generations of end-products (Clark and Fujimoto, 1991). Therefore, we expect that supplier entry will tend to occur rather shortly after an incumbent buyer leads the way, if the suppliers expands at all.

> Hypothesis 5: The likelihood that a supplier will establish a foreign production facility will first increase, and then decrease in an inverted U-shaped form as a function of the time since at least one current domestic buyer entered the foreign market.

We expect the same effect to arise when suppliers follow the lead of a potential buyer. Again, if a supplier seeks to establish a new link with a transplanted potential buyer, then the most propitious time will be shortly after the buyer expands.

> Hypothesis 6: The likelihood that a supplier will establish a foreign production facility will first increase, and then decrease in an inverted U-shaped form as a function of the time since at least one potential domestic buyer entered the foreign market.

In the case of competing supplier expansion, the dynamics of competition again will constrain the time in which the firm enjoys optimal entry conditions. In choosing how to act when a competitor expands, suppliers face two considerations. On the one hand, given the uncertainty inherent in corporate expansion, immediate entry may not be optimal (Levitt, 1966). An information advantage may accrue to the supplier that waits before expanding so it can learn from observing earlier entrants. On the other hand, late entrants may face high barriers as early entrants appropriate critical resources and preempt key markets (Vernon, 1971; Jacquemin, 1989). This combination of effects promotes an intermediate stance with some entry delay (Levitt, 1966; Mitchell, Shaver and Yeung, 1994).

In practice, we expect that there will be a decision window after the first supplier in a competitor population expands. Supplier expansion into foreign operations will most likely occur within this finite time window. This is consistent with the empirical evidence showing that investments from a given country into a particular foreign host industry tend to cluster in time (Knickerbocker, 1973; Yu and Ito, 1988).

> Hypothesis 7: The likelihood that a supplier will establish a foreign production facility will first increase, and then decrease in an inverted U-shaped form as a function of the time since at least one of its domestic competitors entered the foreign market.

We also expect a window of opportunity to accompany international expansion by non-competing suppliers. Entry by a non-competing supplier may signal an opportunity to participate in establishing a network of complementary suppliers in the host location, which may then exclude later entrants (see Fombrun, 1988; Martin, Mitchell and Swaminathan, 1994, 1995). Entry by a non-competing supplier will also provide the potential entrant with information about how expansion into the host location affects the home-country operations of the supplier. Delays following entry by non-competing suppliers might arise because firms lack information about such firms or consider the information to be less immediately relevant than information about buyers and competing suppliers. Nevertheless, Aharoni's (1966) classic study

suggests that information about other firms' foreign investments can encourage international expansion even by firms operating in unrelated industries.

The information conveyed by the expansion of non-competing suppliers will, however, become obsolete as the environment in the host location changes relative to that under which the early entrant expanded (see Delacroix and Rao, 1994; DiMaggio, 1994; Martin, Mitchell and Swaminathan, 1994). Thus, although the propensity for a supplier to expand may initially increase following the initial expansion by a non-competing supplier, the magnitude of that effect will eventually decrease. This suggests an inverted-U shape for the effect of time since first non-competing supplier entry.

> Hypothesis 8: The likelihood that a supplier will establish a foreign production facility will first increase, and then decrease in an inverted U-shaped form as a function of the time since at least one non-competing domestic supplier entered the foreign market.

This concludes the development of hypotheses about timing effects. In all four cases, we expect that there will be non-linear effects with the probability of supplier international expansion first increasing and later decreasing. We treat the relative width of the timing effects described in this study as a topic for empirical exploration.

DATA AND METHODOLOGY

We tested the hypotheses by analyzing the occurrence and timing of expansion into the United States and Canada by Japanese automotive vehicle assemblers and parts manufacturers between 1978 and 1990, while controlling for all prior cases of Japanese automotive supplier and buyer expansion into the host region. The automotive industry, once described by Peter Drucker (1972, p. 176) as the industry of industries, has been variously characterized as featuring organizational interactions at the buyer-supplier (Asanuma, 1989; Cusumano and Takeishi, 1991), competitor (Helper and Levine, 1992; Lamming, 1993; Hannan, Carroll,

Dundon, and Torres, 1995) and community (Fombrun, 1988) levels. Supplier relations play an important role in allowing automotive assemblers to lower costs, improve quality and develop products quickly (Clark and Fujimoto, 1991; Kenney and Florida, 1993; Lamming, 1993). Moreover, the automotive industry has seen substantial foreign investment activity in recent years. Creeping market and regulatory pressure combined with shifting terms of trade encouraged Japanese firms to set up foreign operations throughout the study period, particularly in the large U.S.-Canadian market (Lamming, 1993). Given its size, diversity, and rich history, the automotive industry is a particularly appropriate context for studying supplier expansion.

We treat the United States and Canada as a combined host location because free trade in automotive products, including parts and assembled vehicles, has existed between these nations since the United States-Canada Automotive Products Agreement of 1965, which is commonly known as the Auto Pact. The U.S. and Canadian automotive component sectors became tightly integrated as a result of this agreement, which encouraged a sharp increase in bilateral trade in finished vehicles and components between the two countries. Difficulties in setting up an independent dealer and maintenance network may have prompted some foreign automobile manufacturers with strong financial constraints, such as Korea's Hyundai, to focus their operations in one country initially. An examination of the standard industry reference source, *Ward's Automotive Yearbook*, however, confirms that all the Japanese assemblers in our data set were selling in both countries within two years of establishing operations in either country. Furthermore, the marketing channel constraint does not apply to the suppliers, whose expansion is our dependent variable. Recent studies of the industry (Womack, Jones and Roos, 1990: 264; Lamming, 1993: 50) identify the United States and Canada as one well-defined and homogeneous host location.

Data Sources

Our sample consists of 547 Japanese automotive component first-tier suppliers and 11 Japanese automobile assemblers. This sample encompasses all known first-tier Japanese suppliers of 136 distinct component categories to the 11 automobile assemblers operating in Japan as of 1978. First-tier suppliers are firms that sell components directly to assemblers, rather than to other suppliers. We excluded from the sample foreign-owned suppliers whose expansion into the United States and Canada would not represent expansion out of Japan, although we controlled for these suppliers' presence in the host location as we describe below. The components, such as crankshafts, wiper blades and headlights, are broadly representative of the entire range of components used by automotive assemblers. The data source was Dodwell Marketing Consultants (1979), a comprehensive industry directory that lists first-tier suppliers to the Japanese automotive industry. We used this well-established data source to identify which supplier manufactured which component for which assembler at the beginning of the study period.

We then used standard industry sources including *Chilton's Automotive Industries*, *Ward's Automotive Yearbook*, and *Automotive News* to establish which of the 547 suppliers and 11 assemblers expanded into the United States or Canada during the study period, and in what year. A total of 118 suppliers established manufacturing plants in the host location between 1978 and 1990. No supplier exited North America during the study period. All the suppliers that expanded into the host location had achieved first-tier status in Japan by 1978 and were therefore properly accounted for both in Japan and in the United States. The 11 assemblers also operated continuously in Japan throughout the study period, and eight of them established manufacturing plants in Canada or the United States between 1982 and 1989. In modeling supplier expansion, we excluded 15 suppliers that established manufacturing plants before 1978 because we could not determine which buyers they served prior to expanding. We included these 15 suppliers in our counts of

prior entrants and in generating competitor and community entry clocks, however, because they were active suppliers during the study period.

Variables

Table 1 provides descriptive statistics and a correlation table for the variables we used in this study. The dependent variable for the study is a binary variable set to 1 if a supplier established its first manufacturing plant in the United States or Canada in a given calendar year and set to 0 otherwise. We labeled the dependent variable "Supplier Entry" because it describes whether the supplier expanded into the host location.

********** Table 1 about here **********

The independent variables measured the cumulative behavior of four sets of organizations: current buyers, potential buyers, competitors, and non-competing suppliers. We derived two time-varying measures for each set of organizations: first, a count variable reflecting the total number of organizations that had expanded into the United States or Canada as of a given year and, second, a clock variable measuring the time since the first organization in the set expanded. This resulted in four entry count variables and four clock variables, all time-varying. We set each entry clock to zero until the first entry by an organization in the relevant set.

In measuring the effects of current and potential buyer expansion we defined a current buyer as one for which the supplier under consideration manufactured at least one component for direct sale in Japan, signifying that a first-tier procurement relationship existed in the domestic country. Potential buyers included those buyers that purchased no component from the supplier in Japan. We classified the buyers based on first-tier links since these accurately define both which firms develop first-hand assembler-specific knowledge and which firms compete directly to supply a given buyer. While no comprehensive record of

second-tier relationships exists, our data source contains few cases where a first-tier supplier also acts as a second-tier supplier to the same buyer, and identifies no case of a supplier operating only as a second-tier supplier to a given buyer while operating as a first-tier supplier to another buyer. This is consistent with studies indicating that a supplier's tier status depends on the components that it manufactures and that tiering practices are broadly consistent across buyers (Asanuma, 1985; Smitka, 1991). Thus, our data accurately classify each Japanese automotive assembler as either a current buyer or a potential buyer relative to each first-tier Japanese automotive component supplier.

Hypotheses 1 to 4: Number of Prior Entries

We combined the data on buyer-supplier links with the data on the timing of buyer expansion in order to assess the effects of prior buyer entry counts. First, we created a count variable measuring how many current buyers of a given supplier had expanded as of a given year. To model the non-linear effect of incumbent buyer expansion we used a logarithmic transformation of the count variable, after adding 1 to the initial count in order to avoid undefined logarithmic values. We used the resulting variable, labeled "Number of Current Buyers Entered", to test hypothesis 1. Second, we used a similar procedure and transformation to measure how many potential buyers had expanded as of a given year. We labeled that variable "Number of Potential Buyers Entered" and used it to test hypothesis 2.

In measuring the effects of entry by suppliers, we distinguished between competing and non-competing suppliers. We coded two suppliers as competitors if the lists of the components they manufactured contained at least one component in common, out of the 136 components covered in this study. This represents a conservative measure of whether two suppliers interact in the same product-market and avoids any double-counting of buyer-supplier links. We coded two suppliers as non-competing if there was no overlap between the lines of components they manufactured. In this way, we classified every supplier as either a competitor or a non-competing supplier relative to a focal supplier.

As a first step towards operationalizing the supplier count effects, we used the two-way classification of competing and non-competing suppliers together with the data about the timing of supplier expansion to compute, for each supplier, a time-varying count of previously entered competitors and a time-varying count of previously entered non-competing suppliers. In a second step we transformed the variables in accordance with hypotheses 3 and 4. Hypothesis 3 involves an inverted-U effect of cumulative entries by competing suppliers. To capture this non-monotonic prediction we included the initial count of prior competing entrants, in a variable labeled "Number of Competitors Entered", together with a squared term. Hypothesis 4 predicts a declining marginal effect of the number of prior entries by competing suppliers. In that case we used a logarithmic transformation of the initial count of prior competing entrants. We labeled the resulting variable "Number of Non-Competing Suppliers Entered".

Hypotheses 5 to 8: Time Since Prior Entries

We also used the data about entry timing and buyer-supplier-component links to construct four sets of timing measures to test hypotheses 5 through 8. To measure the effect of time since first current buyer expansion, we used a clock variable measuring how many years had elapsed since the earliest entrant among a supplier's current buyers first established their first plant in the United States or Canada (hypothesis 5). We labeled this variable "Time Since At Least One Current Buyer Entered". The variable "Time Since At Least One Potential Buyer Entered" measures the number of years since the first potential buyer expanded (hypothesis 6).

We measured timing variables for supplier effects in a similar way. We measured the effect of time since the first competing supplier expanded by the clock variable "Time Since At Least One Competitor Entered" (hypothesis 7). We measured the time since the first non-competing supplier expanded with the clock variable "Time Since At Least One Non-Competing Supplier Entered" (hypothesis 8). We recorded the supplier clock variables in years, like the buyer clocks. The four timing hypotheses predict non-monotonic

time effects. In each case, we expect the effect to first increase, then decrease. We tested the inverted-U hypotheses by including a squared term for each of the four main-effect clocks described above.

We set each clock to zero until the first entry by an organization from a particular group occurred. In that respect the time clocks used in this study are similar to those used by Amburgey, Kelly and Barnett (1993) in their analysis of organizational change and mortality in the Finnish newspaper industry. The operationalization of clocks in the two studies, however, differs in one significant way. Amburgey, Kelly and Barnett (1993) use clocks to identify time since the first change within an organization in order to predict a later change within an organization or failure of the organization. Given that internal changes by a given organization are relatively rare in their study, these authors reset the clock after each change. By contrast we use clocks to identify changes in the interorganizational environment to predict entry by an organization. Because the interorganizational environment consists of many firms, measurable changes in the environment are much more frequent than changes within any one organization. In our case, given the frequency of entries by current buyers, potential buyers, competing suppliers and non-competing suppliers in our data set, it is not practical to reset the clocks after each type of entry. The range of the resulting clocks would be too small to allow meaningful measurement of entry timing effects. Instead, we use the clocks to measure the time elapsed since occurrence of the key signal associated with the first relevant entry, which is consistent with Aharoni (1966: 64-68). Our research design accounts separately for later occurrences of entries repeating the triggering events, as the count variables described earlier measure the number of entries that occur after each clock's first increment.

Control Variables

We included five control variables in the study. Two of the control variables measure characteristics of the suppliers. The third control variable deals with buyer-supplier equity links. The final two control variables measure market and competitive conditions in the host location. First, we controlled for supplier size,

because larger firms are more likely to expand internationally (Horst, 1972; Grubaugh, 1987). We measured size as the natural logarithm of the number of employees of the supplier. Measures of size based on financial data, such as assets, are not available because almost all the organizations in the sample are privately-owned or held as subsidiaries by their parent firm. In the absence of financial data, studies of business growth and change often use employment levels as a measure of firm size (see for example Audretsch, 1995). The employee measure is an important variable for predicting international expansion. Because managers and their awareness of international opportunities play a fundamental role in a firm's growth propensity, firms with a large number of managers are expected to have a stronger propensity to expand internationally (Penrose, 1959; Aharoni, 1966).

Second, we controlled for the number of component lines manufactured by the supplier. This is a count variable based on the 136 categories we used to identify which suppliers compete or do not compete with each other. In part, the measure identifies potential economies of scope. A transplanted supplier may rely upon these economies of scope to compensate for limited scale at entry and to offer a wider range of products to the transplanted buyer, thereby facilitating and accelerating completion of procurement by the buyer (Hymer, 1976; Grubaugh, 1987). The measure also reflects the variety of skills and routines that the supplier possesses (Nelson and Winter, 1982). A supplier with broad capabilities may be better positioned to add further to its product range in order to replace more specialized suppliers, should the latter fail to expand (Vernon, 1971). By controlling for the size and component-market diversity of an organization we account both for its scale and for its scope, two intrinsic characteristics that are fundamental in explaining the growth of firms and industries (Chandler, 1990). Empirically, Grubaugh (1987) found that a count of products was a significant predictor of firms' propensity to expand internationally.

Third, we controlled for the proportion of a supplier's equity owned by transplanted buyers. We measured this as a percentage of the supplier's common equity. We include this control variable because discussions

of the structure of Japanese industry suggest that assemblers might use part-ownership of suppliers as a means of coordinating investment decisions (Lincoln, Gerlach, and Takahashi, 1992; Lincoln, Gerlach, and Ahmadjian, 1996). Empirical evidence regarding the effect of equity ownership on supplier expansion is indirect and ambiguous. The existing evidence on supplier international expansion pertains to membership of suppliers in vertical enterprise groups, rather than to actual proportions of equity held by buyers. Nevertheless, equity ownership is relevant because a buyer heading a vertical enterprise group to which a supplier belongs will often hold equity in the supplier, while a buyer is unlikely to hold equity in a supplier that does not belong to an enterprise group (Lincoln, Gerlach and Takahashi, 1992). The evidence about the effect of membership in a vertical enterprise group on supplier expansion is itself mixed. Hennart and Park (1994) found no statistical evidence that membership in a vertical enterprise group makes a supplier firm more likely to expand internationally when a buyer organization belonging to the group enters a foreign market. On the other hand, Chang (1995) found weak positive evidence ($p < .10$) for the same variable. The frequency with which equity is cited as a factor in affecting the strategy of Japanese firms and the existence of at least limited empirical evidence in support of the argument warrants including equity participation as a control variable in this study.

Fourth, we controlled for the total market demand in the host location. We measured this as the number of cars and light trucks produced in the United States and Canada in a given year, as reported in *Ward's Automotive Yearbook*. This measures the overall size of the market, including locally-owned and transplanted buyers, which represents the overall carrying capacity of the host environment.

Fifth, we controlled for the number of non-Japanese competitors operating in the host location. We obtained this count information from the Automotive Supplier Directory in *Ward's Automotive Yearbook*, after excluding Japanese-owned suppliers and suppliers of manufacturing equipment. This count measures how many non-Japanese suppliers are operating in the United States and Canada. The *Ward's* directory is

the longest-established and most respected directory of its kind to cover the entire study period. The directory is the most reliable source available to assess the trend in the number of non-Japanese suppliers operating in the host location. Furthermore, discussions with three industry experts indicated that United States or Canadian owners hold at least ninety to ninety-five percent of the non-Japanese suppliers, and that the proportion of firms from foreign countries other than Japan was stable over the study period. Thus, our measure closely approximates a count of suppliers based in the host location.

Models and Analysis

The event of interest is whether a supplier establishes its first plant in the United States or Canada during a given year. In order to distinguish the effects of multiple count and timing variables we used a baseline constant-rate model to which we added control variables and a series of time-varying covariates. We decomposed the data on each supplier into annual spells. We updated the time-varying covariates for each supplier at the beginning of each spell. This approach allowed us to distinguish the effects of multiple time-varying counts and clocks while controlling for the baseline trend in supplier entries over time. We assumed the rate of supplier entry to be a loglinear function of the covariates, to ensure predicted rates that are not negative. We employed the following model to estimate the organization-specific instantaneous rate of entry:

$$r_j(t) = \exp\{\alpha_0 + \beta_1 * CBN_j(t) + \beta_2 * CBT_j(t) + \beta_3 * [CBT_j(t)]^2 + \beta_4 * PBN_j(t) + \beta_5 * PBT_j(t) + \beta_6 * [PBT_j(t)]^2 + \beta_7 * CN_j(t) + \beta_8 * [CN_j(t)]^2 + \beta_9 * CT_j(t) + \beta_{10} * [CT_j(t)]^2 + \beta_{11} * NCN_j(t) + \beta_{12} * NCT_j(t) + \beta_{13} * [NCT_j(t)]^2 + \gamma X_j(t)\}$$

In this equation:

- j is an index identifying an organization;

- $r_j(t)$ is the instantaneous entry rate for supplier j after t periods;

- $\mathbf{X}_j(t)$ is a vector of control variables describing supplier j, including supplier size, number of component lines, proportion of equity held by transplanted buyers, and total market size and number of non-Japanese suppliers operating in the host location;

- $CBN_j(t)$ is the logarithmic transformation of the number of current buyers from supplier j that have entered after t periods (variable Number of Current Buyers Entered);

- $CBT_j(t)$ is the number of years since a current buyer from supplier j first entered, measured as of period t (variable Time Since At Least One Current Buyer Entered);

- $PBN_j(t)$ is the logarithmic transformation of the number of potential buyers from supplier j that have entered after t periods (variable Number of Potential Buyers Entered);

- $PBT_j(t)$ is the number of years since a potential buyer from supplier j first entered, measured as of period t (variable Time Since At Least One Potential Buyer Entered);

- $CN_j(t)$ is the number of competitors of supplier j that have entered after t periods (variable Number of Competitors Entered);

- $CT_j(t)$ is the number of years since a competitor of supplier j first entered, measured as of period t (variable Time Since At Least One Competitor Buyer Entered);

- $NCN_j(t)$ is the logarithmic transformation of the number of suppliers not competing with supplier j that have entered after t periods (variable Number of Non-Competing Suppliers Entered);

- $NCT_j(t)$ is the number of years since a supplier not competing with supplier j first entered, measured as of period t (variable Time Since At Least One Non-Competing Supplier Entered).

- α_0 is the estimated regression coefficient associated with the constant term, the β's are regression coefficients estimated for various covariates, and γ is a vector of estimated regression coefficients for the control variables.

We obtained maximum-likelihood estimates of the covariates' effects using Tuma's (1980) RATE program. We evaluated significance levels with F ratios for individual coefficients and by using the χ^2-likelihood ratio test to compare the relative explanatory power of nested models.

RESULTS

Table 2 reports the estimated coefficients for six nested models of supplier entry. Model (1) represents a baseline of control variables. Model (2) adds count and clock variables representing the effects of entry by current buyers. Model (3) adds variables describing entry by potential buyers. Model (3) includes all vertical effects on supplier entry. Model (4a) adds the count and clock variables for entry by competing suppliers. Model (4b), a constrained version of model (4a) that we discuss below, also incorporates competitor effects. Finally model (5) adds variables describing entry by non-competing suppliers, thus incorporating community effects. Each model is significant relative to an intercept-only model, as shown by the model likelihood chi-squares ($p < .01$).

********** Table 2 about here **********

The control effects reported in model (1) are significant and all but one are positive. The results show that larger suppliers and suppliers with a broad range of components are more likely to expand internationally. Such effects are consistent with earlier baseline findings on international expansion (Grubaugh, 1987). Suppliers in which previously transplanted buyers hold an equity stake are also more likely to expand. We return to the equity results in the discussion section. The variables measuring market conditions indicate that a larger downstream market attracts inward transplants but that the presence of many non-Japanese

suppliers operating in the host location discourages expansion. The results for these two control variables are consistent with conventional predictions about the impacts of demand and competition on entry (Bain, 1968; Hannan and Freeman, 1989).[1]

Vertical Effects

Model (2) adds the count and timing variables measuring current buyer effects. The model tests hypotheses 1 and 5. Consistent with hypothesis 1, we find that the likelihood that a supplier will establish a foreign manufacturing facility increases at a decreasing rate with the number of current domestic buyers that have expanded internationally. Figure 1 illustrates the count effect. The figure shows the multiplier associated with incremental entries by current buyers, that is, the independent multiplicative effect of entries over what the supplier entry rate would have been otherwise. The figure shows the multiplier of the supplier entry rate over the entire observed range of the buyer entry count before logarithmic transformation, i.e., from 0 to 8. Using the point estimate for the number of current buyers entered in model (2), we can calculate the multiplier $e^{1.109\ln(N+1)}$ where N, the number of current buyers entered varies from 0 to 8. The multiplier of the rate is plotted against the left axis. We can see for example that suppliers are 2.15 times as likely to enter after the entry of the first buyer compared to the earlier period when no buyer had entered the North American market.

********** Figure 1 about here **********

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[1] We explored the issue of market attractiveness further by estimating models that controlled for growth in the downstream market, measured by absolute and percentage changes in the number of cars and trucks sold in the United States and Canada from the preceding year to a given year. Neither measure of market growth affected supplier entry or the other results. We also estimated all the models in table 2 controlling for the yen/dollar exchange rate. This variable had the expected negative effect on supplier entry in model 1, but it became nonsignificant in subsequent models. Other studies covering similar periods have reported that foreign direct investment to and from several individual countries did not vary substantially with the exchange rate (e.g. Froot and Stein, 1991; Campa, 1993). The effects of other variables remained the same in our supplementary analysis.

The percentage increase in the rate is given by the (multiplier -1) X 100. In figure 1, the increase in the supplier entry rate for incremental entry by current buyers is plotted as a bar graph against the right axis. This shows that supplier entry as a function of buyer entry increases at a decreasing rate. The first entry by a current buyer more than doubles the supplier entry rate — it increases by 115%. At the other extreme, the eighth current buyer to enter the North American market increases the supplier entry rate by a mere 14%. Thus, each additional current buyer entry encourages supplier expansion, but buyers whose entry rank is higher have a smaller incremental impact.

Consistent with hypothesis 5, model (2) also shows that the entry rate first increases and then decreases as the time since first current buyer entry increases. Model (2) shows that the accumulated number of current buyer entries and, with a non-monotonic influence, the time elapsed since a current buyer first entered both affect supplier expansion.

Model (3) adds the effects of cumulative entries by potential buyers. The model tests hypotheses 2 and 6. The results do not support hypothesis 2, because the effect of the number of prior entries by potential buyers is not significant, although the coefficient takes the expected positive sign. This result indicates that, in this sample, the impact of cumulative entries by current buyers is distinctly stronger than the impact of cumulative entries by potential buyers. As we discuss below, however, the results regarding timing effects differ.

The results in model (3) support hypothesis 6. The main and quadratic effects of the clock measuring time since first entry by a potential buyer are both significant. Thus, as with current buyer entry, the effect of potential buyer entry first increases and then decreases with time. The results suggest that entry by a first potential buyer acts as a strong signal to suppliers, whereas the incremental signal associated with later entries by other potential buyers is weak. This is consistent with descriptions of the foreign entry decision

that emphasize discrete changes in an organization's awareness of international threats and opportunities following initial buyer investments in foreign markets (Aharoni, 1966; Johanson and Vahlne, 1977).

The inclusion of the supplier entry variables in models (2) and (3) changes the measured impact of the control variables. The two control variables measuring supplier characteristics, namely number of employees and number of component lines manufactured, remain significant. The control variable that measures equity control by transplanted buyers, however, becomes non-significant. This change suggests that, at least in these data, the vertical variables we identified are more influential than equity ownership by buyers. Also, the variables controlling for demand and the presence of non-Japanese suppliers become non-significant. This suggests that the suppliers respond to the actions of home-country buyers rather than to the state of demand and competition in the host market as a whole. To verify that the non-significant impact of the variable counting non-Japanese suppliers does not hide a nonmonotonic effect, we also estimated the models in Table 2 after including a quadratic term for the count of non-Japanese suppliers. The quadratic term is non-significant and the effects reported in the table are similar. We also re-estimated the models after replacing the total market size variable by a variable measuring the production of non-Japanese buyers only. This resulted in one modest difference in model (2) as the equity variable was slightly more significant (coefficient of 0.11 with standard error of 0.06, $p < .05$), confirming that equity effects appear stronger when the presence of home-country buyers is not controlled. The other effects reported throughout Table 2 were essentially unchanged. Thus, our results appear robust to the specification of local influences.

Both models of vertical influences on supplier entry reported in Table 2 improve the statistical fit relative to the prior nested model, using the loglikelihood ratio test. Model (2) represents a likelihood chi-square increment of 89.6 with the addition of three variables relative to model (1), indicating a very strong effect of current buyer expansion ($p < .01$). The likelihood ratio improvement of 29.7 in model (3) relative to

model (2) means that entry by potential buyers makes a significant difference even after controlling for current buyer entry ($p < .01$ with three additional variables).

Competitor Effects

Model (4a) incorporates the competitor effects stated in hypotheses 3 and 7. Consistent with hypothesis 3, we find a non-linear effect of the number of competitors that have already entered. The positive main effect ($p < .01$) and negative squared term ($p < .10$) show that the propensity of a supplier to expand first increases and then decreases as the number of competitors that have already entered increases. Using estimates from model (4a), we calculated the multiplier of the focal supplier entry rate over the entire observed range of the competitor entry count, i.e., from 0 to 26 and find that the multiplier reaches its maximum value when 15 competitors have established manufacturing operations in North America. The multiplier effect then drops towards but remains above 1, which indicates a neutral effect, as the number of competitors that have already entered approaches the maximum observed value.

The results in model (4a) do not support hypothesis 7, because the effect of the competitor entry clock is negligible. We predicted an inverted-U relationship between time since first competitor entry and subsequent supplier entry. We find that both the main effect and the quadratic effect reported in model (4a) are negative and far from statistically significant. Thus, whereas the number of prior rival entrants influences supplier entry, entry timing relative to the first rival entrant makes no significant difference.

In order to verify that the negative main effect of the competitor clock is not due to spurious correlation with that clock's quadratic effect, we created a variant of model (4a) that omits the squared term of the competitor clock. Model (4b) of Table 2 reports the results. The main effect of the competitor clock remains non-significant and negative. Other coefficients are essentially unchanged, though the significance of the quadratic term of the competitor count (CN*CN) improves slightly (to $p < .05$ from $p < .10$).

Comparing log-likelihood ratios shows that model (4b) contains substantially all the information found in model (4a). Therefore, we use the simpler model (4b) as a baseline model when testing community effects. The results of model (5) are not sensitive to the exclusion of the quadratic term of CT. Models (4a) and (4b) both yield two further findings relative to model (3). First, the effect of supplier size on international expansion remains positive but becomes statistically less significant ($p < .10$) once the competitor influences take effect. This is consistent with other work showing that the effect of firm size on international expansion declines when other characteristics are taken into account (Grubaugh, 1987). Second, the effect of the number of components manufactured by the supplier becomes non-significant. This suggests that the behavior of rival firms influences supplier expansion, while the number of component-markets in which the supplier faces rivals has less influence. Together, the two results regarding control variables suggests that the effect of firm-specific characteristics declines but does not disappear when one accounts for environmental effects.

Community Effects

Model (5) incorporates community effects on supplier international expansion. The model tests hypotheses 4 and 8. The results do not support hypothesis 4, but are consistent with hypothesis 8. The coefficient for the variable counting non-competing supplier entries is positive, as predicted by hypothesis 4, but is not statistically significant.[2] The timing variables show the inverted-U effect predicted by hypothesis 8, because both the positive main effect and the negative quadratic term are significant ($p < .05$ in both cases). The improvement in likelihood chi-square relative to model (4b) is marginally significant (7.56 for three additional variables, $p < .10$).

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[2] Supplementary analysis ruled out multicollinearity among count and timing variables as an explanation for the non-significant findings in all but one case. The effect on the supplier entry rate of the variable measuring the number of non-competing suppliers that have entered the foreign market (NCN) is significant and positive in the absence of other count and timing effects, but this variable loses significance in the more elaborate model 5 in table 2.

One can interpret the community effects in model (5) as follows. The first entry by a non-competing supplier creates a time window within which supplier entry temporarily accelerates. Given that the initial window of opportunity is open, later entries by other non-competing suppliers do not substantially influence the propensity of a supplier to expand internationally. This is consistent with earlier research indicating that a supplier will seek to expand internationally if the supplier perceives the opportunity to participate early in reconstituting a community-wide network of complementary suppliers in the host location (Martin, Mitchell and Swaminathan, 1995). At the same time, the supplier will race to enter before other firms exhaust local inputs and before competition severely intensifies in the new location (see Delacroix and Rao, 1994; DiMaggio, 1994; Martin, Mitchell and Swaminathan, 1994).

Another implication of model (5) is that the effect of equity ownership by transplanted buyers becomes marginally significant again ($p < .10$). This pattern may help to reconcile the conflicting results reported by Hennart and Park (1994) and Chang (1995). The equity-ownership effect on supplier international expansion appears to be positive but at most marginally significant relative to other interorganizational effects. A further result is that the effect of the number of components manufactured by the focal supplier also becomes marginally significant again ($p < .10$). This suggests that the benefits of actual or potential scope, which are a potential driver of international expansion (Hymer, 1976; Grubaugh, 1987), depend in fact on the extent to which suppliers of complementary products have entered the host location.

The Timing Effects Compared

Figure 2 illustrates the shape and range of each of the three significant timing effects identified in this paper. The figure provides a comparative illustration of how quickly the three window-of-opportunity effects emerge and how quickly they decline. The figure uses point estimates from model (5) to show the widths of the windows of opportunity following entry by a current buyer (hypothesis 5), a potential buyer (hypothesis 6), and a non-competing supplier (hypothesis 8). The figure depicts each effect over the

observed range of the corresponding independent variable. One can compare the widths of the windows of opportunity by examining how many years elapse before the multiplier of the supplier entry rate reaches its peak and how many years elapse before the multiplier drops below 1. The peak value indicates the maximum level of the multiplier, beyond which the window of opportunity starts to close. A multiplier below 1 indicates that the underlying variable discourages supplier entry, relative to the case where the clock-triggering event has not occurred. The left Y-axis measures the multiplier for the buyer effects and the right Y-axis indicates the multiplier for the non-competing-supplier effect.

********** Figure 2 about here **********

Compare first the vertical effects associated with entry by current buyers and by potential buyers. The entry rate multipliers for both effects reach their peak when slightly more than three years have elapsed since first buyer entry. Based on the estimated coefficients, the first-order effect indicates that the effect of time since current buyer entry peaks roughly at 3.4 years while the effect of time since potential buyer entry peaks at 3.1 years. The multipliers drop below the neutral value of 1 after twice that many years, i.e., between the sixth and seventh year after first buyer entry. Thus, both effects define windows of opportunity of comparable width, though the window of opportunity effect following entry by a potential buyer is slightly weaker and shorter than that following entry by a current buyer.

Figure 2 also illustrates that entry by non-competing suppliers defines a comparatively wide window of opportunity. The high multiplier values found for the non-competing supplier clock, shown on the right-hand side scale of Figure 2, reflect the fact that the instantaneous supplier entry rate was very low at twelve non-competing suppliers, the minimum value in the observed range. Figure 2 indicates that the multiplier for the non-competing supplier clock peaks towards the middle of the third decade. Specifically, the first-order effect based on the estimated coefficients indicates that the non-competing supplier timing effect peaks at 26 years. The multiplier does not drop back to below 1 within the observed time period. This

suggests that the community-level timing effect is more diffuse than the vertical timing effects, possibly because entry by non-competing suppliers does not indicate opportunities for expansion into the host location as accurately as entry by buyers.

DISCUSSION

We investigated the role of the interorganizational environment in the international expansion behavior of a set of supplier organizations. We described supplier expansion as a form of lumpy growth constrained by access to information about a foreign market and by the relative promise of the market once competitive conditions are accounted for. We identified three classes of interorganizational influences among domestic firms: vertical effects involving current and potential buyers, competitor effects involving rival suppliers, and community effects involving non-competing supplier organizations. A supplier's information and market attractiveness constraints depend on the expansion activities of each of these classes of firms. Furthermore, the information and market conditions will vary over time and with successive entries from each class. We examined the role of cumulative entry counts and clocks on supplier international expansion after controlling for equity links and for firm-specific characteristics.

Five of the eight hypotheses receive statistical support. We find that a supplier is more likely to set up a plant in a foreign location as the number of its current buyers that have expanded increases (a vertical effect from hypothesis 1) and also as the number of its competitors that have expanded increases (a competitor effect from hypothesis 3). We also find that supplier entry is more likely within a short period after the first entry by a current buyer (a vertical effect from hypothesis 5) or by a potential buyer (another vertical effect, from hypothesis 6). A finite decision window also follows entry by a non-competing supplier (a community effect from hypothesis 8). Organizational size and scope and equity control by transplanted buyers have a modest positive effect on supplier international expansion. Below, we discuss the

implications of our findings for research on organizational change in general and international expansion in particular.

Organizational change

We drew on a broad literature about organizational adaptation and change. Our results support a description of supplier expansion as strategic choice subject to two constraints, incomplete information and market attractiveness. Consider the effect of incomplete information first. A supplier will respond to earlier entries by buyers and suppliers alike. While entries by current and potential buyers directly contributes new market information, entries by competing and non-competing suppliers may both affirm the promise of the host market and provide first-hand information about a supplier's options for operating there. Thus, suppliers appear to respond to the information released as firms from each element of the interorganizational environment start expanding into a foreign location. The form of these information effects, however, may depend upon the amount of attention that the focal supplier brings to the various elements of the interorganizational environment. A supplier will tend to monitor current buyers more closely and more continuously than potential buyers and competing suppliers more closely and more continuously than non-competing suppliers (Aguilar, 1967). We find that the impact of current buyer entries is cumulative, as indicated by the count variable, while there is only a one-time impact of potential buyer entry that eventually wanes as indicated by the timing variable. Similarly the impact of competing suppliers is cumulative while the impact of non-competing suppliers is a one-time effect. In both cases, the cumulative effect exists only for the group that the focal supplier tends to monitor more closely. Thus, our results indicate that the way in which a supplier responds to information from its interorganizational environment depends on the extent to which the supplier's monitoring efforts tend to focus on that part of the domestic environment.

Market attractiveness constraints also shape supplier expansion. Suppliers in this sample show relatively little interest in the market consisting of buyers based in the host location, but respond when home-country buyers establish transplant operations in the host location. The occurrence and timing of this response, however, depends on the extent to which this market will be effectively open should the supplier expand. With the passage of time, transplanted buyers are likely to have lined up a set of suppliers to support the startup of their operations, and as competition from transplanted rival suppliers increases, the supplier entry rate declines. Thus, most suppliers appear to time their expansion, if they expand, based on the changing conditions for supplying the transplanted buyers. The resulting pattern of foreign market entry is consistent with density-dependent patterns in market entry observed in many domestic populations (Hannan and Carroll, 1992) and documented more recently in international populations (Hannan, Carroll, Dundon and Torres, 1995), in that intermediate entry timing balances ease of entry with post-entry competitive conditions.

Our results go beyond the existing research by documenting how both count and timing effects occur. In addition to the count effects, we show that timing effects inform research on organizational change in at least two important ways. First, we find that not only the current buyer entry count, but also the current buyer entry clock influences supplier entry. This result suggests that research on the follow-the-buyer effect (Grubel, 1977; Gray and Gray, 1981) should take both effects into account simultaneously. Second, there are significant timing effects for the two sets of organizations with which a supplier is least likely to interact on an ongoing basis, potential buyers and non-competing suppliers. This result shows that populations with which an organization has diffuse links can exert powerful signaling effects (Aharoni, 1966; Spence, 1973; Jacquemin, 1989). These effects, however, would not be readily apparent in density-dependence models limited to count measures.

Research combining timing and count effects is fruitful for the study of organizational change. The number of previous organizations that have changed may influence both the propensity of a focal organization to change and its likelihood of imitating the organizations that have already changed. The timing of previous changes by other organizations affects the salience of information released by these changes for the focal organization. Some scholars such as Strang (1991) and Conell and Cohn (1995) assume an exponential decay process where the likelihood of imitation decreases with time elapsed since the most recent change in a population. For instance, Conell and Cohn's study of diffusion in French coal mining strikes assumes that the informational impact of strike initiation and resolution of stimuli strikes decays with time elapsed since the most recent strike. This is a reasonable way to represent multiple waves of organizational change in populations. In the case of international expansion to a specific location, however, entry is usually clustered in a small time window after which it falls off sharply. Therefore we assume that the salient event is the expansion of the first entrant among each of the three groups of firms that we consider — buyers, competitors, and non-competitors. Unlike previous research, we do not assume that the entry rate decays exponentially since the salient event. Instead, we allow the entry rate to follow a non-monotonic pattern over historical time, initially increasing and then declining. Our results suggest that diffusion research would benefit from exploring the effects of various specifications of time elapsed since previous events on individual rates of adoption (see also Strang and Tuma, 1993: 622).

Evidence of such a pattern at the population level could reflect two scenarios at the organization level. First, as we argue in this paper, each organization's rate of change may be non-monotonically related to the time elapsed since the first change in the reference group. Second, each organization may have a waiting period of zero risk where it is collecting and evaluating information on the consequences of the potential change. Beyond this period of zero risk, the rate of organizational change may jump instantaneously and then decline over time. Variation across organizations in the waiting period of zero risk will result in a non-monotonic pattern at the population level (see Brüderl and Schüssler, 1990: 533-534 for a similar argument

to explain non-monotonic patterns of age dependence in organizational mortality rates). This variation can be a function of organization-specific factors such as efficacy in collecting and processing information about post-change performance of earlier adopters of the change. Further research can attempt to distinguish between these two underlying processes.

Our results also address the broader debate on the levels of analysis at which explanatory processes affect organizational change. Theorists have long argued that interactions with other firms shape a firm's behavior (Phillips, 1960; Thompson, 1967). Much debate remains, however, as to what levels of analysis are appropriate for research on organizational change (Rousseau, 1985; Hannan, 1991). Thus DiMaggio (1994: 445) raised the question, "Is the population the right level of analysis?" and then asked whether researchers should instead be focusing on networks of closely interacting firms. Our results show that, in fact, there is no single "right" level of analysis. The vertical pull of relation-specific skills, the competitive logic of rivals' expansion, and the presence of non-competing suppliers each make a difference.

Recent studies of organizational change emphasize dependence upon the previous experience of organizations with similar changes (Amburgey, Kelly, and Barnett, 1993) or the cumulative experience of significant reference groups for the change in question (see for example Greve, 1996). Our analysis focuses on the influence of three reference groups for supplier organizations: buyers, direct competitors, and non-competitors or firms producing complementary products. Following Greve (1996), supplier expansion to a foreign market can be viewed as adoption of a new strategy that is subject to contagion and heterogeneous diffusion among the firms at risk, Japanese first-tier automotive suppliers in our case. A supplier's rate of expansion can be specified in terms of its propensity to expand internationally (due to non-contagious factors such as organizational size or product diversity), its susceptibility to contagion from previous international expansions and its social proximity to members of reference groups that expand to a new location.

We assume that the same phenomenon, cumulative expansion by direct competitors for example, affects both informational and market attractiveness constraints. Greve (1996), on the other hand, assumes that direct competitors affect mainly the market attractiveness constraint by reducing the resources available to potential entrants. Thus the expansion of direct competitors is likely to reduce the propensity of a focal firm to expand into the new market. Moreover, the focal firm is less likely to imitate the expansion decisions of direct competitors in order to avoid competition in the new market (Greve, 1996: 36). Our model of organizational change may suffer in comparison to heterogeneous diffusion models because we allow the same term, the number of previous adopters in significant reference groups to capture the effects on both the propensity of a focal organization to change and the process of contagion (Greve, 1996: 52).

Yet in principle, it is plausible that organizational change among members of a reference group will simultaneously affect a focal organization's propensity to change, its susceptibility to contagion, and its likelihood of imitation which is a function of the social proximity of the focal organization to the organizations that change. For instance, the international expansion of buyers would affect the supplier's rate of expansion simultaneously through its propensity to expand (by creating growth opportunities in the new location), its susceptibility to contagion (through equity ownership in suppliers by buyers), and its social proximity to the buyers that expand to the new location. One possible solution is to assume that social proximity to buyers, direct competitors, and non-competitors that expand to a new location increases the rate of supplier expansion, but that organizations within these reference groups that expand later are less infectious. Greve, Strang, and Tuma (1995: 414-416; see also Strang and Tuma, 1993: 634-636) show the promise of such an approach in Monte Carlo simulation studies where they model multiple effects of explanatory variables on diffusion within a population. Our empirical results suggest that research along these lines could be valuable, provided it accounts both for multiple levels of influence and for multiple forms of influence at each level.

International Expansion

We also drew upon the literature on foreign direct investment that addresses why individual firms expand internationally. We find that once interorganizational factors are taken into account, the two firm-specific characteristics we control for, size and number of components, play a modest role in shaping international expansion. While this does not represent a comprehensive test of the impact of firm-specific characteristics on supplier expansion, this is intriguing because these two control variables have long been identified as critical determinants of international corporate expansion (Horst, 1972; Grubaugh, 1987; Caves, 1996). Our results are at odds, therefore, with the emphasis on firm-level characteristics that exists in most research on the multinational corporation (Hymer, 1976; Graham and Krugman, 1991; Caves, 1996).

Firm-specific factors at a given point in time are likely to influence the propensity for a firm to expand operations into new geographic or product markets, and perhaps its susceptibility to contagion. Modeling the effect of similar changes by significant reference groups would allow research on international expansion account for the effects of social proximity on firm-level behavior. Future research on the multinational corporation would benefit from continued attention to how the interorganizational environment influences the multinational corporation itself (Martin, 1996).

This is not to say that the firms we studied are powerless to affect their environment. Strong environmental effects such as the ones documented in this study are consistent with strategic choice (Hrebiniak and Joyce, 1985). When one defines the environment in terms of diverse groups of interacting organizations, one firm's determinism becomes another firm's choice. For example, our results show that transplanted current buyers influence both the occurrence and the timing of international expansion by their domestic suppliers. Despite the singular influence with which multinational corporations are sometimes credited (for reviews, see Vernon, 1971; Graham and Krugman, 1991; Caves, 1996), they are fundamentally like other organizations. That is, they are both the products of their past environment and the architects of their future environment.

The next logical step in explaining international expansion by firms would be to condition the rate of expansion on the previous expansion history of firms (Amburgey, Kelly, and Barnett, 1993). In other words, in a given industry, one would model the international expansion over time of all firms to all geographic markets as a function of firm-specific expansion histories and the expansion behavior of significant reference groups. Thus we believe that the conception of organizational change as a path-dependent and contagious process extends beyond national boundaries.

Limitations

Kogut (1991, 1993) has argued that the differentiation of organizational practices by nation of origin is both common and persistent. This study shows that such differentiation may cascade through successive stages of the value chain, and therefore apply to entire interorganizational environments. This may raise a concern regarding the extent to which our results can be generalized. In particular, with various studies highlighting the distinctiveness of Japanese inter-firm relationships (e.g. Clark and Fujimoto, 1991; Smitka, 1991), it is relevant to ask whether our results would apply to non-Japanese firms. We believe that they would, in general, for several reasons. Our study interprets country-of-origin effects in terms of the development of organizational and interorganizational routines but presumes neither that country-of-origin effects are unique to Japan nor that they are immutable. Empirical studies suggest that differentiation of organizational practices across firms from various countries tend to disappear in the medium to long term (see e.g. Chandler, 1990; Kogut, 1993; Kenney and Florida, 1993).

While Japanese firms are sometimes considered as outliers because of the degree to which they emphasize stable vertical relationships, there is considerable historical evidence of non-Japanese firms having a similar emphasis at various points in their history (for the United States see e.g. Macaulay, 1963). This is also true in the context of our study, the automotive industry (Helper, 1991). Recent research by Lamming (1993) and Helper and Sako (1995) provides evidence that automotive assemblers and suppliers in North America,

Europe and elsewhere are increasingly developing interorganizational routines that foster the development of relation-specific skills and knowledge. Seen in this perspective, the vertical mechanisms we describe should be broadly applicable. Likewise, the literature about competitor and community influence includes several examples of such effects occurring among non-Japanese firms (Barnett and Carroll, 1987; Brittain and Wholey, 1988; Greve, 1996).

Regarding international expansion, there is no reason to believe that the influences that we described are specific to Japanese firms. Past studies reviewed earlier in this paper have shown that non-Japanese suppliers, too, will tend to expand into foreign locations where home-country buyers have expanded (Aharoni, 1966; Caves, 1996). Furthermore, the reliance of transplanted buyers on transplanted suppliers is not unique or even distinctive of Japanese firms. There is strong evidence that transplanted buyers from other countries tend to favor home-country suppliers when they first expand - perhaps more so than Japanese firms do (Wilkins, 1974; Drysdale, 1993). Current-buyer and potential-buyer are therefore relevant to non-Japanese firms, too. There is also substantial evidence that non-Japanese suppliers tend to emulate competitors expanding into foreign markets (Aharoni, 1966; Knickerbocker, 1973; Yu and Ito, 1988), and preliminary support regarding non-competing suppliers (Aharoni, 1966). Thus each of the interorganizational components described in this study, taken individually, has been shown to influence supplier behavior in other empirical contexts.

There may, however, be differences across contexts in the relative impact of the interorganizational effects. For example, approximately half the U.S. firms interviewed by Case (1974) expressed at least as much interest in capturing new buyers as current buyers when establishing foreign operations in developed countries. While the same may actually be true of some Japanese suppliers (Martin, Mitchell and Swaminathan, 1995), this would suggest that the impact of potential-buyer expansion could be larger in some samples than in the current sample, and may even be stronger in some cases than that of current-

buyer expansion. Unfortunately, there is very little actual evidence about the relative impact of current and potential buyers. Similarly, no other study has jointly examined the impacts of buyer and supplier expansion. Thus, while the qualitative pattern of interorganizational influences identified in this study is broadly generalizable, the magnitude of these influences may vary across contexts. It will take further empirical work to establish the range and significance of these variations.

We are also cautiously confident that our findings apply to other industries. The data consists of sets of buyers and suppliers that develop complex technical and logistical interactions, while automotive assemblers worldwide faced regulatory and market pressures to establish a broad international presence during the study period. These industry trends may in fact be more the norm than the exception among business enterprises in the modern economic era (Chandler, 1990). Nevertheless, we would expect the results reported here to be less apparent in those industries where the forces of supply chain coordination and global market expansion are substantially weaker. Interorganizational practices may vary more across industries than across countries (Martin, 1996).

Our results are limited, however, in that they control for a relatively narrow set of organization-specific characteristics. Research using multi-industry samples has shown that a supplier's intangible assets tend to influence international corporate expansion (Caves, 1996). We do not measure intangibles directly, although the control variables measuring size and the number of components will tend to correlate with intangibles. We do not measure a firm's assets or profitability either, though capital intensity and profitability may affect a firm's propensity to expand internationally. Most importantly, we ignore the impact of the previous international expansion experience of a firm on the rate of entry into a specific geographic location. Therefore, further research about the ways in which firm-specific characteristics and the interorganizational environment shape the direction and timing of international expansion would be useful.

Future research may also address interactions among elements of the interorganizational environment. There may be interaction effects among count variables, and among timing variables. For example, the combined arguments of Knickerbocker (1973) and Grubel (1977) suggest that the rate of supplier expansion is higher when more buyers and few competing suppliers enter a foreign market. Finally, future research could address the performance implications of foreign entry while controlling for influences on the timing of organizational expansion. Conducting such research could also shed light on the relative impact of the information and market attractiveness constraints on supplier expansion.

CONCLUSION

Modeling supplier firms as strategically autonomous agents subject to information and market attractiveness constraints, we examined the effects of the vertical, competitor and community elements of the interorganizational environment on a firm's propensity to expand its operations. We found that prior entry by current buyers, potential buyers, competing suppliers and non-competing suppliers each influence a supplier firm's international expansion. We found that both the numbers of firms that had expanded and the time since they had expanded influence the likelihood that a supplier would expand.

Several summary results stand out. The strongest set of influences stemmed from existing buyer relationships, which had both count and timing effects on supplier expansion. Clearly, ties with current buyers exert strong pressure on supplier expansion. Each of the other three classes of firms influenced supplier entry, but only in terms of either count or timing rather than on both dimensions. Competitor entry had a non-monotonic count effect, first increasing and then decreasing, suggesting that suppliers that do not react to competitors' expansion lose the opportunity to expand once more competitors have entered. Expansion by potential buyers and non-competing suppliers each had a non-monotonic timing effect, suggesting that indirect links may help prepare the way for a focal supplier's expansion, but only if the supplier acts quickly. We found that all significant timing effects were non-monotonic. This suggests that

international expansion opportunities disappear if supplier firms do not act on them within a reasonable period.

The results paint a complex picture of the dynamics of international organizational expansion. We find that examining the influence of the organizational environment at multiple levels substantially enriches our understanding of organizational expansion. Organizational expansion, whether into new geographic markets or into new product markets, is itself a fundamental mechanism in the evolution of firms and industries. Research about interorganizational influences on organizational expansion is fruitful in exploring how organizations shape and are shaped by the environments in which they operate.

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Table 1

Descriptive Statistics for Variables used in the Analysis*

Variable	Mean	S.D.	Min.	Max.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Supplier Entry	0.02	0.13	0	1	1.00													
(2) Number of Employees of supplier (ln)	7.04	0.86	2.56	11.17	0.05	1.00												
(3) Number of components manufactured by supplier	2.09	2.06	1	28	0.11	0.14	1.00											
(4) % of supplier's equity held by transplanted buyers	6.96	12.16	0	100	0.08	0.02	-0.06	1.00										
(5) Total market size(millions of vehicles sold in the host location)	11.53	1.94	7.93	14.21	0.06	-0.01	-0.01	0.19	1.00									
(6) Number of non-Japanese suppliers operating in the host location	362.00	41.40	300	434	-0.08	-0.03	-0.05	0.50	0.52	1.00								
(7) CBN: Number of incumbent buyers entered (ln(N+1))	0.26	0.43	0	2.20	0.18	0.00	0.06	0.40	0.16	0.55	1.00							
(8) CBT: Time since at least one incumbent buyer entered	0.74	1.66	0	8	0.15	-0.06	0.03	0.35	0.15	0.53	0.76	1.00						
(9) PBN: Number of non-incumbent buyers entered (ln(N+1))	0.80	0.75	0	2.20	0.06	-0.04	-0.09	0.51	0.26	0.81	0.35	0.35	1.00					
(10) PBT: Time since at least one potential buyer entered	2.26	2.67	0	8	0.06	-0.04	-0.07	0.50	0.31	0.89	0.42	0.29	0.92	1.00				
(11) CN: Number of competitors entered	1.75	2.41	0	26	0.15	0.06	0.39	0.25	0.12	0.54	0.39	0.34	0.49	0.53	1.00			
(12) CT: Time since at least one competitor entered	6.94	8.14	0	32	0.06	-0.04	0.27	0.14	0.05	0.23	0.21	0.17	0.24	0.25	0.49	1.00		
(13) NCN: Number of non-competing suppliers entered (ln)	3.47	0.71	2.40	4.86	0.10	-0.04	-0.10	0.54	0.24	0.91	0.60	0.54	0.91	0.93	0.52	0.23	1.00	
(14) NCT: Time since at least one non-competing supplier entered	25.27	4.09	12	32	0.10	0.00	0.10	0.49	0.15	0.71	0.54	0.48	0.82	0.79	0.37	-0.02	0.87	1.00

* N = 6512 for all variables.

Table 2

Effects of Entry by Buyers and Other Suppliers on the Supplier Entry Rate*

Independent Variables	Hypothesis # (Predicted effect)	Model 1	2	3	4a	4b	5
Constant		-6.125*** (1.586)	-8.257*** (1.709)	-8.731*** (2.141)	-7.805*** (2.172)	-7.764*** (2.162)	-36.95*** (13.68)
Number of employees of supplier (ln)		.342*** (.119)	.273** (.109)	.284** (.111)	.207* (.109)	.207* (.109)	.197* (.109)
Number of components manufactured by supplier		.102*** (.019)	.093*** (.021)	.079*** (.021)	.045 (.036)	.043 (.035)	.064* (.039)
% of supplier's equity held by transplanted buyers (multiplied by 1000)		.020*** (.005)	.010* (.006)	.007 (.006)	.009 (.006)	.009 (.006)	.010* (.006)
Total market size (number of vehicles sold in the host location, multiplied by 1,000,000)		.274*** (.077)	.251*** (.091)	-.015 (.106)	-.011 (.107)	-.011 (.107)	.017 (.119)
Number of non-Japanese suppliers operating in the host location		-.012*** (.003)	-.006* (.003)	.002 (.004)	.001 (.004)	.001 (.004)	.004 (.005)
CBN: Number of current buyers entered (ln(N+1)	Hypothesis 1 (+)		1.109*** (.266)	1.513*** (.406)	1.348*** (.409)	1.351*** (.409)	1.122*** (.435)
CBT: Time since at least one current buyer entered	Hypothesis 5 (+)		.419*** (.149)	.732*** (.171)	.734*** (.172)	.734*** (.172)	.572*** (.181)
(Time since at least one current buyer entered)^2	Hypothesis 5 (-)		-.046** (.019)	-.108*** (.024)	-.111*** (.024)	-.111*** (.024)	-.084*** (.030)
PBN: Number of potential buyers entered (ln(N+1)	Hypothesis 2 (+)			.341 (.427)	.153 (.432)	.150 (.432)	-.091 (.460)
PBT: Time since at least one potential buyer entered	Hypothesis 6 (+)			.728*** (.177)	.722*** (.176)	.722*** (.176)	.564*** (.186)
(Time since at least one potential buyer entered)^2	Hypothesis 6 (-)			-.112*** (.022)	-.115*** (.022)	-.115*** (.022)	-.090*** (.028)
CN: Number of competitors entered	Hypothesis 3 (+)				.208*** (.073)	.214*** (.066)	.240*** (.067)
(Number of competitors entered)^2	Hypothesis 3 (-)				-.007* (.004)	-.007** (.003)	-.009*** (.003)
CT: Time since at least one competitor entered	Hypothesis 7 (+)				-.006 (.038)	-.013 (.013)	-.013 (.016)
(Time since at least one competitor entered)^2	Hypothesis 7 (-)				-.0003 (.0014)		
NCN: Number of non-competing suppliers entered (ln)	Hypothesis 4 (+)						.671 (.683)
NCT: Time since at least one non-competing supplier entered	Hypothesis 8 (+)						2.006** (.980)
(Time since at least one non-competing supplier entered)^2	Hypothesis 8 (-)						-.039** (.019)
Likelihood chi-squared ratio		111.90***	201.52***	231.25***	242.91***	242.87***	250.43***
Degrees of freedom		5	8	11	15	14	17

* p < .10; ** p < .05; *** p < .01

* Standard errors are in parentheses. All models include 6512 supplier-year spells and 118 entry events.

Figure 1. Effect of Cumulative Entry by Current Buyers on Supplier Entry.

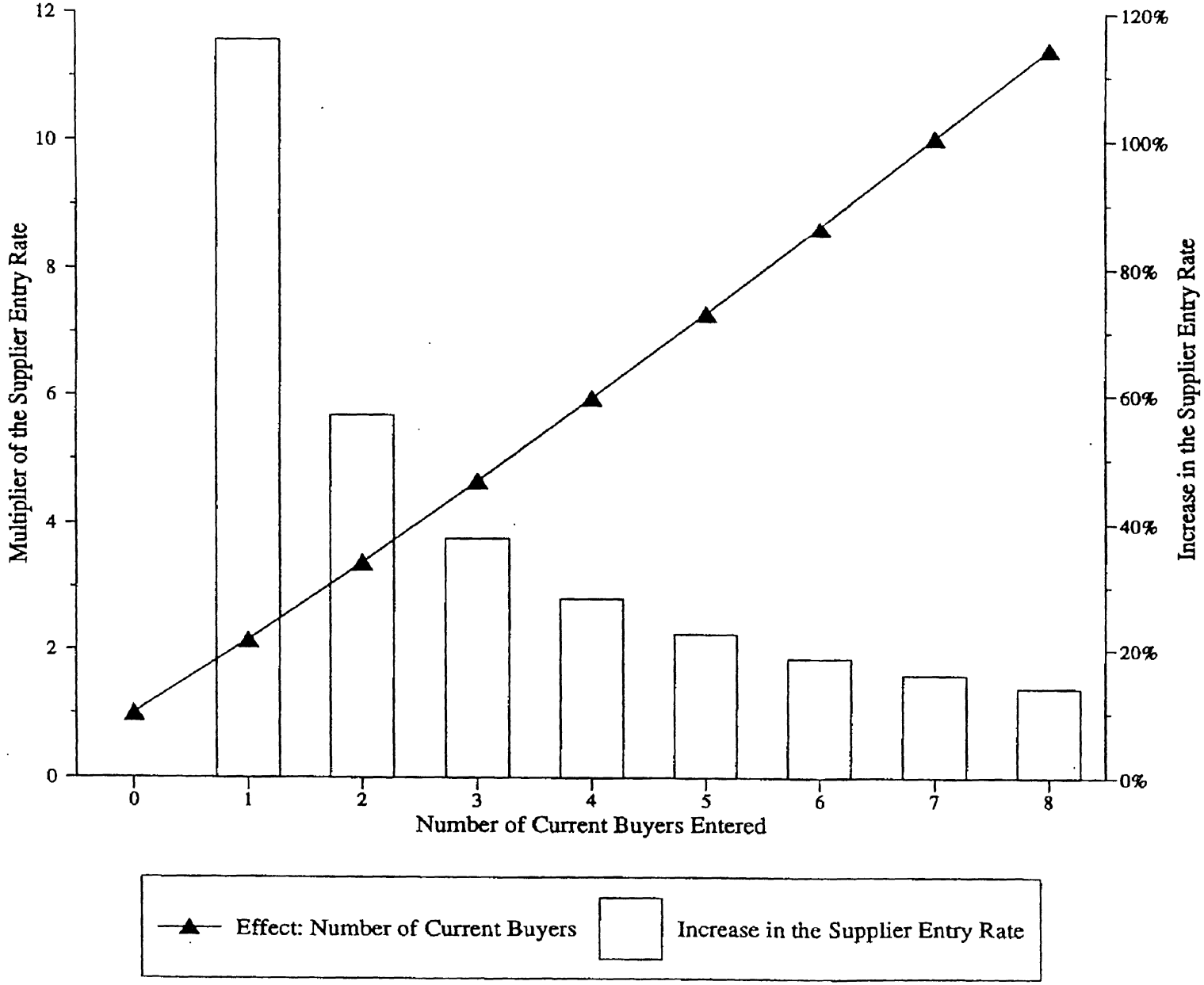
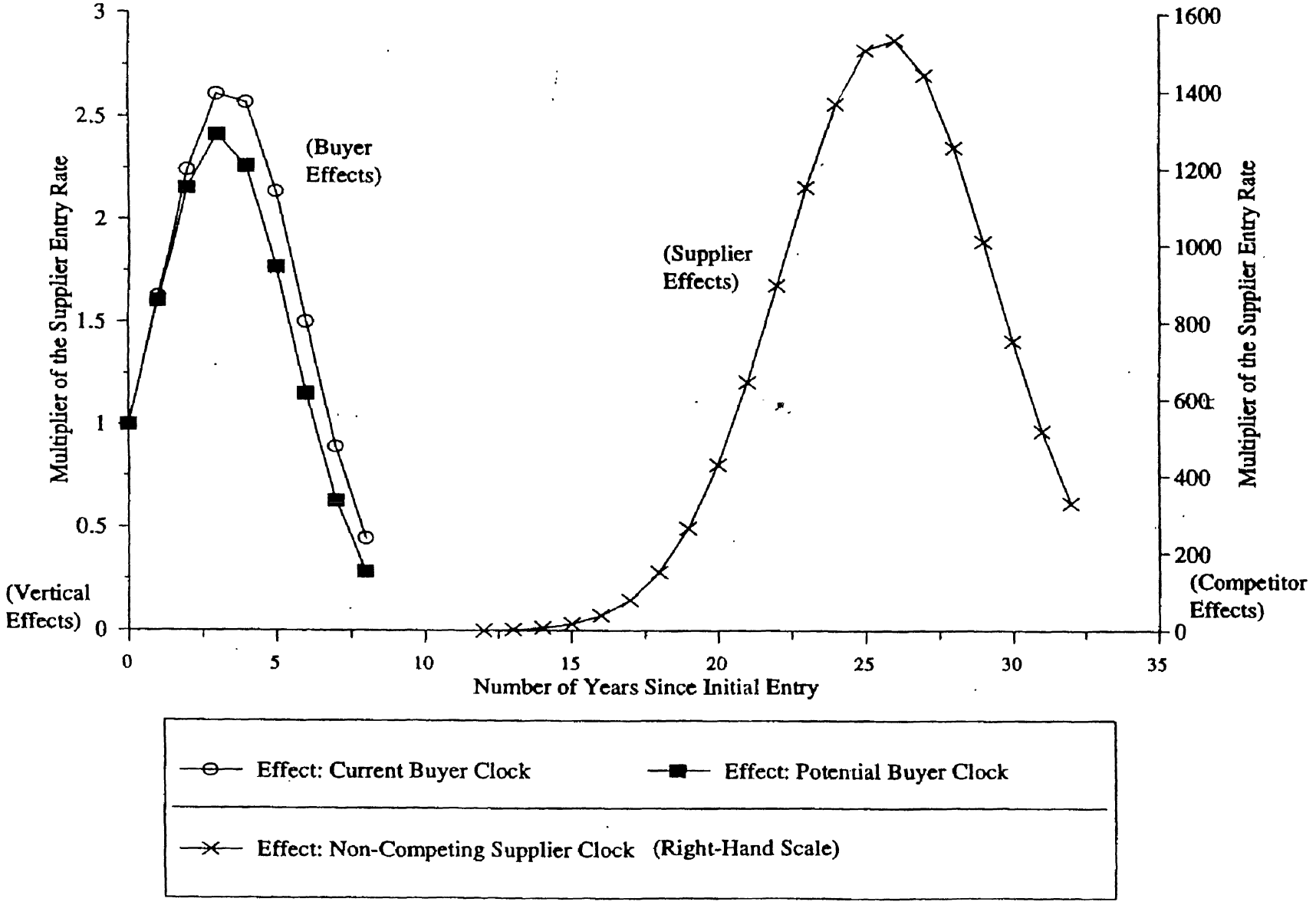


Figure 2. Effects of Time Since Entry by Current Buyers, Potential Buyers and Non-Competing Suppliers on Supplier Entry .



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