ENTRENCHED SUCCESS: THE RECIPROCAL RELATIONSHIP BETWEEN INTERFIRM COLLABORATION AND BUSINESS SALES GROWTH

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ABSTRACT

We show that collaboration and sales reciprocate. Interfirm collaboration during or after industry entry causes greater sales. In addition, large and growing businesses often form new collaborations. Thus, collaboration both contributes to future success and results from past success.

INTRODUCTION

This paper investigates the relationship between business sales growth and collaborative interfirm relationships. Many economics, organizations, and strategy authors argue that businesses benefit from collaborating. Collaborative relationships often improve business performance by reducing costs or by providing access to a wider scope of information, technology, manufacturing capabilities, financial resources, products, and markets than would be available if a business operated independently. Benefits include sharing costs, acquiring tacit knowledge, commercializing complex technology, expanding into new geographic markets, entering industries, and complementing product lines. Business sales play an important intervening role in the relationship between collaboration and superior performance. Businesses with large sales may want to collaborate with other organizations because they may expect to enjoy considerable power over their allies. Their allies may be more willing to collaborate with large-sales firms because of the market power that these firms possess. It is uncertain, however, whether greater business sales induce collaborative relationships or result from past collaboration. This version of the study summarizes a paper containing a longer theoretical and empirical literature review and discussion. We will provide the longer paper on request.

HYPOTHESES

A few large-scale studies report positive relationships between interfirm collaboration and business size or growth. Although these studies use several measures of size, the results concerning sales revenue, unit sales, number of employees, and assets are broadly comparable. Researchers have taken three approaches to investigating the causality of the collaboration-size relationship. First, some studies show a cross-sectional relationship between collaboration and size or growth (Boyle, 1968; Burgers, Hill, and Kim, 1993; Hagedorn and Schakenraad, 1994). Second, a few studies indirectly suggest that collaboration causes business growth (Stearns, Hoffman, and Heide, 1987; Barnett, 1994). While suggesting causality, these studies do not identify the aspects of collaboration that lead to increased growth. Third, several studies suggest that greater size causes collaboration but do not investigate whether past collaboration contributes to growth (Berg, Duncan, and Friedman, 1982-124; Burt, 1983; Mitchell and Singh, 1992; Powell and Brantley, 1992; Gulati, 1993-67; Martin, Mitchell, and Swaminathan, 1995). The central conclusion to be drawn from empirical size-collaboration studies is that causality may be bi-directional. None of the studies, however, investigates the mutual evolution of collaboration and size over time.

We expect businesses that form collaborative interfirm relationships when they enter an industry to achieve greater initial sales levels and initial sales growth than entrants without collaborative relationships. By initial sales levels, we mean sales during the first full year of operation in the industry. By initial sales growth, we mean percentage growth in sales during the years immediately after the first full year, which we operationalize empirically as growth during the second, third, and fourth years of operation. Collaboration at the time of industry entry provides a broader base of technological skills and more extensive market access than most businesses can achieve independently, signaling and reputation advantages, and legitimacy among potential customers.

Hypothesis 1. Businesses that form collaborative relationships when they enter an industry will achieve greater initial sales levels than businesses that do not form collaborative relationships when they enter.

Hypothesis 2. Businesses that form collaborative relationships when they enter an industry will achieve greater initial sales growth than businesses that do not form collaborative relationships when they enter.

We expect entry collaboration with industry incumbents to have earlier impact on sales than partnering with other entrants. Larger partners also might provide a strong boost for early sales. Alternatively, larger partners may collaborate in order to obtain a narrow range of capabilities or fill a narrow niche. If so, then larger partner size would have no relationship or a negative impact on the early sales of industry entrants.

As in the case of entry collaboration, post-entry collaboration provides access to capabilities and legitimacy that would be difficult, costly, or time-consuming to develop independently. We expect post-entry collaboration to lead to sales growth. Collaboration with an industry incumbent is likely to have greater immediate impact on post-entry sales growth than collaboration with an industry entrant, because of the incumbent's established capabilities.

Hypothesis 3a. The formation of collaborative relationships after businesses enter an industry will positively impact business sales growth.

We expect diminishing marginal returns to collaboration such that each new relationship will have less influence on sales growth than earlier relationships. New collaborations will tend to provide lower marginal benefit because problems created by information loss, partnership costs, overlapping resources and organizational complexity will often increase with the number of collaborations.

Hypothesis 3b. The positive impact of collaboration on business sales growth will decline as the number of relationships the business establishes increases.

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We expect that large businesses and businesses that have established previous collaborative links will be more likely to collaborate with new partners in the future, thus reciprocating the impact of collaboration on sales. Large businesses are desirable partners owing to their market success, are better able to bear the costs and risks of collaborating, and often have incentives to form new partnerships in order to support their positions. We expect this relationship to be non-linear, because the incentives to form links may decline past some point of sales.

Hypothesis 4. Business sales will have a diminishing positive relationship with the likelihood that the business will form a collaborative relationship in any period.

We expect business growth to have a positive impact on collaboration. Growing businesses have incentives to form relationships to support continued growth and often are able to attract partners because of their success.

Hypothesis 5. The greater the sales growth of a business, the more likely the business will form a collaborative relationship in any period.

The number of previous collaborative links a business has formed is also likely to play a role in the formation of new collaborations. Businesses that have established collaborative relationships will often internalize relationship management within their organizational routines and managerial expertise. They are desirable partners because they become embedded in an industry network and offer substantial industry-specific information to their partners. Consistent with hypothesis 3b, we expect that the number of past collaborations will have a positive but diminishing impact on the likelihood of forming new relationships.

Hypothesis 6. The number of collaborations that a business has formed will have a diminishing positive relationship with the likelihood that the business will form collaborative relationships in any period.

DATA AND METHODS

We test the hypotheses by examining the sales and collaboration of 938 businesses that commercialized software systems for American hospitals in the period 1961 to 1991. The sample consists of 502 startup firms and 436 established companies that undertook diversifying entry into the industry. We identified 667 cases in which businesses operating in the industry announced marketing or development-oriented collaborative relationships, with such agreements being created by 229 of the 938 businesses in the sample. The collaboration data have two limitations. First, we were unable to control for the quality of collaboration. Second, businesses were much less likely to report agreement termination than agreement creation; therefore, our data record the number of interfirm agreements that each business has created, rather than the number of active agreements during each year.

We defined several dependent variables to test the sales hypotheses. Initial Sales recorded the sales revenue that each business obtained during its first full calendar year in the industry. Initial Sales Growth recorded percentage change in sales for the 1-year, 2-year, and 3-year periods after entrants' first full year of operating in the industry. For businesses that collaborated after industry entry, Post-Entry Sales Growth, recorded percentage change in sales for 1-year and 2-year periods. We defined three 0-1 dependent variables to test the collaboration formation hypotheses. Added Partner recorded whether a business formed at least one new relationship during an observation year. Added Entrant Partner recorded whether a business formed a new relationship with an industry entrant. Added Incumbent Partner recorded whether a business formed a new relationship with an incumbent.

Three independent variables tested the predictions of initial sales level and initial sales growth. Partner At Entry is a dummy variable recording whether a business had formed at least one collaborative relationship by the end of its first full calendar year of participation in the industry. Additional dummy variables denoted whether entrants formed entry relationships with other industry entrants (Entrant Partner) or with industry incumbents (Incumbent Partner). We used the Entrant Partner and Incumbent Partner variables as well as two additional independent variables to test the predictions concerning post-entry sales growth. The Added Entrant Partner and Added Incumbent Partner dummy variables here denoted whether a business formed a relationship with an industry entrant or industry incumbent during each year after the first full year in the industry. We created two variables by multiplying the Entrant Partner and Incumbent Partner dummy variables by the cumulative number of partnerships formed before the current year (Entrant Partner x Past Partners; Incumbent Partner x Past Partners). For the partnership formation predictions, we calculated the log value of annual sales (Log Business Sales) and defined Sales Growth as 1-year percentage change in sales, lagged one year. We also recorded the log of the cumulative number of partnerships (Log Cumulative Partnerships).

We used several business and industry control variables using log values of financial variables (market size, market growth, partner sales, and business sales) for the analyses of sales growth and untransformed values for the analyses of sales. We used least squares linear regression to test the sales level and sales growth hypotheses, following Eisenhardt and Schoonhoven (1990). We used White's (1980) asymptotic variance-covariance matrix to adjust for unknown forms of heteroscedasticity. We used the same approach for the sales growth analyses, following Evans (1987) and Hall (1987). To control for a potential survivor bias in the sales growth analyses, we included an independent variable (Survival) obtained from logistic regression estimates of influences on business dissolution, which recorded the aggregate impact of the independent variables for each business-year spell used in the best-fitting model reported by Mitchell and Singh (1996). We used maximum likelihood binomial logistic regression to test the collaboration formation hypotheses.

RESULTS AND DISCUSSION

Tables 1a to 1d report the results. In order to conserve space, the tables omit the estimated influences of the control variables. All tables are statistically significant, based on loglikelihood ratio tests.

The results in Table 1a support hypothesis 1 for all partners and for incumbent partners, but do not support the prediction for entrant partners. Column 1 shows that entrants with partners during their first year in the industry achieve greater first-year sales than businesses that enter independently. Column 2 next
shows that the larger the sales of a partner, the less the initial sales benefit received by an entrant. Columns 3 and 4 of Table 1a then show that the impact of allying with an industry incumbent is significantly greater than the impact of allying with another entrant. We conclude that only incumbent partners make major contributions to greater first year sales.

Table 1b tests Hypothesis 2, which predicted greater initial sales growth for businesses with entry collaboration. The results support the hypothesis, although partner size introduces some complexity to the interpretation of longer-term growth of entrants that form partnerships with incumbents. Columns 1, 3, and 5 report influences on 1-year, 2-year, and 3-year sales growth. Columns 2, 4, and 6 add the impact of entry partner sales to the adjacent models to check the sensitivity of results to partner size. Partnership with other entrants leads to greater sales growth in all cases (columns 1 to 6). Partnership with incumbents leads to greater 1-year sales growth (columns 1 and 2). By contrast, there is no significant 2-year or 3-year growth benefit of partnering with incumbents when the estimates do not control incumbent size (columns 3 and 5). The central conclusion from Table 1b is that forming entry partnerships with other entrants leads to greater sales growth during the first three years, while entry partnerships with incumbents provide only shorter-term sales growth benefits.

The results in Table 1c test Hypotheses 3a and 3b. Hypothesis 3a predicted that formation of post-entry collaborative relationships will have a positive impact on business sales growth. Hypothesis 3b predicted that the impact will decline as a business forms more collaborative relationships. Columns 1 to 3 report year growth, with column 2 adding the number of past partners and column 3 adding the influence of new-partner size. Columns 4 to 6 report influences on 2-year growth. The 2-year growth analysis includes every second business-year, beginning with the second year that a business participated in the industry. This procedure eliminates the serial autocorrelation that would result if we included overlapping business-year spells in the 2-year growth model. The results in Table 1c support Hypotheses 3a and Hypothesis 3b with respect to incumbent partners. Greater partner sales also have a positive impact on sales growth. The Incumbent Partner influence loses its significance, however, when we add Log Partner Sales in columns 3 and 6. The clearest conclusion from the incumbent results in Table 1c is that incumbent partners contribute to 1-year and 2-year sales growth, with declining positive impact from each new partnership. The results offer mixed support for Hypotheses 3a and 3b with respect to entrant partners. Consistent with Hypothesis 3a, businesses that form post-entry relationships with industry entrants realize a positive impact on 2-year sales growth (columns 1 and 4). Contrary to Hypothesis 3b, however, the impact of allying with entrants does not decline as the relationships increase. The strongest conclusion from the results in Table 1c is that entrant partners contribute to 2-year sales growth, with similar impact from each new partnership.

Three results stand out from comparisons across Tables, 1a, 1b and 1c. First, the Entrant Partner and Incumbent Partner results from Table 1a and Table 1b show that incumbent partners provide greater initial sales impact, but that allying with other entrants provides a stronger base for longer-term growth. The likely explanation for the incumbent partner outcome is that entrants with incumbent allies often use the incumbents' established systems to obtain immediate positions in the market. For longer-term sales growth, though, the entrant in an incumbent-entrant partnership must develop its own capabilities and products, rather than depend on its incumbent partner. By contrast, two allied entrants receive no sales benefits during the first year because they lack established industry-specific capabilities and systems. Nonetheless, the entrants have incentives to work together to gain sales growth for both businesses because they both need to create viable businesses. Thus, it appears that cooperation between entrants often provides longer-term sales benefits for both entrants, while entrant-entrant cooperation provides only shorter-term sales benefits for the entrant.

The second comparison concerns the complementary growth influences found among industry entrants with incumbent partners in Table 1b and incumbent businesses with entrant partner in Table 1c. The results suggest that the entrant in an entrant-entrant partnership realizes growth benefits as early as the first year. By contrast, the impact on sales growth of the incumbent in an entrant-entrant partnership emerges only during the second year. This contrast between entrant and incumbent partnerships is consistent with the analysis of initial sales and initial growth. The results again suggest that the established business systems of an industry incumbent provide an immediate impetus to sales growth, while the new capabilities of an entrant provide longer-term impact.

| Table 1a. Least squares estimates of influences on initial sales levels (938 businesses) |
|---------------------------|---|---|---|---|
| Partner At Entry          | 1.65 *   | 2.85 **  | 0.11     | 0.64     |
| Entrant Partner           |          |          | 2.22 *   | 4.35 *   |
| Incumbent Partner         |          |          |          |         |
| Partner Sales (year 0)    |          |          | -0.06 ** |         |
|                          |          |          |          |         |
| Table 1b. Least squares estimates of influences on initial sales growth |
|---------------------------|---|---|---|---|
|                           | 1. 1-year | 2. 1-year | 3. 2-year | 4. 2-year |
| Entrant Partner           | 0.23 *   | 0.25 **  | 0.31 **  | 0.34 *   |
| Incumbent Partner         | 0.16 *   | 0.25 **  | 0.07     | 0.23 *   |
| Log Partner Sales (year 0)|          |          |          | 0.43 **  |
| Businesses                | 864       | 864       | 731      | 731      |
|                           |          |          | 622      | 622      |

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Table 1c. Least squares estimates of influences on post-entry sales growth

<table>
<thead>
<tr>
<th></th>
<th>1. 1-year</th>
<th>2. 1-year</th>
<th>3. 1-year</th>
<th>4. 2-year</th>
<th>5. 2-year</th>
<th>6. 2-year</th>
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<tr>
<td>Entrant Partner</td>
<td>0.00</td>
<td>-0.01</td>
<td>0.00</td>
<td>0.12 *</td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>Entrant Partner x Total Partners</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Incumbent Partner</td>
<td>0.06 *</td>
<td>0.09 **</td>
<td>0.04</td>
<td>0.08 *</td>
<td>0.11 *</td>
<td>-0.01</td>
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<tr>
<td>Incumbent Partner x Total Partners</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Log Partner Sales (year t)</td>
<td>-0.02 **</td>
<td>-0.02 **</td>
<td>-0.04 *</td>
<td>-0.04 ***</td>
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<tr>
<td>Business-years</td>
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<td>3924</td>
<td>0.02</td>
<td>1768</td>
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Table 1d. Logistic regression estimates of influences on post-entry partnership formation by industry incumbents

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<tbody>
<tr>
<td>Log Business Sales (t-1)</td>
<td>0.29 *</td>
<td>0.29 **</td>
<td>0.26 **</td>
<td>0.28 *</td>
<td>0.29 *</td>
<td>0.27 ***</td>
</tr>
<tr>
<td>Sales Growth (ln(St/t-1/St-2))</td>
<td>0.45 *</td>
<td>0.47 **</td>
<td>0.72 **</td>
<td>0.46 *</td>
<td>0.47 *</td>
<td>0.72 ***</td>
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<tr>
<td>Log Cumulative Partnerships (t-1)</td>
<td>0.19 *</td>
<td>0.17</td>
<td>-0.01</td>
<td>0.05 *</td>
<td>0.05 *</td>
<td>-0.02</td>
</tr>
<tr>
<td>Cumulative Partnerships (t-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partnerships (5720 business-years)</td>
<td>390</td>
<td>377</td>
<td>79</td>
<td>389</td>
<td>376</td>
<td>79</td>
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</table>

Omitted controls (all tables): Intercept; Diversifying Firm; Hardware Experience and No Hardware Experience; Market Size; Market Growth

Table 1a controls: Sales of Acquired Business; Product Line Breadth
Table 1b and 1c controls: Acquired Business; Product Line Breadth; Survival; Business Sales
Table 1d controls: Acquired Business; Product Line Breadth; Added Products; Business Age; Partner Dissolution; Partner Added Partner

* p < .10; ** p < .05; *** p < .01 (one-tailed tests; heteroscedastic-consistent standard errors)

The third comparison concerns the Partner Sales influence on entrants and incumbents. The negative impact of Partner Sales on entrants' initial sales levels and growth contrasts with the positive influence of Partner Sales on incumbent 2-year growth. The polarity of the partner sales results suggests that large incumbents sometimes limit the sales opportunities of their entrant partners. It is possible that the entrants' lack of experience constrains their ability to move beyond helping the incumbents fill specific small market segments. Businesses that form relationships with large partners after becoming established as incumbents themselves, however, are more likely to have the experience and systems required to derive greater benefits from the new partners' size.

The results in Table 1d test Hypotheses 4, 5, and 6, which address post-entry collaboration. Columns 1, 2, and 3 report the results for forming relationships with all partners, incumbent partners, and entrant partners using sales growth and the log value of business sales and cumulative partnerships as the key independent variables. Columns 4, 5, and 6 replace the log of cumulative partnerships with the untransformed value of the variable. Consistent with Hypothesis 4, greater business sales have a diminishing positive relationship with the likelihood that the business will form a collaborative relationship in any period. Consistent with Hypothesis 5, businesses with greater 1-year sales growth are more likely to form collaborative relationships. In sensitivity analyses, we also found similar influences for prior 2-year and 3-year sales growth. The central conclusion is that large businesses and growing businesses often form collaborative relationships. The results in Table 1d offer only partial support for Hypothesis 6. The logarithm of past collaborative relationships has a weak overall impact (column 1) but has no significant impact when we consider incumbent and entrant partners separately (columns 2 and 3). The untransformed value of the cumulative partnership variable (columns 4 to 6) is a better predictor of collaboration formation and has significant impact for all partnerships and partnerships with incumbents (columns 4 and 5). The most robust conclusion is that past collaboration has a positive impact on the likelihood of collaboration with incumbents, but no impact on the likelihood of collaboration with entrants.

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These results suggest that past collaboration plays a different role from business sales and growth in the formation of new collaborative relationships. The Log Business Sales and Sales Growth results show that large incumbents and growing incumbents often form relationships with other businesses, whether incumbents or entrants. The relationships will tend to support the incumbents' sales positions or provide capabilities needed during growth. The need to support current sales and current growth makes a business willing to undertake relationships with entrants, despite the uncertain value of their capabilities, as well as with incumbents. The effects of Cumulative Partnerships with incumbent partners (column 5), by contrast, extend a business's ties with established businesses in industry. These ties provide conduits for obtaining information and resources from other businesses and for influencing them. Thus, collaboration-driven ties serve longer term purposes than sales and growth-driven ties.

These results suggest three different entry and post-entry collaboration routes with different implications for long-term sales growth and business survival. First, entry collaboration with an industry incumbent often provides immediate sales benefits and may help businesses overcome early problems that threaten their survival. Entrants that collaborate with large incumbents also face later growth constraints, however, possibly because their partners place limits on their expansion opportunities. Second, entry collaboration with another entrant provides fewer immediate sales benefits than collaboration with an incumbent, but may provide the base for longer term growth. In the third route, businesses that undertake independent entry tend to attain lower initial sales and initial growth than entrants that form entry collaborations. Independent businesses that manage to achieve substantial sales levels or sales growth become attractive partners for post-entry collaboration. Post-entry partnerships for these firms then provide impetus for further sales growth and for additional collaboration.

CONCLUSION

This study addresses the relationship between collaboration, sales, and growth. The results strongly support our argument that collaboration and business sales are reciprocal forces. Collaboration during entry or after entry to an industry leads to greater business sales. Both during and after entry, collaboration with industry incumbents has an immediate impact on sales, while collaboration with entrants has a longer-term impact. Large businesses and growing businesses often form new relationships with industry incumbents and industry entrants, while businesses with many past collaborative relationships often form new relationships with other incumbents. Clearly, interfirm collaboration both contributes to business success and results from past success and collaboration.

REFERENCES


INTERORGANIZATIONAL EVOLUTION: PAIRWISE, POPULATION AND COMMUNITY EFFECTS ON CORPORATE INTERNATIONAL EXPANSION

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ABSTRACT

We examine relative influences of pairwise (buyer), population (competitor) and community (non-competing supplier) foreign expansion effects on the occurrence and timing of international expansion by supplier firms. Empirically, a multilevel model including count and timing effects helps explain how components of the interorganizational environment affect organizational expansion.

THE INTERORGANIZATIONAL ENVIRONMENT AND ORGANIZATIONAL EXPANSION

The environment in which an organization is founded, grows and dies is a system of identifiable groups of organizations that interact in distinctive ways. An important research question is therefore how the various components of the interorganizational environment affect the growth of individual organizations. This study examines how interorganizational effects shape the occurrence and timing of international expansion by supplier firms. We investigate the extent to which supplier expansion is affected by the number of firms from a given group that have already expanded (count effects), and by the time since firms from each group expanded (timing effects).

We adopt the perspective of a supplier organization so that the study incorporates both vertical relationships with buyers and horizontal influences within and across industries, without loss of generality (Thompson, 1967; Becker & Stigler, 1977). Following Pennings (1981) and Martin, Mitchell & Swamunathan (1994) we identify three strategically distinct components of the interorganizational environment. Buyers are linked to suppliers by vertical interdependence that can be analyzed at the pairwise level. Competing suppliers are involved in horizontal competition at the population level. Finally, there is horizontal complementarity among suppliers that produce different products or services for the same buyers, accounting for community-level interaction. Among past studies of organizational growth and transformation, Barnett & Carroll (1987) have shown that population and community effects matter, while Miner, Amburagey & Stearns (1990) provided evidence of pairwise and population effects. For the first time, we jointly investigate the three levels of interorganizational effects.

We examine corporate expansion that occurs when a firm establishes manufacturing operations in a foreign country. It is relevant to study this form of expansion because it has major influences on individual firms, industries and societies; can be reliably measured; and involves the whole range of interorganizational influences in an economic context that is increasingly pervasive (Caves, 1982). We report evidence on whether and when 547 Japanese automotive component suppliers expanded into the United States and Canada, showing that count or timing effects exist for each of the three components of the interorganizational environment.

HYPOTHESES: COUNT AND TIMING EFFECTS ON INTERNATIONAL EXPANSION

At the pairwise level, vertical relationships in domestic operations give the supplier to intangible relation-specific knowledge consisting of idiosyncratic information about the requirements and capabilities of a buyer (Becker & Stigler, 1977). When a buyer expands internationally, its incumbent domestic suppliers will become more likely to set up foreign facilities of their own. That is because relation-specific knowledge can make a supplier more efficient in serving the transplanted buyer's foreign subsidiary, but because of its intangible nature can only be exploited in foreign markets if the supplier sets up its own operations there (Grubel, 1977; Caves, 1982). International expansion is a means of exploiting such knowledge. It may indeed be an imperative to protect such knowledge. A supplier that fails to expand internationally 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 even threaten the initial supplier in the domestic market (Grubel, 1977). For that reason, not only incumbent but also non-incumbent suppliers may be drawn to foreign markets where buyers expand. We expect these effects to increase less than proportionately to the number of buyers that expand, however, as suppliers face limits on the number of links they could establish concurrently with transplanted buyers. Therefore,

Hypothesis 1: The likelihood that a supplier will establish a foreign manufacturing facility will increase at a decreasing rate with the number of incumbent domestic buyers that have expanded internationally.

Hypothesis 2: The likelihood that a supplier will establish a foreign manufacturing facility will increase at a decreasing rate with the number of non-incumbent domestic buyers that have expanded internationally.

At the population level, studies of corporate international expansion have shown that foreign investments by rival suppliers tend to cluster in time and space (see Caves, 1982). This is akin to legitimacy-competition outcomes whereby a supplier will learn from observing international expansion by early rival entrants, but will eventually face strong competitive obstacles in expanding internationally if a large number of rivals have
preceded it. Haveman (1994) showed that such mechanisms operate in the context of domestic (product-market) diversification. The instantaneous entry pattern corresponding to such mechanisms has the inverted-U shape common in organization ecology studies. That is, Hypothesis 3: The likelihood that a supplier will establish a foreign manufacturing facility will first increase, then decrease as the number of competitors that have expanded internationally increases.

At the community level, populations of non-competing suppliers are likely to have a mutually beneficial relationship in foreign locations. Non-competing suppliers that expand internationally are a source of information about the conditions for foreign expansion and help strengthen transplanted buyers (Martin, Mitchell & Swaminathan, 1995). The benefits from such complementary investment will accrue at a decreasing rate, however. Therefore, Hypothesis 4: The likelihood that a supplier will establish a foreign manufacturing facility will increase at a decreasing rate with the number of non-competing domestic suppliers that have expanded internationally.

Timing of International Expansion

In addition to the above count effects, time elapsed since firms representing each component of the interorganizational environment first expanded may affect the propensity of a focal supplier to expand internationally. Expansion by pioneering organizations will create finite decision windows for other organizations to expand. Following expansion by a buyer, an incumbent or non-incumbent supplier has limited time to act before the transplanted buyer allocates the business to a complement of suppliers that have set up operations in the foreign location. Similarly, competitive logic dictates a relatively narrow window of opportunity for a supplier to follow a pioneer competitor in expanding internationally. Finally, obsolescence of information gleaned from non-competing suppliers that first enter will also define an inverted-U shape for the effect of time since a pioneering non-competing supplier expanded into a foreign location. Thus we expect that the likelihood that a supplier will establish a foreign manufacturing facility will first increase, then decrease as a function of the time since at least one incumbent domestic buyer expanded internationally (hypothesis 5); of the time since at least one non-incumbent domestic buyer expanded (hypothesis 6); of the time since at least one of its domestic competitors expanded (hypothesis 7); and of the time since at least one non-competing domestic supplier expanded (hypothesis 8).

DATA: JAPANESE AUTOMOTIVE FIRMS EXPANDING INTO CANADA AND THE UNITED STATES

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 is an important and leading economic sector that exhibits measurable interorganizational interaction at the pairwise, population and community levels and is therefore both amenable to this research. All data for the study was collected from comprehensive industry directories and publications. Our sample consists of 547 Japanese automotive component first-tier suppliers and 11 Japanese automobile assemblers. This sample encompasses all known suppliers of a representative range of 136 distinct component categories to the 11 Japanese assemblers as of 1978.

We used data about the Japanese automotive industry source to identify which supplier manufactured which component for which assembler as of the beginning of the study period. We then established which of the 547 suppliers and 11 assemblers expanded into the United States or Canada, and in what year. We treated the United States and Canada as a single host location for inward automotive investment because the automotive markets are closely integrated in the two countries as the result of an automotive trade pact created in 1965. A total of 118 suppliers established manufacturing plants in this host location between 1978 and 1990. The testing sample excluded 15 suppliers that expanded before 1978, but those 15 suppliers were incorporated into our count and timing variables. Eight of the 11 assemblers established manufacturing plants in Canada or the United States between 1982 and 1989. No supplier or assembler exited during the study period.

Variables

The dependent variable 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. The dependent variable, like all independent variables in the study, is time-varying. Descriptive statistics can be obtained from the authors.

The independent variables measured the cumulative behavior of four sets of organizations: incumbent buyers, non-incumbent 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. We set each entry count and each clock to zero until the first entry by an organization in the relevant set. In order to test for the non-linear effects of hypotheses 1, 2 and 4 we took the logarithms of the underlying count variables, after increasing all values by 1 to ensure that the logarithm could be computed. In order to test for the
nonmonotonic effect of competitor entry, per hypothesis 3, we included a quadratic term of the count variable. Similarly we used quadratic terms to test for the non-linear clock effects of hypotheses 5-8.

In measuring the effects of incumbent and non-incumbent buyer expansion we defined an incumbent 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. Non-incumbent buyers included those buyers that purchased no component from the supplier in Japan. In this way, we classified each Japanese automotive assembler as either an incumbent buyer or a non-incumbent buyer relative to each Japanese automotive components supplier. We also classified each supplier as either a competitor or a non-competing supplier relative to every other competitor, depending on whether the two suppliers' product lines overlapped. Two suppliers were conservatively counted as competitors if their product lines had at least one component in common, and as non-competing suppliers otherwise.

We included three control variables in the study. First, we controlled for supplier size, because larger firms are more likely to expand internationally (Grubaugh, 1987). We measured size as the natural logarithm of the number of employees of the supplier. Second, we controlled for the number of component lines (out of 136) manufactured by the supplier as firms with wider product lines are more likely to expand internationally (Grubaugh, 1987). Third, consistent with the literature on Japanese enterprise groups, we controlled for the proportion of a supplier's equity owned by transplanted assemblers.

Analysis

In order to distinguish the effects of multiple count and timing (and control) variables on supplier entry we used a baseline constant-rate model to which we added control variables and a series of time-varying covariates. We decomposed the data about each supplier into annual spells. We updated the time-varying covariates at the beginning of each spell for each supplier. 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 log-linear function of the covariates, which specifies non-negative predicted rates. 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 chi-square likelihood ratio test to compare the relative explanatory power of nested models.

RESULTS: EVIDENCE OF COUNT AND TIMING EFFECTS AT MULTIPLE LEVELS

Table 1 reports the estimated coefficients for six nested models of supplier entry. Model (1) represents a baseline of control variables. In model (2) we add count and clock variables representing the effects of entry by incumbent buyers. In model (3) we add variables describing entry by non-incumbent buyers. Model (4) includes all pairwise effects on supplier entry. In model (4a), a constrained version of model (4) that we discuss below, both incorporate population-level effects. In model (5) we add variables describing entry by non-competing suppliers, thus adding community-level effects. Each model is significant relative to an intercept-only model, as shown by the model likelihood chi-squares (p < .01).

The control effects reported in Table 1 are all positive, as expected. Their effects are significant when measured in isolation (model (1)) but become at most marginally significant when the effects of the interorganizational environment are taken into account. This is consistent with earlier findings on international expansion (see Caves, 1982; Grubaugh, 1987).

Model (2) adds the count and timing variables measuring incumbent buyer effects. Hypotheses 1 and 5 are both strongly supported. Consistent with hypothesis 1, the likelihood that a supplier will establish a foreign number of incumbent domestic buyers that have expanded internationally. That is, each additional incumbent 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 incumbent buyer entry increases. Relative to the base model (1), model (2) involves an increase in the likelihood chi-squared ratio of 118.2 for adding three variables. This is highly significant statistically (p < .01) and is evidence that the variables measuring international expansion by incumbent buyers, as a group, have a substantial impact on supplier expansion.

Model (3) adds the effects of non-incumbent buyer entry. The model tests hypotheses 2 and 6. The results do not support hypothesis 2, because the effect of the number of prior entries by non-incumbent buyers is not significant, although the coefficient takes the expected positive sign. They do however support hypothesis 6. As with incumbent buyer entry, the effect of non-incumbent buyer entry first increases and then decreases with time. The results suggest that entry by a first non-incumbent buyer acts as a strong signal to potential suppliers, whereas the incremental signal associated with latermanufacturing facility increases at a decreasing rate with the non-incumbent buyer entries is weak.

As a group, the variables measuring effects from entry by incumbent buyers (model (2)) and entry by non-incumbent buyers (model (3)) have substantial explanatory power: the chi-square for model (3) is higher than that for the base model (1) by 159.64 for six additional variables (p < .01). This shows that pairwise effects matter as a group. Furthermore, model (3)
### Table 1

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

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Hypothesis # (Prediction)</th>
<th>1</th>
<th>2</th>
<th>Model 3</th>
<th>4a</th>
<th>4b</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td>-.7346***</td>
<td>-.7498***</td>
<td>-.8193***</td>
<td>-.6222***</td>
<td>-.6013***</td>
<td>-.3155***</td>
</tr>
<tr>
<td>Number of employees of suppliers (ln)</td>
<td></td>
<td>-.386***</td>
<td>.289***</td>
<td>.282***</td>
<td>.206**</td>
<td>.205**</td>
<td>.197*</td>
</tr>
<tr>
<td>Number of components manufactured by supplier</td>
<td></td>
<td>.100***</td>
<td>.094***</td>
<td>.079***</td>
<td>.045</td>
<td>.043</td>
<td>.060</td>
</tr>
<tr>
<td>% of supplier's equity held by transplanted buyers (multiplied by 1000)</td>
<td></td>
<td>.030***</td>
<td>.013**</td>
<td>.007</td>
<td>.009</td>
<td>.009</td>
<td>.010*</td>
</tr>
<tr>
<td>Number of incumbent buyers entered (ln(N+1))</td>
<td>Hyp. 1 (+)</td>
<td>1.185***</td>
<td>1.440***</td>
<td>1.316***</td>
<td>1.320***</td>
<td>1.030***</td>
<td></td>
</tr>
<tr>
<td>Time since at least one incumbent buyer entered</td>
<td>Hyp. 5 (+)</td>
<td>.544***</td>
<td>.724***</td>
<td>.728***</td>
<td>.728***</td>
<td>.578***</td>
<td></td>
</tr>
<tr>
<td>(Time since at least one incumbent buyer entered)**</td>
<td>Hyp. 5 (-)</td>
<td>-.063***</td>
<td>-.104**</td>
<td>-.109**</td>
<td>-.109**</td>
<td>-.085**</td>
<td></td>
</tr>
<tr>
<td>Number of non-incumbent buyers entered (ln(N+1))</td>
<td>Hyp. 2 (+)</td>
<td>.258</td>
<td>.115</td>
<td>.113</td>
<td>.211</td>
<td>.426</td>
<td></td>
</tr>
<tr>
<td>Time since at least one non-incumbent buyer entered</td>
<td>Hyp. 6 (+)</td>
<td>.717**</td>
<td>.715**</td>
<td>.715**</td>
<td>.572***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Time since at least one non-incumbent buyer entered)**</td>
<td>Hyp. 6 (-)</td>
<td>-.108**</td>
<td>-.113**</td>
<td>-.113**</td>
<td>-.091**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of competitors entered</td>
<td>Hyp. 3 (+)</td>
<td>.209***</td>
<td>.215***</td>
<td>.245***</td>
<td>.245***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Number of competitors entered)**</td>
<td>Hyp. 3 (-)</td>
<td>-.007**</td>
<td>-.007**</td>
<td>-.009**</td>
<td>.003**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time since at least one competitor entered</td>
<td>Hyp. 7 (+)</td>
<td>-.006</td>
<td>-.013</td>
<td>-.015</td>
<td>.016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Time since at least one competitor entered)**</td>
<td>Hyp. 7 (-)</td>
<td>-.0003</td>
<td>.0014</td>
<td>.813</td>
<td>.641</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of non-competing suppliers entered (ln)</td>
<td>Hyp. 4 (+)</td>
<td>1.707**</td>
<td>.857</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time since at least one non-competing supplier entered</td>
<td>Hyp. 8 (+)</td>
<td>.033**</td>
<td>.017</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Time since at least one non-competing supplier entered)**</td>
<td>Hyp. 8 (-)</td>
<td>249.77***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood chi-squared ratio</td>
<td></td>
<td>71.43***</td>
<td>189.63***</td>
<td>231.07***</td>
<td>242.87***</td>
<td>242.84***</td>
<td></td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td></td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>13</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

Significance levels: * p < .10; ** p < .05; *** p < .01

1 Standard errors are in parentheses. All models include 6512 supplier-year spells and 118 entry events. Descriptive statistics are available from the authors.

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itself improves substantially upon model (2) (chi-square increment of 41544 for three degrees of freedom, p < .01). This shows that the follow-the-buyer effect is not limited to incumbent buyers, as some models of supplier international expansion have suggested. Rather, the incentives for suppliers to react to international expansion by non-incumbent buyers appear to be powerful in their own right. Model (4a) incorporates the population-level 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. Hypothesis 7 is not supported as both the main effect and the quadratic effect of time since a competitor first entered are negative and non-significant. To verify that spurious correlation did not cause this result, we remove the quadratic clock effect in model (4b). That model confirms that the time elapsed since first competitor entry has no significant effect. Model (4b) is more parsimonious than model (4a): in model (4a) the likelihood chi-square relative to model (3) increases by only 11.80 at the cost of four degrees of freedom (p < .10) while model (4b) accomplishes essentially the same increment (11.77) for only three degrees of freedom (p < .05). Therefore we use model (4b) as the basis for model (5).

Model (5) incorporates community-level effects on supplier international expansion. The coefficient for the variable counting non-competing supplier entries is positive, as predicted by hypothesis 4, but is not statistically significant. 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 < .06 in both cases). The improvement in likelihood chi-square relative to model (4b) is moderately significant (6.93 for three additional variables, p < .10).

**IMPLICATIONS: DIMENSIONS AND MECHANISMS OF INTERORGANIZATIONAL INFLUENCE ON ORGANIZATIONAL EXPANSION**

In our longitudinal test, a model incorporating both cumulative entry count and timing effects at the pairwise, population and community levels yielded meaningful predictions of the occurrence and timing of supplier international expansion. Five of eight hypotheses were fully supported, and the only one coefficient that did not have the expected sign was far from significant.

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 incumbent 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 nonmonotonic 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 non-incumbent buyers and non-competing suppliers each had a nonmonotonic timing effect, suggesting that indirect relationships 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 nonmonotonic. This suggests that international expansion opportunities disappear past some point if supplier firms do not act on them.

This research inform the debate on appropriate levels of analysis for research on organizational change. Our results show that, in fact, there is no single 'right' level of analysis. We find evidence of significant pairwise, population and community influences on organizational expansion. Thus, rich multilevel analysis can inform research on organizational change. In addition we find that the same type of effect will not apply at all levels of analysis. Thus, we learn from this research not only about the levels of analysis that influence organizational change, but also the ways in which they do so.

The results paint a complex picture of the dynamics of international organizational expansion. We find that examining the organizational environment at multiple levels substantially enriches our understanding of the influences on organizational expansion. Organizational expansion, including establishing foreign operations, is itself a fundamental mechanism in the development of firms and industries. Research into the interorganizational influences on organizational expansion is fruitful in exploring how organizations shape and are shaped by the interorganizational environment.

**REFERENCES**


