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 & Swaminathan (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, Amburgey & 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 loglinear 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 (3) includes all pairwise effects on supplier entry. In model (4) we add the count and clock variables for entry by competing suppliers. Model (4) and 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 later manufacturing 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>3</th>
<th>4a</th>
<th>4b</th>
<th>5</th>
</tr>
</thead>
<tbody>
<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></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>.073</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></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></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of non-competing suppliers entered (ln)</td>
<td>Hyp. 4 (+)</td>
<td>.813</td>
<td>.641</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>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>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>249.77***</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

* Standard errors are in parentheses. All models include 6512 supplier-year spells and 118 entry events. Descriptive statistics are available from the authors.
itself improves substantially upon model (2) (chi-square increment of 4154.4 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 measuring non-privilege 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 < .05 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-privilege 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**


