

SHARED EXPERIENCE AS INCENTIVE FOR HORIZONTAL INTEGRATION IN BUSINESS SIMULATIONS

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ABSTRACT

We put forth a shared-experience algorithm for business simulations that effects an endogenous incentive to horizontal integration, a merger or acquisition involving two directly competing firms. We propose a measure of integration, and report on the degree of integration in a 357-period simulation exercise involving GEO, an Internet-based, computer-assisted simulation that incorporates the algorithm. At the end of the exercise, the degree of horizontal integration was significantly greater than would be expected from chance. The data did not suffice to determine if the result was a particular response to the endogenous incentive of the algorithm or a general response to other incentives for integration that may have been present. We argue for incorporating an endogenous integration incentive in strategic management simulations even if they should be administered for the typical length of about a dozen periods.

INTRODUCTION

Mergers and acquisitions are processes that are usually critical for the parties involved, because very much is at stake that must be decided quickly. Although these processes are the subject of two experiential exercises (Bots & Hofstede, 2004; Veiga, Yanouzas, & Sanders, 1984) and one computer-based simulation (Sord, 1982), they typically have not been incorporated into total enterprise simulations. Thus, in reviewing the suitability of eight total enterprise simulations for strategic management courses, Wolfe and Rogé (1997), although giving a generally favorable assessment, noted as a deficit that “none of the games allowed for horizontal integration” (p. 436).

The problem that Wolfe and Rogé had in mind must not be one of permitting or enabling integration, because, as

Marshall and Eldridge (1991) suggested, “New companies can be started and old companies can be deleted at any time during the play to simulate acquisitions and mergers.” Rather, the problem must be one of having an endogenous incentive for integration, an incentive that is incorporated into the logic of the simulation itself. Herein, we discuss the rationale for integration, show how an endogenous incentive can be incorporated, propose a measure of integration, and present data on the extent to which firms became integrated in a simulation that incorporates the endogenous incentive.

WHY FIRMS MERGE

In this paper, we shall consider a *merger* and an *integration of firms* to be synonymous. A merger can be vertical, involving a firm and either a supplier or a customer; horizontal, involving itself and a direct competitor; or conglomerated, involving itself and a firm that does not fit into any of the other two categories. A merger can occur at any point in the firm’s lifetime, even at birth. Thus, if immediately after a firm is founded it founds a subsidiary, the two firms are considered to be merged.

In the everyday world, the incentive for merger can be viewed from either the perspective of agency theory (Jensen & Meckling, 1976) or stewardship theory (Donaldson, 1990; Donaldson & Davis, 1991). Agency theory considers the self interests of management as primary. From this perspective, firms merge because the firms’ managers see personal rewards in the merger, irrespective of the consequences on shareholders if those consequences do not redound to the managers who executed the merger. Stewardship theory considers the interest of shareholders as primary. From this other perspective, firms merge because shareholders will gain by the merger, irrespective of the consequences on managers provided the managers have been acculturated to their fiduciary duty. Both perspectives

are useful, as reviewers of the two competing theories have concluded (Davis, Schoorman, & Donaldson, 1997; Eisenhardt, 1989), but some see the former as more inclusive than the latter, and vice versa (Albanese, Dacin, & Harris, 1997; Davis, Schoorman, & Donaldson, 1997).

In the case when the welfare of management is perfectly aligned with the welfare of shareholders, an ideal that business simulations attempt to embody, a suitable endogenous incentive would be one that causes the merged firms to increase their collective profits. This can come through a reduction in costs, an increase in business volume, or a higher price for the output of the firm. A reduction in market-transaction costs is a natural accompaniment of vertical mergers, as Coase (1937) observed in his seminal essay on the nature of the firm. No such cost reduction can be expected of horizontal mergers, because competitors do not trade with each other. A merger of competitors does increase the market power of the combination and may allow for cost savings through economies of scale and scope, but the significance of these considerations on costs, prices, and profits depends on the particulars of the situation. Thus, if the merged competitors transforms a duopoly into a monopoly, the combination's market power increases substantially, and if it transforms two firms each operating at substantially below the industry's economical scale into a single firm operating at economical scale, then costs should fall substantially.

The problem for the simulation developer in devising an endogenous incentive for horizontal integration is that the developer has no control over the particulars of the administered situation. A simulation session may allow for few or many firms within each industry. At any time, each firm may be close to or far from its economical scale. These details depend on the number of participants in the exercise, the duration of the exercise, the purpose of the exercise, and the preference of those administering the exercise. The ideal endogenous incentive for horizontal mergers would be one that dominates over the particulars, so that irrespective of situational differences firms gain from mergers unless the administrator chooses to configure the simulation otherwise. We propose that the effect of merger on each firm's experience curve is a suitable endogenous incentive.

THE EXPERIENCE CURVE

The experience curve is a production concept that is often presented as a business strategy (Christensen, Berg, Salter, & Stevenson, 1985). The concept is based on an established observation—that costs decline with cumulative production. Usually defined as the percentage decline in costs with each doubling of output, researchers have established that many industries have experience curves of from 10% to 30% (Boston Consulting Group, 1972; Lloyd, 1979; Wheelen & Hunger, 2004).

As a strategy, the objective is to increase production to a maximum, doubling cumulative output more frequently than competitors do. To heighten the effect of increased production on costs, managers are urged to use the same materials, components, production technology, and labor,

because any large change in these gives rise to a new experience curve and the loss of the previously accumulated cost advantage. The strategy calls for price reductions to accompany cost reductions, thereby placing the firm in a better competitive position (Hodder & Ilan, 1986).

The experience curve strategy has been generalized from its manufacturing base to service industries (Chambers & Johnston, 2000) and to the electricity supply industry (Sharp & Price, 1990). It is an important element of Krugman's (1981) and Lancaster's (1980) strategic rivalry theory of intra-industry trade. Chang (1996) has proposed that the strategy is suitable for operations in global markets, asserting that it applies to many areas, including the ability to ally with foreign partners, to sell in foreign markets, to develop new products, and to manage logistics. In all these areas, costs decline with repetition.

Critics of the experience curve strategy include Ghemawat (1985), Henderson (1984), and Hofer and Schendel (1978), all of whom have cautioned that costs do not decline automatically with production experience. Ford's attempt to apply the strategy to the Model T did not result in cost reductions. DuPont's experience with titanium dioxide was likewise similar. Ghemawat identified limitations of the strategy, including industry life cycle, technological risk, price sensitivity, competitor analysis, government intervention, and shared inputs. He concluded that the strategy will be more successful (a) when the industry is in the early stages of its life cycle, during which the doubling of production can occur frequently; (b) in industries with stable technology, because each new technology will initiate a new experience curve; (c) in industries with high price elasticity, because the price declines that it enables will have the greatest impact on demand; (d) if competitors are not able to imitate the firm's experience curve strategy; (e) if government does not proscribe low pricing as anticompetitive; and (f) if firms produce products that use overlapping components.

Other researchers also have pointed out limitations of the strategy. Arguing that the experience curve effect is composed of a learning effect and a scale effect, Amit (1989) asserted that learning effects are a source of sustainable competitive advantage but that scale effects are not, because scale effects can be imitated by competitors. Moreover, experience curve effects may not be important strategically, because the most important cost declines are due to innovation and not simply to improving the efficiency of a set process of production (Alberts, 1989). As a result, firms that hold on to repetitive production processes may achieve less cost reduction than firms that exploit new technologies.

Even so, the experience curve concept and its associated strategy is a central issue of strategic management. Providing an endogenous incentive to horizontal mergers based on the effect of the mergers on the merged firms' experience curve may therefore be seen as fitting by scholars of the discipline. The task for the simulation developer is to construct a transparent algorithm for the purpose.

THE EXPERIENCE CURVE ALGORITHM

Our approach to the experience curve algorithm begins with Reguero's (Gaither, 1994) classic work on the measurement of learning. In that formulation, learning occurs whenever a task is performed. Its affect is observed when the same task is repeated. If T_1 is the time it took to perform the task the first time, then T_n will be the time it should take to perform the same task the n th time, moderated by a learning coefficient (ϕ), as follows:

$$T_n = T_1 n^{\log_2 \phi} = T_1 n^{\frac{\log \phi}{\log 2}}. \quad (1)$$

The learning coefficient is a parameter that expresses the extent to which the task is amenable to learning. A task whose pace is constrained by a machine of invariable speed cannot be done faster, so its learning coefficient is 1. Otherwise, the learning coefficient will be less than 1 and greater than 0, so $T_n \leq T_{n-1}$.

Accounting for the time to produce each individual item in a simulation wherein many items are produced each period gives rise to an unnecessarily complicated formula. We simplify by defining a firm's experience credit (x) as the number of units the firm has produced cumulatively up to the most recently elapsed period, and computing a current experience factor (γ) based upon that credit, as follows:

$$\gamma = (x + 1)^{\log_2 \phi}. \quad (2)$$

For example, if the learning coefficient is .95, a newly created firm, having no experience credit ($x = 0$), has a current experience factor of 1, and a firm with 99 units of experience credit ($x = 99$) has a current experience factor of .71. If experience reduces production time, it increases production capacity, so we apply γ to compute the firm's current production capacity (q) based on its administratively set zero-experience capacity (q_0), as follows:

$$q = \frac{q_0}{\gamma} = \frac{q_0}{(x + 1)^{\log_2 \phi}}. \quad (3)$$

Thus, if the firm's zero-experience production capacity is administratively set to 10 units, the example firm's 99 units of experience credit gives it a current production capacity of 14 units.

In the case of horizontal integration, when two firms producing the same kind of product merge, we define an integration factor (κ) such that it is the product of an ownership ratio (μ), the proportion of the acquired firm's outstanding shares owned by the acquiring firm in the integration, and an administratively set share experience factor (λ), as follows:

$$\kappa = \mu \lambda. \quad (4)$$

The share experience factor expresses the extent to which the integration is endogenously rewarded. Set at 0, horizontal integration is not rewarded. Set at 1, the integration is rewarded by exactly by the amount of each firm's experience. Set greater than 1, the integration is rewarded by more than the experience of each firm. For example, if the acquiring firm bought 80% of the outstanding shares of the acquired firm when the share experience factor is set at 1, then the integration factor is (.8) (1) = 0.8. We apply the integration factor to compute the acquiring (subscript a) and acquired (subscript b) firm's post-integration experience credit (x'), respectively, as follows:

$$x'_a = x_a + \kappa x_b \quad (5a)$$

and

$$x'_b = x_b + \kappa x_a. \quad (5b)$$

For example, if the acquiring firm entered into the integration with 99 units of experience credit and the acquired firm entered into it with 40 units, then $x'_a = 99 + 0.8(40) = 131.0$ and $x'_b = 40 + .8(99) = 119.2$. These figures would then be entered into Equation 3 to determine each firm's post-integration production capacity for the period.

For an endogenous incentive to directly affect participants' strategies in a simulation, participants must be able to grasp the consequences of their actions. Although our model does not make this easy in the general case when the integrating firms differ in experience credit and production capability, we shall show that in the special case when the firms are identical in these respects, the consequence of integration can be estimated by a simple formula.

Let subscript t represent the period of integration. Let x_{t+1} and x'_{t+1} represent the firm's experience credit in the immediately following period without and with the endogenous incentive of integration, respectively. If q_{t+1} and q'_{t+1} are the firm's production in period $t+1$, without and with the endogenous incentive of integration, respectively, then, in the absence of incentive:

$$x_{t+1} = x_t + q_t \quad (6a)$$

and

$$x_{t+2} = x_{t+1} + q_{t+1} = x_t + q_t + q_{t+1}. \quad (6b)$$

Thus, in the general case for any period u following integration:

$$x_{t+u} = x_t + \sum_{i=t}^{t+u-1} q_i. \quad (7)$$

If the endogenous incentive accompanies the acquisition of m firms identical to the acquiring firm, then for each of the integrated firms:

$$x'_{t+1} = x'_t + (m\kappa + 1)q'_t \quad (8a)$$

and

$$x'_{t+2} = x'_{t+1} + (m\kappa + 1)q'_{t+1} = x'_t + (m\kappa + 1)(q'_t + q'_{t+1}) \quad (8b)$$

So, for the general case:

$$x'_{t+u} = x'_t + (m\kappa + 1) \sum_{i=t}^{t+u-1} q'_i. \quad (9)$$

The consequence of horizontal integration for any period can be measured by the incentive production ratio, q'_{t+u} / q_{t+u} . Combining Equations 3, 7, and 9, we have:

$$q_{t+u} = \frac{q_0}{(x_{t+u} + 1)^{\log_2 \varphi}} = \frac{q_0}{\left(x_t + \sum_{i=t}^{t+u-1} q_i + 1\right)^{\log_2 \varphi}} \quad (10a)$$

$$q'_{t+u} = \frac{q_0}{(x'_{t+u} + 1)^{\log_2 \varphi}} = \frac{q_0}{\left(x'_t + (m\kappa + 1) \sum_{i=t}^{t+u-1} q'_i + 1\right)^{\log_2 \varphi}} \quad (10b)$$

so the incentive production ratio is as follows:

$$\frac{q'_{t+u}}{q_{t+u}} = \frac{\left(x_t + \sum_{i=t}^{t+u-1} q_i + 1\right)^{\log_2 \varphi}}{\left(x'_t + (m\kappa + 1) \sum_{i=t}^{t+u-1} q'_i + 1\right)^{\log_2 \varphi}} = \frac{\sum_{i=t}^{t+u-1} q_i + (x_t + 1)}{(m\kappa + 1) \sum_{i=t}^{t+u-1} q'_i + (x'_t + 1)}. \quad (11)$$

Since $0 < \varphi \leq 1$, $\log_2 \varphi \leq 0$, and since $x_t = x'_t$ and $q_i \leq q'_i$ for every i , it follows that:

$$\frac{q'_{t+u}}{q_{t+u}} \leq \frac{\left(\sum_{i=t}^{t+u-1} q_i\right)^{\log_2 \varphi}}{\left((m\kappa + 1) \sum_{i=t}^{t+u-1} q'_i\right)^{\log_2 \varphi}}, \quad (12)$$

and

$$\left(\frac{1}{m\kappa + 1}\right)^{\log_2 \varphi} \leq \frac{\left(\sum_{i=t}^{t+u-1} q_i\right)^{\log_2 \varphi}}{\left((m\kappa + 1) \sum_{i=t}^{t+u-1} q'_i\right)^{\log_2 \varphi}}. \quad (13)$$

Accordingly, provided φ is not far from 1, the left-hand side of Equation 13 is a reasonable estimate of the consequence of horizontal integration. When $u \rightarrow \infty$, the incentive production ratio approaches its asymptote, which can be found by noting that:

$$\frac{q'_i}{q_i} \geq \frac{q'_{i-1}}{q_{i-1}} \geq \dots \geq \frac{q'_t}{q_t}, \quad (14)$$

so

$$\frac{q'_{t+u}}{q_{t+u}} \geq \frac{\sum_{i=t}^{t+u-1} q'_i}{\sum_{i=t}^{t+u-1} q_i}. \quad (15)$$

Combining Equations 12 and 15 results in the following:

$$\frac{q'_{t+u}}{q_{t+u}} \leq \frac{\left(\frac{1}{(m\kappa + 1) \frac{q'_{t+u}}{q_{t+u}}}\right)^{\log_2 \varphi}}{\left(\frac{1}{(m\kappa + 1) \frac{q'_{t+u}}{q_{t+u}}}\right)^{\log_2 \varphi}}, \quad (16)$$

which reduces to

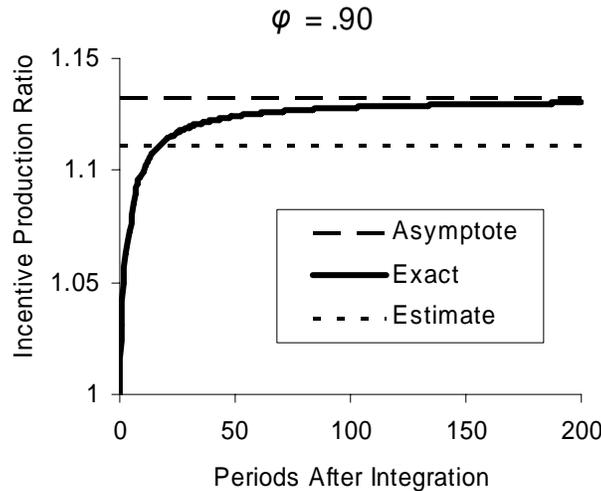
$$\frac{q'_{t+u}}{q_{t+u}} \leq \left(\frac{1}{m\kappa + 1}\right)^{\frac{\log_2 \varphi}{1 + \log_2 \varphi}} = \left(\frac{1}{m\kappa + 1}\right)^{\frac{\ln \varphi}{\ln 2 \varphi}}. \quad (17)$$

Figure 1 shows how the estimate from the left-hand side of Equation 13 and the asymptote from the right-hand side of Equation 17 compare with exactly computed results for $\varphi = .90$ when $q_0 = 100$, $x_t = 1000$, and $m\kappa = 1$.

MEASUREMENT OF INTEGRATION

If participants are responsive to an integration incentive, the firms of the simulation should manifest a higher degree of integration than they would otherwise. We propose an integration ratio (r) as a measure of the degree to which a firm is integrated with other firms, such that r is the ratio of the number of shares owned by other firms (s) divided by the number of shares the firm has outstanding (S) as follows:

Figure 1: Incentive Production Ratio after Horizontal Integration



$$r = \frac{s}{S} \quad (18)$$

Accordingly, if all shares outstanding are owned directly by participants, the firm's integration ratio is 0, and if they are all owned by other firms, the ratio is 1. We define a family of firms as a group of firms owned by a parent firm. If the maximum size of a family of firms is Z firms, then the maximum average integration ratio (r^*) for an economy of firms is as follows:

$$r^* = \frac{Z-1}{Z} \quad (19)$$

Equation 19 holds when cross-ownership is not permitted, so that if Firm A owns shares in Firm B, Firm B cannot own shares in Firm A, either directly or indirectly through a firm owned by either Firm B or another firm in the ownership chain following Firm B. Thus, if each firm can own shares in five other firms, so that $Z = 6$, the highest level of integration is reached when a parent firm owns all the outstanding shares of $Z - 1$ subsidiary firms. In this case, the integration ratio of the parent is 0, that of each subsidiary is 1, so the average of the 6 is $5/6 = .833$.

The integration ratio can be averaged over all firms irrespective of product, or it can be averaged only over firms that produce the same kind of product. When averaged over all firms irrespective of product, the ratio measures participants' responsiveness to incentives for integration generally; when averaged over firms that produce the same kind of product, it measures participants' responsiveness to the incentive for horizontal integration in particular.

If participants are responsive to incentives for integration generally, then the integration ratio over all firms should exceed the ratio expected from chance. When chance is the only operative mechanism, a participant founding six

firms must necessarily found the first directly, so its integration ratio must be 0. The remaining five firms can be founded either directly or indirectly, as a subsidiary of a founded firm. Chance implies that the likelihood that each of the remaining firms will be founded directly is 50%, so the expected integration ratio of each remaining firm is .50, and the expected integration ratio of the six firms is $2.5/6 = .417$. In general, the average integration ratio of chance (r^{\sim}) is:

$$r^{\sim} = \frac{r^*}{2} \quad (20)$$

A complication of using the average integration ratio to measure responsiveness to integration incentive is that participants might have reason to allow some shares of a subsidiary firm to be purchased directly by other participants. Finance and compensation are two possible reasons. Finance is the reason when the subsidiary can secure needed capital from other participants at less cost than the parent firm would require. Compensation is the reason when the subsidiary issues stock options that are exercised by employees. In these two instances, the resulting lower average integration ratio reflects other substantive considerations, and do not mean that participants are less responsive to integration incentive. Accordingly, if the integration ratio of a firm is limited to the binary values of 0 and 1, such that 1 applies when any share of the firm is owned by another company, the resulting collective integration ratio (r^{\wedge}), should be a more precise measure of participants' responsiveness to integration incentives. This ratio is computed by dividing the number of firms with another firm as its shareholder (w) by the total number firms (W) as follows:

$$r^{\wedge} = \frac{w}{W} \quad (21)$$

HYPOTHESES

If participants are responsive to integration incentives, \hat{r} should exceed \tilde{r} . So the first hypothesis of our study is as follows:

Hypothesis 1: The collective integration ratio across all firms will be greater than the average integration ratio of chance.

We consider a firm to be horizontally integrated only when its shares are owned by another firm that produces the same kind of product. Accordingly, if participants are responsive to *horizontal* integration incentive, \hat{r} taken across firms that produce the same kind of product also should exceed \tilde{r} . So the second hypothesis of our study is as follows:

Hypothesis 2: The collective integration ratio across firms that produce the same kind of product will be greater than the average integration ratio of chance.

If participants are responsive particularly to the endogenous incentive for horizontal integration, the integration ratio over firms that produce the same kind of product should move inversely with the learning coefficient of the firms, inasmuch as the incentive moves inversely also (Equation 11). That is, where there is more learning, more is gained by sharing the learning. So the third hypothesis of our study is as follows:

Hypothesis 3: The collective integration ratio across firms that produce the same kind of product will be lower when the learning coefficient of production is higher and vice versa.

METHOD

We applied the experience curve algorithm to GEO, an Internet-based (Pillutla, 2003), computer-assisted (Crookall, Martin, Saunders, & Coote, 1986) business gaming simulation involving 36 students enrolled in an undergraduate strategic management course. Students participated in the simulation for the entire six-week duration of the summer course.

The simulation tracked each participant. Each logged into the simulation program with a unique user name and password, was given a periodic income, and allowed to found companies that produced products that were sold through auction. Each participant could found up to five firms, and each company could acquire up to five subsidiary firms. Accordingly, the maximum size of a family of integrated firms is six (one parent and five subsidiaries), and the expected integration ratio of chance is .417, as discussed earlier.

Participants' scores were based on their consumption of the products the companies produced, such that those who consumed more and did it more evenly received higher scores. Time in the simulation was clock-and-activity driven (Chiesl, 1990; Thavikulwat, 1996), with a period elapsing automatically every few hours whenever participants were active. Participants could access the simulation any time from virtually anywhere, so periods elapsed throughout the week at almost any time of the day and night.

The simulated economy encompassed five related industries, labeled service, energy, material, chemical, and textile. Participants could found firms in and consume the products of any industry. Each firm could produce only one line of products, one that was identical in kind to the products produced by all other firms of the same industry. Participants received 1 point towards their score for consuming a service unit, 3 for an energy unit, 3 for a material unit, 6 for a chemical unit, and 40 for a textile unit. These point values were assigned to approximate the relative resource costs and managerial difficulties of producing each virtual product. The supply chain of the simulated economy is shown in Figure 2.

Figure 2: Supply Chain of Industries

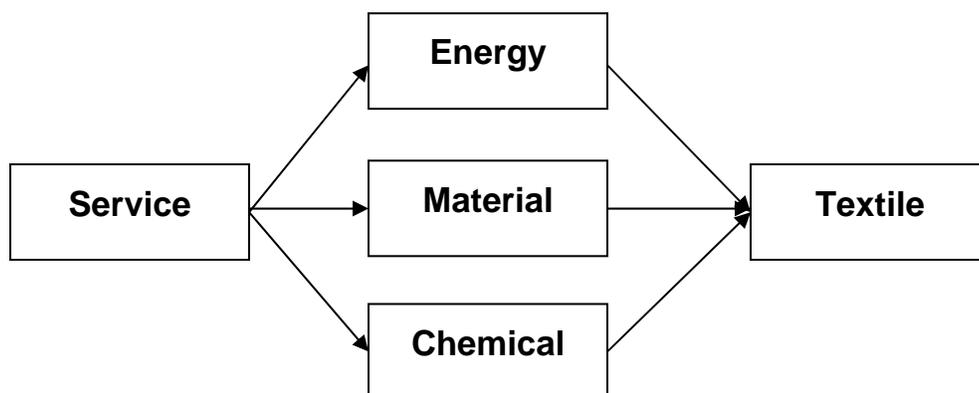


Table 1: Integration of Companies

	Industry				
	Service $\varphi = .95$	Energy $\varphi = .93$	Material $\varphi = .98$	Chemical $\varphi = .98$	Textile $\varphi = .98$
No. of Firms	49	6	7	3	4
Across Industries:					
Average Family Size	2.400	1.333	1.500	2.667	2.000
No. of Six-Firm Families	5	0	0	0	0
Partially Integrated	12	3	0	3	3
Wholly Integrated	26	2	3	0	0
Average Integration Ratio	.647	.481	.429	.656	.359
Collective Integration Ratio	.776** ($\chi^2 = 24.50$)	.833 ($\chi^2 = 2.74$)	.429 ($\chi^2 = 0.10$)	1.000 ($\chi^2 = 2.14$)	.750 ($\chi^2 = 0.71$)
Within Industry:					
Average Family Size	2.020	0	0	1.333	0
No. of Six-Firm Families	2	0	0	0	0
Partially Integrated	14	0	0	1	0
Wholly Integrated	21	0	0	0	0
Average Integration Ratio	.563	0	0	.032	0
Collective Integration Ratio	.714** ($\chi^2 = 16.65$)	.000 ($\chi^2 = 2.74$)	.000 ($\chi^2 = 3.43$)	.333 ($\chi^2 = 0.09$)	.000 ($\chi^2 = 1.40$)

** $p < .001$ as compared with the chance value of .417.

RESULTS

By the end of the exercise, 357 periods had elapsed and the participants had founded 69 firms with shares outstanding, of which 21 were partially integrated across industries and 31 were wholly integrated. A partially integrated firm had some shares outstanding that were owned directly by participants; a wholly integrated firm had no shares outstanding that were owned directly by participants. Across industries, the average integration ratio was .594. The collective integration ratio was .754, significantly greater than the chance value of .417 ($\chi^2 = 30.86, p < .001$). Accordingly, Hypothesis 1 is supported.

Table 1 is a breakdown of the results by industry. As the table shows, the collective integration ratio across firms within the service industry is .714, significantly greater than the chance value of .417. Accordingly, Hypothesis 2 is supported.

The χ^2 statistic requires a minimum count of 5 for every case (Dixon & Massey, 1969). As Table 1 shows, this requirement is not met for within-industry integrated companies in any industry other than the service industry. Accordingly, the data are insufficient to test Hypothesis 3.

CONCLUSION

We designed an endogenous incentive for horizontal integration and incorporated it into GEO, an Internet-base, computer-assisted business gaming simulation. Students in an undergraduate strategic management course participated in the exercise. By the end of the exercise, the participants owned 69 firms, of which 71.4% were horizontally integrated. This percentage is significantly greater than the 41.7% that would be the case were chance the only operative mechanism. We conclude that the participants of

the simulation were responsive to horizontal integration incentive.

The data did not suffice to establish that participants were responsive particularly to the endogenous incentive that we had devised. Participants may have engaged preferentially in horizontal integration for tax and financial reasons only. Thus, after founding one successful firm, they may have concluded that using the firm's available cash to found a subsidiary firm would be more advantageous than disbursing that cash through dividends to found a second firm independent of the first. Further study is needed to disentangle these possibilities.

One advantage that the simulation we used has over many others that are administered in strategic management courses is that it is designed to run through hundreds of periods in each administration, as compared with the typical run of 4 to 16 periods (Anderson & Lawton, 1992; Rollier, 1992). Hundreds of periods are advantageous in simulations that incorporate strategic management issues, because these are issues whose consequences naturally become clear only after many periods of decision have elapsed. Thus, in horizontal integration, the effect of sharing experiences should accumulate over many periods. To model its effect with an algorithm that causes a firm to become substantially more productive in a few periods would distort the issue.

Even so, some distortion of issues is unavoidable in any simulation. The task for the developer is to minimize the distortion where it matters. Incorporating an endogenous incentive into a simulation that runs for only about a dozen periods engages the issue of horizontal integration in a more natural way than an exogenous incentive could. The improvement may suffice for the purpose of the exercise.

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