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GETTING THERE IN A GLOBAL INDUSTRY: IMPACTS ON PERFORMANCE OF CHANGING INTERNATIONAL PRESENCE

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We investigate the effects of increasing and decreasing international presence on market share and survival in the American medical diagnostic imaging equipment industry. Imaging equipment manufacturers possessing international medical operations tend to achieve superior market share and longer survival, but we find that attempting to become an international medical player is risky. Both increasing and decreasing international presence have negative associations with survival, while decreased internationalization is associated with decreased American market share. Brief case studies suggest that the ingredients for success in internationalization may include preparedness, focused management, and learning from international experience.

We have long recognized that multinational firms achieve superior performance in some industries (Bartlett and Ghoshal, 1989; Caves, 1971; Hymer, 1976; Prahalad and Doz, 1987), but little empirical research has addressed the risks of becoming an international player. Yet the 'risks of going global' (O'Byle, 1991: A1) may be substantial. In this paper, we examine changes in the market share and survival of manufacturers operating in the American medical diagnostic imaging equipment market as they expanded or contracted their global operations between 1975 and 1989.

Our empirical estimates suggest that attempting to become an international player in this global industry is risky. Although firms having greater international presence tend to enjoy superior performance, both increasing and decreasing international presence have negative associations with survival in the key American market. We also find that international expansion and contraction have mixed relationships with American market share performance. Four brief case studies suggest that successful international expansion may require preparedness, focused management, and learning from international experience.

Key words: Global competition, business survival, changing international strategy

BENEFITS AND RISKS OF EXPANSION

Internationalization theory argues that firms expand globally in order to realize the value of intangible assets (e.g. Buckley and Casson, 1976; Caves, 1971; Coase, 1937; Hymer, 1976; Magee, 1977; Rugman, 1981; Teece, 1976). Examples of intangible resources include tacit understanding of technical capabilities, marketing skills, and organizational competence. Recent empirical analysis (Morck and Yeung, 1991a, 1992) finds that a multinational structure enhances firm value and that the benefit is due to the application of information-based resources to multiple markets.

More broadly, recent analyses of international strategy argue that firms may increase and leverage the value of assets by expanding globally (e.g. Bartlett and Ghoshal, 1989; Casson, 1982,

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1990; Kogut, 1985; Porter, 1980, 1986; Prahalad and Doz, 1987). Porter (1980: 275) defines a global industry as one in which the 'positions of competitors in...national markets are fundamentally affected by their overall global positions'. There is long-standing empirical evidence that an international firm in a global industry has advantages in the national markets in which it operates (e.g. Dunning, 1973; Kim, Hwang and Burgers, 1989; Rugman, 1979; Vaupel, 1971; Vernon, 1971).

Yet, while being international may be valuable, changing international presence may have both costs and benefits. A few empirical studies have examined the consequences of expansion, finding both positive and negative effects. In a financial event study, Morck and Yeung (1992) found that foreign acquisitions often increase an acquiring firm's value, if it possesses intangible assets. Otherwise, the effect of foreign acquisitions is at best neutral and may even be harmful. Newbould, Buckley and Thurwell (1978) examined 43 smaller firms that expanded internationally for the first time. They noted that problems encountered by the expansion subsidiary sometimes affected the entire corporation. In Table 1, we summarize several advantages and disadvantages that may stem from international expansion.

Table 1. Some advantages and disadvantages of global expansion

Expansion advantages
1. Volume economies (Mitchell and Singh, 1991)
   a. Gain scale economies (e.g. Caves, 1971; Hymer, 1976)
   b. Gain scope economies (e.g. Teece, 1980) by adding technically or market-related products
   c. Gain learning economies (e.g. Buckley and Casson, 1976; Amit, 1986) when selling in several markets increases cumulative production
2. R&D or manufacturing improvement
   Create 'an international intelligence system' (Buckley and Casson, 1976: 35) to acquire commercially applicable R&D and manufacturing knowledge
3. Sales stabilization
   Gain operational flexibility when socioeconomic conditions are imperfectly correlated across different international markets (e.g. Hirsch and Lev, 1971; Rugman, 1979; Caves, 1982; Kogut, 1985; Kim, Hwang and Burgers, 1989)
4. Tax rate arbitrage
   Play off tax rate differentials (e.g. Lessard, 1979; Harris *et al.*, 1991)
5. Organizational advantages
   a. Become more effective because of facing greater competition (e.g. Leibenstein, 1966)
   b. Develop sophisticated structure and control systems required to manage participation in more than one environment (e.g. Chakravarthy and Lorange, 1984)

Expansion disadvantages
1. Management problems
   a. Multinationals are more complicated than domestic firms (e.g. Caves, 1982). Cross-fertilization among national operations in product development, production, and marketing may not materialize if organizational complexity creates confusion
   b. A firm's managers may not be suited to running a multinational firm
   c. Transferring intangible assets is often uncertain (e.g. Nelson and Winter, 1982)
   d. Cultural diversity encountered when operating in several countries (Hofstede, 1980) may create communication, coordination, and motivation problems
2. Inertia
   Structural inertia may inhibit attempts to change (e.g. Hannan and Freeman, 1977)
3. Ephemeral advantages
   a. Expected benefits may be less real than apparent
   b. Competitive advantages may erode, leaving a firm with the costly and difficult to manage shell of a multinational structure (Morck and Yeung, 1991b)

PROPOSITIONS AND RESEARCH QUESTIONS

We turn now to our specific research questions concerning the effects of changing international presence on market share and survival in a key market, which we define as a market in which a firm must compete if it is to gain the benefits of global presence.[1] In this study, we will refer primarily to increased and decreased internationalization in general. Although changes in international operations may take many forms, including importing, exporting, manufacturing,

[1] Examining market share and survival is consistent with the recognition that managers must evaluate a broad set of criteria in order to evaluate the long-term potential of their businesses (Eccles, 1991). We focus our attention on performance in the American market because global performance data are not available for this study. The U.S. market is a key market of the imaging industry, in which international manufacturers must compete successfully, because it accounts for about half of global imaging equipment sales and is the source of many technical advances.

acquiring foreign firms, setting up new ventures, and joining alliances, only for importing will we discuss the possible effects of a specific form of internationalization. We plan to explore the effects of different types of expansion and contraction in later research, but initially approach the issue in broader terms and limit ourselves to a brief description of the empirical effects of some different types of internationalization strategy. We take this approach because the data that we use for this study is appropriate for exploratory coarse-grained analysis.

We expect a strategy of decreased internationalization to be associated with shorter survival and lesser increase in the market share in the key market. The rationale underlying these predictions is that decreased internationalization in an industry in which international players tend to achieve superior performance is likely to occur when firms encounter problems in their operations. We expect the weakness to be evident in their performance in a key market.[2]

Proposition 1. Decreased internationalization will be associated with smaller increase in current market share in a key market.
Proposition 2. Decreased internationalization will be associated with shorter survival in a key market.

Past decreases in internationalization may be associated with further decline in market share in the key market if there are long-term negative effects. Alternatively, past decreases in internationalization might be associated with increased market share in the current period. The logic underlying this alternative is that market share analyses contain a survivor bias. If international contraction leads to exit from the industry, then the only firms for which lagged strategic changes are relevant will be the survivors. These surviving firms are the most likely to recover from the problems that caused the international contraction and gain strength in a later period. We pose this issue as a research question, which we will limit to effects on market share because we do not have sufficient data to estimate effects of past strategic change on survival.

Research Question 1. Will past decreased internationalization be associated with greater or lesser increase in current market share in a key market?

One might assume that a firm will achieve increased performance when it increases its international presence in a global industry. As we have argued, though, the benefits of being international will not accrue to all firms that attempt to increase their international operations. Therefore, the effects of increased internationalization on market share and survival are open questions. The advantages of international operation may be strong enough that firms tend to achieve greater market share and survival when they expand. On the other hand, the cost and difficulty of expansion may be strong enough that many firms suffer, rather than benefit, at least initially. The problems incurred in managing international business may be significant enough to force many firms to exit the industry, so that only those which survive enjoy the benefits of global presence. Because the relationships between increased internationalization and performance are uncertain, we pose the following empirical research questions.

Research Question 2a. Will increased internationalization tend to be associated with shorter or longer survival?
Research Question 2b. Will increased inter-

[2] We cannot make an unassailable case for the order of causality, particularly in Proposition 1. That is, market share problems in the national market may cause or result from the international contraction. The general issue here is that strategy may lead performance, as we suspect is the case in this study, but performance may also cause strategic change. Ultimately, we are guided by our interest in the question of the effects of strategic change on performance. We attempt to control the possibility of reverse causality by including measures of past market share change in the statistical analyses and by carrying out the survival analyses. In order for the survival results to stem from reverse causality—so that future failure would cause both international expansion and international contraction—we would have to assume that managers who believe that their firms will soon exit the industry systematically tend to change their international presence (both increase and decrease). Moreover, we would have to believe that such changes are consistently ineffective, that is, the actions do not increase the survival of the firms. This logic may apply to some cases, but we find the opposite reasoning more systematically likely: that changing internationalization strategy may be risky. We believe that we have made a strong *a priori* case that changing internationalization strategy may affect performance and wish to explore the issue empirically. When taken as a whole, our results are more consistent with our causal argument than with the reverse direction, but we are conservative in our interpretations.

nationalization tend to be associated with greater or lesser increase in current market share in a key market?

We are also interested in investigating the longer term effects of increased internationalization. Whether the first period effects are positive or negative, we should find that the benefits of international expansion lead to long-term performance increases for surviving firms. This expectation is based on the large literature documenting the superior performance of multinational firms. Nonetheless, if problems encountered during the first period of expansion cannot be overcome or if a firm rests on its laurels after first period success, then performance in the second period may suffer.

Research Question 3. Will past increased internationalization tend to be associated with greater or lesser increase in current market share in a key market?

Finally, we will investigate the relationship with key market performance of becoming an importer, which we view as a distinct category that might have either positive or negative association with performance. Firms may import products manufactured by another company in order to broaden a product line, perhaps as a temporary strategy before undertaking in-house manufacture either domestically or abroad. When importing is undertaken as such an increase in product breadth, then becoming an importer may be a sign of strength and be associated with improving performance. On the other hand, a firm may turn to importing because its internal manufacturing capabilities are weak, much as Chrysler now imports much of its small car line. In such cases, becoming an importer is likely to be associated with decreased key market performance.

Research Question 4a. Will current and past strategies of becoming an importer be associated with greater or lesser increase in market share in a key market?
Research Question 4b. Will a current strategy of becoming an importer be associated with longer or shorter survival?

IMAGING INDUSTRY DATA

The data with which we examine these issues consists of firms that manufacture medical diagnostic imaging equipment, which is used by physicians and other health care workers to nonintrusively examine organs and physiological activity within live beings. The study contains six technical subfields of the imaging equipment industry, including conventional x-ray, nuclear medical, ultrasonic, computed tomographic, magnetic resonance, and digital radiographic imaging systems. Total imaging equipment sales in the American market rose from about $1.2 billion in 1975 to $2.7 billion in 1988, reported in constant 1988 dollars. These figures represented almost half of total world sales for medical diagnostic imaging systems, about twice the sales in the second largest national market (Japan) and about double the combined sales in the major Western European nations. All international industry leaders compete keenly in the U.S. market.

The empirical setting is consistent with the global industry context in which we posed the propositions and research questions. During the 1960s, single-country players could maintain positions among the leaders in national markets of the imaging industry. By 1975, however, international firms had performance advantages in the U.S. market. Because similar products are purchased in many countries, some scale and scope volume economies became available. Perhaps of greater importance, advances in imaging technical design and manufacturing processes now occur regularly on at least three continents, although American advances continue to be critically important. When they attempt to incorporate such advances into their product line, firms with sales, design, and manufacturing operations that are spread throughout the world have advantages relative to companies that compete only in one country. The world leaders in the industry—which include the General Electric Company, Siemens AG, the Toshiba Corporation, Philips NV, and Hitachi Ltd.—all possess extensive technical and market-related medical sector operations throughout the world.

As we report later in the paper, the more extensive the international status of a participant in the industry, the stronger its performance in the U.S. market. Nonetheless, significant fine-tuning is required for most geographic markets,

because the hospital and other health care markets in each country differ significantly, so that domestic specialists may exist and thrive. Therefore, the context for the study is an industry in which international operations offer significant but not overwhelming advantages. In Prahalad and Doz's (1987) terms, the medical diagnostic imaging equipment is an industry requiring both high global integration and high local responsiveness. This is descriptive of many industries today.

Measures of performance

We focused our attention on two measures of performance in the industry. The first measure is the change in imaging equipment industry American market share held by a manufacturer from one period to the next. The second performance measure is the length of continued participation of a corporation in the American market after a given year, which we also refer to as survival. We recorded an exit if an imaging business unit was dissolved or if a corporation sold its imaging equipment subunit to another firm. The participation and market share data were gathered from an extensive archival search of academic, industry, and government sources, supplemented by interviews with industry and academic participants. The participants include all identifiable manufacturers of human diagnostic imaging equipment systems that sold devices, either directly or through distributors, in the U.S. market at any point during the 1975–89 period. We excluded firms that manufactured only imaging components or only distributed imaging systems manufactured by other companies.

We used the participation and market share data to define two dependent variables, MARKETSHARE and LIFE. In this discussion, we use the term 'record year' to refer to the years for which international strategy variables were available (1975, 1978, 1983, 1986, and 1989), as we discuss below. The dependent variable for the market share analysis was a firm's average annual change in industry market share between successive record years. The dependent variable for the survival analysis was the number of years that a corporation continued to participate in the industry after each record year, with a minimum value of one year for firms that exited during a record year. A 0–1 right-censor dummy variable recorded firms that continued to participate in the industry at the end of the study. Our base sample consisted of 111 firms, with a total of 210 record periods.

Internationalization strategy variables

To identify the internationalization strategies followed by manufacturers in this industry, we turned to a series of medical sector trade guides (Hale and Hale, 1975, 1978, 1983, 1986, 1989). The guides estimate several major aspects of the medical sector internationalization strategy followed by imaging equipment manufacturers. Where possible, we recorded a corporation's overall medical sector internationalization strategy and the internationalization strategy followed by the firm's imaging-related business unit.

We measured internationalization strategy at the corporate medical sector level because it is difficult to gauge distinct business unit strategy. In addition to data constraints, it is conceptually difficult to separate corporate medical sector internationalization strategy from individual business actions. Significant changes in medical sector international presence that are carried out by a corporation will usually influence all its medical businesses, particularly those which compete in global industries such as the diagnostic imaging industry.[3]

Nonetheless, some internationalization strategies carried out at the corporate medical sector level may not affect a particular medical imaging equipment business unit. Where possible, therefore, we also recorded internationalization strategy for the operating units that included the firms' imaging businesses. For 40 firms in our sample, imaging equipment sales exceeded 50% of medical sector revenue, so that their corporate medical sector and imaging business unit strategy were largely identical. For 34 of the remaining 71 multibusiness firms, meanwhile, the trade guides consistently recorded operating unit strategy as well as corporate medical sector strategy

[3] R&D practices, for instance, tend to have strong corporate components (Scott, 1984). A move to undertake a major corporate-owned distribution system in Europe or Japan, as another example, will both draw resources from most or all medical sector businesses and provide direct or indirect services to them.

for the 1978–89 period.[4] Thus, we obtained business level information for 74 firms, providing operating unit strategy for 129 record periods (61 percent of the base sample).

The trade guides classify medical sector companies in five relevant categories of international strategy for the years 1975, 1978, 1983, 1986, and 1989. The categories in the guides, which are listed in part A of Table 2, include domestic-only, importer, exporter, overseas manufacturer, and multinational status.[5] The categories are not mutually exclusive; for example, a firm might be both an importer and an exporter. We identified the value of the international strategy variables for each firm in our sample in each year that the directory was published and treated the categories as 0-1 dummy variables.

The trade guides used the following definitions when assigning classifications. Domestic-only status implies no significant medical sector activity outside the U.S.A. by the firm, whether by export, import, or manufacturing. The importer category applies to firms that import a nontrivial and verifiable portion of the medical goods that they sell in the U.S. The importer category is defined only for firms that purchase goods from other manufacturers; that is, selling medical goods in the U.S.A. that were manufactured overseas in a company-owned plant is not treated as importing. The exporter category applies to firms that export a nontrivial and verifiable portion of the medical goods that they manufac-

Table 2. International strategy variables

A. Period strategy dummy variables[a]

Period variable	Classification	Description
DOM	Domestic only	No significant international activity
IMP	Importer	Import for sale in U.S.
EXP	Exporter	Export from U.S.
OVM	Overseas manufacturer	Own manufacturing facilities outside U.S.
MNE	Multinational	Extensive international activity

B. Composite variables recording change in strategy from period t to period $t + 1$[b]

Change variable	Change in strategy	Description
IINT[c] (Increased internationalization)	a. $MNE_{t,t+1} = 0$ to 1	Become international
	or b. $OVM_{t,t+1} = 0$ to 1	Start overseas manufacture
	or c. $EXP_{t,t+1} = 0$ to 1[d]	Start exporting
DINT (Decreased internationalization)	a. $MNE_{t,t+1} = 1$ to 0	Cease to be international
	or b. $OVM_{t,t+1} = 1$ to 0	Stop overseas manufacture
	or c. $EXP_{t,t+1} = 1$ to 0[e]	Stop exporting
	or d. $DOM_{t,t+1} = 0$ to 1	Become solely domestic
IMPORT	$IMP_{t,t+1} = 0$ to 1	Start importing

[a]A period strategy measure of 1 means that the firm fit the category in the year of record (e.g. DOM = 1 implies 'domestic only', DOM = 0 implies 'not domestic only).
[b]Periods $t,t + 1$ include 1975–78, 1978–83, 1983–86, and 1986–89 for the corporate medical sector analyses; the business unit analyses omit 1975–78.
[c]We omitted the $DOM_{t,t+1} = 1$ to 0 strategic change from IINT because the guides did not code it consistently.
[d]$EXP_{t,t+1} = 0,1$ was defined as IINT only if $MNE_{t,t+1} \neq 1,0$ and $OVM_{t,t+1} \neq 1,0$.
[e]$EXP_{t,t+1} = 1,0$ was defined as DINT only if $MNE_{t,t+1} = 0,0$ and $OVM_{t,t+1} = 0,0$.
Sources: Hale and Hale (1975, 1978, 1983, 1986, 1989).

[4] We omitted 1975 operating unit international strategy information, owing to data inconsistency.

[5] In some cases, the guides did not assign importer, exporter, overseas manufacturer, or multinational status, but also did not assign domestic-only status. Because all such firms were small, we treated them as domestic-only cases.

ture in the U.S.A. The overseas manufacturer category applies to firms that own and operate medical sector manufacturing facilities outside North America. Multinational status was assigned to firms that the editors of the guides judged to possess 'a combination of domestic and foreign manufacturing, as well as importing and exporting', such that the firms have achieved 'truly international scope and influence' in their medical sector activities (Hale and Hale, 1989: III-1).

The internationalization strategy categories provide coarse measures of strategy, because they do not measure major increases or decreases of commitment or resources within a category. The overseas manufacturer category notes only whether or not a firm had significant manufacturing capability outside the U.S.A., for instance, not whether it had changed its existing overseas manufacturing capability. Although systematically identifying incremental changes in strategy would increase the richness of a study such as ours, the more quantum measures that we employ contain important information. Quantum changes—such as from having no significant overseas manufacturing presence to setting up a first manufacturing facility outside the U.S.A.—may have particularly strong effects in the survival analyses owing to the disruption to the existing organization.

To confirm our assessment that this industry is one in which possessing international operations is associated with superior performance in a key national market, we regressed absolute levels of current U.S. market share and the length of continued participation after each record year on the measures of corporate medical sector international strategy. As expected, multinational status was significantly associated with greater market share and survival. The overseas-manufacturer internationalization strategy variable also was significantly associated with greater market share. Most other variables had no significant relationships with market share or survival. The positive association between multinational medical sector status and imaging equipment industry performance is consistent with our assessment that this is a global industry.[6]

We then recorded the change in the international strategy variables for each participant that survived from one directory year to the next. As reported in Part B of Table 2, we used the change record to define three composite variables recording change in internationalization strategy: IINT (increased internationalization), DINT (decreased internationalization) and IMPORT (start importing). In keeping with Research Question 4, we defined the import category separately because we could not make a strong prior argument for whether it represented increased or decreased international presence, but we are interested in determining whether importing was consistently associated with changes in performance.

Other independent variables

In addition to variables that recorded change in strategy, we defined three control variables. We recorded the nationality of majority ownership in a 0-1 dummy variable, with U.S. ownership set equal to 1. Prior empirical work has found differences in survival among firms based in the U.S. and other countries (e.g. Mitchell, 1991), while several studies have found that cultural and other differences often cause differences in strategy and performance (e.g. Kogut and Singh, 1988). We defined a lag change in market share dummy variable, with cases in which market share decreased during the prior period set equal to 0. This measure addresses the possibility that past performance in the national market is the primary determinant of current performance. Finally, we recorded corporate age during the record year in an age measure, in order to control possible positive or negative influences of age-

[6] We estimated the following equations to test for global industry status, using normally distributed MLE linear regression for equation (i) and logistically-distributed accelerated failure-time log-linear regression for equation (ii).

$$\text{SHARE} = \alpha_S Z + \nu_S \quad \text{(i)}$$

$$\text{Ln(LIFE)} = \alpha_L Z + \nu_L \quad \text{(ii)}$$

SHARE and LIFE recorded current U.S. market share in each record year and the length of continued participation after each record year. The Z matrix consisted of the values of the period strategy dummy variables (five variables) listed in Table 2 in each record year, plus a unit intercept vector. The α_S and α_L vectors contain the coefficients associated with each independent variable in the share and survival equations; the ν terms are random errors. Based on one-tailed tests, the positive coefficient of the multinational status period strategy dummy variable was significant at the 0.01 level in the market share equation and at the 0.10 level in the survival equation.

related experience or inertia. The correlation matrix and descriptive statistics for the independent variables are reported in Table 3.[7]

STATISTICAL METHODS

We used conventional maximum likelihood linear regression to test the market share propositions and examine the market share research questions. For the survival propositions and questions, we used log-linear maximum likelihood accelerated event-time regression (Cox and Oakes, 1984; Kalbfleisch and Prentice, 1980). The accelerated time-event models were estimated with the PROC LIFEREG procedure of SAS (SAS Institute, Inc., 1985). The equations took the following functional forms:

$$\text{SHARECHANGE} = \beta_S X + \epsilon_S \quad (1)$$

$$\text{Ln(LIFE)} = \beta_L X + \epsilon_L \quad (2)$$

In these equations, X is a matrix containing the value of the independent variables in each record period (including a unit intercept vector), β_S and β_L are the associated coefficient vectors, and ϵ_S and ϵ_L are the parametrically distributed errors (variance-related scale parameters, σ_S and σ_L, are also estimated for the distributions). We assumed a normally distributed error for the market share equation. For the survival equation, meanwhile, we employed a log-logistic distribution as the baseline parametric assumption because this distribution has been found to fit well in previous studies of industry exit (e.g. Mitchell, 1991). We also found the survival results to be robust to other parametric specifications, including the Weibull and normal distributions.

The accelerated event-time model treats coefficient effects as log-linear accelerations or decelerations of a baseline distribution of event times that would be found if all independent variables were zero. The principal advantage of the method is that it permits us to include the information that an event is right-censored, that is, that a firm was still participating at the end of the study. If right-censored cases were treated as though they had exited or were omitted, as would have to be done with conventional regression methods, the results would be seriously biased. The model incorporates the information that a firm has not exited by including uncensored events in calculation of the probability density

Table 3. Correlation matrix and descriptive statistics (medical sector strategy)

Variables[a]	1	2	3	4	5	6	7	8	9	10
1. Market share change	1.0	−0.5	0.01	−0.16	−0.31	−0.02	−0.10	0.24	−0.01	0.15
2. DINT		1.0	−0.05	−0.04	−0.01	−0.03	0.41	0.10	0.07	0.05
3. IINT			1.0	0.04	0.16	−0.04	−0.09	0.05	−0.03	0.11
4. IMPORT				1.0	0.42	−0.04	0.21	−0.08	−0.08	0.09
5. Lag change in market share					1.0	−0.06	0.21	−0.15	−0.01	−0.30
6. Lag DINT						1.0	−0.05	−0.04	0.14	−0.05
7. Lag IINT							1.0	−0.10	0.03	0.13
8. Lag IMPORT								1.0	−0.8	0.03
9. American firm									1.0	−0.18
10. Firm age										1.0
Descriptive statistics										
Mean	0.06	0.05	0.06	0.05	0.73	0.03	0.09	0.08	0.67	38.5
Standard deviation	0.43	0.22	0.24	0.21	0.45	0.17	0.29	0.27	0.47	26.4

[a]All but market share change and firm age are 0-1 dummy variables. n = 210 for all but the lag measures (n = 99).

[7] Corporate size and diversification may also affect performance. In the subset of the sample for which we have corporate size information, total sales were too strongly correlated with age to produce independent information. To examine possible effects of corporate diversification, we also calculated market share and survival models that included an 'imaging share' variable (imaging business sales/corporate sales) with the subset of our sample for which we have reliable parent size measures. Incorporating this variable in our regression analyses produced no qualitative differences from those reported in the paper.

function (the probability that an event happened at a specific date) and censored cases in calculation of the survival function (the probability that an event will happen sometime after a specific date).

RESULTS

The results of the analyses are reported in Table 4.[8] We first consider the corporate medical sector strategy results, reported in columns 1–3. As predicted by Propositions 1 and 2, decreased international presence (DINT) is associated with smaller market share increases (columns 1 and 2) and shorter survival (column 3). The market share result reported in column 1 reached statistical significance, as did the survival results reported in column 3. When lagged values of the strategy variables were included in column 2, the market share result lost significance, although it remained more than a standard deviation beyond zero.[9]

The corporate medical sector strategy results also shed light on the research questions. Investigating Research Question 1, we found no significant association between past decreased internationalization (Lag DINT) and current change in market share (column 2). It is possible that the firms that suffer most severely from past decreased internationalization have exited the industry by the time that the current period occurs, while those that survive manage to do no more than stem their past losses. It appears to be difficult to recover from the effects that forced a retreat from markets outside the U.S. market.

Research Question 2a concerned the effects on survival of attempts to increase internationalization. We find that IINT is significantly associated with shorter survival (column 3). This result is consistent with the argument that undertaking a major change will often cause a firm to fail, even when the industry is one in which firms possessing international operations tend to be the strongest performers.

Research Question 2b concerned the effects on market share of attempts to increase internationalization. Although the estimated effects are positive, the results are statistically insignificant in both column 1 and 2. It appears that increased internationalization is an ambiguous event. For firms that survive the process of internationalization, the most likely result is increased market share, but some may suffer decreases, at least initially. Past increased internationalization (Lag IINT) took a very nonsignificant association with current increased market share, consistent with the uncertainty expressed in Research Question 3.

We also carried out preliminary investigation of some of the effects of the component parts of the IINT and DINT corporate medical sector strategy variables. Perhaps the most notable finding was that retrenchment, whether by ceasing to operate overseas manufacturing facilities or by becoming a U.S.-only participant (components 'b' and 'd' of the DINT variable described in Part B of Table 2), was associated with poorer market share performance. However, the converse case of initiating overseas manufacturing (component 'b' of the IINT variable) was not associated with current improvements in market share performance. These results further suggest that there is an asymmetry between decrease and increase in international activities. Decreased internationalization may be associated with current poor market performance, while increased internationalization has no definite relationship with current performance. It is possible that many internationalization advantages do not emerge until subsequent periods.

Research Questions 4a and 4b concerned the

[8] Because our sample consists of a pooled cross-section and times series, we checked the results for possible effects of serial correlation of the dependent variables. First, we calculated firm-level product-moment correlations for the 'change in market share' dependent variable, finding no statistically significant correlation (the product-moment correlation was −0.13, with a probability value of 0.18). We also checked the survival analyses for stability in each year of record (because of right censoring, calculating product-moment correlations for the survival variable was not appropriate); the single year results were consistent with those reported.

[9] Including lagged values of the variables causes the market share sample size to drop from 210 to 99 observations (59 firms) in column 2, while the survival sample totals 137 observations (85 firms). Observations are lost for three reasons: (1) dependent variables in the 1975–78 period cannot be included in the models that include lagged independent variables, because we have no records of the international status-independent variables before 1975; (2) firms that entered the medical sector during a period are omitted because they lack prior period status for the lagged independent variables; and (3) firms that exited during a period are omitted because we lack a measure of the change in market share dependent variable.

Table 4. Association between changes in U.S. performance and changes in international presence (s.e. in parentheses)

	Medical sector strategy			Business unit strategy	
	Market share		Survival	Market share	Survival
	1	2	3	4	5
CHANGE IN INTERNATIONAL PRESENCE					
DINT	−0.18*	−0.22	−0.69**	−0.30**	−0.94**
	(0.13)	(0.18)	(0.42)	(0.14)	(0.48)
Lag DINT		0.03			
		(0.25)			
IINT	0.06	0.17	−0.75***	−0.07	−0.94**
	(0.12)	(0.15)	(0.33)	(0.14)	(0.43)
Lag IINT		−0.01			
		(0.17)			
IMPORT	−0.34***	−0.49***	−0.08	−0.63***	−0.48
	(0.14)	(0.18)	(0.45)	(0.18)	(0.66)
Lag IMPORT		0.33***			
		(0.16)			
OTHER INFLUENCES					
Lag change in market share		−0.07	0.01		−0.53**
		(0.11)	(0.03)		(0.30)
U.S.-firm	0.01	−0.04	−0.80***	−0.06	−0.74**
	(0.06)	(0.09)	(0.28)	(0.06)	(0.39)
Corporate age (10 years)	0.027***	0.039***	0.15***	0.015*	0.103*
	(0.011)	(0.018)	(0.05)	(0.010)	(0.065)
Intercept	−0.03	−0.03	2.32***	−0.07	2.54***
	(0.07)	(0.15)	(0.30)	(0.06)	(0.42)
SCALE PARAMETER					
Normal distribution	0.41	0.41		0.30	
	(0.02)	(0.03)		(0.02)	
Loglogistic distribution			0.59		0.51
			(0.07)		(0.09)
n (exited)	210	99	137.(53)	129	73.(24)
Model χ^2 (d.f.)	13.6**	22.4***	26.0***	22.3***	18.2***
	(5)	(8)	(6)	(5)	(6)

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ (one-tailed tests)

effects on market share and survival of becoming an importer. We find that importing has significant negative current association with market share increase and significant positive lagged associations with market share increases (columns 1 and 2). At the same time, importing has an insignificant association with survival (column 3). These results are consistent with a scenario in which a firm imports products to deal with problems that are affecting current market share. If the firm overcomes the problems, and so survives, then it is likely to regain market share during the following period.

The control variables in the corporate medical sector strategy analyses reported in columns 1–3 achieve mixed significance. Lag change in market share is not significantly associated with current market share change or survival. Older corporations, which in this study also tend to be larger firms, have both market share and survival advantages. In additional analyses, we calculated models that included dummy variables for each period, but found no qualitative difference from the results reported.

The analyses include the American market performance of foreign-owned firms operating in

the U.S.A. Because the U.S. market is a key market in the industry, foreign firms are keenly interested in their performance in the U.S. market. We include the nationality variable in the statistical analyses to control for systematic differences based on nationality of ownership. U.S. ownership is not associated with market share, but is associated with shorter survival. This is consistent with the argument that the medical imaging industry is becoming global, with less home country advantage, so that weaker American firms are being forced to exit.

Let us now compare the imaging-related business unit strategy results in columns 4 and 5 to the medical sector strategy analyses in columns 1 and 3. The negative effects of decreased and increased international presence on survival are again found at the business unit level, as is the negative association between DINT and market share (we omitted the lag strategy variables from the business unit analyses owing to sample size). The only notable difference from the corporate medical sector analyses is that lag change in market share (no decrease) is associated with shorter survival.[10] In general, there is marked consistency in the effects of the DINT, IINT, and IMPORT strategies in both the medical sector and business unit cases.

Our results suggest that changing a firm's internationalization strategy is risky. Both increased and decreased internationalization have a significant negative association with a firm's survival in the U.S.A. Increased internationalization has some association with increase in U.S. national market share, especially in the case of business-specific expansion. On the other hand, decreased internationalization, which may be the result of failed past expansion, is often associated with decreased current U.S. market share. Although our results are tentative, they contain an important lesson. While being international may be associated with superior performance, as it is in the diagnostic imaging equipment industry, becoming international is a difficult and risky process.

[10] A possible explanation for the lag market share relationship with shorter business unit survival is that lag market share change is positively correlated with past increases in international presence, which in turn is negatively related to survival. The negative current impact on survival, therefore, may stem from difficulties brought on by past expansion.

HOW SOME FIRMS GOT THERE: CASE EXAMPLES

What, then, does it take to succeed in international expansion? To flesh out the statistical study and raise questions for further research, we turn to four brief case studies of firms in our sample that undertook increased internationalization.

Winner

The first firm realized increased U.S. market share in the period during which the increased internationalization took place and also in the next period. The firm is a diversified electronic equipment manufacturer, with medical sector sales accounting for about 10% of corporate sales. Most of its medical sales were of imaging-related products. Before 1983, the firm exported medical equipment and had overseas manufacturing operations in Japan and Europe. In 1986, the firm achieved medical sector multinational status after expanding its direct sales and service network outside the U.S.A. The company increased its imaging equipment industry American market share between 1983 and 1986, in part because it incorporated Japanese technical advances into a new imaging device. The winner's market share increased again between 1986 and 1989 as the technical capabilities of its products continued to grow.

Chastened

The second firm initially lost U.S. market share while increasing its international presence, but regained U.S. share in the following period. The firm manufactures laboratory instrumentation; about 10% of its sales occurred in the medical sector, with almost all medical sales being imaging-related. In 1978, it was classified as a medical device exporter. By 1983, it had expanded its international position by undertaking overseas manufacturing, but its share in the U.S. imaging equipment market shrunk, as its product line lagged technically. The chastened company regained the lost share by 1986, partly because it incorporated advances from its non-U.S. plants into the U.S. product line.

Complacent

The third firm initially gained increased U.S. market share while increasing its internationali-

zation strategy, but then lost share in the next period. The firm is a diversified electronics equipment manufacturer for which medical equipment, almost all of which was imaging-related, represented about 1% of corporate sales. The firm was a medical equipment exporter in 1978 and then credited with multinational status in 1983, after increasing its medical sales to foreign markets. The firm increased its U.S. market share between 1978 and 1983 as it introduced new products in order to undertake its foreign expansion. However, the increases in both international status and U.S. share were only temporary. Most foreign sales took place through distributors rather than through company-owned offices and the company could not sustain its foreign position. By 1986, the company had lost the U.S. market share that it earlier had gained and had been down-graded from multinational. The firm had exited the imaging equipment industry altogether by 1989.

Loser

The fourth firm lost share while undertaking increased internationalization and then continued to lose U.S. market share in the following period. The firm is a manufacturer and distributor of a broad set of medical supplies. The corporation's imaging equipment business was an important player in some technical subfields of the imaging equipment industry, but a small part of the corporation's total activity. Before 1986, the company was classified as an exporter and overseas manufacturer in the medical sector. In 1986, after expanding its non-U.S. sales and service network, the company was credited with multinational status. At the same time, however, it lost share in the U.S. imaging device market. In part, the decline occurred because of technical problems in its product line. In addition, competitors with more broadly-based imaging equipment sales and service systems overtook the firm's more limited imaging equipment operations.

There are several common threads in the preceding four cases. Each of the firms started with some international presence and then expanded. In addition, the firms operated non-imaging medical sector businesses. Therefore, each firm had a base from which to support international expansion of its imaging-related businesses.

At the same time, three distinctions between the more successful and less successful participants stand out. First, the U.S. imaging equipment business of the winner firm was profitable and strong technically when it increased its international presence. At least one of the less successful firms, meanwhile, was undergoing financial and technical difficulties in the U.S. The winner's strength in the key American market likely provided the base for successful expansion.

Second, the medical businesses of the winner and the chastened firms were nontrivial proportions of total sales and primarily consisted of imaging-related lines. In contrast, the medical businesses of the complacent and loser firms were either tiny proportions of total sales or included many nonimaging products. One implication of this contrast is that the more successful firms had both the incentive to attend to their imaging equipment business and the focus to do so successfully while undertaking the difficult process of international expansion. The less successful firms had either less incentive to attend to the imaging equipment business because it was such a small part of corporate operations, or too many diverse products to focus successfully on the imaging equipment market.

The third difference lies in the apparent use of overseas operations. The more successful firms (winner and chastened) improved the products sold in the United States by incorporating some of what they learned from their manufacturing and sales operations in other national markets, consistent with Bartlett and Ghoshal's (1989) advice to learn from your international operations. The less successful firms appear to have used the new foreign operations primarily as sales outlets, rather than as important opportunities to gain technical advantage.

Three propositions emerge from the cases. To gain from increased international presence in technically sophisticated industries a firm must have a strong base in a key market. It must expand in product areas in which it is a serious competitor. And it must use the foreign operation to learn about technical advances, as well as to gain foreign sales. Firms that are not ready, try to operate outside their core capabilities, or miss opportunities to strengthen their capabilities are likely to suffer more than they gain from international expansion. These issues will provide fruitful ground for further research.

CONCLUSION

As part of a large isolated country, most U.S. businesses traditionally have ignored international markets or viewed them simply as opportunities to extend domestic activities. These views are now changing, and the recent international strategy literature argues that firms can often achieve greater national market performance by creating effective international operations. The dominant theoretical view of foreign direct investment, internalization, also holds that multinational firms possess competitive advantages. While this prediction receives much empirical support, little research has been done to investigate the dynamic process of creating international operations.

Our study suggests that attempting to achieve the international payoff in a global industry is risky. Firms encountering difficulties during the attempt to expand internationally may not survive. Even if international difficulties do not force a firm to exit from a key market, many businesses will suffer market share losses if they must retrench.

The possibility that even potentially desirable international expansion may lead to eventual failure is instructive. Our results, though tentative, suggest that the internationalization process is complex and that many firms will fail. The selection of the winners is likely due to a combination of luck, the firms' characteristics, and the capabilities of their managers. Our case examples suggest that those able to overcome the odds will have a strong enough base that they are ready to expand, have a clear focus in the industry in which they are expanding, and learn from their experience as they move along the international expansion process.

Much room remains for further research concerning how a firm's performance is affected when it changes its international presence. We employed coarse measures of internationalization strategy, and research examining more incremental changes in the degree of international presence would undoubtedly produce important results. Similarly, analyzing the effects of taking different expansion paths, and addressing the question of whether there are stages of expansion that can successfully be omitted, would also be invaluable. Nonetheless, the findings in this paper shed light on an important issue.

As Bartlett and Ghoshal (1989) argue, successful international companies must operate transnationally, not just in many countries. More than export, set up international sales subsidiaries, and establish foreign manufacturing plants, companies must become 'truly international [in] scope and influence', in the words of the industry guide that we used to complete this study (Hale and Hale, 1989: III-1). Examination of these themes will provide a fruitful focus for further research.

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