DOWNSIDE RISK IMPLICATIONS OF INTERNATIONAL INVESTMENTS IN SUBSIDIARY NETWORKS AND JOINT VENTURES

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This paper examines international investments thought to enhance corporate flexibility and thereby reduce risk. Recent theory on the multinational firm emphasizes the flexibility and risk benefits attainable from a foreign subsidiary network that enables global shifts in value chain activities. International joint ventures (IJVs) have also been viewed as an attractive means of reducing risk by providing firms flexibility and growth options with a limited capital outlay. This paper empirically tests these ideas using a downside conception of risk. The empirical evidence indicates that firms with broad subsidiary networks and firms active in forming IJVs experience higher, rather than lower, levels of downside risk compared to other organizations. These findings suggest firms' capabilities in avoiding downside outcomes and seizing upside opportunities through multinational involvement and IJVs may actually be rather limited.

A central issue in organizational research is the degree to which firms can benefit from adapting to uncertain and changing environments. Various bodies of research approach this issue from different perspectives. For instance, population ecology work focuses on large firms' complex internal procedures and the constraints imposed by external stakeholders (e.g., Hannan & Freeman, 1984), asserting organizations are highly inertial. Economic perspectives on competitive strategy underscore the importance of commitment and path dependency in developing sustainable advantages over rivals (e.g., Dierickx & Cool, 1989; Ghemawat, 1991). Behavioral theory highlights individual and organizational mechanisms used to avoid or buffer against uncertainties influencing the firm's risk (Cyert & March, 1963).

At the same time, organizational research also emphasizes that firms can benefit from self-directed adaptation in uncertain and changing environments. Strategy work, for example, has long focused on the role of general managers in selecting and subsequently altering firms' strategies (e.g., Hofer & Schendel, 1978). More recently, proponents of real options theory have suggested that firms can create value by proactively embracing uncertainties through incremental, staged investments in technologies and markets (e.g., Bowman & Hurry, 1993; Hurry, Miller, & Bowman, 1992; Kogut, 1991; McGrath, 1997; Sanchez, 1993). Research on the multinational corporation (MNC), for instance, portrays the internationally diversified firm as a collection of options (e.g., Kogut, 1983, 1989).

Within this broader theoretical context, this paper empirically examines the downside risk implications of specific forms of international investment thought to enhance corporate flexibility, namely foreign subsidiary networks and international joint ventures (IJVs). While these international investments may offer firms the potential to seize opportunities and avoid losses through flexibility, they may also

expose firms to other risks due to coordination difficulties, organizational complexity, joint control, and so forth. As such, the actual organizational risk implications of these investments are ultimately an empirical matter.

The downside conception of risk used in this study contrasts traditional notions of risk found in prior research in management and international strategy. Miller and Reuer (1996) reviewed decision theory, finance, and management perspectives on risk and concluded these different perspectives provide a strong theoretical basis for moving from conventional variance-based notions of risk to downside conceptions. Actual empirical applications of downside risk remain fairly limited, however.

The essence of downside risk is its focus on the firm's potential performance below some target value or aspiration level. For instance, downside risk can be thought of in terms of the probability of failing to meet a performance objective or expected loss. Downside notions of risk such as these can be found throughout the strategy literature (e.g., Aaker & Jacobsen, 1990; Ansoff, 1965; Collins & Ruefli, 1992; Porter, 1985: 476). Many other downside risk formulations exist depending upon the selected target level (e.g., based on competitors' performance, historical performance, break-even, etc.) and the specific weighting of performance shortfalls.[1] However, the most important point is that downside risk incorporates the distribution of a firm's outcomes that are below a target value. This distinguishes downside risk from conventional notions of risk incorporating the entire distribution of a firm's outcomes, whether above or below some target level. For example, risk has commonly been viewed as income stream instability, which is often measured by the variance or standard deviation of the firm's ROA or ROE.

For the purposes of this study, a downside conception of risk is attractive because it is conceptually compatible with the claims of real options theory. As

McGrath states, "[t]he distinguishing characteristic of an options approach lies in firms making investments that confer the ability to select an outcome only if it is favorable" (1997: 975). For instance, in the international setting, real options theory suggests firms investing in a subsidiary network can avoid downside outcomes and exploit upside opportunities by shifting sourcing, production, marketing, and other value-chain activities across countries in a selective fashion in response to changes in local demand, competitors' actions, currency movements, input prices, and other contingencies (e.g., Allen & Pantzalis, 1996; Kogut, 1983, 1989). This paper seeks to empirically test whether firms with internationally-dispersed subsidiary networks in fact obtain lower levels of downside risk.

Management and international strategy researchers have also for some time viewed firms' investments in IJVs as flexible, and thus attractive from a risk standpoint, owing to firms' lower initial capital investments, focus on core capabilities, access to partners' skills, and faster market entry, among other factors (e.g., Contractor & Lorange, 1988). More recently, scholars espousing a real options perspective have argued that certain international investments like IJVs limit subsequent downside risk due to their option-like characteristics. The crucial assumption underlying the real option argument is that a firm may simultaneously maintain a claim on future economic rents while deferring irreversible investment (McDonald & Siegel, 1986). Real options create value in uncertain environments by providing a device through which firms can actively manage the asymmetry between potential upside gains and downside losses. For instance, Kogut (1991) used real options theory to suggest that joint ventures limit the parent firm's downside risk to an inconsequential level while allowing claims on upside possibilities. Should the venture's market or activity prove to be unexpectedly lucrative, the firm exercises the

option created by its initial investment and increases its commitment to the business to capture growth opportunities. If the firm chooses not to exercise its option, it cuts its losses by avoiding subsequent investment in the venture. For instance, the firm may either completely dissolve the venture or maintain its position if there is a possibility of favorable changes in the future. In either case, losses are limited to the initial outlay while the possibility of large gains is maintained. Although the attractiveness of IJVs has long been attributed to their presumed flexibility and risk benefits, we know of no study that empirically examines the organizational risk implications of IJV involvement.

The paper proceeds as follows: the second section provides background theoretical material and develops competing hypotheses relating firms' international investments in subsidiary networks and IJVs to organizational downside risk. The third section focuses on methodological issues, and the empirical results are contained in a subsequent section. Evidence from U.S. manufacturing firms reveals corporations with internationally-dispersed subsidiary networks obtain higher, rather than lower, downside risk levels. Firms that are active in forming IJVs also experience higher levels of subsequent downside risk. The paper concludes with a discussion of these findings and their implications for theory and international strategy research.

THEORY AND HYPOTHESES

The risk of international expansion and the risk profiles of internationally diversified firms are two important themes running through the empirical literature on MNCs. These issues are closely linked with the theory of foreign direct investment (FDI), which starts with the fundamental assumption that foreign firms' lack of familiarity with local markets places them at a disadvantage vis-à-vis local firms. This

disadvantage requires the MNC to possess certain compensating advantages in order for the MNC to be a viable competitor in the local market (e.g., Hymer, 1976; Buckley & Casson, 1976; Caves, 1971; Dunning, 1988).

It follows that building a foreign presence is a risky undertaking. The risk of foreign direct investment is evidenced by the high turnover of foreign subsidiaries (e.g., Torneden, 1975; Wilson, 1979). The risk of international expansion appears particularly great for first-time, unrelated, and partially-owned entries (Li, 1995). Cultural differences magnify dissolution risks, though previous experience in a host country can mitigate such risks to some degree (Barkema, Bell, & Pennings, 1996). Firms can also reduce their risk of failure by delaying entry into a host market in order to learn from earlier entrants, provided that growing levels of competition do not dissipate opportunities for rent creation (Mitchell, Shaver, & Yeung, 1994). Knowledge spillovers from previous entrants are especially beneficial when the international expansion simultaneously involves entry into a new target industry (Shaver, Mitchell, & Yeung, 1997).

Research on the MNC also examines the risk profiles of firms having undergone the process of diversifying internationally. For instance, Mitchell, Shaver, and Yeung (1992) find that multinational firms have a lower risk of business failure, yet this risk increases if the firm either increases or decreases its multinational presence. Numerous studies report that multinational involvement tends to stabilize firms' profitability levels (e.g., see Qian, 1996 for a recent review). For example, Kim, Hwang, and Burgers (1993) report that international diversification is associated with the twin benefits of lower risks and higher returns.

Real options theory suggests that firms with international operations will have lower downside risk in particular. The theory contends that the real options conferred

by dispersed FDI allow the firm to maintain flexibility to avoid downside outcomes and exploit upside opportunities generated by unexpected changes in environmental conditions (Kogut, 1983, 1989). More specifically, the MNC can selectively shift value-chain activities when environmental cues signal profit-making opportunities from unexpected changes in labor costs, competitors' actions, foreign exchange rates, or industry demand, all of which may vary across country boundaries in which the firm has operations (e.g., Kogut & Kulatilaka, 1994a). Hence, dispersed operations may provide the firm with the potential to select favorable outcomes over others (McGrath, 1997). The following hypothesis results:

H1a: The breadth of the firm's network of foreign subsidiaries will be inversely related to downside risk.

While domestic firms or firms with limited international operation may lack such real options, they may also avoid the costs and risks involved in developing and maintaining a multinational presence. The contention that multinational firms can obtain lower downside risk implies the flexibility benefits noted above outweigh the risks and costs associated with maintaining option positions, coordinating global changes in the value-chain, monitoring and responding to developments in the firm's environment, dealing with any principal-agent hazards as the subsidiary network grows in size, and so forth.

In fact, prior research has observed that foreign subsidiary networks are complex to manage and coordinate (Roth, 1992; Roth, Schweiger, & Morrison, 1991). Moreover, the costs of holding real options may be substantial if the MNC must commit additional capital over time or incur on-going costs, for instance if the firm needs to carry excess capacity to facilitate shifts in value-chain activities across borders. Such problems would challenge the firm's ability to limit downside outcomes.

International diversification may also result in higher transaction costs by placing heavy information processing demands on managers (Hitt, Hoskisson, & Ireland, 1994; Jones & Hill, 1988). If managers' monitoring capabilities are limited or organizational inertia is present, it is not likely the firm will be able to selectively exploit emerging global opportunities while avoiding downside outcomes. If significant, these problems may nullify the theorized downside risk benefits of dispersed FDI presented earlier. Hence, the following competing hypothesis is also offered:

H1b: The breadth of the firm's network of foreign subsidiaries will not be inversely related to downside risk.

The international strategy literature has also viewed the attractiveness of engaging in IJVs from a risk perspective. For instance, firms may establish IJVs to spread various risks over multiple capital providers. Firms might also use IJVs to overcome the liability of foreignness (e.g., Zaheer & Mosakowski, 1997) by linking up with a local partner with deep local connections, market knowledge, and other supporting resources. The local partner, for example, can buffer the MNC from the host government, a function that reduces possible hold-up risks after sunk investments are made (Teece, 1986). The firm might also use the IJV as a springboard for further commitments and growth once the firm accumulates localized knowledge (e.g., Inkpen & Beamish, 1997). Contractor and Lorange (1988) review other reasons why IJVs might offer organizational risk benefits.

Real options theory suggests firms can use IJVs to reduce downside risk in particular. Specifically, the venture is thought to possess the same characteristics as a financial call option (Kogut, 1991). Firms can make a small initial commitment, or platform investment, to an uncertain market or technology through an IJV. If the market or technology proves to be unexpectedly favorable, the firm can expand

through acquisition by exercising the call option. The firm is under no compulsion to expand, however, if market or technological prospects turn out to be less lucrative. Rather than divesting the assets, the firm can adopt a wait-and-see approach if more favorable outcomes are possible in the future. Real options theory therefore suggests that downside outcomes are inconsequential and the same non-linear payoff function applicable to financial call options carries over to the firm's investments in IJVs (Kogut, 1991). The following hypothesis results:

H2a: Controlling for the firm's multinational presence, the firm's involvement in IJVs will be inversely related to downside risk.

While IJVs potentially mitigate organizational risks of different forms, complications might affect the firm's ability to actually obtain lower downside risk through IJVs. In particular, the hypothesis presented above hinges on at least two assumptions. First, firms do not experience significant recurring costs or large requirements for additional capital infusions while managing the IJV over time. If this assumption does not hold, downside possibilities may be nontrivial. The second assumption is that the firm is able to secure a claim to emerging upside opportunities via the initial IJV investment. This assumption holds if the firm truly has a call option on the venture. However, if this is not the case, it is plausible that the selling firm will share in the venture's emerging prospects by negotiating a higher price for its equity stake in the event of a buyout. Bargaining power issues and many other factors may affect *ex post* negotiations, but the point remains that the initial IJV investment may be an imperfect claim on upside possibilities in the absence of an explicit call option. Hence, if either of these assumptions does not hold, the ability of firms to use IJVs to avoid downside outcomes and seize emerging opportunities may be limited.

The low survival rate of IJVs also raises the question of whether many IJVs are simply high-risk projects or, as predicted by real options theory, are truly being managed for their downside risk benefits. Empirical research shows IJVs are unstable organizational forms that are very difficult to manage (e.g., Barkema, Bell, & Pennings, 1996; Blodgett, 1992; Li, 1995; Park & Ungson, 1997; Pennings, Barkema, & Douma, 1994). Empirical studies also find parent firms' satisfaction levels with IJVs are low – sometimes reported well below fifty percent – and may be declining (e.g., Beamish, 1985; Beamish & Delios, 1997; Kogut, 1988). Earlier work by Franko (1971) and Killing (1983) shows that specific organizational structures and IJV control mechanisms can limit a parent firm's ability to manage collaborations. In the U.S. hospital software systems industry, Singh and Mitchell (1997) find that a parent firm's fate can become linked with a partner's decisions: the firm's dissolution risk increases when partners form new relationships or shut down. In light of the assumptions presented above and the empirical evidence on collaborative ventures, the following competing hypothesis is also offered:

H2b: Controlling for the firm's multinational presence, the firm's involvement in IJVs will not be inversely related to downside risk.

METHODOLOGY

Model Specification

The basic structure of the statistical model is as follows:

(1) $\text{Risk}_t = \beta_0 + \beta_1\text{network breadth}_{t-1} + \beta_2\text{IJV involvement}_{t-1} + \beta_3\text{firm size}_{t-1} + \beta_4\text{industry risk}_t + \varepsilon_t.$

Subscripts indicate time lags used to rule out problems from potential reverse causality in cross-sectional risk models (e.g., Bromiley, 1991). Following Miller and Leiblein

(1996), this study used two contiguous five-year periods to calculate downside risk and its determinants, as discussed below.

Control variables

Previous research would indicate that other firm-specific and industry variables affect organizational risk. While our interest is in developing a parsimonious model to assess the impact of network breadth and IJV formation on firm risk, it is important to include appropriate organizational and industry controls.

Towards this end, we included measures of firm size and contemporaneous industry risk as controls for other firm- and industry-specific factors that have an impact on risk but which are not explicitly considered in our model. The firm size measure controls for firm-specific factors affecting risk such as financial, human, and other resources. Larger firms, for instance, may have the ability to hedge overall risk by investing in multiple projects (Scherer & Ross, 1990).

The contemporaneous industry risk variable accounts for inter-industry risk differences and other unobservable effects at the industry level. For example, high average downside risk for other firms in an industry indicates the presence of firms with large performance deviations below aspirations and suggests deteriorating industry-wide conditions (Miller & Leiblein, 1996). The average downside risk for other firms in an industry is thus expected to be positively related to the downside risk for a particular firm.

Measures and Data

Risk. Organizational downside risk was operationalized as a function of the firm's performance relative to a target level each year. Firm performance was measured using annual ROA data over the five-year period 1990-1994. Average ROA values for the firm's two-digit SIC industry in the preceding year were used to proxy

each firm's target level, which changed from year to year. Following Miller and Leiblein (1996), each firm's downside risk was then measured as a second-order root lower partial moment (RLPM) using firm and industry ROA data:

$$(2)\ \text{Risk}_t = \sqrt{\frac{1}{5}\sum_{\text{ROA}_j < \text{IROA}_j}(\text{IROA}_j - \text{ROA}_j)^2},$$

where ROA_j is firm j's return on assets and $IROA_j$ is the average ROA for firm j's two-digit SIC industry in the preceding year. The squared difference term is summed over all years in the five-year period for which firm j's performance (i.e., ROA_j) falls short of its target level (i.e., $IROA_j$). In other years in the five-year period, the performance shortfall is equal to zero. Accounting data used to measure downside risk were collected from the Compustat data files.

Explanatory variables. The breadth of the firm's international network was measured as the number of countries in which the firm has foreign subsidiaries. Firms that are subsidiaries of foreign corporations were not included in the sample, nor were firms that are subsidiaries of other U.S. corporations. Foreign subsidiary data were obtained from the 1990 edition of National Register Publishing's Directory of International Affiliations. The number of countries in which the firm has foreign subsidiaries was coded as missing if a firm did not appear in this source, unless the firm appeared in the companion Directory of Affiliations so it could be established that the firm's subsidiaries were located only in the U.S.

The firm's involvement in IJVs was calculated as the number of equity joint ventures formed abroad or with a foreign partner during the 1985-1989 time horizon. Announcement searches were carried out using the Lexis-Nexis database, which draws upon more than 2,300 business, trade, and press release sources. Despite the comprehensiveness of this database, the use of public announcements and the lack of

reporting requirements may bias alliance count measures in favor of more significant cross-border ventures. Recognizing this issue and seeking to avoid other potential problems that may arise from pooling different types of alliances, our focus was strictly on equity joint ventures, which involve the establishment of a distinct business entity owned by two or more firms.

Firm size was operationalized as the firm's net sales averaged over the 1985-1989 period. Finally, industry risk was proxied as the average downside risk for all other firms in the firm's two-digit SIC industry for the contemporaneous (1990-1994) period. At least seven firms reported data in each two-digit SIC industry-year used in the calculation of these averages. Both of these control variables were constructed using accounting data from the Compustat data files.

Sample

The sample consisted of all manufacturing firms in the SIC range 3000-3999 that were listed in the 1990 edition of National Register Publishing's Directory of International Affiliations and for which the necessary accounting data were available for the years 1984 through 1994 in the Compustat data files. Accounting returns data for 1984 were used to calculate firms' 1985 target returns under the assumption that firms adapt their target levels to the industry average performance level in the previous year. The final sample consisted of 353 U.S. manufacturing firms.

RESULTS

All analyses were performed using the SAS v6.12 software package. Descriptive statistics indicated that the average sampled firm had subsidiaries in just under six countries in 1990 and had average sales of $3.353 billion during the 1985 to 1989 time period. Average sales during this period ranged from roughly $12 million

for the smallest firm to over $121 billion for the largest firm. Approximately 28 percent of the firms had purely domestic operations (i.e., network breadth = 0), while the most internationally diversified firm operated in 44 countries. A large percentage of the sampled firms, 63 percent, did not enter into a single international joint venture during the 1985 to 1989 time frame. Firms' IJV formation levels were quite varied, however. The maximum number of joint ventures formed by a single firm during this period was thirty.

Data Screening

Visual inspection of the variables' distributions as well as an analysis of the skewness statistic indicated that three variables – network breadth, IJV formation, and firm size – exhibited significant positive skew. Regression analysis involving variables with extremely skewed distributions are particularly susceptible to generalizability concerns as well as Type I and Type II errors (Tabachnick & Fidell, 1996: 65-66). The use of a logarithmic transformation has been shown to remedy the problems associated with skewness to the extent that the transformed variable's distribution more closely approximates normality (Tabachnick & Fidell, 1996: 81-84). Hence, we redefined our measure of network breadth to be equal to the log of one plus the number of countries in which the firm had foreign subsidiaries. The IJV formation variable was transformed using the same procedure. Finally, a logarithmic transformation was also used on the firm's average net sales during the 1985-1989 time period.[2]

Correlation Analysis

Table 1 presents descriptive statistics and zero-order correlations for the explanatory variables as well as downside risk. The correlation matrix indicates that a negative bivariate relationship exists between downside risk and firm size ($p<0.05$).

The matrix also shows that organizational downside risk is not significantly correlated with the breadth of the foreign subsidiary network, IJV formation activity, or industry downside risk at the 0.10 level. However, larger firms have broader subsidiary networks ($p<0.001$) and engage in more IJVs ($p<0.001$). Further, firms with dispersed international operations also display a tendency toward forming more IJVs ($p<0.001$).

Insert Table 1 about here

The strong positive correlations among firm size, network breadth, and IJV formation activity suggest that multivariate analyses using these variables may be susceptible to multicollinearity. Extreme multicollinearity results in inflated standard errors and conservative biases in the interpretation of statistical significance (Berry, 1993; Johnston, 1987). Tabachnik and Fiddel (1996: 85-87) indicate that multicollinearity is likely to create a logical problem of interpreting the partial effects of individual variables when bivariate correlations exceed 0.70 and a statistical estimation problem when bivariate correlations exceed 0.90. Although the correlations presented in Table 1 are below both of these thresholds, they are high enough to warrant further investigation. As such, we calculated variance inflation factors (VIFs) for each of the independent variables to determine the proportion of any one explanatory variable's variance that is captured by the other independent variables in equation (1). The maximum VIF of 2.38 was substantially below the rule-of-thumb cutoff value of ten for multiple regression models (Neter, Wasserman, & Kutner, 1985: 392). This result provides additional evidence that multicollinearity problems are not present.

Statistical Technique

A significant proportion of firms, 19.5 percent, obtained a zero value for downside risk. Downside risk is a limited dependent variable because firms cannot, by

definition, obtain negative downside risk. Since conventional OLS regression methods fail to account for the qualitative difference between limit and continuous observations, the use of OLS regression with data that includes limit observations may lead to inconsistent parameter estimates (Greene, 1993: 691). These inconsistencies can be large, particularly as the proportion of limit observations increases (Davidson, Russell, & MacKinnon, 1993: 538). The preferred methodology for analyzing data when the values for a range of the dependent variable are all transformed to a single value is the censored Tobit regression model, which can be expressed as follows:

(3) $Y^* = \mathbf{X}(\beta) + \varepsilon$, where $Y = Y^*$ if $Y^* > 0$; $Y = 0$ otherwise.

In this model, Y^* is a latent variable that is observed only when the value of the dependent variable is positive. As in conventional OLS regression techniques, **X** represents a vector of independent variables and β is a vector containing the coefficients for the independent variables. The error term, ε, is assumed to be normally distributed.

Tobit Model Results

Table 2 presents the results for five different model specifications. Log-likelihood statistics (i.e., $L(\beta)$) are provided at the bottom of the table to permit overall fit comparisons between the models. Model I presents a Tobit analysis of only the two control variables, firm size and industry risk. This model provides a baseline against which other models can be tested. Model II adds the direct effects of the theoretical variables, network breadth and IJV formation. It is possible, however, that the relationships expressed in the two hypotheses might be moderated by firm size. For example, the organizational risk implications of forming an additional JV or having an additional country of operation might be more substantial for smaller firms given the

larger relative size of the investment. Model III thus includes two multiplicative terms – network breath * firm size and IJV formation * firm size – to check for this possibility. Models IV and V provide weaker tests for the significance of the two interactions by examining their effects independently.

Insert Table 2 about here

A series of log-likelihood statistics are presented at the bottom of Table 2 to compare Models II-V with Model I, the baseline model including only the control variables (i.e., see the $-2[L(\beta_I) - L(\beta)]$ values). The log-likelihood statistic provides a test of the null hypothesis that the coefficients for variables added to the baseline model are jointly zero. The log-likelihood test statistic is χ^2 distributed with degrees of freedom equal to the number of variables added. For example, a comparison of the log-likelihood statistics between the control model (Model I) and the direct effects model (Model II) indicates that inclusion of the theoretical variables, network breadth and IJV formation, significantly improves the model's explanatory power ($p<0.02$). This finding provides evidence that the breadth of a firm's foreign subsidiary network and its IJV formation activity jointly affect organizational downside risk. Log-likelihood ratio tests revealed that Models III, IV, and V do not explain more variance in downside risk than Model II at the 0.10 significance level. This result indicates that the two theoretical variables do not have size-moderated effects on downside risk.[3]

The competing hypotheses suggested that the breadth of the firm's foreign subsidiary network may be inversely (i.e., H1a) or not inversely (i.e., H1b) related to organizational downside risk. The positive coefficient for network breadth in Model II ($p<0.10$) indicates that firms with more dispersed subsidiary networks are more apt to

obtain higher, rather than lower, levels of downside risk. As such, support is found for H1b rather than H1a.

Competing hypotheses were similarly posed for the relationship between a firm's involvement in establishing IJVs and downside risk. The firm's IJV formation activity may have a negative (i.e., H2a) or non-negative (i.e., H2b) impact on subsequent downside risk. The significant positive coefficient on the IJV formation variable indicates that firms active in forming IJVs experience higher subsequent downside risk ($p<0.05$). This finding lends empirical support for H2b rather than H2a.

Consistent with expectations, the firm-level control for firm size was negatively related to subsequent downside risk ($p<0.05$). Larger firms tend to experience lower levels of downside risk than smaller corporations. However, the control for contemporaneous industry downside risk was not significantly related to organizational downside risk at the 0.10 level.

DISCUSSION

A substantial body of theoretical and empirical research considers how flexible firms are or should be. Real options theory offers a relatively new perspective in this dialogue, suggesting that firms can avoid downside outcomes and exploit upside opportunities through real investments conferring options and thus flexibility. One such vehicle for flexibility is an internationally-dispersed subsidiary network that enables firms to shift value-chain activities in a selective fashion in response to changing environmental conditions, be they changes in input prices, exchange rates, competitors' moves, or others.

This study finds, however, that firms' abilities to actually obtain lower levels of downside risk through international networks may be rather limited. In fact, the

empirical evidence shows organizational downside risk is positively related to the breadth of the firm's subsidiary network. This result suggests the risks and costs of international investment and any value-chain reconfigurations that occur outweigh the flexibility benefits identified by real options theory. While it is certainly premature to discount either the positive or the normative contributions of the real options approach to international investment, the empirical evidence presented here suggests firms are not exploiting the potential flexibility of FDI to obtain lower downside risk. Future research might model specific contingencies affecting firms' abilities to obtain operational flexibility benefits, whether reduced downside risk, growth, or other organizational outcomes. These contingencies include internal factors such as structural and administrative mechanisms used by firms to coordinate actions across their subsidiary network as well as external factors giving rise to profit-making opportunities from shifting value-chain activities. For instance, future research might examine how characteristics of the team charged with integrating a firm's subsidiary network or the location of profit and loss responsibility in the network affects the relationship between network breadth and downside risk. Alternatively, future research could explicitly examine how changes in environmental conditions (e.g., in local factor markets, exchange rates, etc.) moderate the network breadth – downside risk relationship.

The finding that the breadth of the firm's foreign subsidiary network is positively related to organizational downside risk also has broader implications for how researchers conceptualize risk in theoretical and empirical research. In particular, this result is striking in light of previous studies reporting international involvement offers diversification benefits that stabilize firms' profit levels (e.g., Qian, 1996). As such, the organizational risk implications of international involvement are sensitive to the

conceptualization and measurement of risk. It is possible therefore that incorporation of downside risk in other areas of international strategy and organizational research will also produce new insights. As mentioned in the introduction, using a downside conception of risk is attractive in empirical studies applying real options theory because of the basic idea that options offer firms the potential to avoid unfavorable outcomes and select favorable outcomes (McGrath, 1997).

While researchers have also identified several characteristics of IJVs that make them attractive from a risk standpoint, we know of no empirical study that directly tests the organizational risk implications of IJV involvement. The evidence presented here reveals firms actively engaged in forming IJVs obtain higher, rather than lower, levels of subsequent downside risk. This finding suggests the challenges of managing IJVs outweigh the flexibility benefits that have been attributed to IJVs as resource-sharing, incremental investments offering quick market entry. As the theory section emphasized, it is also less likely firms will be able to avoid downside outcomes and exploit upside opportunities through IJVs if additional capital infusions are needed, recurring costs are significant, or the IJV represents an imperfect claim on emerging upside opportunities. While more research is needed in this area, our findings would suggest that the high instability of IJVs reflects their risky nature in general rather than parents using transitional IJVs to reduce downside risks.

The finding that IJV formation increases organizational downside risk raises the question whether the same result would hold for domestic joint ventures, which may not involve some of the managerial challenges (or opportunities) that arise from operating in a foreign country or with a foreign partner. To address this issue, we re-estimated the Tobit models by replacing the IJV formation variable with an analogous measure for domestic ventures (i.e., JVs that operated in the U.S. and that were

formed with U.S. partners). The results (not presented here) revealed that domestic JV formation activity also increases subsequent organizational downside risk ($p<0.01$). This analysis indicates that the risks attending collaborations are not confined to cross-border ventures.

The results and limitations of this paper point to several areas for future research. First, future work might characterize the firm's international investments using different measures or a taxonomy of investments. The present study is limited in its use of count measures for foreign operations and equity joint ventures. Research in this direction might also identify contingencies explaining which firms have capabilities to avoid downside outcomes and exploit upside opportunities, and reasons why this capability is less developed in other firms. Second, future research might examine operational flexibility and environmental cues directly (e.g., Hurry, Miller, & Bowman, 1993; Kogut & Chang, 1996), assess other real investments providing options to organizations (e.g., Bowman & Hurry, 1993; Kogut & Kulatilaka, 1994b; McGrath, 1997), and incorporate other organizational outcomes in research designs. Research might also examine firms' motives for specific international investments through primary data collection. For instance, the diversity of JVs and firms' formation motives challenges the application of real options theory (or any other theory) alone when examining a broad cross-section of ventures. Such research could enhance understanding of the boundaries of real options theory and can address the extent to which firms' real investments of various types should be viewed as literal or metaphorical options. Finally, downside notion of risk implemented in the present study might be adopted in future international strategy research.

ENDNOTES

[1] For instance, Miller and Leiblein (1996) provide a general formula for a set of downside risk measures using lower partial moments (LPMs) and accounting returns data:

$$\text{(E.1)} \quad LPM_{\alpha}(\tau; j) = \left(\frac{1}{N}\sum_{t=1}^{N}\delta_{jt}^{\alpha}\right)^{1/\alpha}, \quad \alpha \geq 0.$$

Defining τ_{jt} as the target return for firm j in period t and r_{jt} as firm j's actual return in period t, the performance shortfall given by δ_{jt} in equation (E.1) is equal to $\tau_{jt} - r_{jt}$ if $\tau_{jt} > r_{jt}$ and zero if $\tau_{jt} \leq r_{jt}$. The parameter α weights the importance of small versus large deviations from the target value, and N is the number of periods.

[2] Since the natural logarithm of zero is not defined and a number of firms did not have any foreign subsidiaries or did not enter into IJVs, we used the following equation to transform our skewed variables: new variable = natural logarithm (old variable + 1).

[3] Due to the correlations between the direct effects and their corresponding interaction terms, the maximum variance inflation factor increased to 35.20 when the multiplicative terms were added in Model III. Following Jaccard, Turrisi, and Wan (1990) and Cronbach (1987), we centered the variables about their means before forming the multiplicative terms in order to limit any distortions created by multicollinearity. The parameter estimates remained virtually unchanged after these corrections. The parameter estimates were also not sensitive to the exclusion or inclusion of possible outlying observations as determined by the DFFITS statistic.

REFERENCES

Aaker, D. A., & Jacobson, R. 1987. The role of risk in explaining differences in profitability. Academy of Management Journal, 30: 277-297.

Allen, L., & Pantzalis, C. 1996. Valuation of the operating flexibility of multinational corporations. Journal of International Business Studies, 27: 633-653.

Ansoff, H. I. 1965. Corporate strategy. New York, NY: Wiley.

Barkema, H. G., Bell, J. H. J., & Pennings, J. M. 1996. Foreign entry, cultural barriers, and learning. Strategic Management Journal, 17: 151-166.

Beamish, P. W. 1985. The characteristics of joint ventures in developed and developing countries. Columbia Journal of World Business, 20: 13-19.

Beamish, P. W., & Delios, A. 1997. Improving joint venture performance through congruent measures of success. In Beamish, P. W., & Killing, J. P. (Eds.). Cooperative strategies: European perspectives: 103-127. San Francisco, CA: New Lexington Press.

Berry, W. D. 1993. Understanding regression assumptions. Newbury Park, CA: Sage.

Blodgett, L. L. 1992. Factors in the instability of international joint ventures. Strategic Management Journal, 13: 475-491.

Bowman, E. H., & Hurry, D. 1993. Strategy through the options lens: An integrated view of resource investments and the incremental-choice process. Academy of Management Review, 18: 760-782.

Bromiley, P. 1991. Testing a causal model of corporate risk taking and performance. Academy of Management Journal, 34: 37-59.

Buckley, P. J., & Casson, M. 1976. The future of the multinational enterprise. Basingstoke and London, UK: Macmillan.

Caves, R. E. 1971. International corporations: The industrial economics of foreign investment. Economica, 38: 1-27.

Collins, J. M., & Ruefli, T. W. 1992. Strategic risk: An ordinal approach. Management Science, 38: 1707-1731.

Contractor, F. J., & Lorange, P. 1988. Why should firms cooperate? The strategy and economics basis for cooperative ventures. In Contractor, F. J., & Lorange, P. (Eds.). Cooperative strategies in international business: 3-30. New York, NY: Lexington Books.

Cronbach, L. 1987. Statistical tests for moderator variables: Flaws in analysis recently proposed. Psychological Bulletin, 102: 414-417.

Cyert, R. M., & March, J. G. 1963. A behavioral theory of the firm. Englewood Cliffs, NJ: Prentice-Hall.

Davidson, R., & MacKinnon, J. G. 1993. Estimation and inference in econometrics. New York, NY: Oxford University Press.

Dierickx, I., & Cool, K. 1989. Asset stock accumulation and sustainability of competitive advantage. Management Science, 35: 1504-1514.

Directory of Affiliations. 1990 Edition. New Providence, NJ: National Register Publishing.

Directory of International Affiliations. 1990 Edition. New Providence, NJ: National Register Publishing.

Dunning, J. 1988. The eclectic paradigm of international production: A restatement and some possible extensions. Journal of International Business Studies, 19: 1-31.

Franko, L. G. 1971. Joint venture survival in multinational corporations. New York, NY: Praeger Publishers.

Ghemawat, P. 1991. Commitment: The dynamic of strategy. New York, NY: Free Press.

Greene, W. H. 1993. Econometric analysis (Second Edition). New York, NY: MacMillan.

Hannan, M. T., & Freeman, J. 1984. Structural inertia and organizational change. American Sociological Review, 49: 149-164.

Hitt, M. A., Hoskisson, R. E., & Ireland, D. R. 1994. A mid-range theory of the interactive effects of international and product diversification on innovation and performance. Journal of Management, 20: 297-326.

Hofer, C., & Schendel, D. 1978. Strategy formulation: Analytical concepts. St. Paul, MN: West Publishing.

Hurry, D., Miller, A. T. , & Bowman, E. H. 1992. Calls on high-technology: Japanese exploration of venture capital investments in the United States. Strategic Management Journal, 13: 85-101.

Hymer, S. 1976. The international operations of national firms: A study of direct foreign investment. Cambridge, MA: MIT Press.

Inkpen, A. C., & Beamish, P. W. 1997. Knowledge, bargaining power, and the instability of international joint ventures. Academy of Management Review, 22: 177-202.

Jaccard, J., Turrisi, R., & Wan, C. K. 1990. Interaction effects in multiple regression. Newbury Park, CA: Sage Publications.

Johnston, J. 1987. Econometric methods (Third Edition). New York, NY: McGraw-Hill.

Jones, G. R., & Hill, C. W. L. 1988. Transaction cost analysis of strategy-structure choice. Strategic Management Journal, 9: 159-172.

Killing, J. 1983. Strategies for joint venture success. New York, NY: Praeger Publishers.

Kim, W. C., Hwang, P., & Burgers, W. P. 1993. Multinationals' diversification and the risk-return tradeoff. Strategic Management Journal, 14: 275-286.

Kogut, B. 1983. Foreign direct investment as a sequential process. In Kindleberger, C. P., & Audretsch, D. B. (Eds.). The multinational corporation in the 1980s: 62-75. Boston, MA: MIT Press.

Kogut, B. 1988. Joint ventures: Theoretical and empirical perspectives. Strategic Management Journal, 9: 319-332.

Kogut, B. 1989. A note on global strategies. Strategic Management Journal, 10: 383-389.

Kogut, B. 1991. Joint ventures and the option to expand and acquire. Management Science, 37: 19-33.

Kogut, B., & Chang, S. J. 1996. Platform investments and volatile exchange rates: Direct investment in the U.S. by Japanese electronic companies. Review of Economics and Statistics, 78: 221-231.

Kogut, B., & Kulatilaka, N. 1994a. Operating flexibility, global manufacturing, and the option value of a multinational network. Management Science, 40: 123-139.

Kogut, B., & Kulatilaka, N. 1994b. Options thinking and platform investments: Investing in opportunity. California Management Review, 36: 52-71.

Li, J. 1995. Foreign entry and survival: Effects of strategic choices on performance in international markets. Strategic Management Journal, 16: 333-351.

McDonald, R., & Siegel, D. 1986. The value of waiting to invest. Quarterly Journal of Economics, 101: 707-28.

McGrath, R. G. 1997. A real options logic for initiating technology positioning investments. Academy of Management Review, 22: 974-996.

Miller, K. D., & Leiblein, M. J. 1996. Corporate risk-returns relations: Returns variability versus downside risk. Academy of Management Journal, 39: 91-122.

Miller, K. D., & Reuer, J. J. 1996. Measuring organizational downside risk. Strategic Management Journal, 17: 671-691.

Mitchell, W., Shaver, J. M., & Yeung, B. 1992. Getting there in a global industry: Impacts on performance of changing international presence. Strategic Management Journal, 13: 419-143.

Mitchell, W., Shaver, J. M., & Yeung, B. 1994. Foreign entrant survival and foreign market share: Canadian companies' experience in United States medical sector markets. Strategic Management Journal, 15: 555-567.

Neter, J., Wasserman, W., & Kutner, M. H. 1985. Applied linear statistical models (Second Edition). Homewood, IL: Irwin.

Park, S. H., & Ungson, G. R. 1997. The effect of national culture, organizational complementarity, and economic motivation on joint venture dissolution. Academy of Management Journal, 40: 279-307.

Pennings, J. M., Barkema, H., & Douma, S. 1994. Organizational learning and diversification. Academy of Management Journal, 37: 608-640.

Porter, M. E. 1985. Competitive advantage: Creating and sustaining superior performance. New York, NY: Free Press.

Qian, G. 1996. The effect of multinationality measures upon the risk-return performance of US firms. International Business Review, 5: 247-265.

Roth, K. 1992. International configuration and coordination archetypes for medium-sized firms in global industries. Journal of International Business Studies, 23: 533-549.

Roth, K., Schweiger, D., & Morrison, A. 1991. Global strategy implementation at the business-unit level: Operational capabilities and administrative mechanisms. Journal of International Business Studies, 22: 361-394.

Sanchez, R. 1993. Strategic flexibility, firm organization, and managerial work in dynamic markets: A strategic-options perspective. In Shrivastava, P., Huff, A., & Dutton, J. (Eds.). Advances in Strategic Management, 9: 251-291. Greenwich, CT: JAI Press.

Scherer, F. M., & Ross, D. 1990. Industrial market structure and economic performance (Third Edition). Boston, MA: Houghton Mifflin.

Shaver, J. M., Mitchell, W., & Yeung, B. 1997. The effect of own-firm and other-firm experience on foreign direct investment survival in the United States, 1987-1992. Strategic Management Journal, 18: 811-824.

Singh, K., & Mitchell, W. 1996. Precarious collaboration: Business survival after partners shut down or form new partnerships. Strategic Management Journal, 17 (Summer Special Issue): 99-115.

Tabachnick, B. G., & Fidell, L. S. 1996. Using multivariate statistics (Third Edition). New York, NY: Harper Collins.

Teece, D. J. 1986. Transaction cost economics and the multinational enterprise: An assessment. Journal of Economic Behavior and Organization, 7: 21-45.

Torneden, R. L. 1975. Foreign disinvestment by U.S. multinational corporations, with eight case studies. New York, NY: Praeger.

Wilson, B. D. 1979. Divestment of foreign subsidiaries. DBA thesis, Graduate School of Business Administration, Harvard University.

Zaheer, S., & Mosakowski, E. 1997. The dynamics of the liability of foreignness: A global study of survival in financial services. Strategic Management Journal, 18: 439-464.

TABLE 1

Descriptive Statistics and Correlations[a]

Variable	Mean	Std. Dev.	Risk	Network Breadth	IJV Formation	Firm Size
Risk	0.045	0.054				
Network Breadth	1.338	1.085	-0.016 (0.762)			
IJV Formation	0.461	0.731	-0.009 (0.874)	0.430*** (0.0001)		
Firm Size	6.317	1.835	-0.132* (0.013)	0.627*** (0.0001)	0.660*** (0.0001)	
Industry Risk	0.045	0.007	-0.061 (0.255)	0.124* (0.020)	-0.028 (0.606)	0.034 (0.528)

a† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Number of observations = 353.
p-values appear in parentheses.
Means, standard deviations, and correlations are reported for the log-transformed variables (i.e., network breadth, IJV formation, and firm size).

TABLE 2
Results of Tobit Models[b]

Variable	Model I	Model II	Model III	Model IV	Model V
Intercept	0.088*** (0.025)	0.113*** (0.026)	0.102*** (0.028)	0.086* (0.039)	0.111*** (0.030)
Network Breadth		0.008† (0.004)	0.022 (0.015)	0.019 (0.013)	0.008† (0.004)
IJV Formation		0.013* (0.006)	0.005 (0.024)	0.015* (0.007)	0.016 (0.022)
Firm Size	-0.004* (0.002)	-0.010*** (0.003)	-0.008* (0.003)	-0.008* (0.003)	-0.010** (0.003)
Industry Risk	-0.583 (0.479)	-0.639 (0.480)	-0.651 (0.480)	-0.655 (0.480)	-0.642 (0.480)
Network Breadth *Firm Size			-0.002 (0.002)	-0.002 (0.002)	
IJV Formation *Firm Size			0.001 (0.003)		-0.000 (0.002)
Log Likelihood $L(\beta)$	318.389	322.287	322.839	322.746	322.300
$-2[L(\beta_I) - L(\beta)]$		7.796*	8.9	8.714	7.822
$-2[L(\beta_{II}) - L(\beta)]$			1.104	0.918	0.026

b† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Number of observations = 353.
Standard errors appear in parentheses.