



# Subsidiary expansion/contraction during times of economic crisis

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## Abstract

This paper compares two real options – within-country growth and across-country operational flexibility – to examine subsidiary expansion/contraction during times of economic crisis. Specifically, we examine how the real options orientations of individual subsidiaries interact with the general characteristics of multinational enterprise networks. Our main findings are that: (a) economic crises can be detrimental for subsidiaries with stronger within-country orientations, and advantageous for those with stronger across-country orientations; and (b) network characteristics are not the sole determinants of subsidiary expansion/contraction – what really matters is how the real options orientations of individual subsidiaries mesh with the overall characteristics of the network they belong to.

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## INTRODUCTION

To maintain competitive advantage, multinational enterprises (MNEs) must make rapid adjustments to their international investments in response to fluctuating global market demands and competition. A major challenge for MNEs is reconfiguring their value chain activities in a timely fashion to address volatile contingencies in the countries where they operate subsidiaries. The real options literature emphasizes flexibility for MNEs trying to cope with heightened uncertainty. Most studies in this area have focused on the characteristics of multinational networks and their impacts on the market valuation of firms (Allen & Pantzalis, 1996; Pantzalis, 2001; Tang & Tikoo, 1999); others have focused on downside risks for MNEs (Reuer & Leiblein, 2000; Tong & Reuer, 2007). However, when addressing overall MNE network characteristics, researchers have overlooked the real options orientations of individual subsidiaries that make up MNE networks. Without knowing how those orientations mesh with the overall characteristics of an MNE network, our understanding of real options in a multinational context will be limited.

MNE subsidiaries can be oriented toward within-country growth or across-country operational flexibility options, with the first based on a host country's economic growth potential and the second emphasizing operational flexibility among affiliated subsidiaries within a multinational network (Kogut & Kulatilaka, 1994a).

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A subsidiary may emphasize one option over the other if it perceives local market adaptation and growth to be more important than serving as a global export platform, or vice versa. This relative perception becomes embedded in subsidiary operations and determines how subsidiaries develop their real options orientations. Our main argument in this paper is that these orientations influence the realization of MNE flexibility. Examining the corporate characteristics of an MNE is required because they exercise real options in their subsidiary portfolios. However, it is important not to overlook the essential component that supports MNE flexibility: the individual subsidiaries that constitute its network.

Since most real options studies focus on MNE flexibility at the corporate/network level, there is a tendency to look at overall levels of aggregated subsidiary operations without paying sufficient attention to the real options orientations of individual subsidiaries. A general assumption is that MNE subsidiaries are more or less the same because they belong to the same parent firm and are therefore treated as though their individual real options orientations have little effect on MNE flexibility. The truth is that each subsidiary has its own real options orientation based on the path-dependent development of its strategy. Therefore research needs to consider individual subsidiary orientations in order to build a more complete understanding of MNE flexibility.<sup>1</sup>

In a multinational context, formulating real options logic based solely on a subsidiary's real options orientation is also inappropriate. For a more complete understanding of real options in an MNE context, we believe it is necessary to investigate both the real options orientations of individual subsidiaries and how those orientations mesh with overall network characteristics. We examine interactions between the real options orientations of individual subsidiaries and three network-based characteristics: (a) the relative performance of a focal subsidiary *vis-à-vis* its affiliated subsidiaries in the same parent network; (b) the size of the multinational parent network to which a focal subsidiary belongs; and (c) multinational network redundancy – that is, the overlap between a focal subsidiary location and its affiliated subsidiary locations in terms of macroeconomic conditions. We argue that the scope of a subsidiary's operations is not determined solely by the general characteristics of its parent MNE; what really matters is the interaction between the real options orientation of each

subsidiary and the overall characteristics of the network to which it belongs.

Given that within-country and across-country options coexist in a foreign subsidiary, it is essential to establish a boundary condition under which one option has greater value. For this task we will use the Asian economic crisis that started in 1997 and persisted for several years. After almost three decades of strong growth and numerous claims of an impending “Asian economic miracle,” the crisis was a major shock to firms operating in the region (Singh & Yip, 2000). Our analysis uses data for 1519 subsidiaries of 471 Japanese MNEs in 52 manufacturing industries, located in five countries affected by the crisis between 1997 and 2001.

### REAL OPTIONS, EXPANSION/CONTRACTION, AND CRISIS

Two types of real options are represented in the literature: *incremental* and *operational flexibility* (Bowman & Hurry, 1993; Sharp, 1991). Incremental options consist of *put* and *call* options.<sup>2</sup> When a firm sees little potential in an investment, it may exercise a put option and reduce its exposure, and when an opportunity emerges it may exercise a call option and expand its commitment. Examples of incremental options include divesting/acquiring stakes in joint ventures (Chi, 2000; Kogut 1991) decreasing/increasing investments in existing facilities or technologies (Coucke, Pennings, & Sleuwaegen, 2007; Hurry, 1993). According to the operational flexibility option, firms maintain open options for change in preparation for future uncertainties; since uncertainty limits planning effectiveness, operational flexibility is considered complementary to planning (Volberda, 1997). This option can be analyzed as a bundle of interdependent options: two examples are retaining multiple suppliers in order to cope with future supply fluctuations (Richardson, 1993), and investing resources in multiple locations so that certain outlets can come to the rescue when one encounters problems (McGrath, 1999).

Kogut and Kulatilaka (1994a) applied the strategic management concepts of incremental vs operational flexibility options to the MNE context and identified two real options: “a *within-country option* which, by establishing a grand label or simple knowledge of the market, provides a platform for the introduction of new products ... [and] an *across-country option* provided by operational flexibility” (124–125). The primary difference is that the first is based on belief in a host country's



economic growth potential and the second emphasizes operational flexibility across multinational networks. MNEs often exercise within-country options upon learning about a country's economic potential (Kogut, 1991), and use an existing subsidiary in that country as a sensor for deciding when to increase or decrease a commitment (Reuer & Tong, 2005). In this scenario, local responsiveness and chains of incremental options in individual subsidiaries are central to maintaining the within-country growth option (Kulatilaka & Perotti, 1998; Song, 2002; Tong, Reuer, & Peng, 2008).

The across-country option maximizes operational flexibility by shifting production and sourcing among affiliated subsidiaries according to changes in host-country economies, with the most important factors being integration and interaction with other subsidiaries within the MNE network. According to this option, when one subsidiary encounters difficulties, its problems may be solved through interaction with sister subsidiaries in its multinational network (Belderbos & Zou, 2009; Johnson, 1995; Kogut & Kulatilaka, 1994a; Reuer & Leiblein, 2000; Roth & Morrison, 1990; Tang & Tikoo, 1999). MNE flexibility can therefore be conceptualized as an opportunity cost, in that across-country options investment may mean giving up a degree of local responsiveness in exchange for operational network flexibility (Rangan, 1998).

### Real Options Orientation and Subsidiary Expansion/Contraction

The focus of a subsidiary's operations has important implications for the path-dependent development of its real options orientation (Rangan, 1998). Kogut and Kulatilaka (1994b) suggest that real options investments made *a priori* reveal their value during times of uncertainty, and Rangan (1998) maintains that for MNE subsidiaries to be flexible across borders during any given period, they must have been originally developed with across-country flexibility in mind. Thus a subsidiary with a stronger focus on global exports than on local markets is likely to develop an across-country flexibility orientation, and a subsidiary with a stronger focus on local markets is likely to develop a within-country growth orientation.

The primary implication of an across-country orientation is that MNE subsidiaries will benefit from a geographically dispersed network for reconfiguring value chain activities during times of uncertainty.<sup>3</sup> Since they are more likely to have previously interacted with network subsidiaries

in other countries, the operational flexibility of global export-focused subsidiaries helps them exploit opportunities generated by fluctuating economic conditions between countries (Kogut & Kulatilaka, 1994a; Tang & Tikoo, 1999). For example, when one country's currency sharply depreciates, MNE subsidiaries can shift production to take advantage of reduced labor and input costs (Jacque & Vaaler, 2001). MNE networks can be designed so that subsidiaries acquire raw materials and other inputs from cheaper local markets, produce intermediate and finished products in low-cost manufacturing locations, and then redirect the products to more lucrative export markets (Chung, Lu, & Beamish, 2008; Miller, 1992; Sundaram & Black, 1992).

Enacting shifts in value chain activities is more difficult for subsidiaries oriented toward local markets. Rangan (1998) suggests that orientation toward local responsiveness inhibits attempts to increase flexibility across multinational networks. Further, subsidiaries with strong local market orientations may have fewer interactions with subsidiaries in other countries, and therefore experience difficulties when attempting to coordinate production across borders. This is consistent with the real options logic that firms tend to behave in a path-dependent manner (Kogut & Kulatilaka, 1994b; Rangan, 1998). Since the focus of a within-country orientation is host-country economic potential, abrupt demand reduction during an economic crisis can make a location unattractive for MNE subsidiaries interested in taking advantage of that potential. However, the same crisis can support low-cost manufacturing expansion if subsidiaries exploit across-country operational flexibility options via their multinational networks. Based on this background, Hypothesis 1 is established as:

**Hypothesis 1:** During times of economic crisis, a subsidiary with a stronger orientation toward an across-country flexibility option is more likely to expand its operations.

### Interaction Effects between Real Options Orientation and Network-based Characteristics

**Relative performance.** A poorly performing subsidiary is an indicator that an MNE might benefit from restructuring (Haynes, Thompson, & Wright, 2003). Retaining such a subsidiary during a crisis period can only add to existing problems,



which is why MNE executives demand that every subsidiary demonstrate its worth during times of adverse environmental change (Birkinshaw & Hood, 1997; Feinberg & Keane, 2006). Therefore, during times of economic crisis, MNEs tend to reexamine past internationalization efforts, beginning with subsidiaries experiencing performance problems (Rugman, 1979). During restructuring, an MNE is likely to focus initially on subsidiaries in crisis-stricken countries, but performance evaluation usually entails comparisons of poorly performing subsidiaries in crisis-stricken countries with all other subsidiaries in the same network. Subsidiaries in crisis-stricken countries may not be the worst performers – those with across-country orientations may be better performers due to manufacturing cost advantages.

For subsidiaries with within-country orientations, decreased local market demand can exacerbate existing performance problems and encourage contraction. Contraction is made easier when subsidiaries with this orientation are isolated, since the impacts are less likely to affect others in the same network (Birkinshaw, Holm, Thilenius, & Arvidsson, 2000). Compared with subsidiaries with across-country orientations, those with within-country orientations are more likely to work in isolation because their focus is on local adaptation, resulting in reduced compatibility (Johnson, 1995; Roth & Morrison, 1990). Accordingly, sudden demands for global coordination may not be readily achievable – if attempted, considerable disagreement and disharmony may arise (Chung & Beamish, 2005a; Monteiro, Arvidsson, & Birkinshaw, 2008), exacerbating performance problems for within-country-oriented subsidiaries.

Poor performance is not as problematic for subsidiaries that have an across-country orientation, since cost advantages maintain or increase the potential to benefit from operational flexibility across a network during times of economic crisis, thanks to exchange rate depreciation, lower factor costs, and other favorable trade conditions (Jacque & Vaaler, 2001; Tambunan, 2000). For subsidiaries with across-country orientations, past interactions with other subsidiaries in the same network may result in advantageous production shifts (Kogut & Kulatilaka, 1994a; Rangan, 1998). Especially compared with isolated subsidiaries, the operating scopes of well-connected subsidiaries oriented toward across-country flexibility are not limited to specific subsidiaries, but are linked to those of multiple subsidiaries located in different countries

(Birkinshaw et al., 2000; Tang & Tikoo, 1999), thus providing more avenues for addressing performance problems. Based on this rationale, we propose:

**Hypothesis 2:** During times of economic crisis, the lower the performance of a subsidiary relative to other subsidiaries in the same network, the more likely it is that a subsidiary with a stronger focus on the across-country option will expand its operations.

**Network size.** An important difference between the within- and across-country options is tied to a subsidiary's independence from (or interdependence with) other subsidiaries in the same network (Kogut & Kulatilaka, 1994a). Subsidiaries with stronger within-country orientations are more independent: therefore network size is not as important when they must decide to expand or contract their operations. In other words, subsidiaries oriented toward the within-country option are less likely to benefit from the across-country operational flexibility associated with large subsidiary networks (Lee & Makhija, 2009a; Monteiro et al., 2008).

In contrast, subsidiaries with stronger across-country orientations are more dependent on other network subsidiaries, since any shift in value chain activities must involve at least two parties (Allen & Pantzalis, 1996). Having subsidiaries in multiple countries enhances flexibility by allowing subsidiaries to coordinate production in response to environmental change. Benefits from operational flexibility are especially important when host-country operating environments become hostile (Pantzalis, Simkins, & Laux, 2001; Tang & Tikoo, 1999). Greater breadth in subsidiary dispersion provides greater operational flexibility to subsidiaries in trouble (Allen & Pantzalis, 1996), and membership in a large network can provide opportunities for redirecting intermediate and finished goods to more lucrative export markets (Lee & Makhija, 2009b). Based on this rationale, we propose:

**Hypothesis 3:** During times of economic crisis, the larger the multinational network, the more likely it is that a subsidiary oriented toward the across-country flexibility option will expand its operations.



**Network redundancy.** Decreased manufacturing costs can make subsidiaries candidates for production shifts, but the potential is lower when subsidiaries in the same network experience similar cost decreases – in other words, when considerable macroeconomic overlap exists in multiple locations (Fisch, 2008). This fits with Kogut's (1989) description of multinationality as a bundle of options whose value grows as differences across options increase (Girotra, Terwiesch, & Ulrich, 2007; McGrath, 1999). When MNE subsidiaries in different countries have little overlap, the resulting diversity gives the greatest advantages to subsidiaries oriented toward the across-country option – in other words, the combination of a strong focus on the across-country option and dispersal across multiple countries with diverse macroeconomic conditions provides super-additive synergies during times of uncertainty (Tanriverdi & Venkatraman, 2005). In such scenarios, joint value becomes greater than the sum of the two combinations (Davis & Thomas, 1993).

However, when macroeconomic conditions are similar in multiple countries where an MNE operates subsidiaries, the value of across-country flexibility is lower than where a broader range of macroeconomic diversity exists. In environments marked by similar macroeconomic conditions, the option values of individual subsidiaries are only partly additive, and become sub-additive or redundant when their option characteristics overlap with those of other affiliates. Accordingly, a subsidiary will have lower across-country option value if the environmental changes it faces resemble those faced by sister subsidiaries. When strong correlations exist among macroeconomic changes in countries with MNE subsidiaries, those oriented toward the across-country option will have less room for production shifts.<sup>4</sup> Our final hypothesis reflects the idea that greater overlap in the potential value of across-country options among subsidiaries in an MNE network reduces the ability of across-country-oriented subsidiaries to exploit country differences by shifting sourcing and production to subsidiaries with more favorable cost structures:

**Hypothesis 4:** During times of economic crisis, the greater the degree of redundancy in macroeconomic conditions among subsidiary locations in a multinational network, the less likely it is that an across-country option-oriented subsidiary will expand its operations.

## RESEARCH METHOD

### Data and Sample

Foreign subsidiary data were derived from the *Trend Survey of Overseas Business Activities*, published annually by the Japanese Ministry of Economics, Trade and Industry (METI). METI gathers information on the business activities of foreign subsidiaries for all Japanese corporations except those in real estate, finance, and insurance. METI distributes copies of the Trend Survey (one for the parent firm and one for each of its foreign subsidiaries), and in some cases conducts supplementary interviews by phone or other means. The survey purpose is to support industrial and trade policy decisions; therefore the data are organized according to industry type. Compiled data are published by the Enterprise Statistics Office of the Research and Statistics Department and the Trade and Investment Facilitation Division of the Trade and Economic Cooperation Bureau.

For the empirical context we used the 1997 Asian economic crisis. Our sample consists of subsidiaries in the five countries most affected by the crisis: Thailand, Indonesia, South Korea, Malaysia, and the Philippines (UNCTAD, 2000). Our observation period was from 1997 to 2001, a sufficient time frame for capturing the real impacts of the crisis, and for mitigating a potentially serious right-censoring problem. Our sample was limited to manufacturing subsidiaries owing to the likelihood that the manufacturing, service, and trade industries may not have reacted to the crisis in the same manner. We followed the established real options research practice of focusing on manufacturing subsidiaries in order to reduce the potential for compounding across different industry types (Allen & Pantzalis, 1996; Belderbos & Sleuwaegen, 2005). The final sample consisted of 1519 manufacturing subsidiaries of 471 Japanese corporations in 52 industries, operating in five Asian countries between 1997 and 2001.

### Variables

**Dependent variable.** The dependent variable for the four hypotheses was a change-based continuous measure of subsidiary expansion/contraction from year  $t-1$  to year  $t$ .<sup>5</sup> We used two measures to operationalize subsidiary expansion/contraction: percentage change in subsidiary sales, and percentage change in subsidiary employees. To control for size bias, percentages were used instead of

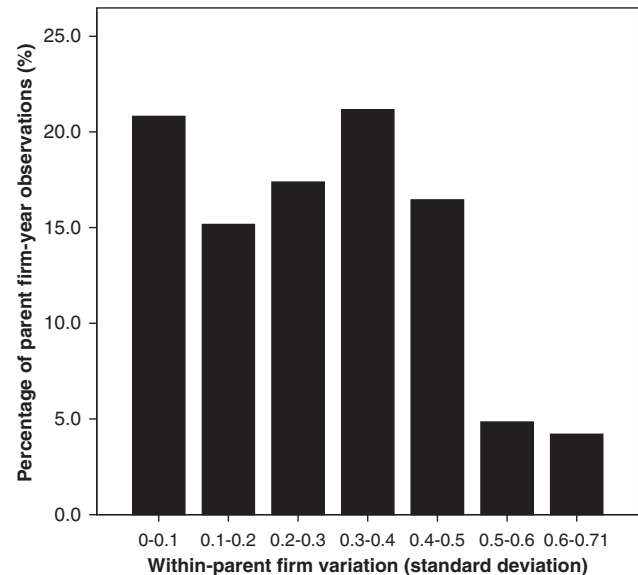


unit changes. Any analysis of subsidiary expansion/contraction without considering continuation/termination will create a selectivity problem. During the observation period, 187 of the 1519 manufacturing subsidiaries in the sample were terminated. As we will explain in the statistical analysis section, a two-stage procedure was used in response to the selectivity problem arising from subsidiary continuation/termination (Heckman, 1979; Wooldridge, 1995).

**Independent variables.** Given that our dependent variable is a change-based measure, to avoid reverse causality problems we investigated the effects of independent variables at time  $t-1$  on the change-based dependent variable from time  $t-1$  to time  $t$ . Our main independent variable was the real options orientation of each subsidiary, reflecting the relative importance of the across-country flexibility and within-country growth options (Hypothesis 1). We used the ratio of export vs local sales at the subsidiary level, since it is an efficient proxy for the relative importance of either option embedded in each subsidiary. For the sake of consistency, we used the export ratio with all empirical models.

As explained above, we believe it is inappropriate to assume that the real options orientations of subsidiaries are automatically identical because they belong to the same parent firm. We therefore examined variation in subsidiaries belonging to the same firm in terms of export ratios by calculating within-firm variation across subsidiaries for a given year, and found that some firms have a standard deviation as high as 0.71. As shown in Figure 1, the majority of parent firms had large within-firm variation in subsidiary export ratios, with many implementing subsidiary-specific strategies emphasizing either export or local sales. For example, in 1998 one firm had 19 subsidiaries worldwide and a within-firm standard deviation of 0.38. Of the 19 subsidiaries, two were located in a country affected by the 1997 Asian crisis; although operating in the same country they exhibited different orientations – an export ratio of 0.07 in one and 0.55 in the other.<sup>6</sup>

Hypothesis 2 addressed the interaction between the main independent variable and the relative performance of a focal subsidiary in the context of other affiliated subsidiaries in the same parent network. Since a focal subsidiary's performance must be compared with subsidiaries owned by the same parent firm but located in other countries or



**Figure 1** Distribution of within-parent firm variation on subsidiaries' export ratios.

*Notes:* Percentage of parent firm-year observations in each within-parent firm variation category;  $N=27,837$  parent firm-year observations worldwide.

regions, we computed an average return on sales (RoS) for all other subsidiaries in the same network, then subtracted the RoS for a subsidiary of interest from the average RoS for all affiliated subsidiaries. This reverse operationalization of *poor* relative performance allows for a more intuitive interpretation, since our theoretical arguments focus on the relatively poor performance of individual subsidiaries. The higher the value of this variable, the lower the relative performance of a subsidiary compared with its affiliates in the same parent network.

The second interaction we examined was with multinational network size (Hypothesis 3) – that is, the number of countries in which affiliated manufacturing subsidiaries are located in a given year. Given that country risks are homogeneous for subsidiaries located in the same host country, this is an adequate measure from a real options theory perspective. A second possible measure of network size is the number of affiliated manufacturing subsidiaries in a given year. These variables are highly correlated (0.90); we chose the number of countries in the network because we believe it is more relevant to real options theory. The number of subsidiaries was used as a robustness check.

The third interaction effect was with the averaged sum of exchange rate correlations between one subsidiary and other manufacturing subsidiaries in the

same network but in other countries or regions. Following the example of Belderbos and Zou (2009), we calculated annual correlations of monthly real exchange rates between a subsidiary's host country and other countries with subsidiaries from the same parent firm in a given year. We then averaged the sums of annual correlations of real exchange rates of a subsidiary's host country and other countries associated with the network. We extended two empirical aspects of Belderbos and Zou's network correlation measure: (a) while they computed multinational network correlations for nine Asian countries, we incorporated all countries in the world, resulting in a more complete measure of multinational network correlations; (b) while they used static network correlations measured in 1995 only, we used a more dynamic network correlation variable reflecting year-to-year changes in exchange rates and network configurations.

**Control variables.** Our real options logic was based on competitive devaluation in crisis-stricken countries: therefore we controlled for structural devaluation by operationalizing it as change in the institutional development of crisis-stricken countries (Chung & Beamish, 2005b). A negative change was perceived as indicating structural devaluation and a positive change as indicating structural enhancement, with different magnitudes representing different change values. We used Chan et al. (2008) institutional development score to compute change in institutional development from year  $t-1$  to year  $t$  in individual crisis-stricken countries.

According to the real options literature, different subsidiary orientations determine accompanying options during times of uncertainty (Kogut & Kulatilaka, 1994b; Rangan, 1998). However, a subsidiary may respond to an economic crisis by dramatically altering its export ratio. To control for this alternative explanation, we incorporated export ratio change for subsidiaries in crisis-stricken countries. Another growth option is change in the number of subsidiaries in each host country, but this occurs at the parent firm rather than subsidiary level. Since our focus was on the subsidiary level, we controlled for this growth option possibility. To control for what takes place outside crisis-stricken countries, we also included change in the number of subsidiaries in the rest of the world.

We incorporated the effects of parent firm and subsidiary size to control for the liability of smallness (Stinchcombe, 1965) and structural inertia

(Hannan & Freeman, 1984) during times of economic crisis, using parent firm sales and subsidiary sales as the size measures. We incorporated two types of parent firm experience – international and local – to control for the ability of MNEs to manage foreign subsidiaries in multinational networks and host countries, respectively. We measured parent firm international experience as the number of years with foreign operations, and local experience as the number of years operating in a specific host country. Acknowledging a liability associated with newness (that is, older subsidiaries may be more efficient than younger ones because they have more cumulative experience, more established organizational routines, a more experienced workforce, etc.; Stinchcombe (1965)), we incorporated subsidiary age to control for the experience factor at the subsidiary level. To control for other unobserved effects, we used dummies for calendar year, country, industry, and parent firm. For manufacturing industry dummies, we used the Japanese equivalent of a two-digit Standard Industry Classification code. In our empirical models we included dummies for 5 years, five countries, 52 manufacturing industries, and 471 parent firms.

### Statistical Analysis

If subsidiary continuation/termination is not taken into consideration, any analysis of subsidiary expansion/contraction may encounter selectivity problems. We used a two-stage procedure in response to this potential problem (Heckman, 1979). Since our analysis was based on panel data, we used a panel data extension of this procedure as described in Wooldridge (1995). In the first-stage selection model we estimated a probit of subsidiary continuation/termination on  $x_i$  for each  $t$  (i.e., period-specific estimation) and calculated the inverse Mills ratio  $\lambda_{it}$  for all  $i$  and  $t$ . For the first-stage model we used a set of independent variables similar to those used in the second-stage model, but with a different number of variables to minimize the identification problem (Sartori, 2003). We excluded the interaction terms and added a new variable: whether a focal subsidiary is the parent firm's only subsidiary in a host country in a given year – that is, a country platform subsidiary.<sup>7</sup> In the main second-stage model we ran a pooled linear regression of subsidiary expansion/contraction for continuing subsidiaries with the selectivity correction term  $\lambda_{it}$ , and corrected the asymptotic variance of  $\beta$  for general heteroskedasticity and serial correlation.<sup>8</sup>



Given the study objective, we used random effects as our estimation in the second-stage model. Our focus was on between-subsidiary variation (i.e., differential effects of real options orientations between subsidiaries) rather than within-subsidiary variation (i.e., the changing effects of real options orientation in a subsidiary over time). Note also that the fixed-effects model does not allow the inclusion of variables that do not vary over time – that is, the country, industry, and parent-firm dummies used to control for unobserved heterogeneity.

## RESULTS

Descriptive statistics and correlation matrices for the variables are presented in Table 1. Pearson correlations were calculated between two interval

variables: biserial correlations between dichotomous and interval variables, and tetrachoric correlations between two dichotomous variables. We conducted variance inflation factor and tolerance level tests, and found no evidence of a multicollinearity problem. The sales percentage-change variable mean was 0.24, with a standard deviation of 0.95. The employee percentage-change variable mean was 0.12, with a standard deviation of 0.64. The correlation between the sales and employee change variables was 0.41. This positive correlation indicates that subsidiary sales and employee numbers generally changed in the same direction, with sales changing to a greater degree. The export ratio change (control variable) mean was 0.00, with a standard deviation of 0.16, suggesting that subsidiaries may not be capable of dramatically

**Table 1** Descriptive statistics and correlations

	Mean	s.d.	1	2	3	4	5	6	7	8
1 Sales percentage change	0.24	0.95	1.00							
2 Employment percentage change	0.12	0.64	0.41	1.00						
3 Export ratio	0.26	0.35	0.27	0.06	1.00					
4 Relative performance	0.03	0.71	0.09	0.01	0.03	1.00				
5 Network size	8.06	7.04	0.01	0.01	0.05	0.02	1.00			
6 Network redundancy	2.37	2.90	-0.02	-0.01	-0.06	0.02	0.52	1.00		
7 Interaction b/w rel. performance and export ratio	0.04	0.35	0.62	0.03	0.45	0.16	0.00	-0.01	1.00	
8 Interaction b/w network size and export ratio	2.15	9.71	0.38	0.03	0.66	0.03	0.19	0.08	0.37	1.00
9 Interaction b/w network redundancy and export ratio	-0.20	1.20	0.09	-0.02	0.50	0.01	0.14	0.21	0.11	0.62
10 Change in institutional environment	-0.08	0.23	0.01	0.01	0.00	-0.01	-0.01	-0.22	-0.01	-0.01
11 Parent firm sales (log)	11.56	3.62	0.01	0.00	-0.04	0.00	0.49	0.33	0.00	0.08
12 Subsidiary sales (log)	6.99	3.18	0.02	0.01	-0.02	0.05	0.16	0.12	0.02	0.03
13 Parent firm international experience	15.67	10.42	0.00	-0.01	-0.01	0.02	0.38	0.24	0.01	0.10
14 Parent firm local experience	13.27	9.60	-0.03	0.00	-0.07	0.03	0.26	0.17	0.01	0.03
15 Subsidiary age	12.42	9.06	-0.04	-0.02	-0.09	0.06	0.14	0.12	0.02	-0.05
16 Change in subsidiary export ratio	0.00	0.16	-0.29	-0.05	-0.70	-0.03	-0.01	0.02	-0.36	-0.48
17 Change in no. of subsidiaries in each host country	0.04	0.41	0.00	0.01	0.01	-0.01	0.10	0.05	0.01	0.07
18 Change in no. of subsidiaries outside crisis countries	0.37	1.49	0.02	0.01	0.00	-0.02	0.18	0.06	0.00	0.07
	9	10	11	12	13	14	15	16	17	18
9 Interaction b/w network redundancy and export ratio	1.00									
10 Change in institutional Environment	-0.06	1.00								
11 Parent firm sales (log)	0.07	0.00	1.00							
12 Subsidiary sales (log)	0.02	0.00	0.14	1.00						
13 Parent firm international experience	0.08	-0.01	0.15	0.12	1.00					
14 Parent firm local experience	0.03	0.01	0.18	0.14	0.44	1.00				
15 Subsidiary age	-0.04	0.00	0.09	0.15	0.33	0.58	1.00			
16 Change in subsidiary export ratio	-0.28	-0.05	0.00	0.01	0.02	0.02	0.04	1.00		
17 Change in no. of subsidiaries in each host country	0.04	0.04	0.07	0.01	-0.01	0.06	0.02	0.01	1.00	
18 Change in no. of subsidiaries outside crisis countries	0.03	0.04	0.09	0.03	0.02	0.04	-0.01	-0.04	0.32	1.00

Note: Correlations with 5 year dummies, five country dummies, 52 industry dummies, and 471 parent firm dummies are not shown because of space constraints.





changing their export ratios owing to cost and capability issues associated with switching from a local to export orientation (Rangan, 1998).

Regarding results estimated from the first-stage selection model, we found that during times of economic crisis a subsidiary was more likely to continue operations if it had a higher export ratio, was the only subsidiary of a parent firm in a host country, or had a larger amount of total sales. The main effects of relative performance and network size indicate that a subsidiary exhibiting stronger relative performance and larger network size was more likely to continue operating, but the results were not statistically significant. Moreover, according to the main effect of network redundancy, a subsidiary was less likely to continue operating if its location was highly correlated with those of other subsidiary locations in the same network in terms of macroeconomic conditions – but again, this result was not statistically significant. A panel data procedure based on Wooldridge's (1995) two-stage model generated period-specific probit estimations. The five first-stage estimations used to compute the selectivity correction term for each year between 1997 and 2001 are reported in the Appendix.

Estimates for the second-stage models with corrections for selectivity are shown in Table 2 (percentage change of subsidiary sales) and Table 3 (percentage change of subsidiary employees). In Table 1 we first included all main effects variables (export ratio, relative performance, network size, and network redundancy) in addition to various control variables (Model 1). Next, we introduced each interaction term separately before creating a full model: the interaction between relative performance and export ratio in Model 2, the interaction between network size and export ratio in Model 3, and the interaction between network redundancy and export ratio in Model 4. Model 5 is the full model containing all three interaction terms. The same method was applied in Table 3 (Models 6–10). To minimize the potential for multicollinearity we centered all variables used to create the interaction terms.

We used the ratio of export vs local sales at the subsidiary level to operationalize the relative importance of across-country flexibility versus within-country growth options embedded in each subsidiary. The positive coefficient of the export ratio variable in Model 1 ( $\beta=1.121$ ;  $p<0.01$ ) indicates that the stronger the subsidiary's across-country flexibility orientation, the greater the likelihood of the subsidiary increasing its sales

during times of economic crisis. Conversely, this suggests that when a local market collapses during times of economic crisis, then the stronger the within-country orientation of a subsidiary, the greater the likelihood of it experiencing decreasing sales. Hypothesis 1 is therefore supported.

The negative coefficient of the relative poor performance variable in Model 1 indicates that, during times of economic crisis, poorly performing subsidiaries generally face reduced sales, but the main effect was not statistically significant. Its interaction effect with the real options orientation of the subsidiary is worth noting. In Model 2, the positive interaction between relative poor performance and export ratio ( $\beta=0.228$ ;  $p<0.01$ ) indicates that even though poorly performing subsidiaries contract their operations in general, some subsidiaries expand if they have greater focus on the across-country operational flexibility option, thus supporting Hypothesis 2.

In Model 3 the positive coefficient of the interaction term between network size and export ratio ( $\beta=0.675$ ;  $p<0.01$ ) indicates that during times of crisis, the larger the size of a multinational network, the greater the likelihood of a subsidiary with an across-country orientation experiencing an increase in sales, thus supporting Hypothesis 3. However, the main effect of network size alone did not significantly increase subsidiary sales in Model 1. Combined, these results indicate that membership in a large multinational network does not necessarily help subsidiaries in crisis-stricken countries increase sales. Instead, a more important factor is how a large multinational network meshes with the real options orientations of individual subsidiaries: if the orientation is local, membership in a large multinational network is not as useful as when the orientation is toward across-country flexibility. This explains our observation of a significant and positive interaction effect between network size and export ratio in Model 2, and a non-significant effect of network size alone in Model 1.<sup>9</sup>

In addition to the two positive interaction effects of the across-country option embedded in individual subsidiaries, we also investigated that option's negative interaction effect when combined with network redundancy. During times of economic crisis, across-country-oriented subsidiaries can make better use of a network that is dispersed across multiple countries. However, if affiliated subsidiaries in the same network experience similar production cost decreases, the production shift may not be as large as when greater variety in

**Table 2** Percentage change in subsidiary sales

	Model 1		Model 2		Model 3		Model 4		Model 5 (full model)	
	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.
<i>Independent variables</i>										
Export ratio (Hypothesis 1)	1.121***	(0.122)	1.119***	(0.120)	1.319***	(0.118)	1.072***	(0.122)	1.212***	(0.112)
Relative performance	0.003	(0.006)	0.037***	(0.007)	-0.004	(0.006)	-0.004	(0.006)	0.027***	(0.006)
Network size	0.100	(0.363)	0.103	(0.358)	0.110	(0.349)	0.123	(0.362)	0.226	(0.331)
Network redundancy	-0.009	(0.132)	-0.040	(0.130)	-0.051	(0.127)	-0.072	(0.132)	-0.160	(0.121)
Interaction b/w relative performance and export ratio (Hypothesis 2)			0.228***	(0.019)					0.173***	(0.017)
Interaction b/w network size and export ratio (Hypothesis 3)					0.675***	(0.033)			1.087***	(0.039)
Interaction b/w network redundancy and export ratio (Hypothesis 4)							-0.538***	(0.109)	-1.437***	(0.121)
<i>Control variables</i>										
Selectivity correction ( $\lambda_{it}$ )	3.309**	(1.382)	3.663***	(1.362)	3.789***	(1.327)	3.258**	(1.378)	4.119***	(1.259)
Change in institutional environment	1.843	(1.238)	1.788	(1.220)	1.327	(1.190)	1.872	(1.235)	1.102	(1.129)
Parent firm sales (log)	0.092	(0.119)	0.109	(0.117)	0.043	(0.114)	0.088	(0.118)	0.009	(0.108)
Subsidiary sales (log)	0.259***	(0.097)	0.299***	(0.095)	0.242***	(0.093)	0.249***	(0.096)	0.218**	(0.088)
Parent firm international experience	-0.008	(0.084)	-0.005	(0.082)	-0.025	(0.080)	-0.010	(0.083)	-0.039	(0.076)
Parent firm local experience	-0.07	(0.048)	-0.076	(0.047)	-0.101**	(0.046)	-0.061	(0.047)	-0.085**	(0.043)
Subsidiary age	-0.072*	(0.043)	-0.055	(0.042)	-0.021	(0.041)	-0.081*	(0.043)	-0.022	(0.039)
Change in subsidiary export ratio	2.930***	(0.341)	2.985***	(0.336)	3.008***	(0.328)	2.615***	(0.347)	1.665***	(0.319)
Change in no of subsidiaries in each host country	-0.377	(0.585)	-0.322	(0.577)	-0.963*	(0.563)	-0.326	(0.584)	-1.045*	(0.534)
Change in no. of subsidiaries outside crisis countries	0.036	(0.111)	0.001	(0.110)	0.002	(0.107)	0.042	(0.111)	-0.016	(0.101)
Year dummies	Included		Included		Included		Included		Included	
Country dummies	Included		Included		Included		Included		Included	
Industry dummies	Included		Included		Included		Included		Included	
Parent firm dummies	Included		Included		Included		Included		Included	
Constant	-0.210	(9.835)	-0.169	(9.689)	0.280	(9.447)	-0.452	(9.811)	-0.487	(8.964)
Wald statistics	1256.58***		1443.93***		1771.79***		1387.01***		2510.09***	

Note: Results are based on 1519 subsidiaries of 471 Japanese MNEs, operating in 52 manufacturing industries of five crisis-stricken countries between 1997 and 2001.

\* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\*  $p < 0.01$ ; all from two-tailed tests.

**Table 3** Percentage change in subsidiary employees

	Model 6		Model 7		Model 8		Model 9		Model 10 (full model)	
	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.
<i>Independent variables</i>										
Export ratio (Hypothesis 1)	0.364***	(0.134)	0.137	(0.152)	0.319**	(0.138)	0.204	(0.138)	0.107	(0.154)
Relative performance	0.097	(0.144)	0.150	(0.144)	0.096	(0.144)	0.111	(0.143)	0.148	(0.144)
Network size	0.032	(0.024)	0.046*	(0.024)	0.047*	(0.024)	0.050**	(0.024)	0.051**	(0.024)
Network redundancy	-0.071	(0.049)	-0.069	(0.049)	-0.072	(0.049)	-0.091*	(0.049)	-0.091*	(0.049)
Interaction b/w relative performance and export ratio (Hypothesis 2)			0.183***	(0.057)					0.113**	(0.055)
Interaction b/w network size and export ratio (Hypothesis 3)					0.022**	(0.011)			0.032*	(0.019)
Interaction b/w network redundancy and export ratio (Hypothesis 4)							-0.205***	(0.044)	-0.244***	(0.058)
<i>Control variables</i>										
Selectivity correction ( $\lambda_{it}$ )	0.769*	(0.401)	0.795*	(0.481)	0.773*	(0.451)	0.767*	(0.435)	0.779*	(0.423)
Change in institutional environment	0.298	(0.486)	0.300	(0.486)	0.287	(0.486)	0.291	(0.485)	0.310	(0.485)
Parent firm sales (log)	-0.021	(0.034)	-0.02	(0.034)	-0.02	(0.034)	-0.021	(0.034)	-0.022	(0.034)
Subsidiary sales (log)	0.007	(0.035)	0.005	(0.035)	0.006	(0.035)	0.007	(0.035)	0.008	(0.035)
Parent firm international experience	-0.006	(0.012)	-0.005	(0.012)	-0.005	(0.012)	-0.005	(0.012)	-0.006	(0.012)
Parent firm local experience	0.016	(0.016)	0.016	(0.016)	0.017	(0.016)	0.020	(0.016)	0.019	(0.016)
Subsidiary age	-0.021	(0.016)	-0.022	(0.016)	-0.022	(0.016)	-0.025	(0.016)	-0.024	(0.016)
Change in subsidiary export ratio	0.140	(0.138)	0.166	(0.138)	0.141	(0.138)	0.061	(0.139)	0.062	(0.140)
Change in no. of subsidiaries in each host country	0.090	(0.254)	0.090	(0.254)	0.108	(0.254)	0.113	(0.254)	0.086	(0.254)
Change in no. of subsidiaries outside crisis countries	0.003	(0.044)	0.003	(0.044)	0.004	(0.044)	0.004	(0.044)	0.003	(0.044)
Year dummies	Included		Included		Included		Included		Included	
Country dummies	Included		Included		Included		Included		Included	
Industry dummies	Included		Included		Included		Included		Included	
Parent firm dummies	Included		Included		Included		Included		Included	
Constant	0.153	(0.852)	0.228	(0.851)	0.143	(0.851)	0.074	(0.850)	0.122	(0.850)
Wald statistics	493.28***		582.94***		501.40***		601.88***		731.95***	

Note: Results are based on 1519 subsidiaries of 471 Japanese MNEs, operating in 52 manufacturing industries of five crisis-stricken countries between 1997 and 2001.

\* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ ; all from two-tailed tests.



macroeconomic conditions exist throughout the network. The negative coefficient for the interaction between network redundancy and export ratio in Model 4 ( $\beta = -0.538$ ;  $p < 0.01$ ) confirms that the stronger the correlation of macroeconomic conditions with other subsidiaries in the same parent network, the less likely it is that an across-country oriented subsidiary will expand during times of economic crisis. Model 4 therefore supports Hypothesis 4. These results did not change substantially when we added all three interaction terms to the full model (Model 5).

We also estimated the second-stage model using percentage changes of subsidiary employees as a dependent variable (Table 3). In Model 6, we found that the stronger the orientation of a subsidiary to global export, the greater the likelihood of that subsidiary increasing the number of employees ( $\beta = 0.364$ ;  $p < 0.01$ ). We also found a positive interaction effect between relative poor performance and export ratio in Model 7 ( $\beta = 0.183$ ;  $p < 0.01$ ), a positive interaction effect between network size and export ratio in Model 8 ( $\beta = 0.022$ ;  $p < 0.05$ ), and a negative interaction effect between network redundancy and export ratio in Model 9 ( $\beta = -0.205$ ;  $p < 0.01$ ). These results did not change in the full Model 10, thus supporting all four hypotheses. While the results for the percentage change of subsidiary employees are consistent with the results for the percentage change of subsidiary sales, the employment results are weaker than the sales results in terms of both the significance level and coefficient size. We speculate that change in employees may be less evident than change in sales because people can do overtime or work less hours during times of uncertainty. Change in employees is also a more sticky issue, because it is harder to hire or fire people compared with increasing or decreasing sales.<sup>10</sup>

The control variable results shown in Tables 2 and 3 are worth noting. The selectivity correction term coefficient is positive and significant in all second-stage models, reflecting a covariance of error terms in the first-stage (continuation/termination) and second-stage (expansion/contraction) equations, and underscoring the importance of correcting the selectivity bias in our main empirical models. Given that our real options logic is based on competitive devaluation during times of economic crisis, we also controlled for the structural devaluation of crisis-stricken countries. Although the Table 1 descriptive statistics show that the five crisis-stricken countries in our sample experienced

structural devaluation between 1997 and 2001, results from a multivariate analysis indicate that the impact of devaluation on subsidiary expansion/contraction was not statistically significant. It is possible that the positive effect of competitive devaluation offsets the negative effect of structural devaluation. This explanation is consistent with the core real options premise that successful firms capitalize on uncertainty rather than run away from it (Amram & Kulatilaka, 1999; Garud, Kumaraswamy, & Nayyar, 1998).<sup>11</sup>

## DISCUSSION AND CONCLUSION

This paper makes several contributions to the real options literature. In MNE contexts, real options studies originally focused on the impact of multinationality on firm values at the corporate level. As the field developed, researchers started using a multinational network perspective when focusing on actual configurations of international investments. Given the emphasis on a multinational network perspective, real options researchers have primarily examined overall MNE network characteristics at the expense of addressing the real options orientations of individual subsidiaries that constitute MNE networks – the focus of our research. We also examined how the real options orientations of individual subsidiaries mesh with the overall characteristics of their MNE networks. Our results show that general MNE characteristics are not the sole determinants of subsidiary expansion/contraction – the real options orientation of individual subsidiaries is an equally important factor.

Another shortcoming in the real options literature is that researchers have tended to investigate either within-country or across-country options individually rather than simultaneously. According to our comparison of the two, the same economic crisis can spell disaster for subsidiaries with a strong within-country focus while creating opportunities for those with a strong across-country focus. Our results indicate that subsidiaries with a stronger across-country focus are more likely to expand than contract operations during times of economic crisis, since they are positioned to extract benefits from production and sourcing shifts within their networks (Kogut & Kulatilaka, 1994a).

According to our results, subsidiaries oriented toward the across-country option are more likely to benefit from real options investments, especially when host countries suffer severe damage during times of economic crisis. In other words, MNE



success requires having subsidiaries in different host countries and knowing how to use them during times of crisis. As Rangan (1998: 220) notes, “[to] be flexible in the current period, MNEs need to have planned and invested accordingly in previous periods.” However, benefits tied to an across-country orientation are not cost-free: investing in that option means giving up the benefits of local responsiveness when a country’s economy starts to recover. Instead of refuting a within-country perspective outright, our findings clarify the boundary condition under which one option or the other has greater value.

Whereas previous real options studies on MNE flexibility have looked at the general effects of multinational networks, we examined network-specific conditional effects in relation to the relative importance of within-country versus across-country options embedded in each subsidiary. We found that during times of economic crisis, the inferior/superior performance of a subsidiary in comparison to its affiliated subsidiaries in the same parent network is not the sole determinant of subsidiary contraction/expansion. When a local market collapses, what really matters is a subsidiary’s real options orientation, which determines its ability to take advantage of changing conditions. Similarly, even though multinational network size by itself may not affect expansion/contraction decisions for individual subsidiaries, the interaction between network size and a subsidiary’s across-country flexibility orientation does matter. This may explain, at least in part, the non-significant or mixed results from previous examinations of the general characteristics of multinational networks (e.g., Allen & Pantzalis, 1996; Rangan, 1998; Reuer & Leiblein, 2000; Tang & Tikoo, 1999).

We also examined a negative interaction effect in the form of network redundancy, and found that subsidiaries oriented toward the across-country option are less likely to expand if their environmental changes resemble those faced by other affiliates in the same network. Accordingly, even if MNE subsidiaries are capable of shifting sourcing and production from one location to another, they are less likely to do so if fewer benefits are to be gained from exploiting country differences. This is consistent with what real options theory suggests: MNEs positioned to take advantage of environmental changes do not have to do so when conditions are not favorable, and only those MNEs ready to take advantage of such changes can do so when opportunities arise.

In terms of managerial implications, our results suggest that during times of economic crisis, subsidiaries with a stronger focus on across-country operational flexibility are better positioned to take advantage of their multinational networks. Awareness of how past investment decisions and strategic orientations affect specific subsidiaries during crises can provide managers with *a priori* insight. Although operational flexibility is normally considered an adaptive and reactive response to environmental change, MNE subsidiaries may use their operational flexibility to proactively redefine market uncertainties. The across-country perspective of real options theory helps firms battle with (McGrath, 1997), capitalize on (Amram & Kulatilaka, 1999; Garud et al., 1998), and even befriend the uncertainty that is a constant factor in today’s global economy.

Our data sources emphasize large and established Japanese firms rather than small or entrepreneurial ones: therefore our sample may have biased our results toward across-country operational flexibility. Future researchers may be interested in examining how small and/or entrepreneurial firms manage their foreign subsidiaries, and how these firms’ decisions regarding subsidiary expansion and contraction during times of economic crisis differ from those of their larger counterparts. They may also be interested in comparing our results with those for non-crisis periods. Given country-specific differences, there is also a need to examine other host countries.

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## NOTES

<sup>1</sup>Some researchers have examined the implications of real options for subsidiary growth and divestment using individual subsidiaries as the unit of analysis (e.g., Belderbos & Zou, 2007, 2009), but their focus has mostly been on environmental factors and not on the real options orientations of individual subsidiaries.

<sup>2</sup>The holder of a put option has the potential (but not the obligation) to sell a particular asset at a given price – known as the *exercise* or *strike* price. A call option confers the privilege of purchasing an asset at a specified exercise price.



<sup>3</sup>Our focus is on two sources of uncertainty that reflect economic conditions in a crisis-stricken country: changes in demand (Bell & Campa, 1997; Brouthers, Brouthers, & Werner, 2008; Campa, 1994) and changes in factor prices due to fluctuations in exchange rates and input prices (Kogut & Chang, 1996; Pantzalis et al., 2001; Miller & Reuer, 1998; Rangan, 1998). Both are at the center of the real options literature in MNE contexts.

<sup>4</sup>This sub-additive logic has been studied in the contexts of alliances (Vassolo, Anand, & Folta, 2004), R&D projects (Girotra et al., 2007), and a regional subsidiary network (Belderbos & Zou, 2009).

<sup>5</sup>Since the dependent variable emerges from a change-based measure of subsidiary expansion/contraction, we used the Trend Survey data from 1996 to 2001.

<sup>6</sup>The Trend Survey is conducted under the authority of Article 4 of the Statistical Reports Coordination Act in Japan, therefore the names of the participating corporations and subsidiaries are confidential.

<sup>7</sup>The following variables were included in the first-stage model: country platform subsidiary, export ratio, relative performance, network size, network redundancy, change in institutional environment, parent firm sales, subsidiary sales, parent firm international

experience, parent firm local experience, subsidiary age, change in subsidiary export ratio, change in the number of subsidiaries in each host country, change in the number of subsidiaries outside crisis countries, and country dummies.

<sup>8</sup>See Wooldridge (1995) for formal equations and detailed descriptions.

<sup>9</sup>We also operationalized network size by counting the number of subsidiaries under the same parent firm: this alternative option did not affect our results.

<sup>10</sup>We also investigated the percentage change of subsidiary capitalization using the same independent variables of interest. While the directions of the coefficients were generally consistent with those reported here, the results were not statistically significant. We speculate that subsidiary capitalization may not be easily adjusted according to changes in external environments such as economic crises.

<sup>11</sup>We also ran fixed-effects models as a robustness check. Since the fixed-effects model prevents the inclusion of variables that do not vary across time, we could not add the time-invariant indicators for countries, industries, or parent firms to the fixed-effects model. Results for the fixed-effects models were generally consistent with the random-effects results.

## REFERENCES

- Allen, L., & Pantzalis, C. 1996. Valuation of the operating flexibility of multinational corporations. *Journal of International Business Studies*, 27(4): 633–653.
- Amram, M., & Kulatilaka, N. 1999. *Real options: Managing strategic investment in an uncertain world*. Boston: Harvard Business School Press.
- Belderbos, R., & Sleuwaegen, L. 2005. Competitive drivers and international plant configuration strategies: A product-level test. *Strategic Management Journal*, 26(6): 577–593.
- Belderbos, R., & Zou, J. 2007. On the growth of foreign affiliates: Multinational plant networks, joint ventures, and flexibility. *Journal of International Business Studies*, 38(7): 1095–1112.
- Belderbos, R., & Zou, J. 2009. Real options and foreign affiliate divestments: A portfolio perspective. *Journal of International Business Studies*, 40(4): 600–620.
- Bell, G., & Campa, J. 1997. Irreversible investments and volatile markets: A study of the chemical processing industry. *Review of Economics and Statistics*, 79(1): 79–87.
- Birkinshaw, J., & Hood, N. 1997. An empirical study of development processes in foreign-owned subsidiaries in Canada and Scotland. *Management International Review*, 37(4): 339–364.
- Birkinshaw, J., Holm, U., Thilenius, N., & Arvidsson, N. 2000. Consequences of perception gaps in the headquarters–subsidiary relationship. *International Business Review*, 9(3): 321–344.
- Bowman, E., & Hurry, D. 1993. Strategy through the option lens: An integrated view of resource investments and the incremental-choice process. *Academy of Management Review*, 18(4): 760–782.
- Brouthers, K., Brouthers, B., & Werner, S. 2008. Real options, international entry mode choice and performance. *Journal of Management Studies*, 45(5): 936–960.
- Campa, J. 1994. Multinational investment under uncertainty in the chemical processing industries. *Journal of International Business Studies*, 25(3): 557–578.
- Chan, C. M., Isobe, T., & Makino, S. 2008. Which country matters? Institutional development and foreign affiliate performance. *Strategic Management Journal*, 29(11): 1179–1205.
- Chi, T. 2000. Option to acquire or divest a joint venture. *Strategic Management Journal*, 21(6): 665–687.
- Chung, C. C., & Beamish, P. W. 2005a. Investment mode strategy and expatriate strategy during times of economic crisis. *Journal of International Management*, 11(3): 331–355.
- Chung, C. C., & Beamish, P. W. 2005b. The impact of institutional reforms on characteristics and survival of foreign subsidiaries in emerging economies. *Journal of Management Studies*, 42(1): 35–62.
- Chung, C. C., Lu, J., & Beamish, P. W. 2008. Multinational networks during times of economic crisis versus stability. *Management International Review*, 48(3): 279–295.
- Coucke, K., Pennings, E., & Sleuwaegen, L. 2007. Employee layoff under different modes of restructuring: Exit, downsizing or relocation. *Industrial and Corporate Change*, 16(2): 161–182.
- Davis, R., & Thomas, L. 1993. Direct estimation of synergy: A new approach to the diversity-performance debate. *Management Science*, 39(11): 1334–1346.
- Garud, R., Kumaraswamy, A., & Nayyar, 1998. Real options or fool's gold? Perspective makes the difference. *Academy of Management Review*, 23(2): 212–214.
- Girotra, K., Terwiesch, C., & Ulrich, K. 2007. Valuing R&D projects in a portfolio: Evidence from the pharmaceutical industry. *Management Science*, 53(9): 1452–1466.

- Hannan, M. T., & Freeman, J. 1984. Structural inertia and organizational change. *American Sociological Review*, 49(2): 149–164.
- Haynes, M., Thompson, S., & Wright, M. 2003. The determinants of corporate divestment: Evidence from a panel of UK firms. *Journal of Economic Behavior and Organization*, 52(1): 147–166.
- Heckman, J. 1979. Sample selection bias as a specification error. *Econometrica*, 47(1): 153–161.
- Hurry, D. 1993. Restructuring in the global economy: The consequences of strategic linkages between Japanese and US firms. *Strategic Management Journal*, 14(Summer Special Issue): 69–82.
- Feinberg, S., & Keane, M. 2006. Accounting for the growth of MNC-based trade using a structural model of US MNCs. *American Economic Review*, 96(5): 1515–1558.
- Fisch, J. 2008. Investment in new foreign subsidiaries under receding perception of uncertainty. *Journal of International Business Studies*, 39(3): 370–386.
- Jacque, L., & Vaaler, P. 2001. The international control conundrum with exchange risk: An EVA framework. *Journal of International Business Studies*, 32(4): 813–832.
- Johnson Jr, J. 1995. An empirical analysis of the integration-responsiveness framework: US construction equipment industry firms in global competition. *Journal of International Business Studies*, 26(3): 621–635.
- Kogut, B. 1989. A note on global strategies. *Strategic Management Journal*, 10(4): 17–31.
- Kogut, B. 1991. Joint ventures and the option to expand and acquire. *Management Science*, 37(1): 19–33.
- Kogut, B., & Chang, S.-J. 1996. Platform investments and volatile exchange rates: Direct investment in the US by Japanese electronic companies. *Review of Economics and Statistics*, 78(2): 221–231.
- Kogut, B., & Kulatilaka, N. 1994a. Operating flexibility, global manufacturing, and the option value of a multinational network. *Management Science*, 40(1): 123–139.
- Kogut, B., & Kulatilaka, N. 1994b. Options thinking and platform investments: Investing in opportunity. *California Management Review*, 36(2): 52–71.
- Kulatilaka, N., & Perotti, E. C. 1998. Strategic growth options. *Management Science*, 40(8): 744–758.
- Lee, S., & Makhija, M. 2009a. The effect of domestic uncertainty on the real options value of international investments. *Journal of International Business Studies*, 40(3): 405–420.
- Lee, S., & Makhija, M. 2009b. Flexibility in internationalization: Is it valuable during an economic crisis? *Strategic Management Journal*, 30(5): 537–555.
- McGrath, R. G. 1997. A real options logic for initiating technology positioning investments. *Academy of Management Review*, 22(4): 974–996.
- McGrath, R. G. 1999. Falling forward: Real options reasoning and entrepreneurial failure. *Academy of Management Review*, 24(1): 13–30.
- Miller, K. D. 1992. A framework for integrated risk management in international business. *Journal of International Business Studies*, 23(2): 311–331.
- Miller, K. D., & Reuer, J. J. 1998. Firm strategy and economic exposure to foreign exchange rate movements. *Journal of International Business Studies*, 29(3): 493–513.
- Monteiro, L., Arvidsson, N., & Birkinshaw, J. 2008. Knowledge flows within multinational corporations: Explaining subsidiary isolation and its performance implications. *Organization Science*, 19(1): 90–107.
- Pantzas, A. 2001. Does location matter? An empirical analysis of geographic scope and MNE market valuation. *Journal of International Business Studies*, 32(1): 133–155.
- Pantzas, C., Simkins, B., & Laux, P. 2001. Operational hedges and the foreign exchange exposure of US multinational corporations. *Journal of International Business Studies*, 32(4): 793–812.
- Rangan, S. 1998. Do multinationals operate flexibly? Theory and evidence. *Journal of International Business Studies*, 29(2): 217–237.
- Reuer, J., & Leiblein, M. 2000. Downside risk implications of multinationality and international joint ventures. *Academy of Management Journal*, 43(2): 203–214.
- Reuer, J., & Tong, T. W. 2005. Real options in international joint ventures. *Journal of Management*, 31(3): 403–423.
- Richardson, J. 1993. Parallel sourcing and supplier performance in the Japanese automobile industry. *Strategic Management Journal*, 14(5): 339–350.
- Roth, K., & Morrison, A. 1990. An empirical analysis of the integration-responsiveness framework in global industries. *Journal of International Business Studies*, 21(4): 541–564.
- Rugman, A. M. 1979. *International diversification and the multinational enterprise*. Lexington, MA: Lexington Books.
- Sartori, A. E. 2003. An estimator for some binary-outcome selection models without exclusion restrictions. *Political Analysis*, 11(2): 111–138.
- Sharp, D. J. 1991. Uncovering the hidden value in high-risk investments. *Sloan Management Review*, 32(2): 69–74.
- Singh, K., & Yip, G. 2000. Strategic lessons from the Asian crisis. *Long Range Planning*, 33(5): 706–729.
- Song, J. 2002. Firm capabilities and technology ladders: Sequential foreign direct investments of Japanese electronics firms in East Asia. *Strategic Management Journal*, 23(3): 191–210.
- Stinchcombe, A. L. 1965. Social structure and organizations. In J. G. March (Ed.), *Handbook of organizations*. Chicago, IL: Rand McNally.
- Sundaram, A. K., & Black, J. S. 1992. The environment and internal organization of multinational enterprises. *Academy of Management Review*, 17(4): 729–757.
- Tambunan, T. 2000. *Development of small-scale industries during the new order government in Indonesia*. Oxon, UK: Gower Publishing Limited.
- Tang, C., & Tikoo, S. 1999. Operational flexibility and market valuation of earnings. *Strategic Management Journal*, 20(8): 749–761.
- Tanriverdi, H., & Venkatraman, N. 2005. Knowledge relatedness and the performance of multibusiness firms. *Strategic Management Journal*, 26(2): 97–119.
- Tong, T. W., & Reuer, J. J. 2007. Real options in multinational corporations: Organizational challenges and risk implications. *Journal of International Business Studies*, 38(2): 215–230.
- Tong, T. W., Reuer, J. J., & Peng, M. W. 2008. International joint ventures and the value of growth options. *Academy of Management Journal*, 51(5): 1014–1029.
- UNCTAD. 2000. *World investment report 2000: Transnational corporations, market structure and competition policy*. New York: United Nations.
- Vassolo, R. S., Anand, J., & Folta, T. B. 2004. Non-additivity in portfolios of exploration activities: A real options-based analysis of equity alliances in biotechnology. *Strategic Management Journal*, 25(11): 1045–1061.
- Volberda, H. 1997. Building flexible organizations for fast-moving markets. *Long Range Planning*, 30(2): 169–183.
- Wooldridge, J. 1995. Selection corrections for panel data models under conditional mean independence assumptions. *Journal of Econometrics*, 68(1): 115–132.

## APPENDIX

See Table A1.

**Table A1** Period-specific first-stage selection results

<i>Dependent variable (Continuation = 1; Termination = 0)</i>	1997		1998		1999		2000		2001	
	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.
<i>Independent variable</i>										
Export ratio	1.345	(2.101)	1.616**	(0.805)	0.402**	(0.201)	3.434**	(1.722)	0.606**	(0.250)
Country platform	1.235*	(0.739)	0.740	(0.652)	0.413*	(0.238)	0.305*	(0.179)	0.117	(0.095)
Relative (poor) performance	-0.026	(0.075)	-0.014	(0.116)	-0.037	(0.031)	-0.005	(0.036)	-0.003	(0.032)
Network size	0.051	(0.444)	0.043	(0.276)	0.110	(0.091)	0.077	(0.096)	0.031	(0.052)
Network redundancy	-0.019	(0.103)	-0.002	(0.001)	-0.001	(0.001)	-0.002	(0.005)	-0.001	(0.003)
Change in institutional environment	1.968	(3.310)	0.611	(1.459)	0.294	(0.374)	0.041	(1.416)	0.326	(0.431)
Parent firm sales (log)	-0.037	(0.213)	-0.081	(0.079)	-0.119*	(0.069)	0.006	(0.048)	-0.145***	(0.052)
Subsidiary sales (log)	0.299***	(0.097)	0.271***	(0.064)	0.253***	(0.051)	0.240***	(0.049)	0.132***	(0.027)
Parent firm international experience	0.016	(0.056)	0.022	(0.026)	0.003	(0.012)	0.003	(0.021)	0.014	(0.009)
Parent firm local experience	0.082	(0.091)	-0.037	(0.031)	0.005	(0.014)	-0.042	(0.027)	0.002	(0.011)
Subsidiary age	-0.027	(0.050)	0.007	(0.030)	-0.018*	(0.010)	0.012	(0.023)	-0.004	(0.010)
Change in subsidiary export ratio	0.477	(5.302)	0.862	(3.712)	0.410	(0.327)	2.132	(3.225)	-0.002	(0.091)
Change in no. of subsidiaries in each host country	-0.052	(0.877)	0.502	(0.793)	-0.176	(0.232)	-0.136	(0.509)	0.111	(0.246)
Change in no. of subsidiaries outside crisis countries	0.079	(0.130)	0.079	(0.164)	0.011	(0.054)	0.005	(0.079)	-0.006	(0.039)
Country dummies	Included		Included		Included		Included		Included	
Constant	0.836	(2.918)	2.990	(1.876)	3.746**	(1.874)	2.439**	(1.135)	2.339***	(0.726)
Number of manufacturing subsidiaries	943		1104		1174		1214		1254	
LR chi-square	181.68***		253.55***		119.12***		149.14***		163.5***	

Note: Parent firm and manufacturing industry dummies are not included, since several parent firms and industries in the sample had only one subsidiary in crisis-stricken countries in a given year; those parent and industry dummies would have been perfectly correlated with subsidiary continuation/termination.

\*p < 0.10; \*\*p < 0.05; \*\*\*p < 0.01, all from two-tailed tests.





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