

# DOWNSIDE RISK IMPLICATIONS OF MULTINATIONALITY AND REAL OPTIONS

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## *Abstract*

This paper studies the relationship between multinationality and performance under a real options lens. Based on a cross-sectional panel of multinational corporations (MNCs) that are likely to use real options reasoning for the management of their operations, we test the impact of operating and strategic options on firms' risk-returns parameters. Our evidence reveals that both multinationality and flexibility enhance corporate performance and reduce downside risk.

## *Keywords*

Multinationality, Real Options, Downside risk, Empirics

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## **Introduction**

The importance of real options theory in modern business disciplines is now a widely accepted fact. No serious academic work dealing with the topic of uncertainty can nowadays afford to disregard the issue of managerial flexibility or real options in planning and decision making. Options are everywhere in every day life, ready to determine the paths for our future operating and strategic actions. In corporate environments, real options (options on real assets) can be exercised at any level of the value chain and any rank of the managerial hierarchy. This specificity makes the academic subject applicable to every area of economic and organisational sciences. Real options can in general be viewed as capabilities enabling firms to make optimal decisions under uncertainty or as simple heuristics shaping the strategic agenda of organisations (McGrath, 1997; Kogut and Kulatilaka, 2004). In theory, an option entitles its owner the possibility to benefit from upside opportunities and reduce downside risk. Despite a large body of literature on the concept, empirical works testing the performance impacts of real options are scarce (Allen and Pantzalis, 1996; Reuer and Leiblein, 2000; Bloom and Van Reenen, 2002; Ramezani et al., 2002; Tong and Reuer, 2004; Bulan, 2005). This gap in knowledge makes the theory vulnerable in face of recent criticism raised by practitioners and corporate strategy scholars (Busby and Pitt, 1997; Coff and Laverty, 2001; Carr, 2002; Adner and Levinthal, 2004). We aim to overcome some of these limitations by empirically testing the performance and downside risk impacts of multinationality and real options in global firms.

This paper proceeds as follows: the second section reviews the main hypotheses relating multinationality and flexibility to firms' profits and downside risks. The third section presents the research methodology of the study and highlights our empirical findings in a subsequent section. The conclusion discusses the various results and suggests some directions for further research.

## **Theory and Hypotheses**

The incorporation of real options theory into the international business literature has helped shed light on the potential benefits of internationalisation to multinational firms (Rugman and Li, 2005; Reuer and Leiblein, 2000). Thanks to a worldwide network of operations and the heterogeneity of foreign markets, international companies are able to benefit from growth and arbitrage opportunities that domestic firms do not have (Kogut, 1984, 1989). Specifically, a multinational enterprise holds a portfolio of operating and strategic real options that enable it, through managerial flexibility, to avoid events of unfavourable nature and select outcomes with better endings (Kogut, 1983; Trigeorgis, 1996, McGrath, 1997). Thus, as a response to

potential changes in local demands, hostile governments/competitors' actions or adverse movements in foreign exchange rates, a multinational corporation has the right but not the obligation to shift production and operations across borders for more favourable locations (Kogut and Kulatilaka, 1994a; Allen and Pantzalis, 1996; Reuer and Leiblein, 2000). These kinds of operating options are not held by domestic rivals. In the same manner, the decision to enter new markets or invest in international R&D provides multinational firms with growth option opportunities that domestic firms might lack of (Trigeorgis, 1996).

Drawn from the theory of real options, this idea of multinationals' competitive advantage (Kogut, 1983), also referred to as the multinational network hypothesis (MNH) (Pantzalis, 2001), posits that the dispersion of foreign activities combined to the embedded flexibility of operations entitles global corporations to mirror higher levels of performance than domestic counterparts. In other words, multinationality and flexibility are performance driving parameters that increase profits of MNCs and reduce downside risk. In spite of the significant number of works investigating the validity of the theory<sup>2</sup>, only few have attempted to treat the topic using a real options perspective (Allen and Pantzalis, 1996; Pantzalis, 2001; Reuer and Leiblein, 2000; Reuer and Tong, 2003; Tong and Reuer, 2004). Reuer and Leiblein (2000) in particular, test the effects of multinationality and international joint ventures (IJVs) on U.S manufacturing firms' downside risk. Their findings reveal that US firms with greater multinationality or greater investments in IJVs do not generally obtain lower levels of downside risk. These results become inaccurate once we know that not all companies in the world adopt an option based view towards investments (Graham and Harvey, 2001). Echoing Kogut's call for research (1984) about company capability to manage its real options, we affirm that only firms that have developed adequate organisational structures or managerial systems to manage flexibility are able to validate MNH. Reuer and Leiblein (2000) seem to defend this idea as well.

We intend to complement their findings by highlighting the importance of "real options awareness" in the management of multinational flexibility. We believe that this knowledge factor can be seen as a significant step towards the determination of the so called "capability" defended by Kogut (1984). Based on a sample of 96 multinational corporations likely to be using real options reasoning/modelling for investments appraisal, we empirically show that multinationality can reduce downside risk and increase profits as predicted by the Multinational Network Hypothesis (Kogut, 1983) and hence real options theory (Trigeorgis, 1996; McGrath, 1997).

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<sup>2</sup> See Gomes and Ramaswamy (1999) for a detailed review

## **Background**

The investigation of the performance-multinationality linkage in international firms has become a key research topic in the international business (IB) literature since the work of Vernon (1971)<sup>3</sup>. Driven by the theoretical predictions of diversification, internalisation and other international strategy theories, researchers from various academic fields have continuously attempted to capture the performance effects of multinationality in organisations through time (Pantzalis, 2001; Seth et al., 2002). Thus, some scholars examined the impact of multinationality on corporate profits, based on accounting measures such as return on assets, return on sales, sales growth or return on equity (Buckley, Dunning and Pearce, 1978; Rugman, 1986; Kumar, 1984; Grant, 1987, Ramaswamy, 1995; Gomes and Ramaswamy, 1999), others focused on the risk-return effects of international FDI using specific market-based metrics of financial performance, such as excess market value (Kim and Lyn, 1986; Doukas and Travlos, 1988; Morck and Yeung, 1991; Seth et al., 2002), stock returns or financial market risks (Miller and Pras, 1980; Rugman, 1986; Kim et al., 1993). Variety in performance and multinationality metrics as well as significant differences in research and statistical designs have been advocated as the main factors explaining the recurrent empirical inconsistencies characterising the topic since Vernon (1971) (Sullivan, 1994; Allen and Pantzalis, 1996; Gomes and Ramaswamy, 1999). As a matter of fact, there is no consensual agreement about the nature of the relationship between multinationality and performance in IB research. Some researchers suggest that the association can be positive (negative) and linear vis-à-vis profits (risk) (Vernon, 1971; Grant, 1987; Qian, 1996; Kim et al., 1993) others might argue that this association is in fact insignificant (Kumar, 1984; Tallman and Li, 1996), negative (Chang and Thomas, 1989) or curvilinear (Sullivan, 1994; Gomes and Ramaswamy, 1999).

We believe that the confinement of the study of this linkage within a real options framework might help overcome these empirical inaccuracies. In accord with the MNH, we conjecture that only firms that have chosen to exercise the option to manage their real options will display a positive performance-multinationality association, i.e.: positive (negative) relationship between profits (downside risk) and multinationality. The multinationality of companies' operations and strategic investments indeed enables every MNC to exercise its options to delay entry in a new market, expand or contract production via outsourcing, switch use of inputs through operations shifting or grow into new expanding markets (Trigeorgis, 1997). Trigeorgis (1996) map these various managerial actions into growth (strategic flexibility) and operating options (operating or operational flexibility), depending on the

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<sup>3</sup> See Osegowitsch (2003) for a complete review on the subject

nature of striking the option and the environmental factors surrounding the timing of exercise. Growth options can accordingly be exemplified via any strategic investment embedding a successive chain of interdependent real options that might only appear when a next option is exercised (Smit and Trigeorgis, 2004). Specifically, the decision to enter a new market through greenfield or R&D investments, in addition to present an immediate expansion opportunity, grants the owner of the option, the right to benefit from further growth opportunities that might emerge following a successful exercise of the original option. Operating options on the other hand, are represented by the set of operational hedges to be exercised within a company's internal operations, following a change in endogenous and exogenous uncertainties. The options to shift operations from one country to another subsequent to an adverse movement in exchange rates as well as delaying production or shutting down operations after a sudden decline in products demands, illustrate three flexibility cases allowing options' owners (the firm) to protect their risk exposure from downside movements (Trigeorgis, 1996). The validity of these statements is amplified by the impact of internationalisation, as a construct, on firms' operations and strategic investments. Multinationality should naturally yield a higher number of operating and strategic options to MNCs.

Whether most multinational companies are aware of their real options and are able to manage them accurately is the question of crucial significance in this research. In accord with Kogut (1984), we affirm that it is the management of embedded options that drives performance and not only multinationality in itself. This latter only builds the landscapes for an options' harvest. The ability to pick edible tomatoes from a tomatoes' garden is indeed function of the gardening skills of who will be picking them (Luehrman, 1998). In this direction, it is interesting to point out that, according to the findings of some influential capital budgeting surveys (Ryan and Ryan, 2002; Graham and Harvey, 2001), only 10 to 26%, depending on the period, of Fortune 1000 companies casually use real options techniques for their real assets allocation. In a similar scope, Busby and Pitts (1997) divulge that out of the set of UK FTSE100 companies they surveyed, only 25% were interested in applying real options reasoning to monitor their investments. In fact, Ryan and Ryan (2002) highlight that 88.6% of companies they consulted, rarely or never used real options as a capital budgeting tool. These figures provide a clear answer to the capability issue raised by Kogut and Kulatilaka (1994b) and partly undermine Reuer and Leiblein (2000) findings.

By selecting all U.S manufacturing firms in the SIC range 3000-3999 that had data available for their period of study, the authors erroneously supposed that an option-based approach towards international investments might have been a common practice in the U.S

manufacturing sector. Clearly, this was far from being the case. The main contribution of the present study lies in our ability to identify a real options awareness factor predisposing firms to confirm the contents of the MNH and use this kind of capability as a criterion for our sample selection. We consider that the introduction of this real option knowledge parameter might overcome the limits of Reuer and Leiblein (2000) findings. We define “real options awareness” as a firm’s ability to recognise and manage its real options using an option-based view of decision making, i.e.: real options thinking or/and modelling.

## **Hypotheses**

Given that the firm is aware of its real options:

Hypothesis 1. A firm’s multinationality will be positively (negatively) related to performance (risk)

- Hypothesis H1.a. A firm’s multinationality will be positively related to its profits
- Hypothesis H1.b. A firm’s multinationality will be inversely related to its downside risk.

The geographic dispersion of operations provides firms with hedging and arbitrage opportunities than domestic competitors cannot have. Growth and operating options are embedded in these operations. Multinationality sets the ground for the “markets” in which these options can be exercised. Clearly, a corporation’s multinationality should positively contribute to its performance.

Hypothesis 2. A firm’s operating flexibility or operating options will be positively (negatively) related to performance (risk)

- Hypothesis H2.a. A firm’s operating options will be positively related to its profits
- Hypothesis H2.b. A firm’s operating options will be inversely related to its downside risk.

Operating options are hedging tools contained in a company’s current operations. Because of the operational nature of these decisions (shifting, deferral or extension), it is predictable to account for operating options in plants, properties and equipments (Ramezani et al., 2002). The firm’s overall performance should be function of these components.

Hypothesis 3. A firm's growth options or strategic flexibility will be positively (negatively) related to performance (risk)

- Hypothesis H3.a. A firm's growth options will be positively related to its profits
- Hypothesis H3.b. A firm's growth options will be inversely related to its downside risk.

Strategic options are determined by a firm's growth opportunities. These are in turn reflected in the company's strategic investments i.e., FDI and R&D. The excess market value of assets is an indicator of a firm's growth potential (Kester, 1984). Naturally, growth should positively contribute to performance.

## Methods

### Model Specification

Based upon the few "real options" studies that have examined the performance-multinationality linkage (Allen and Pantzalis, 1996; Pantzalis, 2001; Reuer and Leiblein, 2000; Reuer and Tong, 2003; Tong and Reuer, 2004) and the various predictions drawn from the previous section, we obtained the following multivariate statistical models:

$$P_t = B_2 \text{Multinationality}_{t-1} + B_3 \text{OperatingOptions}_t + B_4 \text{GrowthOptions}_{t-1} + B_5 \text{Organisational Slack}_t + B_1 \text{Firm Size}_t + B_6 \text{Industry}P_t + e_t \quad (1)$$

$P_t$ : Firm performance, including returns (ROA, ROE, ROI) and downside risks

$\text{Multinationality}_{t-1}$ : The spread of firm overseas activities across countries

$\text{Industry}P_t$ : Industry average performance (return) or average downside risk

The subscripts indicate the time lags that were used (for growth and multinationality) in order to rule out potential problems of reverse causality in cross sectional risk and return models (Bromiley, 1991). The validity of this model is tested on performance data from to the 2000-2004 period. Two adjacent five-year periods during the years 1995-2004 were used for model setting. The availability of data about real options potential users for both periods, justifies the specific timing. Claims made by Triantis and Borison (2001) regarding the importance of the 1990s era in the spread of real options techniques in industry comfort this position. Organisational slack is introduced as a control variable, in order to capture an organisation's ability to buffer against uncertainty (Thompson, 1967; Reuer and Leiblein, 2000). Consistent with previous studies on the subject (Buckley, Dunning and Pearce, 1977; Gomes and

Ramaswamy, 1999; Reuer and Leiblein, 2000), firm size has been explicitly controlled for. Controls for industry risk and performance are evidently incorporated in the models.

### Measures and Data

**Performance.** Six performance metrics have been selected as the dependent variables of our models; return on assets (ROA), return on equity (ROE), return on invested capital (ROI) and their specific downside equivalents. The first three are calculated as the arithmetic average returns of each company from 2000 to 2004. This specificity intends to capture the long term effect of real options, as well as maintain the assumption of a firm's strategic stability. The downside risk measures have been drawn from Miller and Leiblein (1996) and Reuer and Leiblein (2000) set of risk indicators. We specified downside risk as a function of a firm's annual return (ROA, ROE and ROI) relative to a target level (Miller and Reuer, 1996). The mean ROA, ROE and ROI of the industry for each of the five years became a proxy for this target level. We considered that downside risk might be represented by any downside outcome relative to the industry current annual performance. Downside risks have been computed as second order roots lower partial moments:

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

These measures that are probability weighted functions of below target performance outcomes have been previously used in strategy and IB studies dealing with the question of downside risk (Miller and Leiblein, 1996; Reuer and Miller, 1996; Reuer and Leiblein, 2000; Reuer and Tong, 2003). First introduced by Bawa (1975) and Fishburn (1977), the family of lower partial moments or below-target risk measures aim to capture performance outcomes that are falling below a set target, in contrast to conventional variance metrics that emphasize the entire performance distribution of firm performance. For comparison and robustness purposes, equation (2) was implemented for ROE and ROI as well. The downside risk ROA measure is reflective of a company income stream risk (Reuer and Miller, 1996; Reuer and Leiblein, 2000). Downside risk ROE can be an indicator of bankruptcy risk due to its high correlation with Altman Z (Miller and Reuer, 1996). Downside risk ROI would simply be an investment risk indicator.

### Explanatory Variables

Multinationality is defined as the logarithm of 1 plus the number of countries in which a firm has foreign subsidiaries. This definition of multinationality has been followed by Caves and



Mehra (1986), Allen and Pantzalis (1996) and Reuer and Leiblein (2000). Foreign subsidiaries data have been obtained from the 1995-1999 Lexis-Nexis International Directory of Corporate Affiliations.

Operating Flexibility or Operating Options (OO) is defined as the set of operational hedging decisions enabling firms to diminish their exposure in face of downside losses. As revealed in the previous subsection, these hedges should be located in a company's plants, properties and equipments (Ramezani et al., 2002; Trigeorgis, 1996). Subsequently, we use the net ratio of plant, property and equipment over assets (PPEOA) as a proxy for operating flexibility. This metric measures the extent to which a company uses its capital installations and is supposed to positively contribute to performance. Bernardo et al. (2001) and Ramezani (2003) use PPEOA as a real options proxy. We set the firm's (2000-2004) average PPEOA as  $OO_t$  in our models.

Strategic Flexibility (GO) combines two specific growth proxies, mainly the Market-to-Book Asset ratio (MA) (Ramezani et al., 2002) and R&D intensity (Allen and Pantzalis, 1996; Tong and Reuer, 2004). The first ratio is used in the finance literature as a means of approximating a company's growth opportunities (Kester, 1984). The treatment of R&D investments as compound options in the real options literature (Trigeorgis, 1996) has naturally justified the inclusion of R&D intensity in our models. Tong and Reuer (2004) moreover show that this variable positively contributes to a company's growth option value. Both ratios have been respectively computed following Ramezani et al. (2002) and Tong and Reuer (2004) methods. We decided to combine them within one proxy, using principal component analysis. The implementation of factor analysis helped us build a homogenous growth indicator able to capture the impact of firm external and internal strategic capabilities. This indicator is computed as the arithmetic mean GO of a company over the first half of our study period (1995-1999).

### **Control Variables**

Because of their potential relationships with dependant and theoretical variables, we decided to include size, organisational slack (Miller and Leiblein, 1996) and industry average risks and returns as our control variables. These measures have been incorporated in preceding multinationality (Buckley, Dunning and Pearce, 1977; Gomes and Ramaswamy, 1999; Reuer and Leiblein, 2000) and real options studies (Reuer and Leiblein 2000; Tong and Reuer, 2004).

Firm size has been measured as the log of average net sales over the 2000-2004 period. We calculated organisational slack using the ratio of a firm's selling, general and administrative expenses to total sales (Singh, 1986; Bromiley, 1991; Tong and Reuer, 2004). This ratio was normalised by the industry average. The average organisational slack over the period of study was incorporated in the multivariate models. Industry performance (risk) was the mean performance (downside risk) for all other similar size firms in the firm's industry. Accounting data on the different variables was obtained from Datastream and Worldscope financial databases.

## **Sample**

The base sample of this research (N=122) consisted of all MNCs that have shown an awareness towards real options theory in recent years. Companies cited in the literature or acknowledged to have received consulting expertise in real options management have been identified as **significantly aware** of their real options. Firms that have shown significant interest in the theory, mainly through symposiums' or training attendance, were classified as **potentially aware**. We assume that this awareness is significant enough to be used as a planning and thinking tool. If our results contradict Reuer and Leiblein (2000) results, which is the case, this will simply mean that this factor contributed to companies' performance.

After a careful review of the real options literature, we found that up to 37 MNCs have been cited as either using the real options technology or considering its implementation (Amram and Kulatilaka, 1999; Bowman and Moscovitz, 2001; Triantis and Borison, 2001; Copeland and Antikarov, 2001; Schwartz and Trigeorgis, 2001; Smit and Trigeorgis, 2004, Kemna, 1993; Pennings and Lint, 1997; De Neufville, 2003; Mun, 2002; Mun, 2003; Borissiouk and Peli, 2001; Copeland and Tufano, 2004; Rohini, 2002; Raynor, 2002; Pandza et al., 2003). Thirty one companies have received specific consulting expertise or training in real options modelling/thinking from leading consulting groups as Decisionneering, Inc; The Real Options Group (ROG); or Deloitte. Information about client companies can be found in the groups' internet portals. Seventy six MNCs took part to international symposiums dealing with the topic of real options. The lists of participants attending the ROG annual conference from 2001 to 2005 were used as our main source of information for this selection criterion. Thus, every international company that participated to the ROG conferences from 2001 to 2005 has been considered as a potential real options' thinking user. The various investigations have yielded a number of 122 companies (111 of which are international firms) displaying a non negligible awareness of the real options technology. Significantly, we found out that all these firms were part of Forbes 1500 biggest companies, which is consistent with the proportions highlighted by the above mentioned surveys (Ryan and Ryan, 2002)..

Given the diversity of sources, some scepticism might be raised vis-à-vis the degrees of significance of the awareness skill and hence the reliability of our final sample. This might be perceived as one limitation of the study and it is; however, the work itself is a good first step towards more accurate testing (i.e. empirical tests on real options users only) of some of the theory's main predictions. We naturally admit that obtaining this sample does not necessarily guarantee that the MNCs selected have institutionalised the real options technology in headquarters; we only consider that these firms have at least reached a competitive step towards doing so. Determining the nature and dimension of this step is indeed worth investigating. Still, MNCs which are armed with the “real options awareness” specificity are more inclined to validate Kogut's (1983) MNH. The final sample (N=96, 86 of which are manufacturing firms) consisted of all firms from the previous 111 that had accounting and multinationality data available from Datastream, Worldscope and the international directory of corporate affiliations for the period.

## Results

Table 1.1 below presents a correlation matrix for our performance and risk variables. One can clearly observe the strong negative correlations between returns (ROA, ROE and ROI) and their downside risk counterparts (-0.716; -0.583; -0.72 respectively). This confirms the consistency of our risk measures. In the same sense, one can see the positive correlations between the three risk indicators. Tables 1.2 (ROA), 1.3 (ROE) and 1.4 (ROI) highlight the descriptive statistics of our models as well as correlation matrices for all variables. The average firm in the sample has foreign subsidiaries in more than 13 countries and average sales of US\$20.8 billion. One can also observe the negative (positive) correlations between downside risks (returns) and the model's independent variables. Nevertheless, the significant correlations among these constructs justify a use of multivariate analysis.

**TABLE 1.1**  
**Correlation Matrix (Dependent Variables)**

Variable	Mean	s.d.	1	2	3	4	5	6
1. ROA	0.0625	0.0632						
2. Downside risk, ROA	0.0193	0.0302	<b>-0.716**</b>					
3. ROE	0.1472	0.2364	0.783**	-0.541**				
4. Downside risk, ROE	0.0591	0.0921	-0.554**	<b>0.797**</b>	<b>-0.583**</b>			
5. ROI	0.1018	0.1080	0.955**	-0.723**	0.796**	-0.566**		
6. Downside risk, ROI	0.0315	0.0521	-0.675**	<b>0.958**</b>	-0.514**	<b>0.788**</b>	<b>-0.72**</b>	

+ p < .10  
 \* p < .05  
 \*\* p < .01  
 \*\*\* p < .001

**TABLE 1.2**  
**Descriptive Statistics and Correlation Matrix (ROA)**

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. ROA	0.0618	0.0638									
2. Downside risk, ROA	0.0199	0.0307	-0.716**								
3. Firm size	9.9420	1.1195	0.097	-0.253*							
4. Multinationality	2.6871	1.0747	0.299**	-0.279**	0.315**						
5. Operating options	0.3045	0.1669	0.120	-0.161	-0.065	-0.304**					
6. Growth Options <sup>a</sup>	0	1	0.352**	-0.074	-0.203*	0.171	-0.43**				
7. IndustryROA	0.0640	0.0341	0.606**	-0.113	-0.042	0.211*	0.133	0.302**			
8. IndustryRisk, ROA	0.0166	0.0053	0.164	0.120	-0.186 <sup>+</sup>	0.149	-0.32**	0.236**	0.128		
9. OrganisationalSlack	0.0572	0.8451	0.191 <sup>+</sup>	-0.167	-0.161	0.038	-0.076	0.110	0.007	0.031	

<sup>a</sup>This item is a principle component factor combining the MA ratio and R&D intensity

<sup>+</sup> p < .10  
\* p < .05  
\*\* p < .01  
\*\*\* p < .001

**TABLE 1.3**  
**Descriptive Statistics and Correlation Matrix (ROE)**

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. ROE	0.1472	0.2365									
2. Downside risk, ROE	0.0591	0.0920	-0.583**								
3. Firm size	9.9420	1.1195	0.094	-0.195 <sup>+</sup>							
4. Multinationality	2.6871	1.0747	0.269**	-0.201*	0.315**						
5. Operating options	0.3045	0.1669	0.094	-0.130	-0.065	-0.304**					
6. Growth Options <sup>a</sup>	0	1	0.173 <sup>+</sup>	-0.074	-0.203*	0.171	-0.43**				
7. IndustryROE	0.1394	0.1036	0.574**	0.091	0.023	0.182 <sup>+</sup>	0.128	0.176 <sup>+</sup>			
8. IndustryRisk, ROE	0.0541	0.0288	0.406**	0.139	-0.112	0.298**	-0.13	0.210*	0.487**		
9. OrganisationalSlack	0.0572	0.8451	0.238*	-0.150	-0.161	0.038	-0.076	0.110	0.010	0.029	

<sup>a</sup>This item is a principle component factor combining the MA ratio and R&D intensity

<sup>+</sup> p < .10  
\* p < .05  
\*\* p < .01  
\*\*\* p < .001

**TABLE 1.4**  
**Descriptive Statistics and Correlation Matrix (ROI)**

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. ROI	0.1018	0.1080									
2. Downside risk, ROI	0.0315	0.0521	-0.719**								
3. Firm size	9.9420	1.1195	0.117	-0.204*							
4. Multinationality	2.6871	1.0747	0.299**	-0.264**	0.315**						
5. Operating options	0.3045	0.1669	0.083	-0.174 <sup>+</sup>	-0.065	-0.304**					
6. Growth Options <sup>a</sup>	0	1	0.282**	-0.054	-0.203*	0.171	-0.43**				
7. IndustryROI	0.0998	0.0506	0.514**	-0.101	-0.025	0.231*	0.101	0.281**			
8. IndustryRisk, ROI	0.0271	0.0085	0.033	0.126	-0.145	0.039	-0.42**	0.379**	-0.119		
9. OrganisationalSlack	0.0572	0.8451	0.210*	-0.143	-0.161	0.038	-0.076	0.110	0.017	0.083	

<sup>a</sup>This item is a principle component factor combining the MA ratio and R&D intensity

<sup>+</sup> p < .10  
\* p < .05  
\*\* p < .01  
\*\*\* p < .001

We investigated potential multicollinearity problems through variance inflation factors (VIFs) and tolerance levels and found that there is no such evidence in the fourteen models presented in tables 2.1 (without multinationality) and 2.2 (including multinationality) below. The analysis of studentized residuals has produced no evidence of heteroskedasticity.

### Regression Results

Least Square regression techniques were used for the estimation of our models. Two regression models have been implemented to each of our performance measures. Models 1 to 4 (table 2.1) highlight the impact of strategic and operational flexibility on companies' profits without the multinationality variable. Model 8 to 11 (table 2.2) include the direct effects of this construct. Models 5 to 7 (table 2.1) display association of GO and OO with downside risk, without multinationality. Model 12 to 14 (table 2.2) incorporate this variable. Models 8 to 14 aim to capture the direct effect of multinationality on the various performance (profit and risk) indicators. Our findings (**significance levels for all models were determined by t-tests**) for Model 1 indicate that size ( $p < 0.01$ ) and organisational slack ( $p < 0.01$ ) have significant positive impacts on firm returns on assets. This statement is also true for firms' operating and strategic options ( $p < 0.05$ ,  $p < 0.001$  respectively). It further appears that operating options are most significantly related to ROA. These results are confirmed by the statistical outputs of Model 2. Size and slack are thus positively linked to return on invested capital ( $p < 0.01$ ). Strategic and operating options also show a valid association ( $p < 0.05$ ,  $p < 0.1$  respectively). Model 3 coefficients contradict part of these conclusions. It indeed turns out

that growth and operating options do not contribute to ROE. We presumed that this was due to the inability of financial markets to capture details of firms' R&D activities. We decided to exclude R&D from the ROE regression and consider the market to book asset ratio as the only growth indicator for this model. This hypothesis was comforted by subsequent results. Model 4 hence exhibits the positive effects of growth, size and slack on ROE ( $p < 0.05$ ,  $p < 0.05$  and  $p < 0.01$ ) and highlights a quasi association for operating options ( $p = 0.102$ ). Results for Models **1, 2 and 4** are in accord with the findings of Ramezani et al. (2002). Hypotheses 2a and 3a predictions are validated by those results. The introduction of the multinationality variable in Models 8 to 11 increases the  $R^2$  statistics to more accurate levels. This suggests that the internationalisation construct is not a negligible component of a firm overall performance. In the same scope, one can clearly observe the significant positive relationship between ROA and multinationality ( $p < 0.05$ ), ROI and multinationality ( $p < 0.1$ ) and ROE and multinationality ( $p < 0.1$ ,  $p < 0.05$ ). This association is even valid for Model 10 ( $p < 0.1$ ). Conclusions induced from table 2.1 (Models 1, 2 and 4) regarding strategic and operating flexibility also hold for the multinationality models treated in table 2.2 (Models 8, 9 and 11). These findings validate the predictions of hypotheses H1.a, H2.a and H3.a and reaffirm the positive linear association between profits and multinationality observed in the IB literature (Vernon, 1971; Grant, 1987; Allen and Pantzalis, 1996; Qian, 1996; Ramaswamy, 1999).

**TABLE 2.1**  
**Results of Least Square Regression Analyses (excluding multinationality)**

Variable	Profits							Downside Risk		
	Models 1 & 2		Models 3 & 4			Models 5 & 6		Model 7		
	ROA	ROI	ROE	ROE	ROA	ROI	ROE	ROI	ROE	
Intercept	-0.155** (0.047) <sup>++</sup>	-0.247** (0.089)	-0.401* (0.189)	-0.425* (0.183)	0.110*** (0.032)	0.165** (0.055)	0.305*** (0.092)			
Firm size	0.013*** (0.004)	0.022** (0.008)	0.033 <sup>+</sup> (0.018)	0.03 <sup>+</sup> (0.017)	-0.009*** (0.003)	-0.014** (0.005)	-0.023** (0.008)			
MA				<b>0.022</b> * (0.01)						
Operating options	<b>0.087</b> * (0.034)	<b>0.122</b> <sup>+</sup> (0.134)	0.161 (0.031)	0.165 (0.122)	<b>-0.055</b> ** (0.019)	<b>-0.084</b> * (0.035)	<b>-0.139</b> * (0.061)			
Growth options <sup>a</sup>	<b>0.021</b> *** (0.006)	<b>0.029</b> * (0.011)	0.031 (0.023)		<b>-0.012</b> ** (0.004)	<b>-0.016</b> * (0.006)	<b>-0.023</b> * (0.010)			
Organizational slack	0.016** (0.006)	0.029** (0.011)	0.07** (0.023)	0.069** (0.023)	-0.008* (0.003)	-0.012 <sup>+</sup> (0.006)	-0.021* (0.011)			
Industry	0.908*** (0.155)	0.902*** (0.191)	1.21*** (0.194)	1.172 (0.190)	1.242 <sup>+</sup> (0.708)	1.044 (0.743)	0.425 (0.318)			
R Square	49.8%	38.1%	41.2%	43.1%	22.4%	17.6%	15.2%			
Model F	17.9	11.13	12.6	13.7	5.19	3.73	3.22			
N (96-1 outlier)	95	95	95	95	95	95	95			

<sup>a</sup> Principle component factor combining the MA ratio and R&D intensity

<sup>+</sup> p < .10  
\* p < .05  
\*\* p < .01  
\*\*\* p < .001

++ Standard errors are between brackets

TABLE 2.2

Results of Least Square Regression Analyses (including multinationality)

Variable	Profit						Downside Risk			
	Models 8 & 9		Models 10 & 11		Models 12 & 13		Models 14			
	ROA	ROI	ROE	ROE	ROA	ROI	ROE	ROE	ROI	ROE
Intercept	-0.146** (0.050) <sup>++</sup>	-0.231** (0.088)	-0.376* (0.187)	-0.416* (0.179)	0.102*** (0.031)	0.161** (0.054)	0.271** (0.091)			
Firm size	0.010* (0.005)	0.017 <sup>+</sup> (0.009)	0.022 (0.019)	0.018 (0.018)	-0.007* (0.003)	-0.009 <sup>+</sup> (0.005)	-0.015 <sup>+</sup> (0.009)			
Multinationality	<b>0.009*</b> (0.004)	<b>0.015<sup>+</sup></b> (0.008)	<b>0.031<sup>+</sup></b> (0.017)	<b>0.037*</b> (0.017)	<b>-0.007**</b> (0.002)	<b>-0.011*</b> (0.004)	<b>-0.019*</b> (0.008)			
Operating options	<b>0.107**</b> (0.035)	<b>0.155*</b> (0.065)	0.223 (0.137)	<b>0.259*</b> (0.127)	<b>-0.066**</b> (0.019)	<b>-0.104**</b> (0.035)	<b>-0.167**</b> (0.061)			
Growth options	<b>0.021**</b> (0.006)	<b>0.028*</b> (0.011)	0.028 (0.023)		<b>-0.011**</b> (0.004)	<b>-0.013*</b> (0.006)	<b>-0.021*</b> (0.010)			
Organizational slack	0.015* (0.006)	0.027* (0.011)	0.068** (0.023)	0.065** (0.022)	-0.007* (0.003)	-0.011 <sup>+</sup> (0.006)	-0.019 <sup>+</sup> (0.011)			
MA				<b>0.024*</b> (0.009)						
Industry	0.825*** (0.157)	0.804*** (0.196)	1.137*** (0.196)	1.067*** (0.192)	1.386* (0.686)	0.896 (0.725)	0.659* (0.328)			
R square	<b>52.1%</b>	<b>40.7%</b>	<b>43.3%</b>	<b>46.1%</b>	<b>29.2%</b>	<b>23.7%</b>	<b>19.9%</b>			
Model F	16.16 95	10.1 95	11.316 95	12.67 95	5.883 95	4.322 95	3.643 95			
N (96-1 outlier)	95	95	95	95	95	95	95			

<sup>a</sup>Principle component factor combining the MA ratio and R&D intensity

<sup>+</sup> p < .10

\* p < .05

\*\* p < .01

\*\*\* p < .001

<sup>++</sup> Standard errors are between brackets



Downside risk outcomes are found in Models 5 to 7 and 12 to 14. One can observe that hypotheses H2.b and H3.b are validated in the various models. Size, slack, growth and especially operating options contribute to the reduction of firms' downside risks. GO and OO display significant inverse relationships with income stream risk ( $p < 0.01$ ), bankruptcy risk ( $p < 0.05$ ) and investment risk ( $p < 0.05$ ,  $p < 0.01$  respectively). The impact of the multinationality variable appears of strong significance again.  $R^2$  statistics are indeed enhanced in Models 12, 13 and 14 by significant amounts. This reflects the hedging role of multinationality in firm performance. Table 2.2 also depicts the significant negative relation between multinationality and downside risks ( $p < 0.01$  for Downside ROA;  $p < 0.05$  for Downside ROE and Downside ROI). Despite not being as important as the association between operating/strategic flexibility and performance, one can still say that multinationality reduces firms' downside risks. H1b is thus validated. The accuracy of the various downside risk models is acceptable for a cross sectional risk framework. These findings contradict Reuer and Leiblein (2000) results and validate the three hypotheses developed above. The MNH hypothesis works well with MNCs that have been aware of their real options.

## **Conclusion**

The main finding of this study is that multinational companies with "partial" real options capabilities are able through multinationality, operating and strategic flexibility to reduce their downside risk and take advantage of the upside opportunities available to them. The results authenticate the theoretical predictions of real options theory and Kogut's (1983) MNH. In continuation of Reuer and Leiblein (2000) research, this study sets the grounds for new ways of investigating the risk and return impacts of multinationality in MNCs and empirically underlines the benefits of real options management in strategy and operations. These findings strongly discredit the recent criticism raised by corporate strategy scholars towards the pertinence of real options in strategic management (Coff and Laverty, 2001; Carr, 2002; Adner and Levinthal, 2004). Areas of further study would consist into testing the validity of our conclusions using residual income performance variables (EVA and MVA) or comparing these outcomes with findings involving randomly selected samples. Testing the whole framework using more sophisticated statistical techniques (i.e. structural equation modelling) might also help increase the accuracy of results. The examination of the degree of diffusion or awareness of real options principles in multinational companies' headquarters should be another opportunity for further research. The incorporation of international joint ventures in the models is another option.

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