

Multinational Investment and the Value of Growth Options

**Multinational Investment and the Value of Growth Options:  
Alignment of Incremental Strategy to Environmental Uncertainty**

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## **Abstract**

**Research Summary:** One of the motivations for multinational firms' investment in foreign affiliates in uncertain environments is the future growth opportunities the investment may bring. We argue that whether firms derive growth option value from their multinational investment is determined by the interaction between market uncertainty and firms' incremental investment strategy. We show evidence that multinational investment creates growth option value for firms operating affiliates in host countries with high market uncertainty. In such uncertain environments, however, incremental investment strategies – limiting the equity stake or the size of investment in affiliates, across all countries or within each country – prove critical to the value of growth options. Creating growth option value therefore requires an alignment of firms' incremental investment strategy to the uncertain country environments they confront.

**Managerial Summary:** Managers have long recognized the importance of taking an incremental approach to strategy making, but evidence on whether and when strategic incrementalism is valuable to firms remains scarce. This study focuses on two ways Japanese multinational firms invest incrementally by limiting the equity stake or the size of investment in their foreign affiliates, and analyzes when such incremental strategies create growth option value. We find that these strategies, whether implemented across all host countries or within each country, do create significant growth option value, and that such option value is elevated the most under high market uncertainty. The findings highlight the importance of aligning firms' incremental strategy to the environmental uncertainties they confront, in line with the notion of fit core to strategic management.

**Keywords:** Real options theory, growth option value, multinational investment, incremental strategy, uncertainty, environmental conditions, alignment

## INTRODUCTION

Strategy scholars have long observed that firms often make strategic decisions incrementally (Mintzberg, 1978; Quinn, 1980; Miller and Friesen, 1982), and have sought to develop a theoretical explanation for the use of such incremental strategies. Research based on real options theory proposes that one of the key reasons why firms invest incrementally under uncertainty is to obtain growth options for future exercise (Kogut, 1991; Bowman and Hurry, 1993). This idea draws on the insight that the value of many corporate investments consists of not only income from the assets in their current use, but from options to grow in the future (Myers, 1977) and that current investment generates future growth opportunities (Baldwin, 1982). Existing strategy research has examined the notion of growth options in a large range of corporate investment contexts, including alliances and joint ventures (Kogut, 1991; Chi, 2000; Kumar, 2005), market entry (Folta and O'Brien, 2004; Chi and Seth, 2009), R&D (McGrath and Nerkar, 2004; Oriani and Sobrero, 2008; Czarnitzki and Toole, 2011), venture capital projects (Hurry, Miller, and Bowman, 1992; Li and Chi, 2013), and multinational investment (Kogut, 1983; Chang, 1995; Kogut and Chang, 1996; Rivoli and Salorio, 1996; Tong *et al.*, 2008).

Most of the existing studies adopt a decision-theoretic approach, focusing on how firms' investment behavior may change according to levels of uncertainty. Whereas research based on this approach has significantly increased our understanding of firms' investment under uncertainty, considerably less work has examined whether and when undertaking investments with embedded growth options contributes to firms' valuation or performance outcomes (Li, James, Madhavan, and Mahoney, 2007; Reuer and Tong, 2007). While prior studies have examined the growth options embedded in joint ventures (e.g., Kumar, 2005; Tong *et al.*, 2008), advancing our understanding of how firms may create growth option value from their investments requires a framework integrating the roles of firm (investment)

heterogeneity and uncertainty, which are core concepts in strategic management and real options research, respectively (Tong and Reuer, 2007; Smit and Trigeorgis, 2017; Trigeorgis and Reuer, 2017).

In this study, we contribute to extant research by investigating how incremental strategy and environmental uncertainty interact to generate growth option value from firms' multinational investment. Moving beyond the foundational idea that multinationality embeds valuable growth options, we argue that firms can use two strategies of incremental resource commitment to obtain greater growth option value when investing in foreign affiliates under market uncertainty: firms may hold a smaller equity share in their affiliates, or they may keep the size of the investment committed to the affiliates smaller. In particular, market uncertainty in the host countries drives firms' value of growth options foremost when firms adopt such incremental investment strategies. Thus, our arguments emphasize the importance of aligning firms' incremental investment strategy to the level of uncertainty in their host countries in order to reap growth option value.

Our focus on multinational firms is a specific one, but is suitable for our purpose given that foreign direct investment (FDI) in a host country creates so-called "within-country growth options" (Kogut and Kulatilaka, 1994a: 124; Kogut and Chang, 1996). In addition, multinational firms often need to confront high levels of uncertainty in their international operations, thus a focus on real options theory is fitting given the theory's emphasis on the role of uncertainty in shaping firms' investment behavior. While the particular characteristics of foreign expansion by multinational firms render applications of real options theory promising, leading to a growing literature in the international strategy domain (Chi *et al.*, 2018), the question of when firms can reap growth option value from their foreign investment portfolio has not received much attention.

Our empirical analysis uses a panel dataset of Japanese firms and their investment in

foreign manufacturing affiliates. Strategic management scholars have long argued that Japanese firms' strategies tend to evolve incrementally (e.g., Smothers, 1990), favoring incremental strategies involving "sequential investment of organizational resources under constraints of environmental uncertainty" (Hurry *et al.*, 1992: 98). Our analysis of Japanese multinational firms therefore is consistent with prior management research on incremental strategy making under uncertainty, and prior real options studies of Japanese multinationals' sequential investment (e.g., Chang, 1995; Kogut and Chang, 1996).

Although conceptual research in real options has called for limiting 'the size of organizational investments' under uncertainty (Bowman and Hurry, 1993: 767) in order to create option value, we offer a first direct test of the prediction that firms following this strategy in the context of multinational investment can obtain greater growth option value. We show that the creation of growth option value from multinational investment under uncertainty depends crucially on the use of incremental strategies and whether such strategies are aligned with uncertainty conditions present in the host countries in which firms operate affiliates, pointing to important boundary conditions for the relationship between multinationality and firms' value of growth options. In addition, our study connects prior (finance) research on valuations of real options (Berk, Green, and Naik, 1999; Brealey and Myers, 2006) with real options research on investment decisions (Dixit and Pindyck, 1994; Trigeorgis, 1996; Smit and Trigeorgis, 2004, 2017), by relating firms' value of growth options to their investment strategies as well as the uncertainty surrounding their investments. Finally, going beyond the contributions to the real options literature, our research adds to a large body of research on the multinationality and performance relationship (e.g., Hitt, Hoskisson, and Kim, 1997; Goerzen and Beamish, 2003; Lu and Beamish, 2004; Qian *et al.*, 2010; Kirca *et al.*, 2011), by responding to calls to analyze factors, including characteristics of foreign affiliates and conditions in host countries, that may moderate the effect of multinationality on

performance (e.g., Hennart, 2007, 2011; Wiersema and Bowen, 2011).

## **THEORY AND HYPOTHESES**

In strategic management, Mintzberg (1978) was among the first to propose that firms often follow an incremental strategy by making decisions in sequential ways. The notion of incremental strategy has since become key to much of the literature on how firms manage strategic change processes and resource allocation decisions under uncertainty as time and other conditions evolve (e.g., Quinn, 1980; Miller and Friesen, 1982; Johnson, 1988). In the context of foreign direct investment, incremental investment strategies, for instance through investments in international joint ventures, have been suggested to enable firms to undertake broader global expansions despite financial constraints (e.g., Hill, Hwang, and Kim, 1990). As another example, the stage theory of internationalization emphasizes how sequential, incremental expansion strategies can help firms to accumulate experience and overcome the liability of cultural and other distances (Johanson and Vahlne, 1977).

Real options theory is distinct from these perspectives as the theory offers an “economic logic for firms’ incremental resource investment” under uncertainty (Bowman and Hurry, 1993: 760). The economic logic lies in the theory’s focus on the asymmetry of a firm having the right, but not the obligation, to expand after making a limited initial commitment, thus viewing the firm as being able to exploit future growth opportunities under uncertainty (Kogut, 1991; Kogut and Kulatilaka, 1994a; Brouthers and Dikova, 2010; Smit and Kil, 2017). Such option rights can be valuable under conditions of uncertainty (Myers, 1977; Chi and McGuire, 1996; Sakhartov and Folta, 2014). Specifically, to the extent that firms are able to commit resources incrementally and exploit growth opportunities selectively if uncertainty is resolved favorably (Bowman and Hurry, 1993), they should be well-positioned to create growth option value from multinational investment (Kogut and Kulatilaka, 1994b). A key and distinct notion of real option theory is that uncertainty shapes firms’ multinational investment

behavior (Kogut, 1983; Chi and McGuire, 1996; Li and Rugman, 2007) and affects the value of growth options embedded in such investment (Tong *et al.*, 2008; Cuypers and Martin, 2010). Hence, by studying the interrelationships between firms' value of growth options, incremental investment, and uncertainty, researchers can isolate the role of real options theory from other explanations of incremental investment strategies.

Studying the growth option value embedded in multinational investment is related to a large body of international strategy research on the multinationality-performance (M-P) relationship. This literature focuses on the relationship between the degree of multinationality and firms' general performance measures (e.g., return on assets), by drawing on theories such as transaction cost economics or Dunning's (1988) OLI model. Extant research has tested for linear and nonlinear effects of multinationality on performance, and has examined various conceptual and methodological refinements (see Hennart, 2007, 2011; Kirca *et al.*, 2011). Despite its significant contributions, this body of work has often neglected the heterogeneity of host country environments, and similarly has paid insufficient attention to the importance of firm or affiliate characteristics (Hennart, 2007; Li, 2007; Verbeke, Li, and Goerzen, 2009). In this regard, Hennart (2011: 148) points out that the "fit" between environmental conditions and firm strategies in multinational investment, rather than multinationality itself, should be a most critical determinant of performance—a notion that has been central to the contemporary thinking in strategic management for many years (Andrews, 1971).

Drawing on real options theory and building on the foundational ideas on uncertainty, incremental strategy, and fit, our hypotheses development below takes an integrative perspective, arguing that both environmental uncertainty and incremental investment strategies, and in particular an *alignment* between the uncertainty conditions in host countries and the use of incremental strategies, are crucial for firms to obtain growth option value from multinational investment.

### **Multinational investment and growth option value: the role of uncertainty**

One of the key ideas in real options theory is that firms' investment projects often create value not only because of the immediate cash flows from their current operation, but also from the growth options that may arise in the future (Myers, 1977; Kester, 1984). In essence, growth options are discretionary future investment opportunities for the firm; they have option-like features in that the firm has the right, but not the obligation, to decide in a future period whether or not to exploit the opportunities depending on how uncertainty and other conditions evolve (Kogut, 1991; Kogut and Kulatilaka, 1994a; Dixit and Pindyck, 1995). Given that the firm can be valued as a portfolio of investment projects (Luehrman, 1998; Zingales, 2000), firms' value of growth options should increase by undertaking projects with greater embedded growth options such as multinational investment.

Consistent with these notions, Kogut (1983: 41) first proposed that multinational investment provides firms with growth options that are "an important contribution to the value of the firm." Kogut and Kulatilaka (1994a) formalized the idea that firms' investment in a host country creates a growth option: by investing in a host country, firms create a platform to further expand in the country in the future. This growth option may be subsequently exercised in several ways: firms may purchase additional equity stake from their partner in a joint venture affiliate (Kogut, 1991; Kumar, 2005), increase the scale of an affiliate (Kogut, 1983), or open new establishments should conditions warrant (Kogut and Kulatilaka, 1994a; Fisch, 2008). Empirical research on multinational firms' investment patterns also shows that subsequent to their initial investment in a host country, firms often expand their commitment in the country in ways consistent with option theory's predictions. As uncertainty recedes and host markets develop, firms can exercise options by increasing commitments and engaging in



sequential investment (e.g., Kogut, 1983; Kogut and Kulatilaka, 1994a; Chang, 1995; Kogut and Chang, 1996; Fisch, 2008).<sup>1</sup>

To the extent that investment in a host country creates a growth option, firms investing in a larger number of host countries should be able to derive greater growth option value as they are better positioned to exploit a broader set of growth opportunities present in these markets. In this regard, a central premise of real options theory is that uncertainty enhances the value of options embedded in corporate investment and that option value is magnified under conditions of uncertainty (Dixit and Pindyck, 1994). Specifically, the theory and related literature on investment under uncertainty suggests that it is exogenous uncertainty, or environmental uncertainty, that can only reduce with the passage of time, that will bring about option value (Pindyck, 1988; Folta, 1998; Cuypers and Martin, 2010). Endogenous uncertainty, or uncertainty that firms can actively shape through investment or other means, may not be systematically related to option valuation *per se* (Folta, 1998; Adner and Levinthal, 2004).<sup>2</sup>

Consistent with prior work (Ghosal, 1991; Li and Li, 2010), we suggest that host countries' market uncertainty confronted by multinational firms is a most salient type of environmental uncertainty that will shape firms' value of growth options. As multinational firms invest in countries with heterogeneous market and economic conditions and develop different geographic activity configurations, they confront differing levels of market uncertainty in their foreign investment portfolio. Investment in high-uncertainty host countries carries a significant growth option, which provides firms with opportunities to

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<sup>1</sup> In the current study, we also find patterns of growth option exercise to be consistent with theory. We report on this finding in the Supplementary Analysis section.

<sup>2</sup> In this regard, Cuypers and Martin (2010) find evidence that multinational firms' choice of equity shares in international joint ventures is affected by market uncertainty but not by uncertainty related to cultural distance and partner trust, which firms could address through appropriate partner choice and human resource strategies. We note, however, that whether and when endogenous uncertainty can be considered a source of option value is subject to some debate (Chi *et al.*, 2018).

expand when the uncertainty reduces and the growth potential manifests itself (Kogut, 1983; Kogut and Kulatilaka, 1994a; Chi and McGuire, 1996). Firms operating in such countries will therefore be able to obtain greater growth option value from multinational investment. By contrast, for firms operating affiliate portfolios in countries with relatively low market uncertainty, multinational investment will create lesser growth option value. This prediction is stated in the hypothesis below, which contrasts the effect of multinationality on the value of growth options between firms operating in host countries with on-average high uncertainty and those operating in host countries with on-average low uncertainty:

**Hypothesis 1 (uncertainty):** *Firms operating in host countries with on-average high market uncertainty exhibit a stronger positive relationship between multinationality and the value of growth options than firms operating in low market uncertainty environments.*

#### **Moderating role of incremental investment**

There are two ways in which firms may commit resources incrementally to position themselves to obtain greater growth option value from multinational investment: to hold smaller equity shares in their foreign affiliates or to limit the size of operations and financial resources committed to those affiliates.

First, by assuming partial ownership in a joint venture rather than investing in a wholly-owned venture, the firm is positioned to expand if market uncertainty is resolved favorably, while it can still hold on to its initial investment if favorable signals do not materialize (Kogut, 1983; 1991). Further, by limiting its equity share, the firm is exposed less to negative market developments, and it stands to capture more value if economic conditions prove favorable and trigger the firm to exercise its option *ex post*. Indeed, prior theoretical analysis (e.g., Chi and McGuire, 1996; Chi, 2000) and conceptual discussions (e.g., Kogut, 1991; Reuer and Tong, 2005; Tong and Li, 2013) have argued for a negative relationship between firms' equity share in a venture and the growth option value embedded in the

venture. Second, another way the firm can commit resources incrementally to enhance its growth option value from multinational investment is to limit the size of investment in its foreign affiliates, reducing the scale of operations while preserving the potential to scale up later (Hurry *et al.* 1992; McGrath, Ferrier, and Mendelow, 2004). Bowman and Hurry (1993: 767-768), in this regard, argue that “small investments” not only limit the downside risk of exploration for the firm, but they also favorably position the firm to expand in future periods. Similarly, Kogut and colleagues also suggest that firms’ initial, limited investment serves as a platform to facilitate subsequent expansion (Kogut and Kulatilaka, 1994b; Kim and Kogut, 1996).

Multinational firms may exercise growth options by acquiring additional equity shares, increasing the size of operations and investment in an affiliate, or establishing new affiliates. Although growth options embedded in multinational investment are often shared options in nature (Tong *et al.*, 2008), prior work has suggested and found that foreign direct investments are often of a sequential nature (Kogut, 1983; Kogut and Kulatilaka, 1994a), and that firms indeed leverage their initial investment as a platform to expand commitments subsequently (Chang, 1995; Kogut and Chang, 1996; Fisch, 2008).<sup>3</sup>

Real options theory thus suggests that firms investing in a larger number of host countries (multinationality) will in particular be better positioned to obtain valuable growth options from their investment, if they limit the equity stakes in their affiliates or the size of the financial resources committed to the affiliates. This notion suggests a moderating role of incremental investment strategies in shaping the relationship between multinationality and the value of growth options. Again, this moderating relationship should be expected to be most salient for firms operating in high-uncertainty environments. Precisely in high-uncertainty

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<sup>3</sup> Prior research suggests that with small investments, there can still be significant growth option value to obtain, especially under high uncertainty (Hurry, Miller, and Bowman, 1992; Bowman and Hurry, 1993; Trigeorgis, 1996). In the context of our study, empirical evidence presented in the Supplementary Analysis section confirms that small equity stakes indeed can facilitate firms’ exercise of growth options.

countries, firms need to make incremental investments to create growth options for future exercise while limiting the potential downside. It follows that an alignment of incremental investment strategies with the uncertainty conditions in the set of host countries in which firms operate foreign affiliates is expected to generate greater growth option value. The two hypotheses below formalize our arguments about the moderating role of the two incremental investment strategies:

**Hypothesis 2a (incremental investment):** *In high market uncertainty environments, the relationship between multinationality and the value of growth options is stronger, the smaller the firm's equity stake in its affiliates. This moderation effect is less pronounced for firms operating in low market uncertainty environments.*

**Hypothesis 2b (incremental investment):** *In high market uncertainty environments, the relationship between multinationality and the value of growth options is stronger, the smaller the firm's size of investment in its affiliates. This moderation effect is less pronounced for firms operating in low market uncertainty environments.*

### **Country-level alignment of incremental strategy to uncertainty**

The hypotheses above focus on the firm's investments in all of its host countries, by relating the firm's value of growth options to the market uncertainties it confronts and the incremental investment strategies it deploys *across* these countries of its affiliate portfolio. The arguments about incremental investment under uncertainty across countries at the portfolio level should also apply to firms' investments *within* a country, as there can also be substantial heterogeneity in how firms deploy incremental investment strategies in a host country according to that country's uncertainty conditions. Specifically, alignment of investment strategies to each host country's environmental uncertainty improves the 'fit' between investment strategy and uncertainty at the individual country level, and thus can be expected to enhance the value of growth options of the firm as a whole as well. Following the

reasoning earlier, an aligned configuration would be one of relatively small investments (in terms of equity stake and size) in countries exhibiting relatively high-uncertainty, or one of relatively large investments in countries exhibiting relatively low-uncertainty. This effect of country-level alignment on the value of growth options will again be most salient if the host countries in which the firm operates exhibit high uncertainty on average. These arguments thus suggest the following hypothesis:

**Hypothesis 3 (country-level investment alignment):** *For firms operating in high market uncertainty environments, there is a positive relationship between the firm's value of growth options and an alignment within each country between incremental investment and each country's market uncertainty (as characterized by smaller financial commitments in a country with higher market uncertainty). This relationship is less pronounced for firms operating in low market uncertainty environments.*

## **DATA AND METHODS**

Studying the relationship between firms' incremental investment and the value of growth options presents several empirical challenges. It is generally difficult to measure the value of growth options for firms; in addition, data on the size of investment at the fine-grained establishment, or project, level are not usually available for a large sample of firms longitudinally. As explained below, we measure the value of growth options as the firm's market valuation minus the value of assets in place following prior related work in finance, while we use detailed affiliate-level data on Japanese multinational firms' investments in their foreign affiliates to create measures of incremental investment.

Data used to calculate firms' values of growth options are obtained from the *Stern Stewart Performance 1,000* for Japanese firms and are available for the period from 1994 to 2001. This dataset, developed by Stern Stewart & Co., a financial consultancy specialized in developing value-based performance metrics (Stewart, 1991), covers the 1,000 largest

Japanese publicly listed firms based on their market value, and has been used in prior strategy research (e.g., Hawawini, Subramanian, and Verdin, 2003; Tong *et al.*, 2008). We merge this dataset with other financial and accounting information obtained from the Development Bank of Japan, which derives its data directly from the financial reports submitted by Japanese firms to the Japanese Ministry of Finance. We then match these firms to the *Directory of Overseas Affiliates* published by Toyo Keizai, Inc. The *Directory* provides detailed information on the foreign affiliates of Japanese listed firms, including the affiliates' industry, establishment year, number of employees, paid-in capital, and parent firms' equity stakes in the affiliates. We use information collected from the yearly electronic versions of the *Directory*, as well as information from separate lists of divested affiliates published in hardcopy by Toyo Keizai, to determine when each affiliate was established and until which year the affiliate survived and was owned by the Japanese parent. Consistent with prior research, affiliates in which the Japanese parent has at least a ten percent equity stake are included; if there are multiple Japanese parents for an affiliate, the affiliate is assigned to each parent (Makino, Isobe, and Chan, 2004).

We impose several sampling screens on the merged dataset. First, we limit the sample to manufacturing firms and affiliates, given the difficult-to-reverse nature of these firms' capital investment, which is a central tenet of real options analysis (Dixit and Pindyck, 1994). This screen results in a sample of 420 manufacturing firms covered in both the Stern Stewart dataset and the Toyo Keizai *Directory*. Second, given our interest in the characteristics of multinational investment and the host countries in which firms invest, the analysis is restricted to firms operating at least one foreign manufacturing affiliate. After accounting for missing data for variables, applying the sample screens generates an unbalanced panel dataset comprising 396 firms and a total of 2,054 firm-year observations.

## **Variables and measures**

**Dependent variable.** Our dependent variable is the firm's *Value of Growth Options*, which is the part of the market valuation of the firm that is attributable to future growth opportunities (Myers, 1977; Smit and Trigeorgis, 2004). Our approach to calculating this variable is consistent with that used in prior research (e.g., Kester, 1984; Brealey and Myers, 2006; Alessandri, Lander, and Bettis, 2007; Tong *et al.*, 2008). The market value of the firm can be decomposed into the value of growth options and the value of assets in place, with the latter being the sum of the replacement value of assets and the present value of economic value added (EVA). Economic value added, also called economic profit (Marshall, 1890), measures profit net of all capital charges. The present value of EVA is calculated by dividing the firm's EVA by its weighted average cost of capital; thus, it is the part of a firm's valuation that would be obtained if the firm would generate the current level of EVA in perpetuity. The variable *Value of Growth Options* is expressed in units of billion Yen.

**Explanatory variables.** The core explanatory variable used to test Hypothesis 1 is *Multinationality*, measured as the number of host countries in which the Japanese operates manufacturing affiliates. The other key measure in Hypothesis 1, *Market uncertainty*, is the market uncertainty that the firm faces in the host countries in which it operates affiliates. We capture the volatility of a host country's economic growth by regressing the country's GDP over five years against time, and using the standard error of the regression coefficient scaled by the value of GDP to arrive at a standardized proxy of market uncertainty for each host country and year (e.g., Kogut, 1991; Li and Li, 2010). *Market Uncertainty* is then the average of the uncertainty measures across the host countries in which the firm is active.

To test Hypotheses 2a and 2b, we create two variables *Equity Stake* and *Investment Size*. *Equity Stake* is calculated as the Japanese firm's average equity stake in its foreign affiliates (Chi and McGuire, 1996; Reuer and Tong, 2005). *Investment Size* is a measure of

financial resources invested in the foreign affiliate. Given our panel data design, we need to construct a time-varying measure of investment size using data at the affiliate level. Although the *Toyo Keizai Directory* provides information on the value of the paid-in capital of affiliates, information on the value of total assets is not available. Paid-in capital, the equity capital provided initially by the parent firm(s) at the time of establishment, however, often does not vary much over time, as an affiliate may later use other means of finance, such as loans or its retained earnings. On the other hand, the number of employees as a measure of affiliate size is available on a systematic and yearly basis, but is not an accurate measure of financial commitment. Our approach is therefore to combine information on employment and paid-in capital to arrive at a time-varying measure of investment size. We calculate a country- and industry-specific, paid-in capital to employment ratio, and then multiply the ratio by each affiliate's annual number of employees (matched by country and industry). This approach can be justified as most of the variation in capital intensity is across industries; in addition, there is also substantial country variation in capital intensity due to cross-country differences in factor costs (such as labor costs) and productivity (e.g., Kogut and Kulatilaka, 1994a).<sup>4</sup>

*Investment Size* is calculated as the average financial investment of the firm's affiliates in a year expressed in units of hundred-million Yen. To test Hypotheses 2a and 2b, we interact *Multinationality* with *Equity Stake* and *Investment Size*, respectively.

Testing for Hypothesis 3 (country-level investment alignment) necessitates an elaborate measure, taking into account affiliate size, parent equity stake, and uncertainty in each host country. For each host country, we need to determine if the firm's investment strategy is aligned with the level of uncertainty, which requires the determination of investment and uncertainty thresholds. To keep the analysis tractable, we develop an

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<sup>4</sup> We note that a limitation of this approach is that employment increases are assumed to be always associated with greater investment size, which may not be the case for smaller changes in employment.



integrated indicator of incremental strategy based on the parent firm's total investment in an affiliate, measured as the investment size of the affiliate times the firm's equity share in the affiliate. As there is no clear guidance on the 'magnitudes' of alignment, we adopt a simple but intuitive approach. Specifically, the indicator variable *Country-Level Investment Alignment* takes the value 1 if a firm's investment in an affiliate is low when country uncertainty is high, or if its investment is high when country uncertainty is low; both cases indicate an alignment between incremental investment strategy and uncertainty. The variable takes the value -1 if the opposite holds.<sup>5</sup> For investment size, the threshold to determine high or low levels of investment is the average investment size of the affiliates of all Japanese sample firms in the industry (to normalize for differences in capital intensity across industries). For market uncertainty, this threshold is the average uncertainty in the set of countries in which the sample firms operate manufacturing affiliates. If a firm has multiple affiliates in a country, the values of the indicators are averaged across the affiliates. To arrive at a firm-year measure of *Country-Level Investment Alignment* across the firm's portfolio of host countries, the indicators are summed up across all host countries. *Country-Level Investment Alignment* aims to capture the additional growth option value due to a within-country alignment of investment strategy to uncertainty suggested by H3.

**Control variables.** The model includes a series of control variables to isolate the effects of the hypotheses-testing variables. First, we include *Firm Size*, which is measured as the firm's value of consolidated assets in units of ten-billion Yen. Second, export may provide firms not only with current-period profit but also with future growth opportunities (Campa and Goldberg, 1995). We include *Export Intensity*, measured as the value of a firm's exports divided by its total sales. In addition, the analysis includes *Sales Affiliates*, measured as the number of a firm's foreign affiliates that are engaged in sales related activities (distribution,

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<sup>5</sup> We did not identify asymmetries in the consequences of aligned or nonaligned country investment effects.

wholesale, promotion, service), as prior research suggests that a firm's foreign sales affiliates may offer subsequent expansion opportunities (Chang, 1995; Kogut and Chang, 1996).

Fourth, we control for *Leverage*, measured as the ratio of a firm's long-term debt to its total capital, as growth options are more likely to be financed by equity than debt (Myers, 1977).

Fifth, prior research suggests that greenfield ventures and acquisitions may confer different option values (e.g., Brouthers and Dikova, 2010; Smit and Kil, 2017), so we include the variable *Acquisition Ratio*, measured as the percentage of entries through acquisition in a firm's foreign affiliates. Finally, we control for the value of switching options available from the firm's network of multinational operations (Kogut and Kulatilaka, 1994a; Tong and Reuer, 2007; Fisch and Zschoche, 2012; Chang, Kogut, and Yang, 2016) by including the variable *Switching Flexibility*, calculated as one minus the correlation in labor cost across all host countries (e.g., Belderbos, Tong, and Wu, 2014).

A second set of control variables includes three proxies of firms' intangible assets.

First, research suggests that R&D investment carries substantial growth option value (Levitas and Chi, 2010), thus we control for *R&D Intensity*, measured as the R&D expenditure of the firm divided by its total sales. Second, we add a variable representing a firm's reputation and brand image due to investments in customer service and advertising. *Sales Cost* encompasses the firm's expenditures on advertising, sales force, and warranties and service. These expenditures are part of SG&A (selling, general, and administrative expenses), which in the economics and finance literature has been suggested to represent forms of organizational capital (Prescott and Visscher, 1980) and positively correlates with firm value (Eisfeldt and Papanikolaou, 2013). Third, we control for firms' *International Experience*, calculated as the average number of years in operation for the firm's foreign affiliates, which may enhance the firm's capabilities to recognize and exercise growth options (Tong and Li, 2013).

Two other control variables pertain to the environments in which firms operate

foreign affiliates. We include the average *GDP Growth* of the host countries in which the firm operates affiliates, as well as *Cultural Distance*, calculated as the average of the cultural distance measure between Japan and each host country (Kogut and Singh, 1988; Nachum and Zaheer, 2005). Finally, we include a set of *Firm Fixed Effects* (see below), and *Year Fixed Effects* to control for time-variant economic shocks to firm profits or growth opportunities (McGahan and Porter, 1997). Since the value of growth options is derived from end-of-year stock market valuations, which reflect relevant strategic decisions (multinational investment strategies) and financial conditions during the year, we follow prior work to measure all time-variant variables above in year *t*.

### **Statistical approach**

We exploit the longitudinal dimension of the data and estimate panel data models to test our hypotheses. Panel data estimators provide a powerful control for unobserved firm heterogeneity that may influence firms' value of growth options but may not be captured by the control variables (Hsiao, 2003). Hausman tests indicated that fixed effects models were to be preferred over random effects models. We also tested whether the fixed effects model or first difference model is appropriate for our research. Both models control for unobserved firm characteristics but the fixed effects model is appropriate and efficient when the error terms are serially uncorrelated, while the first difference model is more efficient when error terms follow a random walk (Woodridge, 2002: 284-285). Results of our tests favored the use of the fixed effects model. The fixed effects model fits our purpose by studying the 'within-firm' dimension of the value of growth options, namely, how changes in the value of growth options within the firm *between* years are affected by changes in the firm's multinational investment strategies.

To test the hypotheses on the effect of *Multinationality* (H1), moderating effects of *Equity Stake* (H2a) and *Investment Size* (H2b), and the effect of *Country-Level Investment*

*Alignment* (H3), we examine the coefficient estimates of variables and their significance levels by performing subsample analysis, with the split at the median level of market uncertainty in the host countries in which the sample firms have manufacturing affiliates.<sup>6</sup> Subsample analysis is widely used for comparing coefficients between groups due to the many advantages it offers (Greene, 2008): subsample analysis does not require that unexplained variances be identical between the two groups of firms, and it allows the effects of the right-hand-side variables to differ between the groups, leading to consistent within-group estimates (Hoetker, 2007). In addition to examining the significance levels of the estimated coefficients for each subsample (high- and low-uncertainty), we also perform Wald tests on coefficient equality across subsamples.

## RESULTS

Table 1 reports descriptive statistics and correlations for all variables for the high-uncertainty subsample, low-uncertainty subsample, and full sample. The correlations and additional diagnostic checks do not suggest concerns about multicollinearity.

-----Insert Table 1 about here-----

Table 2 reports fixed effects panel regression results for the determinants of firms' value of growth options. Columns 1-3 report results of models with only control variables included, and Columns 4-6 report results of models with the hypothesis testing variables added. In addition to performing analysis for the high-uncertainty (Columns 1 and 4) and low-uncertainty subsamples (Columns 2 and 5), the table includes results for the full sample for completeness (Columns 3 and 6).

-----Insert Table 2 about here-----

Focusing on Columns 1-3, *Firm Size* has a negative and significant coefficients in all

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<sup>6</sup> A split around the median has the advantage that the empirical results are less likely to be affected by different sample sizes. A split around the mean produces comparable results.

models, consistent with the idea that smaller firms usually possess greater future growth opportunities (Loughran and Ritter, 2004). The coefficient on *Export Intensity* is negative and significant in the full sample model, thus it appears that exporting primarily has an impact on firms' current profitability rather than future growth opportunities, a pattern that is likely to arise if exports focus on mature markets. In contrast, we observe a positive and significant coefficient on *Sales Affiliates* in the high-uncertainty and full samples, a finding in line with prior research suggesting that sales and distribution facilities in host countries can serve as a platform for firms' growth in the countries in subsequent periods (Kogut and Chang, 1996). *R&D Intensity* has a positive and significant coefficient throughout all models, consistent with prior emphasis on the substantial growth option value embedded in firms' R&D investment (Myers, 1977; Reuer and Tong, 2007; Levitas and Chi, 2010). Finally, both firm and year fixed effects are jointly significant, pointing to the importance of controlling for unobserved firm heterogeneity and macroeconomic conditions.

Turning to the hypotheses testing models (Columns 4 and 5), we first observe that multinational investment has a positive and significant effect on the value of growth options in the high-uncertainty subsample (Column 4), but an insignificant effect in the low-uncertainty subsample (Column 5). Wald tests indicate that the difference in the coefficients between the subsamples is significant ( $p=0.034$ ). Hence, these results support Hypothesis 1. Hypotheses 2a and 2b posit that the impact of multinationality on the value of growth options will be greater as firms take smaller equity stakes in their affiliates or establish smaller-sized affiliates, in particular in high-uncertainty environments. Results in Columns 4 and 5 provide support for these hypotheses: the coefficient on the interaction of *Equity Stake* and *Multinationality* is negative and significant in Column 4 but insignificant in Column 5, and this is the same for the coefficients on the interaction of *Investment Size* and *Multinationality* in these two columns. The difference in the coefficients is statistically significant in both

cases ( $p=0.017$  and  $p=0.034$ , respectively). Finally, Hypothesis 3 on country-level investment alignment receives qualified support. In line with our predictions, the coefficient on *Country-Level Investment Alignment* is positive and significant in the high-uncertainty subsample ( $p=0.042$ ), but insignificant in the low-uncertainty subsample. The difference in the coefficients is statistically insignificant ( $p=0.233$ ), however, possibly due to the relatively large estimated standard error for this variable in the low-uncertainty subsample.

In line with the finding that the effect of multinationality is most salient in the high-uncertainty subsample, we note that adding the focal hypotheses testing variables significantly improves model fit for the high-uncertainty subsample (and full sample), but not for the low-uncertainty subsample, as shown by the log likelihood ratio test statistics in the bottom row of Table 2.

### **Interpretation of results**

It is important to provide an economic interpretation of the estimated effects of the focal variables. The implied impact of *Country-Level Investment Alignment* in high-uncertainty environments can be derived from the coefficient estimate: it can be calculated that a one standard deviation increase in such alignment leads to a 19 billion Yen increase in value. The implied economic effect of *Multinationality* in high-uncertainty environments crucially depends on the moderating variables. To facilitate interpretation of interaction effects, Figures 1 and 2 plot the estimated marginal effect of *Multinationality* on the value of growth options for various values of *Equity Stake* and *Investment Size*, respectively. The figures are drawn for the high-uncertainty subsample (Column 4 of Table 2) in which the estimated coefficients are significant. In each figure (e.g., Figure 1), to highlight the role of the focal moderator (e.g., *Equity Stake*), the level of the other moderator (e.g., *Investment Size*) is held constant at its sample minimum value. The middle line is the calculated marginal effect of *Multinationality*; the bottom and top lines represent the lower and upper bounds of the 90

percent confidence interval of the marginal effect, respectively.

-----Insert Figures 1 and 2 about here-----

Figure 1 shows that the positive effect of *Multinationality* on the value of growth options declines with the average level of equity stake of the firm in its overseas affiliates. For instance, at an equity stake of 25 percent, investing in a manufacturing affiliate in a new host country increases the estimated value of growth options by about 40 billion Yen. This effect is reduced to a level close to zero, however, if the firm takes an equity stake close to 100 percent in its foreign affiliates. The bottom line shows that the effect of *Multinationality* loses its significance if the firm holds an average 70 percent equity stake in its affiliates, a level that is surpassed for 63 percent of the firm-year observations in the high market uncertainty subsample. Figure 2 shows that the marginal effect of *Multinationality* on the value of growth options reduces as investment size increases. The effect of *Multinationality* is significant up to a threshold value of investment size of about 250 million Yen. This value is about two and a half times the mean value of *Investment Size*, with few firms operating affiliates beyond this level.

Overall, these results point to the strong boundaries for the relationship between multinationality and the value of growth options, and suggest that a number of firms in our sample could further enhance their value of growth options by adopting a more incremental investment strategy.

### **Supplementary analyses**

**Growth analysis.** The analysis above does not directly examine the dynamics of changes in the firm's value of growth options as a function of changes in multinationality, uncertainty, and characteristics of the affiliates. A simple analysis of the change in *Multinationality* (the count of host countries) would however not be able to fully capture the complexity and heterogeneity of changes in investments and uncertainty in a firm's affiliate portfolio: such

changes can be due to changing investments and uncertainty in existing affiliates and host countries, to new country entries, and to exits from host countries.

We aim to gain further insights by decomposing the effect of multinational investment into the effects of entries, exits, and adjustments in the existing portfolio. We calculate three variables. *Existing Portfolio Alignment* measures changes in the (mis)alignment of affiliates' investment with host country uncertainty in the existing portfolio. Affiliate alignment takes the value 1 if investment in the affiliate decreases when uncertainty of the host country increases (between year  $t-1$  and year  $t$ ), or if investment increases when such uncertainty decreases. The variable takes the value -1 in case of opposite patterns (misalignment), and the value 0 if investment remains constant irrespective of movements in country uncertainty. The indicator is averaged across the firm's affiliates in the country in case of multiple affiliates, and then summed up over the countries in the portfolio. This procedure cannot be followed for newly established or divested affiliates. We therefore create the variables *Country Entry Alignment* and *Country Exit Alignment*, based on the threshold values and procedure used for calculating the hypothesis-testing variable *Country-Level Investment Alignment* earlier. Specifically, if investment in a newly established affiliate is aligned with uncertainty levels in the host country, the indicator *Country Entry Alignment* takes the value 1; if not aligned, -1. If a divested affiliate is not aligned with host country uncertainty, the indicator *Country Exit Alignment* takes the value 1; if aligned, -1. The growth model then relates year-on-year changes in the value of growth options to these three sources of changing multinational investment alignment, as well as year-on-year changes in the control variables. To control for remaining firm heterogeneity that is unobserved, the models also conservatively include firm fixed effects.<sup>7</sup>

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<sup>7</sup> Since this growth model uses one extra firm-year observation for the dependent and independent variables, and because some firm observations are available only intermittently across years thus not allowing the calculation of variables in growth terms, the number of observations in the panel is reduced to 1,613.



The estimation results are reported in Table 3. Variables such as *R&D Intensity*, *Export Intensity*, and *Firm Size* have similar effects on the firm's value of growth options as those reported in Table 2. While changes in alignment in the existing portfolio (*Existing Portfolio Alignment*) are significantly related to changes in the value of growth options, no significant relationship is found with *Country Entry Alignment* or *Country Exit Alignment*. Further inspection shows that on average, countries of new entry exhibit lower uncertainty levels than countries in the existing portfolio: the mean value of uncertainty is 0.057 in countries of entry versus 0.067 in existing countries in the portfolio, with the difference statistically significant at  $p=0.002$ . The findings suggests that firms' new entries may often seek to avoid uncertainty, motivated by other factors than just the creation of growth options, such as the exploitation of existing firm-specific advantages, a point that we will return to in the Discussion section.

-----Insert Table 3 about here-----

**Robustness tests.** We also perform a series of robustness tests. One possible concern is that the empirical regularities we show may be the result of reverse causality: firms with excessive market values may seek to undertake more foreign investments. While our sample period (1994-2001) starts after the major stock market bubble in Japan in the late 1980s, and prior seminal work suggests that FDI reflects market failure rather than capital flow or financial arbitrage considerations (Dunning and Rugman, 1985; Caves, 1996), we nevertheless examine this possibility empirically. Specifically, if reverse causality is an issue, we should observe the firm's value of growth options (reflecting overvaluation) to lead to an increase in the firm's *Multinationality*, or an increase in its *Equity Stake*, *Investment Size*, or *Country-Level Investment Alignment*. We ran four regression models with the firm's value of growth options as the core explanatory variable, while controlling for firm fixed effects and year fixed effects. In none of these models did the contemporaneous or lagged term of the

firm's value of growth options have a significant effect on the dependent variables.

In addition, we examine whether the focal variables could be considered strictly exogenous in our panel data specification. The estimated coefficients in fixed effects models can be inconsistent if there are correlations between the error term of the equation and future values of the investment and alignment variables (that is, fixed effects models assume strictly exogenous regressors). We examine whether the strict exogeneity assumption holds by conducting the test suggested by Wooldridge (2002: 285). Specifically, we add the one-year lead ( $t+1$ ) values of *Multinationality*, *Equity Stake*, *Investment Size*, and *Country-Level Investment Alignment* to the model. We find that the null hypothesis that the lead values of these variables are jointly zero cannot be rejected ( $F=0.79$  for the full sample,  $F=1.16$  for the high-uncertainty subsample, and  $F=0.67$  for the low-uncertainty subsample).

We also examine several alternative specifications for our empirical models and alternative ways to measure particular focal variables. First, we examine whether we observe decreasing marginal effects of multinationality on the value of growth options. A squared term of *Multinationality* added to the models is not significant, suggesting, in line with our arguments, that host country characteristics and affiliate investment patterns rather than the sheer number of countries give bounds to the effect of multinationality. Second, a decreasing effect of multinationality may also be observed if firms face resource constraints in exercising growth options in multiple countries at the same time. Adding a variable indicating whether multiple exercises may be likely (incremental affiliate investments by the firm in multiple high-uncertainty host countries) does not change the results. We suspect that problems with simultaneous exercise of growth options, although possible in theory, are less likely to occur in practice. This is because the simultaneous resolution of uncertainty across multiple host countries may be rare or difficult to predict, and because firms may have the resources in place to deal with the simultaneous exercise of growth options.

One possible concern is that the estimated relationship between *Multinationality* and the value of growth options may be spurious through their shared correlations with firm size – although this would not directly affect the hypothesized moderating roles of incremental investment strategy or market uncertainty that are core to our study. We conducted a number of tests to ascertain that this relationship is not spurious. Inclusion or exclusion of *Firm Size* in the empirical models had no material influence on the effects of the focal variables, and the firm-level (within-firm) correlation between firm size and the value of growth options was negative rather than positive. These regularities do not suggest that size-related factors spuriously drive a positive effect of *Multinationality* on the value of growth options. In addition, we find remarkably stable results when we follow precedents (Gaver and Gaver, 1993) to use as an alternative dependent variable the principal component of three proxies of growth options (i.e., the current measure of value of growth options, the ratio of this value to firm assets, and Tobin's  $q$ ), the latter two being measures scaled by size.

Other alternative model specifications produce little variation in empirical results. First, if manufacturing affiliates are established primarily as export platforms benefiting from low labor cost in host countries, they may embed less within-country growth option value. We identify affiliates that have an export-oriented motive and create a variable indicating whether or not the focal firm operates at least one such affiliate in a given year. Including this indicator and its interactions with *Multinationality* does not produce significant coefficients. Second, we obtain qualitatively similar results when utilizing an alternative time-variant uncertainty measure that varies not only by the host country but also by the industry. Third, we do not find a measureable effect of competition that may hamper growth option value, as shown by an insignificant coefficient on the Herfindahl index of the focal firm's home industry (Knickerbocker, 1973), or the number of Japanese manufacturing affiliates in the host country in the industry. Finally, we find that the magnitude of the moderating effect of

*Investment Size*, while significant, is halved in capital-intensive industries, where a small size may have a drawback to limit the realization of scale economies.

**Evidence on firms' exercise of growth options.** Finally, we also examine whether the multinational firms in our sample exercise growth options in ways consistent with predictions from real options theory. The basic prediction is that when a firm faces receding uncertainty in a host country and a favorable resolution of uncertainty, the firm is expected to exercise its growth options, by increasing its equity stake in existing affiliates, enlarging the size of investment in existing affiliates, or establishing new affiliates in the country. As expected, we find that firms operating affiliates in host countries with above-median uncertainty reduction and above-median GDP growth (indicating a favorable resolution of uncertainty), are significantly more likely to exercise growth options in all three possible ways, as compared to firms operating affiliates in countries not exhibiting strong uncertainty reduction. In addition, in such cases of favorable resolution of uncertainty, firms with a minority equity stake in their affiliates show a significantly greater probability of increasing equity shares than firms with a majority equity stake. Overall, this analysis produces strong evidence consistent with the idea of growth options: firms do exercise growth options under receding uncertainty, in particular if this is accompanied by host market growth.

## **DISCUSSION**

The results of this study demonstrate important boundary conditions for the relationship between multinational investment and firms' value of growth options. We found that a positive relationship between multinational investment and the value of growth options only applies to firms investing in host countries with high market uncertainty. Precisely in these environments, firms need to use an incremental investment strategy in order to obtain greater growth option value from their foreign investment, by holding a smaller equity share in their affiliates or by keeping the size of investment in the affiliates smaller. Taking a high

equity share and investing a large amount of capital in affiliates in such environments, on the other hand, can reduce the growth option value from multinational investment to close to zero. Consistent with these findings, we confirmed that firms exercise growth options by increasing their investments in host countries if uncertainty resolves favorably. Hence, to obtain growth option value critically requires firms to align their incremental investment strategies to environmental uncertainties across the host countries, as well as within each country, in which they operate. Prior research has emphasized the importance of alignment for strategy making in general (Andrews, 1971) and for a better understanding of the multinationality-performance relationship (Hennart, 2011). Our study contributes by providing evidence that such alignment of incremental investment under uncertainty (e.g., Hurry *et al.*, 1992; Bowman and Hurry, 1993) is crucial to the creation of growth option value in the context of multinational investment.

Our supplementary analysis aiming to decompose the drivers of increases in growth option value into the influences of entry into new countries, exits from countries, and improved alignment of investment strategies in firms' existing affiliate portfolios suggests that increases in growth option value are predominantly due to alignments within the existing portfolio rather than to new entries or exits. This finding can be explained in part by firms' entry patterns focusing on host countries with relatively low uncertainty in our sample. Such entry patterns are consistent with the broader internationalization literature suggesting that firms avoid high-uncertainty environments (e.g., Johanson and Vahlne, 1977; Delios and Henisz, 2011), highlighting that firms undertake multinational investment for many reasons other than just the creation of growth options (Caves, 1996; Dunning, 1988). In particular, foreign entries often focus on the more certain direct returns by exploiting existing firm-specific assets in host countries and current market opportunities. In addition, assuming larger equity shares and greater control over affiliates facilitates system-wide coordination that is

critical to switching option value and operating flexibility (Tong and Reuer, 2007; Belderbos and Zou, 2009; Belderbos *et al.*, 2014; Chang *et al.*, 2016). In all, the finding implies an important qualification to the relationship between multinational investment and the value of growth options: while alignment in terms of pursuing incremental investment strategies in high-uncertainty environments can create substantial growth option value contributing to firms' market valuation, firms face a tradeoff between the pursuit of growth option value and other objectives of multinational investment, such that growth option considerations may not necessarily be the predominant feature of investment.

Our study complements prior real options research that takes a decision-theoretic approach to examine how firms' investment behavior or decision pattern is driven by uncertainty through its effects on the value of the embedded options in investments (e.g., Kogut, 1991; Kogut and Chang, 1996; Folta and Miller, 2002; Folta and O'Brien, 2004; Li and Li, 2010; Xu, Zhou, and Phan, 2010). In addition, our study provides a bridge between this stream of research with the (finance) literature that focuses on the valuation of real options (e.g., Brealey and Myers, 2006; Smit and Trigeorgis, 2017), by linking the value of growth options to firms' investment strategies and the uncertainties surrounding their investments. Our study also joins recent work on the valuation effects of firms' investments with option-like features, including R&D capital (Oriani and Sobrero, 2008), technology development (Levitas and Chi, 2010), and joint ventures (Kumar, 2005; Tong *et al.*, 2008), and we contribute a contingency framework to improve existing knowledge of the conditions under which firms obtain growth option value from their investments.

Our paper also has implications for extant research on the relationship between multinationality and performance (e.g., Tallman and Li, 1996; Hitt *et al.*, 1997; Goerzen and Beamish, 2003; Lu and Beamish, 2004; Qian *et al.*, 2010; Kirca *et al.*, 2011). Despite its significant contributions, scholars have argued that this body of work has paid insufficient

attention to multinational firms' investment strategies and host countries' heterogeneous conditions (see Hennart, 2007, 2011). Our focus on firms making limited investment commitments across countries under uncertainty takes into account both environmental conditions and host country-specific strategies, thus addressing some of the limitations in the M-P literature. Our findings indicate that the key to unlock future growth opportunities resides not only in the number of host countries to invest in, but also in particular types of countries to enter and types of investment strategies to employ. Our study suggests that future research on the M-P relationship will benefit from explicitly accounting for the heterogeneous attributes of firms' affiliates and the diverse characteristics of host countries.

Our study is not without limitations and we highlight a more salient one here. We examined firm-level values of growth options, rather than the growth option value of specific projects or investments, and our measure was calculated as a residual using information on the value of the firm and the (expected) value of assets in place (Brealey and Myers, 2006; Alessandri *et al.*, 2007; Tong *et al.*, 2008). Although the measure has significant precedent in the literature and we found comparable results using the principal component of different proxies of growth options as a dependent variable, the measure comes with its limitations. For instance, it might be affected by stock market noises and fluctuations, and it might correlate with firms' intangible assets (Myers, 1977; Kumar, 2010). We encourage future research to derive finer-grained measures of growth option value by collecting more detailed data on firms' investment projects and how they manage such projects over time, which will necessitate other research methods such as surveys or case studies (Loch and Bode-Greuel, 2001; Smit and Trigeorgis, 2004).

Our analysis was limited to the role of host market uncertainty, and we abstracted from other sources of uncertainty firms may be confronted with, such as those related to the institutional and political environment. In a cross-country comparative analysis of publicly

listed firms, Smit *et al.* (2017) observe that the relationship between growth options and economic uncertainty is weaker in countries with higher institutional transaction uncertainty, where firms' opportunities to exercise options are limited. Future research may find fertile ground in examining the interactions between institutional and market uncertainty in firms' multinational investment (Chi *et al.*, 2018). Such analysis will need to overcome the complexity in isolating portfolio level characteristics from environmental and investment characteristics at the host country level. Alternative conceptualizations of alignment at the portfolio level, beyond the average portfolio characteristics examined in the current paper, may be required to address these more complex relationships in detail.

Our study joins recent research applying real options theory to study multinational firms based in other countries than the U.S. (Belderbos and Zou, 2009; Lee and Makhija, 2009; Driouchi and Bennett, 2011; Lee and Song, 2012), yet our findings might be partially specific to multinational firms based in Japan. For instance, compared to their U.S. counterparts, Japanese multinationals have invested substantially in a wide array of emerging economies that are more heterogeneous in their economic developments and market uncertainties, as well as in developed economies that are more stable and homogeneous. Also, Japanese firms' investment strategies have been suggested to evolve incrementally (e.g., Smothers, 1990; Hurry *et al.*, 1992), involving sequential commitment of resources in international expansion (Chang, 1995; Kogut and Chang, 1996). The period we studied also encompasses the Asian financial crisis with substantial amounts of uncertainty. This is an appropriate period to identify the crucial role of uncertainty in shaping firms' value of growth options, but at the same time this period constitutes a set of relatively unique environmental conditions. We encourage future studies to extend our integrated framework to firms based in other home countries to examine our study's generalizability.



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**Table 1. Means, standard deviations, and correlations**

	High market uncertainty (N=1027)	$\mu$	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Value of growth option	107.832	220.159	1.000																
2	Firm size	42.663	87.034	<b>0.338</b>	1.000															
3	Export intensity	0.078	0.164	<b>0.170</b>	0.068	1.000														
4	Sales affiliates	3.227	3.429	<b>0.275</b>	<b>0.393</b>	<b>0.178</b>	1.000													
5	Leverage	28.217	20.699	<b>0.159</b>	<b>0.109</b>	-0.003	-0.026	1.000												
6	Acquisition ratio	3.778	9.558	0.008	0.036	0.034	0.038	0.004	1.000											
7	R&D intensity	2.751	2.182	0.056	<b>0.088</b>	0.075	<b>0.234</b>	<b>-0.185</b>	0.027	1.000										
8	Sales cost	2.300	4.722	-0.053	0.061	-0.022	<b>0.193</b>	<b>-0.189</b>	<b>0.124</b>	<b>0.115</b>	1.000									
9	International experience	8.016	2.858	<b>-0.085</b>	0.079	<b>-0.166</b>	<b>0.098</b>	-0.009	0.053	0.004	<b>0.114</b>	1.000								
10	GDP growth	3.815	3.816	<b>0.196</b>	0.009	<b>0.393</b>	0.041	0.047	-0.021	0.028	-0.058	<b>-0.374</b>	1.000							
11	Cultural distance	3.459	0.563	-0.029	-0.057	-0.065	<b>-0.199</b>	<b>0.112</b>	<b>-0.098</b>	<b>-0.116</b>	-0.075	0.016	-0.076	1.000						
12	Market Uncertainty	0.100	0.045	-0.055	<b>-0.094</b>	0.002	<b>-0.144</b>	-0.009	-0.041	-0.075	0.003	-0.073	<b>-0.238</b>	<b>0.166</b>	1.000					
13	Switching flexibility	-0.364	0.303	<b>-0.113</b>	-0.038	<b>-0.262</b>	-0.026	-0.034	-0.039	<b>0.096</b>	<b>0.099</b>	<b>-0.125</b>	<b>-0.273</b>	-0.066	0.012	1.000				
14	Multinationality	5.451	3.466	<b>0.288</b>	<b>0.469</b>	-0.006	<b>0.240</b>	0.057	0.077	0.077	0.017	<b>0.190</b>	0.023	<b>-0.104</b>	<b>-0.204</b>	<b>-0.210</b>	1.000			
15	Equity stake	0.639	0.204	-0.003	-0.043	<b>0.148</b>	<b>0.179</b>	<b>-0.232</b>	0.078	<b>0.167</b>	<b>0.101</b>	-0.001	0.016	-0.014	<b>-0.122</b>	-0.030	-0.028	1.000		
16	Investment size	1.050	3.273	0.046	<b>0.161</b>	0.015	0.044	0.066	0.048	-0.005	-0.009	<b>0.103</b>	0.015	0.029	-0.032	-0.065	<b>0.163</b>	-0.025	1.000	
17	Country-level investment alignment	-0.269	1.920	-0.024	-0.006	-0.007	0.011	0.057	0.024	<b>-0.143</b>	0.010	-0.059	-0.071	<b>0.142</b>	<b>0.232</b>	-0.044	<b>-0.270</b>	-0.018	<b>0.081</b>	1.000

	Low market uncertainty (N=1027)	$\mu$	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Value of growth option	146.417	212.206	1.000																
2	Firm size	35.011	49.111	<b>0.563</b>	1.000															
3	Export intensity	0.146	0.198	<b>0.145</b>	<b>0.135</b>	1.000														
4	Sales affiliates	2.806	3.123	<b>0.302</b>	<b>0.456</b>	<b>0.297</b>	1.000													
5	Leverage	31.108	20.281	<b>0.198</b>	<b>0.127</b>	-0.004	0.030	1.000												
6	Acquisition ratio	5.768	15.526	0.033	-0.009	-0.044	0.002	-0.045	1.000											
7	R&D intensity	2.927	2.949	0.011	0.051	-0.014	<b>0.115</b>	<b>-0.177</b>	-0.020	1.000										
8	Sales cost	3.356	5.991	-0.077	0.041	<b>-0.182</b>	0.074	<b>-0.160</b>	<b>0.176</b>	<b>0.117</b>	1.000									
9	International experience	6.480	2.689	-0.066	0.057	<b>-0.134</b>	<b>0.149</b>	-0.060	0.080	<b>0.081</b>	<b>0.105</b>	1.000								
10	GDP growth	8.950	3.986	<b>0.172</b>	-0.023	<b>0.303</b>	-0.017	<b>0.084</b>	<b>-0.126</b>	<b>-0.152</b>	<b>-0.156</b>	<b>-0.362</b>	1.000							
11	Cultural distance	3.372	0.626	0.035	-0.009	0.018	<b>-0.114</b>	<b>0.098</b>	<b>-0.117</b>	-0.063	<b>-0.096</b>	-0.047	<b>0.242</b>	1.000						
12	Market Uncertainty	0.031	0.013	<b>0.199</b>	<b>0.243</b>	0.057	<b>0.227</b>	0.003	-0.052	-0.073	<b>-0.118</b>	0.066	-0.059	0.026	1.000					
13	Switching flexibility	-0.433	0.365	<b>-0.182</b>	<b>-0.105</b>	<b>-0.186</b>	-0.013	<b>-0.128</b>	0.044	<b>0.114</b>	<b>0.123</b>	0.030	<b>-0.416</b>	<b>-0.194</b>	<b>-0.085</b>	1.000				
14	Multinationality	4.017	3.052	<b>0.479</b>	<b>0.553</b>	<b>0.126</b>	<b>0.219</b>	0.069	-0.002	-0.072	<b>-0.081</b>	0.049	<b>0.129</b>	0.040	<b>0.452</b>	<b>-0.337</b>	1.000			
15	Equity stake	0.672	0.222	-0.073	-0.051	<b>0.187</b>	<b>0.115</b>	<b>-0.184</b>	0.078	<b>0.117</b>	<b>0.082</b>	<b>0.161</b>	<b>-0.263</b>	-0.036	<b>-0.082</b>	<b>0.179</b>	<b>-0.140</b>	1.000		
16	Investment size	0.944	2.389	<b>0.096</b>	<b>0.110</b>	<b>0.186</b>	0.050	-0.011	0.052	-0.047	-0.062	0.055	0.040	-0.011	0.030	-0.073	<b>0.108</b>	0.002	1.000	
17	Country-level investment alignment	-1.837	1.987	<b>-0.202</b>	<b>-0.083</b>	<b>0.191</b>	<b>0.099</b>	<b>-0.081</b>	-0.029	0.052	<b>0.110</b>	0.074	<b>-0.104</b>	-0.069	-0.027	<b>0.224</b>	<b>-0.422</b>	<b>0.232</b>	<b>0.194</b>	1.000

**Note:** Correlations in **bold** are significant at  $p < 0.01$  (two-tailed test).

**Table 1. Means, standard deviations, and correlations (continued)**

	Full sample (N=2054)	$\mu$	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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## Multinational Investment and the Value of Growth Options

1	Value of growth option	127.125	217.026	1.000															
2	Firm size	38.837	70.750	<b>0.397</b>	1.000														
3	Export intensity	0.112	0.185	<b>0.169</b>	<b>0.077</b>	1.000													
4	Sales affiliates	3.017	3.285	<b>0.280</b>	<b>0.406</b>	<b>0.221</b>	1.000												
5	Leverage	29.662	20.537	<b>0.183</b>	<b>0.107</b>	0.010	-0.005	1.000											
6	Acquisition ratio	4.773	12.928	0.029	0.009	-0.003	0.011	-0.020	1.000										
7	R&D intensity	2.839	2.595	0.033	<b>0.064</b>	0.026	<b>0.163</b>	<b>-0.175</b>	-0.003	1.000									
8	Sales cost	2.828	5.418	-0.056	0.043	<b>-0.098</b>	<b>0.120</b>	<b>-0.164</b>	<b>0.165</b>	<b>0.119</b>	1.000								
9	International experience	7.248	2.878	<b>-0.097</b>	<b>0.081</b>	<b>-0.190</b>	<b>0.134</b>	-0.051	0.044	0.035	<b>0.077</b>	1.000							
10	GDP growth	6.383	4.670	<b>0.202</b>	-0.032	<b>0.383</b>	-0.024	<b>0.093</b>	-0.029	-0.045	-0.041	<b>-0.442</b>	1.000						
11	Cultural distance	3.416	0.597	-0.003	-0.032	-0.031	<b>-0.150</b>	<b>0.099</b>	<b>-0.113</b>	<b>-0.086</b>	<b>-0.094</b>	0.004	0.039	1.000					
12	Market Uncertainty	0.065	0.048	<b>-0.064</b>	0.008	<b>-0.125</b>	0.005	-0.055	<b>-0.078</b>	<b>-0.066</b>	<b>-0.087</b>	<b>0.167</b>	<b>-0.495</b>	<b>0.130</b>	1.000				
13	Switching flexibility	-0.399	0.338	<b>-0.157</b>	-0.054	<b>-0.231</b>	-0.013	<b>-0.091</b>	0.008	<b>0.103</b>	<b>0.102</b>	-0.013	<b>-0.348</b>	<b>-0.131</b>	<b>0.066</b>	1.000			
14	Multinationality	4.734	3.343	<b>0.346</b>	<b>0.486</b>	0.019	<b>0.238</b>	0.046	0.012	-0.011	-0.054	<b>0.176</b>	<b>-0.058</b>	-0.016	<b>0.112</b>	<b>-0.242</b>	1.000		
15	Equity stake	0.655	0.214	-0.032	-0.048	<b>0.181</b>	<b>0.141</b>	<b>-0.200</b>	<b>0.082</b>	<b>0.139</b>	<b>0.096</b>	0.057	<b>-0.068</b>	-0.031	<b>-0.122</b>	<b>0.080</b>	<b>-0.096</b>	1.000	
16	Investment size	0.997	2.865	<b>0.064</b>	<b>0.146</b>	<b>0.087</b>	0.047	0.032	0.045	-0.025	-0.035	<b>0.085</b>	0.011	0.012	-0.001	<b>-0.064</b>	<b>0.141</b>	-0.014	1.000
17	Country-level investment alignment	-1.053	2.105	<b>-0.137</b>	-0.010	0.024	<b>0.073</b>	-0.038	-0.037	-0.040	0.025	<b>0.105</b>	<b>-0.273</b>	0.054	<b>0.365</b>	<b>0.134</b>	<b>-0.229</b>	<b>0.077</b>	<b>0.125</b>

**Note:** Correlations in **bold** are significant at  $p < 0.01$  (two-tailed test).



**Table 2. Multinational investment and value of growth options: fixed effects panel data estimation results**

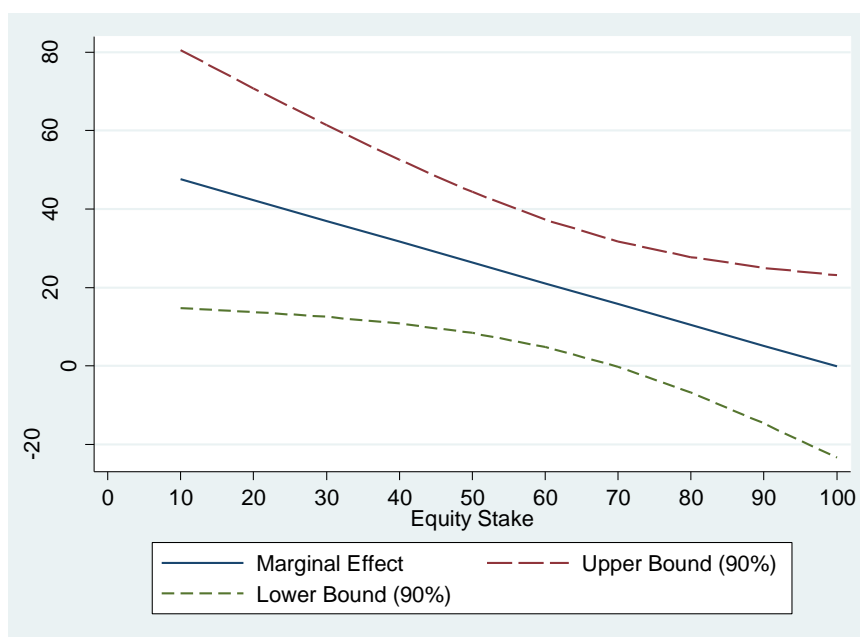
	(1)	(2)	(3)	(4)	(5)	(6)
	High	Low	Full	High	Low	Full
Firm size	-1.59 (0.026)	-4.04 (0.000)	-1.66 (0.000)	-1.68 (0.019)	-4.16 (0.000)	-1.73 (0.000)
Export intensity	-72.12 (0.140)	8.32 (0.835)	-80.24 (0.008)	-75.80 (0.118)	-1.82 (0.964)	-89.16 (0.004)
Sales affiliates	18.99 (0.000)	-7.17 (0.132)	8.22 (0.011)	18.34 (0.001)	-5.30 (0.274)	9.24 (0.005)
Leverage	-1.16 (0.174)	0.97 (0.066)	0.29 (0.474)	-1.24 (0.144)	0.85 (0.109)	0.24 (0.553)
Acquisition ratio	3.42 (0.151)	0.19 (0.769)	0.63 (0.340)	2.38 (0.318)	0.13 (0.841)	0.44 (0.513)
R&D intensity	16.32 (0.005)	8.02 (0.055)	14.06 (0.000)	15.66 (0.007)	8.52 (0.044)	13.46 (0.000)
Sales cost	-3.39 (0.664)	14.98 (0.005)	1.30 (0.736)	-3.86 (0.619)	15.12 (0.005)	1.23 (0.752)
International experience	5.21 (0.461)	5.28 (0.175)	3.85 (0.254)	10.22 (0.192)	8.73 (0.047)	9.45 (0.013)
GDP growth	1.70 (0.696)	1.64 (0.476)	1.74 (0.366)	2.65 (0.543)	1.45 (0.541)	2.31 (0.238)
Cultural distance	34.40 (0.188)	-3.67 (0.808)	5.96 (0.675)	25.87 (0.373)	-6.58 (0.685)	5.41 (0.717)
Market Uncertainty	-114.28 (0.633)	470.43 (0.336)	111.69 (0.413)	-85.91 (0.720)	209.24 (0.685)	96.31 (0.490)
Switching flexibility	28.60 (0.482)	-28.38 (0.202)	-17.19 (0.369)	38.74 (0.338)	-29.06 (0.197)	-18.29 (0.339)
Multinationality				52.91 (0.020)	-11.67 (0.530)	23.01 (0.067)
Equity stake				157.67 (0.317)	-10.31 (0.889)	80.67 (0.234)
Equity stake * Multinationality				-53.05 (0.086)	40.16 (0.120)	-9.02 (0.594)
Investment size				26.48 (0.116)	-1.51 (0.779)	5.19 (0.336)
Investment size * Multinationality				-5.73 (0.018)	-0.16 (0.918)	-2.30 (0.026)
Country-level investment alignment				9.68 (0.042)	1.88 (0.589)	2.01 (0.378)
Constant	109.05 (0.380)	159.30 (0.033)	108.22 (0.082)	-51.25 (0.748)	127.00 (0.179)	-28.60 (0.721)
Firm fixed effects	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included
N	1027	1027	2054	1027	1027	2054
Log Likelihood	-6274.03	-5963.73	-12691.16	-6260.82	-5958.68	-12678.95
Log Likelihood Ratio Test ( $\chi^2$ )				26.42 0.000	10.10 0.121	24.43 0.000
Wald Tests of Coefficient Equality ( $\chi^2$ )						
Multinationality				4.49(0.034)		
Equity stake * Multinationality				5.66(0.017)		
Investment size * Multinationality				4.51(0.034)		
Country-level investment alignment				1.42(0.233)		

**Notes:** *p* values within parentheses; LLR test compares Models 4, 5 and 6 with Models 1, 2 and 3 (base models), respectively; firm and year fixed effects are included but not reported (both  $p < 0.001$ ). High and Low refers to average market uncertainty in the host countries in which the firm operates manufacturing affiliates.

Table 3. Results of growth analysis: decomposing effects of changes in multinationality and alignment

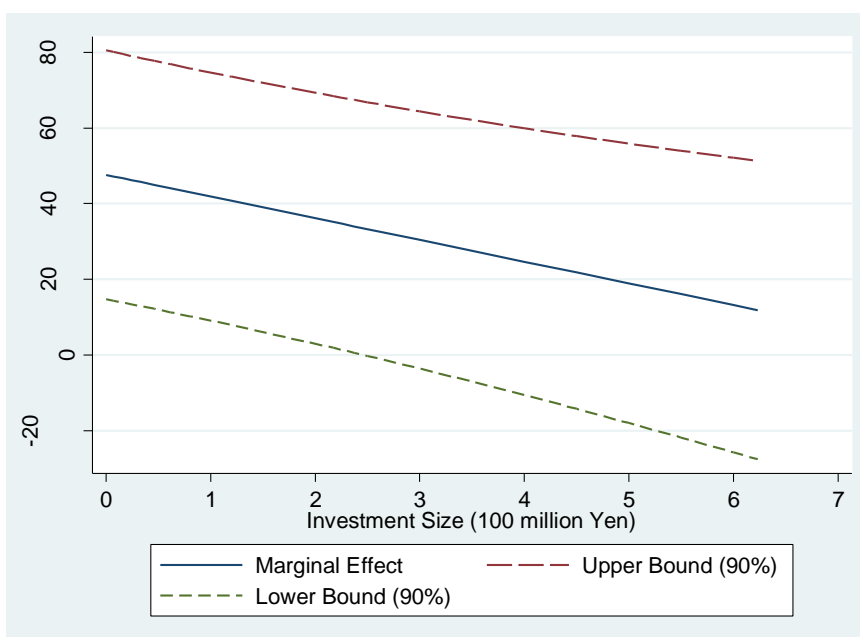
	(1)	(2)
Firm size	-5.67 (0.000)	-5.73 (0.000)
Export intensity	-86.50 (0.035)	-81.80 (0.047)
Sales affiliates	1.49 (0.754)	1.86 (0.695)
Leverage	-0.32 (0.531)	-0.32 (0.525)
Acquisition ratio	0.06 (0.957)	0.12 (0.915)
R&D intensity	18.62 (0.000)	18.88 (0.000)
Sales cost	6.64 (0.346)	6.53 (0.354)
International experience	1.94 (0.684)	1.96 (0.683)
GDP growth	1.55 (0.638)	1.58 (0.633)
Cultural distance	8.05 (0.733)	9.19 (0.698)
Market Uncertainty	124.23 (0.462)	82.13 (0.632)
Switching flexibility	-14.59 (0.745)	-17.29 (0.700)
Existing country alignment		4.40 (0.041)
Country entry alignment		-0.75 (0.943)
Country exit alignment		-16.26 (0.339)
Constant	44.07 (0.000)	41.23 (0.001)
Firm fixed effects	Included	Included
Year fixed effects	Included	Included
N	1613	1613
Log Likelihood	10123.93	10120.70
Log Likelihood Ratio Test ( $\chi^2$ )		6.46 (0.091)

**Notes:** *p* values within parentheses; firm and year fixed effects are included but not reported (both  $p < 0.001$ ).



**Figure 1. Marginal effects of multinationality on the value of growth Options in high market uncertainty environments: the moderating impact of equity stake**

**Notes:** The graph is drawn based on the results reported in Column 4 (high-uncertainty) in Table 2 and are based on significant coefficients. The vertical axis denotes the marginal effect of *Multinationality* on the value of growth options (in billion Yen), and the horizontal axis denotes *Equity Stake* (in percentage). The solid line in the middle is the estimated marginal effect of *Multinationality* on the value of growth options. The bottom and top lines represent the lower and upper bounds of the 90 percent confidence interval of the marginal effect of *Multinationality*, respectively. The graph is drawn with the value of *Investment Size* being held constant at its sample minimum.



**Figure 2. Marginal effects of multinationality on the value of growth Options in high market uncertainty environments: the moderating impact of investment size**

**Notes:** The graph is drawn based on the results reported in Column 4 (high-uncertainty) in Table 2 and are based on significant coefficients. The vertical axis denotes the marginal effect of *Multinationality* on the value of growth options (in billion Yen), and the horizontal axis denotes *Investment Size* (in hundred million Yen). The solid line in the middle is the estimated marginal effect of *Multinationality* on the value of growth options. The bottom and top lines represent the lower and upper bounds of the 90 percent confidence interval of the marginal effect of *Multinationality*, respectively. The graph is drawn with the value of *Equity Stake* being held constant at 10 percent, and with the value of *Investment Size* increasing from its sample minimum to the 99<sup>th</sup> percentile.