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## UNCERTAINTY AND LEARNING IN INTERNATIONAL JOINT VENTURES

### ABSTRACT

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This study deals with the potential interplays between two uncertainty types (endogenous vs. exogenous uncertainty) and the role of learning in joint ventures (JVs) from the real options perspective. Regarding the role of learning under different types of uncertainty in JVs, one stream of real options research argues that learning has nothing to do with investment decision, while the other stream of research argues that investment decision is endogenous to learning. Considering that investment decisions embedded in JVs are affected by endogenous uncertainty (e.g., partner uncertainty) and exogenous uncertainty (e.g., demand uncertainty), this study suggests a conceptual model which takes into account the impact of endogenous uncertainty and firm's learning of JV partners and market demand on real options value and exercise. Since almost all real options research focuses on exogenous uncertainty and less study learning under the real options framework, we add to this literature by touching upon possible roles of endogenous uncertainty and learning in driving firm's strategic choices.

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*Key words: international joint ventures, uncertainty, learning, real options*

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## INTRODUCTION

Multinational companies (MNCs) face multiple types of external uncertainty associated with fluctuations in exchange rates, demands, or institutions (Chung and Beamish, 2005; Chung, Lee, Beamish, and Isobe, 2010; Cuypers and Martin, 2010; Kogut, 1991; Kumar, 2005; Santoro and McGill 2005; Vassolo, Anand, and Folta, 2004). Real options view argues that under the conditions of heightened uncertainty, it is recommended that a firm have real options, future decision rights embedded in its investment, by investing at comparatively lower level (e.g., international joint ventures (IJVs)) than wholly-owned subsidiaries or acquisitions (Cuypers and Martin, 2010; Kogut, 1991; Kumar, 2005; Tong, Reuer, and Peng, 2008). Considering the irreversibility and sunk-cost risks of investments, shared ownership with other companies can reduce a firm's potential downside risks (Cuypers and Martin, 2010; Reuer and Leiblein, 2000; Tong, Reuer, and Peng, 2008). Additionally, a relatively smaller-sized investment in an uncertain environment allows MNCs to engage in subsequent decisions in incremental ways with smaller risks (Chi, 2000; Chi and McGuire, 1996; Folta, 1998; Kogut, 1991).

The extant IJV literature taking real options view makes two assumptions. First, real option value primarily originates from options-like investments under "exogenous uncertainty," sourced by price, market, or technology (Folta, 1998; Kogut, 1991; Kumar, 2005; Vassalo, Anand, and Folta, 2004). Meanwhile, it is argued that endogenous uncertainty is irrelevant for the real options argument because this uncertainty can be resolved by firms' actions (Chi and Seth, 2002; Cuypers and Martin, 2010; Folta, 1998; McDonald and Siegel, 1986; Roberts and Weitzman, 1981). Second, it is argued that real options with a discretionary nature are therefore valued and exercised only following arrival of external information (Adner and Levinthal, 2004a, 2004b). In contrast, path-dependent and open-ended learning is assumed to have nothing to do with traditional real options logic (Adner and Levinthal, 2004a, 2004b; Cuyper and Martin, 2010).

However, two fundamental questions relating to these assumptions remain unsolved. First, given that more than one company is involved in an IJV and partner capability or credibility could therefore be primary sources of uncertainty, and endogenous uncertainty may affect the realization of real options value embedded in IJVs. What if endogenous uncertainty interacts with exogenous uncertainty, influencing the value and exercise of real options embedded JVs? Second, although the literature notes that certain types of real options provide the firm with flexibility to learn (i.e., the option to defer, growth option in small scaled investment, etc.), the role of learning within the real options framework

remains unanswered. Real option is at least partly endogenous to learning considering that prior learning about market and partner can influence the decision about whether to exercise or not, or how to exercise. Likewise, it remains for us to carefully examine whether or not learning has any relevance to the real options argument.

The purpose of this paper is to discuss uncertainty and learning in IJVs from the real options perspective, and suggests a conceptual model for firm's optimal decisions. The model takes into account endogenous uncertainty and firm's learning of partners and market demand. This is one way to explicitly incorporate managerial considerations into the more economically driven real options theory. Prior studies have dealt with real options arguments and learning separately.

## **LITERATURE REVIEW**

### **Endogenous vs. exogenous uncertainty in IJVs**

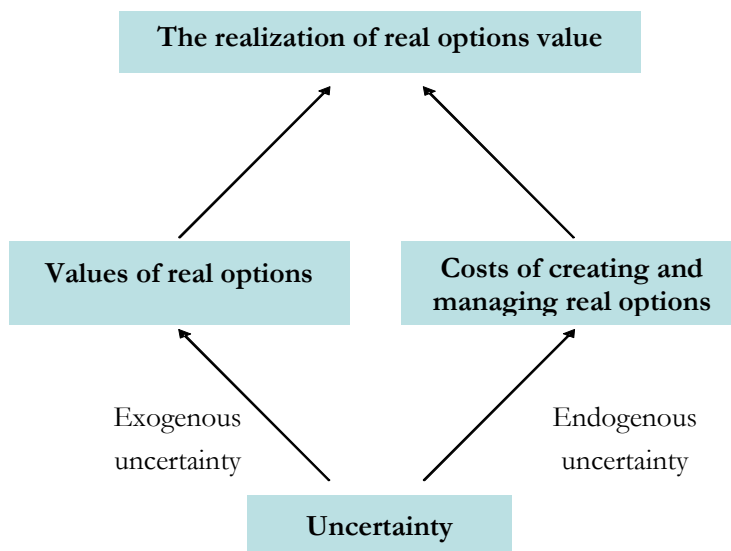
The notion of uncertainty can be characterized as situations where firms can not assess the value of an investment due to randomness or arbitrariness of events in the environment. Real option theorists have focused on exogenous uncertainty as the key driver of the values of real options investments (Folta, 1998; Cuypers and Martin, 2010). Here exogenous uncertainty refers to the volatility of the economic returns caused by unpredictability of the external environment (Chi, 2000; Dixit and Pindyck, 1994; Folta, 1998). For example, uncertainty associated with currency exchange rates is exogenous to the firm since these rates are determined in atomistic markets (Campa, 1994). Uncertainty over the economic value of an exchange, including that relating to price, markets, and technology, is the issue of concern to firms investing in real options (Folta, 1998; Kogut, 1991; Kumar, 2005; Santoro and McGill, 2005; Vassalo, Anand, and Folta, 2004).

While exogenous uncertainty is a key element in the real options argument, endogenous uncertainty is not an important issue in this regard. While endogenous uncertainty is controllable by firms' effort, for example, by engaging in more learning, exogenous uncertainty indicates that firms cannot predict and value it exactly and so firms cannot control it (Chi and Seth, 2002; Cuypers and Martin, 2007; Folta, 1998; McDonald and Siegel, 1986; Roberts and Weitzman, 1981). Regarding the relationship of these two uncertainty types and the theoretical boundary of real options, Adner and Levinthal (2004a) argue that firm's effort to learn to reduce endogenous uncertainty allows them to sometimes discover new and unanticipated opportunities and paths and thus to

invest and commit resources rather than to wait. They also argue that endogenous uncertainty may undermine the discrete nature of real options investments and thus the validity of real options theory as a decision-making tool (Adner and Levinthal, 2004a; Cuyper and Martin, 2010). Relevantly, Cuyper and Martin (2010) empirically compare three exogenous uncertainty types (exchange rate, demand, and institution) with three endogenous uncertainty types (capability, size, and culture) in terms of their impact on the choice of minority ownership in Chino IJVs. They found that JV partners choose minority IJVs ownership under each of three exogenous uncertainty types, while they do not under each of three endogenous uncertainty types. Their findings are in line with the real options argument supporting the firm's choice of real options investment under the influence of exogenous uncertainty.

The question is whether endogenous uncertainty is independent of or interacts with exogenous uncertainty. While financial options are strictly associated with exogenous uncertainty, real options are associated with both endogenous and exogenous uncertainties (McGrath, Ferrier, and Mendelow, 2004). High external uncertainty is positively associated with behavioral uncertainty (Barney and Lee, 2000; Williamson 1985). For example, in JV settings, partners' behavioral uncertainty enhances appropriation concerns and can be further compounded by exogenous shocks (Gulati and Singh, 1998).

Real options theory argues that firms are able to preserve upside gains by increasing their involvement when they capture a favorable market signal while limiting downside losses by giving up this option in cases of unfavorable situations (Trigeorgis, 2002). They can also delay their decision until a later time without exercising or giving up the options. However, in the face of the high management costs associated with endogenous uncertainty, firms in JVs are likely to risk losing this flexibility. If management costs are non-trivial and therefore termination is at hand, firms cannot retain this option value any longer and partially or completely lose this expected options value (Reuer and Leiblein, 2000; Tong and Reuer, 2007). Therefore the actual realization of real options is influenced by the cost of creating and managing real options. No consideration of these costs associated with endogenous uncertainty may lead to a completely incorrect decision as implied in Figure 1.

**Figure 1: The Impact of Two Uncertainty Types**

### Learning in IJVs

According to the real options view, IJVs are considered an entry mode with two main motives: to learn local markets and partners, and in order to retain flexibility (Kogut, 1991; Chi and McGuire, 1996; Chi, 2000; Tong, Reuer, and Peng, 2008). With these objectives, this transitory organizational form has often been used to overcome market uncertainty and hierarchical costs in international business (Reuer, 1998; Tong et al., 2008).

It is widely accepted that the main advantage of an options perspective is its ‘wait-and-see’ nature. Specifically, firms wait and see until information associated with uncertainty embedded in initial investments and make subsequent decisions including waiting, acquiring, or divesting (Bowman and Hurry, 1993; Dixit and Pindyck, 1994; Folta, 1998; Folta and Miller, 2002; Kogut, 1991; Kogut and Kulatilaka, 2001; Kumar, 2005; McDonald and Siegel, 1986; Pindyck, 1991; Trigeorgis, 2002). By the way, what would be occurring during the time between the creation and the exercise of real options? A simple answer is, firms might be involved in several types of learning activities. By having time before additional investment, firms may gather information about market and partner in alliance for instance, develop capabilities through learning, or wait and see at least.

Most of the real options literature admits the learning component of the real options framework. However, this learning is viewed as a passive consequence of the delay period. The traditional argument is that only information associated with exogenous uncertainty affects the changes in real options values and the exercise of real options. However, if endogenous uncertainty and learning were taken into account in a specific setting such as JVs, learning concerning endogenous uncertainty could be discussed in the real options context. Relevantly, McGrath et al. (2004) agreed with Bowman and Hurry's (1993) assertions that options are vehicles for path-dependent strategic change and choice. In addition, they seek to develop a better mechanism for understanding the strategic effects of resource accumulation and learning processes. A firm's stock of knowledge, as the base of the initial abandonment decision, will likely change partially due to the exogenous resolution of uncertainty and partially to the firm's own trial-and-error search initiatives.

It can be drawn from a prior argument that real option is at least partly endogenous to learning. Prior learning about market and partner, it facilitates decisions about whether to exercise or not. This idea is in the similar line with what Chi and McGuire (1996) attempt to value JVs among partners based on asymmetric learning about partner and demand. A relevant research hole is to investigate the impact of the actual learning in alliances and subsequent evolution including buyouts and sell-offs. And learning secures at least first mover advantage by knowing what partners know in competitive situation. This view on active roles of learning is contrasting to the traditional argument that learning within real options framework means passive waiting and seeing.

## **MODEL DEVELOPMENT**

### **Choices after learning: Bayesian approach**

While the real options literature has analyzed these sequential investment decisions, less attention has been given to how information acquisition or learning impacts the real option value. We take a Bayesian approach to examine what firm's choices will be after learning. Among several learning objects, firms are mostly interested in learning about demands and their partners. For example, multinational companies do not know exactly specifics concerning the local market (Campa, 1993; Kogut, 1991). They have limited information regarding local competition, supply and demand, culture, institutions, etc. Additionally, they usually do not have information regarding the economic players in the market, particularly, their preferences, reputations, and credibility. For example, when investing JVs, they must overcome dual uncertainties, market uncertainty and the partner's

behavioral uncertainty. In this context, learning and adaptation are the most important activities of a multinational corporation (Chi and McGuire, 1996; Doz, 1996). Here demand is one source of exogenous uncertainty, while the partner is a source of endogenous uncertainty. This information flow can be performed either passively or actively, and is influenced by the focal firm's absorptive capacity or ability to perceive and process external information. The organization's accumulated learning not only provides it with capabilities that give preferential access to opportunity, but it also influences sense making and the recognition of shadow options (Bowman and Hurry, 1993).

However, in reality, these market demands and partner characteristics are likely to be known to the MNC retroactively (Teece, 1987; Chi and McGuire, 1996). It indicates that the MNC cannot acquire relevant information far enough in advance of undertaking a JV, instead waiting for some extended period of joint operation (Chi, 1994). Therefore, an MNC's decisions made following the initial investment are likely to be based on Bayesian thinking. On the condition that an MNC actually knows the local demand for their product and how capable and credible partner is, they will make subsequent decisions by weighing the values of various options such as divesting, searching for another partner, acquiring, or waiting. This point is in line with the argument that a JV gives an MNC more flexibility in their investment decisions than other organizational forms. As the collaboration progresses, the valuation of the JV is susceptible to learning more about the market's response to the venture's product and the extent to which their independently held assets complement those of the venture (Chi, 2000).

After the initial investment (time 1), MNCs are supposed to decide on next actions (time 2): waiting (i.e., maintaining the status quo), exercising (i.e., acquiring the local partner's share), or giving up (i.e., selling its own interest to the local partner or another partner) (Chi and McGuire, 1996; Chi, 2000). Here exercising the options means increased acquisition of the partner's share. Since the firm has learned about the local economic environment from its initial investment (and possibly from its partner), the ex-ante risk associated with this investment opportunity is lower. If this is the case, initial partnering with a local firm may not provide the same level of benefits as in the initial investment in terms of risk reduction and learning about the environment (Chi and McGuire, 1996; Chi, 2000). However, it is worth noting that a reduction in the MNCs' need for their partner does not always mean that the foreign partner will acquire the JV business or establish a subsidiary (Inkpen and Beamish, 1997; Folta and Miller, 2002). As the foreign partner

increases its local knowledge various outcomes are possible. For instance, as the foreign partner learns about local market realities it may decide to withdraw from the market. In contrast, the foreign partner may seek a more prominent role in the management of the JV (Chung and Beamish, 2010; Inkpen and Beamish, 1997).

Here decision-making among various choices would depend on what the MNC learns regarding market demand and its partner’s capability and credibility. If the MNC learns that its partner is both trustworthy and capable and there is significant market demand for their product, then waiting or acquiring would be optimal (cell 1 in Figure 2). Maintaining the JV or acquiring partner’s share will be valuable in this case. According to real options logic, purchasing the partner’s shares in a JV is analogous to exercising the call option the firm acquired via the initial joint ventures investment. For example, full-scale acquisitions buy the underlying securities of a target market. In contrast, if an MNC learns that its partner is untrustworthy or incapable and that market demand is insignificant, they attempt to divest (cell 4). In this case, the MNC cannot gain any advantage from the JV, and may not need to wait any longer. If only one of either market or the partner is favorable to the MNC, they retain various alternatives. If market demand is significant but the partner is not trustworthy and incapable, the MNC can acquire partner’s share or search for another partner (cell 2). In this case, the MNC can keep or end the present JV, then begin with a new JV. On the other hand, if the partner is trustworthy and capable but market demand is insignificant, then the MNC can divest. Alternatively they attempt to continue the present JV by modifying their product, nurturing new market demand (cell 3).

**Figure 2: A Conceptual Model about Optimal Investment Decisions**

		Partner Characteristics	
		Trustworthy/ Capable	Not Trustworthy/ Not Capable
Market Demand	Significant Demand	1. Maintain/ Acquire	2. Find New Partner/ Acquire
	Non-significant Demand	3. Divest/ Modify Product	4. Divest



## **MODEL APPLICATION**

### **An application: formal vs. informal institution in foreign countries**

Environmental uncertainty, in terms of its impact on value and/or cost of investments or exchanges, has taken several forms in the extant literature on transaction cost economies, real options views, and so on. It is characterized in the unique institution of an economy. Regarding the relationship between institution and uncertainty, it is expected that formal institution, such as politics and economics, is associated with exogenous uncertainty (not resolved by firms' effort), while informal institution, such as culture, is associated with endogenous uncertainty (resolved by firm's learning). However, two dimensions have been so far dealt with independently or with one controlled in relevant study. Instead, it is necessary to look into some interactions (e.g., contrasting or positive relationships) between two types of uncertainty in that two types of institution are interacted with each other. Culture influences firms' preference for flexibility because it has a bearing on the level of perceived endogenous uncertainty and filters the perceptions of exogenous uncertainty. Few previous research have explicitly examined how national culture influences the desire for flexibility (e.g., maintaining equity collaborations) or the willingness to commit (e.g., partner acquisition or dissolution) (Folta and Ferrier, 2000). This point adds an extension to the controversy over commitment versus flexibility.

For foreign firms, this unique characteristic of formal and informal institution is attributed to the source of exogenous uncertainty and endogenous uncertainty each, under which they have to make their strategic decisions. Among the foremost and important ones, the choice of commitment and flexibility is at their near hand. If they commit themselves, foreign firms are expected to take advantage of new opportunities at their disposal. However, they will also have to take subsequent risks (e.g., irreversibility) in that their investment could be locked in potential instability of local politics and economics. By contrast, flexibility consideration could be adopted in this context. In specific, real option logic argues that firms make option-like investments specifically under high uncertainty. Here uncertainty means in specific exogenous uncertainty, which is not resolved by firms' efforts. And these exogenous uncertainties come mainly from formal institution. Economic and political risks are two representative examples of this kind. According to the real option logic, foreign firms are predicted to enter a market by low-involvement (e.g., minority IJVs or M&As) at first. Regarding the impact of exogenous uncertainties in

different cultures, it is expected that real option logic would be valid in low cultural distant areas. Meanwhile, in high cultural distant areas, a tradeoff would exist between flexibility and commitment.

## **DISCUSSION AND CONCLUSION**

In spite of a volume of research, controversies remain regarding the relationship among learning, real options, and uncertainty types. This study analyzes these controversies and attempts to suggest parsimonious models for testing and resolving them. Learning is regarded as the most important objective of JVs. In specific, learning about market demand to JV products and the partner's capability and credibility are key factors affecting the future of a JV. In the initial stages, a JV can be adopted as a hybrid form between the market and hierarchy. According to the real options perspective, it gives the focal firms' flexibility that allows the firms opportunities to make subsequent decisions after the conditions of uncertainty and new opportunities. In the process, what they learn about the market and their partner is expected to influence the next actions the firms undertake. In this paper based on key concepts of the real options perspective we propose various strategic options that the firms use in making optimal choices. On the condition that firms learn more regarding market demand and partner characteristics after a period of actual management, they retain their current JV business, acquire the partner's interest, or search for alternatives including another partner or new market demand. Taking these endogenous and exogenous factors into account, real options theory provides some explanation of firms' decisions regarding optimal investment modes. This article therefore makes some academic contributions by adopting the real options perspective, and additionally suggests a conceptual framework explaining firms' flexible choices under the Bayesian approach.

While the value of having flexibility in investments has now been widely studied in the real options literature, the learning involved in keeping and managing real options investments has not received much attention. Although the option to defer and learn is an important type of flexibility, the role of learning within the real options framework is still unclear. We find three key issues relevant to the role of learning in real options logic: (1) understanding the reasons and conditions under which firms would want to learn at cost, since in real options theory, learning matters for resolving endogenous uncertainty, but does not matter for resolving exogenous uncertainty, (2) identifying the conditions that make it possible to learn at low cost under high uncertainty, and (3) determining the

timing of learning under which decision makers would want to exercise the uncertainty-reducing learning option, even in the existence of a tradeoff between cost of learning and quality of information.

In regards to the uncertainty types and conditions of valuable learning option, Grenadier and Malenko (2010) examined the optimal timing of investment by focusing on the case in which uncertainty about past shocks comes from a firm's inability to distinguish between temporary and permanent shocks to the cash flow process. They extended the standard Brownian uncertainty driving traditional real options models with additional Bayesian updating (or learning), and showed that this gives rise to two different real options embedded in investment: the waiting option as in traditional real options literature, and a learning option – i.e., the option to learn more about the nature of past shocks. In this case, we expect that what is learned in time I influences specific decisions at time II. A relevant research topic for future research is, for example, to investigate the impact of the actual learning in alliances and subsequent decisions such as buyouts and sell-offs. In competitive situations, learning is likely to help to secure, at the very least, first mover advantages by knowing what partners know. Nevertheless, it is also expected that costs of learning are non-trivial under high uncertainty. Therefore, when considering the optimal timing for learning, the firm faces a tradeoff situation. On the one hand, by delaying the learning activity, the firm postpones the cost of learning as well, but, on the other hand, the delay increases the probability that learning will reveal information that would have been more beneficial if received earlier.

It will be also interesting to identify the conditions under which it would be possible to learn at low cost under high uncertainty. Prior international business studies suggest that governance modes can affect the relative opportunity cost of learning. For example, the opportunity costs of learning associated with alliances are likely to differ under different contexts. We posit that controlling for other strategic benefits and costs of alliances, alliances in highly concentrated industries will create higher opportunity costs of learning than those in less concentrated industries. In addition, it will be valuable to test our ideas empirically using mathematical or statistical models built using the reference of a financial options pricing model. It is worth evaluating the explanatory power between transaction cost theory and real options theory, based on the level of these two uncertainties. For example, transaction cost economics also considers uncertainty and irreversibility of international investments (e.g., Anderson and Gatignon, 1986). Drawing on transaction

costs logic, international researchers have traditionally stressed that such investments allow firms to extend their borders to overseas locations through internalization of key transactions (Buckley and Casson, 1998; Dunning, 1981). Uncertainty is viewed primarily as a source of transaction costs, and implies the need to minimize them through internalized control (e.g., higher ownership). Transaction cost economics does not, however, fully recognize potential opportunities embedded in uncertainty nor fully value managerial flexibility in adjusting investment decisions in response to the revelation of uncertainty. A real options lens can suggest ways to structure international investments in order to reduce transaction costs under uncertainty. It will be interesting to compare the conditions whereby commitment is oriented at the expense of flexibility or vice versa.

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