

## EXPLORING MODES OF ENTRY INTO INTERNATIONAL MARKETS: DIRECT INVESTMENT OR CONTRACTUAL RELATIONS

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**Abstract.** We consider the multinational company's decision on whether to enter a new foreign market using direct investment by establishing a subsidiary, direct exporting or contracting a local distributor, with the option to invest later. We develop two models, based on the real options theory, to support such decisions. The option on direct exporting or on a local distributor allows the firm to minimize risks by finding out if the market is large enough to support future direct investment. We find the direct investment to be the desirable mode of entry in large markets subject to low demand uncertainty. Overall, the investigation increases the knowledge related with exploring new markets subject to demand uncertainty, valuing the flexibility of present and future options.

**Keywords:** internationalization, foreign markets entry modes, investment decisions, demand uncertainty, real options, flexibility.

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### Introduction

A fundamental problem in new markets approach is how the foreign markets (FMs) should be served, considering the inherent costs of doing business abroad. The traditional explanation to enlarge business into FMs relies on cost advantages, scale economies, product differentiation or brand reputation. Despite the possible advantages there is always a doubt regarding the entry mode (EM) and related amount that the multinational company (MNC) wish to afford.

In this paper, we provide an alternative approach to the traditional evaluation using discounted cash flows technique, to support the choice between EM using a subsidiary

(own company (OC) or joint venture (JV)), direct exporting (DE) and a local distributor (LD). In this last choice, the MNC adopts a contractual arrangement with a local provider to maximize the information regarding local market.

The setting when a MNC seeks to sell its products in a new FM is that the revenues are uncertain. In entering the FM the MNC can exercise the option to invest immediately, in its own sales operation, or contract a local agent and eventually invest later using better market knowledge.

Within this setting, we derive two research questions: (1) the optimal mode of entry, also as the (2) moment for future changes. The model predicts that a contractual arrangement is more likely when markets are on average small, there is down-side risk in sales revenue and the change between LD and OC can be achieved in a short period of time.

The research challenge, using the existing background literature, is related with the high costs of switching between different EMs, forcing a period of inaction, during which the corporation continues to use its current mode, even if the immediate profits favored switching strategies. In sum, existing studies on dynamic EM choice emphasize the value of the option to defer; however, when facing high uncertainty and irreversibility of investment, MNCs tend to choose low-commitment EMs and hesitate to make switching decisions.

With this study we enrich the application of real options (RO) theory to the international business literature on choice of host markets EMs under demand uncertainty. Our model implies that the choice of EM depends mainly on the market uncertainty magnitude.

This paper is structured as follows. In the next two sections, the background theory is supported and the reasoning for the used techniques to solve the problem is presented. Section 3 illustrates the problem under study. Section 4 presents the formulation of the models, with generic sets. Section 5 describes the MNC case study, presents and discusses the results. The paper concludes with some final remarks, limitations and a discussion on future research.

## **1. Literature review**

The process of globalization represents one of the most significant trends that accelerate rapid growth of global corporate strategies. Firms that want to internationalise must decide on a fitting EM in order to make the best use of their scarce resources. But it's important to analyse MNCs' motives for exploring a FM. Therefore, MNCs aim international markets for two main reasons: (1) FMs are growing faster than the domestic markets; and (2) searching greater sales volume in order to achieve higher competitiveness, through cost advantage or releasing resources for additional efforts in a product/service push strategy.

According to Czinkota and Ronkainen (1995) and recently following Hollensen (2011), the motives for entering a FM can be split in proactive and reactive. Proactive motives are related with growth goals, economies of scale, tax or other legal benefits. On the other hand, reactive reasons are due to competition, limited domestic market or over-

capacity. Despite the fact that the EM decision received considerable attention in the literature with numerous theoretical and empirical contributions (e.g. Brouthers, Hennart 2007; Morschett *et al.* 2010) its determinants remain inconclusive (B. B. Nielsen, S. Nielsen 2011).

When a firm is going to explore a FM, the choice of the best EM is decided by the firm's expansion strategy in which, most frequently, the EM has been examined in terms of selecting between OC and a JV (Morschett *et al.* 2010). The decision of how and the moment to enter a FM can be highly risky due to firms' industry competitive conditions, mainly in the critical start-up stage, confronting the speed to get accepted profitability levels versus the survival capacity (Mudambi, Zahra 2007). Information asymmetry and distinct differences in operational environments between countries have also been explored in the literature (Luo, Shenkar 2011).

Companies can expand into FMs using the following mechanisms (Root 1994):

- exporting: (1) direct exporting (DE) using a domestic-based export department, or (2) export sales representatives sent abroad to find business;
- overseas direct investment: (1) creating a new OC, or acquire a participation on an existing firm to handle sales, promotion and distribution activities, or (2) establishing a JV;
- foreign-based distributors or agents: LDs might be given exclusive rights to represent the company in the host country.

The EM that a MNC chooses has advantages and disadvantages that will determine the resources to commit, the risk level, the degree of control and potential return over the operations, (Erramilli, Rao 1993) and may affect the overall exporting performance (Brouthers 2002; Pineda, Hurtado 2011).

EM has been one of the most researched field in international management (Werner 2002) and is presented as the structured way organizations employ to gain, entry and operate in a new FM (e.g. Sharma, Erramilli 2004). Past studies have suggested that the choice of EMs is related to a firm's familiarity with the FM (e.g. Kim, Hwang 1992; Sarkar, Cavusgil 1996), which means that firms with prior host market experience are more likely to choose a direct investment mode. A number of FM characteristics can affect the choice of market servicing modes. The commonly examined characteristics are attractiveness and market size (Sarkar, Cavusgil 1996). Root (1994) suggests that small markets favour EMs which require a low break-even sales volume (e.g. DE), while markets with high sales potential justify the employment of high resource commitment (OC or JV). Recently, industry environment, the country risk, location and legal rules have also been considered in studies regarding EMs (Ghauri, Cateora 2010; Malhotra, Sivakumar 2011). For Mudambi and Zahra (2007), when industry conditions are highly uncertain, new international ventures exhibit advantages in terms of value-adding and disruption capabilities, which enable higher growth rates. According to Morschett *et al.* (2010), companies prefer cooperative EMs in situations with a higher country risk. Driffield *et al.* (2010) and Duanmu (2011) correlated, despite their opposite views, the country risk with the level of foreign ownership. Arslan and Larimo (2011) found that different legal systems results in preference of acquisitions.

The DE has advantages like low investment level and the possibility to postpone an investment decision (Johanson, Vahlne 1990); the common disadvantages are trade barriers (e.g. tariffs) and logistic factors (Hill 2007). DE allows a firm to internationalize without major investment effort and minimum risk; briefly, it can be the first step in the internalization process (Hollensen 2011). However, it is also associated with a low profit return (incorporates only part of the margin) and provides little control (Agarwal, Ramaswami 1992). In opposition to the gradual internationalization approach, some firms, according to their strategic challenge (Kwon, Konopa 1993) and location related factors (Chung, Enderwick 2001), enter a FM through direct investment. In contrast to DE, direct investment offers the firm a higher degree of control over its international business and greater revenues. However, direct investment modes are also associated with greater risks, they imply higher management commitment and operations complexity. The most widely used direct modes include JVs, wholly OCs, and strategic alliances (Kwon, Konopa 1993). JVs represent an agreement between two parties to operate in a particular market, aiming performance incentives with knowledge share (Duarte, Suárez 2010), which may minimize entering costs for start-up the business (Fey, Shekshnia 2011). One of the disadvantages is the need of a win to win partnership. The firm will not have a tight control on the business and the shared ownership may cause conflicts. We found a category of studies based on a RO approach that consider whether JVs can be viewed as effective RO. These studies suggest that a JV provides a firm with the ability to exploit upside potential by acquiring the partner's equity (option to grow), or to avoid future downside losses by selling the equity to its partner (option to abandon) (Estrada *et al.* 2010; Fisch 2011). Foreign direct investment using OC involves capital, technology and personnel, and can be made through the acquisition of an existing entity or the establishment of a new subsidiary or extension (branch). Direct ownership provides a high degree of control and better knowledge about the market. However, it requires a high level of investment and a high degree of commitment. Acquisitions are often made as part of a company's rapid growth strategy, whereby it is more beneficial to take over an existing firm's operations when compared to expanding on its own (Lee, Lieberman 2010). Nevertheless there could be limited influence of local management and as a consequence, the participation relies on a special distribution agreement.

According to Hill (2007) the decisions about entering in a FM can be progressive and split in: market choice, time, scale of entry and strategic commitments. The chain of establishment, or "Uppsala model", is one of the earlier schools of thoughts and draws on the assumption that the entry option into new markets is the result of a series of staged and incremental decisions (Edwards 2002). Mudambi and Zahra (2007) compared the performance of MNCs by adopting direct investment with those that follow a sequential approach and found that a new venture strategy is no more likely to fail than a sequential approach to internationalisation. Later on, Kalinic and Forza (2012) found that a sequential approach targeting host market relationships and a flexible strategic focus will affect the speed of internationalization.

## **2. Reasoning to choose ro to solve the problem**

Investment analysis is usually conducted using the Net Present Value (NPV) approach. Under NPV approach, the potential investor chooses the best combinations of alternative markets to explore, based on the projected values and its budgeting limitations. The NPV indicates the magnitude of potential investment, using implicit assumptions that reflect the basic inadequacy of this approach (Smit, Trigeorgis 2004; Dixit, Pindyck 1994). These limitations can be overcome by using a different perspective on investment under uncertainty, which is recognized as the RO approach.

The NPV assumes that the investor has to make the investment now or the investment will not be available in future. However, in the real world there's usually the possibility to delay the investment option until new information arrives and uncertainty about the future market is reduced. This possibility introduces the "value component" to the investment option that impacts the decision to invest and its timing.

The usage of the RO technique is deemed appropriate only if there is (Dixit, Pindyck 1994) uncertainty, managerial flexibility, and totally or partially irreversible investment. While RO valuation has been recognized by the scientific community, the approach yet lacks a practical breakthrough (Lander, Pinches 1998). The models presented in this paper aim at facilitating the understanding and practical application of the RO. The framework we propose is organized across organizational, strategic, valuation and controlling aspects of RO. The first layer focuses on organizational aspects of RO valuation - input parameters (Claeys, Walkup 1999). The second layer refers to the link of RO value to strategy frame. The third layer refers to valuation aspects for which we propose different techniques. The fourth and final layer is about the controlling aspects of RO. Options are only valuable if they are exercised accordingly, as so, monitoring the respective decision rules and properly execution will enhance the learning process (Copeland, Howe 2002). One of the most important questions in RO analysis is to determine the optimal timing in which the investor should exercise his opportunity. Time is critical since the value of the investment opportunity depends on the market potential that changes over time. An appropriate investment analysis approach must be able to address these challenges.

Recent studies have also used the benefits of RO methodology to support EMs choices under uncertainty (Brouthers, Dikova 2010; Cuypers, Martin 2010; J. Li, Y. Li 2010). In this article, we further extend this last stream of research by quantifying MNCs' choice of market EM under uncertainty as options, including the decision time frame.

## **3. Problem description**

Research question (RQ) 1 – choose location. We consider two factors: the market uncertainty level and the option entry costs. Our main question is in which location should the MNC establish its investment in moment zero - that is, which location provides the MNC with a higher option value? Demand uncertainty concerning potential upside benefits associated with international expansion will be measured as the demand uncertainty in the target market. Two practical questions must support the decision to define

the market uncertainty: (a) what is the potential market size and (b) what is the growth potential for the product/service in that country?

RQ 2 – choose FM entry mode (EM). We also consider two factors: the market uncertainty level and the option entry costs. Our main question is what EM should the MNC use when deciding in moment zero - that is, which EM provides the MNC with a higher option value? The options exist in the identified EMs: (a) DE and LD provide options to growth in the future or to give up by minimizing investment costs; (b) OC provides options realizing full capacity to explore market opportunities; (c) JV provides options as it can be possible to buy the partner position.

RQ 3 – change FM sales existing mode. Our main question relates with the moment to change the actual EM to a new one – that is, what is the moment at which a new mode can provide the MNC with a higher option value?

Next section presents the model development to quantify decisions for research questions 2 and 3. Research question 1 is considered in the demand process representation.

#### **4. Model formulation**

In this section we present the mathematical formulation with generic sets. The parameters and the objective function will follow.

Demand uncertainty in the FM is the uncertainty concerning potential upside benefits associated with international expansion. McGrath (1997) suggests that two factors may influence demand uncertainty: potential FM size and potential growth rate. Folta and Miller (2002) make a similar argument suggesting that the level of market uncertainty and size of the market have a combined effect on the option value. Following (Brouthers *et al.* 2008) suggestion we included in the model factors like operating revenues and costs.

We consider a situation in which a producer (P) of established products  $\varphi \in \Phi^i$ , located in origin country (O), has decided to sell his products in a FM  $f \in F$ , a market in which P has no sales experience. Among the options available for selling in  $f$  we find four as potentially profitable: (a) DE, (b) contracting with a LD, (c) establishing OC sales operation (throw subsidiary or branch concept) and (d) participation in a JV.

The problem resolution will be split according each challenge for research questions (RQ) 2 and 3. The model for RQ 2 is a single period model, formulated as a profit maximization problem with a stochastic variable. The model for RQ 3 will be treated in continuous time, assuming that there is a deferring option without limit in time and that the investment, once implemented, will produce impacts in perpetuity (Dixit, Pindyck 1994). One important consequence of this assumption is that as time tends to infinite ( $T = \infty$ ), the cash flows tend to zero. In this line, the investment can be seen as an optimal stopping problem, where “stopping” means that the investment decision is implemented.

We now list the sets and indexes to support a general application for different investment modes and business realities:

- $F = \{1, 2, \dots, p\}$ : foreign countries (= FMs), each country is represented by  $f \in F$ , where  $p$  represents the total number of available locations:  $|F| = p$ ;
- $X_f \subset F$ :  $X_f$  is a subset of  $F$  that represents the direct tax rate (on profits) inside each FM  $f \in F$  and is represented by  $\chi_f \in X_f$ ;
- $\Phi \subset I = \{1, 2, \dots, g\}$ :  $\Phi$  is a subset of  $I$  that represents all sku's inside product group  $I$ , each sku is represented by  $\phi \in \Phi$ , where  $g$  represents the total number of product groups to be traded in FM  $f \in F$ :  $|I| = g$ ;
- $\tilde{\lambda} = \{DE, LD, OC, JV\}$ : alternative foreign EM, represented by  $\lambda$ , where  $|\tilde{\lambda}| = 4$ .

To facilitate the formulation of the model, we introduce the following notation:

- $\gamma_f(\lambda)$  represents the present value of investment, for each EM  $\lambda \in \tilde{\lambda}$  and FM  $f \in F$ ;
- $\phi_f(\lambda)$  represents the operating costs to run the business after investment, for each EM  $\lambda \in \tilde{\lambda}$  and FM  $f \in F$ ;
- $c_v$  represents the unit product variable cost;
- $p_{vf}(\lambda)$  unit product selling price for each EM  $\lambda \in \tilde{\lambda}$  and FM  $f \in F$ ;
- $c_{LD}$  represents the co-participation on sales value, applied to a local distributor;
- $p_t$  represents the unit transfer price;
- $\chi_f$  represents the tax rate applied in FM  $f \in F$ .

#### 4.1. Modelling the demand process

The main source of uncertainty affecting the investment decision is the market demand. We assume that the demand is a stochastic variable, denoted by  $Q$  and follows a geometric Brownian motion (similar assumption in Bengtsson (2001)), subject to jumps modelled as a Poisson process, such that:

$$dQ = \mu_Q Q dt + \sigma_Q Q dz_Q + Q dq, \quad (1)$$

where:  $\mu_Q$  = instantaneous demand drift,  $\sigma_Q$  = market demand volatility,  $dz_Q = \varepsilon(t)\sqrt{dt}$ ;  $\varepsilon(t) \approx N(0,1)$ ,  $dz_Q$  = increment of a wiener process, where  $\varepsilon(t)$  is a serially uncorrelated and normally distributed random variable;  $dq = (1+u)$  with probability  $\lambda_u$  and demand jumps intensity represented by  $u$ . The time required since the decision to the availability of the EM (mainly when a subsidiary or partnership is needed) will be denoted as “preparation stage” and is represented with  $n$ . This moment considers mainly the legal affairs and resources allocation to endow start-up operation.

It's expectable that in a certain moment  $t$ , including the preparation period, there will be a demand level that supports the decision to invest in a new FM, using one of the available EMs  $\tilde{\lambda}$  or change the actual existing operating mode, considering the preparation period and the outcome results. To model our problem, we will assume a different profit function prior (no sales in FM or existing operating mode) and after the decision (entry in the foreign country using one of the available EMs or change the existing mode) that we will denote as  $\pi_{before(f)}(\lambda) \sum_{i=1}^g Q_{\phi}^{i, t+n}$  and  $\pi_{after(f)}(\lambda) \sum_{i=1}^g Q_{\phi}^{i, t+n}$ , respectively.

We also assume that the decision to invest in a FM is affected only by profit advantages, and not by competitive advantages through proper market positioning, such as the degree of product differentiation (simplification also defended by Hamada (2010)).

**4.2. Model I – choice of market EM model**

At time zero, the MNC compares the RO value of investing in FMs and chooses the location, which provides a higher option value. Formally, the MNC’s optimal profit function to enter in a single FM  $f \in F$ , in moment  $t + n$ , is represented as:

$$E \left[ \pi_{after(f)}(\lambda) \sum_{i=1}^g Q_{\phi}^i \right] = E \left( \max \left[ \pi_{(f)}(\lambda) \sum_{i=1}^g Q_{\phi}^i \right] \right), f \in F \forall \lambda \in \tilde{\lambda}, \tag{2}$$

$$\left\{ \begin{array}{l} \pi_{(f)}(DE) \sum_{i=1}^g Q_{\phi}^i = \sum_{i=1}^g Q_{\phi}^i (p_{vf(DE)} - c_v) - \Phi_{f(DE)} - \rho \gamma_{f(DE)} e^{\rho n}, \\ \pi_{(f)}(LD) \sum_{i=1}^g Q_{\phi}^i = \sum_{i=1}^g Q_{\phi}^i (p_{vf(LD)} - c_v - c_{LD}) - \Phi_{f(LD)} - \rho \gamma_{f(LD)} e^{\rho n}, \\ \pi_{(f)}(OC) \sum_{i=1}^g Q_{\phi}^i = \sum_{i=1}^g Q_{\phi}^i \left[ (p_{vf(OC)} - p_t)(1 - \lambda_f) + (p_t - c_v) \right] - \Phi_{f(OC)} - \rho \gamma_{f(OC)} e^{\rho n}, \\ \pi_{(f)}(JV) \sum_{i=1}^g Q_{\phi}^i = \sum_{i=1}^g Q_{\phi}^i \left[ (p_{vf(JV)} - p_t)(1 - \lambda_f) \eta + (p_t - c_v) \right] - \Phi_{f(JV)} - \rho \gamma_{f(JV)} e^{\rho n}, \end{array} \right. , f \in F, \phi \in \Phi, i \in I, \tag{3}$$

where  $\rho$  is the discounted rate.

**4.3. Model II – choice the moment for changing the actual EM**

$$\left\{ \begin{array}{l} \pi_{before(f)}(\lambda) \sum_{i=1}^g Q_{\phi}^i \\ \pi_{after(f)}(\lambda) \sum_{i=1}^g Q_{\phi}^i \end{array} \right. , \lambda \in \tilde{\lambda}. \tag{4}$$

Now we denote by  $t^*$  the timing of the decision to change the actual mode to support sales in FM, therefore we split to moments, before  $t^*$  and after  $t^*$ , for which a different profit function will be applied: for simplification we will denote  $Q_{\phi}^i$  as  $Q$ :

$$\sup_Q E_Q \left[ \int_0^{\infty} \pi_{before(f)}(\lambda) e^{-\rho t} \sum_{i=1}^g Q e^{-\rho n} dt - \int_{t-n}^{\infty} \pi_{before(f)}(\lambda) e^{-\rho t} \sum_{i=1}^g Q e^{-\rho n} dt + \int_{t-n}^{\infty} \pi_{before(f)}(\lambda) e^{-\rho t} \sum_{i=1}^g Q e^{-\rho n} dt - \int_t^{\infty} \pi_{before(f)}(\lambda) e^{-\rho t} \sum_{i=1}^g Q e^{-\rho n} dt + \int_t^{\infty} \pi_{after(f)}(\lambda) e^{-\rho t} \sum_{i=1}^g Q e^{-\rho n} dt \right]. \tag{5}$$

Considering only the members that depend on  $t$  (relevant moment impacting the decision process), the previous formula comes as:

$$\sup_Q \int_t^{\infty} \left( \pi_{after(f)}(\lambda) - \pi_{before(f)}(\lambda) \right) e^{-\rho t} \sum_{i=1}^g Q e^{-\rho n} dt. \tag{6}$$

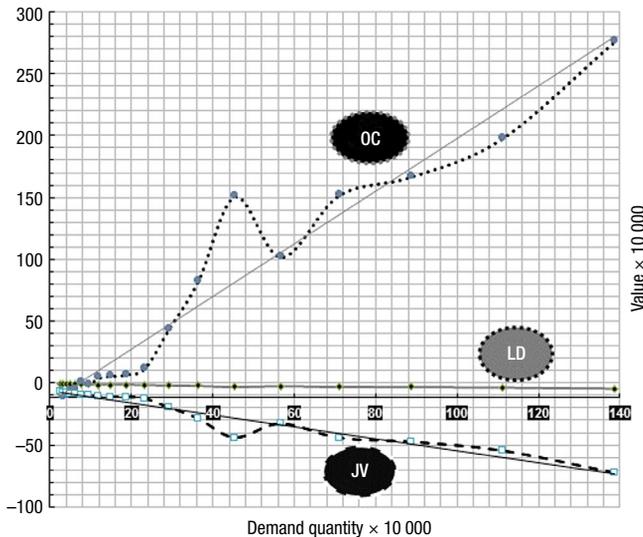
As stated before, we assume the existence of a preparation period  $n$  during which the change will occur. This is logic and is according the reality as firms cannot endow such decisions with instantaneous results.

## 5. Application of the framework to a case study

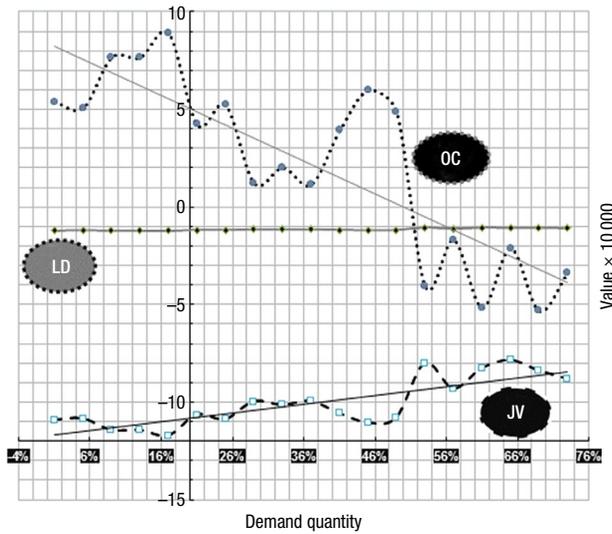
### Model I

To support the application of the proposed models, we will use the case study of a MNC that wants to extend its operations to a new FM. The management team has decided to use DE but, considering the potential growth of the target market, the MNC wants to prepare conditions for an additional and fast extension of its operations. The values used in the case study are presented in Table 1 – appendix B.

Figure 1 provides results comparing the entry options with the demand quantity evolution. It is assumed that DE is always an available entry option and the values reported consider the difference between DE and other possible alternatives like LD, OC and JV. Analysing the results we conclude that the demand quantity, for demand volatility level equal to 20%, influences the options regarding the EM in a new FM. LD option has the same value as DE despite the quantity level; as such the difference between these two EMs is close to zero. OC option value increases as the demand quantity increases, which reflect the scale effect (this has been one of the valid arguments used for long time in transaction cost theory (Anderson, Gatignon 1986)). JV is not a profitable option in the conditions presented and it seems to be worst as the quantities increase.



**Fig. 1.** Simulation of different options for entering in a FM, considering different demand quantity levels



**Fig. 2.** Simulation of different options for entering in a FM, considering different volatility levels

On Figure 2 we study the effect of demand volatility on the available options value, for demand quantity equal to 100.000 sqm. The values report the difference between LD, OC and JV when compared with DE. The results show that in very high uncertain FM (more than 40% volatility levels) the option using OC compared with DE is negative, meaning that the company in such FM should opt for DE as the risk is high. In general, as the volatility levels increase, the alternative entry options, when compared with DE, become less attractive. At the end, Figure 2 supports that when uncertainty is high the firm opts to invest in low-commitment EMs such as DE or LD. Indeed, the learning process argument has been supported by the literature that suggests collaborative EMs like LDs and JVs to be especially suited for exploring FM and building capabilities (Ireland *et al.* 2002; Kogut, Kulatilaka 2001; Meyer *et al.* 2009). At the end, the model results support that entering a FM in the face of high uncertainty can be rational, even though traditional theories of market entry, using the NPV, advise not to invest (Fisch 2008).

Figure 3 considers the effect of tax regimes (direct taxes on profits) in FMs. The results show that the tax policies can influence the decision on the EM; more aggressive tax regimes are less attractive for direct investment to establish the local operation (OC or JV). According to Figure 3 the option for OC versus DE has no additional value for tax rates above 30%. The interpretation of these results must be complemented with previous studies, like the one from Davies *et al.* (2010) that explored the relation between taxation and foreign investment. We also show that even with harmonized taxes, the international firm may choose OC. As such, in non-cooperative tax regimes, the host country can use its profit tax strategically in order to enforce a more desirable EM.

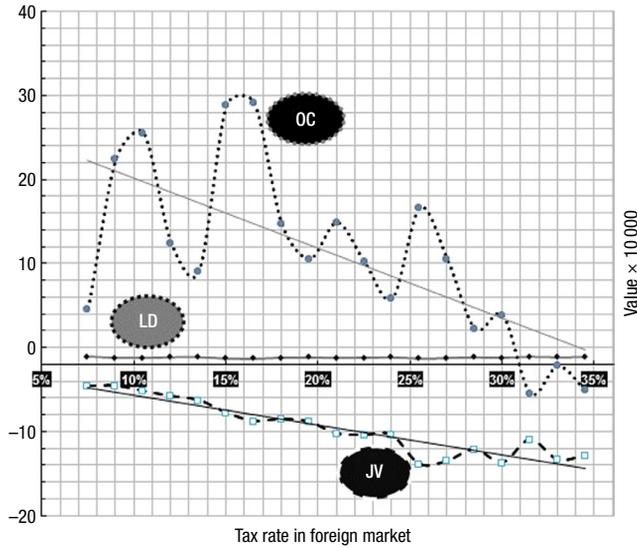


Fig. 3. Simulation of different options for entering in a FM, considering different tax rates

## Model II

The model II explores the moment for the change. In the case study we will consider the change from the actual mode DE to OC mode. The results can also be extended to other EMs.

In Figure 4 the analysis refers to the impact of demand behaviour (volatility level, jumps probability and intensity) on the trigger moment (optimal quantity level) in the option to change from the actual mode DE to a new one OC. The trigger moment is defined considering the demand quantity level and assumes that the investor can cover a bigger share of fixed costs at higher growth rates over time and, as such, he is willing to switch into OC earlier (Hiller, Yalcin 2009). In particular, the results show that the demand level required for the change in the EM increases as the volatility level increases, which means that, in high unpredictable markets, the time to decide investing in a subsidiary is much longer when compared with more stable markets. These results complement the work of Fisch (2008), by analysing the success of applying RO reasoning to the timing of entry.

An additional simulation in Figure 5 considers the impact of the preparation period in the moment for the change in the EM. Figure 5 describes the relation between the preparation periods – steps – to endow the initiative to invest in a subsidiary. As the steps to ramp-up the operation become longer and time consuming, the decision must be anticipated in time, even if the demand levels are still low. A possible interpretation of these results is that the early movers prefer a non-equity mode with lower preparation period; on the other hand, the late movers prefer the equity mode as their EM strategy (Isa et al. 2012). Complementary, these findings follow the study carried out by Schwens and Kabst (2009) where the early movers, as compared to late movers, preferred cooperative modes of market entry with less preparation period, such as DE or LDs.

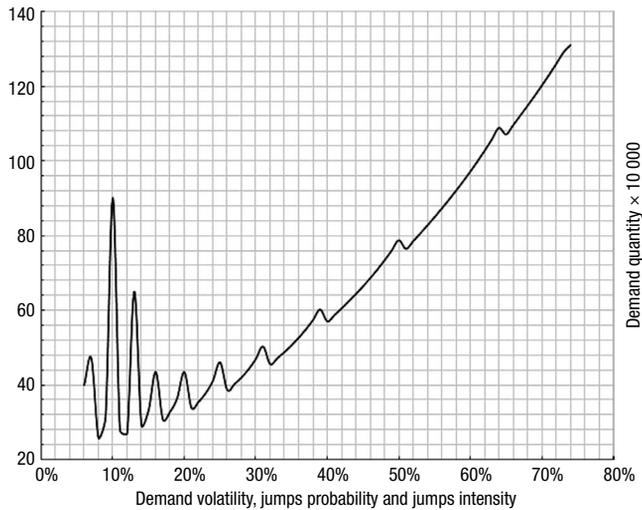


Fig. 4. Simulation of the trigger moment for the change of EM, considering different demand volatility levels, jumps probability and intensity levels

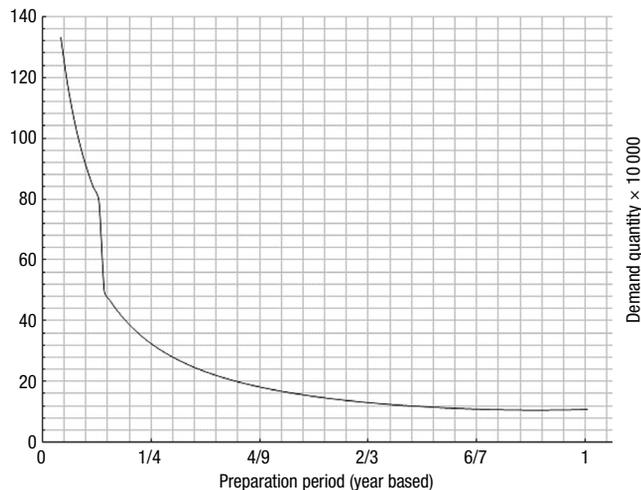


Fig. 5. Simulation of the trigger moment for the change of EM, considering different preparation periods to support the investment

## Conclusions

We extend applications of RO theory to enrich the foreign investment literature on choice of EM under uncertainty. Our models provide an example to illustrate how to apply RO to topics in international business.

Specifically, by taking into consideration market volatility in FMs, we have examined the conditions under which each EM, such as DE, LD, OC or a JV, is optimal. Com-

plementary, we introduce the relevant timing moment to endow a corporative decision on EM option.

Our results indicate that EM choice essentially depends on the magnitude of FM uncertainty. When uncertainty is high, firms are inclined to invest in low-commitment EMs, such as DE, as they valuable options to abandon. If FM uncertainty is low, MNCs may change their decisions by investing in high commitment market modems, such as OC or JV, as they are more likely to provide valuable growth options, such as first mover advantages. If a wholly owned EM is selected, firms need to choose between starting that venture from the beginning or acquiring an existing venture (acquisition) reducing the preparation period.

The results have important implications for theory development and future research. EM choice is one important international strategic decision that firms make; future research may wish to examine other critical international strategic decisions, such as international market selection. In addition, there may be future opportunities to further expand the decision criteria relevant to explaining market EM choices by taking a broader view of the factors contributing to value the new market entry.

At the end, the results provide partial support for internationalization theory, as well as justify the validity of using high-commitment EMs, even under high levels of uncertainty.

The results of this study are likely to be helpful in the formulation and support of market entry strategies. However, caution must be exercised while generalising the findings of the current study. This study is based on a single case and presents a number of limitations typical for this type of international research. In order to control the possible existence of country or industry key determinants, it is necessary to repeat the research in other industries with different attractiveness considering the number of players (Tran *et al.* 2012) and different demand behaviours. For future, carrying out the application of the model with additional case studies, would allow having a control group in order to understand whether the strategic focus differs between successful and unsuccessful internationalizations.

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## APPENDIX A

Technique resolution for Model II: from DE to OC. In the actual situation investment has already been decided to change from DE to OC.

$$\begin{cases} \pi_{(f)}(DE) \sum_{i=1}^g Q_{\phi}^{i,t+n} = \sum_{i=1}^g Q_{\phi}^{i,t+n} (P_{v(DE)} - c_v) - \Phi_{f(DE)} \\ \pi_{(f)}(OC) \sum_{i=1}^g Q_{\phi}^{i,t+n} = \sum_{i=1}^g Q_{\phi}^{i,t+n} \left[ (P_{v(OC)} - p_t)(1 - \chi_f) + (p_t - c_v) \right] - \Phi_{f(OC)} - \rho \gamma_{f(OC)} e^{\rho n} \end{cases} \quad (A1)$$

$$\sup_{\underset{Q}{*}} E_Q \left[ \int_t^{\infty} e^{-\rho t} \left( \left[ P_{v(OC)} - \chi_f (P_{v(OC)} - p_t) \right] \sum_{i=1}^g Q e^{-\rho n} - P_{v(DE)} \sum_{i=1}^g Q e^{-\rho n} + \right) dt \right] - \left( \Phi_{f(OC)} + \Phi_{f(DE)} \right) e^{-\rho n} - \rho \gamma_{f(OC)} \quad (A2)$$

Because we assume that  $\sum_{i=1}^{g+t+n} Q$  follows a geometric Brownian motion subject to a Poisson process (see extended equation (1)), the expected optimal value  $\pi_{Q^*}$  at time  $t^*$  comes as:

$$\pi_{Q^*} = \frac{\left[ P_{V(OC)} - \chi_f \left( P_{V(OC)} - P_t \right) \right] (Q^*) e^{(\mu_Q + \lambda_u u - \rho)n}}{\rho - \mu - u\lambda_u} - \frac{P_{V(DE)} (Q^*) e^{(\mu_D + \lambda_u u - \rho)n}}{\rho - \mu - u\lambda_u} - \frac{\left( \phi_f(OC) + \phi_f(DE) \right) e^{-\rho n}}{\rho} - \gamma_f(OC). \quad (A3)$$

We are going to define a simple notation for each part of equation:

$$\frac{\left[ P_{V(OC)} - \chi_f \left( P_{V(OC)} - P_t \right) \right] e^{(\mu_D + \lambda_u u - \rho)n}}{\rho - \mu - u\lambda_u} \text{ as A; } - \frac{P_{V(DE)} e^{(\mu_D + \lambda_u u - \rho)n}}{\rho - \mu - u\lambda_u} \text{ as B;}$$

$$- \frac{\left( \phi_f(OC) + \phi_f(DE) \right) e^{-\rho n}}{\rho} \text{ as C and; } -\gamma_f(OC) \text{ as E.}$$

We can obtain the profit value  $\pi$ , in actual moment, by maximizing equation (A2), satisfying the following differential equation:

$$\frac{1}{2} \sigma_Q^2 Q^2 \frac{\partial^2 \pi}{\partial Q^2} + \mu_Q Q \frac{\partial \pi}{\partial Q} - (\rho\pi + \lambda_u)\pi(Q) + \lambda_u \pi[(1+u)Q] = 0; Q \neq Q^*. \quad (A4)$$

Initial condition:  $\pi(0) = 0$ ; Value matching condition:  $\pi(Q) = A.Q + B.Q + C + E$ ; Smooth condition:  $\frac{\partial v}{\partial Q} = A + B$ , with  $Q = Q^*$ . If we consider (A4) a second order Cauchy-Euler function (Ross 1996), the solution can be written as:  $\pi(Q) = a_1 Q^{r_1}$ ; where  $r_1$  is the result of the following non-linear equation:  $\frac{1}{2} \sigma_Q^2 r_1 (r_1 - 1) + \mu_Q r_1 - (\rho + \lambda_u) + \lambda_u (1+u)^{r_1} = 0$ .

For a given value of  $Q$  and for  $t = 0$ , the value  $Q^*$  that maximizes  $\pi(Q)$  is given by the solution of the following equation:

$$A.Q^{*(1-r_1)}(1-r_1) + B.Q^{*(1-r_1)}(1-r_1) - C.Q^{*-r_1} r_1 - E.Q^{*-r_1} r_1 = 0. \quad (A5)$$

## APPENDIX B

**Table 1.** Data to support the case study

notation	value	unit	notation	value	unit	notation	value	unit
$\sum_{i=1}^{t+n} Q_{\phi}^i$	100.000	sqm	$c_v$	14	euros/sqm	$\phi_{f(DE)}$	55.000	euros/year
$\mu_Q$	5	%	$p_{vf(LD)}$	26.25	euros/sqm	$\gamma_{f(DE)}$	45.000	euros
$\sigma_Q$	20	%	$c_{LD}$	$5\%p_v(LD)$	%	$\phi_{f(LD)}$	80.000	euros/year
$r$	5	%	$p_{vf(OC)}$	35	euros/sqm	$\gamma_{f(LD)}$	45.000	euros
$n$	$\frac{1}{4}$	years	$p_t$	17	euros/sqm	$\phi_{f(OC)}$	250.000	euros/year
$p_{vf(DE)}$	25	euros/sqm	$\chi_f$	25	%	$\gamma_{f(OC)}$	350.000	euros
$p_{vf(JV)}$	35	euros/sqm	$h$	50	%	$\phi_{f(JV)}$	100.000	euros/year
$\lambda_u$	10	%	$u$	3	%	$\gamma_{f(JV)}$	150.000	euros

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