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ABSTRACT

The Choice and Timing of Foreign Market Entry under Uncertainty*

This Paper sheds new light on why timing and entry mode should be considered simultaneously. We derive the profit levels at which it is optimal to switch from exporting to setting up a wholly owned subsidiary, creating a joint venture, or licensing production to a local firm. The preferred entry mode depends on uncertainty about future profits, tax differentials between the home and the foreign country, the cost advantages of local firms, institutional requirements, and the degree of cooperation between partners in a joint venture.

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NON-TECHNICAL SUMMARY

The OLI-paradigm in the international business literature suggests that ownership, location and internalization advantages dictate whether firms serve foreign markets through export, a foreign direct investment (FDI), or licensing their technology to foreign firms. Ownership advantages refer to some aspect that the firm does better than others, e.g. by holding patents or well-organized distribution channels. Location advantage refers to some aspect that makes producing in that place more attractive than producing in another place, e.g. proximity to natural resources, a harbour, or a mass consumer market. Internalization advantage refers to some aspect that makes keeping transactions within the firms preferable to arms-length transactions between firms.

This Paper answers the question of when it is optimal for a firm to undertake FDI and licensing. In a complete static environment the answer obviously boils down to a trade-off between benefit and cost. Once FDI provides a firm with a higher net pay-off than exporting, the firm will undertake FDI. Literature suggests that the timing of such a switch to FDI depends on the market growth. Since FDI entails a high fixed cost while exporting has a relatively low variable cost, a growing market may make a firm want to avoid the high fixed cost of exporting by establishing a plant near the consumer market.

Such a static analysis neglects random changes in profitability. Profitability may be uncertain due to unexpected changes in demand, corporate taxation, environmental regulation, etc. Investing in a production plant abroad may be profitable now, but may turn out unprofitable once the investment cannot be reversed. Literature on investment under uncertainty has claimed that there is a value in waiting to invest when an investment is irreversible and has a random pay-off. Accordingly, the theory on FDI should take the option value of waiting into account.

In the Paper we examine for which profits it is optimal to wait and for which it is optimal to invest. The standard theory of irreversible investment to FDI can easily be applied to FDI when the multinational enterprise (MNE) decides to establish a wholly owned subsidiary. We find that higher uncertainty and higher local tax rates deter investment in a wholly owned subsidiary. However, when the MNE creates a joint venture, the decision of when to invest depends not only on the MNE, but also on the local partner. Moreover, the MNE not only decides on when to invest, but also on the equity share of the players. The local partner decides on the transfer price it charges to compensate for the costs of establishing the local plant.

The results of when to invest in a joint venture critically depend on the market structure and the level of cooperation between both firms. When both firms exercise monopoly power and do not cooperate in the sense that they maximize their own profits rather than maximizing the profits of the joint venture, it is shown that the critical value at which it is optimal to create the joint venture is very high as compared to the case where the MNE decides to invest solely. When the local firm faces perfect competition domestically, a joint venture may have a lower critical profit level as compared to the case where the MNE decides to invest solely. The intuition behind this result is that the joint venture can avoid taxes through a relatively large equity share for the local partner. To compensate for this large share, the local partner pays the MNE in the form of (untaxed) transaction costs.

Many studies have shown that there is often a lack of cooperation between firms in a joint venture, especially within joint ventures between western firms and Chinese firms. The results show that the optimality of investing critically depends on the cooperation between both firms, when they both exercise monopoly power.

Also, there are examples of governmental restrictions on joint ventures, most importantly a minimum share required by the local firm. We show the situations in which such a minimum share requirement becomes effective and affect the decision rule of when to create a joint venture.

Having derived explicit decision rules for the different modes of undertaking FDI, we are able to compare them. We show graphically the impact of uncertainty on the decision between waiting and exporting on the one hand and the different modes of FDI on the other hand. The mode of FDI that shows the lowest trigger value mainly depends on the costs associated with the different modes, differences in taxation between the home and the host country, and uncertainty surrounding future profits.

1. Introduction

The literature on investment under uncertainty claims that there is a value of waiting in addition to the net present value (NPV) in investments that are irreversible and subject to an uncertain payoff (McDonald and Siegel, 1984. Dixit and Pindyck, 1994). Empirical evidence of this stream of literature supports this option view of investment (Leahy and Whited, 1996; Guiso and Parigi, 1999). It is acknowledged that foreign direct investments (FDI) typically involve sunk costs and that their payoff is affected by exchange rate uncertainty (Campa, 1993; Darby et al., 1999) and policy uncertainty (Rodrik, 1991). In an empirical paper analyzing different measures of uncertainty, Brunetti and Weber (1998) found that both institutional uncertainty and volatility in exchange rates have a negative impact on investment.

The way a firm internalizes its advantage over other firms has been subject to numerous studies. The most influential paper within this respect is Buckley and Casson (1981) who use a cost-benefit analysis for the choice between exporting and FDI. Under the assumption that exporting has a low fixed cost and a high variable cost while the opposite holds for undertaking FDI, they find that exporting is optimal when the foreign market is relatively small whereas FDI is optimal when the market is relatively large. At the time they wrote their paper option theory was in its childhood stages and the effect on investment timing of uncertainty surrounding future payoffs was typically ignored.

A small body of literature has paid attention to the creation of joint ventures between a multinational enterprise (MNE) and a local firm when there is a differential taxation between the home country of the MNE and the country in which the MNE intends to set up a joint venture. Svejnar and Smith (1984) showed that the MNE wants to minimize its share in the joint venture in order to avoid tax payments by the joint venture when taxes are lower in the host country than in the MNE's home country.

The introduction of uncertainty in foreign market entry decisions was first established by Dixit (1989) and Kogut (1991). Dixit shows that uncertainty affects the timing of market entry. Kogut analyzes a joint venture as an option to acquire or expand. In recent contributions on operational flexibility within FDI, Rivoli and Salorio (1996) and Chi and McGuire (1996) discuss the strategic perspectives on the timing of investment and the choice of market entry respectively, but up to now there is no theoretical model that successfully unifies market timing and the mode of entry under uncertainty.

This paper aims to integrate the previous studies and to provide decision rules of when to switch from exporting to creating a joint venture (JV) or setting up a wholly owned subsidiary (WOS) under differential taxation. We analyze the profit levels at which it is optimal to give up the value of waiting to invest in exchange for reaping the benefits of FDI. Recent contributions in the field of strategic management have stressed the importance of a simultaneous analysis of entry mode and performance. Luo (1996) suggests that the profitability of a wholly owned subsidiary in China is significantly higher than the profitability of a Chinese joint venture. On the contrary, Pan and Chi (1999) find that joint ventures are more profitable than wholly owned subsidiaries. We show that the payoff at which it is optimal to create a joint venture critically depends on the type of joint venture, e.g. it hinges on the degree of which both firms are willing to cooperate. Also minimum share requirements by local authorities which play an important role in the creation of joint ventures in China (see e.g Svejnar and Smith, 1984) may have a large impact on the decision when and how to undertake investments abroad.

The paper shows that the choice of switching from exporting to a JV or a WOS mainly depends on the uncertainty surrounding future payoffs, the costs associated with the entry modes, the tax differential between the home country of the MNE and the host country, and the degree of cooperation in the JV. When there are only local partners with whom the MNE share little common interests, we find that the MNE will favor a WOS. Analyzing JVs in China Vanhonacker (1997) observes that the interesting partners have been cherry-picked by early entrants such as Coca-Cola. More importantly, he observes that there is a tendency in China to set up a WOS instead of a JV because most JVs do not function well. He argues that often 'companies share the same bed but have different dreams'. For example, it is widely acknowledged that most Chinese companies seek profits on a much shorter horizon than foreign investors do. The distinction between cooperative and non-cooperative JVs made in this paper is crucial for the decision between a WOS and a JV.

The paper is organized as follows. Section 2 discusses the background and basic assumptions. In section 3 we derive the critical value at which it is optimal for a MNE to invest in a WOS. The next section analyzes non-cooperative JVs in three different settings: (i) the local partner acts as monopolist; (ii) the MNE has a monopoly while there is perfect competition among local partners; and (iii) there is bilateral power and imperfect information about the payoffs and the cost of the project. Section 5 examines the investment rules for JVs under cooperation in a Nash-bargaining framework. In section 6, the decision to switch from exporting to setting up a JV or a WOS is considered. Finally, section 7 provides some concluding remarks.

2. Background and Assumptions

As usual in the literature on investment under uncertainty we suppose that (i) the MNE has clear advantages over other firms which render the MNE a monopoly over entering a foreign market, (ii) the costs that are required for undertaking FDI are sunk, (iii) the profits of entering the foreign market, π, follow a geometric Brownian motion with drift μ and standard deviation σ, (iv) there is a traded asset whose stochastic fluctuations are perfectly correlated with the stochastic process for the profits, and (v) the drift rate is smaller than the riskfree rate of return, denoted by r. We assume that profits are not affected by entry mode. Mathematically expressed,

$$d\pi = \mu\pi dt + \sigma\pi dz \tag{1}$$

where z is a Wiener process, μ denotes the drift and σ denotes the standard deviation. The value of the investment project (t=current time) is given by

$$V(t) = E\left[\int_t^\infty \exp(-\rho(s-t))\pi(s)ds\right] = \frac{\pi(t)}{\rho-\mu} \tag{2}$$

subject to the condition that the appropriate discount rate (ρ) exceeds the drift rate of the pre-tax profits. Since V is a constant multiple of π, V also follows a geometric Brownian motion with a drift of μ and a standard deviation of σ, so

$$dV = \mu V dt + \sigma V dz \tag{3}$$

When profits are taxed by the foreign government at rate $0 \le \tau_f < 1$, profits at time t are given by $(1-\tau_f)\pi(t)$ and the value of the project at time t changes into $(1-\tau_f)V(t)$.

The irreversible cost of investment is denoted by c_W for a WOS and by c_J in the case of a JV. The cost of market entry may differ between both entry modes when a local company with which the MNE creates the joint venture has an information advantage that allows it to optimally select suppliers, distribution channels, and marketing channels, and to gain support from various local governments. The more experience the MNE has in prior establishments of wholly owned production plants in foreign countries, the less the set-up cost for a new WOS (Woodcock et al., 1994). Hence, when prior experience in setting up a WOS is substantial, Pan and Chi (1999) argue that the total combined costs can be higher for a JV than for a WOS. Finally, given the current size of the market, the cost of exporting is denoted by c_E .

3. Wholly Owned Subsidiary

From the theory of investment under uncertainty, it is well-known that giving up an irreversible cost of investment in return for reaping the profits is optimal when the (after-tax) profit level exceeds the cost by a certain markup. When the MNE has the resources and capabilities to undertake the investment in the foreign itself, and is not hampered by foreign regulations[1], the company can be considered as vertically integrated. In this case the analysis follows the basic theory on investment under uncertainty developed by McDonald and Siegel (1986) and summarized by Dixit and Pindyck (1994). The following proposition summarizes the trigger value at which it is optimal to set up the WOS, and the value of the opportunity to establish a WOS.

Proposition 1. Let V_W^* and F_W denote the critical present value of profits at which it is optimal for the MNE to undertake a WOS, and the value of the opportunity to create a WOS, respectively. Then, the critical value can be expressed as

$$(1-\tau_f)V_W^* = \beta c_W / (\beta - 1), \tag{4}$$

where

(5)

[1] E.g., a WOS is not permitted in some industries in China, such as financial services and insurance.

$$\beta = -\left(\mu - \tfrac{1}{2}\sigma^2\right)/\sigma^2 + \sqrt{\left(\left(\mu - \tfrac{1}{2}\sigma^2\right)/\sigma^2\right)^2 + 2r/\sigma^2} \ ,$$

with the property that $\frac{\partial\beta}{\partial\sigma} < 0$, and $\frac{\partial}{\partial\sigma}\left(\frac{\beta}{\beta-1}\right) > 0$, see Dixit and Pindyck (1994, p.144).[2]

Proof. Equations (4) and (5) follow immediately from Dixit and Pindyck (1994).

4 Non-Cooperative Joint Ventures

This section analyzes non-cooperative joint ventures. We define a JV as non-cooperative when the MNE and the local firm pursue maximization of their own profits. It is assumed that in maximizing their profits, the MNE decides on when to set up the JV and on the profit share of the local company, while the local partner charges a transfer price to the MNE for setting up the local plant, infrastructure and marketing. Non-cooperative JVs appear when parties are forced to work together. This type of JV is likely to exist in countries as China where cultural differences between the MNE and the local firm as well as government regulations are predominant (Yan and Gray, 1994; Vanhonacker, 1997). Supporting evidence is given in Contractor (1990) who finds that many firms starting as a JV turn into a WOS once restrictions on foreign ownership are removed. Cooperative JVs where the MNE and the local firm intend to maximize the total profits of the JV are considered in the next section.

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[2] The value of the opportunity to create the WOS can be written as $F_W = \left(V(t)/V_W^*\right)^\beta \left(V_W^* - c_W\right)$ when V(t)<V_W^*, and $F_W = V_W^* - c_W$ otherwise. The option value equals $V_W^* - c_W$ (the payoff at the time of creating the WOS) discounted to the current time, where the discount factor, $E\left[\exp\left(-r\left(T_W - t\right)\right)\right]$ with $T_W = \arg \min_s \left\{V(s) = V_W^*\right\}$, equals $\left(V(t)/V_W^*\right)^\beta$; see Harrison (1990).

This section analyzes two different industry structures: in 4.1 the local firm has a monopoly over setting up a joint venture with the MNE, and in 4.2 there is perfect competition among the local firms. In both paragraphs it is assumed that the MNE and its local partner both have perfect information about the sunk outlays that are required to enter the industry at an efficient level of production, and the expected profits that are generated by entry. In 4.3 we relax this assumption and consider the case where the MNE strategically fixes the value of the investment project and the local firm reports the local cost of the investment to the MNE.

4.1 Non-Cooperative Joint Ventures: Local Monopoly

The MNE's value of the opportunity to set up a joint venture with the local firm, F_{NM}, can be written as

$$\underset{\delta_{NM},V_{NM}^*}{Max}\ (1-\tau_o)\left(\delta_{NM}(1-\tau)V_{NM}^* - X_{NM}\right)\left(V(t)/V_{NM}^*\right)^{\beta}, \tag{6}$$

where τ stands for the relative difference in the tax rate levied by the foreign government and the tax rate τ_o levied by the government of the MNE's country of origin[3], V_{NM}^* is the critical value at which it is optimal for the MNE to create the joint venture, δ_{NM} (with $0 \leq \delta_{NM} \leq 1$ by assumption) is the equity share of the MNE, and finally X_{NM} is the net transfer price from the MNE to the local partner, reflecting the costs of the investment made by the local firm and the compensation for the MNE's input of knowledge and technology. Similarly, the value of the local partner, G_{NM}, can be written as

(7)

[3] $1-\tau = (1-\tau_f)/(1-\tau_o)$

$$\underset{X_{NM}}{Max}\left((1-\delta_{NM})(1-\tau_o)V^*_{NM} + X_{NM} - c_J\right)\left(V(t)/V^*_{NM}\right)^{\beta},$$

with c_J being the cost of setting up the JV.

Proposition 2. In a non-cooperative joint venture where the local partner has a monopoly and acts as a leader, the timing of entry is determined by the optimal transfer price and equity share of $\hat{\delta}_{NM} = Min\left[\left\{\tau - 1 + \sqrt{(\tau-1)^2 + 4\beta/(\beta-1)}\right\}/2\beta, 1\right]$, and $\hat{X}_{NM} = \beta\hat{\delta}_{NM}(1-\tau)c_J / \left(\beta - \hat{\delta}_{NM} + \hat{\delta}_{NM}\tau - \beta\hat{\delta}_{NM}\tau\right)$, respectively. The trigger value[4] for creating a non-cooperative JV, induced by both optimal parameters, is $V^*_{NM} = \beta^2 c_J / (\beta-1)\left(\beta - \hat{\delta}_{NM} + \hat{\delta}_{NM}\tau - \beta\hat{\delta}_{NM}\tau\right)$.

Proof. When the MNE maximizes its profits, the trigger value of investment is given by $\delta_{NM}(1-\tau)V^*_{NM} = \beta X_{NM}/(\beta-1)$. Now rewrite G_{NM} as[5]

$$\underset{X_{NM}}{Max}\, E\left[\int_t^{\infty}\left(X_{NM} - c_J + (1-\delta_{NM})V^*_{NM}\right) f(X,s)\exp(-rs)ds\right] \tag{8}$$

s.t.

$$ \tag{9}$$

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[4]The value of the investment opportunity for both firms can be written as

$F_{NM} = V^{\beta} c_J^{1-\beta}\left(\beta - \hat{\delta}_{NM} + \hat{\delta}_{NM}\tau - \beta\hat{\delta}_{NM}\tau\right)^{\beta-1}\beta^{-\beta}\left(\frac{\beta-1}{\beta}\right)^{\beta-1}\hat{\delta}_{NM}(1-\tau)$ if $V<V^*_{NM}$,

$F_{NM} = (1-\tau)\hat{\delta}_{NM}V/\beta$ if $V \geq V^*_{NM}$, and

$G_{NM} = V^{\beta} c_J^{1-\beta}\left(\beta - \hat{\delta}_{NM} + \hat{\delta}_{NM}\tau - \beta\hat{\delta}_{NM}\tau\right)^{\beta}\beta^{-\beta}\left(\frac{\beta-1}{\beta}\right)^{\beta}\frac{1}{\beta-1}$ if $V<V^*_{NM}$,

$G_{NM} = V - c_J - (1-\tau+\tau\beta)\hat{\delta}_{NM}V/\beta$ if $V \geq V^*_{NM}$, respectively.

Note that the difference between $V - c_j$ and $F_{NM} + G_{NM}$ is received by the foreign government, and equals $\tau\hat{\delta}V$.

[5] Since τ_o does not affect the investment decision, but merely renders part of the profits of the MNE and local partner to the government of the local partner, it is omitted in the remainder. Also from now on we drop the time index in V(t).

$$f(X,s)=\begin{cases}1 & \mathrm{V(s)} \geq V_{NM}^{*} \\ 0 & \mathrm{V(s)} < V_{NM}^{*}\end{cases}.$$

Since V_{NM}^{*} obviously depends on X_{NM}, the local partner can influence the timing of setting up the JV. Setting a high $\hat{X}_{NM}$ by the local company induces a high return, but this return will be achieved at a later date. A lower $\hat{X}_{NM}$ implies a lower return, but obtained at an earlier date. Using a standard indicator function 1_A which takes the value 1 on the set A, and 0 otherwise, the maximization problem can be rewritten as

$$\underset{X_{NM}}{Max}\left(X_{NM}-c_J+(1-\delta_{NM})V_{NM}^{*}\right)E\left[\exp(-rT_{NM})\right]1_{\left[V<V_{NM}^{*}\right]}+\left(X_{NM}-c_J+(1-\delta_{NM})V_{NM}^{*}\right)1_{\left[V\geq V_{NM}^{*}\right]} \qquad (10)$$

where $T_{NM}=\arg\underset{s}{min}\left\{V(s)=V_{NM}^{*}\right\}$. Hence, the equation turns into

$$\underset{X_{NM}}{Max}\left(X_{NM}-c_j+(1-\delta_{NM})V_{NM}^{*}\right)\left(V/V_{NM}^{*}\right)^{\beta}1_{\left[V<V_{NM}^{*}\right]}+\left(X_{NM}-c_j+(1-\delta_{NM})V_{NM}^{*}\right)1_{\left[V\geq V_{NM}^{*}\right]} \qquad (11)$$

.

Solving for X_{NM}, we find that

$$\hat{X}_{NM}=Max\left[\beta\delta_{NM}(1-\tau)c_J/(\beta-\delta_{NM}+\delta_{NM}\tau-\beta\delta_{NM}\tau),\delta_{NM}(1-\tau)(\beta-1)V/\beta\right]. \qquad (12)$$

When the first term in the Max[.,.] operator is chosen, $V<V_{NM}^{*}\left(\hat{X}_{NM}\right)$, and postponement is optimal. When the second term is chosen, $V\geq V_{NM}^{*}\left(\hat{X}_{NM}\right)$, and immediate investment is optimal. The critical value at which it is optimal to create the JV is the value of V for which the local partner is indifferent between postponement and immediate investment. So, V_{NM}^{*} is the value of V for which the first term in the Max-operator in (12) equals the second term. Hence,

$$V_{NM}^{*}=\beta^{2}c_J/(\beta-1)(\beta-\delta_{NM}+\delta_{NM}\tau-\beta\delta_{NM}\tau). \qquad (13)$$

Considering the optimal equity share for the MNE, we can substitute (13) and (12) into (6) and maximize with respect to δ_{NM}. The maximization problem can be written as

$$\underset{\delta_{NM}}{Max}\, \omega(\beta - \delta_{NM} + \delta_{NM}\tau - \beta\delta_{NM}\tau)^{\beta-1}\delta_{NM}\ , \tag{14}$$

where ω is a constant that is independent of δ_{NM}. The optimal share[6] is the positive root of a quadratic equation that is obtained from the first order condition. Since the share has a maximum value of 1, the optimal equity share is

$$\hat{\delta}_{NM} = Min\left[\left\{\tau - 1 + \sqrt{(\tau-1)^2 + 4\beta/(\beta-1)}\right\}/2\beta, 1\right]. \tag{15}$$

Q.E.D.

Under a non-equity JV (i.e. δ_{NM} =1 ex ante) where the MNE retains control over the JV and no differential taxation (i.e. τ=0), it is immediate from (12) that $\hat{X} = \beta c_J/(\beta - 1)$ and $V^*_{NJVM} = \beta^2 c_J/(\beta-1)^2$. This means that both companies want to have the same markup over their sunk cost. As a result the critical value at which it is optimal to create a joint venture is a quadratic function of the markup coefficient that applies when investment is undertaken by a single firm. This establishes an important difference with the results obtained in the previous paragraph.

Depending on the restrictions on the contractual agreement, there may exist two suboptimal situations; (i) The government imposes that the MNE must at least pay the cost of the input of the local company, or the local company cannot finance

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[6] Nakamura and Yeung (1994) provide a principal-agent model where the optimal share of the MNE is a trade-off between the benefit and cost (agency cost and technology spillover) of increased ownership. Nakamura and Xie (1998) propose a model where both partners negotiate a contract that specifies the shares. The dynamic

the cost (in particular in developing countries), i.e. $X_{NM} \geq c_J$; and (ii) The government imposes a maximum share of the MNE in the profits of the JV.

Case 1. The restriction on δ_{NM} is that $X_{NM} \geq c_J$, or

$\beta\delta_{NM}(1-\tau) \geq \beta - \delta_{NM} + \delta_{NM}\tau - \beta\delta_{NM}\tau$, so

$$\delta_{NM} \geq \beta/(\beta+1-\tau) \tag{16}$$

which induces a minimum share for entry, required by the MNE. Under infinite uncertainty and no taxes, the minimum share is one half. Under certainty, the MNE demands the full share and pays the MNE the cost of investment. The minimum share is decreasing with uncertainty and increasing with the tax rate. Since the *optimal* share is increasing with uncertainty and decreasing with the tax rate, the deviation from the optimal share can be substantial when uncertainty about future profits is low. In this case, the optimal share for the MNE is low, while its minimum share is high.

Substituting the minimum share into (13) gives

$$V_{NM}^{*} = (1-\tau+\beta)c_J/(\beta-1)(1-\tau) \tag{17}$$

So the threshold decreases in comparison with the critical value derived for a joint venture without a contractual share. When $c_J = c_W$, the threshold in (17) exceeds the one of (4). A JV will only be preferred when $c_J < \beta c_W/(1-\tau+\beta)$.

Case 2. When the government imposes a maximum share by the MNE in the JV profits, the results are opposite to the previous findings. A maximum share leads to inefficiency when the MNE requires a high equity share. This occurs when uncertainty is relatively high and taxes are relatively low.

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model in this paper can be extended accordingly to account for agency cost and technology spillover.

The MNE faces an interesting trade-off in imposing the optimal share. By requiring a lower equity share, the MNE faces less uncertainty by rendering uncertainty in the payoff to the local firm. As a reward for the lower equity share requirement, the local firm will charge the MNE a lower transfer price. Thus, when uncertainty is high and there is a high value in waiting, the MNE has no incentive to speed up the JV, and will require a high equity share.

Considering the effect of taxation on the optimal share, the MNE invests as soon as its after-tax return on investment exceeds some critical value. A higher differential taxation leads to a lower after tax payoff, which can only be compensated by a higher payoff before taxes. One way of obtaining a higher payoff is imposing a higher equity share. Figure 1 illustrates δ_{NM} for different combinations of β and τ. It shows that the optimal equity share is sensitive to uncertainty, but rather unaffected by differential taxation.

------------------------------------- Insert figure 1 about here ---------------------------------

As uncertainty decreases, the local partner receives more of the expected profits. When uncertainty goes to zero, the MNE does not require a markup at all, and will be satisfied with a JV that has a zero net present value. Knowing this, the local company will charge the full difference between the value of the investment and the irreversible cost of setting up the JV as transaction cost. The expressions for F_{NM} and G_{NM} confirm this result: since β goes to infinity as σ goes to zero, $F_{NM} = 0$, and $G_{NM} = (1 - \tau\hat{\delta}_{NM})V - c_J$. Moreover, the expression for $\hat{\delta}_{NM}$ tells that the optimal share is zero, when uncertainty is zero. This, again, reflects the power that the local company has over the decision. Though the MNE makes the investment decision, the local partner can gain all excess profits. The next paragraph considers the case where there is perfect competition among the local firms.

4.2 Non-Cooperative Joint Ventures: Monopoly for MNE, Competition among Local Partners

The local monopoly is not attractive for the MNE, especially when the expected profits of the JV are substantial. This paragraph takes a look at another extreme: there is perfect competition among the local partners. Let V_{NC}^* denote the critical value at which it is optimal for the MNE to create the JV, X_{NC} denote the transaction cost charged to the MNE by the local firm, and $\hat{\delta}_{NC}$ denote the optimal share by the MNE when there is perfect competition among the local firms. Under perfect information, perfect competition drives the compensation for the investment outlays down to its cost. This allows us to derive the following result.

Proposition 3. When there is perfect competition among local firms, the timing of entry is determined by the optimal transfer price and equity share of $\hat{X}_{NC} = -c_J/(\beta - 1)$ and $\hat{\delta}_{NC} = 0$, respectively. The trigger value[7] for setting up the non-cooperative JV is $V_{NC}^* = \beta c_J/(\beta - 1)$.

[7] The value of the investment opportunity for both firms can be written as $F_{NC} = c_J/(\beta - 1)\left(V/V_{NC}^*\right)^{\beta}$ if $V \le V_{NC}^*$, $F_{NC} = V - c_J$ if $V > V_{NC}^*$ and $G_{NC} = 0$, respectively.

Proof. By substituting the zero profit condition $X_{NC} - c_J + (1-\delta_{NC})V_{NC}^* = 0$ in the optimization equation of the MNE (i.e. equation (6)), it immediately follows that the payoff to the MNE is maximized when $\delta_{NC} = 0$ and $V_{NC}^* = \beta c_J / (\beta - 1)$. Substituting this result in the zero profit condition, we find that $\hat{X}_{NC} = - c_J / (\beta - 1)$.

Q.E.D.

The trigger value for setting up a JV is substantially lower if there is perfect competition among local partners. Whether the MNE sets up a WOS or a JV under local competition depends on the cost of entry under the different entry modes.

4.3 Non-Cooperative Joint Ventures: V and c_j as Strategic Variables

In the previous extreme cases, there is complete and common knowledge about V and c_J. Since the local company knows V, acting as a monopolist it can charge the excess profits of the JV, where excess profits are defined as the difference between the payoff of the JV and the critical value of the payoff at which it is optimal to create the JV. In the case of perfect competition among local partners, the MNE receives all excess profits. This paragraph extends the model of local monopoly by making V and c_J strategic decision variables of the MNE and the local partner, respectively. In general, the MNE does not know about the true cost of the local partner in setting up the JV, and the local partner does not know the expected profits of the JV. An extension of the model with competition among local partners is straightforward, because the local firms will set the cost equal to the actual cost. Otherwise another firm will charge a cost between the true cost and the cost reported by the other firms, and this process will continue until a local firm sets the cost equal to actual cost.

The JV will be set up as soon as $\hat{V} \geq V_{NS}^{*}$ where $\hat{V}$ is the reported value of the JV, and V_{NS}^{*} consists of the minimal required monopolist profit of the local company plus the minimal required pre-tax monopoly profit of the MNE. Thus V_{NS}^{*} equals V_{NM}^{*} with c_J replaced by $\hat{c}_J$, being the cost reported by the local partner rather than the actual cost. The implied difference with the model discussed in 4.1 will be in the distribution of the excess profits, i.e. $V - V_{NS}^{*}$. While the sequential monopoly renders all excess profits to the local partner, with imperfect information the local partner and the MNE bargain over the excess profits of the JV. When it is optimal to wait with creating the JV, there will be no excess profits once the firms set up the JV, and hence the previous obtained results prevail. For ease of exposition, suppose there are no taxes, and there is a zero share of the local partner. With symmetric information about V and c_j, the partners wait with undertaking the venture until $V = V_{NM}^{*}$. At this moment, the local partner gets $X = \beta c_J / (\beta - 1)$, and the MNE receives $V = \beta X / (\beta - 1)$.

We show that the extended bilateral model does not raise the critical value of the profits for setting up the JV. Under the new assumptions, the MNE may be inclined to report a lower value of the investment, while the local company may report a higher cost. The local company will only report the true cost as long as the value reported by the MNE is relatively low. To be more precise, c_J is reported when immediate investment is not optimal, given the reported value of the project, i.e. when $\hat{V} < V_{NS}^{*}$. In that case, setting a higher (lower) value than c_J leads to a later (earlier) realization of the cash flows, and is from equation (12) not optimal.[8] When $\hat{V} \geq V_{NS}^{*}$,

[8]Note that the local partner could achieve a higher payoff as well by increasing X.

the reported V exceeds the double markup, and the local company will fix $\hat{c}_J$ so that the MNE just tends to invest. So, the local company's optimal cost setting conditional on the MNE's optimal report of the value it receives from investing, is

$$\hat{c}_J \left| \hat{V} = Max\left[\left(\tfrac{\beta-1}{\beta}\right)^2 \hat{V}, c_J\right]. \right. \quad (18)$$

The MNE's optimal value setting is V as long as investment is not optimal, given the reported cost of construction. When investment appears to be optimal given the reported cost of construction, i.e. $V \geq \left(\frac{\beta}{\beta-1}\right)^2 \hat{c}_J$, the MNE will report the smallest value such that the MNE invests, i.e. $\hat{V} = \left(\frac{\beta}{\beta-1}\right)^2 \hat{c}_J$. When investment is not optimal yet, the MNE also reports the true value. Hence,

$$\hat{V} \left| \hat{c}_J = Min\left[\left(\tfrac{\beta}{\beta-1}\right)^2 \hat{c}_J, V\right]. \right. \quad (19)$$

Figure 2.1 and 2.2 show the optimal cost and value setting of the local partner and MNE for a relatively high V and a relatively low V. For high V, i.e. $V \geq \left(\frac{\beta}{\beta-1}\right)^2 c_J$, immediate investment is always optimal.

------------------------------------- Insert figure 2.1 about here --------------------------------

In figure 2.1, we have V=12, c_J=2 and β=2, leading to V_{NS}^*=8. The reaction functions of the partners overlap at $\hat{c}_J = \frac{1}{4}\hat{V}$ for $8 \leq \hat{V} \leq 12$. This line yields the Nash equilibria. There is no need for the MNE to report a lower value of the JV, and no need for the local company to report higher cost. The payoff to the MNE (local partner) ranges from 8 (2) when $(\hat{V}, \hat{c}_J) = (8,2)$ to 6 (4) when $(\hat{V}, \hat{c}_J) = (12,3)$. In a sequential monopoly, the payoffs equal the latter payoffs; i.e. for the MNE the payoff equals the worst outcome of the Nash equilibria, and for the local partner the payoff equals the best outcome.

------------------------------------ Insert figure 2.2 about here -------------------------------

In figure 2.2, the same parameter values for c_J and β are used as in figure 2.1, but the value of the project decreases to V=6. In this case, postponement is optimal. The reaction curves intersect at a unique Nash equilibrium: $\hat{V} = 6, \hat{c}_J = 2$. In this case, the companies do not bargain over excess profits. Both partners recognize that reporting the true value leads to the most rapid realization of the pie consisting of the minimum required markup for both partners, and hence to the biggest pie. Proposition 4 summarizes the result.

Proposition 4. In a non-cooperative joint venture where the MNE (local firm) has no information about the cost (project value), the timing of the JV is unaffected by the information asymmetry while any distribution between the two parties of the excess profits establishes a Nash equilibrium.

Apart from a market structure with perfect competition among local firms, the solution under non-cooperation is far from efficient, as it leads to a very high threshold for undertaking the JV. The next section shows how cooperation between both partners may lower the trigger value of investment.

5 Cooperative Joint Ventures

For the analysis of a cooperative JV, let γ_v denote the bargaining power of the MNE and γ_x the bargaining power of the local partner. The bargaining powers are normalized so that they sum up to unity ($\gamma_v+\gamma_x=1$). Blodgett (1991), Fagre and Wells (1982) and Lecraw (1984) suggest a positive relation between the bargaining power and the percent equity ownership. They explore the relationship between the characteristics of a MNE and the percent equity ownership that the MNE achieves in the foreign country. It is found that firm-specific advantages such as leadership in technology, production, marketing, finance, and management are critical for the bargaining power of the MNE. The bargaining power of the foreign company depends on the country-specific advantages of the firm's home country, such as natural resources, market size, income level, and factor costs.

Furthermore, let V_C^*, δ_C and X_C be the critical value of profits at which it is optimal to switch from exporting to creating the cooperative JV, and the corresponding share and transfer price, respectively. The Nash bargaining solution, where the threat points of not undertaking FDI are assumed to be zero[9] for the purpose of tractability, is the outcome to the following maximization problem:

$$\max_{\delta_C, V_C^*, X_C} \left\{ \left(\delta_C (1-\tau) V_C^* - X_C\right)\left(V/V_C^*\right)^{\beta} \right\}^{\gamma_v} \left\{ \left(X_C - c_j + (1-\delta_C) V_C^*\right)\left(V/V_C^*\right)^{\beta} \right\}^{\gamma_x} . \qquad (20)$$

The outcome of the maximization problem is summarized in the following proposition.

[9] I.e. it is assumed that $V=c_E$.

Proposition 5. In a cooperative joint venture, the optimal transfer price and equity share are $\hat{X}_C = -\gamma_V c_J / (\beta - 1)$ and $\hat{\delta}_C = 0$, respectively. The timing of entry[10] is determined by the trigger value $V_C^* = \beta c_J / (\beta - 1)$.

Proof. See appendix.

The proof in the appendix shows that the payoff to the partners in the JV is fixed, while the trigger value of creating the JV depends on the share of the MNE in the JV. The higher the share of the MNE, the larger the stake of the foreign government and the longer it will take before the trigger value is reached. The optimality of a zero share by the MNE generalizes the results by Svejnar and Smith (1984) to a dynamic and stochastic setting. Thus, minimum share requirements by the host government have no impact on the optimal solution. We provide the additional insight that deviations from the optimal share lead to postponement of the JV from which only the government benefits.

As in the previous section, financial constraints lead to a suboptimal solution. When we impose that the local firm cannot raise external capital ($X_C \geq c_J$), the share by the MNE is minimized when $X_C = c_J$. Substituting $X_C = c_J$ and condition (A3) from the appendix into equation (A1) from the appendix, and rearranging gives $\hat{\delta}_C = (\beta + \gamma_v - 1)/(\beta - \tau + \tau\gamma_v - 2\beta\tau\gamma_v)$. Subsequently, substituting this result for the

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[10] The value of the investment opportunity for both firms can be written as
$F_C = (\gamma_V c_J / (\beta - 1))(V/V_C^*)^\beta$ if $V < V_C^*$, $F_C = \gamma_V c_J / (\beta - 1) + \gamma_V (V - V_C^*)$ if $V \geq V_C^*$
and
$G_C = (\gamma_X c_J / (\beta - 1))(V/V_C^*)^\beta$ if $V < V_C^*$, $G_C = \gamma_X c_J / (\beta - 1) + \gamma_X (V - V_C^*)$ if $V \geq V_C^*$,
respectively.

optimal share into equation (A3) from the appendix yields $V_C^* = (\beta - \tau + \tau\gamma_v - 2\beta\tau\gamma_v)c_J / (1 - 2\tau\gamma_v - \tau)(\beta - 1)$. Needless to say that this trigger value is higher than the one derived without financial constraints.

When the costs of FDI are the same for a WOS and a JV, the results in proposition 1 and proposition 3 show that the trigger value for establishing a cooperative JV is lower than the trigger value for setting up a WOS as long as there is a tax differential between the home and the host country. The reason behind this result lies in the possibility of tax avoidance by the MNE in a cooperative JV.

6. Exporting and licensing versus FDI

In the absence of restrictions on the shares, the previous sections showed that a transfer payment from the local firm to the MNE while all equity is allocated to the local firm is optimal. In other words, licensing of technology by the MNE appears the first best solution under differential taxation.[11] The transfer price is increasing in uncertainty, the bargaining power of the MNE and the cost of the investment. So, the larger the investment project, the higher the price of the license. Note that under licensing the critical value at which investment takes place is equal to the trigger value of investment for a local company that owns the investment opportunity and has the required knowledge of technology. So, an interesting feature of the optimal solution in the cooperate model is that licensing as optimal solution encourages investment whereas licensing by the MNE as a take-it-or-leave-it offer to the local firm would

[11] In a deterministic model Horstmann and Markusen (1987) built a static model of the tradeoff between licensing and FDI. They argue that reputation is an important motive for building a plant in a foreign country instead of licensing production to an existing foreign producer.

severely delay investment. In the latter case namely the local firm's sunk cost consists of c_J and the licensing fee.

------------------------------------- Insert figure 3 about here --------------------------------

Now that we have analyzed the critical values at which it is optimal to switch from exporting to a WOS and different modes of JVs, we summarize in figure 3 the differences between the trigger values of creating a WOS, a non-cooperative JV, and a cooperative JV. The figure also shows the current cost of exporting. The share of the MNE within the JV is unrestricted and set equal to the optimal value. The cost of investment for the JV (c_J), the WOS (c_W), and exporting (c_E) are 1, 1.5 and 2.25, respectively. The thresholds for a non-contractual JV and a WOS exceed the one of a contractual JV for all values of β. Given the possibility of a cooperative JV, the MNE will stick to exporting when (i) uncertainty is high, and (ii) V does not exceed the trigger value of a cooperative JV, even when FDI renders a positive profit. When uncertainty is relatively low, the MNE can benefit from a cooperative JV through the lower cost and the profit sharing with the local partner. Without the possibility of a cooperative JV, the MNE will stick to exporting when (i) uncertainty is high, and (ii) V does not exceed the trigger values of a non-cooperative JV or a WOS. When V rises, it first hits the investment threshold of a non-contractual JV when uncertainty is relatively low, while V first hits the trigger value of a WOS when uncertainty is relatively high.

7. Conclusion

Under a tax differential between the home and the host country it is shown that the lowest trigger value of investment is reached when the MNE licenses the technology to a local firm or the MNE can set up a joint venture with one of many local partners. We showed that there is a worst case scenario when there is no cooperation between both firms and the MNE wants to retain all control in the JV. In this scenario the JV will only be set up when the profits exceed the quadratic relative markup that is optimal for a vertically integrated firm. The reason is that the MNE waits until the project value exceeds the transfer price charged by the local company by a certain markup, while the local company adds the same mark-up to the cost of investment when it fixes the transfer price.

Kogut (1991) found that a joint venture is often followed by a sale of the local partner's share to the MNE. In our analysis, we neglected the sequential option to acquire the local company that accompanies the equity JV. Under a licensing agreement, the MNE foregoes the option to acquire. Acknowledging the option to expand, the MNE may want to wait until the project value reaches the trigger value of an equity JV, and ignore licensing. Hence, when the sequential option to acquire the local company is included, the optimal policy will not be to have a zero share, but to have a small positive share. This sheds other light on the conjecture of Svesjnar and Smith (1984) that a JV will refrain from a zero share because a low equity share would alert the host government to the problem of tax avoidance.

An empirical test of the results is an interesting pave for further research. The observations by Vanhonacker (1997) and the results in this paper provide a rationale why firms would prefer setting up a WOS instead of a JV. Though out of the context of joint ventures, an empirical study by Fan (1999) shows that petrochemical firms tend to be more vertically integrated when input price uncertainty is high. We conjecture that preventing a high markup by other firms could be the reason for a firm to undertake activities on its own, especially when uncertainty is high.

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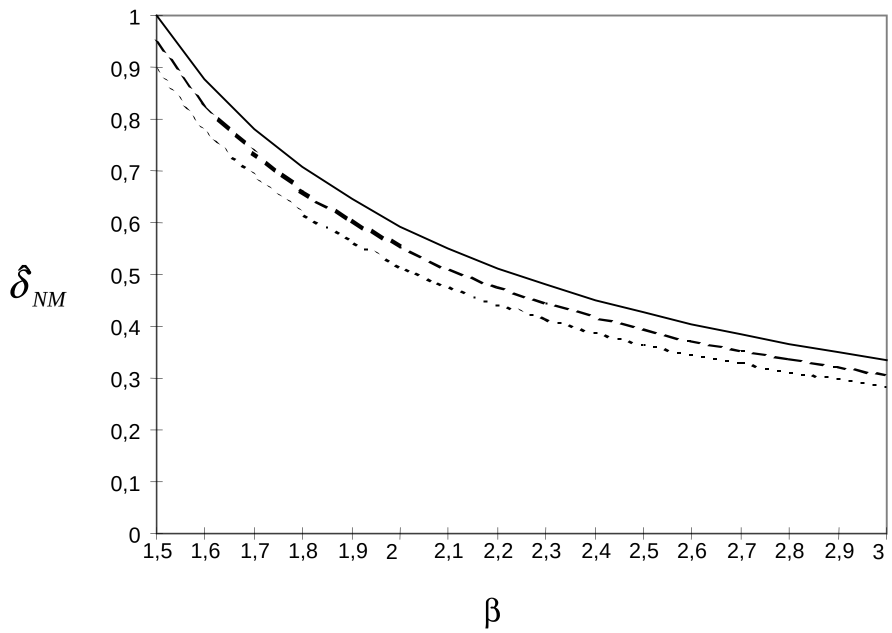

Figure 1: Optimal equity share of the MNE for different values of β and τ (dotted line: τ=0.1; dashed line: τ=0.3; solid line: τ=0.5).

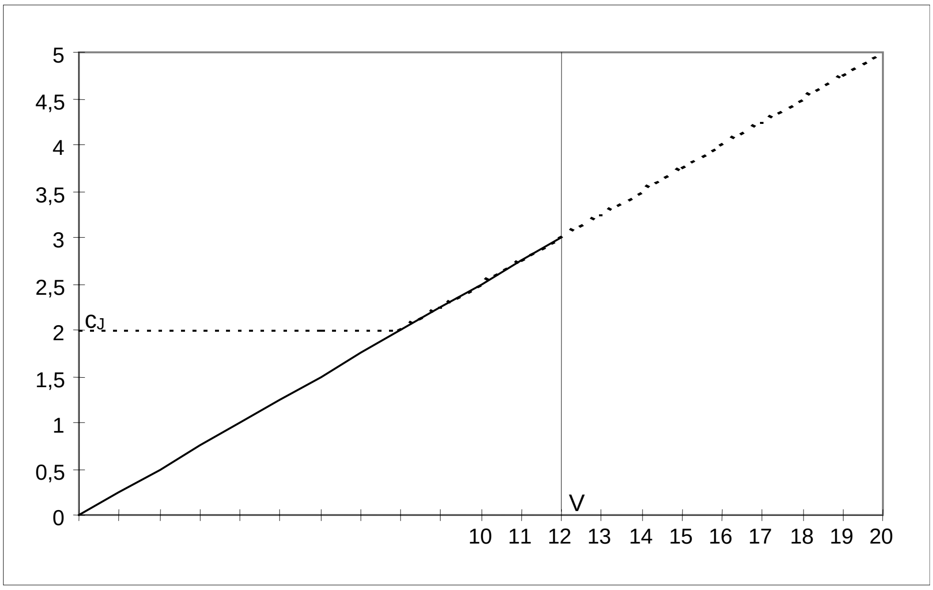

Figure 2.1: Reaction functions for the MNE (solid line) and the local firm (dotted line). Parameter values: V=12, c_J =2, β=2, V_{NS}^{*} =8. Nash equilibria: $8 \le \hat{V} \le 12$; $\hat{c}_J = \frac{1}{4}\hat{V}$.

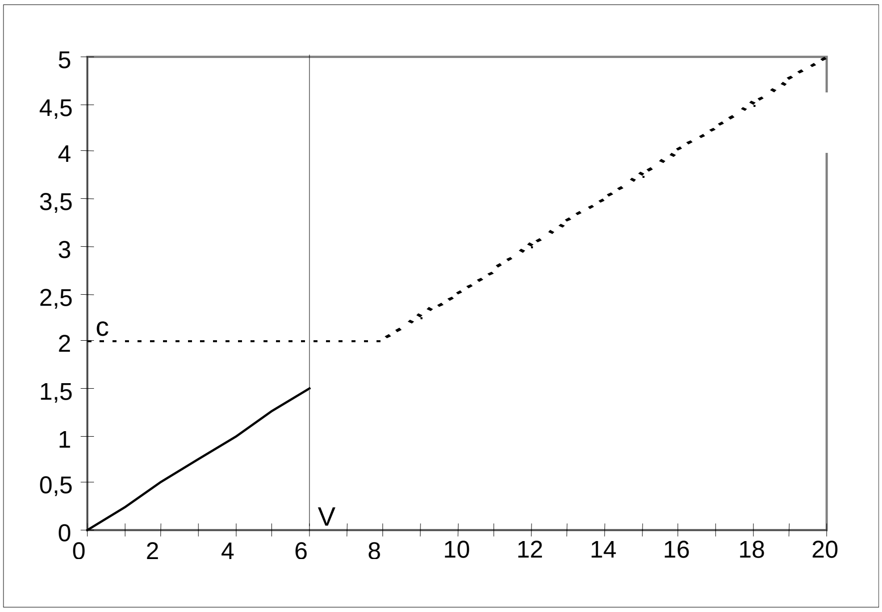

Figure 2.2: Reaction functions for the MNE (solid line) and the local firm (dotted line). Parameter values: V=6, c_J =2, β=2, V_{NS}^{*} =8. Unique Nash equilibrium: $\hat{V} = 6$; $\hat{c}_J = 2$.

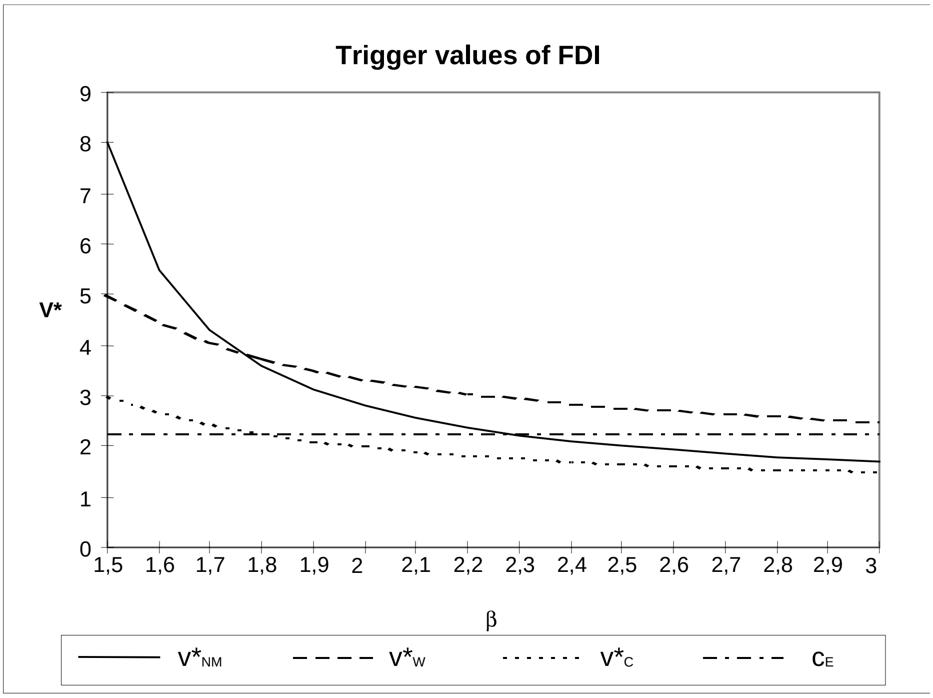

Figure 3: Trigger values for a non-cooperative JV, a WOS, a cooperative JV, and the current cost of exporting.

Appendix

Proof of proposition 5.

Setting the partial derivative with respect to X_C equal to zero gives

$$(1-\tau)\delta_C V_C^* - X_C = \gamma_v\left(V_C^* - c_J - \tau\delta_C V_C^*\right), \tag{A1}$$

and also

$$(1-\delta_C)V_C + X_C - c_J = \gamma_x\left(V_C^* - c_J - \tau\delta_C V_C^*\right) \tag{A2}$$

Setting the partial derivative with respect to V_C^* equal to zero and substituting (A1) and (A2) in the resulting expression gives

$$V_C^* = \beta c_J / (\beta - 1)(1 - \delta_C \tau). \tag{A3}$$

Substituting (A1), (A2), and (A3) into (21), it is found that the payoff to the cooperative JV is fixed at $c_J/(\beta-1)$. From (A3), this payoff is realized at the earliest moment when δ_C -and hence V_C^*- is minimized, i.e. $\hat{\delta}_C$=0.