

# Foreign Direct Investment For Sale

Onur Koska\*

Preliminary Draft (*Please do not quote*)

---

## Abstract

This study explores the choice of a multinational firm between two alternative modes of entry: a greenfield investment and a joint venture, and the joint venture partner is selected by an auction. The model predicts an auction allows a multinational firm to increase its share up to an extent by which the joint venture becomes always preferable compared with a greenfield investment. The model also examines the nationally optimal entry mode and finds that greenfield investment is more likely to be welfare-reducing. It also concludes that the anticipated welfare implication of a joint venture crucially depends on the expectation of marginal cost of the joint venture. Furthermore, the joint venture is found to be welfare-improving compared with a greenfield investment if the permitted marginal cost distribution is largest.

*Keywords:* Foreign Direct Investment; Modes of Entry; Private Values; Auctions with Externality

*JEL classification:* D44; D82; F23; L13; L24

---

## 1. Introduction

This paper presents a general analysis of a firm's foreign entry choice under incomplete information. We allow the firm intending to enter a pre-determined, single host country to select its entry mode among two options.<sup>1</sup> The first one is to set up its own subsidiary enabling itself to have full control over its activities which we refer to greenfield investments. If the firm has decided not to make a greenfield investment, it can venture with a local firm in the host country, and engage in joint production which we refer to international joint ventures in which both firms have partial control over activities of the established joint venture. A joint venture type of entry requires another decision, that is, to select its local partner among available ones. As we will discuss later, the type of information available to the selecting firm becomes crucial in the selection process. From a theoretical perspective, a firm having an intention of becoming a multinational firm (MNF) may prefer full control over its activities in a host country to avoid costs of shared ownership (e.g., conflict in decision making, moral hazard, and free-riding) if there is no/or less institutional uncertainty. However, if a local firm can be helpful in overcoming country-specific hurdles, it may prefer a partial ownership. For example, non-state firms in China were not allowed to invest overseas before 1980s. This restriction was eased during the liberalization era of late 1980s and non-state firms were permitted to invest abroad provided they had sufficient capital, technical and operational know-how and a suitable joint venture partner (UNCTAD, 2005: 6). Although government-dictated restrictions had led Chinese firms to establish joint ventures, concerns of the Chinese government in those years could easily be associated with the arguments discussed here. Local experience and local knowledge (of economic, policy and political environment) of local firms may make joint ventures more likely to be the first-time entry mode of a firm (Hennart, 1991; Caves, 1996; Das and Katayama, 2003; Asiedu and Esfahani, 2001). Though once the uncertainty disappears and the MNF becomes familiar with the country-specific environment such that it accumulates local knowledge and obtains local experience, it may prefer to set up its own subsidiary. An MNF also tends to go for a full-ownership mode if there is an inherent risk of being expropriated by local partners, because the proximity of local firms to the MNF's intangible assets

---

\*Ph.D. Student, University of Otago, Department of Economics; PO Box 56, Dunedin, New Zealand; Tel.: +64-3-479-8152; fax: +64-3-479-8174 (by name).

*E-mail address:* okoska@business.otago.ac.nz

<sup>1</sup>See Anderson and Gatignon (1986) for a clustering of entry modes. Alternatively, see Buckley and Casson (1998).

enables them to successfully establish rival firms after having used the MNF's key resources in a partnership (Gattai and Molteni, 2007).

In the theoretical as well as the empirical literature, a number of studies has already analyzed an MNF's strategic choice between a joint venture and a greenfield investment. For instance, Gomes-Casseres's 1989 study (quoted in Nisbet *et al.*, 2003: 249-250) examined the propensity of US multinationals to invest via joint venture or wholly-owned subsidiary. The results showed that in countries where governments restricted inward investment the firm was likely to enter through joint venture. Raff *et al.* (2006) find that if partner firms in a joint venture are too asymmetric in terms of their asset structures, the best strategy for an MNF is to set up its own subsidiary instead of forming a joint venture. They also report that joint ventures are less likely relative to whole ownership in concentrated industries. Yu and Tang (1992) find that if there is no/or less cost asymmetry between an MNF and local firms, a joint venture becomes preferable relative to a greenfield investment.

Relatively few studies have formalized negotiations between firms before having established a joint venture. Svejnar and Smith (1984) models international joint ventures through negotiations with a special emphasis on bargaining power of firms, transfer pricing, stock ownership and profit shares. Al-Saadon and Das (1996) endogenously determines ownership shares as the outcome of some bargaining process. Asiedu and Esfahani (2001) provides an alternative examination of ownership structures. Information structure at the time of bargaining process has commonly been considered as perfect in these and many other studies having already addressed the selection of a local partner taking place through negotiations.

In this paper, we are in particular interested in providing an alternative analytical model for MNF negotiating with local firms over a joint venture contract in the presence of asymmetric information. In a two-country three-firm partial equilibrium model with incomplete information, this model explores the choice of an MNF between two alternative modes of entry: a greenfield investment and a joint venture. It is mainly the selection of a joint venture partner on which this paper would like to make progress. The MNF could pick one or both potential partner firms and make a take-it-or-leave-it offer, which is the most common approach in the international joint venture literature. If the MNF were to observe how much local firms would expect to benefit from the joint venture, it could make the offer to the firm that values the contract most. However, it is not always the case that the MNF does know local firms' valuations. There may be asymmetric information between firms. Local firms may not be publicly listed. Hence, the MNF may have limited information about these firms. It may also have poor knowledge of the host country's institutional environment if it has never invested in this country before. Moreover, local firms may also have intangible assets like private connections. These connections may help to eliminate specific obstacles, which may arise due to venturing with a foreign firm (i.e., bureaucratic delays, and extra payments). By successfully eliminating obstacles, a firm may become relatively more efficient than the other firm might do after forming a joint venture with a foreign firm. Therefore, local firms may know better than the MNF how large the scope for reducing marginal costs is.

Hence, this paper assumes that the productivity of the joint venture is private information of the local firms that weakens the bargaining power of the MNF. If there is such an imperfection, the MNF's ability to extract surplus is limited (McAfee and McMillan, 1987; Krishna, 2002). Since local firms' valuations are not known, if the MNF picked one or both firms and made a take-it-or-leave-it offer, only

good offers would be accepted by good types, but by the bad types as well. Alternatively, the MNF can talk to all potential target firms simultaneously and ask them for offers. Multiple negotiations in this sense are strategically equivalent to an auction.<sup>2</sup> As we will show later, holding an auction leads the MNF to avoid the "lemon's problem" such that it always picks a relatively efficient firm which is not necessarily the case for take-it-or-leave-it offers. Since the MNF's main concern is to form a joint venture with a good-type firm, it is likely that the MNF prefers to go for multiple negotiations instead of negotiating with one firm only to which it makes a take-it-or-leave-it offer.<sup>3,4</sup> Therefore, an auction method is considered as the means of selecting a joint venture partner.

In the existing FDI literature, many studies have discussed and determined the equilibrium market structure under FDI. Among others, Gattai and Molteni (2007) provide a theoretical formalization of a joint venture contract as an alternative to greenfield investment. However, in their study, the share parameter determining the net return of a joint venture is imposed exogenously by a local government. Their theoretical model suggests that the joint venture is always preferable for an MNF when the share parameter is high enough. Norback and Persson (2002) examine the interaction between cross-border acquisitions and greenfield investments in a multi-firm setting. Though the selection in their study occurs between an asset acquisition and a greenfield investment, they use common values, first-price auction to determine the equilibrium acquisition price. The same authors have also considered privatization as an entry mode, and they use the same auction format. Selling a state enterprise is the focus in Norback and Persson (2004) where a greenfield investment is the outside option, whereas policy implications are examined in Norback and Persson (2005). Jehiel and Moldovanu (2000) derive the equilibria of private values, second-price, sealed-bid auctions of patents and takeover contests under different circumstances. Their study is neither in the FDI literature, nor concerned with determining the equilibrium market structure.

Our study differs from existing studies in the following respects: first, we concentrate on two alternative modes of entry, a greenfield investment and a joint venture, in which we determine an MNF's share in a joint venture partnership by an auction mechanism, which is analogous to modeling an MNF negotiating simultaneously with potential local partner firms. Second, we assume that an entry of an MNF creates negative externalities on local firms. Finally, our study includes incomplete information between firms. By using a private values model with negative externalities, we conclude that the auction allows the MNF to increase its share up to an extent by which a joint venture becomes always preferable compared with a greenfield investment. We also examine the nationally optimal entry mode and find that greenfield investment is more likely to be welfare-reducing. According to our model, the anticipated welfare implication of a joint venture crucially depends on the expectation of joint venture's marginal cost. Furthermore, we conclude that the joint venture type of entry is found to be welfare-improving compared with a greenfield investment if the marginal cost of the joint venture is distributed such that it just covers the range of negative externalities. The major contribution of this

---

<sup>2</sup> Auctions have been used since antiquity, however, they entered the economics literature in the second half of the 20th century. Today a wide range of objects are being sold by means of auctions (e.g., sale of service rights, privatization of firms, and sale of industrial enterprises).

<sup>3</sup> For instance, in late 1993, two firms were interested in acquiring the US firm Paramount: Viacom and QVC. Paramount agreed to sell itself to Viacom and excluded the other bidder. QVC argued that Paramount should have held multiple negotiations. According to QVC, an auction would have been the appropriate way to maximize shareholder value (Bulow and Klemperer, 1996: 181).

<sup>4</sup> See Bulow and Klemperer (1996). They compare an auction with a negotiation and show under reasonable assumptions that the auction is always preferable to the negotiation with one less bidder.

study is the role of multiple negotiations which are strategically equivalent to an auction. Assuming that the selection of a joint venture partner is undertaken by an auction is, to our knowledge, not well developed in this literature, where the most common approach is to assume a take-it-or-leave-it offer. Additionally, this study might also be seen as a contribution to the international business literature, as it provides an alternative analytical approach to capture effects of institutional uncertainties that an MNF may confront in the host country.

The remainder of the paper is structured as follows: the model is introduced and solved for a greenfield investment only in Section 2. In Section 3, we solve the model for a joint venture type of entry, derive the equilibrium value of a joint venture contract, and we determine the equilibrium market structure. Section 4 investigates the nationally optimal entry mode, and Section 5 concludes. For convenience, we have relegated most of the proofs to the Appendix.

## 2. The Model

In our model, we have two countries: a source country and a host country. The host country has two local firms: firm  $i$  and firm  $j$ . The source country has only one MNF. In the host country, firms are assumed to compete in a homogeneous good market. The local firms have identical marginal costs denoted by  $c$  (i.e.,  $c_i = c_j = c$ ). The MNF is assumed to possess a relatively more efficient technology, which allows itself to produce the homogeneous good with a lower marginal cost denoted by  $c^*$  (i.e.,  $c^* < c$ ). The marginal costs are assumed to take values on the open interval  $(0, 1)$  (i.e.,  $c^*, c \in (0, 1)$ ). There is a linear market demand in the host country, such that the inverse demand function is expressed by  $P(Q) = (1 - Q)$ , where  $Q = q_m + q_i + q_j$ .  $Q$  represents the total amount of homogeneous good produced in the host country, which comprises the MNF's output  $q_m$  and the local outputs  $q_i + q_j$ . The MNF can take advantage of possessing the efficient technology by investing in the host country. There are two ways to enter the host country; the MNF can either make a greenfield investment or form a joint venture.<sup>5</sup> The MNF has also the option to stay outside the host country and not to invest at all. The interaction between firms takes place in four stages. In the first stage, the social planner of the host country decides whether to impose any restriction on available types of the foreign entry. In the second stage, the MNF can form a joint venture partnership with a local firm if it is not restricted by the social planner. In the third stage, the MNF has the option to set up its own subsidiary in the host country if it has not formed a joint venture and if it is permitted to do so. In the fourth stage, all active firms compete in the Cournot fashion. The game is solved backwards.

### 2.1. Autarky of the host country

The MNF has the option to stay outside. There will be only two local firms in the host country if the MNF prefers to stay outside. Denote by  $\pi_i^a$  and  $\pi_j^a$  the local firms' profits when there is no foreign entry. Note that superscript  $a$  refers to autarky. The profit levels of the local firms obtained by the Cournot duopoly game are given by equation (1) (see Appendix for details):

$$(1) \quad \pi_i^a = \pi_j^a = \frac{(1-c)^2}{9} > 0.$$

---

<sup>5</sup>The model concentrates on a horizontal FDI in which the main motivation is to serve consumers in a host country. Furthermore, the model excludes exports as the alternative way of serving consumers in the host country.

Denote by  $\pi_m^a$  the MNF's profit in the host country.  $\pi_m^a$  is equal to zero as the MNF will not involve in production in the host country if it prefers not to invest in this country.

## 2.2. Greenfield investment

The MNF can enter the host country by setting up a wholly-owned subsidiary. Denote by  $f_g$  the fixed costs of making a greenfield investment.<sup>6</sup> In this case, there will be three firms in the host country. Denote by  $\pi_i^g$  and  $\pi_j^g$  the local firms' profits, and by  $\pi_m^g$  the MNF's profit in which superscript  $g$  refers to greenfield. The Cournot triopoly game between firms results in the profit levels given by equations (2) and (3) (see Appendix for details):

$$(2) \quad \pi_i^g = \pi_j^g = \frac{(1 - 2c + c^*)^2}{16} > 0,$$

$$(3) \quad \pi_m^g = \frac{(1 - 3c^* + 2c)^2}{16} - f_g \geq 0.$$

Note that the profitability of the greenfield type of entry depends directly on the amount of fixed costs (i.e.,  $\partial_{f_g} \pi_m^g < 0$ ).  $\pi_m^g$  from (3) takes non-negative values for  $f_g \leq \frac{(1 - 3c^* + 2c)^2}{16}$  and non-positive values for  $f_g \geq \frac{(1 - 3c^* + 2c)^2}{16}$ . If the MNF makes the greenfield investment, local competition will be tougher as the number of firms increases in the host country, where the MNF is more efficient than the local firms.<sup>7</sup> Hence, there will be an increase in total production, which will reduce the local price. Local firms will be negatively affected by the entry of a more efficient firm.

## 3. Joint venture

The MNF has the option to form a joint venture with a local firm, if it does not want to go for a greenfield investment. To form a joint venture, the MNF offers a contract to the local firms to share profits. It is assumed that the local firm, which becomes the joint venture partner of the MNF, is not required to make side payments to the MNF. This contract can be seen as a profit-sharing agreement. The MNF is presumed to have a lack of knowledge of the host country-specific business environment, as this investment is assumed to be its first-time entry to this country. According to the contract, the MNF will enable the joint venture partner to use its more efficient technology. In return, it will get access to its local partner's country-specific knowledge (e.g., customs, government regulations, market access and access to particular distribution channels).<sup>8</sup> Therefore, the cooperation between the MNF and a local firm creates synergies that enhance the efficiency of firms. The local firm, which becomes the joint venture partner of the MNF, will be able to reduce its marginal cost after it has become the joint venture partner, because both firms' assets can be combined in the joint venture.

In this case, only two local firms are active in the market and the joint venture is more productive than the other local firm. Denote by  $\theta = (\theta_i, \theta_j)$  the marginal cost of a joint venture, where  $\theta \ll c$ .

<sup>6</sup>See Horstmann and Markusen (1996), and Helpman *et al.* (2004) for the discussion of fixed costs of a greenfield investment.

<sup>7</sup>Irrespective of the type of foreign entry, local firms are assumed to make positive profits.

<sup>8</sup>See Chowdhury and Chowdhury (2002).

Equations (4) and (5) give the profit levels obtained by the Cournot duopoly game (see Appendix for details):

$$(4) \quad \pi^v = \frac{(1 - 2\theta + c)^2}{9} > 0,$$

$$(5) \quad \pi^e = \frac{(1 - 2c + \theta)^2}{9} > 0.$$

Note that  $\pi^v$  represents the profit of the joint venture and  $\pi^e$  is the other firm's profit. Suppose that firm  $i$  has become the joint venture partner of the MNF. Equations (4) and (5) should read  $\pi^v(\theta_i) = \frac{(1 - 2\theta_i + c)^2}{9}$  and  $\pi_j^e = \frac{(1 - 2c + \theta_i)^2}{9}$ , respectively. The comparison of equations  $\pi^v(\theta_i)$  and  $\pi_j^e$  with (1) posits that the joint venture's profit is higher than joint profits of individual firms in autarky (i.e.,  $\pi^v(\theta_i) > \pi_i^a$ ). But the firm producing relatively less efficiently will be negatively affected (i.e.,  $\pi_j^e < \pi_j^a$ ). There will be an increase in aggregate production as the increase in total production of partner firms resulted from a joint venture will be high enough to compensate its negative impact on production of other firm. Therefore, the price of homogeneous good will decrease.

The net return to the MNF depends on the size of technology improvement as it contributes to its local partner's profit. Denote by  $\pi_m^v$  the MNF's profit in the case that it forms a joint venture. It is mainly the MNF's share in total joint venture profit given in (4). Therefore, the net return of involving in joint venture to the MNF's local partner will be  $\pi_i^v = [\pi^v(\theta_i) - \pi_m^v]$ . The MNF's problem is to maximize the net return to its investment project. The MNF prefers a greenfield investment to staying outside if the net return of a greenfield investment  $\pi_m^g$  from (3) is non-negative. If both  $\pi_m^g$  and  $\pi_m^v$  are non-negative profits, the MNF prefers a joint venture if its share in total joint venture profit is higher than the profit a subsidiary of the MNF would make. Otherwise, it makes a greenfield investment. It is also possible that setting up a new plant in the host country requires high fixed costs, which may result in negative  $\pi_m^g$ . If this is the case, the MNF does opt for a joint venture unless  $\pi_m^v$  is non-positive. Therefore, the size of  $\pi_m^v$  becomes crucial for the MNF while selecting its ownership mode. In the following section,  $\pi_m^v$  is determined by multiple negotiations.

#### *Private Values, second-price, sealed-bid auction*

As usual in the literature, the amount of private information that each firm holds is defined by their types. Since the productivity of a joint venture is private information of the local firms, let the marginal cost of a joint venture represent the local firm's type (e.g.,  $\theta_i$  represents firm  $i$ 's type).<sup>9</sup> We assume that each type is known by the firm, but not known by the other firm or by the MNF.<sup>10</sup> However, the distribution of  $\theta$  is common knowledge. To keep the model as simple as possible,  $\theta$  is assumed to be uniformly distributed on the interval  $(0, \bar{\theta})$  where  $\bar{\theta} \leq \frac{2c+3c^*-1}{4}$ . Putting a restriction on  $\max[\bar{\theta}]$  will guarantee negative externalities irrespective of  $\theta$ . To find a local joint venture partner, the MNF negotiates simultaneously with both firms and asks them for offers; this is strategically

<sup>9</sup>Firm  $i$  is a good-type (bad-type) firm relative to firm  $j$  if  $\theta_i < \theta_j$  ( $\theta_i > \theta_j$ ).

<sup>10</sup>The local firms' types are private information at the time of the auction, but will be revealed after the auction. The revelation assumption allows us to figure out the optimal entry mode of the MNF without assigning any probabilities to the realization of firms' true types. If the local firms' types were to remain private information even after the auction, we would have Bayesian equilibria without further insights such that the local firms would determine their equilibrium production levels according to their beliefs on their opponent's type, and hence the equilibrium profit levels in (4) and (5) would change such that they include beliefs about opponents' types.

equivalent to an auction. There are many formats by which this auction could be run. As we will show later that the expected revenues coincide for all formats, we will consider the simplest auction format, that is, a second-price sealed-bid auction. In this type of auction, each firm independently submits a single bid without seeing the other's bid. The local firms are assumed to be risk-neutral. The firm making the highest bid becomes the joint venture partner and pays the second-highest bid. Note that local firms' bids represent their willingness to pay to share total joint venture profit with the MNF. Therefore,  $\pi_m^v$  will be the runner-up's willingness to pay. As we will also show later, a local firm's willing-to-pay depends on its own type and shows how much this firm values forming a joint venture with the MNF. Local firms' valuations are assumed to be symmetric, independently drawn from an identical, common and strictly increasing distribution. In a second-price sealed-bid auction with symmetric, independent and identically distributed private-values, it is optimal for a firm to bid its true value irrespective of what the other firm does.<sup>11</sup>

The benchmark case for the auction is determined by the credibility of alternative options. For instance, if greenfield investment is not a credible entry mode (i.e.,  $\pi_m^g \leq 0 = \pi_m^a$ ), the outside strategy will be the benchmark case, because the MNF will stay outside the host country if it prefers not to form a joint venture or if forming a joint venture fails for some reason. Similarly, if the greenfield investment is a credible outside option (i.e.,  $\pi_m^g > \pi_m^a = 0$ ), the benchmark case will be greenfield investment, because the MNF will make a greenfield investment if it is not successful in forming a joint venture with one of the local firms. Hence, we have to distinguish these two cases.

**Case 1** *Greenfield investment is not profitable:*

In this case, we have high fixed costs (i.e.,  $f_g \geq \frac{1}{16}(1 - 3c^* + 2c)^2$ ) that results in a non-positive  $\pi_m^g$  in (3). If this is the case, the MNF prefers to stay outside unless it forms a joint venture. Denote by  $b_i$  and  $b_j$  firm  $i$ 's and firm  $j$ 's maximum willingness to pay, respectively. If firm  $i$  is willing to pay  $b_i$  to the MNF as its share of joint venture profit if it forms the joint venture with the MNF, its relative profit change will be  $[\pi^v(\theta_i) - b_i] - \pi_i^a$ . If firm  $j$  forms a joint venture, firm  $i$ 's relative profit change will be  $[\pi_i^e - \pi_i^a]$ . Firm  $i$ 's maximum willingness to pay will be the amount that makes itself indifferent between these two relative changes such that  $\arg_{b_i} \{[\pi^v(\theta_i) - b_i] - \pi_i^a = [\pi_i^e - \pi_i^a]\} \Rightarrow b_i = [\pi^v(\theta_i) - \pi_i^e]$ . Similarly, firm  $j$ 's maximum willingness to pay will be  $b_j = [\pi^v(\theta_j) - \pi_j^e]$ .

**Case 2** *Greenfield investment is profitable:*

If the fixed costs are relatively low (i.e.,  $f_g < \frac{1}{16}(1 - 3c^* + 2c)^2$ ) such that we have positive  $\pi_m^g$  in (3), staying outside will not be credible. The MNF rather makes a greenfield investment as  $\pi_m^g > \pi_m^a$ . In this case, firm  $i$ 's relative profit change will be  $[\pi^v(\theta_i) - b_i] - \pi_i^g$  if it forms the joint venture by paying the MNF at its maximum willingness-level, and  $[\pi_i^e - \pi_i^g]$  if the MNF forms a joint venture

<sup>11</sup>Suppose that firm  $i$  bids less than its true value (i.e.,  $\forall \varepsilon > 0; b_i = v_i - \varepsilon$ ). If firm  $j$ 's bid  $b_j$  is lower than firm  $i$ 's bid (i.e.,  $v_i - \varepsilon > b_j$ ), firm  $i$  wins the auction and pays  $b_j$ , just as if it bids  $v_i$ . If  $b_j > v_i$ , firm  $i$  loses, just as if it bids  $v_i$ . But if  $v_i > b_j > v_i - \varepsilon$ , bidding  $v_i - \varepsilon$  causes firm  $i$  to lose the auction, whereas if it had bid  $v_i$ , it would have won the auction and paid  $b_j$  for a net surplus of  $v_i - b_j$ . So, firm  $i$  never gains, but might lose if it bids  $v_i - \varepsilon$  that is less than its true value. Suppose that firm  $i$  bids more than its true value (i.e.,  $\forall \varepsilon > 0; b_i = v_i + \varepsilon$ ). If  $v_i + \varepsilon > b_j$ , firm  $i$  wins and pays  $b_j$ , just as if it bids  $v_i$ . If  $b_j > v_i + \varepsilon$ , it loses and pays nothing, just as if it bids  $v_i$ . But, if  $v_i + \varepsilon > b_j > v_i$ , bidding  $v_i + \varepsilon$  causes firm  $i$  to win the auction, but makes itself pay higher than its true value (i.e.,  $b_j > v_i$ ) which results in negative surplus. If it had bid its true value, it would have lost which would have resulted in zero surplus that would have been better than getting negative surplus. So, bidding  $v_i + \varepsilon$  may hurt firm  $i$  compared with bidding  $v_i$ , but it never helps (Krishna, 2002; Klemperer, 2004).

with other firm. Therefore, firm  $i$  will be indifferent for  $b_i = [\pi^v(\theta_i) - \pi_i^e]$ , and so will firm  $j$  for  $b_j = [\pi^v(\theta_j) - \pi_j^e]$ .

Note that maximum willingness to pay does not depend on the profitability of credible options. This is because each firm's maximum willingness to pay represents how much that firm values forming a joint venture with the MNF. Each firm's value changes with its own type, because information about added-efficiency that each firm will gain by forming a joint venture is embedded in each firm's type  $\theta$ . This leads us to Proposition 1 where each firm's equilibrium bid is determined.

**Proposition 1** *Firm  $i$  and firm  $j$  bid  $b_i(\theta_i)$  and  $b_j(\theta_j)$  respectively, where  $b_i(\theta_i) = [\pi^v(\theta_i) - \pi_i^e(\theta_i)]$  and  $b_j(\theta_j) = [\pi^v(\theta_j) - \pi_j^e(\theta_j)]$ .*

**Proof.** Suppose that firm  $i$  is the good-type firm relative to firm  $j$  (i.e.,  $\theta_i < \theta_j$ ). If both firms bid according to Proposition 1, there is no doubt firm  $i$  wins and pays the amount firm  $j$  has bid as  $b_i(\theta_i) > b_j(\theta_j)$  since  $\partial_{\theta_i} [b_i(c, \theta_i)] < 0$  and  $\partial_{\theta_j} [b_j(c, \theta_j)] < 0$ .

Now, let  $\hat{\theta}_j$  be firm  $i$ 's anticipation of firm  $j$ 's type such that  $\theta_i \leq \hat{\theta}_j < \bar{\theta}$ . And let firm  $i$  bid according to  $b_i(\theta_i, \hat{\theta}_j)$  in which  $\pi_i^e$  depends on  $\hat{\theta}_j$ . This is simply to say firm  $i$  bidding any amount less than the one stated in Proposition 1 (i.e.,  $b_i(\theta_i, \hat{\theta}_j) \leq b_i(\theta_i)$  as  $\theta_i \leq \hat{\theta}_j$  and  $\partial_{\hat{\theta}_j} [b_i(\theta_i, \hat{\theta}_j)] < 0$ ). If  $b_j(\theta_j) < b_i(\theta_i, \hat{\theta}_j) \leq b_i(\theta_i)$ , firm  $i$  wins and pays  $b_j(\theta_j)$  just as if it bids  $b_i(\theta_i)$ . But if  $b_i(\theta_i, \hat{\theta}_j) < b_j(\theta_j) < b_i(\theta_i)$ , bidding  $b_i(\theta_i, \hat{\theta}_j)$  causes firm  $i$  to lose the auction, whereas if it had bid  $b_i(\theta_i)$ , it would have won and paid  $b_j(\theta_j)$  for a net surplus. So, firm  $i$  never gains, but might lose if it bids less than  $b_i(\theta_i)$ . Note that there is no possibility firm  $i$  bids more than  $b_i(\theta_i)$  as it is by definition that  $b_i(\theta_i)$  is the maximum amount that guarantees non-negative net surplus. ■

Although both  $\pi^v$  from (4) and  $\pi^e$  from (5) depend on the winner's type, each firm's equilibrium bid depends only on its own type. A firm would never gain by bidding less than the optimal bids, but might lose, as the amount it would pay if it won would not be the amount it had bid, but the amount its opponent had bid. Therefore, both firms prefer to bid as high as they can as long as their bid guarantees a non-negative surplus, which is for each firm to consider  $\pi^e$  from (5) depending on its own type at the time of auction and bid according to Proposition 1.

In the introduction, we have claimed that holding an auction leads the MNF to avoid the "lemon's problem" such that it always picks a relatively efficient firm. This comes from the fact that a firm's maximum willingness to pay is negatively related with its own type. The more productive is the joint venture, the higher will local firms bid. Therefore, the MNF can pick a good-type firm via the auction as there is no doubt the winner will be the highest bid firm, that is, the firm making the joint venture most productive. Given that firms bid according to Proposition 1, the MNF has to compare the second-highest bid with the profit it can make with its alternative outside option that leads itself to its preferred mode of entry, which is indicated in the following lemma.

**Lemma 1** *Both firms submit positive bids such that  $b_i(\theta_i) = [\pi^v(\theta_i) - \pi_i^e(\theta_i)] > 0$  and  $b_j(\theta_j) = [\pi^v(\theta_j) - \pi_j^e(\theta_j)] > 0$ :*

- Define by  $\min\{b_i, b_j\}$  the second-highest bid in the auction that is  $\min\{b_i, b_j\} = \pi_m^v$*
- i) If  $f_g \geq \frac{1}{16}(1 - 3c^* + 2c)^2$ , the MNF forms a joint venture as  $\pi_m^v > \pi_m^a = 0$ ,*
- ii) If  $f_g < \frac{1}{16}(1 - 3c^* + 2c)^2$ , the MNF forms a joint venture as  $\forall \theta_n \in (0, \bar{\theta})$ ,  $\pi_m^v > \pi_m^g$ , where  $n = (i, j)$ .*

**Proof.** [Section (ii)] We want to show  $\forall \theta_n \in (0, \bar{\theta})$ ,  $\pi_m^v > \pi_m^g$ , where  $n = (i, j)$ . We know from (5) and (2) that  $\forall \theta_n \in (0, \bar{\theta})$ ,  $\pi_n^e < \pi_n^g$ . We also know that  $\forall \theta_n \in (0, \bar{\theta})$ ,  $\pi^v(\theta_n) \geq \pi_m^g + \pi_n^g$ . Rearranging the last expression will imply  $\pi^v(\theta_n) - \pi_n^g \geq \pi_m^g$ . Now we can show that  $\pi^v(\theta_n) - \pi_n^e > \pi^v(\theta_n) - \pi_n^g \geq \pi_m^g$  as we know  $\pi_n^e < \pi_n^g$ . By definition,  $b_n(\theta_n) = \pi^v(\theta_n) - \pi_n^e(\theta_n)$ , which allows us to write  $b_n(\theta_n) > \pi_m^g$ . This last expression tells us any bid will be more than the MNF's greenfield profit. Therefore, we can write  $\max\{b_i, b_j\} \geq \min\{b_i, b_j\} = \pi_m^v > \pi_m^g$ . This is simply what we need to prove. ■

Lemma 1 posits that joint venture always dominates greenfield investment in the case of negative externalities. Therefore, we can say the MNF always prefers partial ownership if there is asymmetric information along with a negative externality of a foreign entry and if the MNF simultaneously negotiates with both local firms. Although the result presented so far are derived from a second-price sealed-bid auction, any auction mechanism yields the same result, because the MNF's expected revenue (the net return from the auction) is on average the same. In the literature, this is known as the "Revenue Equivalence Theorem". According to this theorem, if the bidders are risk-neutral and if they have privately known values independently and identically drawn from a common and strictly increasing distribution, any symmetric equilibrium of any standard auction, in which the expected payment of the bidder with the lowest value is zero and the bidder with the highest value wins, yields the same expected revenue for the seller (Vickrey, 1961; Milgrom and Weber, 1982; McAfee and McMillan, 1987; Milgrom, 1989; Krishna, 2002; Klemperer, 2004). Therefore, according to this model, if there is no restriction on any type of entry, the MNF opts for a joint venture instead of a greenfield investment as a result of any standard auction mechanism (e.g., a first price sealed-bid, a second-price sealed-bid, an ascending or a descending auction) by which its share in total joint venture profit is determined. Though, the host country might want to put a restriction on the type of foreign entry. In the next section, we look at the issue from the host country's standpoint and examine the nationally optimal entry mode.

#### 4. Nationally optimal entry mode

The analysis, up until here, has not been concerned with the possibility of any restriction on any type of foreign entry. However, if the MNF's preference on its entry mode was expected to reduce the initial welfare or to reduce the welfare relative to an available alternative entry mode, the host country might prefer to regulate foreign entry to improve local welfare. Therefore, in this section, we first derive welfare implication of a greenfield investment and compare results with autarky level of welfare. Following that, we derive expected welfare implication of a joint venture depending on  $\bar{\theta}$  and illustrate a specific case in which upper bound is equal to the limit of negative externalities, that is,  $\bar{\theta} = \frac{2c+3c^*-1}{4}$ .

Suppose that there is a local social planner that aims to maximize local welfare. Define local welfare ( $W$ ) as the sum of consumer surplus and total profits of domestic firms. Equation (6) gives the functional form of  $W$ :

$$(6) \quad W = \left[ \frac{1}{2} (q_m + q_i + q_j)^2 + \pi_i + \pi_j \right].$$

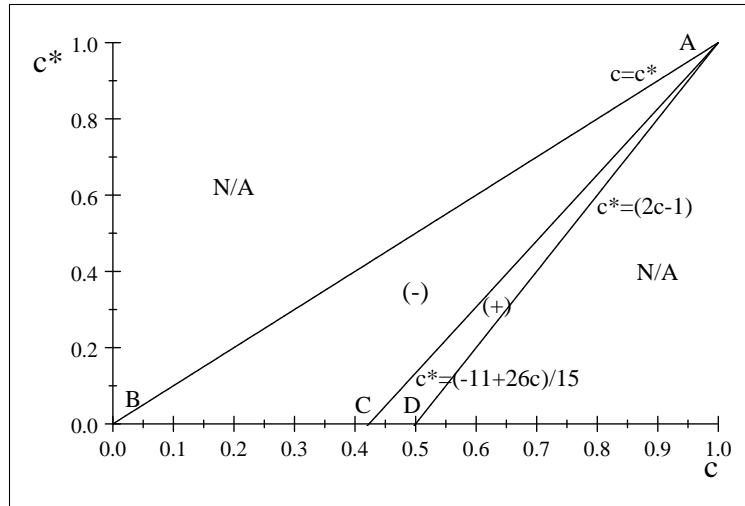
Denote by  $W^g$  the local welfare when the MNF makes a greenfield investment. Also, denote by  $W^a$  the welfare when there is autarky in the host country. The local social planner does not face any

uncertainty while computing  $W^a$  and  $W^g$  as both depends on the parameters  $c$  and  $c^*$ , which are both common knowledge. The functional forms of  $W^a(c)$  and  $W^g(c, c^*)$  computed according to (6) are given by the equations (7) and (8), respectively (see Appendix for details):

$$(7) \quad W^a = \left[ \frac{4}{9} (1 - c)^2 \right],$$

$$(8) \quad W^g = \left[ \frac{3}{8} (1 - c)^2 + \frac{1}{32} (1 - c^*)^2 + \frac{1}{8} (c - c^*)^2 - \frac{1}{8} (1 - c)(c - c^*) \right].$$

We are in particular interested in figuring out how likely the greenfield investment is welfare-improving compared with autarky. Denote by  $W_a^g$  the welfare change relative to autarky when the MNF makes greenfield investment. It is simply the difference between  $W^g$  from (8) and  $W^a$  from (7) and it depends on parameters  $c$  and  $c^*$ . We first set  $W_a^g$  equal to zero and solve the function for  $c^*$  that gives us another function  $c^*(c)$ , which shows the locus  $W_a^g(c, c^*) = 0$ . We then simulate  $c^*(c)$  according to parameter values and illustrate along with specific restrictions on values of  $c^*$  which are imposed by the model in Figure 1.



**Figure 1:** Welfare Change (Greenfield vs. Autarky)

In Figure 1, the left-above area of  $AB - line$  and the right-below area of  $AD - line$  are shown as not available as the model assumes  $c > c^*$  referring to the MNF's cost advantage over local firms and  $c^* > (2c - 1)$  referring to positive profits local firms are making in the presence of greenfield type of entry (see equation 2). Therefore, we should consider the area given by triangle  $ABD$ . The simulated function  $c^*(c)$  is represented by  $AC - line$ .  $W^g$  is equal to  $W^a$  along that line. In the area given by triangle  $ABC$ , the local welfare is decreasing by greenfield investment as  $\partial_c [W_a^g(c, c^*)] > 0$ , as well as  $\partial_{c^*} [W_a^g(c, c^*)] < 0$  for  $c^* \leq \frac{1}{15}(-11 + 26c)$ . Similarly, greenfield investment is welfare-improving in the area given by triangle  $ACD$ . The first-order derivatives  $\partial_c [W_a^g(c, c^*)] > 0$  and  $\partial_{c^*} [W_a^g(c, c^*)] < 0$  show that the less productive are the local firms and the more productive is the MNF, the more likely

is greenfield investment to be welfare-improving. However, Figure 1 also indicates that greenfield investment is more likely to be welfare-reducing as it is approximately 5.7 times more likely that any randomly chosen point in Figure 1 falls in triangle  $ABC$ , where welfare is decreasing by greenfield investment, than it falls in triangle  $ACD$ , where welfare is increasing by greenfield investment.

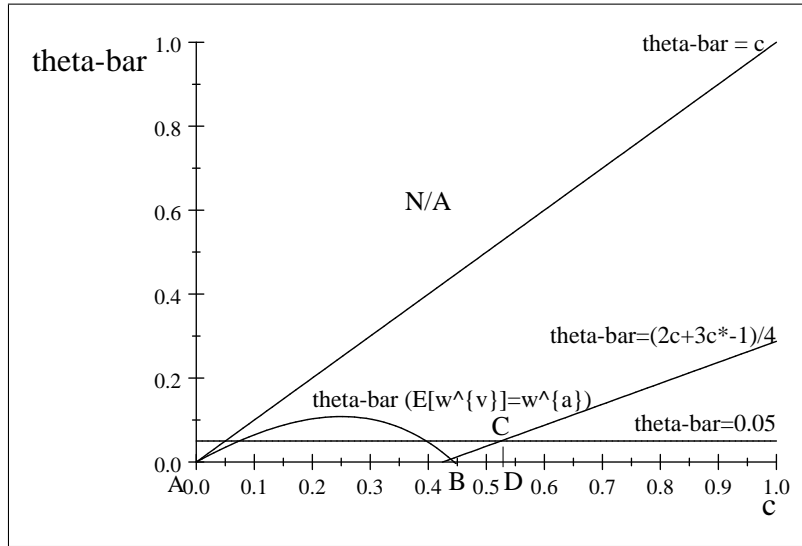
*Welfare implication of a joint venture*

Denote by  $W^v$  the local welfare when the MNF enters the host country by forming a joint venture. The local social planner has to form an expectation over  $W^v$  as it depends on the marginal cost of a joint venture, which is private information also for the planner. Denote by  $E[W^v]$  the expected value of  $W^v$ .  $E[W^v]$  can be expressed in terms of  $\bar{\theta}$  as the expectation of  $\theta$  depends on  $\bar{\theta}$ , because it is uniformly distributed on the interval  $(0, \bar{\theta})$ , where  $\bar{\theta} \leq \frac{2c+3c^*-1}{4}$ . The functional form of  $E[W^v](c, \bar{\theta})$  computed according to (6) is given by equation (9) (see Appendix for details):

$$(9) \quad E[W^v] = \left[ \frac{1}{108} (48 + 102c^2 + (32 - 7\bar{\theta})\bar{\theta} - 4c(30 + 7\bar{\theta})) \right].$$

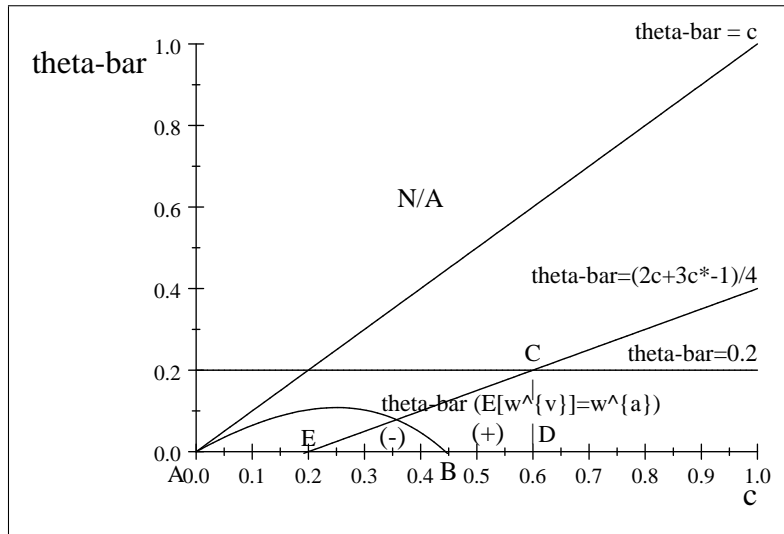
The change in equation (9) with  $\bar{\theta}$  is crucial as it affects  $E[W^v]$ , as well as the comparison with  $W^a$  and  $W^g$ . We find that  $\partial_{\bar{\theta}} [E[W^v](c, \bar{\theta})] > 0$ , that is, the higher is the upper limit of the interval that  $\theta$  is distributed on, the higher is local welfare if the MNF forms a joint venture. The intuition behind that is if  $\theta$  is uniformly distributed on a wider interval, joint venture is expected to be less productive as the expected value of  $\theta$  increases with an increase in  $\bar{\theta}$ . We also analyze the impact of an increase in  $\bar{\theta}$  on each component of the expected welfare function. The results show that the expected consumer surplus is strictly decreasing with  $\bar{\theta}$ , whereas local firms' expected total profits are increasing at a decreasing rate. The social planner expects the price to decrease less as the probability of a joint venture being relatively more efficient is decreasing with an increase in  $\bar{\theta}$ , which explains why the expected consumer surplus is decreasing with an increasing  $\bar{\theta}$ . Similarly, it also expects the negative impact of a joint venture on other firm's profit to be less severe as the opponent of that firm is now expected to be less strong. So, it expects negatively affected firm's profit to increase relatively. Although the joint venture profit is anticipated to be decreasing with an increase in  $\bar{\theta}$ , the net profit of the MNF's local partner is expected to increase as the bids are expected to decrease more than the decrease in expected joint venture profit as a result of increasing  $\bar{\theta}$ .

In order to compare  $E[W^v]$  with  $W^a$ , we take the difference between equations (9) and (7). We set the result equal to zero and solve that for  $\bar{\theta}$ , which yields the function  $\bar{\theta}(c)$ . We then simulate  $\bar{\theta}(c)$  according to parameter values and illustrate along with related assumptions of the model in Figure 2, 3 and 4. Figure 2 accounts low level of  $c^*$  such that  $c^* = 0.05$ , whereas it is moderate in Figure 3 such that  $c^* = 0.2$  and comparatively high in Figure 4 such that  $c^* = 0.35$ .



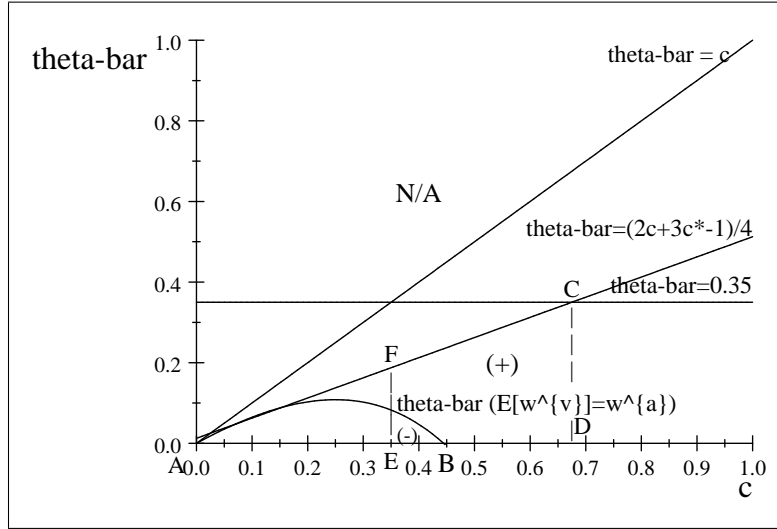
**Figure 2:** Welfare Change (Joint venture vs. Autarky) -  $c^* = 0.05$

Both in Figure 2, 3 and 4, the simulated function  $\bar{\theta}(c)$  is given by  $\widehat{AB}$ . Along that curve,  $E[W^v]$  is equal to  $W^a$ , and the change in welfare is negative below that curve, whereas it is positive above the curve. However, the model puts some restriction on  $\bar{\theta}$  such that  $\bar{\theta} \leq \frac{2c+3c^*-1}{4}$ , which is represented by  $BC$  - line. Note that  $\forall c, c^*, \frac{2c+3c^*-1}{4} < c^*$  which means we should consider values of  $\bar{\theta}$  less than 0.05 in Figure 2. Specifying  $c^*$  at 0.05 also restricts the upper limit of  $c$  as we should have  $(2c - 1) < c^*$ . The upper limit of  $c$  is given by *point* -  $D$ . Therefore, triangle  $BCD$  is the area under consideration. In triangle  $BCD$ , joint venture is always welfare-improving for any values of  $\bar{\theta}$ .



**Figure 3:** Welfare Change (Joint venture vs. Autarky) -  $c^* = 0.2$

In Figure 3, restriction  $\bar{\theta} \leq \frac{2c+3c^*-1}{4}$  is represented by  $EC$  - line, that is, the  $BC$  - line from Figure 2, which has shifted out. The upper limit of  $c$  represented by *point* -  $D$  has moved to the right. Therefore, triangle  $ECD$  is the new area under consideration. It is clear from Figure 3 that joint venture is welfare-reducing for some values of  $\bar{\theta}$  and it is welfare-improving for some other values.



**Figure 4:** Welfare Change (Joint venture vs. Autarky) -  $c^* = 0.35$

In Figure 4, we are interested in area  $EFC D$ . The conclusion is same as it is in Figure 3 except that a joint venture is always welfare-improving in this case if  $\bar{\theta} = \frac{2c+3c^*-1}{4}$ . This is the most optimistic scenario such that we are on the limits of negative externality in which  $E[W^v]$  is at its maximum level. This special case is generalized to any level of  $c$  and  $c^*$  and illustrated below.

*Illustration*  $\bar{\theta} = \frac{2c+3c^*-1}{4}$  :

$E[W^v]$  can be characterized by  $c$  and  $c^*$  only in this case, as the expectation of  $\theta$  depends on  $c$  and  $c^*$ , because it is uniformly distributed on the interval  $(0, \bar{\theta})$  where  $\bar{\theta} = \frac{2c+3c^*-1}{4}$ . The functional form of  $E[W^v](c, c^*)$  computed according to (6) is given by equation (10) (see Appendix for details):

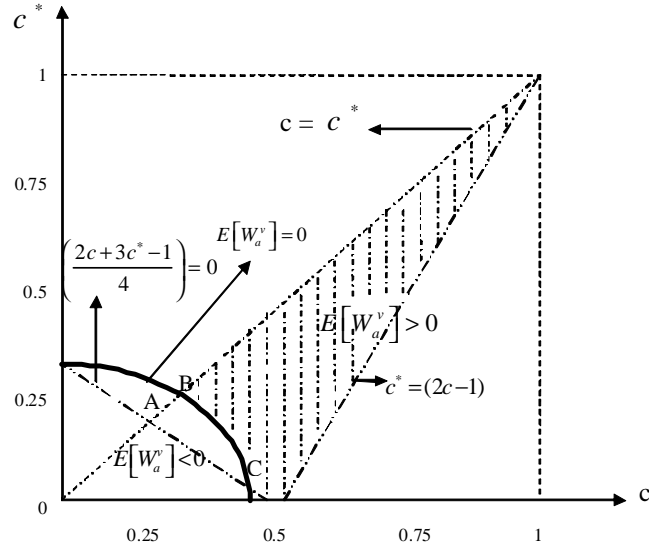
$$(10) \quad E[W^v] = \frac{1}{18} \left[ (8 + 17c^2 - 20c) - \frac{7(2c + 3c^* - 1)^2}{96} + \frac{(16 - 14c)(2c + 3c^* - 1)}{12} \right].$$

Denote by  $E[W_a^v]$  the expected welfare change relative to autarky when the MNF forms a joint venture. It is the difference between  $E[W^v]$  from (10) and  $W^a$  from (7). The solution to  $E[W_a^v] = E[W^v] - W^a$  is given by equation (11):

$$(11) \quad E[W_a^v] = \frac{1}{18} \left[ (9c^2 - 4c) - \frac{7(2c + 3c^* - 1)^2}{96} + \frac{(16 - 14c)(2c + 3c^* - 1)}{12} \right].$$

Compared with autarky, local competition increases by a joint venture, which will make the price decrease and consumer surplus increase. Local competition increases not because the number of firms increases, but because one local firm becomes relatively efficient after it has formed a joint venture with the MNF, and hence its profit increases by which local welfare will increase. However, the other firm is negatively affected and its profit decreases relative to its autarky level by which local welfare will decrease. The MNF also transfers a particular fraction of the joint venture profit to its country-of-origin which will have a negative impact on local welfare. Therefore, the net effect of a joint venture type of entry on local welfare will be ambiguous and will depend on parameter values. In order to

see the net effect changing according to parameter values,  $E[W_a^v]$  from (11) is set equal to zero and solved for  $c^*$ , which gives the function  $c^*(c)$  which defines the locus  $E[W_a^v] = 0$ . The function  $c^*(c)$  is simulated according to parameter values between  $(0, 1)$  and illustrated in Figure 5 along with the model's assumptions.



**Figure 5:** Welfare Change (Joint venture vs. Autarky) -  $\bar{\theta} = \frac{2c+3c^*-1}{4}$

There are three assumptions restricting the parameter values, and hence illustrated explicitly in Figure 5. The first one is  $c^* < c$ . Since the dashed  $45^\circ$  - line shows the locus  $c = c^*$ , the right-below area of this line is the region under consideration. The second one is  $\frac{2c+3c^*-1}{4} > 0$ , so we should consider the right-above area of the straight-line given by  $\frac{2c+3c^*-1}{4} = 0$ . The last one is  $c^* > (2c - 1)$ , so we should consider the left-above area of the line given by  $c^* = (2c - 1)$ . The triangle composed of the shaded-area and area  $ABC$  shows the region under consideration. Note that the thick-black curve is the simulated function  $c^*(c)$ . Along this curve,  $E[W_a^v] = 0$ . Since the change in expected welfare increases by  $c$  (i.e.,  $\partial_c \{E[W_a^v(c, c^*)]\} > 0$ ), in the shaded-area,  $E[W_a^v] > 0$  and in area  $ABC$ ,  $E[W_a^v] < 0$ . Therefore, it is not always the case that a joint venture improves the host country's welfare relative to its autarky. For some values of  $c$  and  $c^*$ , joint venture might be welfare-reducing.

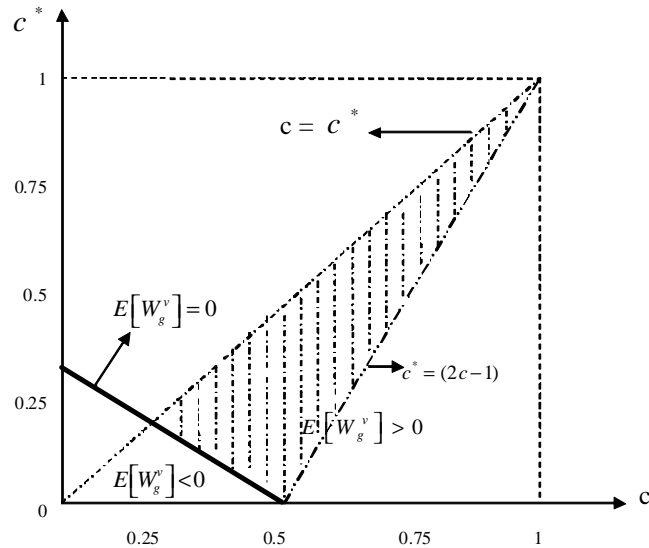
The next step is to compare joint venture with greenfield investment. Denote by  $E[W_g^v]$  the expected welfare change relative to greenfield investment when the MNF forms a joint venture that is the difference between  $E[W_a^v]$  from (10) and  $W^g$  from (8). The solution to  $E[W_g^v] = E[W_a^v] - W^g$  is given by equation (12):

$$(12) \quad E[W_g^v] = \frac{1}{576} \left[ -23 - 4c + 100c^2 + 106c^* + 76cc^* - 111(c^*)^2 \right].$$

Both greenfield investment and joint venture increase local competition relative to autarky. Increase in local competition is due to a market structure effect in the former, whereas it is due to a

cost saving effect in the latter. Market structure changes with a greenfield investment as the number of firms increases by the entry of relatively efficient firm. Production increases, which makes the price decrease. If the MNF forms a joint venture, there will be no market structure effect as only local firms will be active just as if the host country is in autarky. However, there will be a cost saving effect as one local firm will be more productive with a joint venture; even more productive than the MNF's subsidiary would be. Production increases more with a joint venture, and hence price decrease is stronger, because the cost saving effect is stronger than the market structure effect. Therefore, local consumer surplus increases relative to the greenfield case. In addition to these effects, there will be a profit-shifting effect in both type of entries. Profit-shifting effect will decrease local producer surplus more in the joint venture case as the MNF's profit will always be higher with a joint venture. However, the negative effect will be minimized at  $\bar{\theta} = \frac{2c+3c^*-1}{4}$  as the MNF's profit decreases with  $\bar{\theta}$ . As a result,  $E[W_g^v]$  will be positive if the net effect of profit-shifting is compensated by the cost saving effect as well.

Similar to the previous case, in order to assess the net effect,  $E[W_g^v]$  from (12) is set equal to zero and solved for  $c^*$ , which gives the function  $c^*(c)$ , which determines the locus  $E[W_g^v] = 0$ . Figure 6 illustrates the simulation of  $c^*(c)$  along with the model's assumptions restricting the parameter values.



**Figure 6:** Welfare Change (Joint venture vs. Greenfield investment)

According to Figure 6, the shaded-area is the only region under consideration. It is determined by the parameter constraints  $c > c^*$ ,  $c^* > (2c - 1)$  and  $\frac{(2c+3c^*-1)}{4} > 0$ . Therefore, the sign of  $E[W_g^v]$  within the shaded-area determines whether or not a joint venture is welfare-improving relative to a greenfield investment. Note that the thick-black line is the simulated function  $c^*(c)$ , that is, the simulation of  $c^* = \frac{1}{3}(1 - 2c)$ . Along this line,  $E[W_g^v] = 0$ . In the right-above area of this line,  $E[W_g^v] > 0$  as  $\partial_c \{E[W_g^v(c, c^*)]\} > 0$ . Since  $c^* = \frac{1}{3}(1 - 2c)$  along the thick-black line,  $c^* > \frac{1}{3}(1 - 2c)$

above this line. Rearranging this inequality yields  $(2c + 3c^* - 1) > 0$  that has already been imposed by the constraint  $\frac{(2c+3c^*-1)}{4} > 0$ , which is the upper bound assigned to local firms' types. Therefore, we should always be above the thick-black line and within the shaded-area, where  $E[W_g^v]$  is always positive. Irrespective of parameter values, a joint venture is always welfare-improving relative to a greenfield investment. However, that result holds only when  $\bar{\theta} = \frac{(2c+3c^*-1)}{4}$  that is the best scenario local planner could expect ever from a joint venture which still imposes negative externality.

According to this illustration, the host country would not want to restrict the joint venture option and force the MNF to make a greenfield investment, because its welfare would be higher if the MNF formed a joint venture. Depending on the marginal costs of local firms, the host country might want to regulate foreign entry as to stay in autarky as the local welfare would decrease if the local firms had high productivity and if the MNF entered by a joint venture. However, if the contribution of a joint venture to a local firm's efficiency is promising, the host country prefers the MNF forming a joint venture as it improves the local welfare relative to autarky. Since the MNF prefers a joint venture rather than a greenfield investment, the host country does not have to regulate foreign entry to attain the equilibrium market structure it prefers. Furthermore, the host country would not restrict greenfield entry, because the MNF will go for a joint venture.

## 5. Conclusion

In the two-country, three-firm partial equilibrium model with incomplete information, we have examined the equilibrium market structure with different entry options. We have explored the choice of an MNF between two alternative modes of entry: a greenfield investment and a joint venture. It is the selection of a joint venture partner on which this paper wants to make progress. The most common approach in the literature is to model the selection of a joint venture partner by a take-it-or-leave-it offer. According to that approach, an MNF offers a joint venture contract to one or both local firms and forms a joint venture if at least one firm accepts the offer. It assumes that the MNF has a strong bargaining power, and hence can easily determine the amount of offer that maximizes its profit. This is true if the MNF does know how much the joint venture would contribute to the involving firms' efficiencies. However, there might be incomplete information. The productivity of a joint venture might be local firms' private information. As incomplete information restricts the scope of the MNF's use of its bargaining power, it would rather negotiate simultaneously with local firms and ask them for offers. In this sense, multiple negotiations held simultaneously by the MNF are strategically equivalent to an auction. The role of multiple negotiations, and hence making use of an auction as the method of selecting a joint venture partner is, to our knowledge, not well developed in the FDI literature.

Our study is basically composed of two parts. In the first part, we have determined the equilibrium market structure, whereas in the second part, we have studied the nationally optimal entry mode in order to figure out whether the host country wants to regulate foreign entry. According to the main findings of the first part, we have concluded that a joint venture always dominates a greenfield investment such as the MNF always opts for the joint venture irrespective of parameter values. Our main finding is also consistent with other studies' findings in the literature in which a joint venture is found to be the preferable entry mode compared with a greenfield investment if firms are less

asymmetric in their productivity. Furthermore, our findings hold in any efficient auction mechanism; irrespective of the type of auction, the MNF has on average the same expected revenue, which is higher than any other credible possible outcome, and hence makes the joint venture the preferable entry mode. We have also concluded that any efficient auction guarantees that the MNF is able to select the most productive local firm. Since the winner in any efficient auction is the one having the highest value, that is, the most productive firm, there is no doubt that the MNF is able to successfully avoid the "lemon's problem" by simultaneous negotiations.

According to our findings in the second part, the host country does not regulate entry to improve its welfare except if local firms are very productive and setting up a new plant requires very high costs. If the MNF forms a joint venture, local welfare decreases relative to autarky if firms are very productive before the entry, whereas it increases relative to autarky if the contribution of joint venture to the local partner firm's productivity is promising. One of the crucial finding is that the welfare implication of a joint venture depends on the spread of the distribution of joint venture productivity. Furthermore, a joint venture type of entry is always welfare-improving relative to a greenfield type of entry if marginal cost of the joint venture is distributed such that the upper bound is maximized for a negative externality, because the negative effect of profit-shifting in a joint venture is expected to be relatively small, so the cost saving effect is enough to compensate both the negative effect of profit-shifting and the forgone market structure effect.

## Appendix

### A.1. The Cournot Competition and Firms' Profits

#### A.1.1. Autarky in the host country

If there is no foreign entry, there will be two local firms with identical marginal costs competing with each other in the host country. Firm  $i$ 's problem can be expressed by  $\max_{q_i} \{\pi_i\}$  where  $\pi_i = (1 - q_i - q_j - c) * q_i$ . First-order condition  $\partial_{q_i} [\pi_i] = 0$  gives firm  $i$ 's reaction curve, such that:

$$q_i(q_j) = \frac{1 - q_j^* - c}{2}.$$

Similarly, firm  $j$ 's reaction curve can be expressed by  $q_j(q_i) = \frac{1 - q_i^* - c}{2}$ . Firm  $i$  presumes that  $q_j = q_j^*$  in equilibrium. Plugging this into firm  $i$ 's reaction curve will yield firm  $i$ 's equilibrium production level  $q_i^*$ , such that solving  $q_i^* = \frac{1}{2} (1 - (\frac{1}{2} (1 - q_i^* - c)) - c)$  for  $q_i^*$  yields:

$$q_i^* = \frac{1 - c}{3}.$$

Firm  $j$ 's equilibrium production level  $q_j^* = \frac{1}{3} (1 - c)$  can be obtained by following the same steps above for firm  $j$ . Equilibrium profit levels ( $\pi_i^*, \pi_j^*$ ) of these firms can be obtained by plugging the equilibrium production levels into their profit functions (i.e.,  $\pi_i^* = (1 - q_i^* - q_j^* - c) * q_i^*$  and  $\pi_j^* = (1 - q_i^* - q_j^* - c) * q_j^*$ ):

$$\pi_i^* = \pi_j^* = \frac{(1 - c)^2}{9}.$$

Note that within the text,  $\pi_i^*$  and  $\pi_j^*$  above are denoted by  $\pi_i^a$  and  $\pi_j^a$ , respectively, such that  $\pi_i^a = \pi_j^a = \frac{1}{9}(1 - c)^2$ .

#### A.1.2. Greenfield investments

If the MNF sets up its own plant, there will be three active firms in the market; two local firms and the MNF. Firm  $i$ 's problem can be expressed by  $\max_{q_i} \{\pi_i\}$ , where  $\pi_i = (1 - q_i - q_j - q_m - c) * q_i$ . Similarly, firm  $j$ 's problem and the MNF's problem can be expressed by  $\max_{q_j} \{\pi_j\}$ , where  $\pi_j = (1 - q_i - q_j - q_m - c) * q_j$  and  $\max_{q_m} \{\pi_m\}$ , where  $\pi_m = (1 - q_i - q_j - q_m - c^*) * q_m - f_g$ , respectively. First-order conditions  $\partial_{q_i} [\pi_i] = 0$ ,  $\partial_{q_j} [\pi_j] = 0$  and  $\partial_{q_m} [\pi_m] = 0$  yield following reaction curves:

$$q_i(q_j, q_m) = \frac{1 - q_j^* - q_m^* - c}{2},$$

$$q_j(q_i, q_m) = \frac{1 - q_i^* - q_m^* - c}{2},$$

$$q_m(q_i, q_j) = \frac{1 - q_i^* - q_j^* - c^*}{2}.$$

Solving simultaneously the three-equation system given above by considering  $q_i = q_i^*$ ,  $q_j = q_j^*$  and  $q_m = q_m^*$  yields following equilibrium quantity levels:

$$q_i^* = q_j^* = \frac{1 - 2c + c^*}{4},$$

$$q_m^* = \frac{1 - 3c^* + 2c}{4}.$$

Plugging these quantity levels into the firms' profit functions yields following equilibrium profit levels:

$$\pi_i^* = \pi_j^* = \frac{(1 - 2c + c^*)^2}{16},$$

$$\pi_m^* = \frac{(1 - 3c^* + 2c)^2}{16} - f_g.$$

Note that within the text,  $\pi_i^*$ ,  $\pi_j^*$  and  $\pi_m^*$  above are denoted by  $\pi_i^g$ ,  $\pi_j^g$  and  $\pi_m^g$ , respectively.

#### A.1.3. Joint ventures

If the MNF enters the host country by forming a joint venture, there will be only two active firms. Suppose that firm  $i$  becomes the MNF's joint venture partner. Firm  $i$ 's problem can be expressed by  $\max_{q_i} \{\pi_i\}$ , where  $\pi_i = (1 - q_i - q_j - \theta_i) * q_i$ . Similarly, firm  $j$ 's problem can be expressed by  $\max_{q_j} \{\pi_j\}$ , where  $\pi_j = (1 - q_i - q_j - c) * q_j$ . First-order conditions  $\partial_{q_i} [\pi_i] = 0$  and  $\partial_{q_j} [\pi_j] = 0$  yield following reaction curves:

$$q_i(q_j) = \frac{1 - q_j^* - \theta_i}{2},$$

$$q_j(q_i) = \frac{1 - q_i^* - c}{2}.$$

If firm  $j$  were to form a joint venture with the MNF,  $q_i(q_j)$  would read  $\frac{1 - q_j^* - c}{2}$  and  $q_j(q_i)$  would read  $\frac{1 - q_i^* - \theta_j}{2}$ . Solving simultaneously the two-equation system given above by considering  $q_i = q_i^*$  and  $q_j = q_j^*$  yields following equilibrium quantity levels:

$$q_i^* = \frac{1 - 2\theta_i + c}{3},$$

$$q_j^* = \frac{1 - 2c + \theta_i}{3}.$$

If firm  $j$  were to form a joint venture with the MNF,  $q_i^*$  would read  $\frac{1 - 2c + \theta_j}{3}$  and  $q_j^*$  would read  $\frac{1 - 2\theta_j + c}{3}$ . Plugging the quantity levels given above into firms' profit functions yields following equilibrium profit levels:

$$\pi_i^* = \frac{(1 - 2\theta_i + c)^2}{9},$$

$$\pi_j^* = \frac{(1 - 2c + \theta_i)^2}{9}.$$

Note that within the text,  $\pi_i^*$  and  $\pi_j^*$  above are denoted by  $\pi^v(\theta_i)$  and  $\pi_j^e$ , respectively. If firm  $j$  were to form a joint venture with the MNF,  $\pi_j^*$  would be denoted by  $\pi^v(\theta_j)$  and would read  $\frac{(1-2\theta_j+c)^2}{9}$ , whereas  $\pi_i^*$  would be denoted by  $\pi_i^e$  and would read  $\frac{(1-2c+\theta_j)^2}{9}$ .

## A.2. Local Welfare

### A.2.1. Autarky in the host country

If there is autarky in the host country, local welfare will be given by (6), where local production reads  $q_m^a = 0$ ,  $q_i^a = q_j^a = \frac{1-c}{3}$  and firms' profits read  $\pi_i^a = \pi_j^a = \frac{1}{9}(1-c)^2$ . By following the necessary calculations from (6), the local welfare is computed as (7).

### A.2.2. Greenfield investments

If the MNF makes a greenfield investment, local welfare will be given by (6), where local production reads  $q_m^g = \frac{1-3c^*+2c}{4}$ ,  $q_i^g = q_j^g = \frac{1-2c+c^*}{4}$  and firms' profits read  $\pi_i^g = \pi_j^g = \frac{(1-2c+c^*)^2}{16}$ . By following the necessary calculations from (6) the local welfare is computed as (8).

### A.2.3. Joint ventures

If the MNF forms a joint venture, local welfare will be given by (6). Both production levels and profits of firms depend on a random variable. Therefore, the expected values are accounted such that the expected consumer surplus is computed according to the function  $E\left[\frac{1}{2}(q_i + q_j)^2\right]$  that is  $E\left[\frac{1}{2}\left(\left(\frac{1-2\min\{\theta_i, \theta_j\}+c}{3}\right) + \left(\frac{1-2c+\min\{\theta_i, \theta_j\}}{3}\right)\right)^2\right]$ , where  $\min\{\theta_i, \theta_j\}$  is the marginal cost of the local firm forming a joint venture with the MNF and the local firms' expected profits are computed according to the function  $E\left[\left(\frac{1-2\min\{\theta_i, \theta_j\}+c}{3}\right)^2 - \min\{b_i, b_j\}\right] + E\left[\left(\frac{1-2c+\min\{\theta_i, \theta_j\}}{3}\right)^2\right]$ , where  $\min\{b_i, b_j\}$  is the share of the MNF in total joint venture profit and will be the amount that the MNF transfers to its country-of-origin. The amount that the MNF transfers abroad is the runner-up's bid in the auction and computed as  $\min\{b_i, b_j\} = \frac{1}{3}(c - \max\{\theta_i, \theta_j\})(2 - \max\{\theta_i, \theta_j\} - c)$ . Expected values are computed as:

$$\begin{aligned} E[\min\{\theta_i, \theta_j\}] &= \int_0^{\bar{\theta}} \int_0^{\bar{\theta}} \min\{\theta_i, \theta_j\} f(\theta_i) d\theta_i f(\theta_j) d\theta_j \\ &= \frac{1}{3} \bar{\theta} \\ &= \frac{1}{12} (2c + 3c^* - 1) \text{ for } \bar{\theta} = \frac{1}{4} (2c + 3c^* - 1), \end{aligned}$$

$$\begin{aligned}
E [\min\{\theta_i^2, \theta_j^2\}] &= \int_0^{\bar{\theta}} \int_0^{\bar{\theta}} \min\{\theta_i^2, \theta_j^2\} f(\theta_i^2) d\theta_i^2 f(\theta_j^2) d\theta_j^2 \\
&= \frac{1}{6} \bar{\theta}^2 \\
&= \frac{1}{96} (2c + 3c^* - 1)^2 \text{ for } \bar{\theta} = \frac{1}{4} (2c + 3c^* - 1),
\end{aligned}$$

$$\begin{aligned}
E [\max\{\theta_i, \theta_j\}] &= \int_0^{\bar{\theta}} \int_0^{\bar{\theta}} \max\{\theta_i, \theta_j\} f(\theta_i) d\theta_i f(\theta_j) d\theta_j \\
&= \frac{2}{3} \bar{\theta} \\
&= \frac{1}{6} (2c + 3c^* - 1) \text{ for } \bar{\theta} = \frac{1}{4} (2c + 3c^* - 1),
\end{aligned}$$

$$\begin{aligned}
E [\max\{\theta_i^2, \theta_j^2\}] &= \int_0^{\bar{\theta}} \int_0^{\bar{\theta}} \max\{\theta_i^2, \theta_j^2\} f(\theta_i^2) d\theta_i^2 f(\theta_j^2) d\theta_j^2 \\
&= \frac{1}{2} \bar{\theta}^2 \\
&= \frac{1}{32} (2c + 3c^* - 1)^2 \text{ for } \bar{\theta} = \frac{1}{4} (2c + 3c^* - 1).
\end{aligned}$$

Note that  $f(\theta_i) = f(\theta_j) = \frac{1}{\bar{\theta}}$ ,  $f(\theta_i^2) = \frac{1}{2\bar{\theta}} (\theta_i^2)^{-\frac{1}{2}}$ ,  $f(\theta_j^2) = \frac{1}{2\bar{\theta}} (\theta_j^2)^{-\frac{1}{2}}$ . Plugging the expected values of random variables appeared in welfare function yields  $E[W^v]$  given in (9).

**References**

- Al-Saadon, Y., Das, S.P., 1996. Host-country policy, transfer pricing and ownership distribution in international joint ventures: a theoretical analysis. *International Journal of Industrial Organization* 14, 345-364.
- Anderson, E., Gatignon, H., 1986. Modes of foreign entry: a transaction cost analysis and propositions. *Journal of International Business Studies* 17(3), 1-26.
- Asiedu, E., Esfahani, H.S., 2001. Ownership structure in foreign direct investment projects. *The Review of Economics and Statistics* 83(4), 647-662.
- Buckley, P.J., Casson, M.C., 1998. Models of the multinational enterprise. *Journal of International Business Studies* 29(1), 21-44.
- Bulow, J., Klemperer, P., 1996. Auctions versus negotiations. *The American Economics Review* 86(1), 180-194.
- Caves, R.E., 1996. *Multinational Enterprise and Economic Analysis*. Cambridge Surveys of Economic Literature, New York.
- Chowdhury I.R., Chowdhury, P.R., 2002. International joint ventures: a welfare analysis. *Policy Reform* 5(1), 51-60.
- Das, S.P., Katayama, S., 2003. International joint venture and host country policies. *The Japanese Economic Review* 54(4), 381-394.
- Gattai, V., Molteni, C., 2007. Dissipation of knowledge and the boundaries of the multinational enterprise. *Review of World Economics* 143(1), 1-26.
- Gomes-Casseres, B., 1989. Joint ventures in the face of global competition. *Sloan Management Review* 30(3), 17-26.
- Helpman, E., Melitz, M.J, Yeaple, S.R., 2004. Export versus FDI with heterogeneous firms. *The American Economic Review* 94(1), 300-316.
- Hennart, J-F., 1991. The transaction costs theory of joint ventures: an empirical study of Japanese subsidiaries in the United States. *Management Science* 37(4), 483-497.
- Horstmann, I.J., Markusen, J.R., 1996. Exploring new markets: direct investment, contractual relations and the multinational enterprise. *International Economic Review* 37(1), 1-19.
- Jehiel, P., Moldovanu, B., 2000. Auctions with downstream interaction among buyers. *The Rand Journal of Economics* 31(4), 768-791.
- Klemperer, P., 2004. *Auctions: Theory and Practice*. Princeton University Press, New Jersey.
- Krause, L.B., 1972. The international economic system and the multinational corporation. *Annals of the American Academy of Political and Social Science* 403 (The multinational Corporation), 93-103.

- Krishna, V., 2002. Auction Theory. Elsevier Science, Academic Press: California.
- McAfee, R.P., McMillan, J., 1987. Auctions and bidding. *Journal of Economic Literature* 25(2), 699-738.
- Milgrom, P., 1989. Auctions and bidding: a primer. *The Journal of Economic Perspectives* 3(3), 3-22.
- Milgrom, P.R., Weber, R.J., 1982. A theory auctions and competitive bidding. *Econometrica* 50(5), 1089-1122.
- Nisbet, P., Thomas, W., Barrett, S., 2003. UK direct investment in the United States: a mode of entry analysis. *International Journal of the Economics of Business* 10(3), 245-259.
- Norback, P.J., Persson, L., 2002. Cross-border acquisitions and greenfield entry. The Research Institute of Industrial Economics Working Paper 570.
- Norback, P.J., Persson, L., 2004. Privatization and foreign competition. *Journal of International Economics* 64, 409-416.
- Norback, P.J., Persson, L., 2005. Privatization policy in an international oligopoly. *Economica* 72, 635-653.
- Raff, H., Ryan, M., Staehler, F., 2006. Asset ownership and foreign-market entry. CESIFO Working Paper No. 1676.
- Svejnar, J., Smith, S.C., 1984. The economics of joint ventures in less developed countries. *Quarterly Journal of Economics* 99, 149-167.
- UNCTAD, 2005. Linkages, value chains and outward investment: internationalization patterns of developing countries' SMEs. Note by the UNCTAD secretariat. TD/B/COM.3/69, Geneva.
- Vickrey, W., 1961. Counterspeculation, auctions, and competitive sealed tenders. *The Journal of Finance* 16(1), 8-37.
- Yu, C-M.J., Tang, M-J., 1992. International joint ventures: theoretical considerations. *Managerial and Decision Economics* 13, 331-342.