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FIRM'S INTANGIBLE ASSETS AND MULTINATIONAL ACTIVITY: FULL VERSUS SHARED OWNERSHIP

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Abstract

This paper analyses the choice of full versus shared ownership of the production affiliate made by Italian multinationals in Asia, based on an entirely new firm-level dataset, constructed by the author. The decision to internalise production, rather than relying on a local partner, is driven by the threat of *Dissipation of Intangible Assets*, both at a theoretical and an empirical level. In particular, we show that full ownership is more likely to emerge in Asia for Italian firms endowed with better technology and human capital, or belonging to high tech sectors.

Keywords: Intangible Assets, ownership, wholly-owned subsidiary, joint-venture, Asia
JEL: F23, C25, O5

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1. Introduction

During the last few decades, firms have increasingly committed themselves to global markets. This has coincided with a surge of activities by Multinational Enterprises (MNEs) that have expanded abroad through Foreign Direct Investment (FDI), transferring some level of their *Intangible Assets* (IAs) to local subsidiaries.

IAs may consist either in a stock of goodwill, which is associated with product quality *reputation*, or in superior *knowledge*, which is related, for instance, to an idea, a good customer relationship, a new tool, or superior management techniques.

Compared to physical capital, intangible resources are more likely to give rise to FDI because they can be easily transferred back and forth and they are of "public good" nature, being available to additional production facilities at relatively low costs (Markusen, 1995). Notice that the very joint-ness feature that enables MNEs to move IAs at a low cost also exposes them to the risk of *dissipation*[1].

While abstracting from any *reputation* consideration, this paper is intended to explore the exact role that dissipation of *knowledge* plays in orienting multinational activity, with a particular attention to the boundaries of the MNE.

Across the wide array of feasible contracts in a foreign country, we focus specifically on the comparison between wholly-owned subsidiary (WOS) and joint-venture (JV), to assess the relative attractiveness of full versus shared ownership of the production affiliate.

On the one hand, international JVs offer the possibility to make profitable use of the local partner capabilities; they may facilitate cooperation with foreign governments, and generate knowledge that could be valuable in future business operations (Desai et al., 2002). These advantages, however, are often offset by the implicit costs of split ownership: proximity to Intangible Assets may enable the local company to expropriate the MNE's key resource and start a rival firm. On the contrary, wholly-owned subsidiaries secure knowledge within the firm's boundaries, but typically bring higher costs, because an integrated firm is less efficient than a pair of specialized producers, and lacks expertise and familiarity with the local market.

Although the role of IAs in assessing the WOS/JV trade off has been broadly investigated in empirical terms (see, among others: Anderson and Gatignon, 1986; Gomes Casseres, 1989; Hennart, 1991; Agarwal and Ramaswami, 1992; Erramilli, 1996; Buckley and Casson, 1996; Smarzynska, 2000; Desai et al., 2002; Pan, 2002; Chen and Hu, 2002; Herrmann and Datta, 2002; Brouthers, 2002; Guillen, 2003; Mutinelli and Piscitello, 1998a, 1998b; Sanna Randaccio, 1993), it remains surprisingly unexplored in its theoretical aspects; indeed, to the best of our knowledge, all the theoretical formalisations based on Intangible Assets[2] (see, for instance: Ethier and Markusen, 1996; Markusen, 2001; Saggi, 1996, 1999; Fosfuri, 2000; Mattoo et al., 2001; Fosfuri et al., 2001; Glass and Saggi, 2002) compare Foreign Direct Investment and licensing, but they ignore the case of shared ownership, which is typical of a joint-venture agreement.

This paper is intended to fill the gap between the theory and the data, and possibly reconcile the two strands mentioned above.

First, we provide a new firm-level dataset, on the whole population of Italian firms with wholly-owned subsidiaries or joint-ventures in Asia. Data come from an extensive survey, conducted by the author, to derive detailed information on MNEs' Intangible Assets, such as human capital and technology, adding to traditional economic variables. According to the respondents' answers, the main reason for operating in a WOS is the wish to preserve IAs, while joint-venture establishments ground on the attempt at finding a complementary partner, well acquainted with the local market and efficient in input supply.

As a second step, we build on this evidence to explore the trade off between full and shared ownership more rigorously, both in theoretical and empirical terms. On the one hand, we extend the *Dissipation of Intangible Assets* (DIA) framework to incorporate joint-venture contracts; in a two-period, two-country framework, as in studies by (Etheir and Markusen, 1996; Saggi, 1999; Mattoo et al., 2001), we show that full ownership is more likely to emerge the higher the threat of Intangible Assets dissipation, an idea resembling the theoretical findings on the FDI/licensing trade off. On the other hand, we exploit our dataset to test these predictions: probit estimates confirm that Italian firms endowed with better technology and human capital are more prone to internalise

production activities, rather than establishing joint-ventures in Asia, in line with the empirical literature mentioned before.

The present paper relates to several strands.

Our focus on human capital and technology brings the analysis close to the studies on knowledge transfer costs (see Caves, 1974; Teece, 1977, 1986; Davidson and Mc Fetridge, 1984; Ramachandran, 1993; Glass and Saggi, 1999). However we depart from this literature in two aspects: we take the MNE's point of view, and consider knowledge dissipation as a negative aspect, not as a source of growth; moreover, technology transfer is not the ultimate focus of our research, but rather one of the factors that may influence the entry mode decision of Multinational Enterprises.

The great importance of Intangible Assets and their influence on the most appropriate organisational form is also at the heart of a relatively recent strand in the Theory of the Firm, according to which power stems from access to critical resources, rather than ownership of physical assets (Rajan and Zingales, 1998, 2000, 2001). While adopting a similar perspective on the role of IAs in driving the international organisational decision, we are more interested in the WOS-JV trade off, than in the choice between horizontal and vertical hierarchies.

As far as the theoretical part of the paper is concerned, our model is close to the literature on the boundaries of the multinational firm based on the risk of Dissipation of Intangible Assets (Ethier and Markusen, 1996; Markusen, 2001; Saggi, 1996, 1999; Fosfuri, 2000; Mattoo et al., 2001; Fosfuri et al., 2001; Glass and Saggi, 2002). However, instead of sticking to the standard WOS/licensing trade off, we formalize the WOS/*joint-venture* choice in terms of knowledge spillover.

Finally, the empirical part of the paper can be ascribed to those econometric studies (see, among others: Anderson and Gatignon, 1986; Gomes Casseres, 1989; Hennart, 1991; Agarwal and Ramaswami, 1992; Erramilli, 1996; Buckley and Casson, 1996; Smarzynska, 2000; Desai et al., 2002; Pan, 2002; Chen and Hu, 2002; Herrmann and Datta, 2002; Brouthers, 2002; Guillen, 2003; Mutinelli and Piscitello, 1998a, 1998b; Sanna Randaccio, 1993) that regress the choice of full

versus shared ownership on firm, industry, and country characteristics in discrete dependent variable-models. Indeed, we adopt a similar methodology, making large use of micro data, and find consistent results on the role of DIA: whenever intangible resources are included in econometric specifications, they positively affect the choice of full ownership, in line with our model's implications and the empirical evidence reported here. Despite these analogies, the present paper is intended to make a few steps further. The first one relates to the theoretical background. Most of the papers mentioned above are purely empirical: either they ignore any theoretical insight on the topic, treating IAs like control regressors, rather than core ones or they qualitatively extend some formally derived DIA argument about licensing agreements to the case of joint-ventures. In both cases there is no convincing prior over the sign of Intangible Assets in shaping the WOS/JV trade off: either such a prior is dictated by common sense, more than rigorous formalisations, or it comes from models in which joint-venture contracts are not explicitly considered. Our empirical exercise grounds instead on the model's predictions, therefore it is intended to provide a more direct link between the theory and the data. The second step we make refers to the definition of knowledge, as a key asset likely to orient multinational activity. Although knowledge, in theory, should embrace both human capital and technological aspects, it is usually proxied only by technological measures such as patents and R&D expenditure due to the lack of firm-level information. Taking advantage of an extremely detailed dataset, we offer here a more complete characterization of knowledge by adding human capital variables in the form of employees' skills to the broadly documented technological ones. Estimates show that Italian firms endowed with superior technology and better human capital rely more on full ownership when expanding abroad.

The rest of the paper is organised as follows: Section 2 presents the simple theoretical model; Section 3 is entirely devoted to the empirical analysis – data description (3.1), methodology (3.2) and Probit estimates (3.3); Section 4 concludes and sets the future agenda.

2. The model

In a partial equilibrium framework as in (Etheir and Markusen, 1996; Saggi, 1999; Mattoo et al., 2001), consider a two-country - North (*N*) and South (*S*) - two-period -1 and 2 - model in which a multinational firm, located in the North, is willing to produce a final good in the South. To add concreteness to the model, we could think of the North as Italy, of the South as the Asian market, as in the empirical part of the paper. The *S* market is populated by a single firm, which acts as a monopolist, and sells the same good as the MNE in *N*. The Multinational Enterprise has to decide whether to produce in the foreign market within the boundaries of a wholly-owned subsidiary or in joint-venture with the local firm, and it cannot change supply mode between the first and the second period[3].

By assumption, final good production requires two activities - which we call *input manufacturing* and *final good processing* - according to a linear technology that employs 1 unit of input to obtain 1 unit of output.

Notice that these steps can be performed either by the multinational (through its subsidiary) or by the local enterprise, but the two firms are not equally efficient; based on the experience of Italian firms in Asia, we allow the MNE to have an advantage in processing final goods due to its superior knowledge and the other party to do better in input manufacturing due to its familiarity with the local context. Indeed empirical evidence shows that Italian multinationals tend to contribute know-how and technology while relying on their Asian partner for input supply.

To capture this idea without loss of generality, we assume that the cost per unit of each activity is zero, if it is performed by the company that has a relative advantage in it, and *c* (*c>0)* otherwise.

As in (Ethier and Markusen, 1996; Saggi, 1999; Markusen, 2001; Mattoo et al., 2001) demand is linear in the *S* market; in particular:

$$p = a - Q \tag{1}$$

where p is the price, Q denotes the total quantity, $Q = q_{MNE} + q_{local}$ and the parameter $a>0$ captures market size[4]; *MNE* and *local* stand for the multinational and the local firm respectively.

As in Fosfuri (2000), firms attach equal weight to every period, i.e. the discount factor is equal to 1.

Through full ownership of the production affiliate, the Multinational Enterprise keeps all production activities within the boundaries of a wholly-owned subsidiary; in this case it is the same firm that performs both input manufacturing and final good processing, competing in quantities with the local company. Therefore, the Southern market becomes a symmetric Cournot duopoly, with marginal (and average) cost equal to *c*.

The essence of a joint-venture agreement lays, instead, in the partners' complementary skills[5]: in this case, each party performs only the activity in which it has a relative advantage, and sales revenues are shared with weights θ $(0<\theta<1)$ for the MNE and $(1-\theta)$ for the local firm, in the first period, and $\bar{\theta}$ $(0<\bar{\theta}<1)$, $(1-\bar{\theta})$ in the second period. If a JV contract is signed, market *S* becomes a monopoly, and final good production rests with the joint-venture. Although Multinational Enterprises are free to choose their preferred mode of entry into all the countries considered in our empirical analysis, we are aware that some Asian governments still impose restrictions to foreign ownership under the joint-venture contract[6]. Put another way, MNEs can freely decide to establish a wholly-owned subsidiary or to engage in a partnership with a local firm but, in the second case, the host government is likely to fix an upper bound θ for the foreign share. Under these circumstances, it is clear that the multinational firm sets its first period share equal to θ to retain the highest possible part of the joint-venture revenue, provided that the participation constraint of the local partner is satisfied, which is always the case in our model. In the second period $\bar{\theta} \leq \theta$ is chosen by the MNE to avoid Intangible Assets dissipation, as clarified below.

Consider, first, the case of full ownership. After solving the symmetric Cournot game, Equation (2) gives the present value of the MNE profit when final good production is internalised:

$$\Pi_{MNE}^{WOS} = \frac{2}{9}(a-c)^2 \qquad (2)$$

By operating on its own the Multinational Enterprise benefits from keeping entire revenues in both periods, but it entails higher costs in input manufacturing, compared to the local company.

On the contrary, production efficiency is achieved, under a JV agreement, but none of the two parties can appropriate total monopoly revenues, which are, instead, shared. In this case, firms' profits are given by:

$$\Pi_{MNE}^{JV} = \frac{(\theta + \bar{\theta})a^2}{4} \tag{3}$$

$$\Pi_{local}^{JV} = \frac{(1-\theta)a^2}{4} + \frac{(1-\bar{\theta})a^2}{4} \tag{4}$$

The key point of the model is that the joint-venture allows for a potential spillover mechanism between the two firms.

Consider first the possibility of a one-way spillover, running from the MNE to the local firm: having access to the multinational Intangible Assets – human capital and technology - the partner might learn about the processing procedure so that her cost disadvantage *c* drops to a lower level *sc* in the second period, with $0<s<1$[7]. According to our modelling, *s* measures the extent of the spillover effect, lower values being associated with higher degrees of knowledge dissipation.

In this case, while the local firm has the option of breaking up the JV contract, and start a rival firm with the "stolen" know-how, the multinational stops servicing the Southern market if defection takes place. Although this is clearly a strong theoretical assumption (it will be removed later on), it provides a good starting point for the analysis and it can be justified in empirical terms. Indeed, one-way spillovers seem to be the most frequent type of situation for Italian firms in Asia. Based on our data, while MNEs fear to dissipate their crucial resources under joint-venture agreements, they do not rely much on the possibility to learn from a local partner. This probably has to do with the intrinsic nature of Italian FDI in Asia which covers mostly manufacturing activities and the way JV partners share production, with the local company providing inputs due to its familiarity with the local market, and the multinational processing components due to its superior technology. While market knowledge and linkages cannot be quickly appropriated – especially in countries such as China and India – technology is easily exposed to the risk of dispersion[8].

In case of defection – denoted by superscript *d* - the local firm makes profit:

$$\Pi^{d}_{local} = \frac{(1-\theta)a^2}{4} + \frac{(a-sc)^2}{4} \tag{5}$$

while the multinational, having no other option, earns zero.

It is clear that the MNE can prevent defection by setting $\bar{\theta}$ such that the local firm's second period profit, under JV, is not lower than its profit in starting a rival firm; this is the Incentive Compatibility Constraint, which yields the following condition:

$$\bar{\theta} = 1 - \frac{(a-sc)^2}{a^2} \tag{6}$$

In the end, under the assumption of a one-way spillover, the multinational chooses to integrate, rather than partnering if Π^{WOS}_{MNE} from (2) is greater than Π^{JV}_{MNE} from (3), evaluated at the incentive compatible value of the second period share (6):

$$\frac{2}{9}(a-c)^2 > \frac{\theta a^2}{4} + \left[1 - \frac{(a-sc)^2}{a^2}\right]\frac{a^2}{4} \tag{7}$$

Equation (7) gives the condition for the MNE to produce within the boundaries of a wholly-owned subsidiary, instead of signing a joint-venture agreement. It is solved for *s* in Result 1:

Result 1 (See Appendix A for details)

1) Condition (7) is verified - i.e. $\Pi^{WOS}_{MNE} > \Pi^{JV}_{MNE}$ *- for* $s<s_1 = \dfrac{a - \sqrt{\dfrac{9\theta a^2 + 9a^2 - 8(a-c)^2}{9}}}{c}$.

2) i) If $\theta<F(a,c) = \dfrac{17(a-c)^2 - 9a^2}{9a^2}$*, the MNE always chooses full ownership;*

ii) if $F(a,c)<\theta<G(a,c) = \dfrac{8(a-c)^2}{9a^2}$*, both arrangements may emerge, depending on the extent of the spillover effect: for lower values of s (i.e. strong spillover effect), the MNE prefers full ownership to avoid knowledge dissipation; for higher values of s (i.e. weak spillover effect) JV emerges as an equilibrium outcome;*

iii) if $\theta>G(a,c)$*, the MNE always chooses joint-venture;*

iv) the MNE's profit gap, between full and shared ownership $\Pi_{MNE}^{WOS} - \Pi_{MNE}^{JV}$, *increases as long as s decreases (i.e. stronger spillover effect).*

Based on our formalisation, in choosing between full and shared ownership, MNEs trade off the benefit of retaining total revenues and protecting IAs, with the cost of efficiency losses in terms of input manufacturing.

From Result 1, it is clear that the JV option is never appealing if the upper bound, imposed by the local government, is lower than a threshold *F(a,c)*: in this case, the benefit of production efficiency is more than outweighed by the low fraction of the revenues accruing to the MNE. The risk of dissipating knowledge plays no role under these circumstances, because full ownership is per se attractive compared to a partnership in which the foreign firm has just a small stake.

Opposite to this is the situation in which θ is greater than a threshold *G(a,c)* since the MNE's large share in the partnership makes the joint-venture absolutely appealing from the point of view of the Multinational Enterprise, despite the spillover mechanism that benefits the local partner.

The threat of Intangible Assets dissipation comes at play only for intermediate values of the first period share: when $F(a,c)<\theta<G(a,c)$, θ is not large or small enough to drive the MNE's entry mode decision per se; here we see that WOS prevails for lower values of *s* (i.e. higher cost reduction for the local firm, induced by knowledge dissipation), while JV emerges, as an equilibrium outcome, for higher values of *s* (here the spillover effect is so mild that it is completely outweighed by production efficiency considerations).

For the purpose of the empirical analysis, we restrict our attention to this case, because it is the most relevant for Italian companies[9].

Consider now the possibility of a two-way spillover that allows both firms to learn from each other: this reflects the recent view that Multinational Enterprises not only transfer but also absorb technology from the host country (Cassiman and Veugelers, 2002, 2004; Singh, 2007).

The only difference with respect to the basic version of the model is that firms benefit from an equal cost reduction through spillover, therefore the Southern market becomes a symmetric Cournot duopoly (with marginal cost *sc*) in case of defection.

Equations (5'a) and (5'b) give the present value of the two firms' profits in this circumstance:

$$\Pi^{d}_{local} = \frac{(1-\theta)a^2}{4} + \frac{(a-sc)^2}{9} \tag{5a}$$

$$\Pi^{d}_{MNE} = \frac{\theta a^2}{4} + \frac{(a-sc)^2}{9} \tag{5b}$$

Equations (2), (3) and (4) still refer to the multinational profits under full ownership, and the two parties' gains under a JV agreement[10].

In principle, we could think that the possibility of a two-way spillover widens firms' contractual arrangements, making MNEs choose among three candidate solutions: wholly-owned subsidiary, joint-venture in both periods and joint-venture in the first period only. Notice, however, that the basic trade off for the Multinational Enterprise is still between full and partial ownership.

Indeed, before comparing the multinational profits from (2), (3) and (5a) we need to substitute for $\bar{\theta}$. How is $\bar{\theta}$ set by the MNE in case of a two-way spillover? It still satisfies the local party Incentive Compatibility Constraint, but such a constraint crucially depends on the MNE's preference towards joint-venture or defection. This is the key difference with respect to the basic version of the model: if the spillover runs only one-way, the MNE surely wants to prevent defection to avoid zero profit in the second period; if the spillover runs two-ways, the MNE wants to prevent defection only when $\Pi^{d}_{MNE} \leq \Pi^{JV}_{MNE}$, i.e.:

$$\frac{\theta a^2}{4} + \frac{(a-sc)^2}{9} \leq \frac{\theta a^2}{4} + \frac{\bar{\theta}^2}{4} \tag{8}$$

This gives:

$$\bar{\theta} \geq \frac{4(a-sc)^2}{9a^2} \tag{9}$$

Condition (9) thus discriminates between the multinational's preference for JV or defection: depending on (9) holding or not the MNE behaves differently, selecting $\bar{\theta}$ in such a way as to prevent or to induce defection by the local partner. Therefore, the multinational never has the three contractual arrangements to choose from at the same time but, conditional on (9), it compares WOS versus JV in both periods *or* WOS versus JV in the first period only.

Suppose that (9) holds: in this case the MNE makes higher profits under joint-venture than defection, therefore it sets $\bar{\theta}$ to prevent defection, according to the Incentive Compatibility Constraint of the local party - $\Pi_{local}^{JV} \geq \Pi_{local}^{d}$. This yields the following condition:

$$\bar{\theta} \leq 1 - \frac{4(a-sc)^2}{9a^2} \qquad (6')$$

The relevant comparison is between WOS and joint-venture in both periods and the multinational integrates, rather than partnering if Π_{MNE}^{WOS} from (2) is greater than Π_{MNE}^{JV} from (3), evaluated at the incentive compatible value of the second period share (6'):

$$\frac{2}{9}(a-c)^2 > \frac{\theta a^2}{4} + \left[1 - \frac{4(a-sc)^2}{9a^2}\right]\frac{a^2}{4} \qquad (7')$$

Compare (7) with (7'): the left hand side is the same, while the right hand side of (7') is larger. This means that, ceteris paribus, full ownership becomes less attractive when the MNE has the possibility to learn from the local partner. However, results on the role of DIA still hold, since *s* enters (7) and (7') the same way.

Now suppose that (9) does not hold: in this case the MNE makes higher profits under defection than joint-venture, therefore it sets $\bar{\theta}$ to induce defection, violating the Incentive Compatibility Constraint of the local party (6'). Therefore, it selects the highest possible value for the second period share, $\bar{\theta} \to 1$, but this is not compatible with (9) not holding, which we assumed before. As a result, defection never takes place, as in the case of a one-way spillover: to induce an opportunistic behaviour by the local partner, the MNE needs to retain a very high share of the partnership, but in doing this it prefers to preserve the JV contract in both periods, rather than breaking it. Given the logical contradiction, there is no equilibrium in which the local party starts a rival firm with the

stolen know-how. So, we can stick to Result 1 for the main conclusions about the role of DIA in designing the boundaries of the multinational enterprise.

In particular, according to Result 1, the profit gap for the MNE between full and shared ownership is decreasing in *s*, which is in line with the empirical evidence from Mansfield et al. (1979), Mansfield and Romeo (1980), Anderson and Gatignon (1986), Gomes Casseres (1989), Hennart (1991), Agarwal and Ramaswami (1992) Erramilli (1996), Buckley and Casson (1996), Smarzynska (2000), Desai et al. (2002), to mention just a few. This means that the relative profitability of the integrated solution is very high when the risk of spillover is high as well, because avoiding DIA is far more important than being efficient in production; as long as the threat of dissipation decreases, the attractiveness of full ownership decreases as well since firms, having nothing valuable to protect, earn more by being efficient.

Therefore, based on Result 1, we expect to see wholly-owned subsidiaries in circumstances in which know-how easily spills over, corresponding to lower values of the parameter *s* in the model[11]. This gives precious empirical hints at firm and industry level.

At firm level, if we look at the entire population of Italian investors, those endowed with superior knowledge and better human capital are expected to select full ownership of the production affiliate as their preferred mode of entry. This is because firms of this sort have something valuable to protect: given that R&D investment to achieve a high technology level is costly, firms are reluctant to freely share the fruit of their research with a potentially lower skilled partner. The same is true for human capital: skilled employees become such because of the education and regular training that enable them to develop ideas and use sophisticated management techniques. Skilled employees are thus a precious resource but also an extremely costly input from the enterprises's point of view: to attract talents, it needs to pay high wages, and to update its personnel's knowledge, it has to organize training courses, which are costly as well. It is clear that the more a company invests in human capital, the less prone it is to operate abroad in a partnership, being exposed to the risk of dissipating its crucial assets through learning or demonstration effect within the boundaries of a joint-venture.[12]

At sector level, our expectation is that investors belonging to high tech industries have a stronger preference towards full ownership, relative to investors from traditional ones, where firms invest little in R&D and patent less.

Although our simple theoretical exercise was motivated by the wish to explore the correlation between Intangible Assets and multinational activity, given our modelling it is possible to push the analysis a bit farther and discuss to what extent the cost disadvantage *c* and the market size *a* affect the trade off between full and shared ownership and derive some testable predictions, adding to the role of DIA.

Equation (7) is solved for *c* in Result 2.

Result 2 (See Appendix A for details)

1) Condition (7) is verified - i.e. $\Pi_{MNE}^{WOS} > \Pi_{MNE}^{JV}$ *- for* $c<c_1 = a\left[\frac{8+9s-3\sqrt{s^2+16s+8\theta+9\theta s^2}}{8+9s^2}\right]$.

2) i) In the relevant parameter space for empirical purposes (i.e. $F(a,c)<\theta<G(a,c)$*) both arrangements may emerge, depending on the extent of the cost disadvantage: for lower values of c (i.e. weak cost disadvantage) the MNE prefers full ownership, because production inefficiency is not very pronounced; for higher values of c (i.e. strong cost disadvantage) JV emerges as an equilibrium outcome to cut production costs;*

ii) the MNE's profit gap, between full and shared ownership $\Pi_{MNE}^{WOS} - \Pi_{MNE}^{JV}$*, decreases as long as c increases (i.e. stronger cost disadvantage).*

Based on Result 2, we expect to observe a stronger preference towards shared ownership when the cost of operating abroad is prohibitively high for the Multinational Enterprise, so that it needs a local partner well acquainted with the host country, and efficient in input supply. The lack of firm-level information about costs makes us infer that country-level indicators - such as economic freedom and openness – could be reasonable proxies for *c*, measuring the difficulty of operating in the Southern market. The more transparent and dynamic the host country, the easier it is to operate there for the MNE and the more likely the establishment of wholly-owned subsidiaries.

As far as market size is concerned, empirical evidence is mixed: in (Mutinelli and Piscitello, 1998b; Buckley and Casson, 1999) huge host countries are better approached through wholly-owned subsidiaries, while Smarzynska (2000) documents an opposite pattern. Equation (7) is solved for *a* in Result 3 to derive some testable predictions about the impact of market size on firms' ownership decision.

Result 3 (See Appendix A for details)

1) Condition (7) is verified - i.e. $\Pi_{MNE}^{WOS} > \Pi_{MNE}^{JV}$ *- for* $a>a_2 = c\left[8+9s+\sqrt{\frac{\theta s^2+144s+81\theta s^2+72\theta}{8-9\theta}}\right]$

or $a<a_1 = c\left[8+9s-\sqrt{\frac{\theta s^2+144s+81\theta s^2+72\theta}{8-9\theta}}\right]$.

2) i) In the relevant parameter space for empirical purposes (i.e. $F(a,c)<\theta<G(a,c)$*) both arrangements may emerge, depending on market size: for low and high values of market size the MNE prefers full ownership, while for intermediate values JV emerges as an equilibrium outcome;*

ii) the MNE's profit gap, between full and shared ownership $\Pi_{MNE}^{WOS} - \Pi_{MNE}^{JV}$*, decreases as long as a increases up to a threshold* $\hat{a} = c\frac{8+9s}{8-9\theta}$*, then it increases.*

Based on Result 3, wholly-owned subsidiaries prevail for low and high values of market size, reconciling the mixed empirical evidence mentioned above. On the one hand, if the Southern market is small, the multinational prefers full ownership to keep its entire revenues, rather than sharing the little cake it has with a local partner. On the other hand, if the host country is large, wholly owned-subsidiaries are still preferable for appropriating all benefits: in this case, defection by a local partner would be too costly for the MNE to risk knowledge spillover within a joint-venture.

At this stage, it is worth mentioning that the profit gap between full and shared ownership is decreasing in *a* up to a threshold $\hat{a}$, then it is increasing. This gives precious empirical hints at the country level. If we look at the entire set of destination economies, the probability of full ownership

is expected to go down with an increase in market size: larger countries are better accessed with a local partner than alone as long as $a < \hat{a}$. The key point is that the threshold depends on *c*, θ, *s*: huge host economies like the Chinese or the Indian ones, included in our sample, can be below $\hat{a}$ simply because the cost disadvantage of operating there is extremely high or because the profit share accruing to the MNE is large. While the influence of Intangible Assets on the relative attractiveness of full ownership was clear cut, the impact of market size seems to be more subtle, and the ultimate answer will come from the data.

3. Empirical Analysis

In this Section, we test the main findings derived above and empirically assess the choice of full versus shared ownership of the production affiliate made by Italian multinationals in Asia. For the purpose of the present work, a new firm-level dataset is employed. The discussion is organised in three steps: first we present the data (3.1) and the specification (3.2), and then we comment the econometric estimates (3.3) and their matching with the theoretical priors from Section 2.

3.1 Data

The empirical analysis, conducted by the author between 2001 and 2005, builds on a survey questionnaire, exploring the international choices of more than 300 Italian manufacturing companies with production affiliates in Asia which consists of China, India and the South East Asian (SEA) countries - Malaysia, Indonesia, Thailand, Vietnam, Singapore, Philippines, South Korea and Japan.

Although relatively small, we believe that this sample is highly representative of the Italian case, since it accounts for around 90% of all Italian investors in the region of interest[13].

The questionnaire, based on multiple choice responses, consists of two sections: first we ask background information to derive a general profile of the parent company; then we investigate the choice of full versus shared ownership and the major challenges faced in the destination country, for

a total of more than 40 questions overall. Additional balance sheet or industry-level data are derived from AIDA (Analisi Informatizzata delle Aziende) and ISTAT (Istituto Nazionale di Statistica).

The experiences of Italian MNEs in Asia are very diverse. An initial look at the survey results suggests that it is impossible to draw a single "Italian" profile, because investors differ in many regards.

If we look at the number of employees, we find that medium (45%) and large (29%) companies account for the largest presence in Asia, followed by small (25%) and handcraft (6%) ones[14]; according to sales, 44% of the firms top 50 million Euros, 16% is between 25 and 50 million Euros and 22% below 10 million.

Figure 1 displays the sectoral distribution of the parent companies: based on the Bell and Pavitt (1993)[15] classification, Italian MNEs belong to "supplier dominated" sectors the most (37%), followed by the "specialised supplier dominated" (36%), "science based" (14%) and "scale intensive" (13%) ones.

[insert Figure 1 about here]

Interviews reveal that firms pay large attention to the human capital of their employees: many of them require English (70%) and computer (94%) skills from everybody, around 40% organise periodic training courses that last longer than 6 months and the percentage of employees holding a degree is higher than 25% in 43% of the cases.

Experience in managing international operations seems high as well: many respondents have been engaged in licensing activities (9%), import/export (49%), franchising (4%), WOS (20%) and joint-venture (18%) in more than 5 countries (80%) and for longer than 10 years (77%) before the present involvement in Asia.

Figure 2 shows the distribution of Italian affiliates: China is the largest recipient - accounting for 56% of WOS and JV establishments in the whole region - followed by India (17%), Malaysia (9%) and Thailand (6%), while Japan occupies the last position.

[insert Figure 2 about here]

Notice that manufacturing activities in Asia are driven by various purposes, depending on the destination. In particular, market access considerations play a major role in large countries like China, India and Indonesia but also in small ones like Thailand, Singapore and South Korea which serve as a commercial platform for the entire Asian region (see Figure 3). At the same time, the low cost of labour provides an important motive for de-locating production in some developing countries like Vietnam, China, India and the Philippines.

In addition, it is worth mentioning that 45% of the goods produced in Asia are intended to satisfy the local demand, while 55% are exported abroad. Evidence shows that the wish to become more competitive, a good chance, the existence of trade barriers elsewhere or special incentives to foreign activity consist of further reasons to open subsidiaries.

[insert Figure 3 about here]

As far as the WOS/JV trade off is concerned, joint-venture establishments (57%) prove to be the most common mode of entry for Italian companies in Asia. Nonetheless, full ownership of the production affiliate has been extensively preferred to shared ownership in many countries, such as Singapore, South Korea, Japan, Indonesia, Philippines, Vietnam and Malaysia, suggesting that there might be some country-specific effects at play in the real world (see Figure 4).

[insert Figure 4 about here]

According to the survey responses, the reasons to engage in a partnership rather than operating in wholly-owned subsidiaries, range from gaining local support (54%) to risks and costs sharing (20%), from achieving the optimal size (10%) to skills (7%) and competitive position (2%) enhancing or law restrictions (8%)[16] (see Figure 5). This gives a preliminary confirmation to the role of complementary skills stressed in the model, with the Asian firm contributing cheap labour force and deep knowledge of the local market and the MNE providing know-how and managerial techniques.

[insert Figure 5 about here]

Among the 43% of respondents that operate in a WOS, a large majority (83%) choose this mode in order to achieve strong control over technology transfer and high flexibility standards, in line with

our theoretical predictions: especially high tech companies are very reluctant to invest in developing countries since they do not want to share their know-how with a lower skilled partner. Full ownership of the production affiliate seems the most natural way to avoid this risk, as MNEs simply work alone and they do not consult with a local counterpart on management decisions. For about 21% of the sample, the wholly-owned subsidiary represents an evolution from a former JV, while 6% choose to operate alone due to the lack of an appropriate local partner, as reported in Figure 6.

[insert Figure 6 about here]

3.2 Specification

Based on the data briefly reviewed in 3.1, we regress the choice of full versus shared ownership of the production affiliate made by Italian multinationals in Asia, within the DIA framework sketched in Section 2.

Our unit of analysis is the production affiliate. The econometric specification is as follows:

$$\underset{(nx1)}{WOS} = \underset{(nxm)}{F}\ \underset{(mx1)}{\alpha} + \underset{(nxl)}{I}\ \underset{(lx1)}{\delta} + \underset{(nxk)}{C}\ \underset{(kx1)}{\sigma} + \underset{(nx1)}{\varepsilon} \qquad (10)$$

WOS is the *(n x 1)* dependent variable vector, whose elements take value 1 in case of wholly-owned subsidiary, 0 in case of joint-venture.

To capture the higher degree of complexity of the real world, compared to our stylized theoretical framework, explanatory variables are of three types: *F* is a *(nxm)* matrix of *F*irm-level regressors; *I* is a *(nxl)* matrix containing *I*ndustry-level indicators and *C* is a *(nxk)* matrix of host *C*ountry characteristics; α, δ and σ are the vectors of parameters associated to firm, industry and country variables respectively, and ε denotes the error term.

Notice that, within *F*, we distinguish between *core* and *control* regressors: core variables are those measuring Italian firms' Intangible Assets, over which priors have already been derived; control variables denote other firm-level characteristics that may play a role in shaping the Internalisation decision.

Recall from our previous discussion (Sections 1 and 2) that *knowledge* covers both *human capital* and *technological* aspects, so our *core* firm-level regressors refer to *both* types. This is an important

novelty, compared to the previous empirical literature: although human capital is often mentioned as a key asset that is likely to orient multinational activity, it has rarely been included in econometric tests, due to the lack of firm-level information. A few exceptions are (Mutinelli and Piscitello, 1998a, 1998b; Sanna Randaccio, 1993) where human capital is measured at industry level, by the ratio of skilled workers over total workers in the sector of the local unit.

As a proxy for *technology*, we employ alternative indicators, such as the value of patents (*PATENT*)*;* the ratio of patents over sales (*PATENT/SALES*); and, similarly to (Blomstrom et al., 1989; Smarzyinska, 2000), whether or not the parent firm belongs to a high tech sector (*HIGHTECH*), with a particular focus on the *TELECOM* one. To capture the role of technological leadership, the variable *TECH_relative* is also included: it measures the overall technological endowment of the parent company – as the sum of R&D and advertising expenditure - relative to the industry mean (Desai et al., 2002; Smarzyinska, 2000). As far as *human capital* aspects are concerned, two measures are adopted: the extent of the training courses that the parent firm periodically organises for its employees (*TRAINING*), and their level of education (*GRADUATE*).

All these variables refer to the consistency of the parent company's Intangible Assets, so we overall expect a positive sign, based on Result 1: according to the model, full ownership induced by the threat of knowledge dissipation (captured by parameter *s*) is more likely to emerge when know-how easily spills over – i.e. when firms are endowed with more technology and human capital or they belong to high tech industries[17]. Moreover, our indicators of IAs are characterized by a low degree of correlation, meaning that they represent different dimensions of the firms' key resources (see table b3 in Appendix B).

Firm-level control variables include: sales (*SALES*, as in Blomstrom and Zejan, 1991; Meyer 1998; Smarzynska 2000); the destination of the goods produced in Asia (*H_purpose*) which allows us to distinguish between horizontal and vertical purposes; the importance of firm-level scale economies (*SCALE*); a proxy for the MNE's experience in running foreign operations (*COUNTRIES*, similarly to Herrmann and Datta, 2002; Guillen, 2003; Mutinelli and Piscitello, 1998a, 1998b; Sanna

Randaccio, 1993) and its location in Italy (*NORTH-EAST*). A few industry controls - *METAL* and *PRECISION* - are also added to econometric estimates.

As for country variables, we consider: *TRADE*, as a measure of the host market degree of openness (the same measure is employed also in Smith, 2001; Arora at al., 2001; Smarzynska, 2000); a property right index (*PRI*) and an economic freedom index (*EFI*), to capture host country restrictions to foreign ownership (similarly to Rapp and Rozek, 1990; Maskus and Penubarti, 1995; Lee and Mansfield, 1996; Smarzynska, 2000; Mutinelli and Piscitello, 1998a, 1998b; Sanna Randaccio, 1993). In the spirit of Result 2, *TRADE*, *EFI*, and *PRI* can be considered as a measure of the cost disadvantage of the MNE in the host market (parameter *c* in the model). Therefore a positive sign is expected, meaning that full ownership prevails when operating abroad is relatively easy. In addition, the variable *POP* is also included; it is our proxy for market size (parameter *a* in the model) and a dummy (*SEA*), specifying whether the host country belongs to the South East Asian region. While the impact of knowledge spillover and cost disadvantage was clear-cut in the model, the sign of *POP* cannot be predicted ex ante, depending on the threshold $\hat{a}$ (see Result 3).

Appendix B contains more information about the variables included in the econometric specification, and provides summary statistics of the continuous regressors and the correlation matrix of the proxies for Intangible Assets.

Given the binary nature of the dependent variable *WOS*, regressions are carried out within a Probit framework.

3.3 Results

Probit estimates are shown in Table 1.

[insert Table 1 about here]

While keeping into consideration the main theoretical priors from Result 2 it is worth noticing that all the core variables measuring Intangible Assets are significant with the expected sign and they remain so across different specifications. This provides a first important result and suggests quite a good matching between the theory and the data[18].

In particular, moving from the simplest specifications on the left where *WOS* is regressed only on core-type variables to the richer specifications on the right where control variables are also included we see that with an increase in the Italian firms' Intangible Assets, the probability of full ownership increases as well.

Indeed, *HIGHTECH*, *TELECOM*, *PATENT*, *TECH_relative*, *PATENT/SALES*, *GRADUATE* and *TRAINING* all display the expected positive sign; this means that wholly-owned subsidiaries are more likely to be set up by Italian companies that are technological leaders in their respective field, operating in high tech sectors, holding patents in Italy, and possessing well trained and cultured employees. These findings, in line with Result 1, are broadly consistent with the existing empirical literature (see, among others, Smarzynska, 2000; Desai et al., 2001; Brouthers, 2002; Chen and Hu, 2002) and they add precious information about the role of human capital, as a key resource driving the WOS/JV choice of Italian companies in Asia.

As far as control variables are concerned, *METAL* and *PRECISION* turn out to be significant, with a positive sign, meaning that parent firms engaged with production of metal goods or precision instruments, watches and optical appliances have a higher probability of operating through wholly-owned subsidiaries. *SALES* is significant, as well, with a negative sign (as in Blomstrom and Zejan, 1991; Meyer, 1998)[19], suggesting that larger enterprises tend to share ownership with an Asian partner, rather than operating alone. This probably has to do with the bargaining power of the Italian investor: the larger the MNE, the stronger its position in negotiating favourable JV conditions. Not surprisingly, firm-level scale economies (*SCALE*) encourage full ownership, since the integrated solution helps to exploit the cost advantage of production on a larger scale. Estimates also show that investors coming from *NORTH-EAST* are more prone to operate in wholly-owned subsidiaries, while their experience in running foreign operations (*COUNTRIES*) and horizontal purpose (*H_purpose*) lead them towards joint-venture establishment. Indeed, being used to manage foreign operations might help to protect Intangible Assets more effectively and to avoid the risk of knowledge dissipation. At the same time, it is clear that investors wishing to penetrate the local market – horizontal purpose - are more likely to operate in joint-venture in order to to take

advantage of the partner knowledge of the host country[20], whereas investors aiming at producing in Asia but exporting final goods elsewhere – vertical purpose – do not need a local counterpart and better protect their assets through WOS. Notice also that intra-firm trade – which is associated with vertical FDI – implies that the subsidiary should be more tightly knit into the MNE network, thus requiring stronger control as compared to horizontal investment.

According to our data, country variables also play a role in driving the WOS/JV trade off, as suggested by the survey answers. In particular, *TRADE*, *EFI* and *PRI* are significant with a positive sign, meaning that the higher the degree of openness and economic freedom and the lower the property right (PR) protection, the more appealing the integrated solution. These results are not surprising: multinational enterprises clearly prefer to operate alone if PRs are not adequately preserved, to avoid dissipation; full ownership is also favoured by an open and free environment, where economic conditions are transparent and so there is no need for local support. Similar evidence, in line with Result 2, can be found in (Pan, 2002; Chen and Hu, 2002; Smarzynska, 2000)[21]. Notice, also, that operations in South East Asian countries – captured by the dummy *SEA* – are more likely to be conducted via WOS than in joint-venture.

In the end, we find that the size of the recipient country – measured by *POP* – is significant and negative, which implies that larger countries tent to be accessed through joint-ventures rather than wholly-owned subsidiaries. In the model's words even huge host economies, like the Chinese or the Indian, still fall below the threshold $\hat{a}$ identified in Result 3. This probably depends on the high cost disadvantages of operating in those markets or the large profit shares accruing to the MNE.

In certain aspects, the present paper complements previous empirical studies on Italian Foreign Direct Investment due to (Mutinelli and Piscitello, 1998a, 1998b; Sanna Randaccio, 1993). Compared to those studies, first we provide new data through survey interviews, second we build a theoretical model, as a ground for the estimates, and third we investigate the role of DIA, which has been previously neglected. Indeed, in (Sanna Randaccio, 1993; Mutinelli and Piscitello, 1998a, 1998b), the focus is more on knowledge sourcing, rather than knowledge dispersion, but we are

quite confident that the risk of spillover plays a major role in orienting multinational activity, because this comes out in the extensive survey that motivates our theoretical and empirical exercise. Despite the different time span and sample, one striking similarity across all studies – including the present one - is the clear preference of Italian firms for joint-venture establishments. Sanna Randaccio (1993) focuses on roughly 100 Italian MNEs engaged in manufacturing FDI worldwide in the period 1974-1986, Mutinelli and Piscitello (1998a, 1998b) analyse more than 300 Italian parent companies with joint-venture or wholly-owned subsidiaries abroad in 1986-1993, and this paper studies Italian FDI in Asia in the XXI century: irrespective of the period and the data, shared ownership turns out to be the most preferred contract selected by Italian investors. This probably has to do with financial and managerial constraints that limit mostly small and medium enterprises, making them act prudently to minimize risks through the partnership. Indeed, the large majority of Italian firms, being small in size, are likely to face constraints of those types, which push towards shared ownership ceteris paribus.

Before concluding, it is worth mentioning that the estimates from Table 1 might potentially suffer from selection bias since our sample, although highly representative of the Italian case is just a fraction of the universe. Selection bias could originate from our focus on Italy, as the only home country, and Asia as the only recipient region in addition to the fact that we do not include in the analysis firms that did not invest abroad or firms that adopted entry modes different from WOS and JV.

Data constraints make it extremely hard to overcome these problems in a rigorous way; however we believe that the estimates, shown in Table 1, provide quite a realistic approximation of the reality.

First of all, notice that the geographic dimension of the selectivity issue vanishes when we compare these results with the already established empirical literature (see, for instance: Smarzynska, 2000; Desai et al., 2002; Pan, 2002; Chen and Hu, 2002): irrespective of the home and host country, the risk of dissipating Intangible Assets is highly correlated with full ownership of the production affiliate.

Second, wholly-owned subsidiaries and joint-ventures turn out to be the only alternatives chosen by Italian firms in Asia, so it was not a matter of choice to set the comparison between the two.

Third, since the ultimate goal of this research is to provide a link between IAs and the relative attractiveness of full ownership, we interpret the econometric estimates more as a general indication of what is related to the choice of WOS than a precise comparison among the marginal effects of the regressors. In principal, we could allow for a previous step in which MNEs choose whether to go abroad before they select the entry mode; however such a step is deliberately ignored in the theoretical part of the paper to keep the formalisation as simple as possible, and to maintain a better match between the theory and the data. Moreover, based on interviews, we are quite confident that the extent of firms' Intangible Assets is related to the choice of full versus shared ownership, rather than the decision to invest abroad because our database documents the experience of extremely varied companies, some of them being very high tech, others being completely traditional, but all operating in Asia. This is the reason why we believe that technology and human capital are more likely to orient the WOS/JV trade off than the location decision.

Finally, notice that in presenting our estimates, we resist any generalizing attempt and consider them as a simple exercise to check whether the experience of Italian firms in Asia is consistent with the theoretical expectations derived in Section 2. It effectively summarizes the content of many interviews we conducted with the real actors at play.

4. Conclusion

Multinational Enterprises may penetrate into a foreign market through alternative channels from export to wholly-owned subsidiaries, from joint-venture to licensing each of them involving a different degree of Intangible Assets transfers from the parent to the local firms.

This paper studies the relative attractiveness of WOS versus JV, namely the choice of full versus shared ownership of the production affiliate, in terms of DIA.

Although the role of Intangible Assets, in assessing the WOS/JV trade off, has been broadly investigated in empirical terms (see, among others: Anderson and Gatignon, 1986; Gomes Casseres,

1989; Hennart, 1991; Agarwal and Ramaswami, 1992; Erramilli, 1996; Buckley and Casson, 1996; Smarzynska, 2000; Desai et al., 2002; Pan, 2002; Chen and Hu, 2002; Herrmann and Datta, 2002; Brouthers, 2002; Guillen, 2003; Mutinelli and Piscitello, 1998a, 1998b; Sanna Randaccio, 1993), it remains substantially unexplored in its theoretical components, since authors (see, for instance: Ethier and Markusen, 1996; Markusen, 2001; Saggi, 1996, 1999; Fosfuri, 2000; Mattoo et al., 2001; Fosfuri et al., 2001; Glass and Saggi, 2002) usually compare Foreign Direct Investment and licensing, ignoring the case of shared ownership, which is typical of a joint-venture agreement.

This paper is a first attempt at filling the gap between the theory and the data.

For the purpose of the present research, we have been building a new firm-level dataset, on the whole population of Italian firms with FDIs in Asia. According to the survey, wholly-owned subsidiaries are motivated by the wish to preserve knowledge, while joint-venture establishments ground on complementary skills.

Building on this evidence, we explore the WOS/JV trade off more rigorously, both in theoretical and empirical terms. First of all, a simple extension of the DIA framework allows us to incorporate shared ownership as an alternative to the full one. By assumption, wholly-owned subsidiaries avoid knowledge dispersion, but involve efficiency losses; on the contrary, joint-ventures are efficiency enhancing, but firms retain only a share of total revenues and knowledge is subject to dissipation. In a two-period, two-country framework, we show that full ownership is more likely to emerge, the higher the threat of Intangible Assets dissipation, resembling the theoretical findings on the FDI/licensing trade off.

Second, these findings are tested with the data on Italian operations in Asia; probit estimates confirm that wholly-owned subsidiary is preferred when know-how easily spills over – i.e. when firms are endowed with more human capital and technology, belong to high tech industries, or turn out to be technological leaders in their respective sector. Notice that our focus on human capital aspects, beyond the broadly documented technological ones, represents an important novelty with respect to the existing literature, since employees' skills are rarely considered in empirical studies, due to the lack of firm-level data.

Given our promising results, we think that it is worth carrying out further research within the DIA framework, to better investigate its impact on multinational activity. Future steps include the treatment of the whole array of feasible contractual arrangements - namely joint-venture, licensing, export and wholly-owned subsidiaries – in a single unitary model and the provision of further empirical evidence to control for possible selection bias.

Footnotes

[1] *Dissipation*, in this framework, entails a different meaning, depending on the asset under consideration: in the case of *knowledge*, a spillover mechanism is likely to operate, allowing the local counterpart to appropriate production secrets, copy final goods and eventually start a rival firm on the basis of the "stolen" asset; in the case of *reputation*, dissipation comes because the local counterpart benefits form the MNE's brand image, but puts no effort in maintaining and enhancing it.

[2] Building on Dunning (1993)'s OLI paradigm, theories of the boundaries of the Multinational Enterprise have fruitfully developed along three directions, called: *Theories of the Firm*, *Agency Costs*, *Dissipation of Intangible Assets* (See Markusen, 1995; Saggi, 2000; Barba Navaretti and Venables, 2004; Gattai (2006) for surveys). For the purpose of the present work, we focus solely on the DIA approach. Notice that this strand of the literature identifies FDI with wholly-owned subsidiaries. Therefore, in our terminology, it compares the relative attractiveness of *WOS* and licensing, based

on dissipation of intangible assets. The reason why we introduce the term WOS here is that joint-ventures and wholly-owned subsidiaries are often regarded as different types of FDI, thus falling below the same category.

[3] This option is instead considered in Markusen (2001), where the MNE can choose a different licensee in the second period.

[4] Given this functional form, $0<c<a$.

[5] Our modelling of the joint-venture contract is quite close to Ramachandran (1993), Mattoo et al. (2001), Glass and Saggi (2002). Notice that the WOS/joint-venture decision does not necessarily coincide with the Greenfield/Acquisition one. In particular joint-ventures differ from Acquisitions because the local firm is not "bought" by the MNE, and the two enterprises do not "merge" into a new economic entity: they simply make a temporary cooperation agreement in order to produce final goods together. This is the reason why the local partner may deviate in the second period and eventually start a rival firm, as it is explained below, in Section 2.

[6] For more details, see: www.ice.it, www.indmin.nic.in.

[7] Although licensing provides a more direct channel for technology transfer because the licensor has to provide the licensee with the whole set of production tools, working side by side in a joint-venture similarly allows the local firm to learn from the MNE. Notice, moreover, that s is strictly greater than zero, meaning that the cost reduction, induced by knowledge dissipation, cannot make the local firm exactly as efficient as the MNE in processing final goods. At the same time s is strictly lower than 1, meaning that a spillover mechanism – although very weak, if $s \rightarrow 1$ - is always at work in the joint-venture.

[8] In other DIA papers, the asymmetry between the multinational firm and the local licensee is captured by a fixed cost incurred by the MNE in operating alone in the local market (see, for instance: Ethier and Markusen, 1996; Saggi, 1996; Fosfuri, 2000; Fosfuri at al., 2001).

[9] Furthermore, many empirical studies identify the joint-venture as a contract in which the equity owned by the foreign investor is at least 10% and less than 95%, avoiding very low and very high shares (see, among others, Mutinelli and Piscitello, 1998a, 1998b; Anderson and Gatignon, 1986; Sanna Randaccio, 1993; Gomes Casseres, 1989). In our sample we do not have shares lower than 10% or higher than 95%.

[10] Recall that the general expression of firms' profits, under the different contractual arrangements, depends on the market structure, namely monopoly in case of joint-venture, and symmetric Cournot duopoly under full ownership and defection.

[11] Notice that Result 1 is phrased in terms of the parameter θ in order to distinguish between the three cases - *i* (only WOS in the relevant parameter space $0<s<1$) *ii* (WOS or JV in the relevant parameter space $0<s<1$) *iii* (only JV in the relevant parameter space $0<s<1$). As discussed above, for empirical purposes, we restrict attention to case *ii*. Therefore,

for intermediate values of θ (case *ii*), Result 1 predicts how changes in *s* affect the relative attractiveness of full versus shared ownership. This is what we want to test in the empirical part of the paper, finding proxies for the risk of spillover.

[12] It is clear that technology and human capital do not spill over the same way because the former is non-rival, while the second is rival, residing with humans. Human capital potentially spills over through one of the following channels: i) the local company hires skilled personnel from the MNE; ii) learning or demonstrations take place within the joint-venture; iii) human capital represents the stock of non-patented knowledge in the MNE. Based on empirical evidence (see Section 3), we interpret human capital spillover as in ii).

[13] The complete list of investors was obtained through intersection of all the available sources: ICE (Istituto Commercio Estero), Reprint-Politecnico, Italian Embassies and Chambers of Commerce in Asia. In line with the theoretical specification, attention was restricted to manufacturing firms with production activity.

[14] Based on ISTAT classification, *large* enterprises have more than 500 employees, *medium* enterprises have 100-499, *small* and *handcraft* ones have 11-99 or less than 10 respectively.

[15] Based on Bell and Pavitt (1993) firms can be grouped in four categories of technological development: in traditional "supplier dominated" industries – like textile, leather, shoes, furniture, potteries etc. – technical change comes from supplier of inputs, while technology is transferred in the form of capital goods and components; in "scale intensive" industries – like automobile and chemicals – technical change is generated by the design and operation of complex production systems; in "science based" high-tech industries, technology emerges from corporate R&D and it is heavily dependant on academic research; finally, "specialized supplier dominated" firms provide high performance equipment in the form of components, instruments or software to advance users.

[16] See www.ice.it and www.indmin.nic.in for more details about the restrictions to foreign property in the countries of interest.

[17] For the sake of completeness, we should mention that the role of technological leadership – captured by the variable *TECH_relative* – is not so clear-cut. On the one hand, investors enjoying a technological lead in their respective sectors are perceived as more attractive JV partners by local firms and governments; therefore, they are more able to negotiate more favourable terms of agreement. Moreover, the technological gap between foreign leaders and domestic producers may be so large that, even in case of knowledge transfer, the threat of IA dissipation is minimal. On the other hand, the technology gap may not be enough to prevent knowledge dissipation, so investors possessing technological advantage over other firms in their sector may potentially incur in greater losses from knowledge dissipation than investors with less sophisticated technologies. Therefore, the impact of *TECH_relative* might be positive or negative (Smarzynska 2000).

[18] This evidence is also consistent with an explanation à la Antras and Helpman (2004): since full ownership is a very costly mode of entry, the most productive firms in terms of human capital and technology get engaged in WOS, while the least productive ones prefer to operate via joint-venture.

[19] A different result is obtained in (Pan, 2002; Chen and Hu, 2002), where sales are shown to be positively correlated with the probability of entering a foreign market alone.

[20] This is perfectly in line with the questionnaire responses reviewed in Section 2.1: gaining local support – in terms of interacting with local authorities, marketing final products etc. - has proved to be the main reason for Italian MNEs to undertake JV projects in Asia.

[21] The positive sign of *TRADE* and *EFI* can be interpreted also with regard to another common explanation of joint-ventures, namely risk reduction. Risk reduction can take one of the following forms: a) similar resources are pooled together to spread the risk of a large project over more than one firm; b) the investor associates with a local partner to limit the political risks of the foreign operations (Sanna Randaccio, 1993). In this sense, the lack of openness to trade or economic freedom, making the Southern market more risky, might increase the probability of a JV. The importance of risk reduction is well documented in our interviews (see Figure 5).

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Figure 1: Sector of the Italian parent company

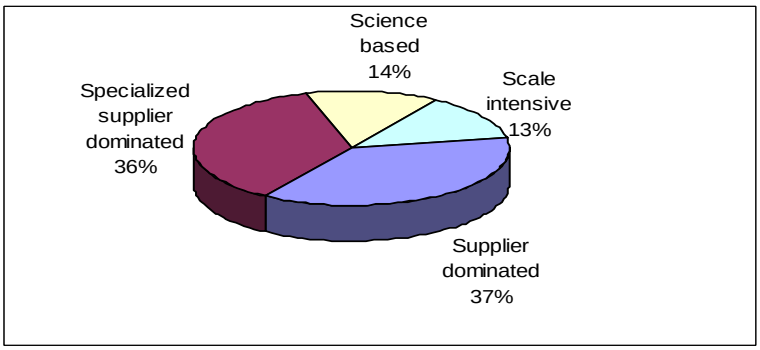

Figure 2: Destination country in Asia

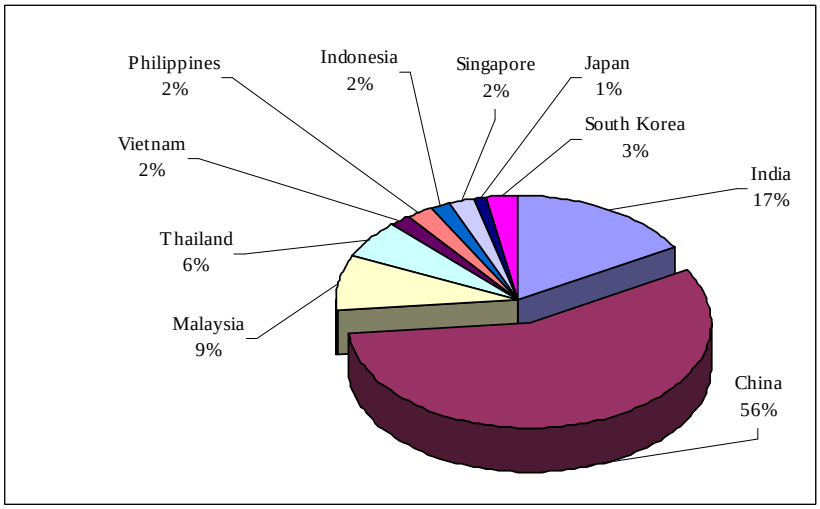

Figure 3: Investors' purpose is establishing their affiliates in Asia, by country

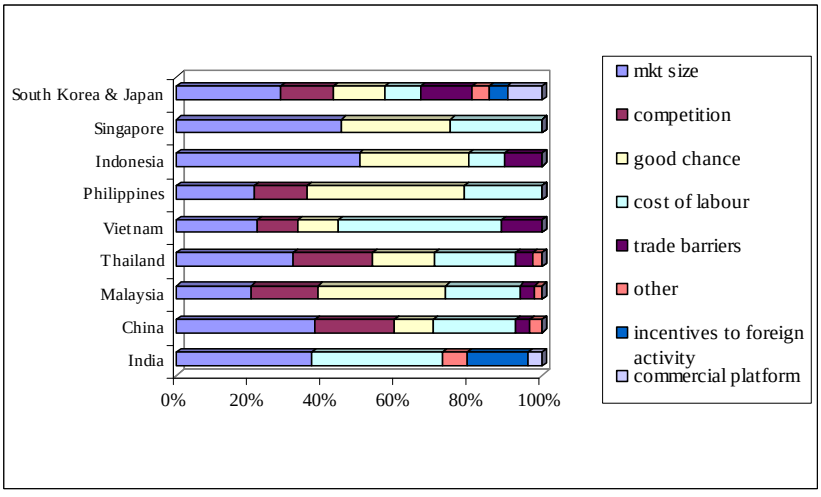

Figure 4: Wholly-owned enterprise versus joint-venture in Asia, by country

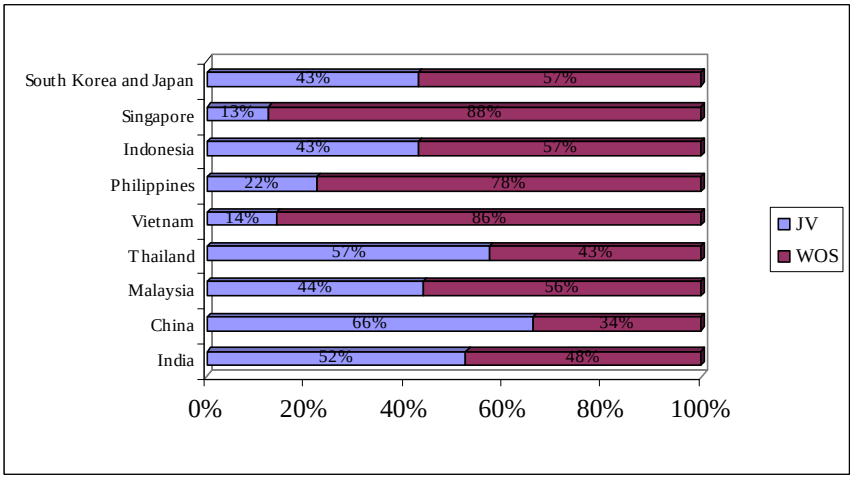

Figure 5: Reason to choose joint-venture over WOS

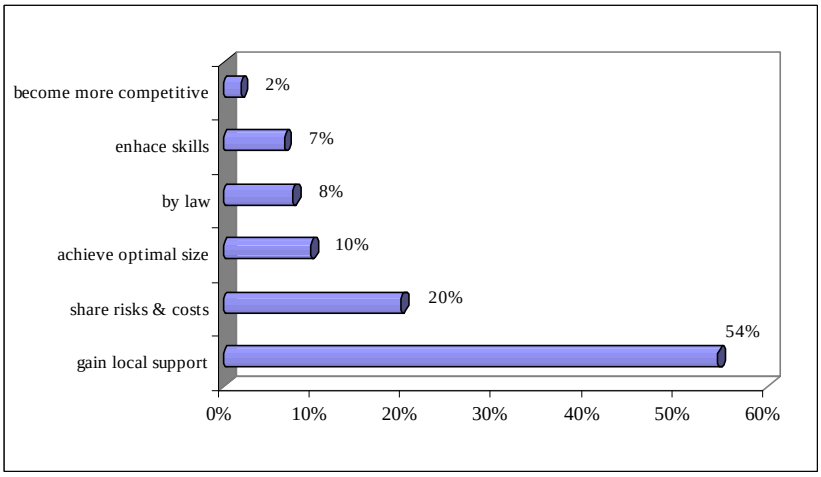

Figure 6: Reason to choose WOS over joint-venture

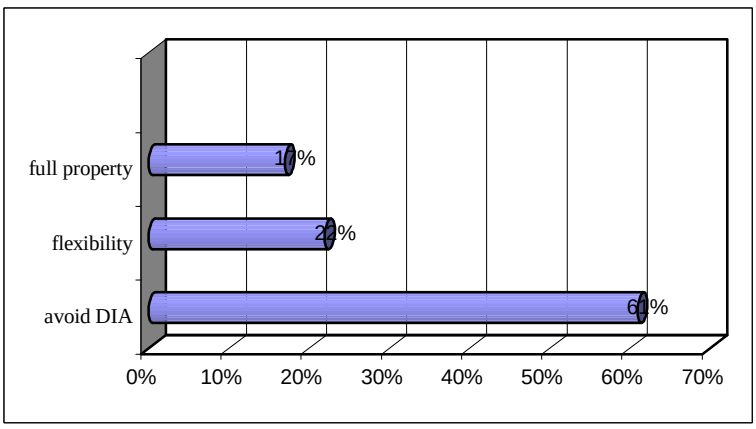

Table 1: Probit estimates

	WOS	*WOS*	*WOS*	*WOS*	*WOS*	*WOS*	*WOS*
GRADUATE	0.142 (0.024)**	0.128 (0.042)**	0.189 (0.003)***	0.193 (0.004)***	0.165 (0.014)**	0.159 (0.018)**	0.130 (0.05)*
TRAINING	0.249 (0.01)**	0.256 (0.008)***	0.257 (0.012)**	0.216 (0.046)**	0.268 (0.012)**	0.273 (0.01)**	0.257 (0.02)**
HIGHTECH				0.138 (0.022)**	0.138 (0.026)**	0.134 (0.031)**	
PATENT	0.026 (0.090)*		0.027 (0.087)*	0.052 (0.04)**			
TECH_relative					0.086 (0.03)**	0.086 (0.031)**	
PATENT/SALES		0.103 (0.050)*					0.092 (0.053)*
TELECOM		0.398 (0.009)***			0.449 (0.004)***	0.453 (0.004)***	0.465 (0.003)***
METAL							0.107 (0.041)**
PRECISION							0.446 (0.027)**
SALES				-0.101 (0.026)**	-0.107 (0.025)**	-0.106 (0.027)**	
H_purpose			-0.139 (0.017)**	-0.106 (0.082)*			
COUNTRIES			-0.171 (0.017)**	-0.133 (0.083)*	0.200 (0.01)**	-0.203 (0.009)***	-0.160 (0.036)*
SCALE			0.208 (0.000)***	0.214 (0.000)***	0.228 (0.000)***	0.223 (0.000)***	0.227 (0.000)***
NORTH-EAST				0.199 (0.027)**	0.246 (0.005)***	0.248 (0.004)***	
PRI				0.202 (0.057)*			
EFI				0.381 (0.001)***			0.185 (0.000)***
POP						-0.026 (0.000)***	
TRADE			0.263 (0.002)***				
SEA					0.305 (0.000)***		
Obs. *p-value^* *Pseudo R^2*	356 0.000*** 0.0377	354 0.000*** 0.0576	356 0.000*** 0.1131	349 0.000*** 0.1700	344 0.000*** 0.1736	344 0.000*** 0.1764	347 0.000*** 0.1647

Marginal effects and P-value in round brackets displayed. * means significant at 10%, ** significant at 5%, *** significant at 1%. Pseudo R^2 is a typical measure for goodness of fit in discrete-dependent-variable models. The expression for Pseudo R^2 is $1-1/[1+2(\log L_1-\log L_0)/N]$, where N is the total number of observations, L_1 is the maximum log-likelyhood value of the model of interest, and L_0 the maximum value of the log-likelyhood function when all the parameters, except the intercept, are set equal to 0. P-value^ denotes the P-value of the joint null-hypothesis.

Appendix A

Appendix A contains the main derivations of Section 2.

A1 Proof of Result 1

1) Equation (7) is equivalent to:

$$s^2c^2 - 2asc + \frac{8(a-c)^2 - 9\theta a^2}{9} > 0 \qquad \text{(a1)}$$

Call:

$$s_1 \equiv \frac{a - \sqrt{\frac{9\theta a^2 + 9a^2 - 8(a-c)^2}{9}}}{c} \qquad \text{(a2)}$$

$$s_2 \equiv \frac{a + \sqrt{\frac{9\theta a^2 + 9a^2 - 8(a-c)^2}{9}}}{c} \qquad \text{(a3)}$$

Solving (a1) for s, we find that it is verified - i.e. $\Pi_{MNE}^{WOS} > \Pi_{MNE}^{JV}$ - for[1] $s>s_2$ or $s<s_1$.

Since $0<s<1$, we need to control whether s_1 and s_2 belong to the interval (0, 1), to draw conclusion on the prevalence of WOS versus JV in the model's range for s.

It is easy to show that $s_2>1$, therefore it falls outside the model's range for s and it is not mentioned in Result 1. On the contrary $s_1>1$ if $\theta<F(a,c)=\frac{17(a-c)^2 - 9a^2}{9a^2}$, $0<s_1<1$ if $F(a,c)<\theta<G(a,c)=\frac{8(a-c)^2}{9a^2}$ and $s_1<0$ if $\theta>G(a,c)$.

2) Recall from above that (7) is verified - i.e. $\Pi_{MNE}^{WOS} > \Pi_{MNE}^{JV}$ - for $s<s_1$, and combine this result with those about s_1. Recall also that $0<s<1$, by assumption of the model. It follows that:

[1] Notice that $\frac{9\theta a^2 + 9a^2 - 8(a-c)^2}{9}$ is positive for $0<c<a$ and $0<\theta<1$, so $\sqrt{\frac{9\theta a^2 + 9a^2 - 8(a-c)^2}{9}}$ exists and it is a real number.

i) If $\theta<F(a,c)$, then $s_1>1$: (7) is always verified. This means that in the model's range for s ($0<s<1$) full ownership of the production affiliate is always preferable to joint-venture because it provides the MNE with higher profits.

ii) If $F(a,c)<\theta<G(a,c)$, then $0<s_1<1$: (7) is verified for $0<s<s_1$. This means that in the model's range for s ($0<s<1$) full ownership prevails for low values of s, while joint-venture is chosen for high values of s.

iii) If $\theta>G(a,c)$, then $s_1<0$: (7) is never verified. This means that $\Pi_{MNE}^{WOS} < \Pi_{MNE}^{JV}$ for $0<s<1$, and full ownership is never chosen.

iv) The profit gap, between WOS and JV, from the point of view of the MNE equals:

$$(\Pi_{MNE}^{WOS} - \Pi_{MNE}^{JV}) \equiv \frac{2}{9}(a-c)^2 - \frac{\theta a^2}{4} - \left[1 - \frac{(a-sc)^2}{a^2}\right]\frac{a^2}{4} \qquad \text{(a4)}$$

The derivative of (a4) with respect to s is:

$$\frac{\partial(\Pi_{MNE}^{WOS} - \Pi_{MNE}^{JV})}{\partial s} = -\frac{c}{2}(a-sc) \qquad \text{(a5)}$$

In the model's range for c and s - $0<c<a$ and $0<s<1$- (a5) is negative, namely a decrease in s (more cost reduction through knowledge spillover) increases the profit gap, for the MNE, between full and shared ownership of the production affiliate. □

A2 Proof of Result 2

1) Equation (7) is equivalent to:

$$c^2(8+9s^2) - c(16a+18as) + (8a^2 - 9\theta a^2) > 0 \qquad \text{(a6)}$$

Call:

$$c_1 \equiv a\left[\frac{8+9s-3\sqrt{s^2+16s+8\theta+9\theta s^2}}{8+9s^2}\right] \qquad \text{(a7)}$$

$$c_2 \equiv a\left[\frac{8+9s+3\sqrt{s^2+16s+8\theta+9\theta s^2}}{8+9s^2}\right] \qquad \text{(a8)}$$

Solving (a6) for c, we find that it is verified - i.e. $\Pi_{MNE}^{WOS} > \Pi_{MNE}^{JV}$ - for[2] $c>c_2$ or $c<c_1$.

Since $0<c<a$, we need to control whether c_1 and c_2 belong to the interval $(0, a)$, to draw conclusion on the prevalence of WOS versus JV in the model's range for c.

It is easy to show that $c_2>a$, therefore it falls outside the model's range for c and it is not mentioned in Result 2. On the contrary c_1 is always smaller than a and $0<c_1<a$ if $\theta < \frac{8}{9}$.

2) i) The relevant parameter space for empirical purposes is the one in which *Dissipation of Intangible Assets* matters for the choice between full and shared ownership, i.e. $F(a,c) < \theta < G(a,c)$ (see comments to Result 1 in Section 2). In this range it is easy to show that $\theta < \frac{8}{9}$. Therefore full ownership is preferred for $0<c<c_1$, while shared ownership emerges for $c_1<c<a$.

ii) The derivative of the MNE's profit gap between full and shared ownership (a4) with respect to c is:

$$\frac{\partial(\Pi_{MNE}^{WOS} - \Pi_{MNE}^{JV})}{\partial c} = -\frac{4}{9}(a-c) - \frac{s}{2}(a-sc) \qquad \text{(a9)}$$

In the model's range for a, s and $c - a>0$, $0<c<a$, $0<s<1$ - the derivative is negative, namely an increase in c (more cost disadvantage for the MNE, relative to the local enterprise) decreases the profit gap between full and shared ownership of the production affiliate. □

A3 Proof of Result 3

1) Equation (7) is equivalent to:

$$a^2(8-9\theta) - a(16c+18sc) + 8c^2 + 9s^2c^2 > 0 \qquad \text{(a10)}$$

Call:

[2] Notice that $s^2+16s+8\theta+9\theta s^2$ is positive for $0<s<1$ and $0<\theta<1$, so $\sqrt{s^2+16s+8\theta+9\theta s^2}$ exists and it is a real number.

$$a_1 \equiv c\left[\frac{8+9s-\sqrt{9s^2+144s+81\theta s^2+72\theta}}{8-9\theta}\right] \tag{a11}$$

$$a_2 \equiv c\left[\frac{8+9s+\sqrt{9s^2+144s+81\theta s^2+72\theta}}{8-9\theta}\right] \tag{a12}$$

Solving (a10) for *a*, we find that it is verified - i.e. $\Pi_{MNE}^{WOS} > \Pi_{MNE}^{JV}$ - for[3] $a>a_2$ or $a<a_1$.

Since $a>0$, we need to control whether a_1 and a_2 are positive, to draw conclusion on the prevalence of WOS versus JV in the model's range for *a*.

It is easy to show that $a_2>0$ and $a_1>0$ if $\theta < \frac{8}{9}$.

2) i) The relevant parameter space for empirical purposes is the one in which *Dissipation of Intangible Assets* matters for the choice between full and shared ownership, i.e. $F(a,c) < \theta < G(a,c)$ (see comments to Result 1 in Section 2). In this range it is easy to show that $\theta < \frac{8}{9}$. Therefore full ownership is preferred for $a<a_1$ or $a>a_2$, while shared ownership emerges for intermediate values of market size.

ii) The derivative of the MNE's profit gap between full and shared ownership (a4) with respect to *a* is:

$$\frac{\partial(\Pi_{MNE}^{WOS}-\Pi_{MNE}^{JV})}{\partial a} = \frac{8a-8c-9a\theta-9sc}{18} \tag{a13}$$

Given the model's range for *a*, *s* and $c-a>0$, $0<c<a$, $0<s<1$ – in the relevant parameter space for the empirical analysis ($\theta < \frac{8}{9}$) the derivative is positive for $a > \hat{a} = c\frac{8+9s}{8-9\theta}$. This means that the profit gap between full and shared ownership decreases as long as *a* increases up to $\hat{a}$ then it increases. □

[3] Notice that $9s^2+144s+81\theta s^2+72\theta$ is positive for $0<s<1$ and $0<\theta<1$, so $\sqrt{9s^2+144s+81\theta s^2+72\theta}$ exists and it is a real number.

Appendix B

Appendix B contains a description of the variables included in econometric specification (Table b1), it provides summary statistics of the continuous regressors (Table b2) and the correlation matrix of the core-type ones (Table b3).

Table b1: Variables description

Variable	***Description***
WOS	Dummy variable, 1 if WOS, 0 if JV. Type: regressand. Source: interviews
GRADUATE	Dummy variable, 1 if the percentage of employees with a degree, in the parent firm, is larger than 25%, 0 otherwise. Type: firm-level *core* regressor; it is a proxy for the human capital of the parent firm. Source: interviews
TRAINING	Dummy variable, 1 if the parent firm organizes training courses for the employees longer than 6 months, 0 otherwise. Type: firm-level *core* regressor; it is a proxy for the human capital of the parent firm. Source: interviews
HIGHTECH	Dummy variable, 1 if the parent firm belongs to a "high tech" sector, i.e. a sector in which the average R&D expenditure is more than 500,000 Euro. Type: firm-level *core* regressor; it is an indicator of technology of the parent firm. Source: personal elaborations from ISTAT (Istituto Nazionale di Statistica) data.
PATENT	Patents of the parent firm (millions Euro). Type: firm-level *core* regressor; it is an indicator of technology of the parent firm. Source: AIDA (Analisi Informatizzata delle Aziende, it is a dataset that comprises balance sheet information of more than 200,000 Italian companies with sales lager than 500,000 Euro)
TECH_relative	Total value of the parent firm's technology – R&D expenditure + advertising expenditure - over its industry mean. Type: firm-level *core* regressor; it is an indicator of technology of the parent firm; in particular it captures the role of technological leadership. Source: personal elaborations from ISTAT and AIDA
PATENT/SALES	Patent over sales of the parent firm. Type: firm-level *core* regressor; it is an indicator of technology of the parent firm. Source: personal elaborations from ISTAT and AIDA
TELECOM	Dummy variable, 1 if the parent firm belongs to the TELECOM sector, 0 otherwise. We call TELECOM the ATECO (NACE REV 1.1) 32 sector, characterized by production of TV and radio equipments. According to ISTAT, this is the manufacturing sector with largest R&D investments in Italy. Type: firm-level *core* regressor; it is an indicator of the level of technology of the parent firm. Source: personal elaborations from ISTAT data.
METAL	Dummy variable, 1 if the parent firm belongs to the METAL sector, 0 otherwise. We call METAL the ATECO (NACE REV 1.1) 28 sector, characterized by production of metal goods. Type: industry-level *control* regressor. Source: personal elaborations from ISTAT data.
PRECISION	Dummy variable, 1 if the parent firm belongs to the PRECISION sector, 0 otherwise. We call PRECISION the ATECO (NACE REV 1.1) 33 sector, characterized by production of precision instruments, watches and optical appliances. Type: industry-level *control* regressor. Source: personal elaborations from ISTAT data.
SALES	Sales of the parent company (billions Euro). Type: firm-level *control* regressor. Source: AIDA
H_purpose	Dummy variable, 1 in case of horizontal purpose – i.e. the goods produced in Asia are addressed to the local market – 0 in case of vertical purpose – i.e. the goods produced in Asia are exported elsewhere. Type: firm-level *control* regressor. Source: interviews
COUNTRIES	Dummy variable, 1 if the parent firm was engaged in international operations with more than 5 foreign countries before the FDI in Asia, 0 otherwise. It is a proxy for the firm's experience in running foreign operations. Type: firm-level *control* regressor. Source: interviews

SCALE	Dummy variable, 1 if firm-level scale economies are important for the parent firm, 0 otherwise. Type: firm-level *control* regressor. Source: interviews
NORTH-EAST	Dummy variable, 1 if the parent firm's headquarter is located in the North-East of Italy, 0 otherwise. Type: firm-level *control* regressor. Source: interviews
PRI	Property Right Index: it scores the degree to which private property rights are protected and the degree to which the government enforces laws that protect private property. In addition, it analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. It ranges from 1 to 5, higher values associated with less protection. Type: country-level *core* regressor. Source: Miles et al. (2004)
EFI	Economic Freedom Index: it measures the degree of economic freedom present in five major areas - Size of Government, Legal Structure and Security of Property Rights, Sound Money, Freedom to Trade with Foreigners, and Regulation of Credit, Labor, and Business. It ranges from 0 to 10, higher values associated to more freedom. Type: country-level *core* regressor. Source: Gwartney et al. (2004)
POP	Population of the host country (millions of inhabitants). Type: country-level *core* regressor. Source: http://humandevelopment.bu.edu/
TRADE	Degree of openness of the host country, measured by (Import+Export)/GDP. Type: country-level *core* regressor. Source: personal elaborations from http://humandevelopment.bu.edu/
SEA	Dummy variable, 1 if the host country belongs to the South East Asian region, i.e. Indonesia, Malaysia, Thailand, Japan, South Korea, Philippines, Vietnam and Singapore, 0 otherwise. Type: country-level *control* regressor. Source: interviews

Table b2: Summary statistics of continuous variables

Variable	***Obs.***	***Mean***	***Std.Dev.***	***Min***	***Max***
PATENT	356	0.6086301	2.012699	0	14.96469
TECH_relative	344	3.936645	10.88662	0	82.71236
PATENT/SALES	356	0.1761435	0.7417115	0	7.073824
SALES	356	0.262313	0.8978276	0.006	6.311476
PRI	356	3.491573	0.7817905	1	5
EFI	349	5.834098	0.7429829	5.3	8.6
POP	356	9.279096	5.341437	0.435389	12.98848
TRADE	356	0.2521991	0.3908543	0.0433201	2.413163

Table b3: Correlation matrix of the variables measuring Intangible Assets

	GRADUATE	*TRAINING*	*HIGHTECH*	*PATENT*	*TECH_relative*	*PATENT/SALES*	*TELECOM*
GRADUATE	*1.0000*						
TRAINING	*0.0794*	*1.0000*					
HIGHTECH	*0.1090*	*0.1141*	*1.0000*				
PATENT	*0.2276*	*-0.0414*	*0.0252*	*1.0000*			
TECH_relative	*0.1875*	*-0.0090*	*-0.1426*	*0.4270*	*1.0000*		
PATENT/SALES	*0.1162*	*-0.0112*	*0.1724*	*0.6036*	*0.1054*	*1.0000*	
TELECOM	*0.1516*	*-0.0628*	*0.2133*	*-0.0420*	*-0.0664*	*-0.0019*	*1.0000*