FIRM'S INTANGIBLE ASSETS AND MULTINATIONAL ACTIVITY:

JOINT-VENTURE VERSUS FDI

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FIRM'S INTANGIBLE ASSETS AND MULTINATIONAL ACTIVITY: JOINT-VENTURE VERSUS FDI

Abstract

This paper analyses multinationals' choice of Foreign Direct Investment (FDI) versus joint-venture, in theoretical and empirical terms. First, we extend the *Dissipation of Intangible Assets* framework – originally applied to the FDI/licensing trade off – to incorporate joint-venture contracts: in a two-period, two-country model we show that Foreign Direct Investment is more likely to emerge the higher the threat of Intangible Assets dissipation. Second, we turn to the empirical analysis, based on an entirely new firm-level dataset, constructed by the author. Probit estimates, on the whole population of Italian multinationals in Asia, are in line with our theoretical predictions.

Keywords: Intangible Assets, Internalisation, FDI, joint-venture, Asia

JEL: F23, C25, O5

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), as measured by Foreign Direct Investment (FDI)[1]; indeed FDI flows have grown much faster than trade and income until 2001, when this figure reversed and FDI started to slow down (UNCTAD 2004).

Globalisation has underlined the need for firms to exploit their *Intangible Assets* (IAs) on a global scale. IAs may consist either in a stock of goodwill – associated with product quality *reputation* – or in superior *knowledge* – related, for instance, to an idea, a good customer relationship, a new tool, or superior management techniques.

That Multinational Enterprises must necessarily transfer some levels of their Intangible Assets, while operating abroad, is close to definitional: an attempt to exploit promising opportunities means a decision concerning the nature of those assets and the methods by which they are to be transferred (Blair and Freeman 2004).

Evidence shows that an industry tends to have a greater proportion of MNEs when its output is characterized by high R&D, marketing expenditures, scientific and technical workers, product innovation and complexity (Markusen 1995). Compared to physical assets, IAs are more likely to give rise to FDI firstly because they can be easily transferred back and forth and secondly because they enjoy a "public good" nature, which makes them available to additional production facilities at relatively low costs. Notice that the same joint-ness features that enable MNEs to cheaply move Intangible Assets expose them to the risk of *dissipation*[2].

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[1] Throughout the paper, we use the term MNE in a broader sense, calling "multinational" a firm that is servicing a foreign market, not necessarily through Foreign Direct Investment

[2] *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, making the local counterpart 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.

Given the great importance of IAs in orienting multinational activity, what are the best ways for MNEs to achieve their goals?

Broadly speaking, we should recognize the existence of different ways of servicing a foreign market – from export to FDI, from joint-venture (JV) to licensing – which can be classified according to their knowledge transfer, from the safest arrangement of export, that secures knowledge inside the firm and the country where it originates, to the most risky case of licensing, through which knowledge is transferred both outside the source firm and the source country. Foreign Direct Investment and joint-venture represent two intermediate steps in this continuum, the former having knowledge inside the source firm but transferred outside the source country, in a wholly-owned subsidiary (WOS), the latter being characterized by the Multinational participating in final good production together with a local partner.

While many authors mention the joint-venture across the wide array of feasible contracts in a foreign country (see, for instance: Teece 1977, Mansfield et al. 1979; Rugman 1985, 1986; Saggi 2000; Ramachandran 1993; Glass and Saggi 1999, 2002a), to the best of our knowledge, no theoretical formalisation has been offered yet, in assessing the *Internalisation issue*, namely the decision of whether to internalise certain activities within firm's boundaries, or to outsource them (Dunning 1993).

International JVs offer the possibility to make profitable use of the specific capabilities of the local partner; they may facilitate cooperation with foreign governments, and generate knowledge that could be valuable in future business operations (Desai et al. 2002). However, these advantages are often offset by the implicit costs of split ownership, and the resulting inability to fully exploit certain resources developed by the parent firm: the risk of being expropriated is always inherent in such an alliance because proximity[3] to Intangible Assets enables the local company to expropriate the MNE's key resource and start a rival firm.

While abstracting from any *reputation* consideration, we are interested in the exact role that dissipation of *knowledge* – in the form of technology and human capital - plays in orienting the MNE decision of FDI versus partnering. This topic is discussed both in theoretical and empirical terms. First, we extend the *Dissipation of Intangible Assets* (DIA) framework – originally applied to the FDI/licensing trade off (Ethier and Markusen 1996; Markusen 1998, 2001; Saggi 1996, 1999; Fosfuri 2000; Mattoo et al. 2001; Fosfuri et al. 2001; Glass and Saggi 2002a) – to incorporate joint-venture contracts. In a two-period, two-country

[3] *Access*, in the Rajan and Zingales (2001)'s terminology.

framework, similar to (Etheir and Markusen 1996; Saggi 1999; Mattoo et al. 2001), we show that Foreign Direct Investment is more likely to emerge the higher the threat of Intangible Assets dissipation, resembling the theoretical findings on the FDI/licensing trade off.

Second, we test these predictions by means of an entirely new firm-level dataset, constructed by the author. The empirical analysis builds on a survey questionnaire exploring the international strategies of more than 300 Italian manufacturing companies (90% of the total) with production affiliates in a region of the world that we call *Asia*, including China, India and the South East Asian (SEA) countries - Malaysia, Indonesia, Thailand, Vietnam, Singapore, Philippines, South Korea and Japan. The questionnaire, structured in multiple choice responses, enables us to derive detailed information not only on traditional variables – such as sales, employees etc. – but also on more subtle aspects referred to MNEs' Intangible Assets – such as the employees human capital and the firm international experience – rarely considered in previous studies due to the lack of firm-level data. Probit estimates on the Italian choice of FDI versus JV in Asia match with our model predictions: the more a firm is endowed with technology and human capital, the more prone to internalise production, rather than partnering with a local company.

This paper relates to several strands of literature.

The choice of the topic and the specific modelling moves our analysis close to the theories of the *Internalisation issue* based on the *Dissipation of Intangible Assets*, where the risk of losing any of the firm's key resources provides a motive for keeping production internal rather than relying on the market.[4] In Horstmann and Markusen (1987b), exporting, setting up a wholly-owned subsidiary and licensing are compared as alternative entry modes for a Multinational Enterprise, renowned for its product quality. In this framework, any licensing contract must provide the licensee with the adequate incentives to enhance the Multinational's *reputation*: when providing incentives of this sort becomes too costly, the foreign firm decides to internalise production. In (Ethier and Markusen 1996; Markusen 1998, 2001; Saggi 1996, 1999; Fosfuri 2000; Mattoo et al. 2001; Fosfuri et al. 2001; Glass and Saggi 2002a) the dissipation of *knowledge* offers a major rational for operating in wholly owned subsidiaries, rather than signing a licensing agreement.

[4] 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 for surveys). For the purpose of the present work, we focus solely on the DIA approach.

In this case the entry mode decision is driven by the extent of a spillover mechanism that might enable the local party to appropriate production secrets, and start a rival firm: the more serious this threat, the more likely the integrated solution. Differently from this literature, we model the choice of FDI versus *joint-venture* - instead of licensing – based on *knowledge* dissipation.

Our focus on human capital and technology - as key assets that a Multinational Enterprise may wish to exploit in its foreign operations - brings this paper 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). Authors belonging to this field assume that modern economic growth is inextricably linked to the successful international transfer of technology, the extent of which crucially hinges on the costs involved. Transfer costs are shown to depend on a number of transferor's and transferee's characteristics, such as the number of previous applications and the age of the technology, the manufacturing experience and the sales of the recipient party etc. Our contribution differs from these in two aspects: first of all, we take the point of view of the MNE, and consider knowledge dissipation as a negative aspect, while it is regarded as a source of growth in (Caves 1974; Teece 1977, 1986; Davidson and Mc Fetridge 1984; Ramachandran 1993; Glass and Saggi 1999); moreover, technology transfer is not the ultimate focus of our research, but rather one of the factors that eventually 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 hart of a relatively recent strand in the Theory of the Firm. Indeed, Rajan and Zingales (1998; 2000; 2001), offer an interesting re-thinking of the concept of power, which no longer stems from ownership of physical assets – as in the Property Right Approach (Grossman and Hart 1986; Hart and Moore 1990) - but rather on access to critical resources. While adopting a similar perspective on the role of IAs in driving the international organisational decision, we are more interested in the FDI-JV trade off, than in the choice between horizontal and vertical hierarchies.

Finally, our contribution relates to the empirical literature on the choice between WOS and JV, where the Internalisation decision is explained in terms of firm, industry, and country characteristics in discrete dependent variable-models (see, among others: Andersen 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). While these papers ground on Coase (1937)'s and Williamson (1985)'s intuitions and qualitatively extend some DIA arguments to the case of joint-venture, the present contribution is intended to provide a theoretical formalisation of the JV option, and show that a DIA mechanism - similar to the one highlighted for the FDI-licensing choice – also drives the FDI-JV trade off. Moreover, an additional element of novelty comes from the dataset employed here and our attempt at measuring human capital aspects beyond the broadly documented technological ones.

The rest of the paper is organised as follows: Section 2 presents the theoretical model, on the entry mode decision of FDI versus JV; 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 similar to (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. 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 serve the foreign market through FDI or in joint-venture with the local firm; moreover, it is not possible for the MNE to change supply mode between the first and the second period[5].

Final good production requires two activities: input manufacturing and processing, according to a linear technology which 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, since the MNE has an advantage in processing final goods – due to its superior knowledge - while the other party does better in input manufacturing[6].

To capture this idea, we assume that the per unit cost of each activity is zero, if it is performed by the company that has a relative advantage in it, and α ($\alpha>0$) otherwise.

[5] This option is instead considered in Markusen (1998, 2001), where the MNE can choose a different licensee in the second period.

[6] This assumption fits the Italian experience in Asia, presented in Section 3. Empirical evidence shows that Italian multinationals tend to contribute know-how and technology while relying on their local partner for input supply.

As in (Ethier and Markusen 1996; Saggi 1999; Markusen 1998, 2001; Mattoo et al. 2001) demand is linear in the S market; in particular:

$$p = 1 - Q \quad (1)$$

where p is the price and Q denotes the total quantity, $Q = q_{MNE} + q_{local}$[7]; *MNE* and *local* stand for the multinational and the local firm respectively.

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

Operating through Foreign Direct Investment means that the Multinational Enterprise keeps production within its boundaries, through a local subsidiary; in this case it is the same firm that performs both input manufacturing and processing. So, competition in the S market results in a symmetric Cournot game, with marginal (and average) cost equal to α.

The essence of a joint-venture agreement lays, instead, in the partners' complementary skills[8]: 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 joint-venture 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 of the fact that many Asian governments still impose restrictions to foreign ownership under the joint-venture contract[9]. 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 a 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

[7] Given this functional form, $0<\alpha<1$.

[8] Our modelling of the joint-venture contract is quite close to Ramachandran (1993), Mattoo et al. (2001), Glass and Saggi (2002a). Notice that the FDI/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.

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

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 it is clarified below.

Consider, first, the FDI case. Equation (2) gives the present value of the MNE profit when final good production is internalised (See Appendix A for details):

$$\Pi_{MNE}^{FDI} = \frac{2}{9}(1-\alpha)^2 \quad (2)$$

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.

Consider now the present value of the two firms' profits under the JV agreement - namely Π_{MNE}^{JV} for the MNE and Π_{local}^{JV} for the local firm:

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

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

In this case, production efficiency is achieved, but each firm retains just a fraction of total revenue.

Operating in joint-venture, the two sides work very close to each other; this might generate a knowledge spillover from the MNE to the local firm during the first period: having access[10] to the multinational Intangible Assets – human capital and technology - the partner might learn about the processing procedure so that her cost disadvantage α drops to a lower level $c\alpha$ in the second period, with $0<c<1$[11]. According to our

[10] 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.

[11] Notice that c 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 c is strictly lower than 1, meaning that a spillover mechanism – although very weak, if $c \rightarrow 1$ - is always at work in the joint-venture.

modelling, *c* measures the extent of the spillover effect, lower values being associated with higher degrees of knowledge dissipation.

It follows that the local firm has the option of breaking up the JV contract, and start a rival firm, with the "stolen" know-how; such an option does not exist for the Multinational Enterprise, this asymmetry depending on the fact that the it has just a poor knowledge of the local market, relative to the partner[12].

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

$$\Pi_{local}^{d} = \frac{(1-\theta)}{4} + \frac{(1-c\alpha)^2}{4}$$

(5)

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

It is clear that the MNE can prevent this defection by setting $\bar{\theta}$ such that the local firm's second period profit, under the JV agreement, is not lower that its profit in starting a rival firm, i.e.:

$$\frac{1-\bar{\theta}}{4} \geq \frac{(1-c\alpha)^2}{4}$$

(6)

This is the Incentive Compatibility Constraint, which yields the following condition:

$$\bar{\theta} \leq 1-(1-c\alpha)^2$$

(7)

The multinational chooses to integrate, rather than partnering if Π_{MNE}^{FDI} from (2) is greater than Π_{MNE}^{JV} from (3), evaluated at the incentive compatible value of the second period share:

$$\bar{\theta} = 1-(1-c\alpha)^2$$

(8)

By evaluating $\Pi_{MNE}^{FDI} > \Pi_{MNE}^{JV}$ at (8) we obtain:

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

(9)

[12] In other DIA papers, this asymmetry 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).

Equation (9) gives the condition for the multinational to internalise, and it is solved in Result 1.

Result 1 (See Appendix A for details)

Condition (9) is verified - i.e. $\Pi_{MNE}^{FDI} > \Pi_{MNE}^{JV}$ *- when* $c>c_2=\dfrac{1+\sqrt{\dfrac{9\theta+9-8(1-\alpha)^2}{9}}}{\alpha}$ *or* $c<c_1=\dfrac{1-\sqrt{\dfrac{9\theta+9-8(1-\alpha)^2}{9}}}{\alpha}$

In choosing between FDI and JV, the MNE trades off the benefit of retaining total revenues and protecting its Intangible Assets, with the efficiency loss in terms of input manufacturing. Such a trade off crucially drives Result 2:

Result 2 (See Appendix A for details)

i) If $\theta < F(\alpha)=\dfrac{17(1-\alpha)^2-9}{9}$*, the Multinational Enterprise will always choose Foreign Direct Investment;*

ii) If $F(\alpha) < \theta < G(\alpha)=\dfrac{8(1-\alpha)^2}{9}$*, both arrangements may emerge, depending on the extent of the spillover effect, captured by c: if* $0<c<c_1=\dfrac{1-\sqrt{\dfrac{9\theta+9-8(1-\alpha)^2}{9}}}{\alpha}$ *(i.e. strong spillover effect), the Multinational Enterprise will choose FDI to avoid knowledge dissipation; if* $c_1<c<1$ *(i.e. weak spillover effect) JV will emerge as an equilibrium outcome; the MNE's profit gap, between FDI and joint-venture, increases as long as c decreases (i.e. stronger spillover effect);*

iii) If $\theta > G(\alpha)$*, the MNE will always choose joint-venture;*

iv) If $1-\dfrac{3}{\sqrt{17}}=\alpha_1<\alpha<1$*, case i) never occurs.*

From Result 2, 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(α) (case i):* 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 FDI 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 $G(\alpha)$ *(case iii)* since the MNE's large stake in the partnership makes the joint-venture absolutely appealing from the point of view of Multinational Enterprise, despite the spillover mechanism that benefits the local partner.

The threat of Intangible Assets dissipation comes at play for intermediate values of the first period share accruing to the foreign firm *(case ii)*: when $F(\alpha) < \theta < G(\alpha)$, θ is not large or small enough to drive the MNE's entry mode decision per se: here we see that FDI prevails for lower values of c (i.e. higher cost reduction for the local firm, induced by knowledge dissipation), while JV emerges, as an equilibrium outcome, for higher values of c (here the spillover effect is so mild that it is completely outweighed by production efficiency considerations). Moreover, the profit gap for the MNE, between operating alone (FDI) or in joint-venture, increases as long as c decreases, in lines with the empirical evidence of Mansfield et al. (1979), Mansfield and Romeo (1980).

Therefore, we conclude that FDI, induced by the threat of knowledge dissipation, is more likely to emerge over JV when know-how easily spills over, namely for firms endowed with superior knowledge or operating in high tech industries.

Notice that these priors are broadly consistent with those derived for licensing (see Section 1) and they match with the empirical evidence on the choice between joint-venture and FDI provided by (Andersen 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).

3. Empirical Analysis

In this Section, we test the main findings derived above and empirically assess the choice of FDI versus joint-venture made by Italian multinationals in Asia. For the purpose of the present work, a new firm-level dataset, constructed by the author, is employed. The discussion is organized 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 between 2001 and 2005, builds on a survey questionnaire, elaborated by the author, exploring the international choices of more than 300 Italian manufacturing companies with production affiliates in Asia.

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 Italian investors; then we investigate the *Internalisation* issue and the major challenges faced in the destination country, for 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 Stastistica).

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.

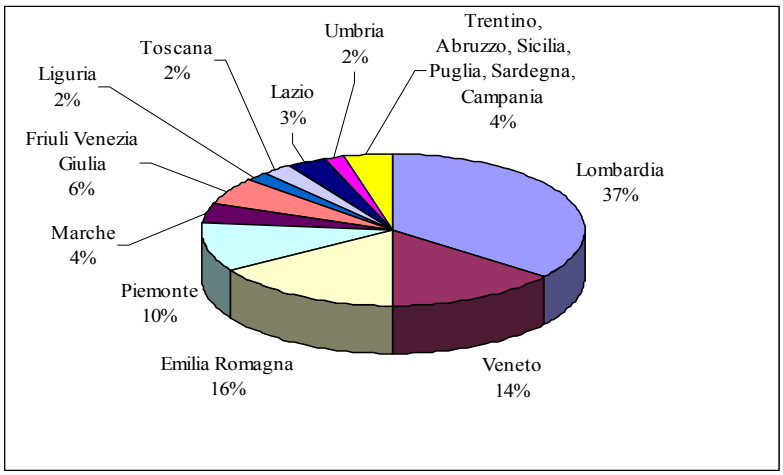
If we look at the number of employees, we find that medium (45%) and large (29%) companies account for the largest presence in Asia, followed by small (25%) and handcraft (6%) ones[14]; according to sales, 44% of the firms top 50 million Euros, 16% is between 25 and 50 million Euros and 22% below 10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

Figure 1 displays the region of origin of Italian parent companies: the largest part of respondents comes from Lombardia (37%), Emilia Romagna (16%), Veneto (14%) and Piemonte (10%) while Southern lands account for a very limited number of MNEs with manufacturing affiliates in Asia.

Figure 1: Region of origin of the Italian parent company

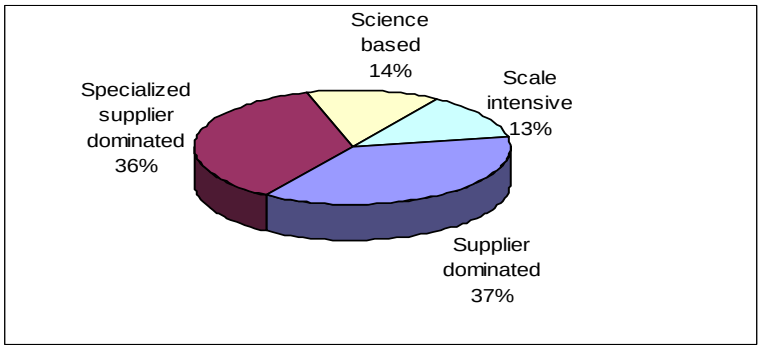
[13] The complete list of investors was obtained through intersection of all the available sources: ICE (Istituto Commercio Estero), Reprint-Politecnico, Italian Embassies and Chambers of Commerce in Asia. In lines with the theoretical specification, attention was restricted to manufacturing firms with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



According to the acquisition of technology, companies can be grouped in four categories of technological development (Bell and Pavitt 1993): 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. From Figure 2, we see that Italian MNEs belong to "supplier dominated" sectors the most (37%), followed by the "specialized supplier dominated" (36%), "science based" (14%) and "scale intensive" (13%) ones.

Figure 2: Sector of the Italian parent company

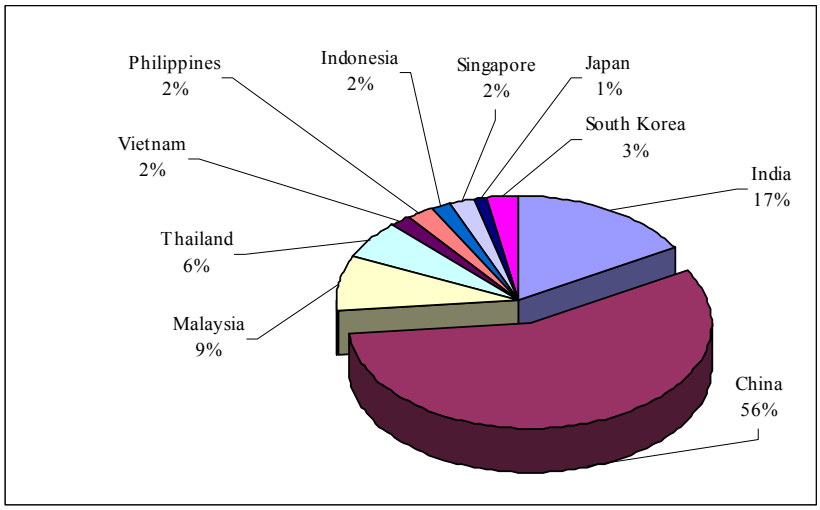


Interviews reveal that firms pay large attention to the human capital of their employees: many of them require English (70%) and computer (94%) skills to everybody, around 40% organizes periodic training courses longer than 6 months and the percentage of employees holding a degree is higher than 25%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

Experience in managing international operations seems high as well: many respondents have been engaged in activities abroad – from licensing (9%) to import/export (49%), from franchising to (4%) to FDI (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 3 shows the distribution of Italian affiliates: China is the largest recipient region - accounting for 56% of FDI and JV establishments in the whole region - followed by India (17%), Malaysia (9%) and Thailand (6%), while Japan occupies the last position.

Figure 3: Destination country in Asia



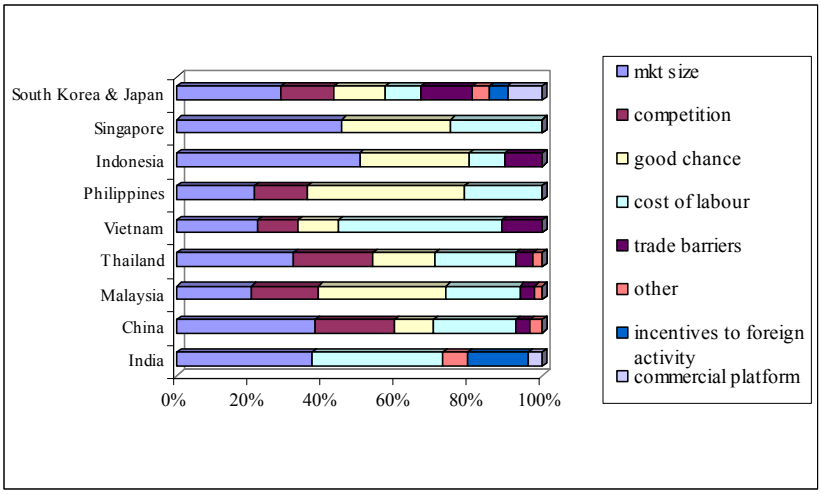
Notice that manufacturing activities in Asia are driven by various purposes, depending on the destination. In particular, market access considerations play a major role in large countries - like China, India and Indonesia - but also in small ones - like Thailand, Singapore and South Korea – which serve as a commercial platform to the entire Asian region (see Figure 4). At the same time, the low cost of labour provides an important rational for de-locating production in some developing countries like Vietnam, China, India and the Philippines.

Adding to this, it is worth mentioning that 45% of the goods produced in Asia is intended to satisfy the local demand, while 55% is exported abroad[15]. Evidence shows that the wish to become more competitive, a good

[15] Using the terminology of the *Knowledge Capital Model* (see Markusen and Maskus 2001 for a survey), we call *horizonta*l purpose the first case, aimed at accessing the local market – i.e. MNEs produce and sell within the local market - and *vertical* purpose the second one, aimed at saving on production costs – i.e. MNEs produce in the local market, because it is cheaper, but they sell abroad.

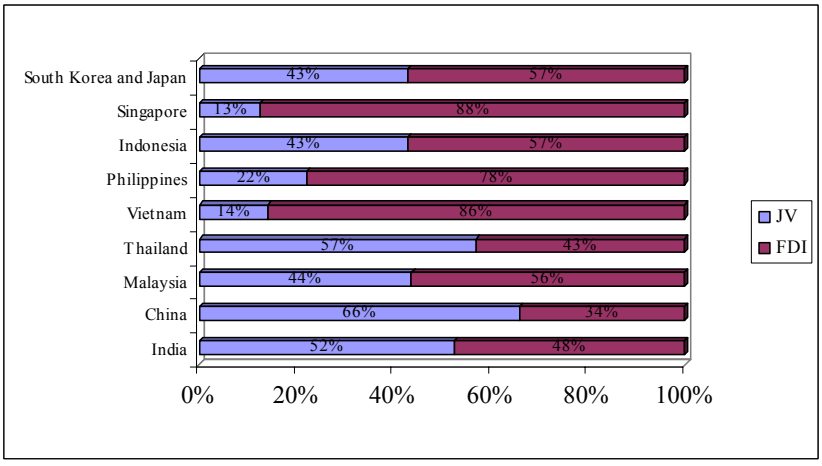
chance, the existence of trade barriers elsewhere or special incentives to foreign activity provide further reasons to open subsidiaries.

Figure 4: Investors' purpose is establishing their affiliates in Asia, by country



As far as the *Internalisation issue* is concerned, joint-venture establishments (57%) prove to be the most common mode of entry for Italian companies in Asia. Nonetheless, FDI has been extensively preferred to JV 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 5).

Figure 5: Internalisation choice in Asia, by country

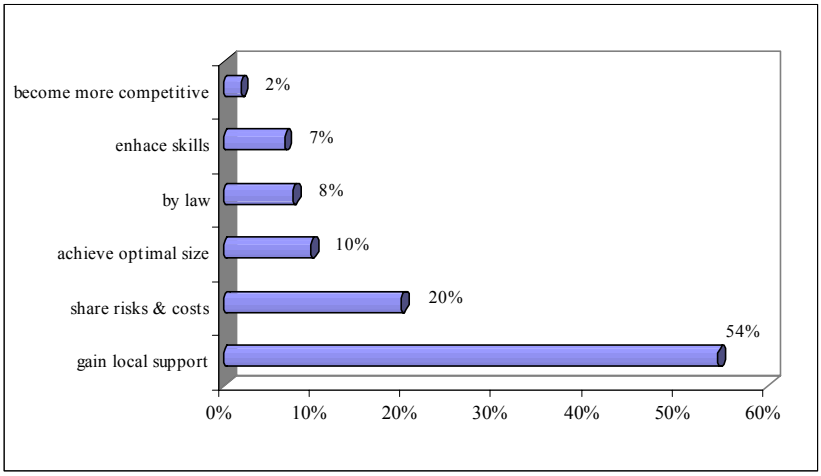


Basing on the survey responses, the reasons to engage in a partnership, rather than operating in wholly-owned subsidiaries, range from gaining local support (54%) to risks and costs sharing (20%), from achieving the optimal size (10%) to skills (7%) and competitive position (2%) enhancing or law restrictions (8%)[16] (see Figure 6). This gives a preliminary confirmation to the role of complementarity stressed in the model, with

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

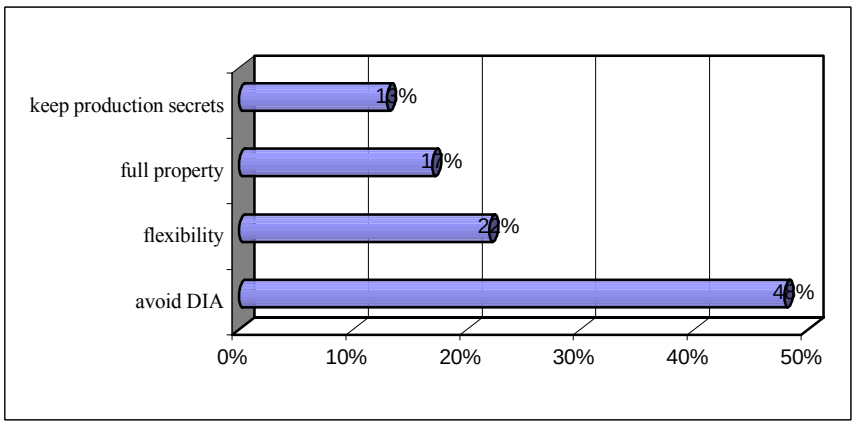
the Asian firm contributing cheap labour force and deep knowledge of the local market and the MNE providing know-how and technology.

Figure 6: Reason to choose joint-venture over FDI



Among the 43% of respondents that operate in a WOS, a large majority (73%) chooses this mode in order to achieve strong control over technology transfer and high flexibility standards, in lines with our theoretical predictions: especially high tech companies are very reluctant to invest in developing countries since they do not want to share know-how with a lower skilled partner. Foreign Direct Investment seems the most natural way to avoid this risk, as MNEs simply work alone and they do not need to 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% chooses to operate alone due to the lack of an appropriate local partner, as reported in Figure 7.

Figure 7: Reason to choose FDI over joint-venture



3.2 Specification

Based on the data briefly reviewed in 3.1, we regress the Internalisation decision – FDI versus joint-venture – of 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:

$$\underset{(nx1)}{FDI} = \underset{(nxm)}{F}\,\underset{(mx1)}{\alpha} + \underset{(nxk)}{C}\,\underset{(kx1)}{\sigma} + \underset{(nx1)}{\varepsilon}$$

(12)

FDI 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 real world, compared to the stilyzed theoretical framework, explanatory variables are of two types: *F* is a *(nxm)* matrix of *F*irm-level regressors; *C* is a *(nxk)* matrix containing host *C*ountry characteristics; α and σ are the vectors of parameters associated to firm 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[17], 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 (Section 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, likely to orient multinational activity, to the best of our knowledge, no attempt in measuring or including it in econometric tests has been made yet. This limitation is probably due to the lack of firm-level information, which poses strict constraints to empirical studies.

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

[17] Intangible assets, here, refer solely to *knowledge* – in the form of technology and human capital - as in the model described in Section 2.

TELECOM one[18]. To capture the role of technological leadership, the variable *TECH_relative* is also included: it measures the overall technological endowment of the parent company, relative to the industry mean (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 organizes 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, basing on the model described before: according to our theoretical findings FDI, induced by the threat of knowledge dissipation, 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[19]. Moreover, our indicators of IA are characterized by a low degree of correlation, meaning that they capture 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 (*HFDI*) – 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), its location in Italy (*VENETO*) and a few industry controls (*METAL* and *PRECISION*).

As far as country variables are concerned, 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 2002); *POP* to describe the local population dimension; a property right index (*PRI*) and an economic freedom index (*EFI*),

[18] Notice that in earlier studies (see, among others: Desai et al. 2002; Smarzynska 2000) R&D expenditure is also employed as a proxy for technology. Due to data missing we preferred to base on patents. However, R&D and advertising expenditures are included in *TECH_relative* (see Appendix B for details).

[19] 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).

to capture host country restrictions to foreign ownership (similarly to Rapp and Rozek 1990; Maskus and Penubarti 1995; Lee and Mansfield 1996; Smarzynska 2002); and a dummy, specifying whether or not the host country belongs to the South East Asian region (*SEA*).

Appendix B contains more information about the variables included in the econometric specification, provides summary statistics of the continuous regressors and the correlation matrix of the core-type ones.

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

3.3 Results

Probit estimates are shown in Table 1.

Reminding the theoretical priors, derived in Section 2, it is worth noticing that all the core variables 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[20].

In particular, moving from the simplest specifications on the left – where *FDI* 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 internalising production, rather than operating in joint-venture, 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 settled by Italian companies operating in high tech sectors, holding patents in Italy, being technological leaders in their respective field and possessing well trained and cultured employees. These results are broadly consistent with the existing empirical literature (see, among others, Smarzynska 2000; Desai et al. 2001; Brouthers 2002; Chen and Hu 2002) and add precious information about the role of human capital, as a key resource driving the *Internalisation* 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

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

and optical appliances have higher probability to operate through FDI. *SALES* is significant, as well, with a negative sign (as in Blomstrom and Zejan 1991; Meyer 1998)[21], suggesting that "richer" enterprises tend to share ownership with an Asian partner, rather than operating alone. This has probably 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 FDI, since the integrated solution helps to exploit the cost advantage of production on a larger scale. Estimates also show that investors coming from *VENETO* are more prone to operate in wholly-owned subsidiaries[22], while experience in running foreign operations (*COUNTRIES*) and horizontal purpose (*HFDI*) push 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 than FDI, in order to take advantage of the partner knowledge of her own country[23], 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.

According to our data, country variables also play a role in driving the FDI-JV trade off, as suggested by the survey answers. In particular, *TRADE*, *EFI* and *PR*I are significant with a positive sign, meaning that the higher the degree of openness and economic freedom and the lower the property right protection, the more appealing the integrated solution. Similar results can be found in (Pan 2002; Chen and Hu 2002; Smarzynska 2002). Notice that the size of the recipient country – measured by *POP* – is also significant and negative, namely larger countries tent to be accessed through joint-ventures rather than wholly-owned subsidiaries. This is a quite plausible result, since Italian firms usually choose large host countries when driven by horizontal purposes, in which case they seek the support of a local partner.

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[21] 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.

[22] We also checked the statistical significance of other regions of origin, but none of them turned out to influence the FDI/joint-venture decision.

[23] This is perfectly in lines 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.

Finally, operations in South East Asian countries – captured by the dummy *SEA* – are more likely to be conducted via FDI than joint-venture.

4. Conclusion

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

Table 1: Probit estimates[24]

	FDI	*FDI*	*FDI*	*FDI*	*FDI*	*FDI*	*FDI*
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)**	
HFDI			-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)***
VENETO				0.199 (0.027)**	0.246 (0.005)***	0.248 (0.004)***	
PRI				0.202 (0.057)*			

[24] 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.

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

While the FDI-licensing trade off has been extensively documented in the theoretical literature based on the *Dissipation of Intangible Assets* (see Section 1), to the best of our knowledge no theoretical treatment of the JV has been offered yet, within the DIA framework.

This paper makes an attempt at filling this gap, by means of a two-country, two-period model in which a Multinational Enterprise has to decide between two modes of servicing a foreign country S - FDI and joint-venture – each of them resulting in a different market structure for S. By assumption, Foreign Direct Investment avoids knowledge dissipation, but involves efficiency losses, since the local company has a relative advantage in input manufacturing, relative to the MNE; on the contrary, JV is efficiency enhancing, but firms retain only a share of total revenues and knowledge is subject to dissipation. In a partial equilibrium framework similar to (Etheir and Markusen 1996; Saggi 1999; Mattoo et al. 2001), we show that the joint-venture is always preferable, for the multinational, when the upper bound for the foreign share θ, imposed by the local government, is large, due to the MNE's considerable stake in the partnership. Contrary, for low values of θ, FDI always emerges since the benefit of production efficiency is more than outweighed by the low fraction of the revenues accruing to the MNE. The threat of Intangible Assets dissipation thus influences multinational activity only for intermediate values of the first period share, making Foreign Direct Investment prevail when the spillover effect is strong. Notice that these predictions are broadly consistent with those derived for the FDI-licensing trade off (Ethier and Markusen 1996; Markusen 1998, 2001; Saggi 1996, 1999; Fosfuri 2000; Mattoo et al. 2001; Fosfuri et al. 2001; Glass and Saggi 2002a), suggesting that a similar DIA mechanism is at play here.

Our theoretical findings on the boundaries of the MNE are tested by means of a new firm-level dataset, constructed by the author through survey interviews. With a reply rate around 90% of the total, we provide evidence on more than 300 Italian firms with manufacturing affiliates in Asia, including detailed information on the human capital of the employees, beyond the firms' technological equipment. Probit estimates show

that Foreign Direct Investment is more likely to emerge when know-how easily spills over – i.e. when firms are endowed with more human capital and technology, they belong to high tech industries, or turn out to be technological leaders in their respective sector. This suggests that the Italian experience is in line with the theoretical predictions derived in Section 2 and highlights the key role of human capital aspects. We believe that this is an important novelty, compared to the previous empirical literature since, to the best of our knowledge, the impact of employee skills on the *Internalisation issue* has not been tested yet, due to a lack of detailed data.

Given our promising results, we think that it is worth carrying out further research within the DIA field, future steps including the treatment of the whole array of feasible contractual arrangements - namely joint-venture, licensing, export and FDI – in a single model and the provision of further empirical evidence by means of new firm-level data.

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Appendix A

In Appendix A, we derive the main results shown in Section 2.

A1. MNE equilibrium profit under FDI (Equation 2)

Under FDI, the MNE and the local firm compete in a symmetric Cournot duopoly, with marginal (and average) cost equal to α.

Each player maximizes a profit function of the type:

$$\pi_i^{FDI} = (1 - q_i - q_j - \alpha) q_i$$

(a1)

where $i = MNE, local$; $j = MNE, local$ and $i \neq j$. (Recall, from Equation (1), that the demand function is $p = 1 - (q_{MNE} + q_{local})$)

From the first order condition, with respect to the quantity, we find firm i's best reply function:

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

(a2)

By symmetry, the equilibrium quantities and price are given by (a3) and (a4):

$$q_i^{FDI} = q_j^{FDI} = \frac{1 - \alpha}{3}$$

(a3)

$$p_i^{FDI} = \frac{1 + 2\alpha}{3}$$

(a4)

Under FDI, the Multinational Enterprise thus makes per period profit:

$$\pi_i^{FDI} = \frac{(1 - \alpha)^2}{9}$$

(a5)

Considering the two-period time horizon, the present value of the MNE profit is given by:

$$\Pi_{MNE}^{FDI} = \frac{(1 - \alpha)^2}{9} + \frac{1}{1 + \delta} \frac{(1 - \alpha)^2}{9}$$

(a6)

where $\frac{1}{1 + \delta}$ is the discount factor. (a6) gives Equation (2), under the assumption that $\delta = 0$:

$$\Pi_{MNE}^{FDI} = \frac{2}{9}(1 - \alpha)^2$$

(2)

A2. MNE and local firm equilibrium profits under JV (Equations 3 and 4)

Under the JV agreement, the MNE and the local firm operate within a single company, making the S market a monopoly, with zero marginal (and average) cost.

Joint profit of the two partners is:

$$\pi^{JV} = (1 - Q)Q$$

(a7)

Maximizing (a7), with respect to *Q*, yields the equilibrium quantity and price:

$$Q^{JV} = \frac{1}{2}$$

(a8)

$$p^{JV} = \frac{1}{2}$$

(a9)

Joint profit $\pi^{JV} = \frac{1}{4}$ is shared between the partners with weights θ and $(1- \theta)$ in the first period, $\bar{\theta}$ and $(1-\bar{\theta})$ in the second one.

Therefore, the present value of the MNE profit, under JV is:

$$\Pi_{MNE}^{JV} = \frac{\theta}{4} + \frac{1}{1+\delta}\frac{\bar{\theta}}{4}$$

(a10)

which gives Equation (3), under the assumption that $\delta=0$:

$$\Pi_{MNE}^{JV} = \frac{\theta + \bar{\theta}}{4}$$

(3)

The present value of the local firm profit, under JV is equal to:

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

(a11)

This yields Equation (4) if $\delta=0$:

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

(4)

A3. Local firm equilibrium profit in case of defection (Equation 5)

In this case, the local company breaks the JV contract at the end of the first period, and starts a rival firm during the second one, by means of the stolen know-how. Therefore, the present value of the local partner profit under defection - Π_{local}^{d} - results from two components: her first period JV profit (see A2) plus her second period monopoly profit (since the local firm remains the only producer of final goods in S), with marginal (and average) cost $c\alpha < \alpha$, due to the spillover effect.

The second period monopoly profit of the local company is:

$$\pi_{local}^{d} = (1 - Q - c\alpha)Q$$

(a11)

Maximizing (a11), with respect to Q, yields the equilibrium quantity and price:

$$Q^{d} = \frac{1-c\alpha}{2}$$

(a12)

$$p^{d} = \frac{1+c\alpha}{2}$$

(a13)

The second period equilibrium profit of the local company is obtained by substituting (a12) and (a13) into (a11):

$$\pi_{local}^{d} = \frac{(1-c\alpha)^2}{4}$$

(a14)

By means of straightforward substitution, Equation (5) gives the present value of the local firm profit under defection *(δ=0)* :

$$\Pi_{local}^{d} = \frac{(1-\theta)}{4} + \frac{(1-c\alpha)^2}{4}$$

(5)

A4. Proof of Result 1

Consider Equation (9), which gives the condition for the MNE to internalise, rather than partnering:

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

(9)

This is equivalent to:

$$(1-c\alpha)^2 > \frac{9\theta + 9 - 8(1-\alpha)^2}{9}$$

(a15)

Call:

$$c_1 \equiv \frac{1-\sqrt{\frac{9\theta + 9 - 8(1-\alpha)^2}{9}}}{\alpha}$$

(a16)

$$c_2 \equiv \frac{1+\sqrt{\frac{9\theta + 9 - 8(1-\alpha)^2}{9}}}{\alpha}$$

(a17)

From (a16), (a17), it is clear that $c_1 < c_2$.

Solving (a15) for c, we find that it is verified - i.e. $\Pi_{MNE}^{FDI} > \Pi_{MNE}^{JV}$ - for[25] $c > c_2$ or $c < c_1$.

□

A5. Proof of Result 2

Lemma 1 and Lemma 2 provide useful information in order to prove Result 2.

Lemma 1: *$c_2 > 1$, where c_2 is given by (a17).*

Proof:

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

$$\frac{1+\sqrt{\frac{9\theta+9-8(1-\alpha)^2}{9}}}{\alpha}>1$$

(a18)

This is equivalent to:

$$\frac{1+\sqrt{\frac{9\theta+9-8(1-\alpha)^2}{9}}-\alpha}{\alpha}>0$$

(a19)

Since $0<\alpha<1$, the Denominator of (a19) is positive, so we need to focus on the Numerator only:

$$1-\alpha+\sqrt{\frac{9\theta+9-8(1-\alpha)^2}{9}}>0$$

(a20)

(a20) is always verified for $0<\alpha<1$ - it is the sum of two positive terms, $(1-\alpha)$ and the square root - so the Numerator of (a19) is positive and $c_2>1$.

□

Lemma 2: $c_1>1$ *if* $\theta < F(\alpha)=\frac{17(1-\alpha)^2-9}{9}$; $0<c_1<1$ *if* $F(\alpha) < \theta < G(\alpha)=\frac{8(1-\alpha)^2}{9}$; $c_1<0$ *if* $\theta > G(\alpha)$;

where c_1 *is given by (a16).*

Proof:

Consider, first, the condition for $c_1>0$:

$$\frac{1-\sqrt{\frac{9\theta+9-8(1-\alpha)^2}{9}}}{\alpha}>0$$

(a21)

Given that $0<\alpha<1$, the Denominator is surely positive, so we need to study only the Numerator:

$$1-\sqrt{\frac{9\theta+9-8(1-\alpha)^2}{9}}>0$$

(a22)

which is equivalent to:

$$1 > \frac{9\theta + 9 - 8(1-\alpha)^2}{9}$$

(a23)

Call:

$$G(\alpha) \equiv \frac{8(1-\alpha)^2}{9}$$

(a24)

Given that $0<\alpha<1$, it is clear that $0< G(\alpha)< \frac{8}{9}$.

From (a23), we see that $c_1>0$ if $\theta<G(\alpha)$; $c_1<0$ if $\theta>G(\alpha)$.

Consider, now, the condition for $c_1<1$[26]:

$$\frac{1-\sqrt{\frac{9\theta + 9 - 8(1-\alpha)^2}{9}}}{\alpha} < 1$$

(a25)

This is equivalent to:

$$\frac{1-\alpha-\sqrt{\frac{9\theta + 9 - 8(1-\alpha)^2}{9}}}{\alpha} < 0$$

(a26)

Given that $0<\alpha<1$, the Denominator is surely positive, so we need to study only the Numerator:

$$1-\alpha-\sqrt{\frac{9\theta + 9 - 8(1-\alpha)^2}{9}} < 0$$

(a27)

Call:

$$F(\alpha) \equiv \frac{17(1-\alpha)^2 - 9}{9}$$

(a28)

Given that $0<\alpha<1$, it is clear that $-1< F(\alpha)< \frac{8}{9}$.

[26] *If $\theta>G(\alpha)$,* then $c_1<0<1$; if $\theta<G(\alpha)$, then it makes sense to check whether c_1 is lower or higher than 1.

From (a27), we see that $c_1<1$ if $\theta>F(\alpha)$; $c_1>1$ if $\theta<F(\alpha)$.

Notice that $F(\alpha)< G(\alpha)$:

$$\frac{17(1-\alpha)^2-9}{9} < \frac{8(1-\alpha)^2}{9}$$

(a29)

This is equivalent to:

$$9(1-\alpha)^2-9<0$$

(a30)

which is always true for $0<\alpha<1$.

It follows that: $c_1>1$ if $\theta < F(\alpha)$; $0<c_1<1$ if $F(\alpha) < \theta < G(\alpha)$; $c_1<0$ if $\theta > G(\alpha)$.

□

Recall from Result 1 that (9) is verified - i.e. $\Pi_{MNE}^{FDI} > \Pi_{MNE}^{JV}$ - for $c>c_2$ or $c<c_1$, and combine this result with Lemma 1 and Lemma 2. Recall also that $0<c<1$, by assumption of the model.

i) If $\theta<F(\alpha)$, then $c_1>1$ from Lemma 2; given that $c_2>1$ from Lemma 1, (9) is always true for $0<c<1$ (See Figure a1: the horizontal line depicts values of c; the bold traits indicate the interval in which (9) is true; according to the model assumption, c is defined only between 0 and 1, i.e. in the white area):

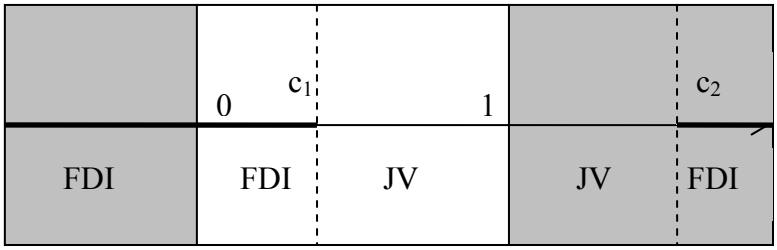
Figure a1: FDI versus JV ($c_1>1$)

This means that – in the model range for c - Foreign Direct Investment is always preferable to joint-venture because it provides the MNE with higher profits.

□

ii) If $F(\alpha) < \theta < G(\alpha)$, then $0<c_1<1$ from Lemma 2; given that $c_2>1$ from Lemma 1, for $0<c<1$ (9) is verified – namely FDI entails higher profit than JV - for $0<c<c_1$ (See Figure a2):

Figure a2: FDI versus JV ($0<c_1<1$)



Furthermore notice that the profit gap for the MNE, between FDI and JV $(\Pi_{MNE}^{FDI} - \Pi_{MNE}^{JV})$ increases as long as *c* decreases.

From (2), (3) and (8), we see that the profit gap equals:

$$(\Pi_{MNE}^{FDI} - \Pi_{MNE}^{JV}) \equiv \frac{2}{9}(1-\alpha)^2 - \frac{\theta}{4} - \left[1-(1-c\alpha)^2\right]\frac{1}{4}$$

(a31)

Now compute the derivative of $(\Pi_{MNE}^{FDI} - \Pi_{MNE}^{JV})$ with respect to *c*:

$$\frac{d(\Pi_{MNE}^{FDI} - \Pi_{MNE}^{JV})}{dc} = -\frac{1}{2}(1-c\alpha)$$

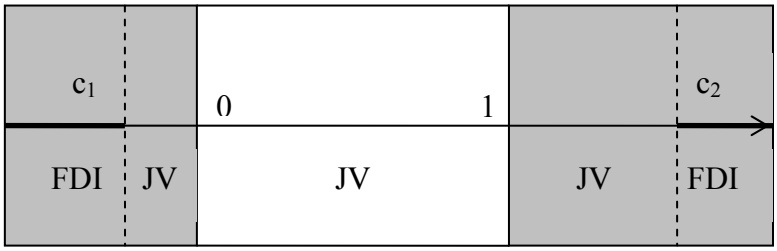
(a32)

For $0<\alpha<1$ and $0<c<1$, (a32) is negative, namely a decrease in *c* (more cost reduction through knowledge spillover) increases the profit gap, for the MNE, between FDI and joint-venture.

□

iii) If $\theta > G(\alpha)$, then $c_1<0$ from Lemma 2; given that $c_2>1$ from Lemma 1, (9) is never true for $0<c<1$ (See Figure a3):

Figure a3: FDI versus JV ($c_1<0$)



This means that $\Pi_{MNE}^{FDI} < \Pi_{MNE}^{JV}$ for $0<c<1$, and FDI in never chosen.

□

iv) Recall from (a28) that: $-1 < F(\alpha) < \frac{8}{9}$. *Case i)* requires $\theta < F(\alpha)$, but θ is strictly between 0 and 1 in the model so, when $-1 < F(\alpha) < 0$, θ cannot be lower than $F(\alpha)$. What are the values of α such that $-1 < F(\alpha) < 0$?

$$\frac{17(1-\alpha)^2 - 9}{9} < 0$$

(a33)

Call:

$$\alpha_1 \equiv 1 - \frac{3}{\sqrt{17}} > 0$$

(a34)

$$\alpha_2 \equiv 1 + \frac{3}{\sqrt{17}} > 1$$

(a35)

Remember that $0 < \alpha < 1$: (a33) is true for $\alpha_1 < \alpha < 1$. For these values of α, $F(\alpha) < 0$, so case i) never occurs.

□

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***
FDI	Dummy variable, 1 if FDI, 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 + patents - 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: firm-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: firm-level *control* regressor. Source: personal elaborations from ISTAT data.
SALES	Sales of the parent company (billions Euro). Type: firm-level *control* regressor. Source: AIDA
HFDI	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
VENETO	Dummy variable, 1 if the parent firm's headquarter is located in Veneto, 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 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 regressor. Source: Gwartney et al. (2004)
POP	Population of the host country (millions of inhabitants). Type: country-level regressor. Source: http://humandevelopment.bu.edu/
TRADE	Degree of openness of the host country, measured by (Import+Export)/GDP. Type: country-level 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 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 core variables

	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*	*0.7270*	*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*