Dissipation of Knowledge and the Boundaries of the Multinational Enterprise

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Summary

This paper provides a theoretical formalisation of the joint-venture contract, as an alternative to Foreign Direct Investment (FDI), within a *Dissipation of Intangible Assets* framework. In a two-period model, we discuss how the threat of knowledge spillover shapes the boundaries of a Multinational Enterprise. Similarly to the theoretical findings on the FDI-licensing trade off, we show that the integrated solution is more likely to emerge when know-how easily spills over – i.e. when firms are endowed with more Intangible Assets or they belong to high tech industries. Probit estimates, from a new firm-level dataset, show that Japanese manufacturing operations in Europe are in line with these predictions.

Keywords: Dissipation, Intangible assets, FDI, joint-venture, Internalisation, Japan

JEL Classification: F23, C25, O5

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1. Introduction

Multinational Enterprises (MNEs) have become key players in globalised modern economies, raising a vivid debate, among policy makers and academics, about their determinants and effects.

MNEs mainly operate abroad through Foreign Direct Investment (FDI), even though we adopt a broader definition here and call "multinational" a firm that is servicing a foreign market in general; the label FDI is instead restricted to the case of wholly-owned subsidiaries (WOS), as opposed to partial ownership typical of joint-ventures (JV).

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Recent years have witnessed a dramatic increase in Foreign Direct Investment and trade in intermediate goods so that, already in the 1990s, more than 40 percent of US imports took place within the boundaries of multinational firms (Zeile 1997), and roughly one third of world trade now occurs intra-firm (Antras 2003).

The terms of "outsourcing", "slicing up the value chain", "disintegration of production" have been coined to label the increasing interconnection of production processes in a vertical trading chain that touches many countries, with each country specializing in a particular stage of production (Hummels et al. 2001; Feenstra 1998; Feenstra and Hanson 1996).

Vertical specialisation takes two primary forms since international operations may be organized either "internally" – in wholly-owned subsidiaries – or "externally" – under arm's length contracts with independent local producers: we call *FDI* or *integration* the first case, while *relying on the market* or *outsourcing* refer to the second one. The decision over the boundaries of the firm – also known as *Internalisation issue* or *entry mode* - concerns the choice between keeping production internal to the firm and relying on the market.

What accounts for a Multinational Enterprise's choice of integration versus outsourcing?

Firms' make-or-buy decision is usually explained in terms of costs and benefits of using the market (Coase 1937; Williamson 1985). Internalising typically brings direct cost penalties, in terms of knowledge, expertise and cost advantage; however, relying on the market may be highly risky due to a number of obstacles such as technology transfer (see, among others: Teece 1977, 1986, Rugman 1986), informational asymmetries (Ethier 1986), moral hazard (Rugman 1985, 1986, Horstmann and Markusen 1996), and reputation concerns (Horstmann and Markusen 1987b). This trade off arises in the domestic, as well as in the foreign scenario, but it is likely that operating abroad exacerbates the costs of outsourcing.

Broadly speaking, we should recognize that there exist different ways of servicing a foreign market – from export to FDI, from joint-venture (JV) to licensing – each of them involving a different degree of knowledge transfer from the parent to the local firms.

While many authors mention the JV 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*.

This paper provides a first attempt at modelling joint-ventures, as an alternative to Foreign Direct Investment, within the *Dissipation of Intangible Assets* (DIA, see Section 2) framework.

In a two-period model, we discuss how the threat of knowledge spillover shapes the boundaries of the Multinational Enterprise.

Similarly to the findings on the FDI-licensing trade-off (see, among others: Ethier and Markusen 1996; Fosfuri 2000; Mattoo et al. 2001;

Markusen 1998, 2001; Fosfuri at al. 2001; Saggi 1996, 1999; Glass and Saggi 2002a), we show that integration is more likely to emerge when know-how easily spills over – i.e. when firms are endowed with more Intangible Assets (IAs) or they belong to high tech industries.
Notice that the DIA approach mainly accounts for theoretical contributions, due to the lack of firm-level data, which makes it hard to test the relevance of IAs on firm's entry mode decision.
For the purpose of the present work, we have constructed a new firm-level dataset on Japanese manufacturing activities in Europe, covering more than 600 observations of joint-venture and Foreign Direct Investment establishments. Basing on these data, Probit estimates match with our model predictions.
The paper is organized as follows: in Section 2, we provide a literature review on the *Internalisation issue*, with a particular focus on knowledge dissipation; Section 3 presents the theoretical model, while Section 4 is entirely devoted to the empirical analysis – data description, methodology and Probit estimates; Section 5 concludes and sets the future agenda.

2. Literature Review

2.1 A general overview

In the last 20 years, the literature on Multinational Enterprises has basically developed around Dunning's OLI framework, considering *Ownership*, *Location* and *Internalisation* advantages as an explanation of Foreign Direct Investment (Dunning 1993).
If MNEs were exactly identical to domestic firms, they would not find it profitable to enter the domestic market, due to the high cost of doing business abroad; since FDIs indeed exist, it must be the case that multinational firms possess some inherent advantage, easily exploitable through direct investment. *Ownership advantages* refer to some product, know-how, reputation or production process to which other firms do not have access. *Location advantages* arise when it is profitable to produce directly in the domestic market, rather than producing at home and servicing the local market via export. *Internalisation advantages* represent the most abstract concept, and relate to the boundaries of the firm.
The earliest studies on MNEs combined Ownership and Location considerations (see, for instance Helpman 1984, 1985; Markusen 1984; Helpman and Krugman 1985; Horstmann and Markusen 1987a, 1992; Brainard 1993), while the *Internalisation issue*[1] has been treated later.

[1] For extensive surveys, see Markusen (1995), Barba Navaretti and Venables (2004), Saggi (2000).

Theories on the boundaries of the Multinational Enterprise can be grouped according to three strands, namely: a) *Theories of the Firm*; b) *Agency Costs*; c) *Dissipation of Intangible Assets*.

The first approach – which we call *Theories of the Firm* - embraces recent contributions in which the firm's make-or-buy decision, at an international level, is assessed through the opening up of the "black box" - traditionally explored by the theorists of the firm – and the simultaneous endogenization of the market environment – as in the International Economics tradition. In particular, three Archetypes – the Grossman-Hart-Moore (G-H-M) treatment of hold-up and contractual incompleteness (Grossman and Hart 1986; Hart and Moore 1990), the Holmstrom-Milgrom (H-M) view of the firm as an incentive system (Holmstrom and Milgrom 1994) and the Aghion-Tirole (A-T) conceptualisation of formal and real authority in organisations (Aghion and Tirole 1997) – have been embedded in industry and general equilibrium models, offering a complete characterisation of the interactions between ownership and location, although confined to a limited menu of contractual arrangements. The boundaries of the Multinational Enterprise are shaped by a comparison between governance and transaction costs in the G-H-M framework (see, among others: Grossman and Helpman 2002, 2003; Antras and Helpman 2004; Antras 2003; Feenstra and Hanson 2003, 2004; Ottaviano and Turrini 2003), by a trade off between control and initiative in the A-T formalisation (Marin and Verdier 2002, 2003), while in Holmstrom-Milgrom-based contributions outsourcing tends to be characterized by high powered incentives whereas Integration emerges when workers earn a fixed wage and use firms' tools (Grossman and Helpman 2004; Feenstra and Hanson 2003, 2004)[2].

The second approach to Internalisation focuses on a different set of costs – called *Agency Costs* - incurred by the multinational (the principal) in contracting with an independent local firm (the agent). They are associated with monitoring the employees and motivating the managers in a setting in which a standard principal-agent problem arises, since the agent's actions are not perfectly observable, and the two parties' interests may not be completely aligned. Although an independent local firm may have superior information about the state of the market, it is not necessarily in her interest to reveal it to the MNE; the agent is likely to have different objectives and the imperfect observability of her actions leaves room for shirking. In Horstmann and Markusen (1996) sales are a function of the agent's effort plus a random component, known to the local firm, but not to the principal. Therefore the multinational cannot distinguish whether a low level of sales is related to low effort by the agent or to a bad state of the market. If designing an incentive scheme, to induce appropriate agent's effort, is too costly for the multinational firm, it may opt for an integrated solution.

[2] For a survey see Gattai (2005).

Another major motive for Internalisation arises from the risk of *Dissipation of Intangible Assets,* while contracting abroad. Intangible Assets may consist either of a stock of goodwill – associated with the *reputation* for product quality – or of superior *knowledge* – related, for instance, to the production process or some managerial techniques.

Suppose that a Multinational Enterprise, renowned for its product quality, has to decide whether to operate abroad via FDI or relying on the market. In Horstmann and Markusen (1987b), exporting, setting up a wholly owned-subsidiary and licensing are considered alternative entry modes. The key argument, here, is that a foreign party may have too few incentives to maintain the MNE's *reputation* high, although benefiting from its strong brand image. This implies that any licensing agreement must provide the licensee with the adequate incentives to enhance the multinational's reputation. When providing incentives of this sort becomes too costly for the foreign firm, it decides to internalise production, thus avoiding the risk of dissipating reputation.

Knowledge is another key resource that a Multinational Enterprise may wish to employ in its foreign activities. This is quite a particular good: some types of knowledge are very difficult to transfer outside the boundaries of the firm in which they originate, while some others easily become available to third parties, once revealed. The first case refers to several forms of know-how that are, to some extent, embodied in the human capital of the employees. Due to its tacit component, it can be difficult to transfer knowledge[3] without direct personal contacts between the contracting parties, lengthy demonstrations and constant involvement. The second case relates more specifically to technology, as an Intellectual Property, i.e. an asset covered by Intellectual Property Rights (IPRs) that define the extent to which their owners may exclude others from activities that infringe or damage the property; the need for IPRs arises from the fact that a piece of potentially valuable information would otherwise suffer from overuse - since access to it is free – therefore limiting the incentives to innovate[4].

Firms' Intangible Assets have a joint-ness or "public good" nature; they can be supplied to additional production facilities at very low costs, thus posing serious questions on the most appropriate mode of foreign production.

Notice that *dissipation*, in this framework, entails different meanings, depending on the asset under consideration: in the case of knowledge – human capital and technology – a spillover mechanism is likely to help the local counterpart in taking over production secrets, copy final

[3] The intrinsic costs of knowledge transfer by MNEs have been empirically investigated in Caves (1974), Teece (1977), and further discussed and documented in Teece (1986), Davidson and Mc Fetridge (1984), Ramachandran (1993), Glass and Saggi (1999).

[4] Under the classical intellectual-property doctrine, we distinguish between two forms of property: industrial property and artistic & literary properties; assets of the first type are usually protected through patents, trademarks, breeder's rights and trade secrets, while artistic & literary properties can be covered by copyrights. For an extensive review of these practices, see Maskus 1998.

goods and eventually start a rival firm on the basis of the "stolen" asset; in the case of reputation, dissipation occurs because the local counterpart benefits form the MNE's brand image, but puts no effort in maintaining and enhancing it. The risk of dissipating any of the firm's key assets provides a motive for keeping production internal rather than relying on the market.

For the purpose of the present work, we move within the DIA framework and, while abstracting from any reputation consideration, we focus only on knowledge, as an asset that is likely to be dissipated during foreign operations. Having provided a basic insight on the topic, it is worth going into the details of the existing literature, which we briefly discuss below. This provides the natural introduction to our own contribution.

2.2 Dissipation of knowledge

Ethier and Markusen (1996) develop a two-period model in which a firm decides whether to internalise production in a foreign country or to operate through arm's length agreements. Working within firm's boundaries, in a wholly-owned subsidiary, involves a fixed cost of doing business in an unknown market, but guarantees lower manufacturing costs; export entails no fixed cost, but higher manufacturing costs; under a licensing contract, production takes place in the host market but outside the firm's boundaries, posing the threat of knowledge dissipation to a licensee that might be capable of producing alone in the second period, through the technology learnt in the first one. As a result, MNEs are more likely to emerge, the more important the Intangible Assets, the lower the discount factor between the first and the second period, the larger the wage gap between the source and the host country and the more concentrated the recipient market.

In Fosfuri (2000), a firm endowed with a new technology has to choose an entry mode among export, licensing and direct investment in order to serve a foreign market. The vintage of the transferred technology is endogenized and the model allows for imitation by the licensee, while subsidiary production and exports are assumed to avoid imitation but entail higher costs for the innovating firm. Notice that the MNE can strategically use the vintage of its technology in order to deter imitation by the local firm; as a result, transfers to affiliates might be of later vintage relative to technologies sold to independent local firms.

Mattoo et al. (2001) develop a model of FDI in which a foreign enterprise can choose between direct entry – what we call Integration – and the acquisition of an existing domestic firm. The Internalisation decision has a direct impact on the local market degree of competition: if we assume that there exists only one domestic firm, setting up a wholly-owned subsidiary results in a Cournot duopoly, while partnering with a local enterprise corresponds to a monopoly[5].

[5] In the paper, they also make a more general case in which the local market is populated by n firms. Under this assumption, the choice of FDI results in a n+1 firms

Production costs are the same for both the foreign and the local firm and technology transfer is assumed to be cost reducing. Prohibitively high or particularly low technology transfer costs generate a divergence between the MNE and the local government most preferred mode of entry, while for intermediate levels, the preferences are aligned and there is no need for policy intervention.

The debate on the effects of Foreign Direct Investments on the host country is at the core of Markusen (1998, 2001)'s two-period model, where contract enforcement – in the form of IPR protection – is shown to influence FDI inflow to developing countries and host countries welfare[6]. While stronger IPR protection leaves the multinational better off, the host country effects are more ambiguous, depending on whether local production would occur even without contract enforcement or not. Differently from the other models in which keeping production within firm's boundaries provides a solution against asset dissipation, here the multinational may find it optimal to export, instead of investing, in order to protect its technology. This result comes from the specific modelling of the FDI case, very close to the licensing contract designed elsewhere.

A similar view is taken in Fosfuri et al. (2001) in analysing the spillover effects of FDI on the whole population of local firms[7] and their interactions with the entry mode decision of a Multinational Enterprise, endowed with a superior technology. In this model, export comes without any knowledge dissipation, while FDI involves technology transfer – as in Markusen (1998, 2001) - through the training of a local worker.[8] According to this framework, the MNE and the local firm do not interact by means of a partnership agreement, but in the run for the trained worker. In solving the model, the authors show that technological spillovers do not occur if the joint profit of the MNE plus the local firm is highest when the multinational

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Cournot game, while operating with a domestic firm collapses in a n firms Cournot market structure.

[6] Transferring technology in the absence of patent protection poses notable risks to an innovating firm in also in Vishwasrao (1994). As an assumption of the model, production of final goods can take place only in two countries of the world, denoted by North and South; a Northern firm has invented and patented a new good, which it wants to introduce to the Southern market, via licensing, export or FDI; IPRs are protected in the North, but not in the South; technology transfer may occur, under a licensing agreement, through imitation. Basing on a different set of theoretical tools, Vishwasrao (1994) incorporates this asymmetric information in a screening game where the Northern enterprise attempts to find a contract that provides information about the local firm's ability to imitate. In choosing between licensing and Foreign Direct Investment, foreign firms trade off the benefit of lower costs with the risk of dissipating knowledge through technology transfer.

[7] This is a notable difference, with the respect to the literature reviewed in this Section, in that it deals with spillover effects to the whole population of domestic firms, rather than on the single firm engaged in the licensing agreement together with the multinational.

[8] Here they are interested in a particular kind of spillover, based on workers mobility. Other sources of spillover are backward and forward linkages (Lall 1980, Rodriguez-Clare 1996), and demonstration effects from foreign affiliates to local firms (Mansfield and Romeo 1980, Blomstrom 1986).

can use the technology as a monopolist; moreover, they find that a low level of absorptive capability by the local firm reduces the potential for FDI generating spillover[9].

In Saggi (1996), the choice of integration, relative to licensing, is motivated by the wish to protect the MNE's key resources not only in the domestic market, but in all the markets in which it potentially competes with a local firm, adding an element of novelty to the existing literature. As a result, FDI becomes a more preferable option if competition from a licensee in one market erodes the licensor's profit in other markets, whereas licensing is chosen if competition can be prevented.

This analysis is extended in Saggi (1999)'s two-period duopoly model, in order to study the impact of the entry mode choice on the incentives for innovation. Relative to licensing, Foreign Direct Investment limits technology spillovers, but dissipates more rents. As a result, the domestic firm's technological development receives the strongest boost if the foreign firm were to follow initial licensing and FDI; however, since the foreign firm's profits under FDI vary inversely with the quality of the domestic firm's technology, it does not choose the selected combination of entry modes, leaving room for policy intervention.

A similar point is made in Glass and Saggi (2002a) where the *Internalisation issue* – FDI versus licensing – is shown to play a role in determining the rate and magnitude of innovation. This paper entails an interesting difference, with respect to the related literature, since the licensing contract is characterized by profit sharing between the foreign and the local firm, rather than having the licensee paying a fee to the licensor and retaining total revenues. In taking the Internalisation decision, MNEs thus trade off the cost disadvantage of operating alone, with the profit retention by the local firm. When the mode choice is fixed, a subsidy to multinational production - by reducing the cost disadvantage of producing abroad - increases the rate, but decreases the size of innovation; when the mode can switch, the rate and level of innovation both increase, provided that the subsidy is not too large[10].

To the best of our knowledge, studies on the boundaries of the Multinational Enterprise, inspired by the *Dissipation of Intangible Assets,* basically cover theoretical contributions. The reason for that is

[9] Technology transfer arising from labour movements is also at the core of Glass and Saggi (1999)' duopoly model. By assumption, all the workers employed by a Multinational Enterprise acquire knowledge of its superior technology; being hired by a local firm, those workers partially dissipate the MNEs intangible assets. In order to prevent workers from leaving the company, the Multinational Enterprise pays a wage premium if local firms are sufficiently disadvantaged and/or there are sufficiently many local firms.

[10] A different result is obtained in Glass and Saggi (2002b)' product cycle model, stronger IPR protection – through the imitation disincentive and resource wasting effects – decreases both innovation and FDI, because multinational firms feel more secure from imitation.

perhaps the difficulty in finding firm-level datasets in order to test the theoretical priors.

A few exceptions are given by Mansfield et al. (1979), Mansfield and Romeo (1980) and Smith (2001), where entry mode and technology transfer decisions by US multinationals are analysed.

Mansfield et al. (1979), Mansfield and Romeo (1980) find that knowledge is more likely to be transferred internally when it is relatively deep and new, since losses from spillover are potentially higher.

In Smith (2001)'s gravity model, the impact of IPR protection is shown to play a role in shaping the servicing choice of US multinationals, within an OLI framework which allows for simultaneity of export, FDI and licensing decisions. As long as IPR protection becomes stronger, by increasing the ownership advantage, it prompts a rise in bilateral exchanges of any kind; moreover, by conferring location advantages, it increases FDI and licensing relative to export, and by strengthening internalisation advantages, it pushes towards licensing.

From the papers reviewed above, it should stand clear that the literature on the *Internalisation issue*, based on the DIA approach, has focused solely on licensing and export, as an alternative to Foreign Direct Investment.

Nonetheless, we should recognize that there exist various ways of servicing a foreign market – export, FDI, joint-venture and 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, the latter being very close to the licensing case, except for the fact that the multinational participates in final good production together with the local partner.

While many authors mention the JV 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 a DIA framework.

In our view, this lack represents one of the main shortcomings of the related literature, given the significant and broadly documented empirical relevance of joint-ventures (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).

The model presented in Section 3 is an attempt at filling this gap, considering a foreign firm's decision of FDI versus JV, grounded on the risk of dissipating knowledge.

3. The model

In a setting similar to Barba Navaretti and Venables (2004), consider a simple economy in which a multinational firm is willing to produce a final good abroad; the MNE has to decide whether to serve the foreign market via FDI or in joint-venture with a local firm[11].

Final good production requires two activities, x and y, which we call *input manufacturing* and *processing* for expositional convenience; technology is linear, i.e. firms employ 1 unit of input to obtain 1 unit of output; x and y are normalized to 1 for simplicity, making sales revenues R constant.

Notice that these activities 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, while the other party does better in input manufacturing[12].

To capture this idea, we assume that the per unit cost of x is a ($a>0$) if this activity if performed by the local firm, $a\alpha$ ($\alpha \geq 1$) if it is, instead, due to the multinational, while the per unit cost of processing is c ($c>0$) or γc ($\gamma \geq 1$) depending on whether the MNE or the local firm acts respectively.

As in (Ethier and Markusen 1996; Saggi 1999; Fosfuri 2000; Markusen 2001), the time horizon covers two periods, which we denote by subscripts 1 and 2; *MNE* and *local* stand for the multinational and the local firm respectively; in principal, we allow for different discount factors for the foreign ($\delta \geq 0$) and the domestic ($\tilde{\delta} \geq 0$) firm.

Operating through Foreign Direct Investment means that the multinational enterprise keeps production within its boundaries, by means of a local subsidiary; in this case it is the same firm that performs both input manufacturing and assembly.

The very essence of a joint-venture agreement lays, instead, in the partners' complementary skills: 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[13].

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[11] In order to keep the formalisation as simple as possible, we do not include set up costs in the foreign market, and we abstract from any matching consideration between the MNE and the local company, taken as given the pair of partners.

[12] This assumption is broadly consistent with the Japanese experience in Europe, presented in Section 4. Empirical evidence shows that Japanese multinationals tend to contribute know-how and technology while relying on their local partner for input supply (Jetro 2004a).

[13] 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

Consider, first, the FDI case.
Equation (1) gives the present value of the MNE profit when final good production is internalised.

$$\Pi_{MNE}^{FDI} = R_1 - a\alpha - c + \frac{R_2 - a\alpha - c}{1+\delta} \tag{1}$$

By operating alone, the Multinational Enterprise benefits from keeping entire revenues R_1 and R_2 in both periods, but it entails higher costs in input manufacturing, with respect to the local firm.
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:

$$\Pi_{MNE}^{JV} = \theta R_1 - c + \frac{\bar{\theta} R_2 - c}{1+\delta} \tag{2}$$

$$\Pi_{local}^{JV} = (1-\theta) R_1 - a + \frac{(1-\bar{\theta}) R_2 - a}{1+\tilde{\delta}} \tag{3}$$

Notice that, in a joint-venture, the two parties operate very close to each other, which allows for a knowledge spillover from the MNE to the local firm during the first period: having access[14] to the multinational intangible assets, the partner learns about the processing procedure so that her cost disadvantage γ drops from a prohibitively high value in the first period to a level $\tilde{\gamma}$ in the second one, with $\gamma > \tilde{\gamma} \geq 1$.
It follows that the local firm has the option of breaking up the JV contract at the beginning of the second period, 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 the it has just a poor knowledge of the local market, with respect to the partner[15].
In case of defection – denoted by superscript *d* - the local firm makes profit:

$$\Pi_{local}^{d} = (1-\theta) R_1 - a + \frac{R_2 - a - \tilde{\gamma} c}{1+\tilde{\delta}} \tag{4}$$

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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 3.

[14] 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.

[15] In other DIA papers, this asymmetry is captured by a fixed cost of operating abroad (see, for instance: Ethier and Markusen 1996; Saggi 1996; Fosfuri 2000; Fosfuri at al. 2001).

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 second period profit, under the JV agreement, is not lower that its profit in starting a rival firm, i.e.:

$$(1-\bar{\theta})R_2 - a \geq R_2 - a - \tilde{\gamma}c \tag{5}$$

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

$$\bar{\theta} \leq \frac{\tilde{\gamma}c}{R_2} \tag{6}$$

The multinational firm chooses to integrate, rather than partnering if its profits Π_{MNE}^{FDI} from (1) are greater that Π_{MNE}^{JV} from (2), evaluated at the incentive compatible value of the second period share $\bar{\theta} = \frac{\tilde{\gamma}c}{R_2}$:

$$\theta R_1 - c + \frac{\bar{\theta}R_2 - c}{1+\delta} < R_1 - a\alpha - c + \frac{R_2 - a\alpha - c}{1+\delta} \tag{7}$$

After some re-arranging, equation (7) gives the following condition:

$$R_1(1-\theta) - a\alpha + \frac{R_2 - a\alpha - \tilde{\gamma}c}{1+\delta} > 0 \tag{8}$$

where θ is an endogenous variable yet to be determined. Suppose that the multinational invites local firms to bid for the first period share: under this assumption θ results from the Participation Constraint, $\Pi_{local}^{JV} = 0$:

$$(1-\theta)R_1 - a + \frac{\left(1 - \frac{\tilde{\gamma}c}{R_2}\right)R_2 - a}{1+\tilde{\delta}} = 0 \tag{9}$$

Solving (9) for *(1- θ)*, we obtain:

$$(1-\theta) = \frac{a}{R_1} - \frac{\left(1 - \frac{\tilde{\gamma}c}{R_2}\right)R_2 - a}{(1+\tilde{\delta})R_1} \tag{10}$$

By substituting (10) in (8), after some re-arranging, equation (11) gives the condition for the multinational to internalise:

$$(\delta - \widetilde{\delta})(R_2 - \widetilde{\gamma}c) > a\left[\alpha(1+\widetilde{\delta})(2+\delta) - (1+\delta)(2+\widetilde{\delta})\right] \qquad (11)$$

In choosing between FDI and JV, the multinational trades off the benefits of protecting its Intangible Assets against the threat of dissipation, with the efficiency loss in terms of input manufacturing.

From (11) we see that, if $\delta = \widetilde{\delta}$, the MNE always chooses joint-venture rather than FDI. Indeed, it is ready to retain a low share $\overline{\theta}$ of sales revenues in the second period - satisfying the Incentive Compatibility Constraint - because this can be fully recouped by setting a high share θ in the first one – according to the Participation Constraint. Since the multinational is able to extract all surplus from the partner, it chooses to operate in joint-venture, to keep production efficiency high.

There are however circumstances in which the MNE is not able to extract the full surplus. This happens, for instance, when the two firms have different discount factors: if $\delta < \widetilde{\delta}$, the multinational puts more weight on the future than the local partner, and FDI may occur. Since the local firm discounts the second period profit more heavily, it is ready to accept a JV contract only if its first period share θ is sufficiently high, which implies a loss for the MNE. Therefore, integration is more likely the larger the difference in discount factors between the actors.

Moreover, from equation (11), we see that the smaller the multinational cost disadvantage α and the smaller $\widetilde{\gamma}$ - meaning a higher degree of knowledge spillover from the foreign to the local firm – the more appealing the FDI solution, confirming the empirical evidence of Mansfield et al. (1979), Mansfield and Romeo (1980).

At a broader level, we can conclude that Foreign Direct Investment, induced by the threat of knowledge dissipation, is more likely to emerge when know-how easily spills over – namely in high tech industries – when MNEs are able to borrow on capital markets at a lower cost – i.e. a higher discount factor – and when host countries governments do not provide strong IPR protection or the local counterpart is capable of fast learning.

Notice that these priors are broadly consistent with those derived for licensing (see Section 2) and they match with the empirical evidence on the choice between joint-venture and FDI (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).

4. Empirical Analysis

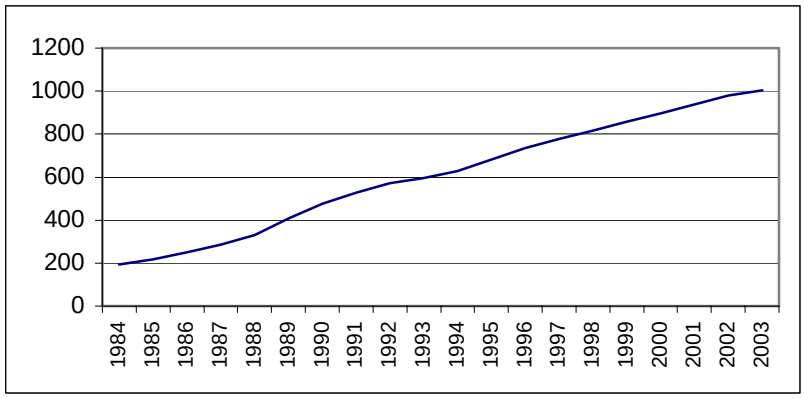
In this Section, we empirically assess the choice of FDI versus joint-venture of Japanese multinational companies in Europe, by means of a new firm-level dataset, constructed by the authors. The discussion is organized in three steps: first we present the data (4.1) and the methodology (4.2), and then we comment the empirical findings (4.3) and their matching with the theoretical predictions, derived in Section 3.

4.1 Data

Since the 1970s, Japanese Foreign Direct Investment has shown a steady trend upwards, driven by limited domestic opportunities and the need to seize openings abroad. The great boost came during the post Plaza agreement bubble period: with the JPY appreciating 46% between 1985 and 1987, FDI almost tripled (Blair and Freeman 2004). Yet, this trend continued even in the 1990s, notwithstanding the collapse of the bubble and the domestic stagnation.

As far as Japanese direct investment to EU15 is concerned, the fiscal year 2003 (April-March) has registered a clear fall in value terms, edging down 20% to 12,034 USD (Jetro 2004b), however the number of manufacturing affiliates in the European region[16] is still growing (see Figure 1).

Figure 1: Number of Japanese manufacturing affiliates in Europe (1984-2003)



Source: Our elaboration from Jetro (2004a)

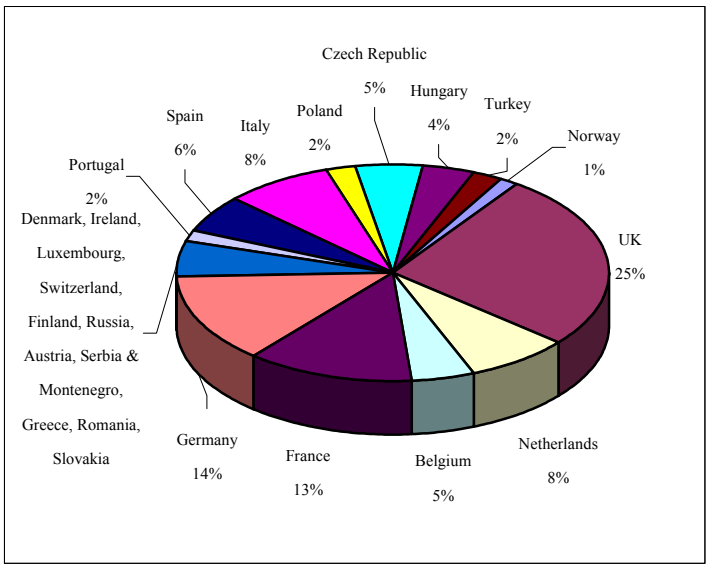
For the purpose of the present work, we have built a new firm-level dataset, covering the whole population of Japanese Multinational Enterprises, engaged in manufacturing activities within Europe - either operating alone (FDI) or in joint-venture with a local partner.

This sample, accounting for more than 600 observations, is the result of a merger between the *Kagai Shinshutsu Kigyo Soran* (2004) – which gives the list of Japanese investors all over the world – and the

[16] By Europe, we mean the countries of interest for our study, namely those depicted in Figure 2.

Kaisha Shikiho (2004) – which provides detailed information on all the Japanese corporations listed on the First Sections of Tokyo, Osaka, and Nagoya stock exchanges. Figure 2 gives the geographical distribution of Japanese activities.

Figure 2: Geographical distribution of Japanese operations in Europe



More than 80% of the operations take place within the EU15 countries, especially across the UK, Germany and France; around 60% of the factories are located in Euro currency-countries.
With respect to our previous discussion on the *Internalisation issue*, it is worth noticing that FDI is the most preferred mode of entry of Japanese companies in Europe, followed by majority joint-ventures (see Figure 3).
Independently of the contractual arrangement, the large majority of the operations were settled in the 1990-2000 period (47%), or between 1980 and 1990 (29%), while investments before 1970 account for a very few cases (see Figure 4).

Figure 3: Japanese share in the European affiliate

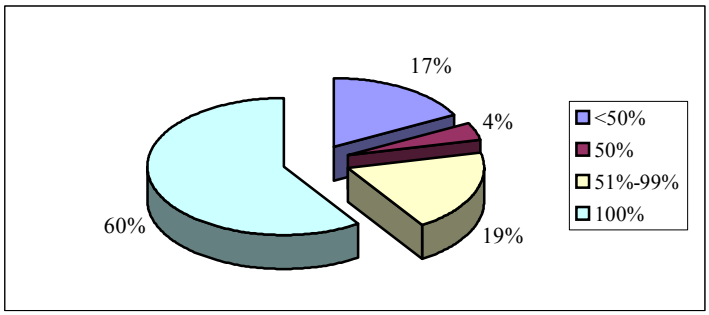
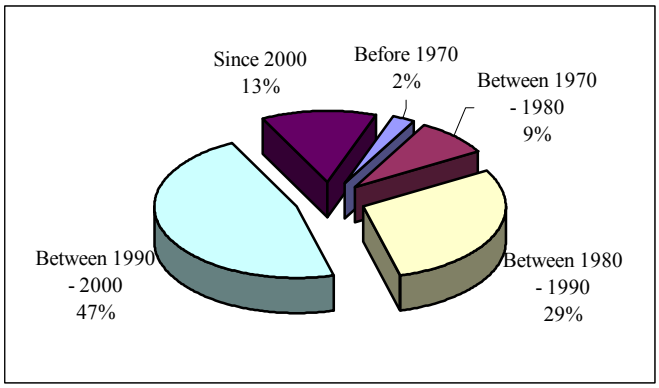
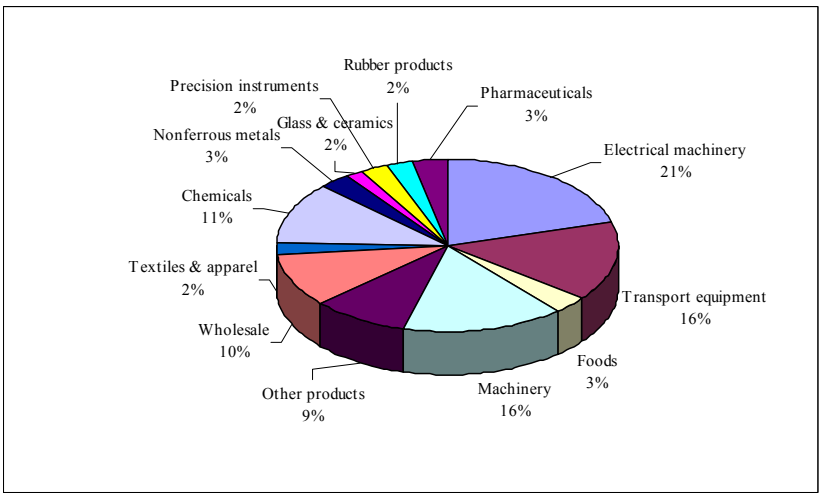


Figure 4: Establishment of the Japanese-invested affiliate in Europe



Japanese companies in our sample are usually large conglomerates, with more than 1000 employees (72%), average sales around 17.400 billions USD and massive investments in Research & Development (R&D)[17].
They belong to the Electrical Machinery (21%), Machinery (16%), and Transport Equipment (16%) industries the most, followed by Chemicals (11%), Wholesale (10%), Pharmaceuticals (3%), Foods (3%), Precision Instruments (2%) and Rubber Products (2%), as depicted in Figure 5[18].

Figure 5: Industry of the Japanese investors



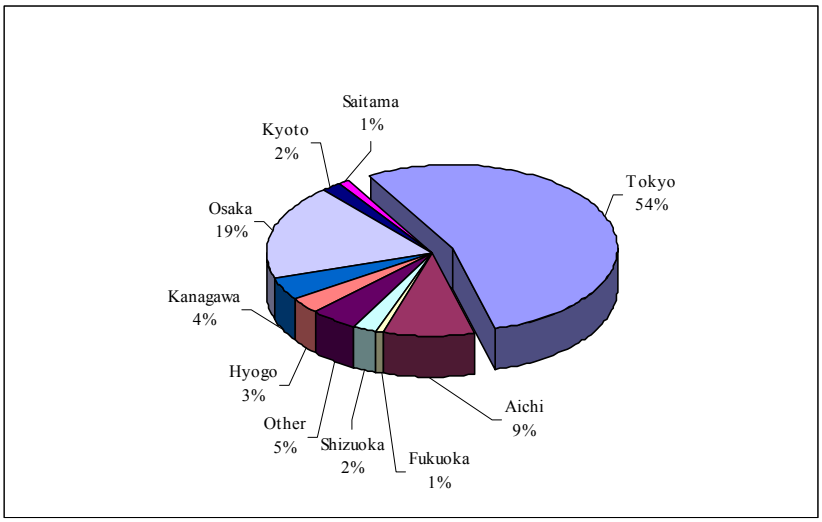
This distribution is not surprising, since Japanese firms are renowned to simply fall back on what they know best when they make an initial investment overseas (Blair and Freeman 2004).

[17] Average R&D expenditure in 2003 was 650 millions USD.

[18] Industries classification is taken from *"Kaisha Shikiho"* (2004) (*"*Japan Company Handbook Quarterly").

As far as the Prefecture of origin is concerned, we see from Figure 6 that the large majority comes from Tokyo (54%), followed by Osaka (19%) and Aichi (9%).

Figure 6: Prefecture of origin of the Japanese investors



4.2 Methodology

Based on the data described above, we regress the Internalisation decision – FDI versus joint-venture – of Japanese multinationals in Europe, within the DIA framework sketched in Section 3.
The empirical specification is as follows:

$$\underset{(nx1)}{FDI} = \underset{(nxm)}{F}\ \underset{(mx1)}{\alpha} + \underset{(nxk)}{C}\ \underset{(kx1)}{\sigma} + \underset{(nx1)}{\varepsilon} \qquad (12)$$

FDI is the *(n x 1)* dependent variable vector, whose elements take the value of 1 in case of wholly-owned subsidiary, 0 in case of joint-venture.
Explanatory variables are of two types: *F* is a *(nxm)* matrix including 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* variables: core variables are those measuring Japanese firms' Intangible Assets[19], over which priors have already been derived; control variables denote other firm-level characteristics that may play a role in shaping the Internalisation decision.
As a proxy for technology, alternative indicators are employed: *R&D* refer to the firm's expenses in Research & Development; *R&D/sales*

[19] Intangible Asset, here, means *knowledge*, as in the model described in Section 3.

gives R&D expenditure as a fraction of the firm's sales; *R&D_average* is the average value of R&D expenditure in the industry; *R&D_relative* measures firm's R&D expenditure relative to the industry mean, to capture technological leaders (as in Smarzynska 2000, 2002; Desai et al. 2002, to mention just a few).
All these variables refer to the consistency of the parent company's Intangible Assets, so we expect a positive sign, basing on the model described before: Internalisation, 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 or they belong to high tech industries.
Control variables include sales (*SALES,* as in Blomstrom and Zejan 1991; Meyer 1998; Smarzynska 2000, 2002); the average age of the employees in the parent company (*AGE)*; the year of the establishment in Europe (*YEAR_EU)*, the industry – *TRANSPORT*, *OTHER*, *WHOLESALE*, *NON FERROUS*, *GLASS* and *INSTRUMENTS* are dummy variables taking the value of 1 if the Japanese company belongs to Transport Equipment, Other Products, Wholesale, Non Ferrous Metals, Glass & Ceramics and Precision Instruments, respectively; to account for possible influence by the Prefecture of origin, *KANAGAWA* is a dummy equal to 1 if the parent firm is located in Kanagawa Prefecture, 0 elsewhere.

Table 1: Variables description

Variable	***Description***
FDI	Dummy variable, 1 if FDI, 0 if JV
R&D	R&D expenditure of the parent company (millions USD)
R&D/SALES	R&D expenditure over sales of the parent company
R&D_average	Mean R&D expenditure in the parent company industry (millions USD)
R&D_relative	R&D expenditure of the parent company over its industry mean
SALES	Sales of the parent company (billions USD)
AGE	Employees average age in the parent company
EU15	Dummy variable, 1 if the destination country belongs to EU15
EURO	Dummy variable, 1 if the destination country currency is Euro
YEAR_EU	Year of establishment in Europe
KANAGAWA	Dummy variable, 1 if the Prefecture of origin is Kanagawa
TRANSPORT	Dummy variable, 1 if the parent company belongs to the Transport Equipment industry
OTHER	Dummy variable, 1 if the parent company belongs to the Other Product industry
WHOLESALE	Dummy variable, 1 if the parent company belongs to the Wholesale industry
NON FERROUS	Dummy variable, 1 if the parent company belongs to the Non Ferrous Metals industry
GLASS	Dummy variable, 1 if the parent company belongs to the Glass & Ceramics industry
INSTRUMENTS	Dummy variable, 1 if the parent company belongs to the Precision Instruments industry
R&D/GDP	R&D as percentage of GDP in the host country
POP	Population of the host country (millions)
CORRUPT	Corruption Index of the host country (Kaufmann et al. 2003), ranging from 0 to 5, higher values meaning more corruption

B&F	Banking & Finance Index of the Host Country, as a variant of the overall Economic Freedom Index (Gwartney and Lawson 2004). It measures the relative openness of a country's banking and finance system. Lower values mean more freedom
TRADE	Degree of openness of the host country, measured by (Import+Export)/GDP (billions, GDP measured in USD))

Table 2: Correlation matrix of the core variables

	R&D	*R&D/SALES*	*R&D_relative*	*R&D_average*
R&D	*1.0000*			
R&D/SALES	*0.2543*	*1.0000*		
R&D_relative	*0.4121*	*0.1641*	*1.0000*	
R&D_average	*0.5473*	*0.4620*	*0.0155*	*1.0000*

As far as country variables are concerned, we include *TRADE*, as a measure of the host market degree of openness (as in Smith 2001; Smarzynska 2002), *POP,* describing the host country population (as in Smarzynska 2002, Smith 2001); a corruption index *CORRUPT* and a variant of the economic freedom index *B&F* (as in Smarzynska 2002); two dummy variables are also constructed to indicate whether or not the destination country belongs to the EU15 (*EU15*), and whether or not the destination country has Euro as its national currency (*EURO*); *R&D/GDP* expresses R&D as a percentage of the GDP in the host economy.
Table 1 provides a summary description of the variables included in Equation (12), while Table 2 displays the correlation matrix of the core variables.
Given the binary nature of the dependent variable *FDI*, regressions are carried out within a probit framework.

4.3 Results

Probit estimates are shown in Table 3.
Reminding the theoretical priors, it is worth noticing that all the core variables are significant with the expected sign in every specification; this provides quite a good matching between the theory and the data.
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 as long as the Japanese firms' Intangible Assets increase, the probability of internalising production, rather than operating in joint-venture, increases as well. *R&D*, *R&D/SALES*, *R&D_average*, *R&D_relative* all display the positive expected sign, meaning that wholly-owned subsidiaries are more likely to be settled by Japanese companies operating in high tech sectors, investing a lot in Research & Development, and being technological leaders in their respective sectors, as in Smarzynska (2000).
As in (Blomstrom and Zejan 1991; Meyer 1998), *SALES* turn out to be significant, with a negative sign, meaning that larger enterprises tend

to share ownership with a European partner, rather than operating alone. Furthermore, we find that investing within the EU15 encourages FDI, while investing in Euro countries pushes towards joint-ventures; more recent establishments are associated with a stronger preference for JV. Among our dummy control variables, *KANAGAWA*, *TRANSPORT*, *WHOLESALE*, *GLASS* and *NON FERROUS* are significant and negative, while *INSTRUMENT* and *OTHER* display a positive sign, providing empirical evidence on the sectors in which FDI are more likely to emerge.

As far as country variables are concerned, Table 3 shows that the larger the *R&D/GDP* ratio, the higher the degree of openness and transparency of the bank and finance sector, and the more corrupted and less populated the host country, the higher the preference for FDI confirming that partners are more useful in countries with less friendly investment climate, in lines with previous studies[20].

Table32: Probit estimates[21]

	FDI	*FDI*	*FDI*	*FDI*	*FDI*
R&D	0.162 (0.010)** [0.060]	0.19 (0.01)** [0.07]	0.19 (0.014)** [0.07]	0.17 (0.014)** [0.06]	0.43 (0.002)*** [0.162]
R&D/SALES	0.91 (0.000)*** [0.379]	0.71 (0.002)*** [0.267]	0.67 (0.004)*** [0.252]	0.54 (0.017)** [0.204]	
R&D_average					0.25 (0.07)** [0.093]
R&D_relative	0.253 (0.000)*** [0.095]	0.25 (0.001)*** [0.094]	0.25 (0.001)*** [0.094]	0.2 (0.001)*** [0.074]	0.13 (0.02)** [0.048]
SALES					-0.17 (0.005)*** [-0.066]
AGE		-0.061 (0.022)** [-0.023]	-0.059 (0.027)** [-0.022]	-0.058 (0.026)** [-0.022]	
EU15			0.57 (0.005)*** [0.221]		0.49 (0.013)** [0.191]
EURO			-0.39 (0.014)** [-0.144]		
YEAR_EU		-0.012 (0.072)* [-0.005]	-0.013 (0.074)* [-0.005]		
KANAGAWA			-1.32 (0.099)* [-0.469]		-1.35 (0.071)* [-0.477]

[20] A measure of IPR protection was also included, but it did not turn significant in any specification.

[21] Marginal effects in round brackets, P-value in square brackets. * 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 loglikelyhood value of the model of interest, and L_0 the maximum value of the loglikelyhood function when all the parameters, except the intercept, are set to 0. P-value^ denotes the P-value of the joint null-hypothesis.

TRANSPORT				-0.34 (0.034)** [-0.133]	
OTHER					0.96 (0.023)** [0.277]
WHOLESALE		-1.79 (0.001)*** [-0.573]	-1.79 (0.001)*** [-0.573]	-1.98 (0.000)*** [-0.602]	
NON FERROUS				-0.62 (0.050)*** [-0.242]	
GLASS			-0.81 (0.056)* [-0.315]	-0.75 (0.081)* [-0.293]	
INSTRUMENTS					0.96 (0.023)** [0.277]
R&D/GDP					0.22 (0.087)* [0.084]
POP					-0.87 (0.002)*** [-0.328]
CORRUPT		0.32 (0.003)*** [0.120]		0.33 (0.001)*** [0.127]	
B&F		-0.16 (0.029)** [-0.06]		-0.19 (0.009)*** [-0.071]	
TRADE			0.71 (0.014)** [0.268]		
Observations P-value^ Pseudo R^2	519 0.000*** 0.0546	495 0.000*** 0.1376	495 0.000*** 0.1395	514 0.000*** 0.1408	517 0.000*** 0.0856

5. Conclusion

Multinational Enterprises may wish to serve a foreign market through alternative channels, from export to FDI, from joint-venture to licensing, each of them involving a different degree of knowledge transfer from the parent to the local firms.

While the FDI-licensing trade off has been extensively documented in the theoretical literature based on the *Dissipation of Intangible Assets* (see Section 2), 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-period model that formalises the mechanism through which the threat of knowledge spillover shapes the boundaries of a Multinational Enterprise, between FDI and joint-venture.

In particular, we show that the integrated solution is more likely to emerge when know-how easily spills over – i.e. when firms are endowed with more Intangible Assets or they belong to high tech industries.

Probit estimates, based on a new firm-level dataset of Japanese production activities in Europe, are in line with these priors.

Given these promising results, we believe that it is worth carrying out further research within the DIA field: future steps should include the creation of an industry equilibrium model on the FDI-JV trade off, and

the treatment of the whole array of feasible contractual arrangements - namely joint-venture, licensing, export and FDI – in a single model. Further empirical evidence is also needed to test the relevance of the theoretical findings, in a multiple-home multiple-host perspective to control for possible selection bias.

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