Paper no. 2013/47

Commonalities and differences between production-related FDI (PFDI) and technology-related FDI (TFDI) in developed and emerging economies

Keyvan Alvandi (keyvan.alvandi@circle.lu.se)
CIRCLE, Lund University, Sweden

Cristina Chaminade (cristina.chaminade@circle.lu.se)
CIRCLE, Lund University, Sweden

Ping Lv (lvping@ucas.ac.cn)
University of Chinese Academy of Sciences, China

This is a pre-print version of a paper that has been submitted for publication to a journal.

This version: December 2013

Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE)
Lund University
P.O. Box 117, Sölvegatan 16, S-221 00 Lund, SWEDEN
http://www.circle.lu.se/publications

WP 2013/47

Commonalities and differences between production-related FDI (PFDI) and technology-related FDI (TFDI) in developed and emerging economies

Keyvan Alvandi, Cristina Chaminade and Ping Lv

ABSTRACT

This paper investigates commonalities and differences in firm level determinants of internationalization of production (production related investments or PFDI) and innovation (technology driven investments or TFDI) by Multinational Enterprises (MNEs). Our database is based on a cross country survey which includes firms within Automotive, Agro-processing and ICT sectors from both developing and advanced economies. Our results show that despite some differences, most of the determinants affect in a similar manner both the PFDI and TFDI which rather contradicts recent arguments claiming significant differences between the two. More interestingly however, we found that institutional determinants such as policies related to foreign direct investments play almost no role in internationalization process of firms while managerial (internal to the firm) determinants had a far greater impact.

JEL Code: F60; F68

Keywords: Foreign direct investment, Multinationals, Globalization, offshoring, TFDI

Commonalities and differences between production-related FDI (PFDI) and technology-related FDI (TFDI) in developed and emerging economies

Keyvan Alvandi, CIRCLE, Lund University, Sweden

Cristina Chaminade, CIRCLE, Lund University, Sweden

Ping Lv, University of Chinese Academy of Sciences, China

Abstract

This paper investigates commonalities and differences in firm level determinants of internationalization of production (production related investments or PFDI) and innovation (technology driven investments or TFDI) by Multinational Enterprises (MNEs). Our database is based on a cross country survey which includes firms within Automotive, Agro-processing and ICT sectors from both developing and advanced economies. Our results show that despite some differences, most of the determinants affect in a similar manner both the PFDI and TFDI which rather contradicts recent arguments claiming significant differences between the two. More interestingly however, we found that institutional determinants such as policies related to foreign direct investments play almost no role in internationalization process of firms while managerial (internal to the firm) determinants had a far greater impact.

1. Introduction

The issue of foreign direct investment (FDI) has long been studied by international business scholars who, by and large, have based their observations on the analysis of multinationals (MNEs) from developed countries whose production activities are located in other developed or developing countries (Lall, 1978; Saliola & Zanfei, 2009). Within this stream of literature, Dunning (1981) pioneered the analysis of three advantages and conditions for foreign investment, typically referred to the OLI framework: ownership advantage, location advantage, and internalization advantage.

However, it has only been in the last two decades that scholars have started to pay attention to the internationalization not only of production activities but also of knowledge-

intensive activities, like R&D. In line with this new stream of literature, some authors have focused specifically on technology-related FDI (TFDI) (Acemoglu et al., 2006; Blanc & Sierra, 1999; Cantwell & Piscitello, 2002, 2005, 2007; Dunning & Lundan, 2009; Lai et al., 2005; Maskell et al., 2007; Zanfei, 2000). These authors argue that FDI related to production (PFDI) entails different strategies and motivations compared to FDI related to innovation activities (TFDI).

For the former, the raison d'être of investment is to exploit the ownership advantages already possessed by the firm in the new (offshore) location by, to name a few, tapping into natural resources, gaining proximity to suppliers and leading users, and gaining access to foreign markets, i.e., market, resource, and efficiency-seeking motivations[1] (Dunning, 2000) resembling an asset-exploiting (Dunning & Narula, 1995) or home-base-exploiting strategy (LeBas & Sierra, 2002). Noteworthy is the role associated to internationalized R&D, which is believed to follow production to fulfill a support function such as adapting the products to the taste of the hosting market (Prahalad & Doz, 1999) while the "main" and bulk of R&D remains at the home base of the firms (Amighini et al., 2013; Archibugi & Michie, 1995 cf.).

For internationalization of innovative activities, however, proximity to certain knowledge sources like innovative firms and their networks, highly skilled personnel, universities, and tapping into knowledge-intensive agglomerations can be seen as important motivations behind investments as they make up for asset-augmenting (Dunning & Narula, 1995) or home-base-augmenting (LeBas & Sierra, 2002) strategies of the firms. It should be noted that market-driven motivations remain the most common rationale behind foreign direct investments, even in the case of internationalizing innovation-related activities; however, knowledge-seeking motives are increasingly gaining importance (see Gammeltoft, 2006; Wolfmayr et al., 2013)

Thus, although TFDI has traditionally been considered as an extension of production, recent evidence suggests that TFDI may be the result of a different strategy which, in turn, requires different competences and networks (Castellani & Zanfei, 2006). Few studies have taken into account the differences between the two strategies from the perspective of firm characteristics. Moreover, there is a certain lack of focus on firms from emerging economies

[1] In later versions of the OLI framework, "strategic asset seeking" was added to account for investments motivated to augment already existing advantages of the firm (see Dunning, 2000). However, this notion is also overshadowed by the overemphasis on production-related activities and is seen rather as an inevitable byproduct of offshoring production.

which, in a concurrent trend, are increasingly involved in asset-augmenting investments by internationalizing their R&D activities. The extent to which TFDI and PFDI differ in their characteristics and, more importantly, in the institutions that affect them will be investigated in this paper using a unique database of firms, from both developed and emerging nations, involved in PFDI and TFDI.

The paper is structured as follows. First, we review the literature on the commonalities and differences between PFDI and TFDI, paying particular attention to the determinants of the two. In section 3 we introduce the data and the methodology of the empirical analysis. The next section presents the main results. The paper ends with conclusions.

2. Review of the literature

2.1. Internationalization of production and innovation

Since the 1980s, firms and in particular MNEs have increasingly internationalized not only sales and manufacturing but also innovation-related activities (Gammeltoft, 2006). In the early years, MNEs internationalized their R&D following other activities, such as production and sales, already set up abroad. Such a strategy was directed at exploiting firm-specific capabilities in foreign environments (Dunning et al., 1997), supporting foreign subsidiaries with complementary design and development capabilities (Gerybadze & Reger, 1999), and adapting products and services to local requirements (Prahalad & Doz, 1999), the motivations of which were referred to as "strategic asset exploiting" (Dunning & Narula, 1995) and "home base exploiting" (HBE) (Kuemmerle, 1997).

R&D operations are often accompanied by a manufacturing operation abroad for supporting the local adaption of products to local conditions (Doh et al., 2005). Defever (2006) finds a strong relation between the location of production and R&D, concluding that production and R&D are mutually attractive and that there are strong vertical linkages between these activities, generating cumulative effects as envisaged by the new economic geography theory (Krugman & Venables, 1995). From the perspective of the firms' motivation for investing in R&D abroad, the early literature on R&D internationalization generally considers product adaptation as the main motivation and, as a consequence, assumes that R&D is a prolongation of the asset-exploiting strategy underlying the OLI model. This is particularly the case when demand and production conditions in the host country differ from those in the home country, or when the geographical proximity of R&D facilities to

manufacturing facilities in the host country reduce the time lag in adjusting production techniques or product characteristics.

However, more recent studies indicate that the R&D function is more and more independent of production; we can say that TFDI shows a different nature with PFDI as it reflects a different strategy – asset seeking – rather than simply asset exploiting or market adaptation. MNEs are currently moving their research centers abroad not only to attain proximity to local markets but also to ensure that they are close to centers of scientific excellence and thus able to take advantage of the knowledge generated there and to participate in global knowledge networks (Alcacer & Chung, 2007; Chaminade & Vang, 2008; Colovic, 2011; OECD., 2004). This argument of the different nature of TFDI applies to MNEs from developed as well as developing countries. Firms from emerging economies have to adopt a relatively "radical" strategy – skipping over the phase of international production and conducting TFDI directly (Deng, 2007, 2009; Hong & Sun, 2006; Rui & Yip, 2008). They treat foreign R&D units as a "springboard" to access advanced technology and tools to develop overseas markets (Luo & Tung, 2007). The mission of knowledge-seeking R&D units is also to draw upon advanced technology in an attempt to preserve the technological lead of the MNEs or support the long-term evolution of the core technology of the MNE at the world technology frontier (Athukorala & Kohpaiboon, 2010). Thus, R&D units set up at selected locations could serve as both stations for recruiting local scientists and technicians and as points of contact with the scientific community in the host country (OECD., 1998).

Thus, although internationalization of R&D has traditionally been seen merely as an extension of production, recent evidence suggests that TFDI may be the result of a different strategy which, in turn, requires different competences and networks. In the next section we review the literature to try to identify the most important determinants of PFDI and TFDI.

2.2. The determinants of PFDI and TFDI

Despite the different natures of production and innovation activities, most of the literature on internationalization tends to discuss the determinants of FDI in very general terms, that is, including both production and innovation. As discussed earlier, this reflects an implicit assumption that R&D is a support function of production aimed at adapting products to the new market (i.e., it is development more than research).

The literature identifies determinants of FDI at the firm, industry, and regional/country level. Firm-level determinants include these competences: R&D, human resources, export, and international experience (Kumar, 2007; Lin, 2010), as well as the networks in which the firm is engaged; industry-level determinants include degree of competition, technological development of an industry, and network linkages (Yang et al., 2009); and country- and regional-level determinants include macroeconomic indicators, development-related indicators, import and export, the institutional environment, and natural resources (Kolstad & Wiig, 2012; Zhang & Daly, 2011).

Firm-level factors

Type of the firm: Size and ownership have traditionally been considered important determinants of the degree of internationalization of a firm. Internationalization is believed to be a resource-intensive and rather risky process. Larger firms, compared to their smaller counterparts, potentially have more resources to take on this process, which is evident as large multinational companies represent the usual suspects in internationalization studies. On the other hand, smaller firms have more organizational flexibility and are less dependent on their internal capabilities as sources of knowledge, which pushes them to look for external sources by, for instance, getting involved in offshoring activities (Fernhaber et al., 2008 c.f.; Herstad & Ebersberger, 2013). Recent studies on "born global" firms bear witness to this notion (Barnard & Chaminade, 2011). Therefore, being a large firm could be seen as both increasing as well as reducing the tendency to get involved in the internationalization process. Moreover, a UNCTAD report (2006) indicated that it is not only the multinational enterprises (and their subsidiaries) but also the standalone companies that are involved in globalization and in particular global innovation networks (ibid.) and should not be excluded when studying different forms of internationalization.

Global orientation: Global orientation has proved to be a determinant of international production. Dunning (1980) points out that international economic involvement is helpful to identify the determinants of whether foreign markets are exploited by trade or by direct investment. Many scholars find that for MNEs there is a strong substitution between global trade and FDI (Horst, 1974). The stages view of internationalization (Johanson & Vahlne, 1977) attributes export as a low-risk activity which firms engage in initially before they move on to perform more challenging tasks such as offshoring production (Wolfmayr et al., 2013). In this view the internationalization of innovation-related activities such as R&D is to follow production, a notion shared by many OLI-based internationalization theories.

As for TFDI, global orientation is still an effective explaining factor. By defining strategic orientation as a construct consisting of underlying interaction of three subcomponents – aspiration level, mindset, and industry context – Kedia et al. (2012) argue that the more global a firm's aspiration level, the more externally focused a firm's mindset, and the more dynamic the industry, the more likely the firm will conduct TFDI.

R&D intensity: Buckley (1980) points out that R&D intensity is an important determinant on MNEs' PFDI decision. Firms with high-level R&D intensity tend to internalize their R&D advantage when developing overseas markets. According to Dunning's (1980) eclectic theory, R&D intensity is a kind of ownership advantage that firms with such advantage would like to exploit in foreign markets to adjust their products to satisfy the need of local customers.

R&D intensity is also an apparent predictor of TFDI. The reasons why MNEs conduct TFDI are mainly based on two aspects: technology exploitation and technology exploration (Gammeltoft, 2006). On the one hand, for MNEs from advanced economies, if their R&D intensity is high, they can exploit such technology advantages to guarantee their market share in foreign markets. On the other hand, for MNEs from emerging economies, high-level R&D intensity means that they value knowledge and technology and can access qualified talent overseas to compensate for their R&D shortcomings through TFDI (Florida, 1997; Granstrand et al., 1992; Håkanson & Nobel, 1993; Minin et al., 2012; Reddy & Sigurdson, 1997).

Innovation: The degree of novelty is also an important determinant of PFDI, particularly if the firm is following an asset-exploiting strategy. Since the research and development of an innovation is a costly process, one may expect that the firm will try to exploit its innovation in different markets to increase the returns on its investment (Archibugi & Michie, 1995). Thus, more innovative firms in terms of output will be more prone to internationalizing their products or services. Furthermore, precisely due to the increasing complexity of technology, we may also expect that firms need to increasingly draw on a variety of sources of knowledge beyond R&D, independent of their physical distance. Therefore, FDI may be a way of gaining proximity to otherwise distant sources of knowledge.

Innovation is considered an important determinant of FDI for MNEs from emerging economies that have built up advantages from the adoption of innovative organizational forms (Mathews, 2006). For example, Bonaglia et al. (2006) describe in detail some of the organizational innovations adopted by three MNEs from emerging economies in the white

goods sector. They notice that rather than adopting an organic pattern of development, these firms have focused their efforts on investing in strategic functions such as top-level human resources and R&D in order to be able to compete with global players either in their home markets or abroad.

***Inter-firm links*:** Participation in networks is a crucial means for MNEs to complement their existing resources (Elango & Pattnaik, 2007). However, of the early studies targeting FDI from advanced economies, very few investigated the phenomenon of linkages, which is of paramount importance for firms in emerging economies (Chen & Chen, 1998; Makino et al., 2002). Just as Mathews (2002, 2006) points out, MNEs from emerging economies could use the linkages with advanced companies as a leverage to overcome their disadvantages as "latecomers." The experience of the Asian tigers shows that through their participation in networks, firms have improved their capabilities and learned how to enter into the international markets (OECD., 2007). In a study of almost 800 Indian firms, Elango and Pattnaik (2007) conclude that firms more easily create their capabilities through learning within established networks rather than building them following a sequential process. Duysters et al. (2009) emphasize that the procession of dynamic capabilities at the entrepreneurship level, innovative management practices, and the ability to enter into new markets and sectors via strategic alliance and acquisitions have allowed two of the most successful MNEs from China and India, Haier and Tata, to grow very large and to be very successful. Besides inter-firm international connections, Buckley et al. (2012) also highlight the important role of home country–host country linkages, including both trade linkage and non-trade linkages, in determining FDI. They find that India's North-South linkages within the G20 and the Commonwealth are significant in explaining foreign acquisitions by Indian MNEs.

Scholars pay much attention to the impact of links with universities on FDI when considering internationalization of R&D rather than internationalization of production. Referring to global R&D investment, a few studies have underlined the important role played by the existence of linkages between universities and firms in particular clusters (Alcacer & Chung, 2007; Audretsch & Feldman, 1996; Thursby & Thursby, 2006). Knowledge clusters are often characterized by high-quality universities, which supply skilled labor as well as basic research. The opportunity to network with high-quality universities in the same region is considered an important location factor because it facilitates knowledge transfer. The more tightly a firm can build linkages with universities and institutions in the host country, the

more likely it would like to conduct TFDI there. More specifically, Liu and Chen (2012) find that regions with a strong knowledge generation and diffusion subsystem, where local research centers, higher education institutes, and technology trading units play active and critical roles, MNEs' local R&D units have a greater tendency to pursue technology-augmenting strategies.

Industry

Audretsch and Feldman (1996) had already by the mid-1990s linked the type of industry to the geography of production and innovation. They indicate that resource-based and science-based industries are geographically more concentrated than scale-intensive ones. Furthermore, in the case of science-based industries, they compare the geography of production to the geography of innovation and show that both production and innovation tend to be concentrated in high-tech or R&D-intensive industries. They also indicate that the propensity to concentrate innovation activity cannot be completely explained by the propensity to concentrate manufacturing activity and that the concentration is higher in highly skilled industries (Audretsch & Feldman, 1996). It has been found that there is always some innovation occurring in production and that there is a certain overlap between GINs and GPNs[2] (Fifarek & Veloso, 2010; Verspagen & Schoenmakers, 2004). In this line of research, Mariani (2002), using data on Japanese subsidiaries in Europe, suggests that innovation tends to follow production but that the more R&D intensive a firm is, the more likely it will be to establish R&D units independent of production. The higher the technology intensity of the firm or industry, the higher the probability to have innovation independent from production. Moreover, firms from different industries are believed to have specific knowledge bases and innovation processes, as well as overall characteristics, that impact their involvement in globalization processes (Asheim & Gertler, 2005).

Institutional factors at regional and country level: The role of policies

Despite the importance of firm-level characteristics in the decision to locate production or innovation activities abroad, FDI is strongly influenced by the institutional environment. Institutions are defined here in broad terms, including policies, norms, rules, conventions, habits, values, and institutional arrangements (like corporate hierarchies or networks) (Hollingsworth, 2000; North, 1990).

[2] Understood as the geographical dispersion of production and innovation.

In the case of TFDI, we might expect that the systems of innovation of both the host and the home countries of the MNE strongly influence TFDI. As Asheim and Gertler (2005) indicate, for a proper understanding of the dynamic of technology-driven activities, it is necessary to look at the context in which firms are located. It is argued that the *local* environment and the social context in which firms are embedded create a favorable milieu for the transfer of tacit knowledge through direct face-to-face contacts, spontaneous mechanisms of learning, common cultural and traditional values, and interpretative schemes (Asheim & Cooke, 1999; Asheim & Gertler, 2005; Asheim & Vang, 2006; Bathelt et al., 2004; Maskell & Malmberg, 1999). However, this rich stream of literature is quite limited when it comes to explaining how national or even international institutional frameworks shape TFDI strategies or the interplay between different levels of institutional frameworks (local, national, international).

It is not at all evident whether the different policies and agreements genuinely provide institutional frameworks that stimulate these TFDI or whether, on the contrary, they are more a hindrance to these cross-national flows. Scholars attach great deal of importance to country-level institutions; some examine the effect of institutional distance (Barnard, 2008; Xu & Shenkar, 2002), while a few others emphasize the influence of institutional quality (Zhang et al., 2011). Industry-level institutional constraints come from industry regulatory standards, intellectual property protection, protection of local "champion" firms from competitive disadvantage, regulated or sensitive industries, and so on. Other firm-level institutional factors include the culture and routines of the organization. Internal characteristics of the firm such as their organizational flexibility are important factors in the way they introduce changes in their routines and organization in order to cope with different environments such as that of their hosting location.

This paper will next investigate the extent to which there are differences between PFDI and TFDI in terms of the determinants in a variety of firms from both emerging and developed countries. It should be noted that this paper does not seek to investigate the co-occurrence of PFDI and TFDI or whether the former leads to or causes the latter (as the traditional literature suggests) but to examine the effect of firm characteristics on the propensity of being involved in one type of FDI or another.

3. Data and variables

3.1. The INGINEUS survey and the sample

The empirical analysis is based on unique cross-country, cross-industry data collected through a survey funded by the 7th Framework Program of the European Commission for the 2009-2011 period which focused on firm-level data on participation in global innovation networks and internationalizing innovative activities to offshore locations. The survey was conducted in three specific industries (information and communication technology [ICT], automotive, and agro-processing) across nine countries: Brazil, China, Denmark, Estonia, Germany, India, Norway, South Africa, and Sweden. A sample frame was established by using existing databases in each country (see EU 2009 report for a detailed methodology report on data collection in INGINEUS database). All databases were filtered to ensure that only firms with five or more employees were contacted.

The information gathering also took place in a variety of different ways. In countries with a culture of participating in surveys, i.e., the Scandinavian countries, firms were sent a link to an online tool. In developing countries, i.e., China and India, data gathering was done either on the telephone or through face-to-face interviews. The survey in general provides a rather unique dataset on firm-level innovation; however, non-response biases and other restrictions faced while gathering data within some countries pose some limitations on the database (ibid). This paper thus presents exploratory findings which in turn need to be interpreted as indications for further in-depth qualitative and quantitative research.

Table 1 offers a summary of the results received from each country.

Table 1 Sample by country and industry

Country	Agro-processing	ICT	Automotive	Total
India	0	324	0	324
China	0	243	0	243
Sweden	0	171	24	195
Norway	2	179	0	181
South Africa	77	1	2	80

Brazil	0	0	69	69
Germany	0	0	53	53
Denmark	49	0	0	49
Estonia	0	17	0	17
Total	**128**	**935**	**148**	**1,211**

3.2. Dependent variables

On the questionnaire, firms were asked whether they offshored production or innovation, which divided our sample into those involved in offshoring and those that are not. Variable *Offshore* has a value 1 for firms that are involved in offshoring activities regardless of the type and 0 for firms that do not offshore at all. Firms that answered "yes" to this question were asked to reflect on a series of important regional factors that affected their decision to offshore. Each factor could then be selected as important for their offshoring of production, offshoring of innovation, both, or neither.[3] We combined the two questions to extract two dummy variables and one categorical variable. These variables categorize firms based on the type of offshoring they do: variable *PFDI* has a value 1 for firms that are involved exclusively in offshoring of production and 0 for firms that are involved exclusively in offshoring of innovation. Variable *TFDI* is similarly coded for offshoring of innovation. Besides the firms that were exclusively involved in offshoring of production or innovation, there were 168 firms that were engaged in both types, and we have included them both in the PFDI sample and in the TFDI sample. In order to account for this, we have created a categorical variable (PFDITFDI) where firms doing "only PFDI" have a value of 0, firms doing "only TFDI" have a value of 1, and firms doing both have a value of 2. This variable will be used in a multinomial logit analysis to check whether contaminating our variables with firms doing both has had a negative impact on our models. Table 2 presents a summary of these variables.

Table 2 Dependent variables

Dependent variables	***0***	***1***	***2***
OFFSHORE	no offshoring	all offshoring	-

[3]The questionnaire also provided an open-ended option to mention other factors affecting their offshoring decision. Only two firms used this option; they were deleted from the sample.

	N=909	N=306	
PFDI	only TFDI N=50	all FDI N=256	-
TFDI	only FDI N=88	all TFDI N=218	-
PFDITFDI	only FDI N=88	only TFDI N=50	both PFDI and TFDI N=168

3.3. Independent and control variables

Organizational type of the firms

In order to reflect on the characteristics of the firms in our sample, the firms were asked to provide information on their organizational type. This will help us better understand their corporate strategy as well as, to some extent, their level of autonomy in carrying out offshoring activities. Firms in the sample belonged to three different organizational types, namely standalone, subsidiaries, and headquarters. This variable (*Type)* was entered into our analyses as a categorical variable and was given values 1, 2, and 3 for each type respectively.

Size of the firm

Information was collected on the number of full-time employees for every firm. This was taken as a proxy for the size of the firms. In our analysis we use a dummy variable (*Large)* that has a value 1 if the firm had more than 250 employees and has a value of 0 if fewer than 250. In accordance with the definition from Commission Recommendation of European Union 2003, this divides our database into SMEs and large firms. We are interested to see whether being a large firm or being an SME makes any difference in the tendency to participate in a certain type of offshoring.

Experience of the firm in international markets (exports)

Firms in our database were asked whether they had a significant share of sales activities abroad. Those involved in exporting have a value of 1 and 0 otherwise in a dummy variable (*Export*). This was done in order to learn whether the firms had any previous experience with exploration of their products or services beyond their domestic market.

Research and Development

Firms in our survey were asked whether they perform significant R&D. Dummy variable *RD* has a value of 1 if they answered "yes" and 0 otherwise.

Innovation level

In the survey we asked the firms whether they had experienced innovation in the past three years (2006–2008) in terms of products, services, and methods. Each firm had the ability to point out the degree of novelty of their innovation by choosing between "new to the world," "new to the industry," "new to the firm," and an option for firms that had not experienced innovation in that period. Four dummy variables *(Inno_WORLD, Inno_INDUSTRY, Inno_FIRM, Inno_NONE)* were created to capture the innovativeness of the firms.

Inter-firm linkages

Sourcing of technology: We want to capture what the most important source of technology was for the firms in our sample. This gives us an idea whether they used internal resources within their organization or tried more to tap into sources external to them. Two dummy variables were created for this. S*ource_internal* has a value of 1 if a firm produced technological inputs in-house or bought from any other unit within the organization, such as branches or subsidiaries, and 0 otherwise. *Source_external* represents firms that bought their inputs from either non-MNEs or firms to which they are not formally connected.

Link to universities: Universities and other research institutes are crucial sources of knowledge generation in every innovation system, and establishing linkages to these actors allows firms to tap into local and global pools of knowledge. To capture this, firms were asked whether they had established links to universities and research institutes, either local or foreign, along with the location of these entities. We have coded variable *link_UNIVERSITY* to have a value of 1 for firms that collaborated with foreign or local universities or research institutions for the development of their most important innovation in the previous three years, regardless of their location.

Foreign linkages: An interesting factor to capture is the linkages that firms establish with foreign actors and organizations. These linkages differ in nature as they are established either formally, with written contracts of the terms of the collaborations or projects, or informally, where there are no written contracts or no financial obligations involved. Firms in

our survey answered whether they had formal, informal, or no linkages with foreign clients, suppliers, competitors, consultancy companies, and governments. Two dummy variables (*foreign_FORMAL, foreign_INFORMAL*) were extracted that captured whether the firms had formal or informal linkages with any of the foreign actors mentioned.[4]

Industry

The survey conducted in the INGINEUS project gathered data from three industries that differ in their research intensity: Information and Communication Technology (ICT) as high research-intensive, Automotive as medium research-intensive, and Agro-processing as low medium research-intensive. More information on how the boundaries of each industry were defined by the project can be found in the project methodology report (EU, 2009). Some countries in our sample provided the opportunity to collect from two industries, such as Sweden, where information was collected from the ICT as well as the automotive sector. But in most cases, each country represented only a single industry. Three dummy variables capture the three industries in our database and analysis.

Institutional factors

In the survey, we aimed to capture the importance of different institutional factors on PFDI and TFDI by asking the firms to what extent certain factors were a barrier in their internationalization process. These barriers could be internal to the firm (for example, lack of knowledge or managerial capabilities) or external (rules and regulations on IPR, trade and investments, or mobility of human capital). To capture the two dimensions, we asked the firms to choose which internal factors had affected their offshoring activities and to what extent – ranging from not a barrier at all to small, moderate, serious, or extreme. *BARRIER_1* has a value of 1 if a firm found "finding relevant new knowledge" an extreme or serious barrier. *BARRIER_2* has a value of 1 if a firm found "managing globally dispersed projects and cultural differences" an extreme or serious issue. These two barriers are used as proxies to capture the managerial barriers where the source of the hindrance comes from within the organization.

Firms were asked which institutional factors they found highly negative, moderately negative, highly positive, or moderately positive, or if they had not experienced that factor at all. In order to capture these factors as barriers (in line with the previous barrier variables), we

[4] In an initial model we tried to capture the linkages with specific actors such as clients or suppliers, but the model did not return any significant difference.

coded three dummy variables that found these factors highly or moderately negative. *BARRIER_3* has a value of 1 for firms that found "the regulations, practice and jurisprudence around intellectual property rights" to be a barrier and 0 otherwise. *BARRIER_4* has a value of 1 for firms that found "the rules and practice regarding foreign direct investment and trade policy" to be a barrier. *BARRIER_5* represents firms that flagged "the rules and practices regarding migration policy regulations for employing foreign scientists/technicians/experts" to be barrier. We use these three variables to capture the relevance of institutional barriers on firms' offshoring activities.

Table 3 Descriptive statistics of variables

Variable	Type	Info	Total obs.	Mean	Std. dev.
OFFSHORE	Dummy	0=no offshoring 1=firms that are involved in any type of offshoring	1215	0.252	0.434
PFDI	Dummy	0=only TFDI 1=firms that are doing offshoring of production	306	0.837	0.370
TFDI	Dummy	0=only PFDI 1=firms that are doing offshoring of innovation	306	0.712	0.453
PFDITFDI	Categorical	0=only PFDI 1=only TFDI 2=both PFDI and TFDI	306	1.261	0.878
ICT	Dummy	1=ICT	1211	0.772	0.419
Agro-processing*	Dummy	1=Agro-processing	1211	0.105	0.307
Auto	Dummy	1=Automotive	1211	0.122	0.327
Large	Dummy	0=SMEs 1=Large firms	1061	.2573	.43735
Type	Categorical	1=Standalone* 2=Subsidiary 3=HQ	1074	1.480	0.708
Export	Dummy	0=No exports 1=Export market	1114	0.406	0.491
RD	Dummy	0=No 1=Yes	1215	0.494	0.500
Source_internal*	Dummy	0=No 1=Yes	1028	0.706	0.456
Source_external	Dummy	0=No 1=Yes	1028	0.271	0.445
inno_WORLD	Dummy	0=No 1=Yes	1215	0.179	0.384
inno_INDUSTRY	Dummy	0=No 1=Yes	1215	0.462	0.499

inno_FIRM	Dummy	0=No 1=Yes	1215	0.579	0.494
inno_NONE*	Dummy	0=No 1=Yes	1215	0.573	0.495
link_UNIVERSITY	Dummy	0=No 1=Yes	1215	0.341	0.474
foreign_FORMAL	Dummy	0=No 1=Yes	1215	0.545	0.498
foreign_INFORMAL	Dummy	0=No 1=Yes	1215	0.305	0.460
BARRIER_1	Dummy	0=No 1=Yes	840	0.498	0.500
BARRIER_2	Dummy	0=No 1=Yes	802	0.540	0.499
BARRIER_3	Dummy	0=No 1=Yes	1215	0.128	0.335
BARRIER_4	Dummy	0=No 1=Yes	1215	0.138	0.345
BARRIER_5	Dummy	0=No 1=Yes	1215	0.121	0.326

* indicators taken as baseline in the analysis

3.4. The econometric analysis

As mentioned before, our aim is to investigate whether there are differences between PFDI and TFDI. In order to do so, we ran two rounds of logistic regression and one multinomial logistic regression that each created a specific equation with the same set of regressors.[5] The multinomial regression was performed as a robustness check for the logistic regression. Table A1 in the appendix shows the bivariate correlations between the variables in the analysis.

4. Results

We started off by looking at a broader picture through examining the differences between firms that are involved in FDI, regardless of the type, and those that are not. This provided an equation including all the aforementioned independent variables in a logistic regression on our dependent variable *OFFSHORE*. Table 2 provides the results of the first round of logistic regression.

[5]We tested whether using probit or mprobit instead makes any difference in the model. The predicted probabilities were highly and significantly correlated between the models, and no changes were seen except in variance of error, which was expected.

Table 4 Logistic regression on all offshoring firms

Variables	Coefficients (Std error)
ICT	0.53
	(0.40)
Automotive	0.30
	(0.47)
Subsidiary	0.85***
	(0.23)
HQ	0.63**
	(0.29)
Large	1.05***
	(0.22)
Export	1.03***
	(0.20)
RD	0.43**
	(0.22)
Source_external	-0.12
	(0.23)
inno_WORLD	-0.10
	(0.23)
inno_INDUSTRY	0.69***
	(0.21)
inno_FIRM	-0.00
	(0.22)
link_UNIVERSITY	0.78***
	(0.20)
foreign_FORMAL	-0.00
	(0.23)
foreign_INFORMAL	0.06
	(0.20)
BARRIER_1	-0.07
	(0.20)
BARRIER_2	0.34*
	(0.20)
BARRIER_3	0.10
	(0.30)
BARRIER_4	-0.03
	(0.29)
BARRIER_5	0.43
	(0.29)
Constant	-3.54***
	(0.50)
N	693

chi-square 216.50***

* p < .10, ** p < .05, *** p < .01 Standard errors in parenthesis

The results of the logistic regression are in line with the existing literature. Being a subsidiary or a headquarter as opposed to being a standalone firm increases the likelihood of a firm offshoring its activities; being large as opposed to being an SME has a positive effect on the likelihood of offshoring; having prior experience in sales abroad has a positive effect on the likelihood of offshoring.

In terms of research and innovation capabilities, performing significant R&D and being linked to local as well as foreign universities and research institutes increases the likelihood for offshoring. Being innovative at the level of industry has positive and significant effect on the likelihood of offshoring while, interestingly, being innovative at the level of the world and the firm has a negative effect, though insignificant.

As the next step, we ran two rounds of logistic regressions: once for firms involved in TFDI (Model A) and once for those engaged in offshoring of production (Model B). In model 1 we included only basic characteristics of the firms. In model 2 we added variables for micro characteristics of the firms. And in model 3 we added managerial and institutional barriers to the equation. Table 5 presents the findings from the two logistic regressions.

Table 5 Logistic regression PFDI vs. TFDI

	TFDI			PFDI		
	A1	A2	A3	B1	B2	B3
ICT	0.44	0.53	-0.41	-0.19	-0.38	-1.02
	(0.51)	(0.57)	(0.75)	(0.80)	(0.88)	(1.20)
Automotive	-0.23	0.14	-0.80	-0.64	-0.97	-2.16
	(0.59)	(0.64)	(0.84)	(0.90)	(0.98)	(1.37)
Subsidiary	0.10	0.05	0.06	0.23	0.21	-0.33
	(0.30)	(0.33)	(0.37)	(0.39)	(0.43)	(0.54)
HQ	0.48	0.21	0.24	-0.31	-0.22	-0.03
	(0.39)	(0.43)	(0.49)	(0.43)	(0.48)	(0.66)
Large	0.50*	0.29	0.37	1.40***	1.21***	1.81***
	(0.29)	(0.32)	(0.36)	(0.40)	(0.43)	(0.60)
Export		0.14	0.33		1.24***	2.14***
		(0.31)	(0.37)		(0.38)	(0.59)
RD		0.79**	0.72*		-0.93*	-1.70**

		(0.34)	(0.38)		(0.48)	(0.69)
Source_external		0.72*	0.80*		0.16	0.02
		(0.37)	(0.43)		(0.44)	(0.58)
inno_WORLD		0.24	0.06		0.23	0.61
		(0.35)	(0.37)		(0.41)	(0.54)
inno_INDUSTRY		0.39	0.65*		-0.06	-0.51
		(0.33)	(0.36)		(0.43)	(0.61)
inno_FIRM		-0.05	-0.13		0.17	-0.23
		(0.34)	(0.37)		(0.39)	(0.52)
link_UNIVERSITY		0.89***	0.87**		0.37	0.19
		(0.31)	(0.35)		(0.38)	(0.50)
foreign_FORMAL		0.12	0.13		0.39	0.78
		(0.36)	(0.41)		(0.42)	(0.55)
foreign_INFORMAL		-0.30	-0.26		0.01	0.52
		(0.31)	(0.35)		(0.39)	(0.52)
BARRIER_1			0.30			-1.03**
			(0.34)			(0.50)
BARRIER_2			-0.48			1.42***
			(0.36)			(0.49)
BARRIER_3			0.65			-0.35
			(0.47)			(0.63)
BARRIER_4			-0.27			-0.24
			(0.45)			(0.63)
BARRIER_5			-0.03			-0.67
			(0.43)			(0.60)
Constant	0.25	-1.31*	-0.60	1.38*	0.91	2.31
	(0.51)	(0.77)	(0.91)	(0.79)	(1.08)	(1.48)
N	299	283	246	299	283	246
chi-square	8.69	38.16***	40.96***	17.28***	33.95***	49.97***
"LL"	-175.06	-150.36	-126.43	-124.73	-110.27	-70.10

* p < .10, ** p < .05, *** p < .01 Standard errors in parenthesis

The industry and organizational type of a firm did not have any effect on its FDI type. Being a large firm remained significant and positive for PFDI firms, but interestingly had no effect on firms involved in TFDI.

Having prior experience with exports is positively related to PFDI. This is perhaps not surprising since many firms start exporting their products or services first, and then they offshore their production. However, having prior experience in terms of formal or informal

linkages with foreign entities (clients, suppliers, competitors, consultancy companies, and governments) had no relevance on the type of offshoring.

Being R&D-intensive was related positively to TFDI and negatively to PFDI. Thus, in contrast with the theories of the 1980s, we find that having significant R&D activity is a predictor not of PFDI but only of TFDI, which points to the first significant difference between the two types. Regarding the different levels of innovativeness, only being innovative at the level of the industry had a marginal effect on firms' offshoring innovation after accounting for managerial and institutional barriers. This could indicate that firms with certain innovative performance (already innovative at the level of the industry) would engage in innovation-related FDI in order to complement their existing advantages to become further innovative, perhaps at the level of the world.

Looking for external sources for its technological inputs increases the likelihood, though marginally, of a firm engaging in TFDI over PFDI. This is interesting since being R&D-intensive is also significant, so firms rely not only on their own R&D but also on buying their inputs from other firms and MNEs. Not surprisingly, being linked to foreign and local universities and research institutes is positively related to offshoring of innovative activities. The combination of the two means that TFDI firms can in fact be attributed true knowledge-seeking characteristics as they actively look for different sources of knowledge, whether internally by performing in-house R&D, externally through links with universities and research institutes, or by purchasing technology from other firms.

For TFDI, none of the barriers were significant. For PFDI, however, having difficulties finding relevant new knowledge reduces the likelihood of offshoring production. On the other hand, difficulties in managing globally dispersed projects and cultural differences increases the likelihood of engaging in offshoring of production.

Interestingly, only managerial barriers were significant regarding firms that are engaged in PFDI, and none of the institutional barriers considered important by the existing literature – like IPR, standards, or migration policy – really mattered.

Table 6 Multinomial logit (only FDI is the base outcome)

	Only TFDI	PFDI and TFDI
ICT	0.74	-0.60
	(1.28)	(0.79)

Automotive	1.53	-1.18
	(1.46)	(0.89)
Subsidiary	0.38	0.02
	(0.59)	(0.39)
HQ	0.19	0.20
	(0.73)	(0.52)
Large	-1.37**	0.65*
	(0.65)	(0.37)
Export	-1.59**	0.86**
	(0.62)	(0.41)
RD	1.95***	0.48
	(0.71)	(0.41)
Source_external	0.62	0.89**
	(0.66)	(0.45)
inno_WORLD	-0.46	0.22
	(0.59)	(0.39)
inno_INDUSTRY	0.86	0.61
	(0.64)	(0.39)
inno_FIRM	0.13	-0.16
	(0.57)	(0.39)
link_UNIVERSITY	0.43	1.04***
	(0.54)	(0.38)
foreign_FORMAL	-0.60	0.38
	(0.59)	(0.44)
foreign_INFORMAL	-0.64	-0.19
	(0.56)	(0.37)
BARRIER_1	1.08**	0.05
	(0.53)	(0.37)
BARRIER_2	-1.57***	-0.25
	(0.55)	(0.38)
BARRIER_3	0.72	0.71
	(0.68)	(0.51)
BARRIER_4	0.00	-0.44
	(0.67)	(0.50)
BARRIER_5	0.59	-0.11
	(0.65)	(0.46)
Constant	-2.36	-1.31
	(1.57)	(0.96)
N		246
chi-square		101.70***
"LL"		-179.51

* p < .10, ** p < .05, *** p < .01 Standard errors in parenthesis

As noted before, firms categorized by the two dummy variables *PFDI* and *TFDI* are not exclusive in the type of offshoring they are involved in. Thus, in both models A and B, our sample is contaminated by those firms that are doing both types of offshoring. In order to account for this and make sure our two logistic regressions are robust, we ran a multinomial logistic regression based on firms that are exclusive in the type of offshoring they are engaged in. We forced the model to hold firms doing only PFDI as the base outcome so we could compare the results of doing PFDI exclusively to TFDI exclusively. The results point to the robustness of our two logit models as the coefficients are similar to the ones in the logistic regression but with different coefficient signs. The exceptions are the linkages with the university, source external and innovativeness at the level of the industry which are only significant when the firm does both TFDI and PFDI simultaneously. Table 6 presents the results from the mlogit analysis.

5. Conclusions

While offshoring of production tends to negatively impact the home region in terms of productivity, offshoring of innovation does rather the opposite. R&D performed abroad tends to complement – rather than substitute – the research done at home, and the positive effects multiply (Castellani & Pieri, 2013). Following this line of reasoning, it is important for policymakers to promote TFDI while trying to control the negative impact of PFDI. Understanding the mechanisms that trigger both phenomena is the cornerstone of these policies.

This paper contributes to the current debate on the differences between offshoring of production and innovation by providing evidence on the firm-based characteristics and barriers which affect both types of investments while considering firms from both developed as well as emerging economies. By using dedicated firm survey data of 1211 firms located in several European countries and emerging economies, we analyzed the commonalities and differences between the offshoring of innovation and the offshoring of production. In contrast to most recent literature on offshoring of R&D, which argue that offshoring of innovation-related activities requires difference capabilities, our results show that most of the firm characteristics, as well as institutional frameworks, affect both phenomena in a similar manner. But some differences do exist. Being R&D intensive is related positively to TFDI, in

line with Audretsch and Feldman (1996), but negatively to PFDI. A key finding of our study is that none of the policies more closely related to the internationalization of production or innovation – such as IPRs, standards, trade policy, or migration policy – is significantly related to PFDI or TFDI either as an enhancer or as a barrier. In contrast, managerial constraints, like the lack of information or ability to cope with multicultural environments, seem to be significantly related. Increasing the direct support to the development of these managerial capabilities may provide better results in terms of stimulus to TFDI than the current focus on IPR or other policies traditionally being used to stimulate PFDI.

Some final cautionary notes are needed. Any analysis can only be as good as the data allows. The value of the dataset used for this paper relies on its novelty and uniqueness as well as its broad national coverage. It is one of the few datasets (if not the sole one) with innovation data on firms and their involvement in global innovation networks and internationalization of innovative activities that are comparable across countries and industries. However, the data does not allow for more sophisticated econometric analysis due to some of the limitations explained earlier. In this sense, this paper should be considered exploratory, pointing to areas where further research needs to be done in order to shed more light on the involvement of firms in TFDI and the different strategies they employ in order to do so. Our analysis does not imply that other factors may not also have a significant influence on TFDI or PFDI. It merely implies that these are the ones that we were able to capture on the basis of the available data.

Further research is needed to understand whether firms are internationalizing their R&D at an early stage to access knowledge and competences that they cannot find in their home country (asset seeking), whether they are mainly internationalizing development activities as an add-on function to production, or both. An interesting aspect to study in the future is the dynamics of the different investments and their relationship, which requires longitudinal data. This is specifically the case for firms that offshore both types of activities. With such information one can examine whether they started with offshoring of one type of activity and moved on to the other or, more interestingly, at what point in time this switch occurs, i.e. when firms move on to internationalize their innovative activities.

Appendix

Table A1 Covariance between variables in the analysis

		1	2	3	4	5	6	7	8
1	**Large**	1.0000							
2	**Export**	0.1640	1.0000						
3	**RD**	0.1504	0.2619	1.0000					
4	**Source_external**	0.0529	0.0080	-0.1225	1.0000				
5	**inno_WORLD**	0.0746	0.0981	0.1854	-0.0342	1.0000			
6	**inno_INDUSTRY**	0.1401	0.1201	0.3666	0.0542	0.1505	1.0000		
7	**inno_FIRM**	-0.0145	0.0042	0.0190	0.0495	-0.1265	0.0598	1.0000	
8	**Link_UNIVERSITY**	0.1589	0.2266	0.2209	0.0555	0.1257	0.2693	0.1056	1.0000
9	**Foreign_FORMAL**	0.2173	0.2622	0.2391	-0.0282	0.1145	0.1911	-0.0801	0.2155
10	**Foreign_INFORMAL**	-0.0151	-0.0211	0.0460	-0.1126	0.0877	0.0600	0.1383	0.0569
11	**BARRIER_1**	0.0717	0.1273	0.0168	0.1851	0.0244	0.0667	0.0412	0.0626
12	**BARRIER _2**	0.1003	0.0829	0.0001	0.1100	0.0612	0.1125	0.0969	0.0882
13	**BARRIER _3**	0.0045	-0.0181	0.0728	-0.1387	0.0395	0.0233	-0.0047	-0.0120
14	**BARRIER _4**	-0.0050	0.0304	0.1037	-0.1177	0.0586	0.0017	-0.0360	-0.0234
15	**BARRIER _5**	0.0392	0.0437	0.1356	-0.1131	0.1485	0.0545	0.0119	0.0344

		9	10	11	12	13	14	15
9	**Foreign_FORMAL**	1.0000						
10	**Foreign_INFORMAL**	-0.0088	1.0000					
11	**BARRIER _1**	0.0779	0.0085	1.0000				
12	**BARRIER _2**	0.0456	0.0314	0.3034	1.0000			
13	**BARRIER _3**	0.0602	0.0893	0.0431	0.0814	1.0000		
14	**BARRIER _4**	0.0974	0.0152	-0.0162	0.0424	0.5142	1.0000	
15	**BARRIER _5**	0.1504	-0.0062	0.0122	0.0659	0.3787	0.4746	1.0000

Bibliography

Acemoglu, D., Aghion, P., & F. Zilibotti. (2006). Distance to frontier, selection, and economic growth. . *Journal of the European Economic Association, 4*(1), 37-74.

Alcacer, J., & Chung, W. (2007). Location strategies and knowledge spillovers. *Management Science, 53*(5), 760-776.

Amighini, A., Cozza, C., Giuliani, E., Rabellotti, R., & Scalera, V. (2013). Technology-Driven FDI: A Survey of the Literature. *Working paper (forthcoming)*.

Archibugi, D., & Michie, J. (1995). The globalisation of technology: a new taxonomy. *Cambridge Journal of Economics, 19*(1), 121-140.

Asheim, B., & Cooke, P. (1999). Local learning and interactive innovation networks in a global economy. In E. Malecki & P. Oinäs (Eds.), *Making Connections* (pp. 145-178). Ashgate: Aldershot.

Asheim, B., & Gertler, M. (2005). The geography of innovation: Regional innovation systems. In J. Fagerberg, D. Mowery & R. Nelson (Eds.), *the Oxford Handbook of Innovation* New York Oxford.

Asheim, B., & Vang, J. (2006). Regional innovation systems in Asian countries: A new way of exploiting the benefits of transnational corporations. *Innovation: Management, Policy & Practice, 8*(1), 27-44.

Athukorala, P., & Kohpaiboon, A. (2010). Globalization of R&D by US-based multinational enterprises. *Research Policy, 39*, 1335-1347.

Audretsch, D. B., & Feldman, M. P. (1996). R&D spillovers and the geography of innovation and production. *The American Economic Review, 86*(3), 630-640.

Barnard, H. (2008). Capability development and the geographic destination of outbound FDI by developing country firms. *International Journal of Technology and Globalisation, 4*(1), 39-55.

Barnard, H., & Chaminade, C. (2011). Global Innovation Networks: towards a taxonomy. *CIRCLE Electronic Working Papers , Lund University, CIRCLE - Center for Innovation, Research and Competences in the Learning Economy, 2011/4*.

Bathelt, H., Malmberg, A., & Maskell, P. (2004). Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography, 28*(1), 31–56

Blanc, H., & Sierra, C. (1999). The internationalization of R&D by multinationals: a trade-off between external and internal proximity. *Cambridge Journal of Economics, 23*(2), 187-206.

Bonaglia, F., Goldstein, A., & Mathews, J. A. (2006). Accelerated internationalization by emerging multinationals: The case of white goods sector. *MPRA Paper, No. 1485,* .

Buckley, P. J., Forsans, N., & Munjal, S. (2012). Host–home country linkages and host–home country specific advantages as determinants of foreign acquisitions by Indian firms. *International Business Review, 21*(5), 878-890. doi: http://dx.doi.org/10.1016/j.ibusrev.2011.10.001

Buckley, P. J., & Mathew, A. M. (1980). Dimensions of the market entry behavior of recent UK first time direct investors in Australia. *Management International Review, 20*(2), 35-51.

Cantwell, J., & Piscitello, L. (2002). The location of technological activities of MNCs in European regions: The role of spillovers and local competencies. *Journal of International Management, 8*(1), 69-96.

Cantwell, J., & Piscitello, L. (2005). Recent location of foreign-owned research and development activities by large multinational corporations in the European regions: The role of spillovers and externalities. *Regional Studies, 39*(1), 1-16.

Cantwell, J., & Piscitello, L. (2007). Attraction and deterrence in the location of foreign-owned R&D activities: the role of positive and negative spillovers. *International Journal of Technological Learning, Innovation and Development, 1*(1), 83-111.

Castellani, D., & Pieri, F. (2013). R&D offshoring and the productivity growth of European regions. *Research Policy, 42*(9), 1581-1594. doi: http://dx.doi.org/10.1016/j.respol.2013.05.009

Castellani, D., & Zanfei, A. (2006). *Multinational Firms, Innovation and Productivity*. Cheltenham, UK: Edward Elgar.

Chaminade, C., & Vang, J. (2008). Globalization of knowledge production and regional innovation policy: Supporting specialized hubs in the Bangalore software industry. *Research Policy, 37*, 1684-1696.

Chen, H., & Chen, T.-J. (1998). Network linkages and location choice in foreign direct investment. *Journal of International Business Studies, 29*(3), 445-467.

Colovic, A. (2011). Towards a better understanding of multinational enterprises' R&D location choices. In F. J. Contractor, V. Kumar, S. K. Kundu & T. Pedersen (Eds.), *Global Outsourcing and Offshoring An Integrated Approach to Theory and Corporate Strategy* (pp. 168-190). Cambridge: University Press.

Defever, F. (2006). Functional fragmentation and the location of multinational firms in the enlarged Europe. *Regional Science and Urban Economics, 36*(5), 658-677.

Deng, P. (2007). Investing for strategic resources and its rationale: The case of outward FDI from Chinese companies. *Business Horizons, 50*(1), 71-81. doi: 10.1016/j.bushor.2006.07.001

Deng, P. (2009). Why do Chinese firms tend to acquire strategic assets in international expansion? *Journal of World Business, 44*(1), 74-84. doi: 10.1016/j.jwb.2008.03.014

Doh, J. P., Jones, G. K., Mudambi, R., & Teegen, H. (2005). Foreign research and development and host country environment: An empirical examination of U.S. international R&D. *Management International Review, 45*(2), 121-154.

Dunning, J. (1980). Toward an eclectic theory of international production: Some empirical tests. *Journal of International Business Studies, 11*(1), 9-31.

Dunning, J. (1981). Explaining the international direct investment position of countries: Towards a dynamic or developmental approach. *Review of World Economics, 117*(1), 30-64. doi: 10.1007/bf02696577

Dunning, J. (2000). The eclectic paradigm as an envelope for economic and business theories of MNE activity. *International Business Review, 9*, 163–190.

Dunning, J., & Lundan, S. M. (2009). The internationalization of corporate R&D: A review of the evidence and some policy implications for home countries. *Review of Policy Research, 26*(1-2), 13-33.

Dunning, J., & Narula, R. (1995). The R&D activities of foreign firms in the United States. *International Studies of Management & Organization, 25*(1/2), 39-74.

Dunning, J., Van Hoesel, R., & Narula, R. (1997). *Third world multinationals revisited: new developments and theoretical implications*: University of Reading, Department of Economics.

Duysters, G., Jacob, J., Lemmens, C., & Jintian, Y. (2009). Internationalization and technological catching up of emerging multinationals: a comparative case study of China's Haier group. *Industrial and Corporate Change, 18*(2), 325-349. doi: 10.1093/icc/dtp006

E.U. (2009). SSH8-CT-2009-225368, D2.2: Complete standardised data set containing all the information collected in all countries. Brussels: European Commission.

Elango, B., & Pattnaik, C. (2007). Building capabilities for international operations through networks: A study of Indian firms. *Journal of International Business Studies, 38*(4), 541-555.

Fernhaber, S., Gilbert, B. A., & McDougall, P. (2008). International entrepreneurship and geographic location: an empirical examination of new venture internationalization. *Journal of International Business Studies, 39*, 267–290.

Fifarek, B. J., & Veloso, F. M. (2010). Offshoring and the global geography of innovation. *Journal of Economic Geography, 10*(4), 559-578. doi: 10.1093/jeg/lbq013

Florida, R. (1997). The globalization of R&D: Results of a survey of foreign-affiliated R&D laboratories in the USA. *Research Policy, 26*(1), 85-103. doi: 10.1016/s0048-7333(97)00004-8

Gammeltoft, P. (2006). Internationalisation of R&D: trends, drivers and managerial challenges. *International Journal of Technology and Globalisation, 2*(1), 177-199.

Gerybadze, A., & Reger, G. (1999). Globalization of R&D: recent changes in the management of innovation in transnational corporations. *Research Policy, 28*(2), 251-274.

Granstrand, O., Hakanson, L., & Sjolander, S. (1992). Technology Management and International Business: Internationalization of R&D and Technology. *Chichester: Wiley*.

Herstad, S. J., & Ebersberger, B. (2013). On the Link between Urban Location and the Involvement of Knowledge-Intensive Business Services Firms in Collaboration Networks. *Regional Studies*.

Hollingsworth, J. R. (2000). Doing institutional analysis: Implications for the study of innovations. *Review of International Political Economy, 7*(4), 595-644.

Hong, E., & Sun, L. (2006). Dynamics of internationalization and outward investment: Chinese corporations' strategies. *The China Quarterly, 187*, 610–634.

Horst, T. (1974). American exports and foreign direct investments *Harvard Institute of Economic Research Discussion*, 362.

Håkanson, L., & Nobel, R. (1993). Foreign research and development in Swedish multinationals. *Research Policy, 22*(5–6), 373-396. doi: 10.1016/0048-7333(93)90008-6

Johanson, J., & Vahlne, J.-E. (1977). The internationalization process of the firm: A model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies, 8*(1), 22-32.

Kedia, B., Gaffney, N., & Clampit, J. (2012). EMNEs and Knowledge-seeking FDI. *Management International Review, 52*(2), 155-173.

Kolstad, I., & Wiig, A. (2012). What determines Chinese outward FDI? . *Journal of World Business, 47*, 26-34.

Krugman, P., & Venables, A. (1995). Globalization and the inequality of nations. *Quarterly Journal of Economics, 110*(4), 857-880.

Kuemmerle, W. (1997). Building effective R&D capabilities abroad. *Harvard Business Review, 75*(2), 61-70.

Kumar, N. (2007). Emerging TNCs: Trends, patterns and determinants of outward FDI by Indian enterprises. *Transnational Corporations, 16*(1), 1-26.

Lai, E. L.-C., Riezman, R., & Wang, P. (2005). *Outsourcing of innovation*. Iowa: Iowa University.

Lall, S. (1978). The pattern of intra-firm exports by U.S. multinationals. *Oxford Bulletin of Economics and Statistics, 40*(3), 209-222.

LeBas, C., & Sierra, C. (2002). Location versus home country advantages' in R&D activities: some further results on multinationals' locational strategies. *Research Policy, 31*, 589-601.

Lin, F.-J. (2010). The determinants of foreign direct investment in China: The case of Taiwanese firms in the IT industry. *Journal of Business Research, 63*, 479-485.

Liu, M., & Chen, S. (2012). MNCs' offshore R&D networks in host country's regional innovation system: The case of Taiwan-based firms in China. *Research Policy, 41*, 1107-1120.

Luo, Y., & Tung, R. L. (2007). International expansion of emerging market enterprises: A springboard perspective. *Journal of International Business Studies, 38*(4), 481-498.

Makino, S., Lau, C.-M., & Yeh, R.-S. (2002). Asset-exploitation versus asset-seeking: Implications for location choice of foreign direct investment from newly industrialized economies. *Journal of International Business Studies, 33*(3), 403-421.

Maskell, P., & Malmberg, A. (1999). Localised learning and industrial competitiveness. *Cambridge Journal of Economics, 23*(2), 167–186.

Maskell, P., Pedersen, T., Petersen, B., & Dick-Nielsen, J. (2007). Learning paths to offshore outsourcing: From cost reduction to knowledge seeking. *Industry and Innovation, 14*(3), 239-257.

Mathews, J. A. (2002). *Dragon multinational: A new model for global growth*. oxford: University Press, USA.

Mathews, J. A. (2006). Dragon multinationals: New players in 21 st century globalization. *Asia Pacific Journal of Management, 23*(1), 5-27.

Minin, A. D., Zhang, J., & Gammeltoft, P. (2012). Chinese foreign direct investment in R&D in Europe: a new model of R&D internationalization? *European Management Journal, 30*, 189–203.

Miriani, M. (2002). Next to production or to technological clusters? The economics and management of R&D location. *Journal of Management and Governance, 6*(2), 131-152.

North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge Cambridge University Press.

OECD. (1998). *The internationalization of industrial R&D: Patterns and trends.* Paris: OECD, Organisation for Economic Co-operation and Development.

OECD. (2004). *Science, technology and industry outlook*. Paris: OECD, Organisation for Economic Co-operation and Development.

OECD. (2007). *Business for development - Fostering the private sector*. Paris: OECD, Organisation for Economic Co-operation and Development.

Prahalad, C. K., & Doz, Y. L. (1999). *The Multinational Mission: Balancing Local Demands and Global Vision*. New York: Free Press.

Reddy, P., & Sigurdson, J. (1997). Strategic location of R&D and emerging patterns of globalisation: The case of Astra Research Centre India. *International Journal of Technology Management, 14*(2), 344-361.

Rui, H., & Yip, G. (2008). Foreign acquisitions by Chinese firms: A strategic intent perspective. *Journal of World Business, 43*, 213–226.

Saliola, F., & Zanfei, A. (2009). Multinational firms, global value chains and the organization of knowledge transfer. *Research Policy, 38*(2), 369-381. doi: http://dx.doi.org/10.1016/j.respol.2008.11.003

Thursby, J., & Thursby, M. (2006). Here or there? A survey on the factors in multinationals R&D location *Report to the Government-University-Industry Research Roundtable*. Washington.

UNCTAD. (2006). FDI from developing and transition economies: Implications for development. In W. I. R. 2006 (Ed.). New York and Geneva.

Verspagen, B., & Schoenmakers, W. (2004). The spatial dimension of patenting by multinational firms in europe. *Journal of Economic Geography, 4*(1), 23-42. doi: 10.1093/jeg/4.1.23

Wolfmayr, Y. c., Christen, E., Falk, M., Hollenstein, H., Knell, M., Pfaffermayr, M., . . . Unterlass, F. (2013). The role and internationalisation strategies of multinational companies in innovation, *Analysis of innovation drivers and barriers in support of better policies; Economic and Market Intelligence on Innovation*. Brussels.

Xu, D., & Shenkar, O. (2002). Institutional distance and the multinational enterprise. *Academy of Management Review, 27*(4), 608-618.

Yang, X., Jiang, Y., Kang, R., & Ke, Y. (2009). A comparative analysis of the internationalization of Chinese and Japanese firms. *Asia Pacific Journal of Management, 26*(1), 141-163.

Zanfei, A. (2000). Transnational firms and the changing organisation of innovative activities. *Cambridge Journal of Economics, 24*(5), 515-542. doi: 10.1093/cje/24.5.515

Zhang, J., Zhou, C., & Ebbers, H. (2011). Completion of Chinese overseas acquisitions: Institutional perspectives and evidence. *International Business Review, 20*, 226-238.

Zhang, X., & Daly, K. (2011). The determinants of China's outward foreign direct investment. *Emerging Markets Review, 12*, 389-398.