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Why do MNE Subsidiaries Outsource R&D in Countries with Weaker National IPR Regimes? The role of local institutions

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Abstract

MNE subsidiaries increasingly outsource R&D to local contractors in weaker IPR countries although R&D outsourcing exposes them to greater appropriability hazards, and internal protection mechanisms involving the entire MNE network may not be an option. Drawing on institutional and transaction costs economics, we argue that in weaker IPR countries the quality of subnational institutions plays a contractual hazard-mitigating role that positively influence the subsidiary decisions to rely more or less extensively on local external (versus internal) R&D partners (i.e. breadth of R&D outsourcing versus insourcing). However, subsidiaries that strategically prioritize external knowledge sourcing in their innovative activity commonly adopt a set of subsidiary-specific appropriability mechanisms that help protecting their knowledge and substitute for high quality subnational institutions. Hence, we predict that for those foreign subsidiaries that give low priorities to external knowledge sources low quality local institutions drastically limits the subsidiary's breadth of R&D outsourcing. We test hypotheses derived from these theoretical arguments on a four country survey of MNE subsidiaries in Central and Eastern Europe.

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ABSTRACT

MNE subsidiaries increasingly outsource R&D to local contractors in weaker IPR countries although R&D outsourcing exposes them to greater appropriability hazards, and internal protection mechanisms involving the entire MNE network may not be an option. Drawing on institutional and transaction costs economics, we argue that in weaker IPR countries the quality of subnational institutions plays a contractual hazard-mitigating role that positively influence the subsidiary decisions to rely more or less extensively on local external (*versus* internal) R&D partners (i.e. breadth of R&D outsourcing *versus* insourcing). However, subsidiaries that strategically prioritize external knowledge sourcing in their innovative activity commonly adopt a set of subsidiary-specific appropriability mechanisms that help protecting their knowledge and substitute for high quality subnational institutions. Hence, we predict that for those foreign subsidiaries that give low priorities to external knowledge sources low quality local institutions drastically limits the subsidiary's breadth of R&D outsourcing. We test hypotheses derived from these theoretical arguments on a four country survey of MNE subsidiaries in Central and Eastern Europe.

INTRODUCTION

International knowledge sourcing increasingly involves emerging economies that traditionally hosted little research and development (R&D) activity (Demirbag & Glaister, 2010; EIU, 2004; Kedia & Lahiri, 2007; UNCTAD, 2005). This trend has been motivated by a combination of traditional efficiency-related motives and an accelerating “global race for talent” (Doh, 2005; Lewin, Massini, & Peeters, 2009). Thus, R&D is increasingly performed at peripheral locations and then transferred to the hubs of global R&D and the operations of multinational enterprises (MNEs) (Reddy, 2002; Yang, Mudambi, & Meyer, 2008). Yet, this trend defies the still far from adequate protection of intellectual property rights (IPR) in many of these locations.

A number of studies have addressed the puzzling situation of MNEs increasingly conducting R&D in countries with weaker IPR protection (Alcácer & Zhao, 2012; Quan & Chesbrough, 2010; Zhao, 2006). The main theoretical conclusion of this research is that weaker IPR locations attract multinationals’ R&D activities to the extent that MNEs possess alternative internal mechanisms for protecting their intellectual properties. In particular, MNEs adopt practices of intellectual segmentation by dividing complex product or process designs into semi-independent modules across the geographically dispersed R&D laboratories of the MNE network. By partitioning technical knowledge about a product or process across R&D laboratories, MNEs reduce the losses associated to appropriability hazards (i.e. hazards of technological leakages) if single modules were expropriated in the weaker IPR host locations. Hence, in this perspective MNE’s internal organizational mechanisms substitute for external host institutions by mitigating appropriability hazards in the host country, and the option to carry out R&D in weaker, although resource-rich, countries is limited to MNEs that have deployed such mechanisms.

These studies overlooks variation across and within weaker IPR countries based on the key assumption that a national IPR regime is the only, or the most important, aspect of the institutional framework governing the appropriation of the results of innovation. A national IPR regime encompasses intellectual property law and law enforcement, which provide *de jure* and *de facto* protection, respectively. However, sub-national institutional conditions shape the transaction costs in pertinent markets and, hence, influence MNEs decisions (Beugelsdijk, McCann, & Mudambi, 2010; Beugelsdijk & Mudambi, 2013; Meyer & Nguyen, 2005; Tan & Meyer, 2011). Nonetheless, sub-

national institutions heterogeneity remains an understudied environmental factors in relation to international knowledge sourcing in weaker IPR countries.

To address this gap, we investigate the influence of the quality of subnational institutions in weaker IPR regimes on the dilemma of MNE subsidiaries of outsourcing/insourcing R&D. To this end, we draw on institution and transaction costs economics (TCE) (Henisz, 2000; Henisz & Williamson, 1999; Williamson, 1991), and studies in this tradition (Colombo, 2003; Mayer & Salomon, 2006; Oxley, 1999) to distinguish between appropriability hazards and contractual hazards (i.e. the hazards of expropriation by the partner). We argue that in host countries with relatively weak IPR protection, the quality of subnational institutions plays a subtle, yet still critical, role when foreign subsidiaries decide whether to rely more or less extensively on local external (*versus* internal) R&D partners. In particular, we focus on judicial, education and health systems that are traditionally the most relevant public services and that, at the same time, are most often financed, administered or politically accounted for by subnational authorities. A high quality of these subnational institutions – defined as effective, impartial and non-corrupt governance (Rothstein & Teorell, 2008) – lowers the transaction costs related to monitoring and non-redeployable assets and, hence, facilitates market transactions by *directly* mitigating contractual hazards and *indirectly* limiting appropriability hazards resulting from the relatively weak IPR regime. Thereby high quality sub-national institutions enable all potential foreign subsidiaries to rely more extensively on external local rather than internal R&D sourcing.

However, the relationship between quality of sub-national institutions and subsidiary decision to rely on local (*versus* internal) R&D partners critically depends on subsidiary open innovation orientation. In particular, we argue that MNE subsidiaries that deployed an open innovation model have developed a set of subsidiary-specific internal appropriability mechanisms that can substitute for the contractual hazards mitigating role of the quality of subnational institutions in weaker IPR regimes. Subsidiaries adopting an open innovation model rely on a set of formal (if available) and informal appropriability mechanisms to make an open innovation model sustainable (Laursen & Salter, 2014). Instead, subsidiaries giving low priority to external knowledge sources are unlikely to have developed such mechanisms to mitigate IPR hazards under adverse conditions, and would benefit to a larger extent from high quality subnational institutions. Therefore, we argue that a subsidiary's orientation to open innovation

negatively moderates the (positive) relationship between the quality of subnational institutions and the sourcing from local external (*versus* internal) R&D partners.

R&D outsourcing is the contractual, remunerated, temporary performance of R&D tasks for a client (Grimpe & Kaiser, 2010; Howells, 1999) with the transfer of research outcomes and all specific exploitation rights to the client upon completion of the task (Teece, 1988). We build on Laursen and Salter (2006) to develop the concept of breadth of R&D outsourcing and insourcing, which we operationalize by the number of R&D partners in the host economy and within the MNE's network, respectively, that foreign subsidiaries employ for their innovation activities. The subsidiary decision of R&D outsourcing *versus* insourcing offers a great opportunity to investigate our research question as this governance mode significantly exposes the foreign subsidiary to appropriability hazards, and practices of mere intellectual segmentation across the MNE network may not be an option. First, the decision to adopt practices of intellectual segmentation is traditionally taken at the HQ level, where such practices can be orchestrated more effectively. In addition, as knowledge is power (Mudambi & Navarra, 2004), subsidiaries may be reluctant to share "modules" of their knowledge with other MNE units. A number of studies have also warned that modularity is not a panacea (Baldwin & Henkel, 2011). Modularization of R&D projects depends on the nature of the technology (Brusoni & Prencipe, 2001), and eases imitation by decreasing complexity of individual components, and making the design more transparent (Ethiraj, Levinthal, & Roy, 2008; Pil & Cohen, 2006; Rivkin, 2000). However, MNE subsidiaries in emerging economies increasingly outsource R&D activities to local providers (Contractor, Kumar, Kundu, & Pedersen, 2010; UNCTAD, 2005).

We empirically investigate the breadth of R&D outsourcing in four transition economies, the Czech Republic, Hungary, Poland and Slovakia. In addition to China and India (Asakawa & Som, 2008), these Central East European (CEE) economies have increasingly attracted strategic asset-seeking FDI (UNCTAD, 2005, 148) and internationally outsourced R&D activities (Marin, 2006) despite their relatively weak IPR regime and, hence the great appropriability hazards foreign investors are exposed to in these countries. Major aspects of the legal framework are uniform in East and West Europe (e.g. all European Union (EU) members are contracting states of the European Patent Convention (EPC) signed in 1973). However, the level of effective protection of IPR varies markedly across EU member countries (EPO, 2013; Javorcik, 2004; Marie,

2012; Sharp & Barz, 1997; van Eechoud, Hugenholtz, Guibault, van Gompel, & Helberger, 2009). Due to incomplete harmonization within the EU IPR framework, each national judicial system retains discretionary power, which an offended party would have to face when aiming to have its exclusive exploitation right recognized within the country, or when referring to the courts to enforce a contract (EPO, 2013; Marie, 2012; van Eechoud, et al., 2009). As a result, appropriability hazards differ markedly between East and West European members being more severe in the former.

Our study offers a number of contributions. First, we contribute to the literature on international knowledge sourcing (Alcácer & Zhao, 2012; Zhao, 2006) by shedding light on the sub-national institutional heterogeneity of weaker IPR regimes. To this research, we suggest that, when MNE subsidiaries outsource R&D to local providers in weaker IPR countries, reliance on internal organizational mechanisms at the MNE level may not be an option and lower layers of the local institutional context become critical. Second, by examining the role of subnational spatial heterogeneity on post-entry strategies we contribute to research in international business which has been primarily concerned with MNE entry and location strategies in relation to subnational heterogeneity (Beugelsdijk, et al., 2010; Beugelsdijk & Mudambi, 2013; Meyer & Nguyen, 2005; Tan & Meyer, 2011).

THEORETICAL FOUNDATIONS

Contractual hazards

Studies at the intersection of TCE and institutional economics have documented that appropriability hazards and contractual hazards (defined as the hazards of expropriation by the partner) are interdependent with the institutional environment that governs the transaction (Henisz, 2000; Henisz & Williamson, 1999; Oxley, 1999). In other words, the institutional environment in form of, for example, the enforcement of property rights and contract law regimes moderate transaction cost, and hence “shift the comparative costs of governance” (Williamson, 1991, , 257).

Contractual hazards traditionally originate from asset-specificity and observability problems (Hölmstrom, 1979; Williamson, 1985). In situations where assets have little value outside of a given context and the quality of output is difficult to observe and measure ex post, suppliers may act opportunistically to extract excessive

rents from customers. If in principle detailed contracts may be a solution to avoid holding-up and monitoring issues, the costs of drafting detailed contracts and enforcing contract law can be so severe that the customer will prefer to internalize the transaction (Shapiro & Varian, 1999). Thus, incomplete contracts arise due to the inability of the parties to specify *ex ante* all possible contingencies that may occur, the prohibitive costs of accounting for all contingencies when one could foresee all of them but the number of contingencies is far too large (drafting costs), and to the excessive *ex post* costs of enforcing the contract (enforcement costs).

Both arguments are directly relevant for R&D outsourcing. Knowledge creating activity is difficult to monitor and evaluate until late in the process when substantial resources have been sunk into a project, and compelling demands for funding may be difficult to refuse (Northcraft & Wolf, 1984; Staw, 1976). In addition, R&D projects require large up-front commitments of non-redeployable assets (Ulset, 1996) that would only be transferable in the form of useful results if the project is successful. These issues are amplified when the contracting firm is a subsidiary of a foreign MNE, which suffers from liability of foreignness (Zaheer, 1995). Thus, foreign subsidiaries unfamiliarity with the local environment further exacerbates contractual hazards.

High-quality institutions reduce a foreign subsidiary's disadvantage in a host country as they support more complex transactions and provide reliable signals of the quality of local human capital (Alsan, Bloom, & Canning, 2006; Barro & Sala-i-Martin, 1995; Bloom & Canning, 2000; Henisz, 2000; Henisz & Williamson, 1999). In particular, the quality of the judicial system influences the costs of *ex-ante* complex contracting and *ex-post* law enforcement, which ultimately enhance firm's appropriability (North, 1992), while the quality of education and health systems influence the observability of local partners' competences (Williamson, 1975). For example, high quality education and health systems provide reliable signals of individuals' competences, and, hence effort.

Several studies document the mitigating role of institutions on contractual hazards (Gatignon & Anderson, 1988; Henisz, 2000; Henisz & Williamson, 1999). However, this research has almost exclusively focused on national level institutions despite the fact that transaction-cost-reducing institutions vary not only between and within countries, but firms and foreign subsidiaries in particular are confronted with a plethora of institutions at multiple levels (Kostova & Zaheer, 1999).

Multiple levels of institutions

International business scholars have acknowledged the influence of host country institutions on foreign firms' entry and post-entry strategies, especially in emerging economies (Feinberg & Gupta, 2009; Henisz, 2000; Meyer, Estrin, Bhaumik, & Peng, 2009; Peng, 2003; Santangelo & Meyer, 2011). Moreover, several studies draw attention to the role of subnational institutions in relation to entry decisions in emerging countries (e.g. Beugelsdijk & Mudambi, 2013; Ma, Delios, & Lau, 2013; Meyer & Nguyen, 2005; Tan & Meyer, 2011). However, our knowledge on the role of subnational institutions in post-entry strategies remains scant.

MNEs are complex organizations with globally dispersed business units that are exposed to a multiplicity of institutions (Kostova & Zaheer, 1999; Zaheer, 1995). These institutions can be classified at a primary level between home country and host country institutions exerting sometimes conflicting pressures (Kostova, Roth, & Dacin, 2009; Meyer & Thein, 2013). However, institutions also vary in higher and lower levels. As illustrated in Table 1, institutions exist at supra-national, national and sub-national levels in form of formal rules, informal rules and rule enforcement. At each level the interplay of multiple levels and types of institutions shape transaction and information costs, as well as uncertainty.

- INSERT TABLE 1 ABOUT HERE -

At a supranational level formal rules are established by multilateral agreements and treaties, informal rules exist in forms of global hypernorms (Donaldson & Dunfee, 1999), and rules are enforced by international arbitration and courts. At a national level, formal rules are established by national constitutions and law incorporating multilateral agreements and treaties, informal rules arise from national culture, and the national court system enforces the rule of law. At subnational level, formal rules relate to laws and regulation delegated by national legislators to provinces or cities, informal rule may vary with cultural diversity within a country, and variations in rule enforcement depend on the rule of law enforcement practices within a country.

Table 2 illustrates institutions of each type at three levels using the four CEE countries as an example. In CEE countries, the supranational level primarily concerns multilateral agreements and treaties at the EU level, in particular the accession treaties. Hypernorms relate to shared European history, and norms and values derived, for

instance, from Christianity. International arbitration and courts exist for example in form of the European Court of Justice and the European Court of Human Rights. At the national level the incorporation of multilateral agreements and treaties requires some sort of adoption by the national parliaments. Although the EU principle of the supremacy of community law applies in these member states, there have been cases of conflict. National culture is grounded in shared national history, norms values and the common linguistic background. The national court system is hierarchically organized around three levels: the supreme court, which exercises judicial supervision over the decision of other courts, the regional/provincial (appeal) courts and the district/general (originating) courts. At subnational level, districts or provinces within CEE countries have been delegated responsibilities in areas such as education and health, and in some CEE countries subnational authorities are also engaged in international and within-country inter-regional cooperation (this is the case in the Czech and Slovak republics). In CEE countries, within-country cultural variation arises primarily due to the presence of ethnic minorities, while, variation in law enforcement practices arise with different legal interpretations within the system.

- INSERT TABLE 2 ABOUT HERE -

These variations across and within countries impact on appropriability concerns with respect to IPR. Specifically, the EU IPR framework has not been fully harmonized across the EU member states and CEE countries in particular. In relation to patents, national courts and authorities of the EPC contracting states are authorized to decide on the infringement and validity of European patents.ⁱ Therefore, differences in national courts' interpretation of harmonized European patent law and in procedural laws, as well as differences in speed (between "slow" and "quick" courts) often arise.ⁱⁱ In addition, official language translation is required in some signatory countries and infringement procedures in one country have no effect in others, which may lead to multiple law suits regarding the same European patent in different countries with sometimes different results (EPO, 2013). The situation is similar with respect to trademarks protection. Two parallel trademark systems coexist (i.e. the European and national system) and registering national trademarks is reserved to national member states' offices (Marie, 2012). Harmonization of copyright protection is also an area of lively discussion among member states (van Eechoud, et al., 2009).

HYPOTHESES DEVELOPMENT

Quality of subnational institutions

Global competition creates pressures on firms to develop innovative products quickly and at competitive costs, which induces firms to source innovations and ideas to a greater extent outside their firm boundaries and to adopt an open innovation model (Chesbrough, 2003; Contractor, et al., 2010; Lewin, et al., 2009). However, in relatively weak IPR countries, foreign subsidiaries interested in outsourcing R&D activities to local partners are exposed to appropriability hazards, which may force them to rely to a greater extent on internal than external knowledge sources. In these countries, subnational institutions may lower contractual hazards by limiting drafting and enforcement costs as well as providing reliable signals of the quality of local human capital, and, as a result, *indirectly* reduce the appropriability hazards. In particular, many of the public services that are most directly relevant to business have often been delegated to subnational authorities such as judicial, education and health systems.

In external R&D projects, transaction costs arise due to monitoring issues and non-redeployable assets. Additional safeguards can be written into private contracts (e.g. exclusivity clauses, stronger administrative control rights) when intellectual property law provides only weak judicial protection (Ulset, 1996). That is, an R&D outsourcing partner cannot freely exploit the weakness of property law after having signed a private contract in which she has explicitly committed herself to refrain from such practice (Stinchcombe & Heimer, 1988, , 201). Effective, impartial and non-corrupt judicial systems enable the contracting parties to limit both drafting and enforcement costs. In these systems, private lawyers assisting both parties would arguably be relatively competent to identify the likely contingencies that may occur when drafting the contract. In the drafting phase, clauses to avoid sub-optimal investments in non-deployable assets and control mechanisms would be included in order to limit contract incompleteness and renegotiations.

Similarly, in these systems the effective and impartial enforcement of a contract would reduce enforcement costs by ensuring rapid decisions and impartial interpretation of contract law. In this perspective, the subnational judicial system is critical as this is the judicial level where the parties negotiate the contract, and the enforcement of contract law would eventually be claimed by an offended party interested in the recognition of its exclusive exploitation right in the country.

Subnational courts are courts of first instance responsible for settling disputes where these first arise. Effective, impartial and non-corrupt enforcement of contract law at this institutional level would reduce transaction costs also when disputes are taken to second and third instance courts as decisions at this level would be time-effective, non-corrupt and based on an impartial interpretation which could be hard to challenge in higher instance courts.

In external R&D contracts, imperfect observability increases the cost of measuring and monitoring behavior. High-quality subnational institutions related to human capital (e.g. education and health system) enhance the observability of local partners behavior by reducing information asymmetries related to partners capabilities, which are a source of monitoring issues in external transactions (Williamson 1975). For example, education is a signal for individual's competences that facilitates processes of hiring and defining payment structures (Spence 1973). Empirical evidence also shows that education certificates mark other unobserved abilities such as motivation and perseverance (Arkes 1999). These arguments however assume that education certificates are granted by effective, impartial and non-corrupt education systems. However, education systems quality varies and only high quality education systems ensure that education certificates effectively signal individuals' competences. In this perspective, high-quality subnational institutions in relation to the education system provide information on the competence and unobserved ability of potential local partners and, as a result, reduce the observability issues characterizing R&D contracts.

Similarly, the health system takes care and eventually certifies individual's wellbeing. An ineffective, partial and corrupted health system favors high rates of absenteeism or individual's turnover, and, as a result, increases observability problems in outsourcing contracts. In an extreme case, illness certificates may be issued to healthy individuals or with some delay to individuals that are actually ill. In contrast, in high-quality subnational institutional environments individuals are less likely to abuse of the illness certification process. Hence, high quality subnational institutions in relation to the health system provide information on the quality of potential local partners and, as a result, reduce observability issues.

This discussion suggests that high-quality subnational institutional environments support more complex economic transactions by reducing contractual costs and making transactions a viable alternative to internalization (Henisz &

Williamson, 1999). Hence in relatively weak IPR countries the choice between more or less extensive R&D outsourcing and insourcing critically depends on the quality of local subnational institutions.

H1: In relatively weak national IPR regimes, the breadth of R&D outsourcing (versus insourcing) of foreign subsidiaries will be greater the higher the quality of subnational institutions.

Subsidiaries orientation to open innovation

Foreign subsidiaries may be more or less oriented toward external knowledge sources (von Zedtwitz, Gassmann, & Boutellier, 2004). This variety is the result of different (past and present) managerial choices about how best to organize the search for innovation, which reflects the particular value proposition pursued by companies (Christensen, Olesen, & Kjær, 2005). Managers' future expectations may differ when facing the same innovation opportunity set because different individuals will have different sets of information and experiences (Shane, 2003). In addition, firms' management of innovation depends critically on the nature of their technology in relation to the specific sector in which it is operating (Christensen, et al., 2005).

Firms more oriented toward external knowledge sources need to protect their knowledge while engaging with a broad set of external actors (Laursen & Salter, 2014). To this end, considerable managerial attention and effort needs to be devoted to the adoption of formal and informal appropriability mechanisms – e.g. patents, trademarks and copyright, and leading time, secrecy and “selecting revealing” (Cohen, Nelson, & Walsh, 2000; Henkel, 2006), respectively -, which would substitute for the contractual hazard-mitigating role of sub-national institution in weaker IPR regimes. That is, subsidiary orientation toward an open innovation model would negatively moderate the (positive) relationship between quality of subnational institutions and the subsidiary's breadth of R&D outsourcing (*versus* insourcing).

More open innovation-oriented foreign subsidiaries are likelier to have adopted informal appropriability mechanisms that make sustainable the open innovation approach and enable to cope with relatively weak IPR regimes. As a result, these subsidiaries would be less sensitive to the quality of subnational institutions and the associated low contractual hazards as the appropriability mechanisms they have

developed substitute for high quality of subnational institutions. Instead, less open innovation-oriented subsidiaries are unlikely to have adopted informal appropriability mechanisms to protect their knowledge and eventually cope with relatively weak IPR regimes. For the former subsidiaries a high quality of subnational institutions can compensate for the lack of informal appropriability mechanisms by lowering contractual hazards, and ultimately ease extensive reliance on external (*versus* internal) knowledge sources.

Hence, foreign subsidiary orientation to open innovation would play a negative moderating role on the (positive) relationship between quality of subnational institutions and the breadth of R&D outsourcing (*versus* insourcing):

H2: In relatively weak national IPR regimes, the orientation of foreign subsidiaries to open innovation will negatively moderate the (positive) relationship between quality of subnational institutions and the subsidiary's breadth of R&D outsourcing (versus insourcing).

METHODOLOGY

Data and Sample

The sample for the analysis is drawn from the IWH-FDI-Micro database, which is a bi-annual survey of foreign affiliates in selected CEE countries since 2007. In particular, we rely on the 2011 survey whose underlying population is drawn from the Bureau van Dijk Amadeus database (edition 2010) according to unified selection criteria. In particular, the sample population concerns firms with a minimum of 10 employees, and one or more foreign investor firms with at least one foreign investor that holds either a minimum of 10% direct shares/voting rights or a minimum of 25% indirect shares/voting rights. These firms are independent affiliates with their own legal or they are branches without a legal entity but with their own commercial register entry. To account for the complex structure of MNEs, shareholders or ultimate owners are not limited to foreign firms headquartered abroad but also include natural persons, donors, foundations and financial investors with HQs outside their respective country. The surveyed firms were stratified for each host country by differentiating between 45 NACE rev.2 industries including both producing industries and selected services. Each sector was further stratified according to firm size in terms of number of employees

following the European Commission (2003) classification (i.e. small 10-49, medium 50-249, and large firms with more than 250 employees).

The survey was implemented by means of computer assisted telephone interviews (CATI) between September and December 2011 in five CEE countries (i.e. Poland, Czech Republic, Slovak Republic, Hungary and Romania). CATI was chosen as the appropriate method because the questionnaire requires a special design for highly standardised surveys, involves complex target groups, and has substantial filtering. The questionnaire was pre-tested in each host country and interviews conducted by native speakers who formerly received intensive training. 620 foreign subsidiaries were surveyed and no significant deviations were detected between the surveyed and population firms by sectoral and size dimension in each of the five countries.

In line with our research question, we model higher appropriability hazards in the host countries by focusing on the 194 foreign affiliates outsourcing R&D and originating from stronger IPR regimes (31.29% of the total surveyed subsidiaries). To this end, we rely on the Intellectual Property Right Index (IPRI), which in addition to an opinion-based measure of IP protection assess the protection of patents and copyrights from *de jure* and *de facto* perspectives (<http://www.internationalpropertyrightsindex.org/>). The index comprises of a total of 10 variables which are drawn from a variety of sources. The overall grading scale of the IPRI ranges from 0 to 10, with 10 representing the strongest level of property rights protection and 0 reflecting the non-existence of secure property rights in a country. Similarly, each component and variable is placed on the same 0 to 10 scale. For the calculation of the final index score, the variables within each component are averaged to derive the score for each of the three components. The final overall IPRI score is itself the average of the component scores. For each foreign subsidiary in the database we calculated the average IPRI for the home and host country over the period 2007-2009. Foreign subsidiaries were included in our sample if the average IPRI of the home country resulted higher than the average IPRI of the host country.

As we are interested in the subnational regional level, we adopt the Eurostat NUTS2 level for all host countries except Hungary where firm data refer to NUTS1 level. Eurostat (2007, 11) documents that “despite the aim of ensuring that regions of comparable size all appear at the same NUTS level, each level still contains regions which differ greatly in terms of area, population, economic weight or administrative

powers". To ensure cross-country regions comparability, we follow the strategy of a number of studies in the regional study tradition (Cantwell & Iammarino, 2000; Santangelo, 2002) and select country-specific NUTS levels which ensure as much cross-country regions comparability as possible. In particular, the NUTS1 level in Hungary is comparable to the NUTS2 level in the other surveyed host countries. However, due to significant deviations of the Romanian sub-sample from the corresponding NUTS2 distribution of the base population, we exclude foreign affiliates based in Romania (11.34% of the sample) from the analysis. We further restrict our analysis to industrial company type (84.3%) and exclude subsidiaries operating in utilities (2.91%). Due to missing data, the econometric analysis is conducted on 117 subsidiaries (i.e. 68% of the subsidiaries outsourcing R&D in the four selected host countries) for which information refer to the period 2009-2011.

We combine the IWH-FDI-Micro survey data with OECD secondary data and data on the quality of host regional institutions drawn from the QoG EU regional database, which derives from a large survey of roughly 34,000 respondents conducted within the EU in December 2009 at regional (NUTS1 and 2) level (Charron, Lapuente, & Dykstra, 2010). The survey focused on three of the traditionally most relevant public services and that, at the same time, are most often financed, administered or politically accounted for by subnational authorities: judicial, education and health care systems.

Measures

To operationalize the breadth of R&D outsourcing (*versus* insourcing), we have followed Laursen and Salter (2006) and Giarratana and Mariani (2013), and proceeded in four steps. At the first step, we distinguished between local and internal R&D outsourcing partners. Local R&D outsourcing partners refer to 1) external enterprises within the host country, and 2) universities and other public sector research institutes within the host country. Internal R&D outsourcing partners relate to 1) other units of the foreign investors' firm group within the host country, 2) HQ or other units of the firm foreign investors' firm group abroad, 3) domestic affiliates owned by the firm within the host count, and 4) foreign affiliate(s) owned by the firm. The reasons for classifying MNEs units that operate in different locations in the same category lies in the idea that the MNE's network is a social community where relationships among geographically disperse units follow internal codes, rules and logics (Kogut & Zander, 1993)

As second step, for each of the two groups of R&D outsourcing partners we coded each partner as a binary variable, 0 being non R&D outsourced and 1 being R&D outsourced to the given partner. Third, for each of the two groups, the partners are added up such that each firm gets a 0 when no R&D is outsourced to any of the group's partners, while the firm gets the value of 2 (4) when R&D is outsourced to all local (internal) partners. As final step, we calculated for each foreign subsidiary the average number of local (hereafter *local*) and internal (hereafter *internal*) outsourcing partners. The final variable *breadth of R&D outsourcing* is the following standardized measure:

$$\textit{breadth of R\&D outsourcing} = \frac{(\textit{local} + 1) - (\textit{internal} + 1)}{(\textit{local} + 1) + (\textit{internal} + 1)} \quad (1)$$

This ratio indicates the relative importance of local *versus* internal R&D outsourcing partners. Even if the same difference in the average number of local and internal partners occurs between two scores, our standardized difference is smaller when the importance of both resources intensifies. That is, the difference takes a lower weight if it derives from the intense use of both types of partners or their difference is small. In contrast, if scores are low or their difference is high, the ratio increases.

Quality of subnational institutional is an index drawn from the QoG EU regional database. To build the index, respondents were asked 16 questions related to the quality, impartiality and level of corruption of the regional judicial, education and health care systems. The answers to the 16 questions were then aggregated into the three pillars (quality, impartiality and corruption) by means of a factor analysis and then averaged to form the final index for each region. The final index is computed as the difference between each region's score calculated and the country average (weighted by regional population) of all regions within the country.

Subsidiary's *open innovation orientation* is a variable equal 1 if the respondent rates the "acquisition and purchase of external knowledge (e.g. license or R&D services)" or "potential cooperation with external partners" as very important or important modes for accessing knowledge relevant for R&D and innovation, 2 if *both* modes are rated as very important or important, 0 otherwise.

We also include a number of controls to account for host-, home- and subsidiary-specific factors. In relation to the host dimension, we account for the *quality of national institutions* by resorting to a composite index based on four World Bank's World Governance Indicators indicators: control of corruption, government effectiveness, rule

of law and voice and accountability (Charron, 2010). The index has been shown to strongly correlate with numerous socio-economic variables as GDP per capita, social capital, income inequality and child mortality rates (Charron, Dijkstra, & Lapuente, 2010). This evidence enables to rule out alternative explanations. In addition, we consider the knowledge endowment of the host region and include in the analysis the average number of patents granted for innovation developed within the host region per million inhabitants (*host region patents*) over the period considered (source OECD patent database). As the presence of foreign investors in a given location reduces uncertainty related to the local environment for other foreign firms located in that location (Mitchell, Shaver, & Yeung, 1994; Shaver, Mitchell, & Yeung, 1997), we include the variable *foreign presence* which measures the number of all foreign subsidiaries minus 1 located in each sub-national region (as logarithm). As for the home country dimension, a binary variable controls for subsidiary headquartered outside Europe (*non-European*).

As for subsidiary-specific factors, prior research identified a positive relationship between subsidiary's collaboration with the local business network and degree of autonomy (Ambos, Asakawa, & Ambos, 2011; Andersson & Forsgren, 1996). We therefore account for *subsidiary autonomy* in relation to R&D decisions with a measure ranging from 1 to 4 depending on whether R&D decisions are taken 1) only by the parent, 2) mainly by the parent, 3) mainly by the subsidiary and 4) only by the subsidiary. Subsidiaries that engage in the innovation process are also more likely to rely on external actors (Cassiman & Veugelers, 2006; Chesbrough, 2003; Laursen & Salter, 2006; Martínez-Noya & García-Canal, 2011) in order to improve their future innovation performance. We control for *subsidiary technological capabilities* with a binary variable equal 1 if the subsidiary has implemented new or significant products or processes during the last three years whose development the subsidiary was responsible for, 0 otherwise. Dependence on the local market may also influence the breadth R&D outsourcing (*versus insourcing*). Local market dependence is measured as the percentage share of local domestic buying in total turnover. Older subsidiaries have also had more time to establish knowledge-related partnerships within the MNE network (Rabbiosi & Santangelo, 2013). Thus, *subsidiary age* is measured as the duration from the year that the subsidiary was established to the year that this survey was conducted (as logarithm). Large subsidiaries have more resources devoted to external relationships (Starbuck, 1964). *Subsidiary size* is the number of employees (as

logarithm). We also control for entry mode as the ability to relate to external partners may be different for greenfield investments and acquisitions (Håkanson & Nobel, 2001). *Greenfield* is equals 1 if the firm was established through a greenfield investments, 0 otherwise. Finally, we control for sectoral differences which may influence relational behavior (Brouthers & Brouthers, 2003; Mudambi & Venzin, 2010) by including a binary variable (*services*) equals 1 if the firm operates in a service sector, 0 otherwise.

RESULTS

Table 3 reports descriptive statistics and correlation matrix. Due to the relatively high correlation between *Host region patents* and *quality of subnational institutions* and *quality of national institutions*, respectively, we run a number of multicollinearity tests as discussed below.

- INSERT TABLE 3 ABOUT HERE -

To investigate the breadth of local *versus* internal R&D outsourcing, we estimated OLS models with robust standard errors. Table 4 reports the results of the estimated models: model 1 includes the main effect and the controls, in model 2 the variable *open innovation orientation* is added, and in model 3 the interaction between quality of subnational institutions and *open innovation orientation*. The results support all our hypotheses.

- INSERT TABLE 4 ABOUT HERE -

To rule out multicollinearity issues, we calculated the variance inflation factors (VIF) and condition number for each of the estimated models. The highest VIF value is 3.72 in models 3, and the highest condition number 3.54 in model 2. These values fall well below the common accepted thresholds, respectively (Belsley, Kuh, & Welsch, 2005; Hair, Anderson, Tatham, & Black, 1995) and suggest that collinearity is not an issue.

In line with studies on R&D outsourcing (Martínez-Noya & García-Canal, 2011), our estimations confirm that subsidiaries owing technological capabilities are more likely to extensively rely on local (*versus* internal) R&D outsourcing partners (*subsidiary technological capabilities* is positive and statistically significant at $p < 0.05$ in all three models). In addition, more open innovation-oriented subsidiaries are more likely to rely more extensively on local (*versus* internal) R&D outsourcing partners (*open innovation orientation* is positive and statistically significant at $p > 0.01$ in model 2 and 3).

Quality of subnational institutions is positive and statistically significant at $p < 0.001$ in all three models. Firms are more likely to rely more extensively on local (*versus* internal) R&D outsourcing partners, the higher the quality of subnational institutions. Hypothesis 1 is supported. As for Hypothesis 2, the estimations confirm the negative moderating effect of *open innovation orientation* on the relationship between *quality of subnational institutions* and *breadth of R&D outsourcing*. The higher the quality of subnational institutions, the more likely R&D outsourcing breadth for less open innovation-oriented subsidiaries than for more open innovation-oriented subsidiaries. The moderating effect is illustrated in Figure 1.

- INSERT FIGURE 1 ABOUT HERE -

Robustness checks

We run a number of alternative estimations to check the robustness of our results.

Studies in the TCE tradition have documented the relevance of the technological characteristic in the firm internalization/externalization decisions (Oxley, 1997; Oxley, 1999). To address this aspect we discount the influence of high-tech sectors (as defined by the Eurostat-OECD (2009) technology-intensive sectoral classification). In these sectors the speed of technological development adds to the uncertainty concerning the assessment of the value of future knowledge (Freeman & Soete, 1997). In addition, in these sectors the degree of information asymmetry in relation to the knowledge capabilities of the partners is hard to evaluate due to the complex and tacit component of the underlying knowledge, and this asymmetry is traditionally a source of monitoring issues (Williamson, 1991; Williamson, 1975). To account for these factors, we single out the sample firms operating in these sectors (i.e. pharmaceuticals and electronics). We then re-run our estimations excluding the five high-tech firms in our sample and find confirmation of our hypotheses.

Research on international knowledge sourcing has documented greater reliance on modularity as an internal mechanisms to protect intellectual property (Quan & Chesbrough, 2010; Zhao, 2006). However, the availability of this strategy strictly depends on the nature of the technology (Brusoni & Prencipe, 2001). In particular, digital technologies such as ICT can be modularized at lower costs and in different ways (Whitney, 2004). As a result, especially ICT firms seem to protect their intellectual property through technological modularity (Quan & Chesbrough, 2010). To address this

issue, we re-run the analysis excluding the four ICT subsidiaries in the sample and obtain confirmation for our results.

To further check the robustness of our results, we also re-run the analysis by including the three foreign subsidiaries operating in utilities and controlling for “utilities” and “other services”. The results are confirmed both with and without ICT, and high-tech firms. These robustness checks are not reported due to space constraints but available from the authors upon request.

DISCUSSION AND CONCLUSIONS

Contributions

In the context of weaker IPR countries, this study has investigated the influence of sub-national institutional heterogeneity on the breadth of R&D outsourcing (*versus* insourcing). Specifically, we focus on R&D outsourcing in four CEE countries where appropriability hazards are still severe, and suggest that in high quality subnational institutional contexts MNE subsidiaries are more likely to rely on external (*versus* internal) R&D outsourcing partners by reducing contractual hazards. In addition our study illustrates that for MNE subsidiaries that strategically prioritize external knowledge seeking subsidiary’s informal appropriability mechanisms substitute for the contractual hazard-mitigating role of sub-national institutions. To this end, we found that MNE subsidiary’s open innovation orientation negatively moderates the (positive) relationship between quality of sub-national institutions and subsidiary’s breadth of R&D outsourcing. The study extends our understanding on the puzzle as to why MNEs subsidiaries outsource R&D activities in spite of relatively weak host IPR regimes shedding light on the role the heterogeneity of subnational institutional conditions play on this decision. In particular, three contributions are offered.

First, we contribute to research on international knowledge sourcing which has so far overlooked the heterogeneity of weaker IPR regimes (Alcácer & Zhao, 2012; Zhao, 2006). To these studies we suggest that, when MNE subsidiaries outsource R&D to local providers in weaker IPR countries, reliance on internal organizational mechanisms at MNE level may not be an option and the heterogeneity of subnational institutional contexts become critical. Instead, subsidiary-specific internal mechanisms are relevant only for subsidiaries innovating through open innovation models as these mechanisms substitute for high quality subnational institutions. Thus, in weaker IPR regimes the

different layers of the host institutional environment gain great importance for foreign subsidiaries to protect their intangibles, and the role of internal protection mechanisms depends critically on the priority the subsidiary gives to external knowledge sourcing.

Third, we offer also a contribution to the study of geography of international business (Beugelsdijk, et al., 2010; Beugelsdijk & Mudambi, 2013; Meyer & Nguyen, 2005; Tan & Meyer, 2011). Research in this area has primarily been concerned with the role of sub-national geography on firm entry strategies, while our knowledge on post-entry strategy remains scant. This study is one of the first to start exploring the role of subnational spatial heterogeneity on post-entry strategies. We argue and show that spatial heterogeneity does matter also after entry when foreign subsidiaries need to make strategic decisions on how to manage their operations in the local environment.

Limitations

As all empirical studies, limitations of the dataset suggest improvement for future research. First, our data do not provide transaction-specific information. However, we have remedied this shortcoming by running a set of robustness checks which aim to control for transaction-specific characteristics at sectoral level. Second, a greater heterogeneity of host country types in the sample would be desirable to account for a larger variety of sub-national contexts within weaker national IPR regimes. Third, we are looking at an aggregate measure of quality of subnational institutions without disentangling its components. It would be interesting to investigate the relevance of each component for the foreign subsidiary decision to extensively outsource R&D. Data availability limits the refining of our argument in this direction. Despite these limitations, we are however, confident on the contribution of the study to extant knowledge on the topic.

Managerial and Policy Implications

Our study illustrates the importance of local institutions for knowledge management, especially for foreign subsidiaries that do not normally rely on external knowledge sourcing in their innovation process and hence do not have internal processes to protect their IPR. For managers this suggests that subsidiary internal priorities need to be adjusted to local institutions in order to make effective use of external knowledge sources without taking undue risks. Subsidiaries failing to do so may miss relevant local opportunities and would be ultimately left behind in the competitive race.

For policy makers, our findings show the importance of developing institutions not only at a national level, but at all levels of government. High-quality institutions at lower level may both attract new investors and motivate incumbent investors, which are not commonly oriented toward external collaborations, to establish relationships with local actors. When local institutions facilitate mutually beneficial relationships between foreign investors and local firms, for example in form of R&D outsourcing, foreign investment is likely to make a more positive contribution to local businesses and the host community. A priority for policy makers thus should be to develop the coherence of institutions across levels of government.

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TABLE AND FIGURES

Table 1 - Formal rules, informal rules and rule enforcement at multiple levels

	Formal Institutions	Informal Institutions	Enforcement Institutions
Supra-national institutions	Multilateral agreements and treaties	Global hypernorms	International arbitration and courts
National institutions	National constitutions and laws, incorporating multilateral agreements and treaties	National culture	National court system
Subnational institutions	Subnational laws and regulation delegated by national legislators to provincial or sub-national regional authorities	Variations of culture within a country	Variations of law enforcement practice within and between court districts

Table 2 – Illustration of multi-level institutions for CEE countries

Level of Institutions	Theoretical constructs	Application to CEE
Supra-national institutions	<ul style="list-style-type: none"> • Multilateral agreements and treaties • Global hypernorms • International arbitration and courts 	<ul style="list-style-type: none"> • European Union, in particular accession treaties • Shared European history, norms and values (e.g. norms derived from Christianity) • European Court of Justice (EU), European Court of Human Rights (Council of Europe)
National institutions	<ul style="list-style-type: none"> • National constitutions and laws, incorporating multilateral agreements and treaties • National culture • National court system 	<ul style="list-style-type: none"> • International agreements are ratified by the Parliament in the <u>Czech Republic</u>, become part of domestic law via their promulgation by legal regulations in <u>Hungary</u>, need to be confirmed by a statute adopted by the Parliament and signed by the President prior to ratification in <u>Poland</u>, are adopted by the National Council in the <u>Slovak Republic</u>. The EU principle of the supremacy of Community law applies also to these member states, although there have been cases of conflict.* • Shared national history, norms and value (e.g. norms derived from Christianity), and language. • The court of third instance, courts of second instance (appeal courts) and courts of first instance (originating courts).*
Subnational institutions	<ul style="list-style-type: none"> • Subnational laws and regulation delegated by national legislators • Variations of culture within a country • Variations of law enforcement practice within a country 	<ul style="list-style-type: none"> • In the <u>Czech Republic</u>, each region is run by a Governor and decisions are made by regional assemblies, which can also submit draft legislation to the national chambers. In <u>Hungary</u>, regions are run by a deliberative body and chair. In <u>Poland</u> regions are self-governed by a legislative and executive body. In the <u>Slovakia Republic</u> regions are run by a legislative and executive body. In all four countries regions are delegated in the field of education and health. In most of them the task of regional government also concerned regional development (with the exception of Hungary) and in the Czech and Slovakian Republic international and inter-regional cooperation.** • In all CEE countries within-country cultural variations is primarily due to the presence of ethnic minorities.*** • The four countries have a uniform system of law. Any disparity between judgments simply means that the law has been interpreted differently.

* Source: https://e-justice.europa.eu/content_eu_courts-15-en.do

** Sources: Council of European Municipalities (2012).

***Source: The Council of Europe/ERICarts (2012).

Table 3 – Descriptive statistics and correlation matrix (N. obs. 117)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Breadth of R&D outsourcing	1													
2 Quality of national institutions	0.095	1												
3 Host region patents	0.087	0.645*	1											
4 Foreign presence	0.109	0.371*	0.466*	1										
5 Non European	0.020	0.044	0.104	0.152	1									
6 Subsidiary autonomy	0.158	0.168	0.064	0.084	0.017	1								
7 Subsidiary innovativeness	0.196*	0.020	-0.002	0.141	0.058	0.212*	1							
8 Subsidiary local market dependence	0.159	-0.073	0.143	-0.089	-0.107	-0.034	-0.066	1						
9 Subsidiary age	0.025	0.2359*	0.264*	-0.043	-0.019	-0.143	-0.078	0.189*	1					
10 Subsidiary size	-0.058	0.300*	0.085	0.240*	-0.048	0.102	0.168	-0.328*	0.195*	1				
11 Greenfield	-0.129	-0.129	-0.001	-0.106	-0.090	-0.083	-0.128	-0.014	0.158	-0.196*	1			
12 Services	-0.006	0.221*	-0.046	0.217*	-0.067	0.136	0.140	-0.403*	-0.170	0.3801*	-0.347*	1		
13 Quality of sub-national institutions	0.069	0.040	-0.501*	-0.281*	-0.087	0.020	-0.091	-0.194*	-0.160	0.024	-0.038	0.264*	1	
14 Orientation to open innovation	0.198*	-0.080	-0.034	0.074	-0.014	0.045	0.037	-0.110	-0.231*	0.013	-0.108	0.107	-0.061	1
Mean	0.122	-0.824	13.544	2.469	0.085	2.350	0.607	44.325	2.431	4.527	0.641	0.607	-0.039	1.034
Std. Dev.	0.162	0.214	15.836	1.256	0.281	0.922	0.491	36.982	0.550	1.291	0.482	0.491	0.254	0.754
Min	-0.200	-1.014	0.140	0	0	1	0	0	0.693	2.303	0	0	-0.500	0
Max	0.333	-0.533	50.803	4.094	1	4	1	100	4.111	8.412	1	1	0.430	2

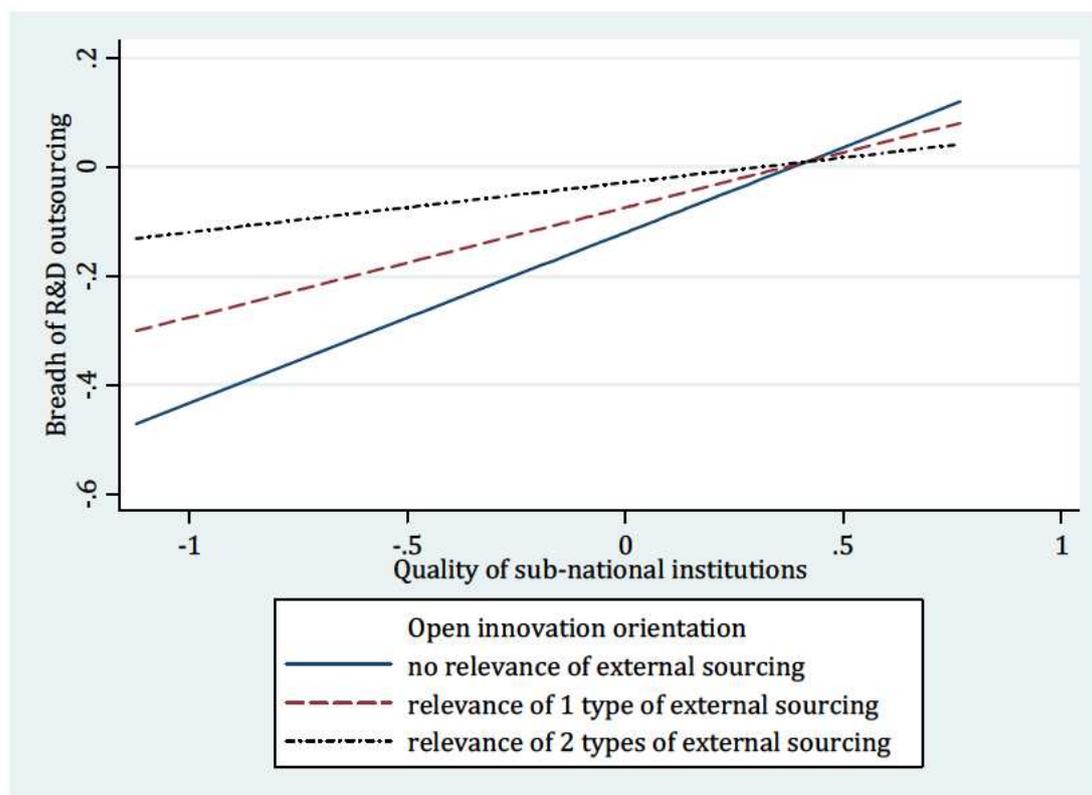
**p < 0.05 (two-tailed test applied).

Table 2 - OLS estimations results^s

	dy/dx	Std. Err.	t	dy/dx	Std. Err.	t	dy/dx	Std. Err.	t
Quality of national institutions	-0.056	0.125	-0.450	-0.041	0.124	-0.330	-0.059	0.132	-0.450
Host region patents	0.002	0.002	0.830	0.002	0.002	0.830	0.002	0.002	0.940
Foreign presence	0.018	0.016	1.160	0.017	0.016	1.060	0.017	0.016	1.050
Non European	-0.007	0.041	-0.170	-0.001	0.040	-0.030	0.001	0.037	0.020
Subsidiary autonomy	0.022	0.017	1.290	0.022	0.016	1.320	0.019	0.016	1.220
Subsidiary innovativeness	0.066	0.032	2.090 **	0.068	0.031	2.190 **	0.067	0.030	2.240 **
Subsidiary local market dependence	0.001	0.000	1.190	0.001	0.000	1.440	0.001	0.000	1.400
Subsidiary age	0.027	0.034	0.770	0.040	0.034	1.200	0.038	0.034	1.130
Subsidiary size	-0.014	0.015	-0.960	-0.015	0.015	-1.000	-0.015	0.014	-1.050
Greenfield	-0.045	0.035	-1.280	-0.039	0.035	-1.130	-0.049	0.035	-1.400
Services	-0.021	0.040	-0.520	-0.025	0.040	-0.620	-0.036	0.041	-0.870
Quality of sub-national institutions	0.164	0.083	1.990 **	0.181	0.084	2.160 **	0.313	0.110	2.840 ***
Orientation to open innovation				0.051	0.018	2.810 ***	0.046	0.018	2.620 **
Quality of sub-national institutions*Orientation to open innovation							-0.111	0.053	-2.090 **
constant	-0.059	0.182	-0.330	-0.133	0.182	-0.73	-0.120	0.184	-0.650
F	1.66	†		2.08	**		2.140	**	
R-squared	0.146			0.198			0.215		

† p < 0.10; **p < 0.05; ***p < 0.001 (two-tailed test applied). No. of obs. 117.

Figure 1: Interaction between quality of sub-national institutions and orientation to open innovation



ENDNOTE

ⁱ A European patent is a patent that, once granted, becomes "a bundle of national patents" in the EPC countries the applicant designs upon application.

ⁱⁱ The Agreement on the Unified Patent Court signed on 19 February 2013 addresses the above problems by creating a Unified Patent Court with exclusive jurisdiction for litigation relating to European patents and European patents with unitary effect (except in Poland, Italy and Spain which have not signed the agreement).