EMERGING MARKET MULTINATIONALS INVESTING IN EUROPE: DO ACQUISITIONS BOOST PATENTS?

Vito Amendolagine (*University of Pavia*)

Elisa Giuliani (*University of Pisa & Lund University*)

Arianna Martinelli (*Sant'Anna School of Advanced Studies)*

Roberta Rabellotti (*University of Pavia*)

Abstract

Notwithstanding the tremendous soaring trend of outward investments from emerging economies to advanced countries, little is known about how much emerging market multinational enterprises (EMNEs) benefit from their acquisitions in terms of their innovative output. This question is relevant to the debate on EMNEs impacts on advanced countries, as it helps enlightening on whether and how EMNEs gain technological advantages *vis à vis* incumbent firms. We address this issue analyzing the extent to which the acquisitions of European (EU27) firms influence EMNEs international patent portfolio – i.e. the number and quality (measured by forward citations) of their EPO and USPTO patent applications. We focus on a sample of medium- to high-tech EMNEs from Brazil, Russia, India, China and South Africa (BRICS) and look at their acquisitions over the period 2004-2012. Our results suggest that first there is wide heterogeneity among the patenting behavior of BRICS firms; second, EMNEs do not benefit from acquiring more innovative European firms located in the most innovative regions. On the contrary, this reduces their probability of patenting after the deal (as well as the citations of their patents). Third, we find that EMNEs with no patents before the acquisition benefit from the innovativeness of their target regions, but not from that of their target firms.

Key words: Emerging market multinationals (EMNEs), Mergers & Acquisitions (M&A), patents, Brazil, Russia, India, China, South Africa, Europe

JEL codes: O30, O10

1. Introduction

The soaring trend of outward investments from emerging economies to Europe[1] has generated a lot of attention in the international economic and political communities. On the one hand, European Union (EU) Governments have an interest in attracting such investments, as they bring fresh capitals to their countries amidst one of the worst economic crisis in history. On the other hand, there are many concerns about the risk that emerging market multinational enterprises (EMNEs) could depredate European firms' valuable strategic assets (e.g. trademarks, patents and other technological skills). These worries are often mainly based on anecdotal evidence about some leading European firms being taken over by EMNEs – see the cases of Jaguar and Land Rover acquired by the Indian Tata Motors in 2008; Volvo acquired by Geely Automobile of China in 2010 and the recent acquisition of the Italian tire producer Pirelli by China National Chemical (ChemChina) in 2015. While these acquisitions may not be detrimental *per se*, reservations arise if (and when) they could lead to a downgrading of pre-existing European strategic assets, or, more worryingly for Europe, the ownership of such assets and the strategic knowledge related with them would be progressively transferred to emerging markets (Giuliani, Martinelli and Rabellotti, 2015).

A more profound understanding of this process is therefore desirable, for it has potentially important policy implications, especially at a time in which the EU is still pondering about its international investment agreement policies with these countries (Dantas, Meyer, and Stehnken 2013, Rugman and Oh 2008). Yet, very little scholarly research has so far investigated the repercussions of EMNEs investments in Europe, as well as elsewhere. Using large scale datasets, a few studies have analyzed the economic impacts of EMNEs Mergers and Acquisitions (M&As) on either the target or the acquiring firm (see e.g. Aybar and Ficici 2009, Gubbi et al. 2010, Chen 2011, Buckley, Elia, and Kafouros 2014, Nicholson and Salaber 2013, Lebedev et al., 2014), while so far the innovative impacts of EMNEs acquisitions have generally been overlooked - with the exception of a few notable case studies (e.g. Bonaglia, Goldstein, and Mathews 2007, Duysters et al. 2009, Nam and Li 2012, Awate, Larsen, and Mudambi , Kedron and Bagchi-Sen 2012, Hansen, Fold, and Hansen 2014).

In particular, we know very little about whether EMNEs investing in advanced countries do benefit – in terms of their innovative output – from their acquisitions, and what factors are likely to condition this impact. This question is relevant to the debate on EMNEs effects on

[1] The share of outward foreign direct investments (OFDIs) from developing and transitional economies increased from 16% in 2007 (the year prior to the financial crisis) to 39% of global direct investment outflows in 2013, reaching a record level of US$460 billion UNCTAD (2011). Europe attracts more than a third of OFDIs from BRICS countries (Brazil, India, China, Russia and South Africa) (UNCTAD, 2014).

advanced countries, as it has implications on the transfer of key technological assets from advanced to emerging market countries and illuminates on whether and how EMNEs can gain technological advantages vis à vis incumbent firms in advanced countries.

In this paper we address this issue and analyze the impact that EMNEs acquisitions of European firms (EU27) have on their patent portfolio – i.e. the number and quality (measured by forward citations) of their EPO and USPTO patent applications. The empirical investigation concentrates on M&As completed in Europe over the period 2004-2012 by medium- to high-tech EMNEs from BRICS countries (Brazil, Russia, India, China and South Africa).

Our results suggest that EMNEs do not benefit from acquiring more innovative European firms, located in the most innovative regions. On the contrary, this reduces their probability of patenting after the deal (and of their patents being highly cited thereafter). At the same time, we find that EMNEs with no patents before the acquisitions do benefit from the innovativeness of their target regions, but not from that of their target firms. Our results have implications for theory and policy, which we discuss in the paper.

The paper is organized as follows. In the next section we briefly review the literature on EMNEs as well as the studies on the impact of acquisitions on the innovative capabilities of the acquiring firms putting forward our hypotheses concerning EMNEs. Section 3 presents the data, the methodology and the variables. Section 4 discusses the empirical findings of the econometric analysis. Concluding remarks are presented in Section 5.

2. M&As and their innovative impact

2.1. How acquisitions impact on innovation?

The relevance of M&As, and more specifically cross-border acquisitions, as a strategy to access and appropriate the technological assets of target firms, has been at the center of scholarly research for a long time with a clear focus on M&As occurring among firms from advanced countries (Graebner, Eisenhardt, and Roundy 2010, Birkinshaw, Bresman, and Håkanson 2000). Based on a resource- and a knowledge-based view of the firm, as well as on the organizational learning theories (Nelson and Winter 1982, Cohen and Levinthal 1990, Grant 1996, Lane and Lubatkin 1998, Kapoor and Lim 2007), scholars have argued that access to valuable knowledge through M&As fosters firms' long-term competitive advantages. Moreover, given the importance of tacit knowledge in conditioning innovative outcomes (de Man and Duyster 2005), acquisitions (*vis à vis* other means of appropriating external knowledge and technologies) are seen as a potential channel to transfer knowledge

from the acquired company (i.e. target) to the acquirer and *vice versa*. Yet, whether acquisitions bring actual beneficial effects for either the target or the acquiring firms innovative performance is still a debated question.

The theoretical arguments pointing at the existence of beneficial effects of acquisitions on innovation performance are several.[2] First, there is emphasis on the opportunity to access and combine the knowledge of both partners with a positive renewal in the knowledge base of the resulting firm. The innovative outcomes are deemed to be particularly valuable when the acquirer and the target are successful in integrating their complementary knowledge bases because complementarity allows synergies and guarantees variety in the knowledge sources (e.g. Cassiman et al. 2005, Makri, Hitt, and Lane 2010). Second, acquisitions may bring fresh capitals from the investing company and boost R&D projects, as well as provide opportunities for achieving economies of scale and scope in innovation, when different innovative processes – deriving from both the acquirer and target pre-acquisition activities – are brought together to share some fixed costs and risks (Karim and Mitchell 2000, Valentini 2012).

In spite of these compelling arguments, the empirical evidence on the impact of acquisitions on the innovative outputs of the acquired or merged firm is rather inconclusive, and it does generally point at an either neutral or negative impact (de Man and Duyster 2005). Works by Hall (1990) and Hitt et al. (1991, 1996) are between the first testing this relationship and finding negative impacts of acquisitions on different innovation-related measures.

The negative impacts have been explained through different theoretical lenses: agency theory and incentive-based perspectives provide an interpretation of why R&D managers, scientists and engineers may become less productive after the acquisition. One motivation is that the re-organization of activities after the acquisition may lead to a reduction of R&D personnel and to a restructuring of the acquired R&D operations, which often means the replacement of R&D top managers. Left without key scientists and engineers, "*the remaining R&D personnel become demoralized*" (Colombo and Rabbiosi 2014 p. 1041) and, therefore, their innovative performance could deteriorate. At the same time, arguments from agency theory suggests that, because the integration between the acquirer and the target increases, at least in the short term, the number of organizational units and actors whose action may influence performance (because of duplication of functions and divisions), managers' individual efforts and their contribution to innovation are less likely to be identified and rewarded. This, in turn, is considered to induce free riding behaviors, especially among talented employees whose skills and efforts are tacit and hard to track (Puranam, Singh, and Zollo 2006).

[2] In this review we focus only on studies exploring the relationships between M&A and innovative performance, while we acknowledge the existence of a much broader literature on M&A impacts on other economic/financial performance indicators (see e.g. King et al, 2004).

Other interpretations concern the disruptive effects of acquisitions on inherited routines at all levels of the organization, which can result in conflicts that negatively impact on the potential benefits of the acquisition. Furthermore, the integration between the acquirer and the target may be very complex and costly, diverting resources from strategic activities like R&D and innovation. During the post-acquisition phase, scholars have also noticed that managers are often stressed about the urge to show that the acquisition is successful and therefore tend to privilege investments likely to guarantee short term rewards rather than risky and uncertain long term investments in more strategic areas such as innovation (Valentini 2012).

While the strategic behavior of managers is certainly an important ingredient to explain failure, scholars have also looked at other factors influencing the impact of acquisitions on innovation. First, a wealth of empirical research has taken a resource based/organizational learning approach to investigate whether and how the similarity or complementarity of the knowledge bases of the acquirer and the target firms might influence the successful redeployment of technological assets and their successful exploitation (e. g. Colombo and Rabbiosi 2014, Ahuja and Katila 2001, Makri, Hitt, and Lane 2010, Valentini and Di Guardo 2012). On this front, studies seem rather conclusive in asserting that the relationship between the knowledge relatedness[3] amongst the acquirer and the target and innovation takes the shape of an inverted U (Ahuja and Katila 2001; Cloodt, Hagedoorn, and Van Kranenburg 2006; Makri, Hitt, and Lane 2010, Colombo and Rabbiosi 2014). Scholars have also found that the ability of the acquirer to identify the target with the desired resources and the right timing are certainly among the most important conditions for success (see Graebner, Eisenhardt, and Roundy 2010; Desyllas and Hughes, 2010).

Perspectives from strategy and international business literatures have also investigated the relationships between acquisitions and innovation performance by focusing on the acquirer-target cultural differences – i.e. differences in beliefs, values and practices between the combined units (Björkman, Stahl, and Vaara 2007). One strand of research emphasizes the 'dark side" of cultural distance, suggesting that the higher the cultural distance between the acquirer and the target, the less they will be able to integrate their assets (e.g.Morosini, Shane, and Singh 1998)– a condition that eventually influences the success of the acquisition. In particular, cultural distance can hamper 'human integration' between the two firms, a concept defined by Birkinshaw, Bresman, and Håkanson (2000) as the development of a shared identity and positive attitudes toward the merged firm. Referring to the resource-based view of the firm, a second strand of research does instead point at a more positive relationship between cultural distance and the post-acquisition performance, as distance my facilitate the

[3]Knowledge relatedness can be measured in different ways Ornaghi (2009). Ahuja and Katila (2001) use the cosine correlation between the two patent portfolios (Jaffe, 1986).

sharing of potentially valuable and complementary capabilities that are embedded in a different cultural or institutional environments (Björkman, Stahl, and Vaara 2007, Stahl and Voigt 2008) envisaging a non-linear U-shaped relationship between cultural distance and the capacity of the firms to transfer capabilities and resources. On conceptual grounds, these studies also remark that, while cultural distance is conventionally thought as reflecting the *national* differences where firms are originally based (see Hofstede 1980), it is also possible that organizational cultural distances hampers the post-acquisition integration (Sarala and Vaara 2010).

2.2 M&As by EMNEs and their Innovative Impacts

2.2.1 EMNEs strategic asset seeking motivations for cross-border acquisitions

M&As represent a growing strategy for EMNEs aimed at acquiring technology, brands, marketing and R&D capabilities, distribution networks, managerial and organizational competencies (Amendolagine, Cozza and Rabellotti, 2014; Cantwell and Barnard 2008, Gammeltoft 2008, Rugman and Oh 2008). Several studies have documented how EMNEs' investments in in the advanced countries are often pushed by asset-seeking motivations (Amighini, Rabellotti and Sanfilippo, 2013; Rabbiosi, Elia, and Bertoni 2012, Buckley et al. 2007; UNCTAD 2006; Makino, Lau, and Yeh 2002; Hitt et al. 2000). Acquisitions are thus seen as a means through which EMNEs, often lacking technological firm-specific advantages, try to rapidly close their technological gap with incumbent firms in advanced countries, facilitating their development of new skills and competences, and providing them with tools for organizational and technological learning (Vermeulen and Barkema 2001). Therefore, EMNEs invest for *developing*, rather than *exploiting* their own set of resources (Mathews 2002).

While we know a lot about EMNEs asset-seeking motivations for undertaking M&As, we know very little about EMNE acquisitions' impact on their innovative outputs. A few case studies have looked at the impact on innovation of EMNEs' cross-border acquisitions, but their results are mixed and hard to generalize. In particular, some studies provide in-depth historical narrations of how eminent EMNEs have upgraded both their production, as well as their technological capabilities through a variety of international connections, among which acquisitions of advanced country technological leaders – see e.g. the cases of Haier (Bonaglia, Goldstein, and Mathews 2007, Duysters et al. 2009), Shanghai Automotive Industry Corporation (SAIC) (Nam and Li 2012) in China, Tata Group (Duysters et al. 2009) and the pharmaceutical companies Ranbaxy and Dr Reddy (Kedron and Bagchi-Sen 2012), in India as well as Mabe in Mexico and Arçelik in Turkey (Bonaglia, Goldstein, and Mathews 2007).

However, other scholars have also noted that, while EMNEs' cross-border investments in advanced countries have indeed boosted acquiring firms' production capacity – i.e. their capacity to *master* advanced technologies – they have not yet necessarily been able to catch up in terms of innovation and technological capabilities – i.e. the capacity to change, improve, explore upon the acquired technologies (see the cases on wind turbine industry by Awate, Larsen, and Mudambi (2012) and on the biomass power plant industry by Hansen, Fold, and Hansen (2014). Also, scholars note that factors inherently tied to the specificities of emerging market investors, hinder their process of technological catching up, such as working practices and cultural distances between the target and the acquiring firms, as well as poor communication and integration processes (Hansen, Fold, and Hansen 2014).

Studies on EMNE acquisitions' economic impacts also contend that EMNEs are often unable to leverage value from their M&As due to their limited M&A experience and capabilities (Bertrand and Betschinger, 2012). However, no study has so far systematically analyzed the impacts of EMNEs' cross-border acquisitions on their innovative output, nor the factors that are likely to condition such outcome. We discuss this below.

2.2.2 The relationship between acquisitions and patents in EMNEs

In this paper we consider three dimensions influencing the innovative output of EMNEs after the acquisition: a) the previous (to the deal) patenting experience of the acquiring firm; b) the patenting portfolio of the target firm, and c) the knowledge base of the region in which the target firm is located.

Insights from the resource- and knowledge-based views of the firm, as well as from organizational learning theories (e.g. Nelson and Winter 1982, Cohen and Levinthal 1990, Grant 1996, Lane and Lubatkin 1998, Kapoor and Lim 2007) would bring us to posit that EMNEs with no prior experience in patenting should have lower capacity to absorb external knowledge. Hence, the conventional expectation is that these inexperienced firms – as compared to other EMNEs with patenting experience prior to the deal – will be less capable of exploiting the knowledge residing in both the target firm and the target regions. At the same time, the learning opportunities for the acquiring firm will be larger, the greater are the knowledge bases of the target firm and of the region, because the acquiring firm could draw on a larger pool of knowledge and could improve its innovative capabilities accordingly. Strong knowledge assets at the level of the target firm may be appropriated via interactions with local employees and access to advanced technologies and sophisticated innovation processes. Furthermore, research in economic geography has shown that regional knowledge spillovers occur through a variety of channels, such as skilled employees' labor mobility

(Breschi and Lissoni 2001), informal exchange on technical advice (Giuliani and Bell 2005), as well as through client-supplier transfer of knowledge, inter-firm imitation effects and innovation linkages between local firms and other institutions such as research centers or university labs (Crescenzi, Rodríguez-Pose, and Storper 2007). While geographic proximity is not *per se* a sufficient condition for the development of spillovers (Boschma 2005, Giuliani 2007), the presence of a strong technological base within a region can indeed provide EMNEs the opportunity to tap into a rich pool of knowledge, complementing the knowledge base of the acquired firm. Based on all what has been said so far, we can therefore elaborate the following hypotheses which will be econometrically tested in the empirically analysis presented below.

H1: *The stronger is the knowledge base of the target firm (and of the target region) the higher is the innovative impact on the acquiring EMNE.*

H2: *The larger is the previous (to the deal) patenting experience of the acquiring EMNE the higher is its capacity of exploiting the knowledge resources available within the target firm (and within the target region).*

3. METHODOLOGY

3.1.Data

We consider all completed and majority-stake cross-border acquisitions made by BRICS firms in Europe (EU 27), as reported by Zephyr (Bureau van Dijk) and SDC Platinum (Thompson), between 2004 and 2012, which have been compiled in EMENDATA (Emerging Multinationals' Events and Networks DATAbase).[4] Following some previous studies about the effects of acquisitions on patenting (Ahuja and Katila 2001, Cloodt, Hagedoorn, and Van Kranenburg 2006, Valentini and Di Guardo 2012), we focus only on medium- and high-tech manufacturing and service industries, which were classified according to NACE codes.[5] Over the observed period, the database includes 326 deals.[6] As shown in Table 1, the distribution of deals is as follows: 41% is from India, 31% from Russia; 14% from China, 11% from South Africa (11.1%) and 3% from Brazil. Deals from China and India are in large part in manufacturing industries, while Brazilian, South African and Russian deals are in the service

[4] EMENDATA is a database that contains all the investment deals by emerging market multinationals from low- and middle-income countries in the EU-27 between 2003 and 2012 (Chaminade, 2015).

[5] In particular we include the following 2-digits NACE codes: 20, 21, 26, 27, 28, 29, and 30 (for manufacturing) and 59, 60, 61, 62, 63,64, 65 66, 69, 70, 71, 72, 73, 74, 78, and 80 (for services). The SDC Classification was used for the deals taken from the SDC-Platinum database.

[6] The distribution of deals is as follows: 17 in 2004 (5.2%); 32 in 2005 (10.8%); 51 in 2006 (16.6 %); 39 in 2007 (12 %); 64 in 2007 (20.6%); 29 in 2009 (9.9 %); 37 in 2010 (11.3 %); 56 in 2011 (17.2 %); 1 in 2012 (0.3%).

industry – mainly in telecommunication and energy industries. Overall, the UK is the most preferred destination with 91 deals. In particular, it is the major target market for Indian and South African M&As (respectively 49 and 24 deals) – in line with the strong historical connections between these countries in the past. The second overall most preferred destination is Germany (50 deals), which is particularly targeted by Chinese and Indian MNEs (respectively 15 and 27 deals).

[Table 1 about here]

3.1.Variables

Table A-1 in the Appendix provides all the details about the variables included in the econometric analysis and described below. Table 2 reports the summary statistics of the variables and Table A-2 (in the Appendix) reports the correlation table.

Dependent Variables

We use patent data to measure the innovative performance of acquiring firms, following a consolidated strand of empirical research on this subject (see e.g. Ahuja and Katila 2001). In particular, we focus on international patents filed by EMNEs investing in Europe through M&As over the period of analysis. International patents are considered both in terms of their quantity and quality. The former is measured as the cumulative number of patent applications to the European Patent Office (EPO) and United States Patent and Trademark Office (USPTO) in the three years after the deal (*EPO-USPTO PATENTS*). The latter is measured as the cumulative number of patent applications to the EPO and USPTO in the three years after the deal, weighted by the number of forward citations received (*EPO-USPTO CITATIONS*) (Trajtenberg 1990).[7] We have retrieved patent data for each acquirer using ORBIS database published by the Bureau van Dijk, and then checking them manually with EPO-PATSTAT database (version April 2014). All patent information (i.e. citations, inventive team, technological classes) is retrieved from EPO-PATSTAT database.

Independent Variables

Following Ahuja and Katila (2001), the knowledge base of the target firm is measured as the sum of the patents of the target firms and their citations (*TARGET_KNOW_BASE*). This variable captures the knowledge mastered by the target firm, and it is constructed using the same sources of the dependent variables (i.e. ORBIS and EPO-PATSTAT).

We measure the knowledge base of the acquirer firm as a dummy equal to 1 when the EMNE has not filed any patents within the three years before the deal, and 0 otherwise

[7] A three-year window period is standard in the literature. To check the robustness of our results we have also considered a 5-year window period. Empirical findings do not change substantially.

(*ACQUIRER_KNOW_BASE*).

Next, we measure the knowledge base of the target region as the cumulative number of patents per capita in the NUTS3 region where the target firm is located (*REGIONAL_KNOW_BASE*). As a further control, we also test this effect with the number of inventors per capita in the NUTS3 region (*REGIONAL_INVENTORS*). Both variables are computed from the 201502_REGPAT database from the OECD (see Maraut et al. 2011 for a description).

Control Variables

In line with earlier research (Ahuja and Katila 2001, Cloodt, Hagedoorn, and Van Kranenburg 2006), we control for the non linear effect of the relative size of the target and acquirer knowledge bases (*REL_KNOW_BASE* and *REL_KNOW_BASE_SQ*), measured as the absolute difference between the number of patents of the acquirer plus their forward citations and the number of patents of the target plus their forward citations.[8]

We also control for the acquirer's previous M&A experience as the cumulative number of majority acquisitions of the firm (*MA_EXPERIENCE*) (see Buckley, Elia, and Kafouros 2014), for whether the acquisition is horizontal (both the target and the acquirer belong to the same SIC 2 digit) (*HORIZONTAL_MA*) (see e.g. Buckley, Elia, and Kafouros 2014, Ornaghi 2009), and for the cultural distance between the target and the acquirer (*CULT_DIST*) with the national cultural measures developed by Hofstede (1980).[9]

Finally, we add standard controls for home country (*INDIA_DUMMY* and *CHINA_DUMMY*), pre-crisis acquisitions (*PRE_2009_DUMMY*), and acquirer size (*NO_BIG_ACQ*). As explained below, controls for industry-specific time-invariant characteristics have been added with macro-sector[10] fixed effects, as there might be inter-sectoral differences conditionining the success of acquisitions (Cloodt, Hagedoorn and Van Kranenburg, 2006).

We provide an overview of the variables, their descriptions, and their sources in the Appendix (Table A-1). Table 2 reports the summary statistics for the variables and Table A-2 (in the Appendix) reports the correlation table.

[Table 2 about here]

3.2.Econometric methodology

[8] Unlike earlier research we do not use the ratio between the target and acquirer knowledge bases given the large number of acquirer with zero patents in our sample.

[9] As a further control we also employ a different measure of cross-national distance developed by Berry, Guillén and Zhou (2010). The results are stable in terms of magnitude and significance.

[10] Given the small variety in the dependent variables within more disaggregated industry sectors (i.e. many zero-values within each industry category), we adopt an aggregate industry classification (i. e manufacturing vs. service) in order to have a sample as large as possible. We have checked for robustness of our findings also adopting NACE 1-digit and NACE 2-digit fixed effects.

As our dependent variables (*EPO-USPTO PATENTS*, *EPO-USPTO CITATIONS*) are count variables we can use either a Poisson or a Negative Binomial model. In more detail, we implement the Poisson Quasi Maximum Likelihood (PQML) estimator (Hu and Jefferson 2009), which allows for the conditional variance to differ from the conditional mean and, therefore, to violate the standard assumption of Poisson models and, at the same time, keep the consistency of the estimator. Moreover, differently from the Negative Binomial estimator, which also tackles the mismatch between the conditional mean and the conditional variance, PQML does not impose any restriction on the functional form of the variance (Gourieroux, Monfort, and Trognon 1984, Wooldridge 2002, Cameron and Trivedi,2005). As anticipated above, in the estimations we include macro-sector fixed effects (Hausman, Hall, and Griliches 1984).

As a robustness check, we control for endogeneous sample selection to address the possibility that the two processes affecting, respectively, the distribution of patents' counts and the selection of companies as acquirers might not be not independent (Valentini and Di Guardo, 2012). Therefore, we implement a two-stage count model with sample selection (Bratti and Miranda, 2011). This econometric approach consists of adding an auxiliary equation, by which we control for the probability to be an acquirer. In particular, we associate the latter to size (Operating Revenues), industry sector (Manufacturing Dummy), country of origin (China Dummy), solvency capability (i.e. Ratio of Shareholders' Assets to Total Assets) and knowledge base of the company (based on patent data). In order to estimate the probability to undertake an international acquisition, we compare our main sample against a control sample consisting of 691 companies that have never undertaken an international acquisition *and* belong to the same high-tech sectors as the acquirering companies in our main sample. The control sample is selected to respect its proportion vs the main sample across countries.

Furthermore, given the skewed nature of our dependent variables and the high number of zeros we check the robustness of our results using a zero-inflated Poisson (ZIP) regression (Hu and Jefferson 2009; Czarnitzki, Hussinger, and Schneider 2011). In this model, the excess of zero counts is generated by a separate process from the count values different from zero, therefore, they can be modelled independently (Cameron and Trivedi 2005). Thus, the zip model has two parts: a Poisson count model and the logit model for predicting excess zeros. For the ZIP estimation, the variables previously employed in the Poisson model affecting patenting at the extensive margin (i.e. size, country of origin, sector, knowledge base of acquirer) and, therefore, explaining an excess of zero counts are now used as regressors in the "inflate" equation.

4. Empirical findings

4.1. Descriptive statistics

Table 3 reports some descriptive statistics about the patenting behavior 3 years before and 3 years after the deal of the acquirers and the targets The total number of patent applications filed by the acquirers either at the EPO or at the USPTO in the three years before and after the deal are respectively 1269 and 1287. The overall increase is minimal, although it may vary across firms and deals. We also find that the aggregate data for citations shows a decrease (from 2707 to 1875) for the acquirers. It is important to note that Brazilian and Russian EMNEs with M&As in Europe do not have any patent application either before or after the deals, while on average Indian firms are those with more patents (a total of 1241 patents, 9.19 per deal prior to the acquisition). Also interesting to note that, in the case of India, target firms have on average less patents than the acquirers (e.g. in the pre-deal period 9.19 for the acquirers vs 0.67 for the targets). Also, the patents by Indian acquirers are more cited on average than those of their European targets in the period prior the acquisition (19.77 vs 1.21). Finally, in the case of South Africa, there is not a significant difference in the patenting behavior of the acquirers and the targets, while Chinese EMNEs acquire European companies with more and more cited patents than their own (e.g. number of patents prior the deal are 0.49 on average for the Chinese acquirers and 1.96 on average the for European target firms).

[Table 3 about here]

4.2.Econometric results

The econometric results are presented in Table 4: in Models 1-4 the dependent variable is *EPO-USPTO PATENTS* and in Models 5-8 the dependent variable is *EPO-USPTO CITATIONS*. We first discuss the results regarding our key explanatory variables, then we discuss the interaction effects, and finally we briefly comment the control variables.

We find that the target firm knowledge base (*TARGET_KNOW_BASE*) is always negatively and significantly related with both the number of patents of the targets and their quality (coefficients are -0.019 and -0.012, respectively in Models 1 and 5). We also find that that the acquirers without patents before the acquisition are less likely to both fill patents and produce high quality patents after the deal (the coefficients for *ACQUIRER_KNOW_BASE* are -2.876 and -3.201 in Models 1 and 5 respectively). When we look at the role played by the degree of innovativeness in the region where the target firm is located (*REGIONAL_KNOW_BASE)*, we find that it negatively affects both the quantity and the quality of post-acquisition patents

(coefficients are -0.002 and -0.005 in Models 1 and 5 respectively).[11] These findings are all pointing in the same direction, indicating that EMNEs are unable to immediately benefit from their acquisitions in Europe, as their patenting performance decreases in the three years after the acquisitions, when they both acquire European firms with strong knowledge bases as well as when their target is located in innovative regions.[12]

To explore more in-depth these puzzling results we investigate the interaction effects between these three variables.[13] In Models 2 and 6 we interact *ACQUIRER_KNOW_BASE* with *REGIONAL_KNOW_BASE,* and find a positive and significant coefficient (0.011 in Model 2 and 0.016 in Model 6). Figure 1 shows the marginal effect of the regional knowledge base on the number of post-acquisition patents (*EPO-USPTO PATENTS*), given the knowledge base of the acquirer. It illustrates that for EMNEs with no patents before the acquisition (*ACQUIRER_KNOW_BASE*=1), the more innovative the region where they direct their investments to, the larger the number of patents they produce (in Model 6 the results for the quality of patents can be interpreted similarly). In contrast, EMNEs with patents before the acquisition do not seem to benefit significantly by the innovativeness of regions where their targets are located.

[Table 4 about here]

In Models 3 and 7 we interact *TARGET_KNOW_BASE* with *REGIONAL_KNOW_BASE* for investigating whether the combined innovativeness of the target firm and the target region produces some effects on EMNEs' post acquisition patent quantity and quality. We find a negative coefficient in Model 3 (-0.001) (while the coefficient is not significant in Model 7). Figure 2 illustrates the results of Model 3 depicting the marginal effect of the regional knowledge base on the predicted value of the post-deal number of patents of the acquirers, given the value of the target knowledge base. The figure shows how many patents the acquirer is expected to fill after the deal, for given combinations of the two knowledge base variables (with all the other variables in the model equal to the mean). Due to negative signs associated to both the individual variables and their interaction, the predicted values of patents are, as expected, negative. More specifically, the figure shows five different boundaries of the predicted values, defined according to the combined values of *TARGET_KNOW_BASE* and *REGIONAL_KNOW_BASE*, such that the largest predicted values of patents (i.e. larger than -0.48 on average) are related to large values of both the regional knowledge base and the target knowledge base. On the contrary, the lowest predicted

[11] This result holds also when we use the alternative measure of regional innovativeness - i.e. *REGIONAL_INVENTORS*.
[12] We find the same result when we consider a 5-year window.
[13] Due to problems of convergence and limited degrees of freedom, we have to test each of the interactive effects separately.

values of post-deal patents (i.e. lower than -1.66 on average) are associated to low values of the regional knowledge base and the target knowledge base. In other words, this result means that, if large values of *TARGET_KNOW_BASE* are combined with large values of *REGIONAL_KNOW_BASE*, ceteris paribus, EMNEs patent less after the acquisition.

Finally, we interact *ACQUIRER_KNOW_BASE* with *TARGET_KNOW_BASE* and find negative coefficients in both Models 4 and 8 (-12.408 and -11.118 respectively). For acquirers with no patents before the deal (*ACQUIRER_KNOW_BASE*=1), Figure 3 shows that the larger the knowledge base of the target firm (*TARGET_KNOW_BASE*), the lower is the effect on post-acquisition patenting. Instead, for acquirers with at least one patent granted before the acquisition (*ACQUIRER_KNOW_BASE*=0), the knowledge bases of the targets do not have any effect on the patenting activity of the acquirers.

Taken as a whole, the econometric tests on the interaction terms confirm that EMNEs do not benefit from acquiring more innovative European firms located in the most innovative regions. On the contrary, the acquisitions reduce their probability of patenting after the deal (and of their patents being highly cited thereafter). This result is coherent with earlier studies pointing to the fact that EMNEs still experience considerable technological backwardness vis à vis firms in advanced countries, for which they may not be able to fully and immediately benefit from their take-overs. In addition, our result about the differences existing between EMNEs with no patents before the deals and EMNEs with patents is adding new insights to the existing empirical evidence. While EMNEs with previous patent experience are unable to benefit from their acquisitions, those inexperienced do indeed profit from the innovativeness of their target regions, but not from that of their target firms. We discuss this result in the conclusive section.

Finally in what follows, we briefly comment the results about our control variables. *CULT_DIST* takes the expected negative sign across all models, though it is not significant. The variable *MA_EXPERIENCE* takes the expected positive and significant sign in all cases, suggesting that the more EMNEs have accumulated worldwide experience in acquisitions, the more they are able to successfully manage the integration of both the target and acquirer knowledge assets in the post-acquisition phase. Chinese and Indian EMNEs (*CHINA_DUMMY*, *INDIA_DUMMY*) are above the average in terms of the quantity and the quality of post-deal foreign patents. Also, acquisitions done before the 2009 financial crisis (*PRE_2009_DUMMY*) produce more and more cited patents. Furthermore, the negative and significant coefficients for *NO_BIG_ACQ* show that larger EMNEs patent more and better quality inventions as compared to smaller ones. Next, we find that acquisitions done in the same sector as the target (*HORIZONTAL_MA*), negatively impact on the acquirer's number of patents and on their quality after the deal, in line with the existence of an out-competition

effect. Finally, in line with other studies we find an inverted U-shaped relationship between *REL_KNOW_BASE* and the post-acquisition innovative performance (see e.g. Cloodt et al., 2006).

[Figures 1, 2 and 3 about here]

Robustness checks

As a robustness check to control for endogenous sample selection as discussed in Section 3.2, we have tested a two-stage model (Table 5). We report here only the results of the main equation whose results are highly confirmatory those obtained in Models 1-8 (Table 4). The knowledge base of both the target company and the region where the investment is carried out has a negative impact on both the quantity and the quality of the post-deal patenting activity of the acquirers. Moreover, the acquirers with no patenting experience before the deal are strongly penalized in their chances to patent after the deal, as also suggested by Models 1 and 5 in Table 4. The control variables do also behave as expected.[14]

Finally, Tables A-3 in the Appendix report the estimation results obtained using ZIP regressions on our dependent variables. Overall, we can see that the results are very similar (in terms of signs and magnitudes) to those of the discussed models (Tables 4 and 5).

[Table 5 about here]

5. Conclusions

Europe hosts more than a third of the FDI from BRICS countries and one of the reason why it is so attractive for them is that European firms are appealing for EMNEs in search of technological assets and strategic knowledge. Besides at a time of economic crisis, many European firms are in great need of fresh capital therefore they welcome new investors from emerging countries. Nevertheless, although EMNEs do invest substantial resources in technology-driven acquisitions, it is still an open question if they are really successful in improving and enhancing their technological capabilities. Acquiring knowledge and technologies is one thing, but the ability to absorb, exploit and therefore benefit from what has been acquired is altogether something different. Substantial research on M&As has shown that acquisition can be a very painful process, characterized by conflicts and dissipation of resources. Organizational learning research has also shown that the absorption of knowledge requires time and commitment to be successfully accomplished, as well as considerable knowledge base strengths on both sides of the deal (Cohen and Levinthal 1990, among

[14] Table 5 does not include the interaction effects because we do not have sufficient degrees of freedom to implement the Bratti-Miranda routine. However, the signs and the magnitude of the interacted variables (i.e. *TARGET_KNOW_BASE, REGIONAL_KNOW_BASE, ACQUIRER_KNOW_BASE*) provide support to the behavior of such interactions in the Models presented in Table 4.

others).

This paper explores the innovative impact of medium to high-tech acquisitions undertaken in Europe by BRICS MNEs, over the period 2004-2012. We have measured the innovative impact through the number and quality (proxied by forward citations) EPO and USPTO patents filled by MNEs from BRICS acquiring European companies.

First, we find that the strongest the knowledge base of the target firm, the worst is the acquirer post acquisition performance both in terms of number of international patents, as well as of their quality. Cloodt, Hagedoorn, and Van Kranenburg (2006) find this effect holding in the long term and for high tech industries, as the target firm knowledge base deteriorates quickly and therefore it represents more a cost than an asset for the acquirer firm. Differently, our results point at a short term negative effect (within three years after the completion of the deal), which may be more likely explained by the incapacity of the acquirer to successfully integrate the acquired assets into its knowledge base and to nurture the acquired technological skills in a meaningful way. We do find an even stronger effect when we interact the target firm knowledge base with the innovativeness of the target region, where we find that EMNEs tend to patent less after the acquisition, the more they invest in innovative regions and innovative target firms. These results can be explained in light of EMNEs inherent technological weaknesses and general inexperience with M&A (Bertrand and Betschinger 2012). It is also possible that, as shown by Valentini (2012) in the context of advanced countries' firms, EMNEs investing in Europe are more interested in transferring and exploiting the value of the acquired technologies to their home markets than in building on them to produce new frontier knowledge. Unfortunately, we could not investigate the impact of M&As on EMNEs' domestic patents because the information available in PATSTAT are not always reliable, in particular they are not trustworthy for India and Brazil while they are more reliable for China.

Second, we find that EMNEs with no patents prior to the deal are less likely to patent after the deal. However, this result is further qualified when we interact the patenting behavior of EMNEs prior to the deal with the target firm knowledge base as well as with the regional knowledge base. We find that neither the target firm, nor the region affect the post-deal patenting activity of EMNEs with patent experience before the deal, while it affects the patenting behavior of EMNEs with no patents prior to the deal. With reference to this latter result, we consider that the simple fact of not having patented an invention prior to an acquisition constitutes, for EMNEs, an important motivational trigger for catching up and for appropriating the intellectual property rights on key discoveries. Such urgency may not characterize EMNEs with an experience in patenting, which may undertake an altogether different learning and innovative behavior. Non-patenting EMNEs may instead be very eager

to bite-the-cake of European technological assets, but our results also suggest that they are unable to learn from the taken-over firms – possibly due to the complexities inherent with the post-acquisition phases of integration (Chakrabarti, Hauschildt and Süverkrüp 1994; Hennart and Reddy 1997). However, as illustrated by other studies (see e.g. Giuliani et al., 2014), EMNEs subsidiaries in Europe engage in a number of networking activities with several actors in the region where they locate – such as e.g. universities, suppliers, business associations and the like. Accessing regional knowledge – while certainly not automatic – may be smoother for EMNEs as they do not have to face the intra-corporate post acquisition frictions.

This interpretation is not without controversies. Most innovation scholars would be puzzled by our results as they would contend that non-innovative EMNEs lack the absorptive capacity (Cohen and Levinthal, 1990, among many others) for exploiting the knowledge resources of the host region. However, we shall recall that the absence of patents does not mean that the firm has not accumulated some productive and/or technological capabilities in its recent past, as learning may take place through R&D, design, training and other innovative activities even when they have not yet led to a patent application. Hence, the lack of prior patents cannot be *a priori* considered to hinder the successful exploitation of regional knowledge sources, as well as the formation of valuable networks with other extra-corporate partners. This is also in line with contemporary accounts of MNEs' behavior (Andersson et al., 2002, 2005), which view MNEs as inter-organizational networks also involving external partners (Ghoshal and Bartlett, 1990), and as subsidiaries representing key nodes of global –local connections (Cantwell and Iammarino, 2001; Marin and Giuliani, 2011).

This study has a number of limitations that we hope to overcome in the future. First, we only focus on EMNEs' international patents, because as said before the quality and availability of information on domestic patents vary across countries but it will be interesting to extend the analysis to take into account possible differences in the international and domestic patenting activity of EMNEs. Second, our estimates do not control for financial and economic performance indicators of the acquirer and the target because for EMNEs these information are very often unavailable in commercial databases and they are systematically available only for public limited companies.

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Tables

Table 1 - Distribution of deals by country of origin, macro-sector, and top destinations (# and %) (2004-2012)

Country of Origin	**Total**		**Manufacturing**		**Services**		**Top destinations** (#)
Brazil	9	2.76	4	1.23	5	1.53	Portugal (4); France (2)
China	45	13.80	36	11.04	9	2.76	Germany (15); UK (9); France (5); Italy (5)
India	135	41.41	79	24.23	56	17.18	UK (49); Germany (27); France (15); Spain (10)
Russia	101	30.98	28	8.59	73	22.39	Cyprus (30); Czech Republic (9); UK (8); Netherlands (8)
South Africa	36	11.04	3	0.92	33	10.12	UK (24); Netherlands (4)
Total	326	100.0	150	46.01	176	53.98	

Source: EMENDATA

Table 2 - Descriptive Statistics

Variables	**N**	**Mean**	**Median**	**St. Dev.**	**Min**	**Max**
EPO-USPTO PATENTS	326	3.948	0	17.100	0	137
EPO-USPTO CITATIONS	326	5.752	0	24.150	0	195
REL_KNOW_BASE	326	47.83	0	168	0	1108
TARGET_KNOW_BASE	326	1.034	0	5.043	0	55
ACQUIRER_KNOW_BASE	326	0.801	1	0.400	0	1
REGIONAL_KNOW_BASE	319	25.210	17.930	33.820	0	377.5
REGIONAL_INVENTORS	312	25.070	16.230	31.960	0	341.2
CULT_DIST	326	1.957	1.779	1.347	0.0770	6.375
MA_EXPERIENCE	326	6.215	3	11.800	0	81
NO_BIG_ACQ	326	0.135	0	0.3422	0	1
HORIZONTAL_MA	324	0.358	0	0.4802	0	1
CHINA_DUMMY	326	0.138	0	0.3455	0	1
INDIA_DUMMY	326	0.414	0	0.4933	0	1
PRE_2009_DUMMY	326	0.712	1	0.4537	0	1

Table 3 - Descriptive Statistics on Acquirer and Target patents pre- and after the acquisition

		ACQUIRER				TARGET	
		# EPO-USPTO PATENTS		***# EPO-USPTO PATENTS FORWARD CITATIONS***		***# EPO-USPTO PATENTS***	***# EPO-USPTO PATENTS FORWARD CITATIONS***
Country of Origin		Pre-Acquisition	After-Acquisition	Pre-Acquisition	After-Acquisition	Pre-Acquisition	Pre-Acquisition
Brazil	*#*	0	0	0	0	2	2
	mean	0.00	0.00	0.00	0.00	0.22	0.22
	sd	0.00	0.00	0.00	0.00	0.67	0.67
	min	0.00	0.00	0.00	0.00	0.00	0.00
	max	0.00	0.00	0.00	0.00	2.00	2.00
China	*#*	22	46	32	52	88	140
	mean	0.49	1.02	0.71	1.16	1.96	3.11
	sd	1.33	4.00	1.93	4.59	5.24	10.48
	min	0.00	0.00	0.00	0.00	0.00	0.00
	max	7.00	21.00	9.00	26.00	28.00	67.00
India	*#*	1241	1287	2669	1875	91	164
	mean	9.19	9.18	19.77	13.49	0.67	1.21
	sd	27.75	25.66	51.86	36.11	3.00	5.70
	min	0.00	0.00	0.00	0.00	0.00	0.00
	max	170.00	137.00	306.00	195.00	26.00	54.00
Russia	*#*	0	0	0	0	6	27
	mean	0.00	0.00	0.00	0.00	0.06	0.27
	sd	0.00	0.00	0.00	0.00	0.37	1.98
	min	0.00	0.00	0.00	0.00	0.00	0.00
	max	0.00	0.00	0.00	0.00	3.00	19.00
South Africa	*#*	6	2	6	2	1	1
	mean	0.17	0.06	0.17	0.06	0.03	0.03
	sd	0.70	0.33	0.70	0.33	0.17	0.17
	min	0.00	0.00	0.00	0.00	0.00	0.00
	max	4.00	2.00	4.00	2.00	1.00	1.00
Total	*#*	1269	1287	2707	1875	188	334
	mean	3.89	3.95	8.30	5.75	0.58	1.02
	sd	18.38	17.12	34.68	24.15	2.81	5.51
	min	0.00	0.00	0.00	0.00	0.00	0.00
	max	170.00	137.00	306.00	195.00	28.00	67.00

Table 4 - Regression Results

	(a) Dependent Variable: EPO USPTO PATENTS				(b) Dependent Variable: EPO USPTO CITATIONS			
	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Model8
CULT_DIST	-0.486	-0.485	-0.488	-0.517*	-0.341	-0.338	-0.325	-0.37
	-0.258	-0.257	-0.257	-0.259	-0.317	-0.315	-0.302	-0.314
MA_EXPERIENCE	0.086**	0.086**	0.086**	0.081**	0.085***	0.085***	0.085***	0.081***
	-0.029	-0.028	-0.028	-0.026	-0.005	-0.004	-0.006	-0.002
CHINA_DUMMY	5.645***	5.378***	5.639***	5.788***	5.981***	5.640***	6.010***	6.194***
	-1.52	-1.482	-1.506	-1.338	-0.022	-0.102	-0.078	-0.099
INDIA_DUMMY	4.877**	4.621**	4.869**	4.900**	5.443***	5.114***	5.490***	5.528***
	-1.749	-1.71	-1.733	-1.57	-0.448	-0.524	-0.486	-0.31
PRE_2009_DUMMY	2.235***	2.270***	2.236***	2.307***	2.760***	2.794***	2.746***	2.846***
	-0.392	-0.346	-0.391	-0.4	-0.677	-0.622	-0.657	-0.679
NO_BIG_ACQ	-13.774***	-14.234***	-13.992***	-19.262***	-15.122***	-15.700***	-16.093***	-19.346***
	-0.725	-0.717	-0.725	-0.718	-0.742	-0.763	-0.743	-0.761
HORIZONTAL_MA	-0.366***	-0.364***	-0.366***	-0.371***	-0.266*	-0.264*	-0.263*	-0.270*
	-0.013	-0.014	-0.013	-0.016	-0.109	-0.11	-0.11	-0.113
REL_KNOW_BASE	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
REL_KNOW_BASE_SQ	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
TARGET_KNOW_BASE	-0.019***	-0.018***	-0.018***	-0.008***	-0.012***	-0.011***	-0.018***	-0.001
	-0.003	-0.003	-0.003	-0.002	-0.001	-0.001	-0.005	-0.002
ACQUIRER_KNOW_BASE	-2.876***	-3.240***	-2.878***	-2.513***	-3.201***	-3.691***	-3.187***	-2.820***
	-0.216	-0.269	-0.214	-0.246	-0.39	-0.528	-0.385	-0.502
REGIONAL_KNOW_BASE	-0.002*	-0.002**	-0.002*	-0.002**	-0.005*	-0.005*	-0.006	-0.005*
	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002	-0.003	-0.002
ACQUIRER_KNOW_BASE X REGIONAL_KNOW_BASE		0.011***				0.016**		
		-0.002				-0.005		
TARGET_KNOW_BASE X REGIONAL_KNOW_BASE			-0.001***				0.001	
			0.001				0.001	
ACQUIRER_KNOW_BASE X TARGET_KNOW_BASE				-12.408***				-11.118***
				-1.052				-1.218
INDUSTRY FIXED EFFECTS	YES	YES	YES	YES	YES	YES	YES	YES
OBSERVATIONS	317	317	317	317	317	317	317	317
LOG LIKELIHOOD	-362.947	-360.691	-362.94	-355.241	-460.033	-456.19	-459.361	-451.892

Legend: *<0.05, **<0.01, ***<0.001. Models are estimated using Poisson Quasi-Maximum Likelihood. Robust Standard errors are also reported.

Table 5- Two-stage count model with sample selection

	EPO-USPTO PATENTS	EPO-USPTO CITATIONS
CULT_DIST	-0.345*	-0.278**
	0.146	0.106
MA_EXPERIENCE	0.001	0.020*
	0.015	0.009
CHINA_DUMMY	1.161*	0.425
	0.460	0.356
PRE_2009_DUMMY	2.075***	2.176***
	0.649	0.532
HORIZONTAL_MA	-0.160*	-0.155**
	0.069	0.052
REL_KNOW_BASE	0.007***	0.008***
	0.001	0.001
REL_KNOW_BASE_SQ	-0.001***	-0.001***
	0.001	0.001
TARGET_KNOW_BASE	-0.021*	-0.024**
	0.010	0.011
ACQUIRER_KNOW_BASE	-3.270***	-3.385***
	0.297	0.271
REGIONAL_KNOW_BASE	-0.011***	-0.002**
	0.001	0.001
CONSTANT	-0.490	-0.734
	0.658	0.532

Legend: *<0.05, **<0.01, ***<0.001. In the sample selection equation, we include for origin country, industry sector, size, knowledge base and solvency ratio of the acquirer. Standard errors are reported below coefficients.

Figures

Figure 1 – Predictive margin *REGIONAL_KNOW_BASE* on *EPO-USPTO PATENTS*

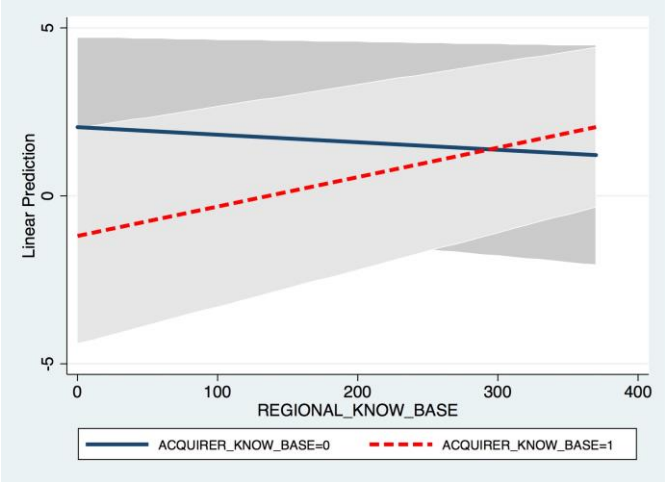


Figure 2 - Predictive margin for *REGIONAL_KNOW_BASE* and *TARGET_KNOW_BASE*

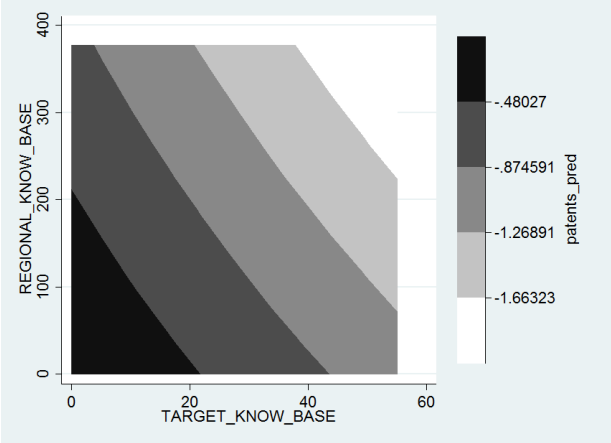
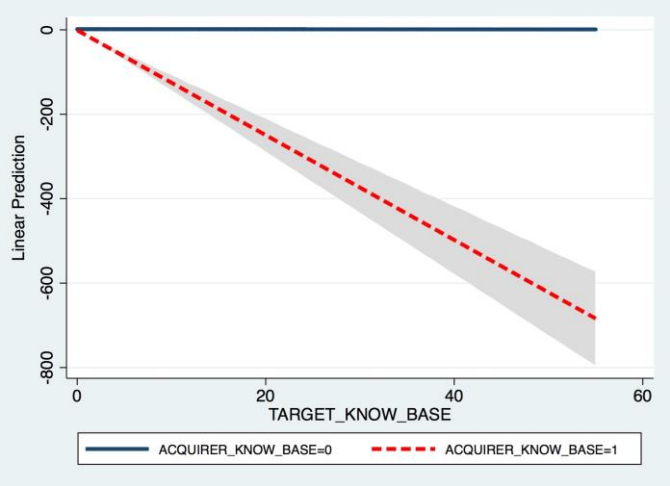


Figure 3 - Predictive margin for TARGET_KNOW_BASE on *EPO-USPTO PATENTS*



APPENDIX

Table A-1 List of variables and sources

NAME	DESCRIPTION	SOURCE
Dependent variables		
EPO-USPTO PATENTS	# of EPO and USPTO patents of the acquirer in the 3 years after the deal	PATSTAT ORBIS
EPO-USPTO CITATIONS	# of EPO and USPTO patents of the acquirer in the 3 years after the deal, weighted by their forward citations	PATSTAT ORBIS
Independent variables		
TARGET_KNOW_BASE	# of patents of the target company plus their cited patents	PATSTAT ORBIS
REGIONAL_KNOW_BASE	Cumulated # of EPO patents per capita in the region (NUTS 3) where the target company is located	OECD REG PAT
REGIONAL_INVENTORS	# of EPO inventors per capita in the region (NUTS 3) where the target company is located	OECD REG PAT
ACQUIRER_KNOW_BASE	Dummy equal 1 if the acquirer has zero patents before the deal.	PATSTAT ORBIS
	Control variables	
HORIZONTAL_MA	Dummy equal 1 if the target and the acquirer are in the same SIC (2 digit) code	ORBIS
CULT_DIST	Cultural distance between the acquirer and target's country	Hofstede
INDIA_DUMMY	Dummy equal to 1 if the acquirer is Indian	EMENDATA
CHINA_DUMMY	Dummy equal to 1 if the acquirer is Chinese	EMENDATA
PRE_2008_DUMMY	Dummy equal to 1 if the deal was closed before 2008	EMENDATA
NO_BIG_ACQ	Dummy equal to 1 if the acquirer is not in the size categories "Large" and "Very Large" as defined in ORBIS	ORBIS
MA_EXPERIENCE	Number of M&A with a majority acquisition prior to the main-deal year	ZEPHYR SDC PLATINUM
REL_KNOW_BASE	Absolute difference between the number of patents of the acquirer plus their forward citations and the number of patents of the target plus their forward citations	PATSTAT ORBIS
REL_KNOW_BASE_SQ	Squared term of *REL_KNOW_BASE*	PATSTAT ORBIS

Table A-2 Correlation table

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	EPO-USPTO PATENTS	1													
2	EPO-USPTO CITATIONS	0.962	1												
3	REL_KNOW_BASE	0.7439	0.7986	1											
4	TARGET_KNOW_BASE	-0.0177	-0.0235	0.1941	1										
5	ACQUIRER_KNOW_BASE	-0.4505	-0.4686	-0.4605	-0.0107	1									
6	REGIONAL_KNOW_BASE	-0.0169	-0.0298	0.0228	0.1034	-0.0867	1								
7	REGIONAL_INVENTORS	0.0167	0.0057	0.0375	0.0864	-0.1104	0.9008	1							
8	CULT_DIST	-0.0642	-0.0631	-0.0391	0.0808	0.0717	0.1454	0.1633	1						
9	MA_EXPERIENCE	-0.0111	-0.0111	-0.0453	-0.0682	0.1114	-0.1627	-0.1488	-0.0193	1					
10	NO_BIG_ACQ	-0.0912	-0.0942	-0.0777	0.0297	0.1746	0.0758	0.0538	0.0128	-0.1736	1				
11	HORIZONTAL_MA	-0.001	0.013	0.0752	0.0148	-0.025	-0.036	-0.0122	-0.0182	-0.1116	-0.0892	1			
12	CHINA_DUMMY	-0.0696	-0.0775	0.0232	0.2664	0.0187	0.197	0.1419	0.3311	-0.1744	0.1288	-0.0427	1		
13	INDIA_DUMMY	0.2558	0.2685	0.2359	-0.0117	-0.4181	0.1304	0.1421	-0.1914	-0.2343	-0.0809	0.1214	-0.3432	1	
14	PRE_2009_DUMMY	0.1519	0.158	0.1395	0.059	-0.1989	-0.075	0.0154	0.0352	0.0182	-0.063	0.0528	-0.0699	0.1408	1

Table A3. Zero-Inflated Poisson regression

	EPO-USPTO PATENTS	EPO-USPTO CITATIONS
REL_KNOW_BASE	0.006***	0.006***
	0.001	0.001
REL_KNOW_BASE_SQ	-0.001***	-0.001***
	0.001	0.001
REGIONAL_INVENTORS	-0.002[#]	-0.003**
	0.001	0.001
TARGET_KNOW_BASE	-0.023*	-0.017*
	0.009	0.008
CULT_DIST	-0.158*	-0.107
	0.079	0.068
MA_EXPERIENCE	0.089***	0.083***
	0.013	0.009
PRE_2009_DUMMY	0.929	1.305*
	0.504	0.6
HORIZONTAL_MA	-0.360***	-0.268***
	0.063	0.05
NACE_1	1.741***	0.796***
	0.107	0.068
CONSTANT	-0.36	0.265
	0.539	0.623

[#]<0.06, *<0.05, **<0.01, ***<0.001. In the inflate equation, we include for origin country, industry sector (including banking), size, knowledge base of the acquirer. Standard errors are reported below coefficients.