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Do Intellectual Property Rights Influence Cross-Border Mergers and Acquisitions?

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Do Intellectual Property Rights Influence Cross-Border Mergers and Acquisitions?

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Abstract

This paper analyses whether the strengthening of intellectual property rights (IPRs) systems affects decisions of cross-border mergers and acquisitions (M&As), and if their influence is different for developed and developing countries, and across industrial sectors. We estimate an extended gravity model to study bilateral number of M&As using data for the post-TRIPS period (1995-2010) and two different indexes that measure the strength of IPRs systems at the country level. We find that IPRs influence decisions of cross-border M&As in all the sectors of different technological content. Furthermore, a strengthening of IPRs leads to a larger increase of M&As in developing countries than in developed countries. This calls the attention on the possible implications for least developed economies.

Keywords: Intellectual Property Rights; Mergers and Acquisitions; Technological Intensity; Gravity Model; Economic Development

JEL Codes: O34; G34; O13; O14

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1 Introduction

The recent process of harmonization and strengthening of intellectual property rights (IPRs) systems is expected to have implications for global relations among countries (Maskus, 2012). However, the effect of IPRs on international trade, foreign direct investment (FDI), technology transfer, and mergers and acquisitions (M&As) is not clear either from a theoretical perspective or from an empirical point of view (Maskus and Penubarti, 1995; Maskus, 2000; Foley et al., 2006; Campi and Dueñas, 2016).

In the case of cross-border M&As, intellectual property (IP) assets are often a relevant part of the value of the target firm and the desire of a firm to access them may be a significant driving force behind a deal. Nevertheless, economic theory sheds an ambiguous light on the relation between IPRs and M&As.

By reducing the risk of imitation, IPRs might affect firms' decisions regarding investment, trade, or licensing. But the effect of this lower risk of imitation may depend on the technological level of firms' products, encouraging firms with knowledge-intensive products to access a foreign market. Notwithstanding, this will not necessarily lead to a burst of M&As because the lower imitation risk of licensed technologies might, conversely, reduce incentives for FDI (Yang and Maskus, 2001). Also, the enforcement of IPRs can affect low-technology products, which are easier to be imitated.

Being a relevant part of the general regulatory system, IPRs systems can affect the investment climate (Fink and Maskus, 2005). However, Maskus (2000) argues that IPRs systems alone cannot explain how firms decide to invest, trade, or license a product to a certain country, as firms' decisions are influenced by other factors. Indeed, the choice among FDI, licensing, and trade is likely to depend on and interact with internationalization advantages that derive from market power, market size, as well as transportation, transaction, and labor costs. These factors, together with financial variables and the institutional system, are usually different in countries of different development level. Therefore, the effect of IPRs on M&As may also be affected differently by the the level of development of the countries involved in the deals.

In the last decades, the growth of FDI at higher growth rates than trade and GDP has been one of the main characteristics of the process of globalization (Feenstra, 1998; Brakman et al., 2010). Cross-border M&As account for a large share of FDI.[1] Simultaneously, the signing of the agreement on Trade-Related Aspects on Intellectual Property Rights (TRIPS) in 1994 led to a process of global diffusion and tightening of IPRs systems. In this process, developed countries (DCs) have increased the level

[1] According to UNCTAD (2001), M&As represented around 80% of the world FDI in 2000.

of existing IP protection and developing or less developed countries (LDCs) have either adopted new systems or adapted their existing systems to the "minimum standards" demanded by the TRIPS. The scope of IP protection has also been broadened, reaching sectors or products, such as plant varieties, micro-organisms, and pharmaceutical products, which were previously excluded from IP protection.

This paper explores whether the strengthening of IPRs systems during the post-TRIPS period (1995-2010) has affected decisions of M&As using an extended gravity model. Our research differs from the existing literature in several aspects. Firstly, most studies that use a gravity model have focused on trade or FDI, while we use a gravity specification to explain M&As. Secondly, most authors addressing the effect of IPRs have focused on FDI. Conversely, we consider the strength of IPRs systems in target countries as a possible determinant of cross-border M&As. Thirdly, while most existing studies focus on single specific determinants of M&As, we consider altogether the more relevant determinants of M&As found in the literature. Finally, we also study whether there is a different impact of IPRs in sectors of different technology intensity, since the effect of IPRs is generally sector-specific.

We use an extended gravity model that includes a set of variables usually considered as determinants of M&As and two different measures of IPRs systems: the index of patent protection of Ginarte and Park (1997), updated by Park (2008), for the manufacturing sector, and the index of IP protection for the agri-food sector, developed by Campi and Nuvolari (2015). In order to take into account a possible differential effect of IPRs for different sectors (Mansfield, 1995; Cohen et al., 2000; Smarzynska, 2004; Nunnenkamp and Spatz, 2004), we split our data on M&As into four groups of different technology content: (i) agri-food; (ii) low-technology industries; (iii) medium-technology industries; and (iv) high-technology industries.

In addition, we consider that the effect of IPRs might also depend on the development level of countries. This may happen for several reasons. Firstly, LDCs have, in general, lower imitation abilities. Secondly, the relevance of agriculture and manufactures of different technology content is different for DCs and LDCs. Thirdly, DCs used to have in place strong IPRs systems, while LDCs are recently adopting strong IP protection systems. And, fourthly, most studies have found differential effects of IPRs on FDI for DCs and LDCs (Seyoum, 1996; McManis, 1997; Kalanje, 2002).

Overall, we find that the recent strengthening of IPRs systems increases the number of cross-border M&As, for all the sectors considered regardless of their technological content. We also find that the positive effect of IPRs on M&As is stronger when the increase in IPRs takes place in a LDCs, compared with DCs.

These results have relevant implications in the context of the global strengthening

and harmonization of IPRs systems. In the first place, if IPRs are likely to affect not only firms' decisions related to M&As but also trade and licensing, then, the design of IPRs systems should consider how they might possibly affect these decisions and the implications for different countries. Secondly, since stronger IPRs attract more M&As in LDCs compared with DCs, the question arises whether M&As are a desirable form of investment for developing countries. Then, although the effect of IPRs is positive for all sectors, our findings suggest that there are differential effects for countries of different development levels.

The remaining of the paper is organized as follows. In the next section, we briefly discuss the possible determinants of M&As, we analyze how IPRs can influence firms' decisions of M&As from a theoretical perspective, and review the empirical evidence. In the third section, we analyze the data. In the fourth section, we explore the effect of IPRs on bilateral flows of M&As. Finally, in Section 5, we discuss the main findings and provide general conclusions.

2 Which factors determine M&As?

A firm that aims to access a foreign market faces different choices. It can export the product, manufacture it locally by undertaking foreign direct investment (FDI), which in turn can mean doing a greenfield investment or a M&A, license the product to a firm in the host country, or undertake a joint venture involving joint production or a technology-sharing agreement (Fink and Maskus, 2005; Helpman, 2006). These decisions are not made independently from each other, nor they are exclusive.

IPRs systems may affect these decisions on several ways. For example, from the domestic firms perspective, a weak IPRs system can allow them to imitate technologies, possibly leading to productivity and economic growth. From the foreign firm perspective, given the higher risk of imitation, a weak IPRs system might discourage FDI or exports to that economy. However, imitation abilities depend not only on IP protection but most importantly on the capabilities of firms to master new technologies and both tacit and codified knowledge. Therefore, the effect of IPRs system has to be considered taking into account imitation abilities of the target countries.

In fact, when imitation abilities are low, weak IPRs could be beneficial for both partners because this combination might encourage foreign firms to engage in joint-ventures and license agreements with domestic firms, as well as simply trade, promoting technology transfer to the domestic market. However, the market power that derives from IPRs may induce firms to reduce sales and increase prices, and it

may also prevent access to new technologies, negatively affecting further innovation. How IPRs influence decisions of firms is mediated by several trade-offs, which explains the difficulty to predict their effect *a priori*.

Which factors affect decisions of M&As is an issue that has been widely addressed in the literature. Most of the existing contributions focus on the macroeconomic causes of FDI and the obstacles to capital flows (such as financial markets failures and asymmetric information), and on specific features of countries (such as GDP, development level, quality of institutions, and openness to trade) (Hyun and Kim, 2010).

The empirical studies find that the more relevant determinants of M&As are: 1) GDP and market size (Brakman et al., 2010); 2) geographical distance as a proxy of transportation and transaction costs (Brakman et al., 2010); 3) cultural differences (Erel et al., 2012); 4) financial market development (Di Giovanni, 2005); 5) openness to trade and economic integration (Cuevas et al., 2005; Hyun and Kim, 2010); 6) quality of institutions (Hur et al., 2011; Hyun and Kim, 2010; Courdacier et al., 2009); and 7) exchange rates volatility (Blonigen, 1997; Brakman et al., 2010).

Recently, some empirical works have started using gravity specifications to explain cross-border M&As because market size, trade barriers, and economic distance are critical for understanding FDI and trade patterns (see, for example: Brakman et al., 2010; Di Giovanni, 2005; Courdacier et al., 2009). Also, gravity models allow for the consideration of other possible determinants at the country level. Given the volatility of M&As time series, explaining them with gravity specifications might be more challenging than in the case of trade (Herger et al., 2008; Wong, 2008). However, several studies have succeeded in fitting and predicting M&As reasonably well with a gravity model (Blonigen, 2005).

2.1 General determinants of M&As

The literature that focuses on macroeconomic volatility as a determinant of FDI and M&As finds mixed evidence. Several studies use the coefficient of variation of the exchange rate as a proxy of macroeconomic stability. For example, Blonigen (1997) finds that the appreciation of the exchange rate in the US has a significant effect on cross-border M&As of Japanese firms, but the impact of the variability of exchange rates is ambiguous. Brakman et al. (2010) find that exchange rate volatility does not affect the value of cross-border M&As.

Several authors provide empirical evidence about the effect of financial market development on M&As. Using a gravity model, Di Giovanni (2005) studies the distribution and evolution of worldwide cross-border M&As, finding that domestic

financial deepening affects firms' decisions of investing abroad and that deep financial markets in the target country also play a relevant role. Brakman et al. (2010) show that financial openness is a prerequisite to attract cross-border M&As. They also argue that the market-seeking motive is an important determinant of M&As and that market size variables related to the target increase the value of M&As.

Other authors explore the effect of openness to trade and regional trade agreements on M&As. Cuevas et al. (2005) conclude that the North American Free-Trade Agreement has a significant positive effect on FDI flows, especially for the smaller members of the agreement. However, Di Giovanni (2005) argues that custom unions and free trade agreements decrease cross-border M&As, while service agreements increase them.

Several scholars analyze whether the quality of the legal and regulatory framework of countries affect M&As. Rossi and Volpin (2004) show that differences in laws and enforcement explain the intensity and the pattern of cross-country M&As: countries with higher accounting standards and stronger shareholder protection receive more M&As. Using a gravity model, Hyun and Kim (2010) find that, in addition to economic integration and geographic characteristics, the quality of the institutions and financial market development are key determinants of M&As. Also, Hur et al. (2011) argue that the quality of institutions is a relevant determinant of M&As. Moreover, they attribute the disparities observed in cross-country M&As inflows to DCs and LDCs to the difference in the quality of their institutions.

2.2 The influence of IPRs on M&As

Intangible assets such as patents, trademarks, and trade secrets, are a part of the value of the target firm in M&As. Therefore, several scholars agree that a relevant driving force behind M&As deals is the acquirer's desire to obtain the target's IP assets (Bryer and Simensky, 2002; Marco and Rausser, 2002). For example, Marco and Rausser (2002) show that M&As of major agricultural business suppliers are designed to expand the IPRs portfolio. This is not surprising if we consider certain behaviors related with IPRs such as patent blocking or the creation of patent thickets, which can create incentives for firms to acquire other firms that hold strategic IPRs (Bessen, 2003; Cohen et al., 2000). Then, we might expect that not only access to IPRs assets but also IPRs systems protecting these assets might induce M&As.

Theoretically, the relation between IPRs and FDI, including M&As, is ambiguous. Strong IPRs may encourage firms with IPRs assets or knowledge intensive products to trade, invest, and license because IP protection reduces the risk of imitation. But the effect of lower imitation risk of licensed technologies may reduce incentives for

FDI and, instead, increase incentives to trade (Yang and Maskus, 2001). Being a relevant part of the general regulatory system, weak IPRs systems may adversely affect the investment climate, discouraging FDI (Fink and Maskus, 2005). However, Maskus (2000) argues that IPRs systems alone cannot explain how firms decide to invest, trade, or license a product. The choice between the different options is likely to depend on internationalization advantages. Thus, there is an interplay between IPRs and market power, market size, transportation and labor costs, transaction costs, and other country specificities. Moreover, trade, licensing, and FDI can be complementary rather than substitutes for each other.

The effect of IPRs on M&As has been less thoroughly studied. The available evidence is mostly gathered from FDI data and it is not conclusive. Several authors find a positive effect of IPRs on FDI. Using a gravity model, Smith (2001) finds a positive link between IPRs and both FDI and licensing of US firms, although this holds for middle-income countries and large LDCs, but not for small and low-income countries. Adams (2010) argues that the strengthening of IPRs in LDCs has a positive effect on FDI, especially after the signing of the TRIPS agreement. Lesser (2002) finds a positive correlation among IPRs and FDI inflows to LDCs. Foley et al. (2006) study the effect of IPRs reforms on US multinationals, finding that stronger IPRs increase technology transfer together with the level and growth rate of non-resident patenting.

On the contrary, other authors find a negative or not significant correlation between IPRs and FDI. Seyoum (1996) explores the relation between IPRs and FDI for 27 countries. He finds that, in the case of LDCs, there is no significant effect of IPRs systems on investment decisions, while for DCs there is a positive effect of trademarks and copyrights but a negative effect of patent protection. Fink (2005) investigates the effect of IPRs on exports, FDI, and licensing arrangements made by Germany and American multinationals. He finds no effect of stronger IPRs systems, except for a negative link between IPRs and sales in the chemical industry. He concludes that variables other than IP protection are explaining the cross-country activity of multinationals. Nicholson (2007) estimates the impact of IPRs on the composition of sector-specific multinational activity. He argues that firms in industries with high capital costs are more likely to maintain control over production knowledge through FDI in countries with weak IP protection. Conversely, firms in industries that are intensive in research and development (R&D) are more likely to engage in licensing when IPRs systems are strong.

As noted above, the effect of IPRs usually depends on the sector considered. Mansfield (1995) provides empirical evidence that firms in the chemical, electrical equipment, pharmaceutical, and machinery sectors are more likely to be affected by

IPRs. Smarzynska (2004) argues that weak IPRs systems have the largest deterring effect on FDI in four technology-intensive sectors: drugs, cosmetics and health care products, chemicals, machinery and equipment, and electrical equipment.

In general, the decision to trade, undertake FDI, or license is a complex process that is affected by several factors and is probably firm specific. Nicholson (2007) argues that firms with natural barriers to imitation tend to choose licensing, while firms vulnerable to imitation tend to choose FDI. Stronger IPRs systems can cause substitution between these modes.

Since the effect of IPRs remains ambiguous, we contribute to this literature with further empirical evidence on whether IPRs systems in target countries affect decisions of M&As. Our main goal is to use a gravity model to explain cross-border M&As including IPRs systems to study their effect on M&As. To our knowledge, this is the first study that considers the strength of IPRs systems in target countries as a possible determinant of M&As using a gravity specification for a large set of countries. Also, while most studies focus on a few variables that affect M&As, we include a set of variables which are considered determinants of M&As in the related literature. In addition, we assess the effect of IPRs on M&As in sectors with different technology content and for countries of different development levels.

3 Data

Data of M&As are from Worldwide Mergers, Acquisitions, and Alliances Databases SDC Platinum (Thomson Reuters). The database reports both the number of transactions and their values in nominal dollars, although in a large number of cases, firms do not disclose the value of the deals. We deflated cross-border flows of M&As using the US imports price index provided by the US Bureau of Labor Statistics and we obtain M&As in constant 2000 dollars.[2]

Factors driving both the number and value of M&As are expected to be very similar. In fact, the correlation of their evolution in our database is as high as 0.91. We use both the number of transactions and their values for the empirical analysis, and we use the number of transactions for the econometric estimations in order to have a higher number of observations.

We consider different sub-samples of M&As in four sectors of different technology content for DCs and LDCs (see the Appendix for the list of countries).[3] Following

[2] `http://www.bls.gov/web/ximpim/beaexp.htm`, accessed on February 2015.

[3] The classification of countries is based on the World Bank and United Nations. See: `http://data.worldbank.org/about/country-and-lending-groups` and `http://www.un.org/en/development/desa/policy/wesp/wesp\_current/2012country\_class.pdf` (accessed on March 2015).

the classification of Lall (2000) and OECD (2011) as a baseline, we have classified our data in four groups of M&As: (i) agri-food; (ii) low-technology industries; (iii) medium-technology industries; and (iv) high-technology industries.

There are several ways of categorizing industries by technology intensity. Pavitt (1984) made a relevant effort, distinguishing between resource-based, labour-intensive, scale-intensive, differentiated and science-based manufactures. Lall (2000) improved this classification, arguing that the analytical distinctions of Pavitt are unclear and present large overlaps among categories. The OECD (2011) uses four categories: high-, medium-high, medium-low, and low technology. This classification is based on direct R&D intensity, and R&D embodied in intermediate and investment goods (Hatzichronoglou, 1997).

Table 1: Technological classification of industries

Classification	Industrial Sectors - Products	SIC Codes
Agri-food		
-Agricultural Products	Crops, livestock and animal specialities, agricultural services, forestry	01, 02, 07, 08
-Food	Food and kindred products, preparation of meats/fruits, beverages, vegetable oils, tobacco manufacturing	20, 21
Low-technology industries		
-Textile/fashion cluster	Textile fabrics, clothing, headgear, footwear, leather manufactures, travel goods	22, 23, 31
-Other low technology	Pottery, simple metal parts/structures, wood products, furniture, jewellery, toys, plastic products	24, 25, 26, 27, 30 (except 3011, 3087, 3089), 3631, 3652, 39
Middle-technology industries		
-Automotive products	Transportation equipment, passenger vehicles and parts, commercial vehicles, motorcycles and parts	37 (except 3721, 3724, 3728, 3761, 3764, 3769)
-Medium-technology process industries	Synthetic bres, chemicals and paints, fertilizers, plastics, iron, pipes/tubes, petroleum refining and related industries	28 (except: 2833-2836), 29, 32, 33, 34
-Medium-technology engineering industries	Engines, motors, industrial machinery, pumps, switch-gear, ships, watches	3011, 3087, 3089, 35 (except 3511, 3571, 3572, 3575, 3577), 36 (except 3631, 3652, 3663, 3669, 3671, 3672, 3674-3676, 3679), 3821
High-technology industries		
-Electronics and electrical products	Office/data processing/telecommunications equipment, TVs, transistors, turbines, power-generating equipment	3511, 3571, 3572, 3575, 3577, 3661, 3663, 3669, 3671, 3672, 3674-3676, 3679
-Other high-technology	Pharmaceuticals, aerospace, optical/measuring instruments, cameras	2833-2836, 38 (except 3821), 3721, 3724, 3728, 3761, 3764, 3769

We must highlight that Lall (2000) considers the technological content of products while our classification is for industrial sectors. In order to create our groups, we first connected the sectors identified by SIC codes in the M&As database and the groups

defined by the OECD (2011) that correspond to the ISIC Rev.3.[4] As both Lall (2000) and the OECD (2011) warn, there is a certain amount of subjectivity in assigning industries to categories. For example, high-technology industries can produce a variety of products ranging between low-tech and high-tech. Also, countries might have slightly different classifications using the same method. However, all these possible drawbacks are present in any given classification and are not expected to affect our research. Table 1 displays the final classification.

Figure 1 depicts the evolution of the volumes in millions (MM) of US dollars (left axis) and the number of total cross-border M&As (right axis) between 1995 and 2010 (including aggregated data from our four sectors).

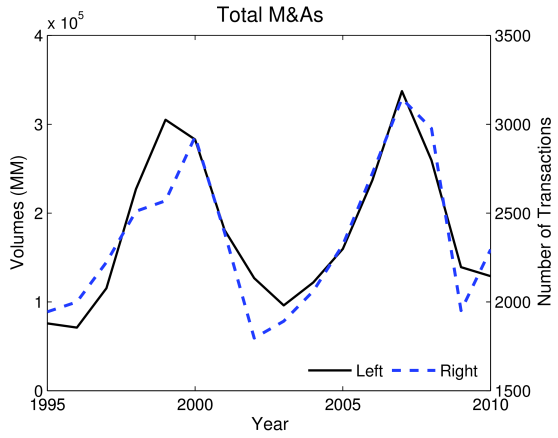

Figure 1: Evolution of total cross-border M&As

The time series displays two peaks, which derive from the "wave-like" behaviour of cross-border M&As, characterized by substantial variation over time, produced by periods of rapid growth and periods of rapid decline (Brakman et al., 2010). In our period of study, cross-border M&As increased between 1995 and 2000, and then decreased until 2003. After this downturn, M&As recovered until 2007 and decreased thereafter. This behaviour characterizes the evolution of both the number and the value of transactions.

Some interesting facts emerge if we discriminate by sector and development level of the target countries. Figure 2 shows the inflows of M&As to DCs and LDCs. We observe that inflows of M&As to DCs almost replicate the behaviour of total M&As and that inflows to LDCs have been increasing, especially since 2003, with the beginning of the second wave.

[4]To do this, we applied a concordance between the ISIC and the NAICS, and between the NAICS and the SIC codes, since there is no direct concordance between the SIC and the ISIC. See: `http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeConcordances.html`, accessed on December 2015.

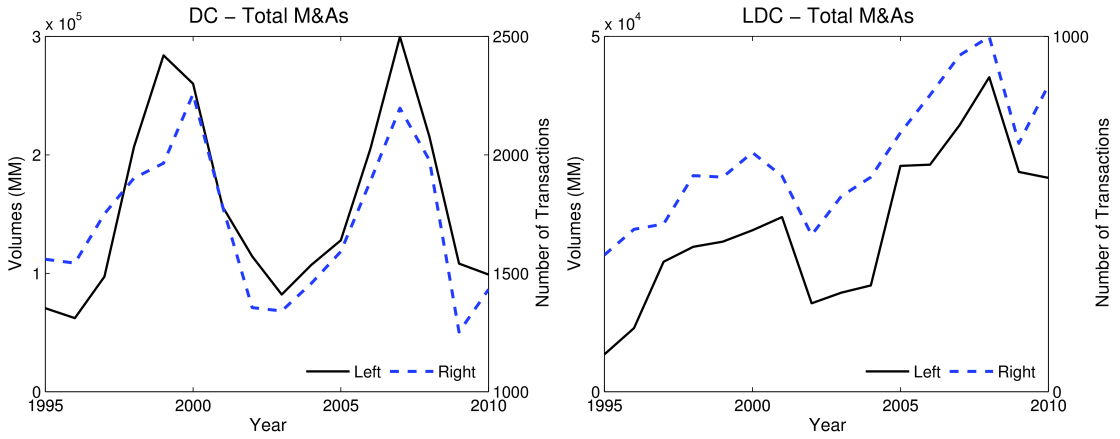

Figure 2: Evolution of total inflows of M&As by development level

Figure 3 shows the inflows of M&As by sector and development level of the target countries. We observe the two-wave pattern in all the sectors, although for LDCs the first wave is less pronounced. Not surprisingly, DCs –that attract and do more M&As– display a more similar pattern to the one observed in Figure 1.

In all the sectors, we observe a similar trend for the number of deals and the volumes of M&As. The inflows of M&As in volumes directed to DCs are in most sectors much higher when compared to LDCs. However, the number of transactions do not show such a big difference, although they are still greater in DCs, especially most of the deals in the high-technology sector take place in DCs. This evidence might indicate tat M&As in DCs are related to high-valued enterprises.

To measure the strength of IPRs systems, for the manufacturing sector (regardless their technological content), we consider the widely used patent protection index of Ginarte and Park (1997), update by Park (2008). For the agri-food sector, we use a yearly index developed by Campi and Nuvolari (2015), which is an indicator explicitly focused on IP protection in agriculture and considers its specific features.[5] Both indexes aggregate different components that indicate the strength of each country's IP protection system.

The index of Ginarte and Park (1997) considers five categories of the patent laws in each country: (i) extent of coverage, (ii) membership in international patent agreements, (iii) provisions for loss of protection, (iv) enforcement mechanisms, and (v) duration of protection. Similarly, the index of Campi and Nuvolari (2015) consists of five components that define the strength of IP protection in the agricultural sector:

[5]Dealing with living organisms, the agri-food sector presents several specificities (compared to the manufacturing sector), which derive in the use of specific related IPRs. For example, plant varieties are mainly protected by plant breeders' rights, rather than by patents.

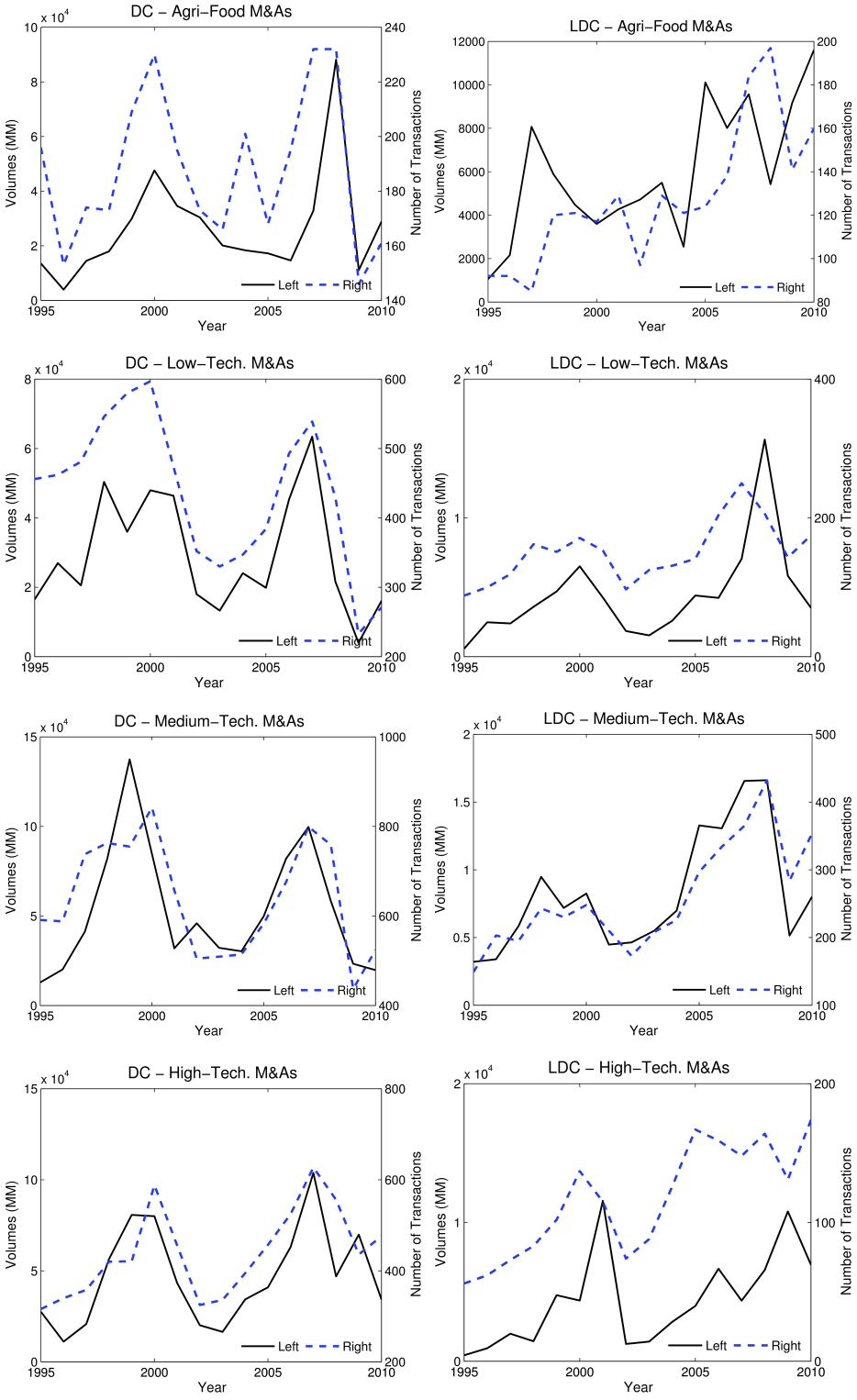

Figure 3: Patterns of total inflows of M&As by sector and development level

(i) ratification of UPOV Conventions; (ii) farmers' exception; (iii) breeder's exception; (iv) protection length; and (v) patent scope.

In both indexes, each of the categories or components were scored with a normalized value ranging from 0 to 1. The unweighted sum of these five values constitutes the overall score of each of the indexes, which range from zero to five. Higher values of the indexes indicate stronger levels of IP protection.[6] The main advantage of using these two indexes is that they provide a yearly measure of the strength of IP protection for a large sample of countries.

Table 2 shows an increase in the average values of the indexes over time. IPRs in LDCs have been increasing at higher growth rates and, although the gap between the level of IPRs in DCs and LDCs has narrowed, the last five-years period still shows a higher average level of IP protection in DCs. Also, there has been a decrease in the within variation (observed in the standard deviations). This evolution reflects the process of strengthening and harmonization of IPRs systems. Since we are interested in whether IPRs attract M&As, we consider the indexes of the target countries.

Table 2: Average value of intellectual property protection

	Agriculture			Manufacture		
	All countries	DCs	LDCs	All countries	DCs	LDCs
1995-1999	1.81(0.99)	2.31(0.89)	1.46(0.91)	2.58(1.09)	3.90(0.76)	2.17(0.82)
2000-2004	2.60(1.01)	2.93(0.83)	2.36(1.08)	3.06(1.01)	4.19(0.54)	2.72(0.85)
2005-2009	3.05(0.92)	3.20(0.78)	2.94(1.01)	3.37(0.89)	4.38(0.34)	3.05(0.76)

Note: Standard deviations in parenthesis.

In the following section, we carry out a regression using a gravity model augmented with measures of IPRs systems. We include the usual variables for a gravity equation that denote market size, geographical distance, and transaction costs, and a set of control variables that might influence M&As: the volatility of the bilateral exchange rate, openness to trade, financial openness, human capital, and political system as a proxy of institutional factors.

The GDP, as an indicator of the market size, but also of economic development, is usually associated with a positive effect on M&As. The effect of distance is expected to depend on the type of products. Some models expect that sectors like agri-food and low-technology manufactures might be more affected by distance

[6]Given that the index of Ginarte and Park (1997) is available at five-year intervals, we have assumed that the index remains unchanged during the five-year interval and replicated the values for the missing years. For example, we have used the value of the index in 1990 for all the years between 1990 and 1994.

because these sectors include perishable and relatively bulkier goods (Frankel et al., 1995). Also, theoretically, distance can have both a negative or a positive effect on M&As depending on the motivation for the transaction. For example, tariff-jumping investment could be positively associated with distance, because it can reduce the transportation costs of exporting. Conversely, market-seeking or outsourcing investments could be negatively related to physical distance, because they are complementary to trade (Hyun and Kim, 2010).

The coefficient of variation of the bilateral exchange rates is computed yearly using monthly data of bilateral exchange rates and we use it as an indicator of macroeconomic volatility. Openness to trade may both increase or decrease M&As given that it also affects firms' exports decisions. Financial openness is an index that measures the degree of capital account openness of a country. It is based on binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions (Chinn and Ito, 2008, 2014). Human capital is an index that considers the average years of schooling and the return to education. We use it as an indicator of the capabilities of a country and as a proxy of imitation abilities. Finally, political system is an indicator that measures the degree of democracy versus autocracy and we use it as a proxy of the quality of institutions.

4 M&As and IPRs: a gravity model

In this section, we perform a gravity model (GM) estimation to explore the possible effect of IPRs on the number of M&As.[7] This model has been largely used to explain bilateral trade flows using GDP and the geographical distance between two countries as the main explanatory variables (see Anderson, 2011, for a review). Other variables that are customarily included are trade barriers, openness to trade, cultural differences, trade agreements, and transaction and transportation costs. Although less frequently, the GM has also been used to estimate bilateral FDI and M&As flows considering other specific explanatory variables. We use as our benchmark specification the following equation:

$$MA_{ij,k}(t) = \exp\{x_{ij,k}(t) \cdot \beta_k\}\eta_{ij,k}(t), \tag{1}$$

[7]We also performed econometric estimations using the value of M&As finding complementary results, which are available upon request.

where $MA_{ij,k}(t)$ denotes the number of M&As from the acquirer country i to the target country j, in sector k, in the year t, and

$$x_{ij,k}(t) = \{Z_i, Z_j, D_{ij}, IP_{j,k}, W_i, W_j, XR_{ij}, \gamma_i, \gamma_j, \gamma_{ij}, \gamma_t\}; \tag{2}$$

$i, j = 1, ..., N$; $Z = \{\log(\text{GDP}), \log(\text{pop})\}$ is a vector containing country-specific variables including GDP and total population; $D = \{\log(dist), \text{contig}, \text{comlang}, \text{comcol}, \text{colony}\}$ is a vector with bilateral-specific variables that includes geographical distance ($dist$), and variables indicating geographical, economic, and cultural barriers (contiguity, common language, common colonizer, colonial link) between both countries; and $IP_{j,k} = \{\text{IPR}_{j,k}\}$ includes two indexes of IP protection of the target country j, that are used in independent estimations for sectors k, the index of Campi and Nuvolari (2015) specific for the agri-food sector, and the index of Ginarte and Park (1997), updated by Park (2008) for the three manufacturing sectors of low-, medium- and high-technological content. To control for other determinants of M&As, we use $W = \{\log(\text{open\_tra}), \text{fin\_open}, \text{h\_cap}, \text{polity}\}$, a vector with country-specific variables that includes openness to trade, an index of financial openness, human capital, and political system; and $XR = \{xr\}$ is the coefficient of variation of the bilateral exchange rate. Finally, γ_i and γ_j are a set of country dummies for the acquirers and the targets, respectively, γ_{ij} is a set of dyadic dummies, and γ_t is a set of time dummies. It is assumed that $E[\eta_{ij}|Z_i, Z_j, D_{ij}, ...] = 1$. Table 3 describes the variables and data sources.

The estimation of Equation (1) involves some econometric challenges mainly derived from its non-linearity. Borrowing from the empirical evidence on international trade, difficulties might be due to heteroscedasticity (Santos Silva and Tenreyro, 2006), endogeneity, and omitted-variable bias (Baldwin and Taglioni, 2006). These difficulties rule out OLS estimates given that they require a log-linearization of the gravity equation that, in principle, might lead to biased and inefficient estimations.

One possible source of endogeneity may be IPRs systems. However, there are no theoretical reasons either to believe that the indexes are not independent from the level of M&As, or that M&As are likely to cause the level of IPRs. Several authors agree that the increase in IP protection after the signing of the TRIPS agreement can be considered exogenous (Ivus, 2010; Delgado et al., 2013). The main reason is that the TRIPS agreement was included in a package of agreements whose acceptance was a compulsory requirement of the World Trade Organization (WTO) membership. Thus, the decision of signing the TRIPS and the implications on IPRs systems might not be seen as determined at the country level, but rather by an external body. In this sense, IPRs systems in the post-TRIPS period might be reasonable regarded as

Table 3: Variables Employed in the Gravity Estimations

Label	Related to	Description	Source
MA	Bilateral	Number of M&As	SDC Platinum (Thomson Reuters)
IPRs systems			
IPR_agri	Country	Index of agricultural IPRs	Campi and Nuvolari (2015)
IPR_manu	Country	Index of patent protection	Ginarte and Park (1997); Park (2008)
Country-specific variables			
GDP	Country	Gross domestic product	Feenstra et al. (2013)
pop	Country	Country population	CEPII (`www.cepii.fr`)
Geographical and cultural variables			
dist	Bilateral	Distance between two countries, based on bilateral distances between the largest cities of those two countries, weighted by the share of the city in the overall country's population	CEPII (`www.cepii.fr`)
contig	Bilateral	Contiguity dummy equal to 1 if two countries share a common border	CEPII (`www.cepii.fr`)
comlang	Bilateral	Dummy equal to 1 if both countries share a common official language	CEPII (`www.cepii.fr`)
comcol	Bilateral	Dummy equal to 1 if both countries have had a common colonizer	CEPII (`www.cepii.fr`)
colony	Bilateral	Dummy equal to 1 if both countries have ever had a colonial link	CEPII (`www.cepii.fr`)
Control variables			
xr	Bilateral	Bilateral exchange rate coefficient of variation	International Financial Statistics of the IMF (`www.imf.org/en/Data`)
fin_open	Country	Index of financial openness	Chinn and Ito (2008, 2014)
open_tra	Country	Openness to trade (Trade % of GDP)	WDI (`http://databank.worldbank.org/`)
h_cap	Country	Index of human capital	Feenstra et al. (2013)
polity	Country	Political System	Systemic Peace (`www.systemicpeace.org`)

"exogenous" (Delgado et al., 2013).

Thus, endogeneity is not a problem up to a certain extent. In fact, the TRIPS agreement establishes certain minimum standards –which are quite high compared to the previous systems– and gives countries the freedom to choose the final design of their IPRs systems. This implies that there are individual reasons for countries to adopt a certain level of IP protection. In order to control for this possible source of endogeneity and also to reduce the probability of omitted variable bias, we have added several time varying covariates, which are theoretically expected to influence M&As. Additionally, in order to avoid an omitted variable bias, we perform robustness exercises using different specifications in order to check if coefficient estimates are stable. We also use origin and destinations dummies (fixed effects), since countries might have individual reasons to adopt stronger IPRs. In addition, we use in other

specifications dyadic dummies in order to control bilateral fixed effects.

We perform the estimations using a count data model. The statistical tests determined that the Poisson Pseudo Maximum Likelihood (PPML) estimation performs better than the Negative Binomial (NB) estimation for all sectors and specifications.[8] Then, we have estimated Equation (1) using a PPML method for the four samples of M&As classified according to technology intensity.

4.1 Estimation results

Table 4 displays the results of the PPML estimations of the number of M&As. We have estimated two models for each of the four sectors.[9] In model (1), we used the baseline specification of the gravity model extended with the IPRs indexes. In model (2), we also included the set of control variables that influence M&As. Note that, in all the estimations, we used the index of IPRs of Campi and Nuvolari (2015) for the agri-food sector, and the index of (Ginarte and Park, 1997) for the manufacturing sectors.

The estimated coefficients of IPRs in the baseline specification (1) show that the strengthening of IPRs systems increases the number of M&As in all sectors regardless their technological content. It is interesting to note that when we include the set of control variables in models (2), the effect of IPRs is positive and significant for all the sectors, except for agri-food. This means that IPRs systems affect M&As even when we consider other factors that also have an impact on the decisions of M&As.

This implies that the interaction of IPRs with other factors such as institutions, financial variables, human capital, and openness to trade, affects the investment climate of countries (Maskus, 2000).

In both specifications, we observe that most of the usual variables related to the gravity equation are significant and present the expected signs. A higher GDP, which is an indicator of market size or potential demand, of both the acquirer and the target, leads to a higher number of deals. M&As decrease when the population of the target grows, while population of the acquirer is not significant, except in the low-technology sector.

We observe that in all the sectors, the estimated coefficients of distance are negative, which agrees with a significant part of the literature, and it is against the view of FDI as a means to avoid trade costs (Di Giovanni, 2005).

We found that sharing a common language, which is an indicator of cultural

[8]The over-dispersion parameter (α) of the NB estimation was always statistically not different from zero. Therefore, the PPML estimation method is preferred over the NB.

[9]We have also estimated the model for the aggregate manufacturing sector finding similar results, which are available upon request.

Table 4: PPML estimations of the number of cross-border M&As with country dummies

Sector	Agri-food		Low-technology		Medium-technology		High-technology	
Model	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
IPRs systems								
$IPR_{j,k}$	0.181***	0.100	0.663***	0.558***	0.682***	0.370***	0.497***	0.436***
	(0.051)	(0.062)	(0.090)	(0.113)	(0.083)	(0.078)	(0.104)	(0.098)
Country-specific variables								
$\ln(GDP_i)$	0.518**	0.769***	1.364***	1.472***	1.451***	1.453***	1.030***	1.286***
	(0.212)	(0.240)	(0.182)	(0.222)	(0.157)	(0.172)	(0.212)	(0.241)
$\ln(GDP_j)$	1.312***	1.914***	0.629**	0.865**	1.466***	1.663***	1.376***	1.378***
	(0.381)	(0.492)	(0.318)	(0.403)	(0.269)	(0.131)	(0.389)	(0.191)
$\ln(pop_i)$	0.144	0.445	-0.520	1.132**	-0.728	-0.421	-0.125	0.482
	(0.624)	(0.431)	(0.325)	(0.519)	(0.608)	(0.271)	(0.786)	(0.947)
$\ln(pop_j)$	0.414	-0.589	0.134	0.581	-0.807	-0.450***	-1.471*	-0.488***
	(0.618)	(1.161)	(0.592)	(0.513)	(0.537)	(0.101)	(0.792)	(0.141)
Geographical and cultural variables								
ln(dist)	-0.933***	-0.853***	-0.835***	-0.793***	-0.621***	-0.571***	-0.465***	-0.409***
	(0.031)	(0.036)	(0.024)	(0.030)	(0.021)	(0.025)	(0.025)	(0.033)
contig	0.321***	0.473***	0.064	0.083	0.132**	0.056	0.160*	0.063
	(0.081)	(0.087)	(0.066)	(0.072)	(0.058)	(0.061)	(0.083)	(0.087)
comlang	0.661***	0.964***	0.804***	0.925***	0.660***	0.764***	0.544***	0.721***
	(0.075)	(0.087)	(0.055)	(0.063)	(0.050)	(0.059)	(0.055)	(0.070)
comcol	0.235	-0.634	0.316*	0.014	0.433***	0.731***	0.428***	0.579***
	(0.309)	(0.505)	(0.161)	(0.197)	(0.142)	(0.167)	(0.128)	(0.194)
colony	0.660***	0.483***	0.543***	0.457***	0.388***	0.296***	0.456***	0.328***
	(0.073)	(0.084)	(0.054)	(0.062)	(0.048)	(0.055)	(0.052)	(0.063)
Control variables								
xr		0.342		-1.046**		-0.860*		-1.351*
		(0.591)		(0.522)		(0.457)		(0.767)
fin_open_i		-0.173		-0.125		-0.035		-0.473**
		(0.179)		(0.162)		(0.141)		(0.212)
fin_open_j		0.688		0.258		0.658***		-0.620**
		(0.460)		(0.315)		(0.236)		(0.267)
$\ln(open\_tra_i)$		-0.403*		0.298*		-0.017		-0.151
		(0.206)		(0.177)		(0.136)		(0.177)
$\ln(open\_tra_j)$		0.124		0.713***		1.029***		0.539***
		(0.284)		(0.201)		(0.123)		(0.162)
h_cap_i		0.742		0.201		0.234		0.725**
		(0.456)		(0.337)		(0.309)		(0.334)
h_cap_j		0.836*		0.065		-0.087		-0.600**
		(0.452)		(0.305)		(0.195)		(0.254)
$polity_i$		0.010		0.023		-0.001		-0.016
		(0.020)		(0.016)		(0.014)		(0.033)
$polity_j$		0.046		-0.005		0.096***		0.079***
		(0.080)		(0.042)		(0.013)		(0.017)
Country dummies	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Observations	58,884	29,709	59,594	32,632	64,532	34,480	37,782	22,478

Note: The dependent variable is the log of the number of M&As. IPR denotes the index of Campi and Nuvolari (2015) for the agri-food sector, and the index of Ginarte and Park (1997) for low-, medium-, and high-technology manufacturing sectors. Standard errors are in parenthesis. Significance level: *** p<0.01, ** p<0.05, * p<0.10.

proximity, is positively related with M&As. Regarding other bilateral-specific variables indicating barriers to trade, they all increase M&As when they turn out to be significant: contiguity (contig), sharing a common colonizer (comcol), and holding colonial links (colony) in the past, which might be a proxy of institutional similarity. Also, sharing a common language, which is an indicator of cultural proximity, is positively related with M&As.

The control variables, when they are significant, present the expected signs.[10] In contrast to Brakman et al. (2010) who find no significant effect, we observe that the coefficient of variation of the bilateral exchange rates decreases M&As in the three manufacturing sectors considered. We observe that an improvement in the index of financial openness is not significant in most cases. We found a positive significant effect of the index of the target countries in the medium-technology sector. In contrast to the findings of Di Giovanni (2005), we observe that when financial openness of both the acquirer and the target improve, M&As in high-technology manufactures decreases.

Openness to trade of the acquirer in the agri-food sector decreases M&As. This could indicate that a firm from a more open economy might decide to export rather than to invest in the agri-food sector. We observe the opposite in the low-technology sector. A more open target country increases M&As, in the manufacturing sectors, regardless their technological level.

The level of human capital is only significant in the agri-food and high-technology sectors, where we observe that human capital of the target country increases M&As in the agri-food sector and decreases M&As in the high-technology sector. Conversely the level of human capital of the acquirer is associated with greater M&As in the high-technology sector. Finally, the index of political system in the target countries displays positive estimated coefficients in the medium- and high-technology industries, meaning that an improvement in political institutions fosters M&As. This agrees with Hur et al. (2011), who argue that the quality of institutions is a relevant determinant of M&As.

As a robustness check, Table 5 displays the results of the PPML estimations for each of the four groups of M&As with dyadic dummies that capture the country pairs fixed effects.

The signs of the estimated coefficients are similar to the ones reported in the estimations with country fixed effects. The main exception is that the variable

[10]Note that, in order to deal with a possible omitted variables bias, we performed all the estimations using country dummies (origin and destination) fixed effects. Therefore, the variables that are country-specific and that do not strongly change over time, such as the set of control variables and also IPRs systems, are relatively less stable because country fixed effects are able to capture, up to a certain extent, their effect.

Table 5: PPML estimations of the number of cross-border M&As adding dyadic dummies

Sector	Agri-food	Low-technology	Medium-technology	High-technology
IPRs systems				
$IPR_{j,k}$	0.111*	0.598***	0.642***	0.606***
	(0.058)	(0.102)	(0.093)	(0.107)
Country-specific variables				
$\ln(GDP_i)$	0.759***	1.277***	1.441***	1.378***
	(0.213)	(0.200)	(0.158)	(0.206)
$\ln(GDP_j)$	1.904***	0.762**	1.709***	1.802***
	(0.465)	(0.302)	(0.293)	(0.352)
$\ln(pop_i)$	-0.508**	-0.371**	-0.474	-0.673**
	(0.259)	(0.179)	(0.463)	(0.274)
$\ln(pop_j)$	-1.473***	0.844	-0.819**	-2.630***
	(0.530)	(0.519)	(0.369)	(0.513)
Control variables				
xr	0.473	-1.178**	-0.963**	-0.751
	(0.623)	(0.557)	(0.451)	(0.786)
fin_open_i	-0.205	-0.141	-0.040	-0.392**
	(0.171)	(0.155)	(0.129)	(0.186)
fin_open_j	0.729*	0.253	0.783***	0.033
	(0.433)	(0.293)	(0.238)	(0.277)
$\ln(open\_tra_i)$	-0.397**	0.301*	0.016	-0.197
	(0.195)	(0.171)	(0.124)	(0.166)
$\ln(open\_tra_j)$	0.144	0.728***	0.244	-0.079
	(0.258)	(0.179)	(0.182)	(0.189)
h_cap_i	0.837**	-0.115	0.151	0.619**
	(0.412)	(0.287)	(0.241)	(0.282)
h_cap_j	0.796*	-0.128	0.180	-0.716**
	(0.429)	(0.248)	(0.222)	(0.281)
$polity_i$	0.013	0.035**	-0.007	0.002
	(0.019)	(0.014)	(0.012)	(0.028)
$polity_j$	-0.002	-0.000	-0.050**	-0.109***
	(0.068)	(0.040)	(0.025)	(0.039)
Country dummies	yes	yes	yes	yes
Dyadic dummies	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes
Observations	29,709	32,632	34,480	22,478

Note: The dependent variable is the log of the number of M&As. IPR denotes the index of Campi and Nuvolari (2015) for the agri-food sector, and the index of Ginarte and Park (1997) for low-, medium-, and high-technology manufacturing sectors. Standard errors are in parenthesis. Significance level: *** p<0.01, ** p<0.05, * p<0.10.

indicating the political system of the target country enters negatively in the estimations for the sectors of medium- and high-technology, while in the previous estimations they were positive.

We observe that IPRs have a positive and significant effect for all the sectors considered. Therefore, these robustness checks confirms our previous results: an

increase in IPRs generates an extension of the number of M&As.

4.2 Interactions between IPRs and development level of countries

In this section, we explore possible heterogeneity on the effect of IPRs depending on the development level of countries. To do this, we estimated a new specification of the model that includes an interaction variable between IPRs and the level of development.

The main idea behind the interaction variable is to control for possible link specificities that may derive from some stylized facts of the data, such as: (i) most cross-country investments are done by developed economies, (ii) since 2003, investments towards LDCs have been increasing, and (iii) after the signing of the TRIPS, IP protection has been increasing at higher growth rates in LDCs.

In order to consider the possible implications of these features, we included the interaction variable LDC_j*IPR_j, which is meant to capture the effect of strengthening IPRs in LDCs independently on the level of development of the acquirer country. This aims to answer the question of whether LDCs attract more investments as a consequence of a tightening of their IPRs system.

Table 6 displays the results of the estimations. In model (1) we use country dummies and in model (2) we also include dyadic dummies, in order to control for country and bilateral time-invariant fixed effects. Note that geographical, cultural, and control variables, all display the same signs as in the previous estimations. In the estimations including the interaction term, we observe that the index of IPRs looses significance in some specifications. The interaction term tells us that in all the sectors considered an increase in the IPRs of developing countries increases M&As relatively more than if developed countries increase their level of IPRs.

Therefore, these estimations conclude that, when developing countries tighten their IPRs systems, they will receive a higher number of M&As compared to developed countries, in all the sectors considered, regardless of their technological content. This calls the attention on the possible implications for developing countries of tighter IPRs systems. Is it beneficial for LDCs to receive an increasing number of M&As? Given that IPRs are also expected to affect trade and licensing, which is the overall outcome of the effect of stronger IPRs systems? These question are surely a relevant issue that deserves further research.

Table 6: PPML estimations of the number of cross-border M&As with interaction variables, country dummies, and dyadic dummies

Sector	Agri-food		Low-technology		Medium-technology		High-technology	
Model	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
IPRs systems								
$IPR_{j,k}$	-0.029	-0.044	0.203	0.213	0.209*	0.845***	0.214	0.907***
	(0.081)	(0.075)	(0.213)	(0.182)	(0.108)	(0.206)	(0.144)	(0.257)
LDC_j*IPR_j	0.259**	0.305***	0.477**	0.460**	0.200**	-0.240	0.268**	-0.362
	(0.110)	(0.103)	(0.225)	(0.179)	(0.083)	(0.204)	(0.114)	(0.264)
Country-specific variables								
$\ln(GDP_i)$	0.711***	0.678***	1.471***	1.255***	1.462***	1.441***	1.308***	1.379***
	(0.242)	(0.213)	(0.223)	(0.200)	(0.171)	(0.158)	(0.245)	(0.206)
$\ln(GDP_j)$	1.799***	1.762***	0.808**	0.910***	1.843***	1.790***	1.593***	1.889***
	(0.484)	(0.465)	(0.399)	(0.287)	(0.166)	(0.299)	(0.229)	(0.361)
$\ln(pop_i)$	-0.022	-0.480*	1.049**	-0.370**	-0.441	-0.455	0.567	-0.673**
	(0.820)	(0.257)	(0.499)	(0.178)	(0.269)	(0.467)	(0.459)	(0.274)
$\ln(pop_j)$	-0.815	-1.456***	0.356	0.963**	-0.613***	-0.854**	-0.699***	-2.590***
	(0.556)	(0.514)	(0.661)	(0.485)	(0.130)	(0.379)	(0.183)	(0.514)
Geographical and cultural variables								
ln(dist)	-0.852***		-0.793***		-0.574***		-0.411***	
	(0.036)		(0.030)		(0.025)		(0.033)	
contig	0.472***		0.082		0.053		0.060	
	(0.087)		(0.071)		(0.061)		(0.087)	
comlang	0.963***		0.925***		0.760***		0.719***	
	(0.086)		(0.063)		(0.059)		(0.070)	
comcol	-0.626		0.014		0.708***		0.557***	
	(0.505)		(0.197)		(0.164)		(0.192)	
colony	0.484***		0.457***		0.299***		0.328***	
	(0.084)		(0.062)		(0.055)		(0.063)	
Control variables								
xr	0.306	0.338	-1.057**	-1.230**	-0.847*	-0.929**	-1.387*	-0.700
	(0.594)	(0.626)	(0.525)	(0.563)	(0.459)	(0.447)	(0.773)	(0.781)
fin_open_i	-0.167	-0.180	-0.117	-0.118	-0.030	-0.046	-0.470**	-0.393**
	(0.180)	(0.171)	(0.163)	(0.157)	(0.141)	(0.129)	(0.210)	(0.186)
fin_open_j	0.649	0.665	0.307	0.315	0.753***	0.746***	-0.531*	0.035
	(0.451)	(0.428)	(0.323)	(0.302)	(0.240)	(0.239)	(0.278)	(0.272)
$\ln(open\_tra_i)$	-0.397*	-0.370*	0.290	0.302*	-0.025	0.018	-0.171	-0.193
	(0.207)	(0.192)	(0.177)	(0.171)	(0.136)	(0.124)	(0.178)	(0.166)
$\ln(open\_tra_j)$	0.035	0.060	0.648***	0.708***	0.869***	0.254	0.377**	-0.044
	(0.274)	(0.257)	(0.207)	(0.180)	(0.139)	(0.180)	(0.173)	(0.187)
h_cap_i	0.754*	0.816**	0.189	-0.111	0.255	0.159	0.784**	0.631**
	(0.457)	(0.410)	(0.337)	(0.287)	(0.310)	(0.241)	(0.310)	(0.281)
h_cap_j	0.736*	0.685	0.235	0.183	0.143	0.074	-0.370	-0.888***
	(0.443)	(0.423)	(0.321)	(0.275)	(0.232)	(0.236)	(0.280)	(0.302)
$polity_i$	0.008	0.006	0.022	0.034**	-0.001	-0.007	-0.015	0.002
	(0.019)	(0.019)	(0.016)	(0.014)	(0.014)	(0.012)	(0.032)	(0.028)
$polity_j$	0.011	-0.040	-0.014	-0.005	0.113***	-0.045*	0.097***	-0.101***
	(0.077)	(0.065)	(0.041)	(0.039)	(0.016)	(0.026)	(0.020)	(0.038)
Country dummies	yes	yes	yes	yes	yes	yes	yes	yes
Dyadic dummies	no	yes	no	yes	no	yes	no	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
Observations	29,709	29,709	32,632	32,632	34,480	34,480	22,478	22,478

Note: The dependent variable is the log of the number of M&As. IPR denotes the index of Campi and Nuvolari (2015) for the agri-food sector, and the index of Ginarte and Park (1997) for low-, medium-, and high-technology manufacturing sectors. Standard errors are in parenthesis. Significance level: *** p<0.01, ** p<0.05, * p<0.10.

5 Concluding remarks

Considering the recent global process of strengthening and harmonization of IPRs systems and the significance of cross-border M&As as the most relevant form of FDI,

we have studied for the post-TRIPS period whether IPRs affect how firms decide to undertake M&As.

The results of the gravity estimations confirm that market size, geographical factors, trade barriers, and cultural differences among countries are important determinants of cross-border M&As. The strengthening of IPRs systems increases M&As in all the sectors considered: agri-food, low-, medium-, and high-technology manufactures.

Several authors have shown that access to IP assets is one of the driving forces for firms to engage in M&As (Bryer and Simensky, 2002; Marco and Rausser, 2002). In line with this evidence, at the country level, our estimations show that IPRs systems protecting these IP assets also affect decisions on cross-border M&As.

Finally, we found that the increase in M&As derived from a strengthening of IPRs systems is higher for developing countries compared with developed countries. These results are robust to different specifications controlling for other possible determinants of M&As, as well as for country and dyadic fixed effects.

Overall, we have shown that several country features influencing or creating an attractive investment environment, are relevant to explain M&As. Some of these features are geography, market size, human capital, openness to trade, financial openness, and also IPRs systems. This finding suggests that the choice between FDI, trade, and licensing is likely to depend on, and interact with, country characteristics. Possibly, an interesting research extension would be to empirically and theoretically investigate how stronger IPRs simultaneously affect trade, licensing, FDI, and technology transfer, at the country level.

Our exercises have some relevant implications for the design of IPRs systems, especially for developing countries. Firstly, given that our results point out different effects for DCs and LDCs, they suggest that IPRs systems should consider specificities of countries and that there might be no unique system suitable for all countries. Secondly, considering that stronger IPRs are increasing M&As directed to the developing world, one should examine whether it is beneficial for LDCs to attract more investments in the form of M&As. Finally, we must recall that IPRs systems are likely to affect not only decisions of firms related to M&As but also trade and licensing. Therefore, the design of IPRs systems should also consider how they may possibly affect these decisions and what are the implications for countries in terms of innovation, technology transfer, and development.

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6 Appendix

List of Acquirer Countries

Developed Countries

Australia; Austria; Canada; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Italy; Japan; Latvia; Lithuania; Malta; Netherlands; New Zealand; Norway; Poland; Portugal; Slovak Republic; Slovenia; Spain; Sweden; Switzerland,Liechtenstein; United Kingdom; United States.

Developing Countries

Albania; Angola; Azerbaijan; Argentina; Bangladesh; Bolivia; Brazil; Bulgaria; Belarus; Cameroon; Central African Republic; Sri Lanka; Chad; Chile; China; Colombia; Costa Rica; Croatia; Cyprus; Dominican Republic; Ecuador; El Salvador; Ethiopia; Fiji; Gabon; Georgia; Ghana; Grenada; Guatemala; Honduras; Hong Kong SAR, China; Indonesia; Iran, Islamic Rep.; Israel; Côte d'Ivoire; Jamaica; Jordan; Kenya; Korea, Rep.; Kyrgyz Republic; Madagascar; Malawi; Malaysia; Mauritania; Mauritius; Mexico; Taiwan; Moldova; Morocco; Mozambique; Oman; Nepal; Niger; Nigeria; Pakistan; Panama; Paraguay; Peru; Philippines; Russian Federation; Rwanda; Saudi Arabia; Senegal; Sierra Leone; India; Singapore; Vietnam; South Africa; Zimbabwe; Thailand; Togo; Trinidad and Tobago; Tunisia; Turkey; Uganda; Ukraine; Macedonia, FYR; Egypt, Arab Rep.; Tanzania; Uruguay; Uzbekistan; Venezuela; Zambia.

List of Target Countries

Developed Countries

Australia; Austria; Canada; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Italy; Japan; Latvia; Lithuania; Malta; Netherlands; New Zealand; Norway; Poland; Portugal; Slovak Republic; Slovenia; Spain; Sweden; Switzerland,Liechtenstein; United Kingdom; United States.

Developing Countries

Azerbaijan; Argentina; Brazil; Bulgaria; Belarus; Sri Lanka; Chad; Chile; China; Colombia; Congo, Rep.; Costa Rica; Croatia; Cyprus; Ecuador; El Salvador; Fiji; Gabon; Ghana; Guatemala; Honduras; Hong Kong SAR, China; Indonesia; Israel; Jamaica; Jordan; Kenya; Korea, Rep.; Malaysia; Mauritius; Mexico; Taiwan; Moldova; Morocco; Oman; Nigeria; Pakistan; Panama; Paraguay; Peru; Philippines; Russian Federation; Saudi Arabia; India; Singapore; Vietnam; South Africa; Zimbabwe; Thailand; Trinidad and Tobago; Tunisia; Turkey; Uganda; Ukraine; Macedonia, FYR; Egypt, Arab Rep.; Uruguay; Venezuela; Zambia.