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Collaboration in Innovation between Foreign-Owned Firms and Local Organizations in Latin America: A Comparative Analysis

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Abstract*

This paper explores patterns of collaboration in innovation between foreign firms and local partners in nine Latin American countries. Using microdata from the harmonized Latin American Innovation Surveys dataset (LAIS) and the Spanish Technological Innovation Panel (PITEC) for comparison, the approach considers factors at micro, meso, and macro-levels to identify and illustrate knowledge flows between local and foreign firms in host countries. The empirical evidence presented shows that technological strategies of foreign subsidiaries, sectoral innovation patterns, and national innovation conditions are key elements in shaping local innovation collaboration with foreign-owned firms. Nonetheless, micro and country-side effects still overshadow sector differences. This study indicates that when foreign investment is focused on creating and increasing the technological capabilities of an MNE, collaboration can strengthen the likelihood of positive knowledge spillovers in local economies. In the Latin American context, differences emerge depending on the types of partners engaged in collaboration, whether R&D, or other firms. National systems of innovation also come into play in defining collaboration patterns of foreign-owned firms, especially in systems with greater technological capabilities. This comparative perspective therefore provides new insights regarding attraction of foreign direct investment (FDI) and innovation policies in the region.

JEL Codes: O19, O30, O36
Keywords: foreign direct investment, foreign subsidiaries, innovation, collaboration/cooperation, Latin America, Spain

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Introduction

The economic globalization of recent decades has led to a proliferation of value-creating activities on the part of multinational enterprises (MNEs). This has coincided with gradual changes in the landscape of technological innovation on an international scale, (Archibugi and Michie, 1995; Archibugi and Pietrobelli, 2003; Dunning and Lundan, 2009; Laurens et al., 2015), and a notable increase in foreign direct investment (FDI). The fact that national economies now rely more heavily on foreign knowledge assets raises new questions concerning international knowledge flows through FDI. Further empirical findings can shed light on collaboration patterns for innovation in specific national contexts.

Latin American countries have been affected by the same processes, though to a much lesser degree than countries in regions such as Asia, where these patterns have contributed significantly to economic growth and technological catching-up (Deng and Lu, 2021). Indeed, though FDI has been central in shaping Latin America's growth pattern and insertion in international markets in recent decades, the impact in terms of technological content, innovation, and research and development (R&D) has been much more moderate (CEPAL, 2018) as well as less studied. It must be noted, however, that foreign-owned firms in certain countries in the LAC region account for over a quarter of business research and development (R&D) investments (OECD, 2015). All of this points to the need for further studies on the innovative behavior of foreign-owned firms, their interrelationships in host locations, and their contributions and effects on the development of national productive and technological capabilities. In turn, such analysis may also serve as an input for improving the design of innovation and the policies to attract FDI.

There is ample literature on technology transfer processes from parent firms to foreign-owned subsidiaries, and technology spillovers to host countries, but research contributions focusing on direct knowledge flows between local and foreign firms remain scarce, especially for global South countries such as LAC. Many empirical studies arrive at an indirect approximation of the effects of FDI on local innovation capabilities, by way of estimating the changes in efficiency experienced by local companies due to the presence of foreign companies, or due to the volume of R&D invested in their sector or value chain (Crespo and Fontoura, 2007; Irsova and Havranek, 2013; Barge-Gil, Lopez and Nuñez-Sanchez, 2020). This is in keeping with the most traditional analyses of spillovers. In a different line of research, another body of literature analyzes the determinants of formal and informal knowledge flows generated between local and foreign firms (Santangelo, 2009; Srholec, 2009; Guimon and Salazar-Elena, 2015; Holl and Rama, 2014; Achcaoucaou, Miravitlles, León-Darder, 2017; Cozza, Perani, and Zanfei, 2018). Other studies in this latter line have shown that collaboration with local actors may be viewed as a strategic resource for foreign companies, enabling them to absorb external knowledge and perhaps

constituting a direct channel for knowledge transmission and access to complementary technological assets between foreign and domestic firms (Srholec, 2009; Achcaoucaou, Miravitlles, and León-Darder, 2017; Cozza, Perani, and Zanfei, 2018; Albis, Álvarez, and García, 2021).

However, according to this evidence, not all subsidiaries have the same motivations, facilities, or ability to collaborate with local organizations. Among other possible factors, this may depend on a subsidiary's technological strategies, the specific localization advantages of a host's national innovation system (NIS), or the sector of a foreign company. At the micro level, it is broadly agreed that the greater the level of autonomy and creative competence of a subsidiary in a host location, the more likely collaborative relationships with local organizations will be established in the host country to access external knowledge sources, in a process referred to as 'local embeddedness' (Birkinshaw and Hood, 1998; Figueiredo and Brito, 2011; Achcaoucaou, Miravitlles, and León-Darder, 2017; Ferraris, Santoro, and Scuotto, 2018; Albis, Álvarez, and García, 2021). Moreover, the host country's innovation systems could play an important role in the processes of diffusion and co-creation of knowledge between local and foreign firms (Narula, 2002; Dunning and Lundan, 2009; Srholec, 2009; Achcaoucaou, Miravitlles, and León-Darder, 2017). On the other hand, sectoral patterns can also influence locational decisions and collaborative strategies of foreign subsidiaries when differences in technological opportunities, sectoral specializations of countries, and appropriability conditions are considered (Narula, 2002; Belderbos et al., 2004; Dunning and Lundan, 2009). The key idea is that the economic, technological, and institutional specialization, coupled with the relevant countries' trajectories, may affect the development and evolution of the technological competences of subsidiaries, as well as their incentives to connect with those local actors with highly scientific and technological capabilities; meanwhile, this positive evolution on the part of subsidiaries may further contribute to upgrading national technological development.

The above factors tie in with a focus on innovative and networking behaviors of foreign-owned firms. This study draws on microdata collected from innovation surveys in eight Latin American countries and Spain between 2014 and 2016 and adopts a multi-dimensional approach with detailed examination of micro, macro, and sector effects. The aim of the paper is to analyze collaborative innovation between foreign-owned firms and domestic organizations, and the determining factors. In particular, it provides a comparative analysis of factors related to the subsidiaries' technological strategies at the micro level, the effect of sectors at the meso level, and the conditions of host national innovation systems at the macro level, serving to outline the extent of knowledge flows which occur through collaborative agreements for innovation between foreign-owned firms and local organizations in LAC countries.

While most studies on local linkages of foreign-owned firms focus on specific national, micro, and sectoral factors separately, this study uses a multi-level perspective to analyze the innovation collaboration patterns of subsidiaries with local organizations, thereby offering a more complete picture of the potential effects on development of national productive and technological capabilities, which may help consolidate linkages and interactions in national systems of innovation.

This approach could also shed light on the ways different national settings, sectoral patterns, or strategic decisions at the micro level might affect how companies with foreign capital disseminate, transfer and exchange knowledge with local organizations. This aspect is even more relevant in a Latin American context, where high heterogeneity prevails at all levels, and where these issues have not been extensively explored.

Thus, the research questions guiding this study are as follows: First, to what extent might the propensity to collaborate for innovation change when considering different types of technological strategies by foreign subsidiaries (namely creative, adaptative, and business process strategies for innovation)? Second, are the results affected by sectors, depending on industrial innovation patterns? Third, do national innovation systems condition the collaboration linkages of foreign-owned firms? A further consideration is whether results differ according to type of partner, (namely science-based institutions versus enterprise partners).

Section 2 reviews the literature background and the development of the authors' hypotheses. Section 3 presents the data sources, method of analysis, and a descriptive analysis. Results of the analysis are discussed in Section 4, and the conclusions are provided in Section 5.

1. Literature Background and Hypotheses Development

Maintaining a competitive advantage depends not only on a firm's capacity to innovate internally, but also on their ability to identify and assimilate different sources of external knowledge and capabilities. This argument has given rise to the concepts of absorptive capacities and open innovation (Cohen and Levinthal, 1990; Chesbrough, 2006; Chesbrough and Bogers, 2014). The literature identifies a set of factors that foster collaborative linkages for innovation in firms. Among the most important of these are a firm's resources, the sector in which they operate, the knowledge-absorptive capacity of the organizations involved, the conditions of knowledge appropriability, and the public and private incentives to innovate (Cassiman and Veugelers, 2002; Lucena and Roper, 2016). Existing evidence shows the degree of effect in terms of innovative performance (Miotti and Sachwald, 2003) and knowledge flows between partners with similar organizational structures (Kafouros et al., 2020). The advantages and motivations of collaborative relationships also depend on the type of organization involved, whether industry-based (clients, suppliers, or competitors) or R&D-based partners such as universities or R&D firms (Tether, 2002; Guimon and Salazar-Elena, 2015; Parrilli, Fitjar, and Rodríguez-Pose, 2016; De Silva and Rosi, 2018).

While these general factors may be significant in explaining collaboration in innovation relationships between foreign-owned firms and domestic organizations, in the context of MNEs there may be specific aspects affecting the nature and extent of these relationships. Previous studies have found a strong relationship between the external linkages of subsidiaries and their strategic orientation, or the mandate set by their parent company, whether toward the exploitation of competencies or the creation of technological competencies abroad (Birkinshaw and Hood, 1998; Birkinshaw, Hood, and Young, 2005; Figueiredo and Brito, 2011; Achcaoucaou, Miravitlles, and León-Darder, 2017; Albis, Álvarez, and García, 2021). In the case of the former, the orientation is toward exploitation of the MNE's existing knowledge assets in a foreign country, while in the latter case it is directed toward generation or acquisition of new knowledge and skills to increase the MNE's capabilities (Cantwell and Mudambi, 2005; Cuervo-Cazurra, Mudambi and Pederson, 2019); the latter is clearly more innovation-oriented. Therefore, these two types of strategy will present different incentives to collaborate with local partners, and this would also depend on the relative position within global or regional value chains, for subsidiaries as well as local firms.

Various elements distinguish creative foreign-owned firms. A critical aspect is that these subsidiaries have greater innovation responsibilities in the host country, aimed at the generation of new knowledge deemed crucial for developing technological capabilities for the MNE group; this includes R&D expenditures carried out by subsidiaries in the host location as well as by active players in international networks (Cantwell and Mudambi, 2005; Marin

and Sasidharan, 2010; Álvarez and Cantwell 2011). Moreover, these innovative efforts can even be translated into product innovations new to the market, where subsidiaries may become centers of excellence at the level of the MNE group (Sadowski and Sadowski-Rasters, 2006; De Beule and Van Beveren, 2019; Albis, Álvarez, and García, 2021). Elsewhere, other subsidiaries may perform certain innovation activities in the host countries, serving an adaptive function and/or addressing business process innovation; it is generally agreed that this definition corresponds to competence-exploiting subsidiaries (Balcet and Evangelista, 2005; Cantwell and Mudambi, 2005; Marin and Arza, 2010).

The point is that, in the presence of more creative foreign subsidiaries, stronger knowledge spillovers to domestically owned firms can be generated, due to the higher potential for knowledge sourcing and diffusion by way of formal or informal contacts with local organizations (Kuemmerle, 1999; Todo and Miyamoto, 2006). Since creative subsidiaries have more autonomy, the possibility for establishing external networks with host-country organizations is greater (Birkinshaw and Hood, 1998; Andersson, Forsgren, and Holm, 2002). By contrast, competence-exploiting subsidiaries tend to establish weaker links with host innovation systems and are more dependent on the knowledge of the parent company—an aspect partly explained by the lesser degree of autonomy and lack of incentive to connect with local partners to innovate (Andersson, Forsgren, and Holm, 2002; Golebiowski and Lewandowska, 2015).

According to extant evidence and the present study's analytical proposal, which assumes that subsidiaries do not express homogeneous technological behavior, the initial hypothesis is that the more creative activities a foreign-owned company engages in, the more likely it is to establish collaborative relationships with organizations in the host country (H1).

Sectoral patterns of innovation could also influence locational decisions of an MNE and, subsequently, the collaborative strategies of foreign subsidiaries. The type of industry affects not only the innovativeness of firms but also the decision by multinational firms to locate R&D activities abroad, assuming there are differences in technological opportunities and conditions for appropriability between sectors (Belderbos et al., 2004). Thus, in their decision to opt for a particular location strategy, multinational companies consider the strengths and weaknesses of the host country in a given industry. For example, in the case of Italy, Balcet and Evangelista (2005) show that the innovation investment strategies of MNE subsidiaries are closely linked to industries where Italian firms are traditionally strong (e.g., mechanical engineering). Marín and Bell (2004) examining the case of Argentina, and Molero and García (2008) in Spain, found that FDI has been directed at sectors which have reached a high degree of technological competence.

Guimon and Salazar-Elena (2015) have explored collaboration in innovation between foreign subsidiaries and local universities in Spain and found no

significant differences at the aggregate level between the propensity of foreign subsidiaries to innovate, compared to Spanish firms; only after controlling for individual industries were they able to detect any relevant differences indicating heterogeneity across sectors. On the other hand, García-Sánchez and Rama (2021) explored this relationship within the ICT industry, also in Spain, and their statistical tests showed a preference by foreign subsidiaries to establish partnerships across the value chain, over partnering with local universities. Nonetheless, it remains unclear as to whether that industrial level of analysis would apply in the LAC region.

Given these arguments and the existing evidence, this study's second hypothesis, in reference to sectors, considers that firms belonging to specific industries may share innovation behaviors. It can therefore be expected that the collaborative behavior of foreign-owned firms may differ across industries, along with their innovation patterns (H2).

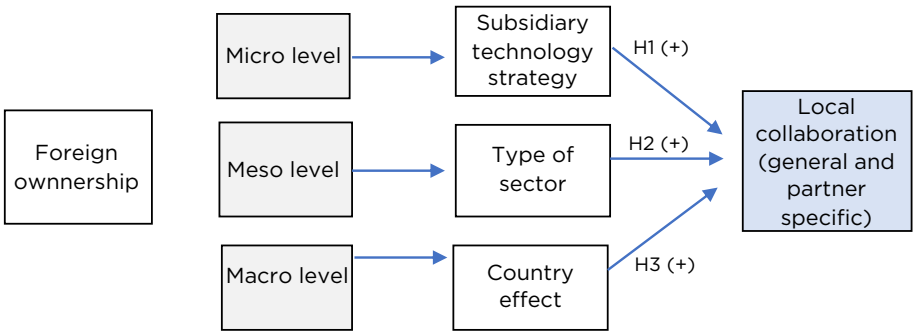
Another aspect affecting innovation collaboration between foreign companies and domestic organizations addresses the specific conditions of the host country. In this area, results for Italy show that R&D cooperation with local organizations can be explained in terms of the specific advantages and disadvantages of multinationality, and not simply due to being a foreign-owned firm (Cozza, Perani, and Zanfei, 2018). Thus, it may be the case that the development of a creative mandate in subsidiaries depends on the degree of sophistication of the economy, the quality of resources available in a specific location, or the institutional context (Carlsson, 2006; Dunning and Lundan, 2009; Achcaoucaou, Miravitlles, and León-Darder, 2017). In other words, national innovation systems tend to show productive and commercial specializations, as well as specific economic and institutional trajectories, that affect the development of technological competencies in subsidiaries; this in turn affects the possibility of establishing local linkages.

On this basis, it is supposed that macro conditions can play a role in the pattern of collaboration in innovation, and therefore this study's third hypothesis is that the likelihood of companies to establish collaborative relationships with local organizations will be higher in national innovation systems with greater technological capabilities (H3).

Hence, conducting comparative studies on patterns of collaboration in the innovation of foreign-owned firms would determine whether such patterns are shaped by commonalities at the firm, industry, or country level. The findings could highlight the key aspects by which to identify more beneficial relationships of foreign-owned firms in host economies, along with aspects to consider in the context of FDI-attraction policies and related implications in the field of innovation policies. Figure 1 summarizes the main dimensions of this paper's analysis of collaboration between foreign-owned firms and

organizations in host countries, and the key relationships that the hypotheses seek to capture in order to establish a multi-level approach.

Figure 1. Analytical Dimensions to Explain Collaboration by Foreign-Owned Firms



Source: Authors' elaboration.

Figure 1 factors in variables according to type of collaboration partner. The motivations to establish external or collaborative relationships for innovation may depend on the types of organizations potentially involved as partners. In the case of linkages that are more market-oriented, the literature has found that customers and suppliers (among others) are crucial for the development of business competencies and innovation in products and processes (Von Hippel, 1998); for example, firms can reduce the risks associated with innovation by providing a better understanding of which innovations will be acceptable (or not) in a given market (Bresciani and Ferraris, 2016; Ciabuschi, Holm, and Martín, 2014).

Linkages with competitors can encourage the setting of standards in introducing new products or services, also serving to share investments in intense innovation or to promote processes of imitation of technologies and best practices (Tether, 2002; Yang, Mudambi, and Meyer, 2008; Figueiredo and Brito, 2011). On the other hand, universities, research and technological centers, and R&D labs can be seen by firms as potential sources of relatively specialized scientific and technological knowledge (Tether, 2002; Guimon and Salazar-Elena, 2015). Another strand of literature indicates that innovation modes also depend on the type of partner with which the firm cooperates (Jensen, Johnson, Lorenz, and Lundvall, 2007; Parrilli, Fitjar, and Rodríguez-Pose, 2016; Huang, Chen, and Liang, 2018). More innovative firms—in the case of this study, creative subsidiaries with radical innovations, and closer to science-knowledge bases—may have a higher propensity to collaborate with R&D organizations, such as universities and R&D centers. Other innovation modes, including learning by doing, using, or interacting, would presumably

be more oriented to collaboration with market organizations, and possibly more related to competence-exploitation strategies.

2. Data and Methodology

2.1. The Dataset

The analysis is based on a firm-level dataset of manufacturing industries in eight Latin American countries (Argentina, Chile, Colombia, Ecuador, El Salvador, Paraguay, Peru, and Uruguay) together with Spain, drawing on the Latin American Innovation Surveys dataset (LAIS) (Crespi et al., 2022) and the Spanish Technological Innovation Panel (PITEC). The LAIS is a harmonized database created by the Inter-American Development Bank. Firm-level data was compiled from 30 innovation surveys conducted between 2007 and 2017 and collected in ten Latin American countries. The harmonization process is necessary; despite the fact that innovation surveys in LAC have similar theoretical and conceptual frameworks based on the Oslo Manual, the Bogotá Manual, and the Community Innovation Survey (CIS), there are still significant differences among the questionnaires, methodologies, and procedures used by countries. The harmonization process was also applied and adapted for the Spanish survey.[1] Spain is included as a benchmark for comparison outside the Latin American region, given its historical and cultural ties and institutional influence, its importance in terms of trade and FDI flows with LAC, and its record as a moderate performer, from an economic and innovation perspective.

The study uses a pool subsample of active-innovation firms from the LAIS and PITEC datasets, encompassing the two most recent waves of innovation surveys, with consideration given to their different timing and the greatest possible comparability between them.[2] Active-innovation firms are defined herein as firms that report investment in innovation activities (including both R&D and non R&D expenditures) over the period examined in each wave of the innovation surveys. Chile and Colombia collect biennial information on innovation activities, while Argentina, Ecuador, El Salvador, Peru, and Uruguay apply a period of observation of three years. The number of observations in the overall dataset amounts to 43,417 (Table 1). Among these, 20,205 observations are related to active-innovation firms, and constitute the sample used for this empirical analysis. Moreover, the sample contains 3,314 observations of firms with foreign capital, 2,184 of which are related to active-innovation firms. Foreign subsidiaries are defined as those firms with a

[1] PITEC, carried out by the INE (Spain's National Statistics Institute), is a longitudinal database of innovative activities of Spanish firms based on the Community Innovation Survey (CIS).
[2] The microdata from Argentina and Uruguay are drawn from a period of observation of three years, while the others collect biannual information on innovation activities.

proportion of foreign capital equal to or greater than 10 percent and belonging to an enterprise group.[3]

Table 1. Characteristics of the Database

Country	Years	All manufacturing firms	Foreign -owned firms	Innovative firms [(c)]	Innovative foreign-owned firms	Foreign presence (% of total sales)	R&D investment accounted for foreign-owned firms (%)
Argentina (ARG)	2010-2012, 2014-2016	7,635	669	5,100	527	26.3	43.1
Chile (CHI)	2013-2016	2,453	205	681	103	27.8	48.0
Colombia (COL) [(a)]	2013-2016	16,782	778	3,585	279	25.9	35.5
Ecuador (ECU)	2009-2011, 2012-2014	2,810	244	1,584	166	18.0	23.6
Spain (ESP) [(b)]	2012-2015	7,923	737	5,944	645	15.8	18.6
Peru (PER)	2009-2011, 2012-2014	2,576	297	1,831	243	34.5	28.7
Paraguay (PYR)	2010-2012, 2013-2015	878	50	440	32	9.8	5.5
El Salvador (SLV)	2010-2012	572	87	278	49	58.0	21.2
Uruguay (URU)	2010-2012, 2013-2015	1,788	247	762	140	34.4	29.0
Total		43,417	3,314	20,205	2,184	24.8	37.8
Total LAC (d)		35,494	2,577	14,230	1,539	24.8	37.9

Source: Authors' elaboration with data from LAIS (BID) and PITEC (INE-Cotec).
[(a)] The foreign ownership variable is obtained by merging the Colombian Innovation Survey with the Annual Manufacturing Survey (Encuesta Anual Manufacturera, or EAM).
[(b)] Access to this dataset is available from PITEC (Panel de Innovación Tecnológica).
[(c)] Firms that report innovation investments in the reference period.
[(d)] Data excluding Spain.

The sample of foreign-owned firms represents, on average, a quarter of sales and over a quarter of R&D investment in the Latin American countries included in this analysis, with the exception of Paraguay where the weights are 9 and 5 percent respectively. This suggests foreign investment flows are important

[3] The LAIS database does not present a foreign capital variable in the case of Colombia. The foreign ownership variable is instead composed by merging the Colombian innovation survey with the Annual Manufacturing Survey (EAM), with which it shares common identifiers per company. For Argentina and Uruguay, information on shares of foreign capital is not available; the LAIS database only includes a dummy variable measuring foreign capital presence. For these two South American countries, the criteria are more flexible due to the availability of information. In this case, firms with foreign capital presence are taken to be foreign owned.

when compiling a complete picture of innovation systems in this region, and as well as points to the degree of interest in better assessing how they work.

In general, the higher the proportion a country's foreign investment, the greater the contribution by companies with foreign capital to invest in innovation in the manufacturing sector. Different foreign-owned firms may have differentiated impacts on local collaboration linkages, which are further translated into local development impacts. It is worth mentioning differences in LAC countries compared to the benchmark country: in Spain foreign presence and R&D investment by foreign-owned firms is relatively low (15.8 percent and 18.6 percent, respectively). This implies that the presence of foreign capital is crucial in the development of innovation capabilities in Latin American countries, at least in the industrial sector.

2.2. Method

To analyze factors affecting establishment of collaboration between foreign-owned firms and local organizations in LAC countries and Spain, a Probit regression is calculated:

$$Pr\left[COOP_i = 1 \mid x_i\right] = \Phi(x_i\beta_k + \varepsilon_i) \qquad \text{(Eq. 1)}$$

where, Pr is the probability; Φ is a probit function with a standard and cumulative normal distribution; $COOP_i$ is the dependent variable related to the type of collaboration partner – general collaboration (any type of partner), R&D firms, and other firms; x_i is the vector of explanatory variables; β is the interest parameter estimated by maximum likelihood; and ε_i is the error term.

Equation 1 was estimated in three ways: (i) using the total sample of Latin American countries; (ii) considering the type of country according to NSI classification (then contrasting with the World Bank country classification, to confirm robustness of results); and (iii) considering the types of sectors, given differentiated industrial innovation patterns.

To ensure the robustness of the estimation, the entire sample of innovative manufacturing firms was used and compared differences in the propensity to collaborate between foreign-owned firms and comparable domestic firms. Moreover, all versions of the model explore how the likelihood of collaboration may be related to the adoption of a different technological strategy, as detailed in the following subsection: creative, adaptative product innovator, or adaptative business process innovator, making it possible to discern whether collaboration in innovation is more likely to occur in foreign-owned creative firms than in adaptative firms and local enterprises. It further enables testing for whether establishing collaborative innovation partnerships with local partners based on the technological strategies of foreign-owned firms is specific to the sector, or to the country.

Considering the diversity of factors that can also affect the pattern of collaboration to innovate, several control variables were introduced: R&D personnel; public support to innovation; formal protection mechanisms; and size. Table 2 provides a detailed definition of variables.

2.3. Variables Included in the Analysis

Regarding the dependent variables, it must be noted that, as with other firms, foreign-owned subsidiaries can establish innovation linkages with a multiplicity of market and non-market partners who may be providers of complementary resources, new knowledge, and capabilities. In other words, firms can collaborate in innovation with both science-based partners and other firms (Huang, Chen, and Liang, 2018).

With the research questions in mind and in keeping with Lagsani (2012) and De Beule and Van Beveren (2019), the following dependent variables were devised to measure collaboration to innovate and the different types of partners: (i) collaboration in general, with any partner, including both industry and science-based organizations; (ii) collaboration with R&D firms or science-based linkages with universities and R&D centers; and (iii) industry-based collaboration with other firms, including linkages with various enterprises in the value chain (customers or suppliers), as well as with competitors, or even firms located in other sectors. It is important to note that all innovation surveys in LAIS have a module related to cooperation for innovation. This includes information about the type of partner and the objective of cooperation. In most surveys, the cooperation question refers specifically to innovation activities, except for El Salvador, Peru in 2015, and Paraguay, where the question refers to the existence of cooperation without eliciting a specific goal.

The main explanatory variables were chosen in view of hypotheses on the (greater) importance of technological strategies foreign-owned that firms may have, that affects their propensity to collaborate with local organizations and other partners. A typology was then designed, consisting of three patterns of innovation defined according to: technological activity of firms; type of innovation or level of novelty (new for the market, new for the company); and presence of R&D activities.

This choice of variables was based on the fact that a variety of patterns of technological strategies in foreign subsidiaries are likely to coexist (Balcet and Evangelista, 2005). Hence, three exclusive types of innovative, foreign-owned firms are defined, according to their technological strategies:

- Creative subsidiaries (CS) are defined as firms introducing product innovations new to the market and investing in internal R&D.
- Adaptative product innovator subsidiaries (APIS) are defined as active-innovation firms introducing products new to the firm itself (but not new to the market).

- Adaptative business process innovator subsidiaries (ABPIS) group the remaining firms that arrive at process, marketing, and organizational innovations, but do not introduce product innovations.

In line with existing literature, classification was based on the following assumptions: First, that R&D activities reflect the highest innovation performance, compared to other activities such as training, external knowledge acquisition, marketing, the purchase of machinery and equipment, or engineering and design (Florida, 1997; Kuemmerle 1999; Le Bas and Sierra, 2002; Cantwell and Mudambi, 2005; Marin and Sasidharan, 2010). Second, that product innovation is linked to a higher level of innovation performance than business process innovation (i.e., marketing, organizational or process innovation) (Balcet and Evangelista 2005; Cantwell and Mudambi, 2005; Giroud, Björn, and Marek, 2012). Third, the greater the scope of the product innovation—new for the firm or to the domestic market—the higher the level of the firm's innovation performance (Pearce, 1999; Sadowski and Sadowski-Rasters, 2006; Álvarez and Cantwell, 2011; De Beule and Van Beveren, 2019; Albis, Álvarez and García, 2021).

To properly determine whether foreign creative companies collaborate more than adaptative product innovators or adaptative business process innovators, they should be compared to a similar domestic counterpart: namely, creative domestic firms (CD), adaptative product innovator domestic firms (APID), and business process innovator domestic firms (ABPID). This classification of national firms was defined according to criteria identical to that used for foreign subsidiaries. In all cases, the benchmark of adaptative business process domestic firms is taken as a reference to avoid problems of collinearity.

The impact of meso-level factors on knowledge flows is measured using the Castellacci taxonomy of sectors which allows for an innovation-based sectoral pattern of classification featuring four different types: Specialized supplier manufacturing, Science-based manufacturing, Scale-intensive manufacturing, and Supplier-dominated goods (Castellacci, 2008).

For macro effects, two different classifications are used. First, the traditional groups of countries ranked by income per capita level, created, and updated regularly by the World Bank; and second, the classifications of countries and NSIs according to Dutrénit et al. (2021), where LAC countries are classified by their socio-political and techno-economic dimensions as follows:

- Biased toward techno-economic spheres (ARG, CHI): Countries biased toward technical, economic and environmental aspects, where labor productivity has a positive impact on GDP per capita, and there is little positive impact of social and political spheres on GDP per capita.
- Biased toward socio-political spheres (SLV, PER, ECU, PYR): Countries biased toward a positive influence of social and political dimensions, but

still with a low impact of these indicators on GDP per capita, and with no favorable presence of technical, economic and environmental aspects.
- More balanced systems (COL, URU): Countries with more balanced systems between both areas and with optimum impact of social and political dimensions on GDP per capita.

Additional control variables consider the effect of structural characteristics and other factors commonly included in empirical studies. These take the form of modeling exercises for analyzing the propensity of firms to collaborate with external organizations, or the performance of open innovation strategies: absorptive capacity, appropriability conditions, public support, and firm size (Veugelers, 1997; Cassiman and Veugelers, 2002; Belderbos et al., 2003; Busom and Fernández-Ribas, 2008; Suzuki, Belderbos, and Kwon, 2017; Ferraris, Santoro, and Scuotto, 2018; Cozza, Perani, and Zanfei, 2018; Stojčić, 2021).

The success of a collaboration process depends on the absorptive capacity of the firms involved (Cohen and Levinthal, 1990; Teece, 1993). To control for this aspect, a variable was used referring to the R&D personnel and measured as a percentage of the total firm's employees. To control for conditions for appropriability, a dummy variable is used that takes the value of 1 if firms have employed patenting, trademarks, design rights, or utility, and 0 if otherwise.

Considering that the probability toward collaboration may in some cases be motivated by the existence of instruments of public support for the innovation activities of firms, a binary response variable has been included indicating whether the firm received innovation subsidies during the reference period of each survey. In addition, firm size, measured as the number of employees in logarithmic terms, is used to control for the fact that larger firms seem to be likelier to have the necessary absorptive capacity by which to further benefit from innovation linkages in the local context. Table 2 provides detailed descriptions of all variables used in the analysis, and a further definition of these is presented in the following subsection.

Table 2. Definition of Variables

Variables	Description
Dependent	
Collaboration in general	Binary response variable for collaboration with local organizations
Collaboration with R&D institutions	Binary response variable for collaboration with local universities and public and private R&D centers
Collaboration with other firms	Binary response variable for collaboration with local clients, suppliers, competitors, and other firms
Independent	
Creative firms	Firms introducing product innovations new to the market and investing in internal R&D. 'New to the market' means new to the country and new to the world market. This definition is used to classify both domestic and foreign-owned firms.
Adaptative product innovator firms	Firms introducing product innovations new to the firm (but not new to the market). This definition is used to classify both domestic and foreign-owned firms.
Adaptative business process innovator firms	Firms that obtain process, marketing, and organizational innovations (without introducing product innovations). This definition is used to classify both domestic and foreign-owned firms.
R&D Personnel	R&D personnel as a percentage of the total firm's employees
Public support	Binary response variable for public support to develop innovation activities
Formal protection	Binary response variable for innovation protection through patent, utility model, or copyright
Size	Number of firm employees (in log).
Industry dummies	Sectoral dummies according to the Castellacci (2008) classification and ISIC revision 3: Specialized manufacturing suppliers (29 and 33); Science-based manufacturing (24, 30, 31 and 32); Scale-intensive manufacturing (25, 26, 27, 28 and 35), and Supplier-dominated goods (15, 16, 17, 18, 19, 20, 21, 22 and 36)*
WB Country classification	Country dummies according to the World Bank (WB) classifications of countries in 2015: High-income country (URU, CHI, SP); Upper-middle-income country (COL, ARG, PER, ECU), and Lower-middle-income country (SLV and PYR)
NSI Country classification	Country dummies according to the Dutrenit et al. (2021) classification: Biased toward techno-economic spheres (ARG, CHI); Biased toward socio-political spheres (SLV, PER, ECU, PYR), and More balanced systems (COL, URU)

Source: Authors' elaboration.

* The correspondence with ISIC codes are the following: machinery and equipment (29), chemicals and chemical products (24), office, accounting and computing machinery (30), electrical machinery and apparatus (31), radio, television and communication (32), rubber and plastics products, medical, precision and optical instruments, watches and clocks (33), Manufacture of rubber and plastics products (25), other non-metallic mineral products (26), basic metals (27), metal products (28), motor vehicles, trailers and semi-trailers (34), other transport equipment (35), food products and beverages (15), tobacco products (16), textiles (17), dress apparel; dressing and dyeing of fur (18), tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear (19), wood and wood and cork products (20), paper and paper products (21), publishing, printing and reproduction of recorded media (22), and furniture and manufacturing n.e.c. (36).

2.4. Descriptive Statistics

Table 3 provides a descriptive overview of the dataset. Approximately two thirds of innovative foreign-owned firms in LAC collaborate to innovate with at least one external partner. Regarding specific partners, 44 percent of foreign-owned firms collaborate with R&D institutions, and 48 percent with other firms. The propensity of foreign firms to collaborate differs across countries, especially where type of partner is concerned. In most of the LAC economies studied (Colombia, Paraguay, El Salvador, and Uruguay), collaboration with other firms is more frequent than with R&D institutions; however, foreign-owned firms collaborate more frequently with the latter in the cases of Spain and Ecuador. Collaboration by foreign-owned firms with R&D and enterprise partners is similar to that of domestic firms in Argentina and Chile.

Regarding explanatory variables, 27 percent of innovative foreign subsidiaries in LAC are creative firms (i.e., they introduce product innovations new to the market and invest in internal R&D), while in the case of Spain this proportion increases to 43 percent. Moreover, a quarter of foreign-owned firms are adaptative product innovators (implying that these subsidiaries are pursuing product innovations new to the firm), and around half of foreign-owned firms are classified as adaptative business process innovator firms[4] (i.e., those introducing innovation in processes, marketing and/or organization). In Spain this represents 29 percent and 28 percent, respectively. In all the countries analyzed in the LAC region as well as in Spain, creative technological strategies seem to be more frequent among foreign-owned firms than their domestic counterparts.

The variable of R&D personnel is on average fairly similar for foreign and domestic firms, as is public support to both types of firms in LAC economies; however, in the case of Spain, public support to foreign-owned firms is double that of support to domestic firms. By country, there is a marked variability in the proportion of foreign-owned firms obtaining public support to innovate: this ranges from null support in Paraguay and Peru, to 34 percent in Uruguay. Moreover, almost two-fifths of the innovating foreign-owned firms use formal methods to protect their innovation, and formal protection is notably higher in foreign-owned firms compared to domestic firms. In the complete set of countries studied, foreign companies are more likely to protect their innovations through formal mechanisms such as patents, utility models, or copyrights. On the other hand, the average size of innovative foreign-owned

[4] This name has been given to underline the relative importance of the type of innovative performance, making it possible to differentiate between firms not engaged in product innovation but showing other types of innovative output and classified according to the Oslo Manual methodology as business process innovators.

firms is larger, except in the case of Argentina and Paraguay, where medium-sized firms prevail.

Most foreign-owned firms are located in supplier-dominated goods sectors and scale-intensive sectors, while the sector with the least number of foreign-owned companies is that of specialized manufacturing suppliers. Finally, science-based sectors show a notably higher presence of foreign-owned firms than domestic ones, both in LAC economies and Spain, a result that likely answers to the fact that the sample selected is of potentially innovative firms.

Table 3. Descriptive Statistics by Country (Averages)

Variables	Argentina		Chile		Colombia		Ecuador		Peru		Paraguay		El Salvador		Uruguay		Total LAC		Spain	
	DOM	FOR	DOM	FOR	DOM	FOR	DOM	FOR	DOM	FOR	DOM	FOR	DOM	FOR	DOM	FOR	DOM	FOR	DOM	FOR
Collaboration in general	0.58	0.68	0.21	0.31	0.30	0.46	0.87	0.82	0.65	0.78	0.45	0.57	0.45	0.57	0.44	0.46	0.54	0.63	0.33	0.47
Collaboration with R&D institutions	0.37	0.51	0.15	0.25	0.12	0.25	0.68	0.72	0.27	0.47	0.16	0.22	0.16	0.22	0.18	0.24	0.31	0.44	0.26	0.39
Collaboration with other firms	0.41	0.49	0.19	0.27	0.27	0.42	0.68	0.64	0.55	0.66	0.42	0.47	0.42	0.47	0.30	0.28	0.42	0.48	0.22	0.32
Creative firms	0.23	0.31	0.09	0.18	0.05	0.15	0.28	0.36	0.10	0.16	0.10	0.29	0.10	0.29	0.18	0.20	0.17	0.27	0.31	0.43
Adaptative product innovator firms	0.34	0.22	0.29	0.32	0.39	0.42	0.14	0.10	0.39	0.31	0.28	0.16	0.28	0.16	0.23	0.20	0.33	0.25	0.28	0.29
Adaptative business process innovator firms	0.43	0.46	0.62	0.50	0.56	0.43	0.58	0.53	0.51	0.53	0.62	0.55	0.62	0.55	0.59	0.60	0.50	0.48	0.41	0.28
R&D personnel	0.03	0.03	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.02	0.02	0.02	0.11	0.11
Public support	0.17	0.08	0.12	0.20	0.04	0.04	0.03	0.05	0.01	0.00	0.07	0.00	0.07	0.00	0.31	0.34	0.11	0.09	0.16	0.27
Formal protection	0.40	0.48	0.21	0.36	0.51	0.65	0.46	0.62	0.72	0.81	0.43	0.55	0.43	0.55	0.41	0.46	0.45	0.55	0.13	0.26
Size (number of employees)	75	197	278	700	212	452	247	662	146	226	193	609	193	609	115	282	156	409	171	282
Size (log)	3.7	4.8	4.41	5.61	4.34	5.52	4.28	5.50	3.87	4.92	4.41	5.58	4.41	5.58	3.89	4.98	4.02	5.22	4.19	4.93
Specialized manufacturing supplier	0.16	0.13	0.03	0.02	0.05	0.05	0.03	0.03	0.02	0.00	0.03	0.02	0.03	0.02	0.01	0.01	0.08	0.06	0.13	0.10
Science-based manufacturing	0.12	0.21	0.16	0.27	0.18	0.31	0.16	0.19	0.14	0.16	0.17	0.20	0.17	0.20	0.20	0.24	0.15	0.23	0.28	0.27
Scale-intensive manufacturing	0.26	0.28	0.16	0.17	0.24	0.24	0.32	0.27	0.23	0.13	0.16	0.16	0.16	0.16	0.19	0.16	0.25	0.24	0.30	0.28
Supplier-dominated goods	0.45	0.37	0.64	0.54	0.53	0.40	0.49	0.51	0.62	0.72	0.64	0.61	0.64	0.61	0.59	0.59	0.52	0.46	0.28	0.34

Source: Authors' elaboration.

3. Results

The results of the estimations reveal that in the sample of Latin American countries there is no relationship between foreign ownership in general and the probability of collaboration to innovate (columns 1, 3, and 5 in Table 4). Conversely, the results differ substantially when examining the different technological strategies—or types of foreign subsidiaries, given their innovative behavior—in detail (columns 2, 4, and 6 in Table 4). In such cases, there is a significant and positive association between both foreign and domestic creative firms and the establishment of collaboration agreements to innovate. That is, the overall results suggest the importance of including technological strategies to explain the relationships of collaboration established by foreign-owned firms with local partners. Therefore, H1 is confirmed.

This is apparent when collaboration takes place in general (any partner), and also when partnerships with R&D organizations and other firms take place separately. However, the results show a clearer relationship in the market-oriented collaboration of creative foreign-owned firms, in terms of both other types of partners, and domestic counterparts. In LAC, patterns of collaboration of foreign-owned firms differ from domestic firms, where the latter are more prone to collaborate with R&D institutions. In fact, compared to domestic creative firms, foreign-owned firms are more likely to collaborate to innovate with local companies than with universities and other R&D institutions. However, this is not the case for companies in Spain, as seen in Table 4 thus consolidating this study's argument for focusing on context (development stage of the countries) and patterns (preferred partners for collaboration). The results of the study confirm that although the coefficients of the association between collaboration and creative firms are positive in both LAC countries and Spain, it should be stressed that: (i) the association is typically stronger in Spain than in LAC countries and (ii) the association is weaker in LAC countries when the partner is a R&D institution, and stronger in Spain when the partner is a R&D institution. This shows how an underdeveloped context can affect this relationship, ruling out linearity or the need for the "more collaboration, more innovation" reasoning typically applied to developed contexts. Besides, that in both contexts an adaptative innovation strategy focused on process innovation is much less collaborative than a strategy focused on product innovation, can also be regarded as a significant finding.

Table 4. Results of the Probit Model of Determinants of Innovation Collaboration: LAC and Spain

Variables	LAC countries						Spain					
	Any partner		R&D Institutions		Other firms		Any partner		R&D Institutions		Other firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Foreign ownership	0.017		0.028		0.018		0.097*		0.092		0.039	
	(0.043)		(0.043)		(0.040)		(0.059)		(0.060)		(0.060)	
Creative foreign-owned firms		0.274***		0.195**		0.235***		0.486***		0.488***		0.466***
		(0.089)		(0.079)		(0.076)		(0.089)		(0.088)		(0.088)
Adaptative business process innovator foreign-owned firms		-0.254***		-0.122**		-0.244***		-0.146		-0.253**		-0.135
		(0.059)		(0.061)		(0.058)		(0.113)		(0.121)		(0.121)
Creative domestic firms		0.209***		0.241***		0.175***		0.345***		0.307***		0.383***
		(0.044)		(0.042)		(0.040)		(0.047)		(0.049)		(0.049)
Adaptative business process innovator domestic firms		-0.214***		-0.134***		-0.242***		-0.199***		-0.171***		-0.204***
		(0.029)		(0.031)		(0.028)		(0.047)		(0.050)		(0.052)
R&D personnel	2.268***	1.678***	2.488***	2.032***	1.357***	0.839***	1.554***	1.269***	1.586***	1.342***	1.454***	1.157***
	(0.322)	(0.298)	(0.280)	(0.267)	(0.226)	(0.221)	(0.137)	(0.138)	(0.138)	(0.140)	(0.136)	(0.140)
Formal protection	0.175***	0.133***	0.279***	0.240***	0.083***	0.038	0.290***	0.193***	0.308***	0.221***	0.233***	0.131**
	(0.026)	(0.026)	(0.027)	(0.028)	(0.025)	(0.025)	(0.051)	(0.052)	(0.052)	(0.053)	(0.052)	(0.053)
Public support	0.270***	0.242***	0.462***	0.435***	0.115***	0.083*	0.859***	0.859***	0.913***	0.911***	0.596***	0.587***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.043)	(0.044)	(0.048)	(0.049)	(0.048)	(0.048)	(0.048)	(0.048)
Size	0.148***	0.134***	0.240***	0.229***	0.105***	0.090***	0.247***	0.217***	0.239***	0.213***	0.272***	0.238***

Variables	LAC countries						Spain					
	Any partner		R&D Institutions		Other firms		Any partner		R&D Institutions		Other firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	(0.010)	(0.010)	(0.011)	(0.011)	(0.009)	(0.009)	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)
Specialized manufacturing suppliers	0.128**	0.085*	0.192***	0.146***	0.035	-0.01	-0.153**	-0.205***	-0.216***	-0.262***	-0.047	-0.094
	(0.051)	(0.051)	(0.052)	(0.053)	(0.049)	(0.050)	(0.062)	(0.063)	(0.065)	(0.066)	(0.066)	(0.067)
Science-based manufacturing	0.174***	0.136***	0.293***	0.261***	0.054	0.011	-0.081*	-0.130***	-0.093*	-0.136***	-0.02	-0.071
	(0.036)	(0.037)	(0.038)	(0.039)	(0.035)	(0.035)	(0.048)	(0.049)	(0.050)	(0.051)	(0.052)	(0.052)
Scale-intensive manufacturing	0.096***	0.082***	0.149***	0.134***	0.056*	0.041	-0.141***	-0.146***	-0.156***	-0.162***	-0.01	-0.009
	(0.030)	(0.030)	(0.032)	(0.032)	(0.029)	(0.029)	(0.046)	(0.047)	(0.049)	(0.049)	(0.049)	(0.050)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.17	0.18	0.21	0.22	0.09	0.10	0.14	0.16	0.15	0.17	0.11	0.14
Observations	12309	12309	12309	12309	12309	12309	5944	5944	5944	5944	5944	5944

Source: Authors' elaboration
Note: the conditional marginal effects are reported at the sample mean, robust standard errors in parentheses.
* Significant at 10% ** Significant at 5% *** Significant at 1%.

Regarding control variables, R&D personnel, formal protection, and size are positively associated with collaboration of any type, while public support is more clearly toward R&D firms; this may relate (for example) to the predominant types of public programs geared to funding research, or technological projects involving firms and R&D firms. This latter result is reinforced in the case of specialized manufacturing suppliers, scale-intensive and science-based sectors in LAC, while it is a negative result in the case of Spain.

Regards the macro-level aspect of this study, and in particular, the adoption of the NSI approach, the findings confirm the relevance of the technological strategies of foreign-owned firms. Tables 5 and 6 summarize the results of the estimations for LAC (income classifications from the World Bank and NSI classification of Dutrénit et al., 2021) and Spain. For the complete results of these estimations with control variables, see Tables A2 to A5 in the Appendix.

Again, no statistically significant relationship was found between foreign ownership in general and collaboration with external partners in any of the countries, except for countries with more balanced systems, such as Colombia and Uruguay, where foreign-owned firms are more likely to cooperate with R&D firms. In contrast, positive associations are observed between firms with more creative technological strategies and the likelihood of cooperation to innovate in more balanced economies, in economies that are techno-economic biased, and in countries classified as having high and upper-middle income groups, and Spain (also a high-income country). This is true for collaboration in general (any partner) and for collaboration with R&D firms. Thus, H3 is confirmed.

A less clear pattern is found in the cases of both adaptative product innovator firms and adaptative business process innovator firms, and in cooperation agreements to innovate established with other firms in LAC economies. Nonetheless, there is a positive association in the case of more balanced systems, also in these types of foreign firms.

The finding here is the absence of a clear pattern that could show heterogeneity in collaboration for innovation according to the company strategies. These results hold up when using the World Bank country classification (Tables 7 and 8): only in high-income and upper middle-income countries does there appear to be a relationship between innovation collaboration and the type of technology strategies of foreign firms. Competence-creating subsidiaries cooperate more with local actors in higher income countries, which may be because the production structure and infrastructure is better suited to support innovation activities and networking.

Table 5. Principal Results of the Probit Model of innovation Collaboration by NSI Country Classification (Model 1)

Variables	Biased toward techno-economic spheres (ARG, CHI)			Biased toward the socio-political spheres (SLV, PER, ECU, PYR)			More balanced systems (COL, URU)			Spain		
	Any partner	R&D Institutions	Other firms	Any partner	R&D Institutions	Other firms	Any partner	R&D Institutions	Other firms	Any partner	R&D Institutions	Other firms
Foreign firms	0.032	0.030	0.072	-0.111	-0.060	-0.118*	0.099	0.143*	0.097	0.097*	0.092	0.039
	(0.060)	(0.060)	(0.057)	(0.075)	(0.070)	(0.065)	(0.068)	(0.079)	(0.069)	(0.059)	(0.060)	(0.060)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.11	0.13	0.04	0.07	0.17	0.06	0.06	0.12	0.09	0.14	0.15	0.11
Observations	5757	5757	5757	4128	4128	4128	4345	4345	4345	5944	5944	5944

Source: Authors' elaboration

Notes: See the definition of type of countries according to Dutrénit et al. (2021) on page 13 above.

Complete estimation in the Appendix A2. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses. * Significant at 10% ** Significant at 5% *** Significant at 1%.

Table 6. Principal Results of the Probit Model of Innovation Collaboration by NSI Country Classification (Model 2)

Variables	Biased toward Techno-economic spheres (ARG, CHI)			Biased toward the socio-political spheres (SLV, PER, ECU, PYR)			More balanced systems (COL, URU)			Spain		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.447***	0.337***	0.550***	0.226	0.024	0.272**	0.774***	0.663***	0.651***	0.685***	0.660***	0.666***
	(0.116)	(0.105)	(0.104)	(0.140)	(0.121)	(0.113)	(0.168)	(0.169)	(0.158)	(0.089)	(0.089)	(0.089)
Adaptative product innovators foreign firms	0.080	(0.019)	0.099	0.071	0.168	0.053	0.463***	0.542***	0.421***	0.197*	0.204*	0.067
	(0.112)	(0.116)	(0.112)	(0.160)	(0.155)	(0.141)	(0.111)	(0.125)	(0.112)	(0.106)	(0.111)	(0.114)
Adaptative business process innovators foreign firms	0.010	0.039	0.047	(0.128)	0.009	(0.130)	(0.019)	0.039	0.069	0.052	(0.082)	0.066
	(0.083)	(0.086)	(0.083)	(0.098)	(0.094)	(0.089)	(0.100)	(0.122)	(0.102)	(0.112)	(0.121)	(0.121)
Creative domestic firms	0.380***	0.317***	0.378***	0.310***	0.280***	0.373***	0.533***	0.663***	0.518***	0.544***	0.477***	0.585***
	(0.052)	(0.052)	(0.050)	(0.074)	(0.064)	(0.062)	(0.090)	(0.097)	(0.088)	(0.047)	(0.049)	(0.051)
Adaptative product innovators domestic firms	0.058	(0.010)	0.099**	0.183***	0.132**	0.194***	0.295***	0.269***	0.325***	0.199***	0.166***	0.222***
	(0.042)	(0.044)	(0.042)	(0.055)	(0.054)	(0.051)	(0.046)	(0.060)	(0.047)	(0.048)	(0.052)	(0.053)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.12	0.14	0.05	0.08	0.17	0.03	0.07	0.14	0.05	0.16	0.17	0.14
Observations	5757	5757	5757	4128	4128	4128	4345	4345	4345	5944	5944	5944

Source: Authors' elaboration

Notes: See the definition of type of countries according to Dutrénit et al. (2021) on page 13 above. See complete estimation in Appendix A3. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table 7. Principal Results of the Probit Model of Innovation Collaboration by World Bank Country Classification (Model 1)

Variables	High-income country (URU, CHI)			Upper middle-income country (COL, ARG, PERU, ECU)			Lower middle-income country (SLV and PYR)			Spain		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Foreign firms	0.017	0.030	0.049	-0.01	0.020	-0.021	0.130	0.086	0.035	0.097*	0.092	0.039
	(0.054)	(0.055)	(0.052)	(0.062)	(0.062)	(0.057)	(0.164)	(0.174)	(0.158)	(0.059)	(0.060)	(0.060)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.09	0.13	0.04	0.22	0.26	0.12	0.08	0.12	0.04	0.14	0.15	0.11
Observations	6519	6519	6519	6997	6997	6997	714	714	714	5944	5944	5944

Source: Authors' elaboration

Note: See complete estimation in Appendix A4. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table 8. Principal Results of the Probit Model of Innovation Collaboration by World Bank Country Classification (Model 2)

Variables	High-income country (URU, CHI)			Upper middle-income country (COL, ARG, PERU, ECU)			Lower middle-income country (SLV and PYR)			Spain		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D Institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.437***	0.357***	0.489***	0.455***	0.204*	0.482***	0.509	0.161	0.091	0.685***	0.660***	0.666***
	(0.106)	(0.098)	(0.096)	(0.141)	(0.118)	(0.114)	(0.335)	(0.340)	(0.306)	(0.089)	(0.089)	(0.089)
Adaptative product innovators foreign firms	0.166	0.079	0.109	0.278**	0.323***	0.287***	0.609*	0.484	0.478	0.197*	0.204*	0.067
	(0.103)	(0.110)	(0.102)	(0.109)	(0.111)	(0.103)	(0.338)	(0.323)	(0.310)	(0.106)	(0.111)	(0.114)
Adaptative business process innovators foreign firms	(0.044)	(0.012)	0.031	(0.059)	0.063	(0.074)	0.045	0.018	0.068	0.052	(0.082)	0.066
	(0.073)	(0.078)	(0.074)	(0.086)	(0.085)	(0.080)	(0.216)	(0.236)	(0.213)	(0.112)	(0.121)	(0.121)
Creative domestic firms	0.366***	0.314***	0.356***	0.416***	0.404***	0.445***	0.665***	0.380*	0.659***	0.544***	0.477***	0.585***
	(0.049)	(0.049)	(0.047)	(0.068)	(0.061)	(0.058)	(0.210)	(0.194)	(0.193)	(0.047)	(0.049)	(0.051)
Adaptative product innovators domestic firms	0.078**	0.005	0.114***	0.260***	0.204***	0.285***	0.205*	0.082	0.159	0.199***	0.166***	0.222***
	(0.039)	(0.043)	(0.040)	(0.039)	(0.043)	(0.037)	(0.114)	(0.129)	(0.112)	(0.048)	(0.052)	(0.053)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.10	0.14	0.05	0.23	0.27	0.13	0.09	0.13	0.06	0.16	0.17	0.14
Observations	6519	6519	6519	6997	6997	6997	714	714	714	5944	5944	5944

Source: Authors' elaboration.

Note: See complete estimation in Appendix A5. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Tables 9 to 12 offer an estimation summarizing the interaction between sector type, foreign ownership, and the differentiated technological strategies of firms. (For the complete results of this estimation see Tables A6 to A9 in the Appendix.) Importantly, differences are again revealed when comparing the types of collaboration agreement, whether general collaboration with any type of partner, with R&D institutions, or with other firms.

The results of these estimations viewed in detail (Table 10) show that, first, specialized manufacturing suppliers have no clear pattern of collaboration with foreign firms. Second, in terms of supplier-dominated goods, there is a clear pattern of open innovation in general (with any partner) by domestic firms (creative and adaptative). This pattern is also clear for foreign creative firms but not significant among adaptative foreign subsidiaries. Third, the creative technological strategies of both domestic and foreign-owned firms have a higher likelihood of collaboration to innovate with other firms, regardless of the innovation patterns of industries. Fourth, when collaboration to innovate is established with R&D institutions, creative firms in science-based manufacturing industries show the highest marginal effects. Finally, when foreign-owned firms are compared, the findings verify that they affect collaboration linkages differently, depending on the type of sector. These results therefore validate H2.

4. Conclusions

Analysis of FDI inflows has previously focused on economic impact (capital flow across countries; generation of value-added and employment; productivity effects and efficiency changes experienced in host economies). Technological transfer and innovation are phenomena now attracting greater interest among academics, stakeholders, and governments. Thus, ongoing empirical studies in this area can provide knowledge about the impacts of FDI in host economies and can help to shape FDI-attraction policies, with an emphasis on generating and absorbing their potentially positive effects on development.

In the case of LAC countries, there is little evidence of the adoption of an approach based on relationships of collaboration to innovate established by foreign-owned firms in host locations. Taking a multi-level perspective of the region, this study seeks to provide deeper knowledge on patterns of collaboration by foreign-owned firms, while considering both the diverse types of subsidiaries and the types of innovations they undertake. The novelty of this contribution stems from its use of a harmonized database, drawing on innovation surveys (LAIS) conducted in LAC countries and comparing results with Spain. The adoption of a multi-level approach, combining micro, sector, and country-side effects is proven to be a powerful tool for deepening analysis of this issue.

Table 9. Results of the Probit Model of Innovation Collaboration by Sectoral Classification, LAC Countries (Model 1)

Variables	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated good		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Foreign firms	-0.013	-0.131	0.268*	0.039	0.025	0.037	-0.005	0.008	-0.011	0.030	0.086	-0.006
	(0.154)	(0.157)	(0.144)	(0.085)	(0.083)	(0.080)	(0.081)	(0.083)	(0.076)	(0.058)	(0.058)	(0.055)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.13	0.16	0.07	0.14	0.15	0.07	0.16	0.21	0.08	0.16	0.20	0.09
Observations	1099	1102	1109	2226	2226	2226	3539	3539	3539	7356	7356	7356

Source: Authors' elaboration

Note: The complete results of estimation can be consulted in Appendix A6. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses. * Significant at 10% ** Significant at 5% *** Significant at 1%.

Table 10. Results of the Probit Model of Innovation Collaboration by Sectoral Classification, LAC Countries (Model 2)

Variables	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated good		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.492	0.571*	0.535**	0.532***	0.290**	0.514***	0.440**	0.232	0.523***	0.444***	0.301***	0.427***
	(0.327)	(0.297)	(0.262)	(0.166)	(0.143)	(0.143)	(0.172)	(0.160)	(0.146)	(0.126)	(0.115)	(0.110)
Adaptative product innovators foreign firms	-0.273	-0.326	0.076	0.286*	0.22	0.250*	0.300*	0.08	0.211	0.241**	0.339***	0.198*
	(0.278)	(0.333)	(0.273)	(0.155)	(0.156)	(0.147)	(0.163)	(0.171)	(0.152)	(0.104)	(0.107)	(0.102)
Adaptative business process innovators foreign firms	-0.025	-0.294	0.381*	-0.158	-0.005	-0.102	-0.056	0.056	-0.012	0.007	0.061	-0.03
	(0.232)	(0.245)	(0.217)	(0.122)	(0.124)	(0.122)	(0.105)	(0.107)	(0.101)	(0.078)	(0.080)	(0.077)
Creative domestic firms	0.203*	0.341***	0.190*	0.324***	0.346***	0.311***	0.493***	0.290***	0.534***	0.422***	0.389***	0.438***
	(0.108)	(0.108)	(0.104)	(0.089)	(0.086)	(0.084)	(0.076)	(0.073)	(0.069)	(0.061)	(0.058)	(0.055)
Adaptative product innovators domestic firms	-0.009	-0.082	0.081	0.069	0.06	0.149**	0.163***	0.101*	0.206***	0.207***	0.120***	0.216***
	(0.102)	(0.109)	(0.102)	(0.072)	(0.076)	(0.071)	(0.054)	(0.058)	(0.053)	(0.036)	(0.041)	(0.036)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.13	0.18	0.07	0.15	0.16	0.08	0.18	0.21	0.10	0.17	0.21	0.10
Observations	1099	1102	1109	2226	2226	2226	3539	3539	3539	7356	7356	7356

Source: Authors' elaboration

Note: The complete results of estimation can be consulted in Appendix A7. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses. * Significant at 10% ** Significant at 5% *** Significant at 1%.

Table 11. Results of the Probit Model of Innovation Collaboration by Sectoral Classification, Spain (Model 1)

Variables	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated good		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Foreign firms	0.149	0.092	-0.166	-0.197	-0.217*	0.351***	0.355***	0.357***	0.12	0.139	-0.248*	0.054
	(0.178)	(0.183)	(0.196)	(0.120)	(0.123)	(0.106)	(0.108)	(0.106)	(0.099)	(0.101)	(0.127)	(0.103)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.16	0.20	0.12	0.15	0.17	0.14	0.16	0.13	0.12	0.12	0.11	0.10
Observations	754	754	754	1674	1674	1796	1796	1796	1720	1720	1674	1720
Chi2	139	148	88	270	292	299	296	256	221	216	183	163

Source: Authors' elaboration

Note: The complete results of estimation can be consulted in Appendix A8. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses. * Significant at 10% ** Significant at 5% *** Significant at 1%.

Table 12. Results of the Probit Model of Innovation Collaboration by Sectoral Classification - (Model 2)

Variables	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated good		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.428*	0.253	0.300	0.382**	0.267	1.079***	1.103***	1.018***	0.712***	0.781***	0.465**	0.652***
	(0.257)	(0.260)	(0.252)	(0.181)	(0.182)	(0.160)	(0.159)	(0.159)	(0.163)	(0.162)	(0.182)	(0.163)
Adaptative product innovators foreign firms	0.383	0.571	-0.958*	0.049	0.03	0.386*	0.276	0.571***	0.151	0.242	-0.093	-0.059
	(0.336)	(0.351)	(0.507)	(0.198)	(0.202)	(0.208)	(0.221)	(0.203)	(0.177)	(0.186)	(0.223)	(0.192)
Adaptative business process innovators foreign firms	0.316	-0.051	0.095	-0.591*	-0.774**	0.263	0.173	0.19	0.172	0.079	-0.59	0.233
	(0.386)	(0.466)	(0.483)	(0.303)	(0.333)	(0.192)	(0.207)	(0.202)	(0.168)	(0.180)	(0.359)	(0.180)
Creative domestic firms	0.374***	0.277*	0.366**	0.527***	0.412***	0.590***	0.548***	0.585***	0.590***	0.565***	0.629***	0.596***
	(0.136)	(0.147)	(0.145)	(0.090)	(0.094)	(0.086)	(0.090)	(0.091)	(0.087)	(0.091)	(0.097)	(0.094)
Adaptative product innovators domestic firms	0.282**	0.223	0.189	0.131	0.103	0.290***	0.198**	0.316***	0.12	0.165*	0.162	0.164*
	(0.141)	(0.155)	(0.152)	(0.094)	(0.100)	(0.087)	(0.094)	(0.093)	(0.088)	(0.093)	(0.104)	(0.099)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.16	0.21	0.14	0.17	0.18	0.17	0.19	0.16	0.14	0.15	0.14	0.13
Observations	754	754	754	1674	1674	1796	1796	1796	1720	1720	1674	1720
Chi2	144	151	99	328	324	353	347	289	261	255	237	198

Source: Authors' elaboration

Note: The complete results of estimation can be consulted in Appendix A9. The conditional marginal effects are reported at the sample mean, robust standard errors in parentheses. * Significant at 10% ** Significant at 5% *** Significant at

The relationships established by foreign-owned firms in Argentina, Chile, Colombia, Ecuador, Peru, El Salvador, Paraguay, Uruguay, and Spain reveal that possibilities for knowledge linkages with local partners will differ depending on the technological strategies of foreign-owned firms. This highlights the importance of differentiating between technological strategies when studying the effects of inward FDI. it also dispenses with the notion that multinational subsidiaries play a neutral or passive role in the generation and transmission of knowledge across national borders.

The findings herein confirm that relatively creative foreign-owned firms are more likely to establish cooperative relationships with organizations in their host countries. However, this pattern varies for collaboration in innovation with science-based partners (R&D institutions), market organizations, or other firms. Creative foreign-owned firms are more likely to establish linkages with firms other than R&D institutions, at both meso and macro levels. Moreover, the pattern is not consistent in terms of sector specificity, or at least this has not been confirmed following innovation pattern of industries. Interestingly, when sector and country levels of analysis are combined, national systems of innovation become relevant to collaboration patterns, in particular for national innovation systems with greater technological capabilities (more balanced systems, or countries biased toward techno-economic factors).

This paper contributes to the empirical literature which argues that the establishment of linkages between foreign companies and local actors will depend on the type of technological strategy followed, whether creative or adaptative (in relation to a firm's innovative behavior). Indeed, this pattern is found to be common across some LAC countries as well as in Spain. The study further corroborates previous findings which show that foreign investment linked to creating and increasing the technological capabilities of an MNE can strengthen the likelihood of positive knowledge spillovers in local economies, for example, through a much more direct co-creation process shared by local and foreign companies. However, differences emerge concerning the types of partners engaged in collaboration efforts, whether they be R&D institutions or other firms. The sector-related factors of FDI invite further consideration of this aspect in order to define actions that can encourage collaboration between foreign and local firms.

Possible implications relate first to the need for a more active and differentiated set of policies to promote knowledge flows between foreign companies and local actors and second, to the need for a greater understanding of the capacities of subsidiaries to generate positive effects at a local level. In particular, further research could address the intensity and purpose of the subsidiaries' collaboration, possible existence of co-dependencies, power relations within global value chains that affect these linkages, and drivers of potential dynamic evolution within national

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Appendix
Table A1. Pairwise Correlations

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Collaboration in general	1.00																	
2	Collaboration with R&D institutions	0.63	1.00																
3	Collaboration with other firms	0.79	0.29	1.00															
4	Foreign ownership	0.06	0.08	0.04	1.00														
5	Creative foreign firms	0.09	0.10	0.08	0.50	1.00													
6	Adaptative product innovator foreign firms	0.02	0.02	0.01	0.48	-0.03	1.00												
7	Adaptative business process foreign firms	0.00	0.03	-0.01	0.67	-0.04	-0.04	1.00											
8	Creative domestic firms	0.18	0.20	0.14	-0.14	-0.07	-0.07	-0.10	1.00										
9	Adaptative product innovator domestic firms	-0.02	-0.07	0.00	-0.23	-0.11	-0.11	-0.15	-0.27	1.00									
10	Adaptative business process innovator domestic firms	-0.14	-0.13	-0.13	-0.31	-0.15	-0.15	-0.21	-0.37	-0.59	1.00								
11	R&D personnel	0.11	0.12	0.07	0.01	0.06	-0.01	-0.03	0.21	-0.03	-0.13	1.00							
12	Public support	0.12	0.15	0.08	0.06	0.08	0.04	0.00	0.14	0.01	-0.15	0.09	1.00						
13	Formal protection	0.07	0.11	0.02	-0.02	0.00	-0.02	-0.01	0.11	0.00	-0.06	0.08	0.06	1.00					
14	Size (log)	0.11	0.19	0.09	0.27	0.17	0.13	0.16	0.03	-0.07	-0.13	-0.09	0.20	0.02	1.00				
15	Specialized manufacturing supplier	0.02	0.03	0.00	-0.02	0.00	-0.01	-0.02	0.12	-0.03	-0.05	0.07	0.01	0.08	-0.11	1.00			
16	Science-based manufacturing	0.04	0.07	0.01	0.07	0.06	0.04	0.03	0.08	0.01	-0.11	0.14	0.13	0.02	0.03	-0.13	1.00		
17	Scale-intensive manufacturing	0.03	0.03	0.02	0.00	-0.01	-0.01	0.01	0.01	-0.01	0.01	-0.04	-0.08	-0.01	-0.03	-0.17	-0.25	1.00	
18	Supplier-dominated goods	-0.07	-0.10	-0.02	-0.04	-0.03	-0.01	-0.02	-0.13	0.02	0.10	-0.10	-0.03	-0.05	0.06	-0.30	-0.45	-0.60	1.00

Source: Authors' elaboration

Table A2. Results of the Probit Model by NSI Country Classification – Model 1 (Complete Estimation)

Variables	Biased toward techno-economic spheres (ARG, CHI)			Biased toward the socio-political spheres (SLV, PER, ECU, PYR)			More balanced systems (COL, URU)			Spain		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Foreign firms	1.732***	2.476***	1.066***	2.032**	2.403***	1.030*	3.570***	2.854***	2.353***	1.554***	1.586***	1.454***
	-0.364	(0.369)	(0.283)	(0.931)	(0.642)	(0.579)	(0.647)	(0.549)	(0.477)	(0.137)	(0.138)	(0.136)
R&D personnel	1.732***	2.476***	1.066***	2.032**	2.403***	1.030*	3.570***	2.854***	2.353***	1.554***	1.586***	1.454***
	-0.364	(0.369)	(0.283)	(0.931)	(0.642)	(0.579)	(0.647)	(0.549)	(0.477)	(0.137)	(0.138)	(0.136)
Formal protection	0.343***	0.375***	0.187***	0.181***	0.305***	0.065	0.096**	0.186***	0.073*	0.290***	0.308***	0.233***
	-0.036	(0.037)	(0.036)	(0.047)	(0.045)	(0.043)	(0.043)	(0.054)	(0.043)	(0.051)	(0.052)	(0.052)
Public support	0.388***	0.470***	0.187***	0.070	0.356***	(0.081)	0.134*	0.433***	0.030	0.859***	0.913***	0.596***
	-0.049	(0.048)	(0.047)	(0.119)	(0.110)	(0.107)	(0.075)	(0.084)	(0.077)	(0.048)	(0.048)	(0.048)
Size	0.207***	0.297***	0.146***	0.083***	0.201***	0.030**	0.171***	0.254***	0.150***	0.247***	0.239***	0.272***
	-0.016	(0.017)	(0.016)	(0.017)	(0.016)	(0.015)	(0.016)	(0.021)	(0.016)	(0.016)	(0.017)	(0.017)
Specialized manufacturing suppliers	0.180***	0.272***	0.063	0.071	0.241*	(0.039)	0.257***	0.250**	0.261***	-0.153**	-0.216***	(0.047)
	-0.053	(0.055)	(0.053)	(0.143)	(0.128)	(0.126)	(0.098)	(0.127)	(0.099)	(0.062)	(0.065)	(0.066)
Science-based manufacturing	0.316***	0.391***	0.068	0.004	0.107	(0.014)	0.210***	0.439***	0.117**	-0.081*	-0.093*	(0.020)
	-0.055	(0.056)	(0.053)	(0.071)	(0.066)	(0.062)	(0.054)	(0.064)	(0.055)	(0.048)	(0.050)	(0.052)
Scale-intensive manufacturing	0.268***	0.325***	0.124***	(0.036)	0.008	(0.005)	0.092*	0.156**	0.079	-0.141***	-0.156***	(0.010)
	-0.043	(0.044)	(0.042)	(0.053)	(0.050)	(0.048)	(0.051)	(0.065)	(0.052)	(0.046)	(0.049)	(0.049)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.11	0.13	0.04	0.07	0.17	0.06	0.06	0.12	0.09	0.14	0.15	0.11
Observations	5757	5757	5757	4128	4128	4128	4345	4345	4345	5944	5944	5944
Chi2	718.6	796.6	315.1	287.6	814.3	82.2	268.4	346.0	151.8	876.5	903.9	668.4

Source: Authors' elaboration
Note: the conditional marginal effects are reported at the sample mean, robust standard errors in parentheses.
* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table A3. Results of the Probit Model by NSI Country Classification and Technological Strategies– Model 2 (Complete Estimation)

Variables	Biased toward techno-economic spheres (ARG, CHI)			Biased toward the socio-political spheres (SLV, PER, ECU, PYR)			More balanced systems (COL, URU)			Spain		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.447***	0.337***	0.550***	0.226	0.024	0.272**	0.774***	0.663***	0.651***	0.685***	0.660***	0.666***
	(0.116)	(0.105)	(0.104)	(0.140)	(0.121)	(0.113)	(0.168)	(0.169)	(0.158)	(0.089)	(0.089)	(0.089)
Adaptative product innovators foreign firms	0.080	(0.019)	0.099	0.071	0.168	0.053	0.463***	0.542***	0.421***	0.197*	0.204*	0.067
	(0.112)	(0.116)	(0.112)	(0.160)	(0.155)	(0.141)	(0.111)	(0.125)	(0.112)	(0.106)	(0.111)	(0.114)
Adaptative business process innovators foreign firms	0.010	0.039	0.047	(0.128)	0.009	(0.130)	(0.019)	0.039	0.069	0.052	(0.082)	0.066
	(0.083)	(0.086)	(0.083)	(0.098)	(0.094)	(0.089)	(0.100)	(0.122)	(0.102)	(0.112)	(0.121)	(0.121)
Creative domestic firms	0.380***	0.317***	0.378***	0.310***	0.280***	0.373***	0.533***	0.663***	0.518***	0.544***	0.477***	0.585***
	(0.052)	(0.052)	(0.050)	(0.074)	(0.064)	(0.062)	(0.090)	(0.097)	(0.088)	(0.047)	(0.049)	(0.051)
Adaptative product innovators domestic firms	0.058	(0.010)	0.099**	0.183***	0.132**	0.194***	0.295***	0.269***	0.325***	0.199***	0.166***	0.222***
	(0.042)	(0.044)	(0.042)	(0.055)	(0.054)	(0.051)	(0.046)	(0.060)	(0.047)	(0.048)	(0.052)	(0.053)
R&D personnel	1.314***	2.128***	0.679**	1.406*	1.851***	0.286	2.594***	2.040***	1.562***	1.269***	1.341***	1.165***
	(0.355)	(0.361)	(0.285)	(0.849)	(0.614)	(0.538)	(0.581)	(0.490)	(0.440)	(0.138)	(0.140)	(0.140)
Formal protection	0.295***	0.333***	0.136***	0.149***	0.280***	0.025	0.050	0.129**	0.027	0.194***	0.220***	0.135**
	(0.037)	(0.038)	(0.036)	(0.048)	(0.045)	(0.043)	(0.043)	(0.055)	(0.044)	(0.052)	(0.053)	(0.053)
Public support	0.365***	0.449***	0.158***	0.050	0.339***	(0.103)	0.122	0.422***	0.014	0.859***	0.911***	0.588***
	(0.050)	(0.048)	(0.047)	(0.120)	(0.110)	(0.107)	(0.075)	(0.084)	(0.077)	(0.049)	(0.048)	(0.048)
Size	0.197***	0.287***	0.134***	0.074***	0.194***	0.019	0.150***	0.229***	0.128***	0.217***	0.212***	0.240***
	(0.016)	(0.017)	(0.016)	(0.017)	(0.016)	(0.015)	(0.016)	(0.021)	(0.016)	(0.016)	(0.017)	(0.017)
Specialized manufacturing suppliers	0.123**	0.214***	0.006	0.030	0.214*	(0.093)	0.202**	0.159	0.201**	-0.205***	-0.261***	(0.098)
	(0.054)	(0.056)	(0.054)	(0.145)	(0.128)	(0.128)	(0.098)	(0.128)	(0.099)	(0.063)	(0.066)	(0.067)
Science-based manufacturing	0.265***	0.343***	0.011	(0.022)	0.083	(0.046)	0.165***	0.398***	0.065	-0.130***	-0.136***	(0.073)
	(0.055)	(0.056)	(0.054)	(0.071)	(0.067)	(0.062)	(0.055)	(0.066)	(0.056)	(0.049)	(0.051)	(0.052)
Scale-intensive manufacturing	0.246***	0.302***	0.102**	(0.042)	0.001	(0.013)	0.067	0.130**	0.053	-0.146***	-0.162***	(0.011)
	(0.043)	(0.044)	(0.043)	(0.053)	(0.050)	(0.048)	(0.051)	(0.066)	(0.052)	(0.047)	(0.049)	(0.050)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.12	0.14	0.05	0.08	0.17	0.03	0.07	0.14	0.05	0.16	0.17	0.14
Observations	5757	5757	5757	4128	4128	4128	4345	4345	4345	5944	5944	5944
Chi2	773.7	847.6	389.9	313.7	833.0	131.4	359.9	439.5	231.2	1019.6	1010.6	785.6

Source: Authors' elaboration

Note: the conditional marginal effects are reported at the sample mean, robust standard errors in parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table A4. Results of the Probit Model by World Bank Country Classification – Model 1 (Complete Estimation)

	High income country (URU, CHI)			Upper middle-income country (COL, ARG, PERU, ECU)			Lower middle-income country (SLV and PYR)			Spain		
Variables	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Foreign firms	0.017	0.030	0.049	-0.01	0.02	-0.021	0.130	0.086	0.035	0.097*	0.092	0.039
	(0.054)	(0.055)	(0.052)	(0.062)	(0.062)	(0.057)	(0.164)	(0.174)	(0.158)	(0.059)	(0.060)	(0.060)
R&D personnel	1.916***	2.332***	1.096***	3.630***	3.228***	2.605***	2.076	3.389**	2.052	1.554***	1.586***	1.454***
	(0.319)	(0.313)	(0.244)	(0.971)	(0.609)	(0.615)	(1.666)	(1.631)	(1.588)	(0.137)	(0.138)	(0.136)
Formal protection	0.306***	0.362***	0.158***	0.114***	0.244***	0.054	0.292***	0.329**	0.248**	0.290***	0.308***	0.233***
	(0.034)	(0.035)	(0.034)	(0.035)	(0.038)	(0.033)	(0.110)	(0.130)	(0.109)	(0.051)	(0.052)	(0.052)
Public support	0.287***	0.398***	0.124***	0.280***	0.619***	0.115	0.257	0.337	0.192	0.859***	0.913***	0.596***
	(0.044)	(0.044)	(0.042)	(0.088)	(0.084)	(0.082)	(0.304)	(0.361)	(0.297)	(0.048)	(0.048)	(0.048)
Size	0.185***	0.280***	0.122***	0.130***	0.220***	0.091***	0.176***	0.288***	0.130***	0.247***	0.239***	0.272***
	(0.015)	(0.016)	(0.015)	(0.013)	(0.014)	(0.012)	(0.040)	(0.044)	(0.039)	(0.016)	(0.017)	(0.017)
Specialized manufacturing suppliers	0.185***	0.278***	0.075	0.115	0.206**	0.07	0.399	-0.083	0.333	-0.153**	-0.216***	-0.047
	(0.052)	(0.054)	(0.052)	(0.086)	(0.090)	(0.083)	(0.339)	(0.487)	(0.325)	(0.062)	(0.065)	(0.066)
Science-based manufacturing	0.289***	0.409***	0.037	0.116**	0.233***	0.071	0.175	0.313**	0.100	-0.081*	-0.093*	-0.02
	(0.050)	(0.052)	(0.049)	(0.050)	(0.053)	(0.046)	(0.146)	(0.152)	(0.141)	(0.048)	(0.050)	(0.052)
Scale-intensive manufacturing	0.228***	0.291***	0.108***	0.032	0.088**	0.028	0.163	-0.033	0.162	-0.141***	-0.156***	-0.010
	(0.040)	(0.042)	(0.040)	(0.041)	(0.043)	(0.038)	(0.126)	(0.140)	(0.123)	(0.046)	(0.049)	(0.049)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.09	0.13	0.04	0.22	0.26	0.12	0.08	0.12	0.04	0.14	0.15	0.11
Observations	6519	6519	6519	6997	6997	6997	714	714	714	5944	5944	5944
Chi2	741.8	837.2	300.9	1745.2	1829.5	1036.8	69.8	79.3	40.6	876.5	903.9	668.4

Source: Authors' elaboration
Note: the conditional marginal effects are reported at the sample mean, robust standard errors parentheses.
* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table A5. Results of the Probit Model by World Bank Country Classification – Model 2 (Complete Estimation)

	High income country (URU, CHI)			Upper middle-income country (COL, ARG, PERU, ECU)			Lower middle-income country (SLV and PYR)			Spain		
Variables	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.437***	0.357***	0.489***	0.455***	0.204*	0.482***	0.509	0.161	0.091	0.685***	0.660***	0.666***
	(0.106)	(0.098)	(0.096)	(0.141)	(0.118)	(0.114)	(0.335)	(0.340)	(0.306)	(0.089)	(0.089)	(0.089)
Adaptative product innovators foreign firms	0.166	0.079	0.109	0.278**	0.323***	0.287***	0.609*	0.484	0.478	0.197*	0.204*	0.067
	(0.103)	(0.110)	(0.102)	(0.109)	(0.111)	(0.103)	(0.338)	(0.323)	(0.310)	(0.106)	(0.111)	(0.114)
Adaptative business process innovators foreign firms	(0.044)	(0.012)	0.031	(0.059)	0.063	(0.074)	0.045	0.018	0.068	0.052	(0.082)	0.066
	(0.073)	(0.078)	(0.074)	(0.086)	(0.085)	(0.080)	(0.216)	(0.236)	(0.213)	(0.112)	(0.121)	(0.121)
Creative domestic firms	0.366***	0.314***	0.356***	0.416***	0.404***	0.445***	0.665***	0.380*	0.659***	0.544***	0.477***	0.585***
	(0.049)	(0.049)	(0.047)	(0.068)	(0.061)	(0.058)	(0.210)	(0.194)	(0.193)	(0.047)	(0.049)	(0.051)
Adaptative product innovators domestic firms	0.078**	0.005	0.114***	0.260***	0.204***	0.285***	0.205*	0.082	0.159	0.199***	0.166***	0.222***
	(0.039)	(0.043)	(0.040)	(0.039)	(0.043)	(0.037)	(0.114)	(0.129)	(0.112)	(0.048)	(0.052)	(0.053)
R&D personnel	1.465***	1.991***	0.706***	2.783***	2.478***	1.741***	0.956	2.589	0.960	1.269***	1.341***	1.165***
	(0.305)	(0.303)	(0.246)	(0.870)	(0.557)	(0.546)	(1.611)	(1.657)	(1.557)	(0.138)	(0.140)	(0.140)
Formal protection	0.261***	0.321***	0.111***	0.079**	0.209***	0.013	0.224**	0.282**	0.192*	0.194***	0.220***	0.135**
	(0.034)	(0.036)	(0.034)	(0.035)	(0.038)	(0.034)	(0.112)	(0.133)	(0.111)	(0.052)	(0.053)	(0.053)
Public support	0.269***	0.380***	0.102**	0.263***	0.606***	0.095	0.195	0.277	0.126	0.859***	0.911***	0.588***
	(0.044)	(0.044)	(0.043)	(0.088)	(0.084)	(0.082)	(0.312)	(0.370)	(0.303)	(0.049)	(0.048)	(0.048)
Size	0.175***	0.270***	0.112***	0.113***	0.207***	0.073***	0.170***	0.281***	0.120***	0.217***	0.212***	0.240***
	(0.015)	(0.016)	(0.015)	(0.013)	(0.014)	(0.012)	(0.041)	(0.046)	(0.040)	(0.016)	(0.017)	(0.017)
Specialized manufacturing suppliers	0.131**	0.220***	0.023	0.066	0.161*	0.012	0.386	(0.096)	0.351	-0.205***	-0.261***	(0.098)
	(0.053)	(0.055)	(0.053)	(0.087)	(0.090)	(0.084)	(0.342)	(0.479)	(0.329)	(0.063)	(0.066)	(0.067)
Science-based manufacturing	0.244***	0.364***	(0.015)	0.078	0.203***	0.029	0.139	0.291*	0.058	-0.130***	-0.136***	(0.073)
	(0.050)	(0.052)	(0.050)	(0.050)	(0.053)	(0.047)	(0.147)	(0.153)	(0.143)	(0.049)	(0.051)	(0.052)
Scale-intensive manufacturing	0.206***	0.268***	0.086**	0.017	0.075*	0.013	0.172	(0.025)	0.177	-0.146***	-0.162***	(0.011)
	(0.040)	(0.042)	(0.040)	(0.041)	(0.043)	(0.038)	(0.126)	(0.141)	(0.123)	(0.047)	(0.049)	(0.050)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.10	0.14	0.05	0.23	0.27	0.13	0.09	0.13	0.06	0.16	0.17	0.14
Observations	6519	6519	6519	6997	6997	6997	714	714	714	5944	5944	5944
Chi2	809.9	896.0	376.4	1766.8	1869.9	1129.7	76.4	84.0	52.0	1019.6	1010.6	785.6

Source: Authors' elaboration

Note: the conditional marginal effects are reported at the sample mean, robust standard errors parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table A6. Results of the Probit Model by Sector for LAC Countries– Model 1 (Complete Estimation)

	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated good		
Variables	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Foreign firms	0.013	0.131	0.268*	0.039	0.025	0.037	0.005	0.008	0.011	0.030	0.086	(0.006)
	(0.154)	(0.157)	(0.144)	(0.085)	(0.083)	(0.080)	(0.081)	(0.083)	(0.076)	(0.058)	(0.058)	(0.055)
R&D personnel	1.604***	2.234***	1.117**	2.084***	2.065***	1.217***	3.368***	3.388***	1.758***	2.693***	2.950***	1.877***
	(0.539)	(0.532)	(0.463)	(0.565)	(0.472)	(0.393)	(0.770)	(0.794)	(0.560)	(0.661)	(0.518)	(0.453)
Formal protection	0.432***	0.390***	0.283***	0.184***	0.273***	0.078	0.231***	0.310***	0.095**	0.178***	0.293***	0.099***
	(0.082)	(0.084)	(0.079)	(0.061)	(0.063)	(0.059)	(0.049)	(0.051)	(0.047)	(0.033)	(0.036)	(0.032)
Public support	0.353***	0.442***	0.250**	0.271***	0.435***	0.066	0.274***	0.455***	0.034	0.306***	0.463***	0.170***
	(0.107)	(0.104)	(0.102)	(0.097)	(0.092)	(0.092)	(0.080)	(0.083)	(0.077)	(0.056)	(0.057)	(0.055)
Size	0.256***	0.303***	0.160***	0.104***	0.182***	0.082***	0.174***	0.254***	0.131***	0.145***	0.254***	0.093***
	(0.046)	(0.045)	(0.042)	(0.024)	(0.025)	(0.023)	(0.021)	(0.022)	(0.019)	(0.012)	(0.014)	(0.012)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.13	0.16	0.07	0.14	0.15	0.07	0.16	0.21	0.08	0.16	0.20	0.09
Observations	1099	1102	1109	2226	2226	2226	3539	3539	3539	7356	7356	7356
Chi2	-652.7	-611.5	-702.9	-1291.5	-1268.2	-1420.2	-2021.0	-1810.0	-2231.8	-4286.9	-3468.9	-4541.1

Source: Authors' elaboration

Note: the conditional marginal effects are reported at the sample mean, robust standard errors parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table A7. Results of the Probit Model by Sector for LAC Countries– Model 2 (Complete Estimation)

Variables	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated goods		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.492	0.571*	0.535**	0.532***	0.290**	0.514***	0.440**	0.232	0.523***	0.444***	0.301***	0.427***
	(0.327)	(0.297)	(0.262)	(0.166)	(0.143)	(0.143)	(0.172)	(0.160)	(0.146)	(0.126)	(0.115)	(0.110)
Adaptative product innovators foreign firms	-0.273	-0.326	0.076	0.286*	0.22	0.250*	0.300*	0.08	0.211	0.241**	0.339***	0.198*
	(0.278)	(0.333)	(0.273)	(0.155)	(0.156)	(0.147)	(0.163)	(0.171)	(0.152)	(0.104)	(0.107)	(0.102)
Adaptative business process innovators foreign firms	-0.025	-0.294	0.381*	-0.158	-0.005	-0.102	-0.056	0.056	-0.012	0.007	0.061	-0.03
	(0.232)	(0.245)	(0.217)	(0.122)	(0.124)	(0.122)	(0.105)	(0.107)	(0.101)	(0.078)	(0.080)	(0.077)
Creative domestic firms	0.203*	0.341***	0.190*	0.324***	0.346***	0.311***	0.493***	0.290***	0.534***	0.422***	0.389***	0.438***
	(0.108)	(0.108)	(0.104)	(0.089)	(0.086)	(0.084)	(0.076)	(0.073)	(0.069)	(0.061)	(0.058)	(0.055)
Adaptative product innovators domestic firms	-0.009	-0.082	0.081	0.069	0.06	0.149**	0.163***	0.101*	0.206***	0.207***	0.120***	0.216***
	(0.102)	(0.109)	(0.102)	(0.072)	(0.076)	(0.071)	(0.054)	(0.058)	(0.053)	(0.036)	(0.041)	(0.036)
R&D personnel	1.359**	1.817***	0.942**	1.564***	1.643***	0.790**	2.422***	2.971***	0.896*	2.106***	2.485***	1.303***
	(0.539)	(0.535)	(0.469)	(0.542)	(0.460)	(0.394)	(0.691)	(0.739)	(0.541)	(0.595)	(0.482)	(0.422)
Formal protection	0.392***	0.316***	0.250***	0.143**	0.238***	0.035	0.179***	0.281***	0.037	0.141***	0.255***	0.058*
	(0.084)	(0.087)	(0.081)	(0.062)	(0.063)	(0.060)	(0.050)	(0.052)	(0.048)	(0.033)	(0.037)	(0.033)
Public support	0.323***	0.386***	0.224**	0.239**	0.397***	0.029	0.252***	0.439***	0.002	0.299***	0.458***	0.161***
	(0.108)	(0.105)	(0.103)	(0.098)	(0.093)	(0.093)	(0.081)	(0.083)	(0.078)	(0.056)	(0.057)	(0.055)
Size	0.249***	0.291***	0.151***	0.092***	0.173***	0.069***	0.163***	0.247***	0.117***	0.133***	0.243***	0.080***
	(0.046)	(0.046)	(0.042)	(0.025)	(0.025)	(0.024)	(0.021)	(0.022)	(0.020)	(0.012)	(0.014)	(0.012)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.13	0.18	0.07	0.15	0.16	0.08	0.18	0.21	0.10	0.17	0.21	0.10
Observations	1099	1102	1109	2226	2226	2226	3539	3539	3539	7356	7356	7356
Chi2	-649	-600	-701	-1277	-1258	-1406	-1995	-1801	-2196	-4247	-3442	-4494

Source: Authors' elaboration

Note: the conditional marginal effects are reported at the sample mean, robust standard errors parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table A8. Results of the Probit Model by Sector for Spain – Model 1 (Complete Estimation)

	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated good		
Variables	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Foreign firms	0.149	0.092	-0.166	-0.197	-0.217*	0.351***	0.355***	0.357***	0.12	0.139	-0.248*	0.054
	(0.178)	(0.183)	(0.196)	(0.120)	(0.123)	(0.106)	(0.108)	(0.106)	(0.099)	(0.101)	(0.127)	(0.103)
R&D personnel	0.863**	1.066***	1.034***	1.601***	1.665***	1.622***	1.682***	1.467***	1.866***	1.767***	1.495***	1.573***
	(0.380)	(0.413)	(0.400)	(0.217)	(0.220)	(0.317)	(0.321)	(0.304)	(0.276)	(0.269)	(0.219)	(0.257)
Formal protection	0.311**	0.389***	0.290**	0.399***	0.439***	0.146	0.097	0.13	0.330***	0.311***	0.277***	0.322***
	(0.122)	(0.126)	(0.124)	(0.091)	(0.092)	(0.097)	(0.098)	(0.098)	(0.110)	(0.114)	(0.092)	(0.111)
Public support	1.079***	1.123***	0.707***	0.712***	0.766***	0.938***	0.982***	0.763***	0.840***	0.913***	0.494***	0.450***
	(0.126)	(0.127)	(0.126)	(0.088)	(0.089)	(0.084)	(0.083)	(0.084)	(0.104)	(0.102)	(0.088)	(0.101)
Size	0.171***	0.215***	0.243***	0.292***	0.300***	0.224***	0.211***	0.252***	0.249***	0.213***	0.263***	0.306***
	(0.054)	(0.064)	(0.058)	(0.030)	(0.031)	(0.028)	(0.030)	(0.029)	(0.029)	(0.030)	(0.032)	(0.032)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.16	0.20	0.12	0.15	0.17	0.14	0.16	0.13	0.12	0.12	0.11	0.10
Observations	754	754	754	1674	1674	1796	1796	1796	1720	1720	1674	1720
Chi2	139	148	88	270	292	299	296	256	221	216	183	163

Source: Authors' elaboration

Note: the conditional marginal effects are reported at the sample mean, robust standard errors parentheses.

* Significant at 10% ** Significant at 5% *** Significant at 1%.

Table A9. Results of the Probit Model by Sector for Spain – Model 2 (Complete Estimation)

Variables	Specialized manufacturing suppliers			Science-based manufacturing			Scale-intensive manufacturing			Supplier-dominated goods		
	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms	Any partner	R&D institutions	Other firms
Creative foreign firms	0.428*	0.253	0.300	0.382**	0.267	1.079***	1.103***	1.018***	0.712***	0.781***	0.465**	0.652***
	(0.257)	(0.260)	(0.252)	(0.181)	(0.182)	(0.160)	(0.159)	(0.159)	(0.163)	(0.162)	(0.182)	(0.163)
Adaptative product innovators foreign firms	0.383	0.571	-0.958*	0.049	0.03	0.386*	0.276	0.571***	0.151	0.242	-0.093	-0.059
	(0.336)	(0.351)	(0.507)	(0.198)	(0.202)	(0.208)	(0.221)	(0.203)	(0.177)	(0.186)	(0.223)	(0.192)
Adaptative business process innovators foreign firms	0.316	-0.051	0.095	-0.591*	-0.774**	0.263	0.173	0.19	0.172	0.079	-0.59	0.233
	(0.386)	(0.466)	(0.483)	(0.303)	(0.333)	(0.192)	(0.207)	(0.202)	(0.168)	(0.180)	(0.359)	(0.180)
Creative domestic firms	0.374***	0.277*	0.366**	0.527***	0.412***	0.590***	0.548***	0.585***	0.590***	0.565***	0.629***	0.596***
	(0.136)	(0.147)	(0.145)	(0.090)	(0.094)	(0.086)	(0.090)	(0.091)	(0.087)	(0.091)	(0.097)	(0.094)
Adaptative product innovators domestic firms	0.282**	0.223	0.189	0.131	0.103	0.290***	0.198**	0.316***	0.12	0.165*	0.162	0.164*
	(0.141)	(0.155)	(0.152)	(0.094)	(0.100)	(0.087)	(0.094)	(0.093)	(0.088)	(0.093)	(0.104)	(0.099)
R&D personnel	0.735*	0.990**	0.898**	1.267***	1.403***	1.313***	1.409***	1.148***	1.580***	1.501***	1.120***	1.317***
	(0.384)	(0.414)	(0.412)	(0.223)	(0.226)	(0.315)	(0.322)	(0.306)	(0.275)	(0.271)	(0.226)	(0.271)
Formal protection	0.277**	0.365***	0.231*	0.341***	0.399***	0.009	(0.041)	0.002	0.198*	0.176	0.206**	0.201*
	(0.124)	(0.129)	(0.130)	(0.093)	(0.094)	(0.097)	(0.098)	(0.099)	(0.113)	(0.117)	(0.095)	(0.114)
Public support	1.104***	1.138***	0.736***	0.726***	0.776***	0.922***	0.969***	0.739***	0.838***	0.908***	0.501***	0.429***
	(0.127)	(0.127)	(0.127)	(0.089)	(0.089)	(0.084)	(0.084)	(0.084)	(0.107)	(0.105)	(0.089)	(0.104)
Size	0.152***	0.199***	0.231***	0.260***	0.273***	0.193***	0.183***	0.222***	0.216***	0.178***	0.224***	0.274***
	(0.056)	(0.066)	(0.058)	(0.031)	(0.032)	(0.029)	(0.031)	(0.030)	(0.030)	(0.031)	(0.032)	(0.032)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R	0.16	0.21	0.14	0.17	0.18	0.17	0.19	0.16	0.14	0.15	0.14	0.13
Observations	754	754	754	1674	1674	1796	1796	1796	1720	1720	1674	1720
Chi2	144	151	99	328	324	353	347	289	261	255	237	198

Source: Authors' elaboration

Notes: the conditional marginal effects are reported at the sample mean, robust standard errors parentheses. * Significant at 10% ** Significant at 5% *** Significant at 1%.