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Exploring the relationship between KIBS co-locations and the innovativeness of manufacturing firms in Latin America

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ABSTRACT:

The literature provides empirical evidence on the importance of geographic location for an effective provision of knowledge intensive business services (KIBS). According to the postulates of territorial servitization, KIBS are also fundamental for the development of manufacturing firms. Despite this, KIBS can be an important source of innovation. In Latin America there is still little attention paid to KIBS, both from academia and from policy makers. The purpose of this research is to analyse the relationship between KIBS co-locations and the innovativeness of the manufacturing firms in context of emerging countries. Drawing on the World Bank Enterprise Survey (WBES) for Latin-American countries, authors analysed 3,029 manufacturing firms using the OLS method. Findings indicated that manufacturing firms' locations based on KIBS proximity, is a critical determinant of innovativeness. This relationship is considerably stronger in Central American countries, while in South America this relationship is negative, which leads to debate.

KEYWORDS: KIBS; Manufacturing; Innovation; Latin America; Firm Location.

JEL CLASSIFICATION: L86; L60; O31; O54; R39.

Explorando la relación entre la co-localización de los KIBS y la innovación de las empresas manufactureras en América Latina

RESUMEN:

La literatura proporciona evidencia empírica sobre la importancia de la localización geográfica para una efectiva provisión de KIBS. Según los postulados de la servitización territorial, los KIBS también son fundamentales para el desarrollo de las empresas manufactureras. A pesar de que los KIBS puede ser una fuente importante de innovación, en América Latina aún se presta poca atención a los KIBS, tanto desde la academia como de los responsables políticos. El propósito de esta investigación es analizar la relación entre la co-localización de los KIBS y la innovación de las empresas manufactureras en contextos de países emergentes. En base a la Encuesta Empresarial del Banco Mundial (WBES) para países de América Latina, los autores analizan 3.029 empresas manufactureras utilizando el método MCO. Los resultados indican que la localización de las empresas manufactureras basadas en la proximidad de los KIBS es un determinante crítico de la innovación. Esta relación es considerablemente más fuerte en los países centroamericanos, mientras que en América del Sur esta relación es negativa, lo cual conlleva a un debate.

PALABRAS CLAVE: KIBS, Manufacturas; Innovación; Latino América; Localización.

CLASIFICACIÓN JEL: L86; L60; O31; O54; R39.

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1. INTRODUCTION

In recent years there has been a growing interest in the geography of KIBS (Müller & Zenker, 2001; Simmie & Strambach, 2006; McCann, 2007; Doloreux & Shearmur, 2012). Researchers have generally adopted the hypothesis that knowledge spillovers are localized and decay across space (Simmie, 2003; Simmie & Strambach, 2006; Antonietti & Cainelli, 2008). Notwithstanding, a second way of conceptualizing the link between innovation and space has recently been derived from the idea that local dynamics are not necessarily those that lead an establishment to innovate (Boschma, 2005; McCann, 2007) and that information exchange and collaboration can occur across space. Indeed, Doloreux & Shearmur (2012) find evidence of a negative innovation-distance relationship across spatial scales. In this way, a long-standing debate still exists around the KIBS location (Antonietti & Cainelli, 2016).

Our study analyses to what extent manufacturing firms' innovativeness is enhanced by KIBS co-location, especially when KIBS may have a positive impact on their innovation capacity (Ciriaci, Montresor & Palma, 2015; Seclen-Luna & Barrutia-Güenaga, 2018). Furthermore, the adoption of servitization strategies provides manufacturers with better information about customers' needs, which is critical to future product development (Visnjic & Van Looy, 2013; Baines et al., 2017) and introduces value-adding services into their operations (Cusumano, Khal & Suarez, 2015; Bustinza et al., 2018), which raises the following research question: Is there a positive relationship between the innovativeness of the manufacturing firms and KIBS co-colocation?

However, most of these theoretical and empirical insights are mainly drawn from the experiences of advanced Western countries where mature market mechanisms have already been established (Wang, Zhang & Yeh, 2016). Latin American countries are very different from these economies. In any case, these issues have so far not been examined in the context of emerging countries (Braga & Marques, 2016). Thus, our research suggests the need for further contextualization of KIBS theories in Latin America. In this way, our contribution is to know whether there is a relationship between KIBS co-location and the innovativeness of the manufacturing firms in Latin America.

Knowledge-intensive services are becoming a prominent way to create or adapt and to implement both technological and non-technological innovation in developing economies (Rubalcaba, Aboal & Garda, 2016). In a recent study, Figueiredo & De Matos Ferreira (2019) affirm that there is the possibility of expanding the perception of emerging countries on the importance of developing KIBS for economic and business development. Especially when the Latin American region has both similarities and differences in terms of its structural characteristics (Dutrénit, 2016), in productive structure and export specialization (Pietrobelli & Rabellotti, 2007), which raises the follow research question: Are there differences in the KIBS co-location and innovativeness for manufacturing firms in Latin America?

The empirical analysis uses the OLS method and is based on a sample of 3,029 manufacturing firms in 11 Latin American countries using data from WBES. Consistent with the work of Vendrell-Herrero et al. (2019), the results for the full sample illustrate the complexity of the location of KIBS for the innovation. For understanding heterogeneities further, we compared the Central and South American regions. The results indicate that the innovation in manufacturing firms from Central America is positively related to proximity to KIBS, while in South America it is negatively related. In this sense, this study contributes to the debate that still exists around the KIBS co-location. More generally, we believe that innovation varies both in the continuous space and in different territories (Doloreux & Shearmur, 2012). In any case, traditional theories that apply to Western economies may not apply to less developed countries (Hsieh et al., 2015; Vendrell-Herrero et al., 2019). The present research examines these relationships in the developing economies of Latin America; the finding of somewhat similar results to those of advanced economies being an important contribution.

Finally, the analysis is relevant since the relationship between KIBS co-locations and the innovativeness of manufacturing firms can help to build a process of territorial servitization (Lafuente et al., 2017) which contributes to the consolidation and resistance of the regional industrial fabric, creating

competitive advantages for companies, leading to an improvement in regional competitiveness (Gomes et al., 2019; Lafuente et al., 2019).

The structure of the paper is as follows: The next section introduces the literature review on the KIBS co-location and this leads to the research hypotheses. The third section details the databases and tests the assumptions. The empirical results are provided in the fourth section. Finally, the fifth section provides some brief conclusions, limitations and future research.

2. LITERATURE REVIEW AND HYPOTHESES

2.1. KNOWLEDGE INTENSIVE BUSINESS SERVICES (KIBS)

Two decades after the seminal contribution by Miles et al. (1995), KIBS are still attracting a great deal of attention. KIBS are service organisations whose primary value propositions include knowledge-intensive inputs to the business processes of customer organisations (Miles, 2005). Thus, their specialisation in the knowledge field constitutes the specific mode of production adopted by them (Den Hertog, 2000). However, owing to KIBS including a set of very heterogeneous services, it is important to notice that they have multiple classifications; these three specific categories of KIBS being the most useful (Miles, 2012): professional services (P-KIBS), technological services (T-KIBS) and creativity services (C-KIBS). The first category is comprised of accounting services, human resources, business management, and others that are characterised by having specialised knowledge in the administration and organisation fields. The second category is made up of designing and maintaining computer systems, software design, programming, engineering services and R&D services. The third category includes advertising and design services that are based on creativity as well as symbolic and cultural knowledge. In this study, we focus on the second category, since the literature identified agglomerations of a specific type of KIBS, the T-KIBS (Guimarães & Meirelles, 2014).

On the other hand, KIBS can be an important source of innovation (Muller & Doloreux, 2009) since they can compensate or complement the innovation capabilities of their client companies (Muller & Zenker, 2001; Seclen-Luna & Barrutia-Güenaga, 2018). Furthermore, they can act as innovation facilitators or knowledge intermediaries (Den Hertog, 2000; Gallego & Maroto, 2015) since they support clients in the development of their innovation processes. Ultimately, KIBS plays a very important role in the context of innovation systems (Cooke & Leydesdorff, 2006; Aslesen & Isaksen, 2010) and in different levels of analysis: micro and sectoral (Doloreux & Shearmur, 2013), urban and regional (Antonietti & Cainelli, 2016), and macroeconomic or across the whole economy (Shi, Wu & Zhao, 2014). For these reasons, KIBS have recently become an important field in both theoretical and empirical study (Braga & Marques, 2016). In summary, KIBS have gradually been perceived as a strategic sector (Hsieh et al., 2015) in the context of the knowledge-based economy (Muller, & Zenker, 2001; Miles, 2005; Koch & Stahlecker, 2006).

2.2. KIBS LOCATION

In recent years there has been a growing interest in the geography of KIBS (Müller & Zenker, 2001; Simmie & Strambach, 2006; McCann, 2007; Doloreux & Shearmur, 2012). Researchers have generally adopted the hypothesis that knowledge spillovers are localized and decay across space. Simmie (2003) argues that when a firm's location is relatively close to other firms, partners, etc., it becomes more likely that such proximity boosts innovation, whereas a rather remote firm cannot benefit from many of these potential spillovers and interactions and, therefore, the likelihood of innovative activities decreases. Antonietti & Cainelli (2008) emphasized the role of agglomeration externalities in affecting the decision to relocate knowledge-intensive activities on a local scale, where geographic proximity, knowledge spillovers and closer interaction among agents make it easier for firms to manage complex transactions and to increase their competitiveness. In this way, the provision of KIBS is thought to rely heavily on strong

supplier–customer interactions (Miles, 2005) and, therefore, the importance of location is a critical variable for understanding the effectiveness of KIBS (Simmie & Strambach, 2006).

Notwithstanding, a second way of conceptualizing the link between innovation and space has recently been derived from the idea that local dynamics are not necessarily those that lead an establishment to innovate. Boschma (2005) and McCann (2007) argue that information exchange and collaboration can occur across space. Specifically, Boschma (2005) argues that proximity per se is not a necessary or sufficient condition for innovative processes. In addition to location, innovation requires a mixture of a firm's absorptive capacity as well as organizational, social and institutional embeddedness in the local economy. In the same vein, McCann (2007) shows analytically that in a monocentric urban economic setting innovation intensity decreases with increasing distance in a convex relationship, depending on the relative importance of proximity and face-to-face contacts. Additionally, Doloreux & Shearmur (2012) find evidence of a negative innovation–distance relationship across spatial scales.

More recently, Brunow, Hammer & McCann (2019) found that proximity to cities matters for innovation and KIBS benefits from urbanization externalities. That is, the innovation probabilities decrease considerably with longer distances to metropolises and decreases innovation probabilities for distances from large and small cities. In this form, a long-standing debate still exists around the KIBS location. Hence, empirical evidence on the spatial organization for KIBS is limited due to a lack of research on the spatial patterns for analysing successful KIBS locations (Antonietti & Cainelli, 2016).

In any case, the existing literature shows that KIBS have a strong concentration propensity and are highly concentrated in metropolitan areas, particularly, in capital cities (Shearmur & Doloreux, 2009). These metropolitan areas are characterized by a high density of innovative industries (Camacho & Rodríguez, 2005; Gallego & Maroto, 2010) that promote information exchange among suppliers and the appearance of knowledge spillovers, having access to transport and communications infrastructures, high-quality labour markets and greater opportunities for face-to-face interaction with clients (Muller & Doloreux, 2009). In addition, the more recent explanations have highlighted the importance of other factors, such as cumulative causation mechanisms and global production networks, especially from the multinational enterprises (Jacobs, Koster, & Van Oort, 2014). However, most of these theoretical and empirical insights are drawn from the experiences of advanced Western countries where mature market mechanisms have been established (Wang, Zhang & Yeh, 2016).

2.3. MANUFACTURING FIRMS, KIBS AND TERRITORIAL SERVICITIZATION

The literature recognized that the evolution patterns for KIBS are affected significantly by the characteristics of the local manufacturing industry (Corrocher & Cusmano, 2014). In this way, a consolidated manufacturing base not only generates economic activity, but also creates the conditions to attract KIBS entrepreneurs to these territories (Lafuente, Vaillant & Vendrell-Herrero, 2017). In the same vein, KIBS activities are of critical importance with respect to the recent dynamics of the production systems. Thus, by acquiring knowledge-intensive services necessary for the realisation of their final products, manufacturing firms also learn by interacting, and acquire technical knowledge and customised problem-solving experience which may have a positive impact on their innovation capacity (Ciriaci, Montesor & Palma, 2015). Furthermore, the adoption of servitization strategies provides manufacturers with better information about customers' needs, which is critical to future product development (Visnjic & Van Looy, 2013; Baines et al., 2017) and introduces value-adding services into their operations (Cusumano, Khal & Suarez, 2015; Bustinza et al., 2018). These arguments suggest a double-sided relationship between manufacturers and service providers, and the local manufacturing fabric can develop and add service offerings to products to build a process of territorial servitization (Lafuente et al., 2017).

Manufacturing firms would be in a better position to exploit knowledge-intensive services, while territorial connectivity networks allow KIBS to better reach all manufacturing firms (regardless of their location) via the development and the provision of value adding services (Arnold et al., 2016). However, owing to the fact that not all KIBS are clearly oriented towards innovation, the innovation is carried out

in several ways due to different competitive strategies which produce different impacts on the business ecosystem or territories (Lafuente et al., 2017). Therefore, not all KIBS require the same level of geographical proximity and more research is needed to better understand how territorial servitization is affecting territorial growth (Lafuente et al., 2019; Castellón-Orozco, Jaria-Chacón & Guitart-Tarrés, 2019).

Lafuente et al. (2017) argued that territorial servitization contributes to the consolidation and resistance of the regional industrial fabric through interactive agglomeration economies, taking into account that such networks and territorial servitization interactions can create competitive advantages for companies, leading to an improvement in regional competitiveness (Gomes et al., 2019; Lafuente et al., 2019). Likewise, territorial servitization has lately been described as a development process based on synergistic joint co-location between manufacturing firms and KIBS (Lafuente et al., 2017), highlighting the benefits of these interconnections and interactions (Gomes et al., 2019). Hence, the existing evidence supports the notion that KIBS contributes to sustaining the competitive advantage of manufacturing firms (Doloreux & Shearmur, 2013). Thus, based on these arguments, we propose the following hypothesis:

Hypothesis 1. Innovativeness for manufacturing firms is positively associated with closeness to KIBS co-location.

2.4. KIBS IN LATIN AMERICA

Despite the recent, rapid economic growth experienced by several Latin American countries during the commodity boom (Brenes, Haar & Requena, 2009), the fall in commodity export prices has underscored the many competitive challenges required for new growth sectors to emerge. Services have become the most important economic sector in the global economy, in developed as well as in most developing economies. In this way, knowledge-intensive services are becoming a prominent way to create or adapt and to implement both technological and non-technological innovation in developing economies (Rubalcaba, Aboal & Garda, 2016). Through knowledge-intensive services, emerging countries can make effective use of accompanying services providing new added value and product/service differentiation (in design, marketing, logistics, distribution, and so forth). Besides this, they can be embedded in the diffusion of information technology that is particularly relevant for developing economies (Guy & Arnold, 1995), in the service components of technological transfer associated with exports and imports (Almeida & Fernandes, 2008) and in the technological catching up prior to innovation (Wang & Tsai, 2010).

Figueiredo & De Matos Ferreira (2019) affirm that there is a possibility of expanding the perception of emerging countries of the importance of developing KIBS for economic and business development. In this way, innovation is perceived as a clear means to stimulate the local economy, as long as it is carried out with the intensive use of knowledge generated by KIBS. In this context, KIBS are the protagonists of the transformative role of services in any productive activity. For instance, the natural resource-processing companies have over the past two decades evolved from vertically integrated production organization to subcontracting and outsourcing major parts of the activity to external service providers and engineering firms. In this way, the outsourcing of production services constitutes one of the main reasons explaining the rapid increase of knowledge intensive service firms now to be seen in many Latin American countries. This has also induced the formation of clusters of specialized suppliers, which gradually develop into an important source of technological change associated to the expansion of natural resource-based industries. The degree of development of these clusters varies from sector to sector and from country to country (Crespi, Katz & Olivari, 2018).

Additionally, within the Latin American region, countries have both similarities and differences in terms of their structural characteristics (Dutrénit, 2016). Even, the productive structure and export specialization show that the region is heterogeneous (Pietrobelli & Rabellotti, 2007). Recently, in the classification of countries by their level of economic development, some countries, such as Honduras or Nicaragua, have economies based on natural resource extraction, while other countries have advanced

towards economies based on efficiency, like Argentina, Colombia, Ecuador, Peru and Uruguay (World Economic Forum, 2017). Thus, based on these arguments, we propose the following hypothesis:

Hypothesis 2. There are differences in the KIBS co-location and innovativeness for manufacturing firms in Latin America.

3. DATA COLLECTION AND METHODOLOGY

3.1. DATA DESCRIPTION

The data is obtained from the World Bank Enterprise Survey (WBES). The WBES data is available for over 130,000 firms in 135 countries. The World Bank collects survey information through face-to-face interviews with firm managers and owners regarding the business environment in their countries and the productivity of their firms. The population of the survey is consistently defined in all countries as non-agricultural, non-extracting, formal, privately owned firms; both the manufacturing and service sectors are covered by the survey. The WBES uses stratified random sampling by location, size, industry, and other country-specific information. The standardization of the enterprise survey across all countries strengthens the level of external validity and provides a basis for comparisons across countries in the region with other developing regions (Grazzi & Pietrobelli, 2016).

The WBES has been used extensively in previous international studies. For instance, in Grazzi and Pietrobelli (2016), the authors focus on firm innovation and productivity in Latin America and the Caribbean using WBES data. Likewise, WBES data has been used in various studies on management and published in relevant journals, for example, see Luo & Bu (2016), Fernández (2017), Montalbano, Nenci & Pietrobelli, (2018), Vendrell-Herrero et al. (2017 & 2019), Moltalbano & Nenci (2019).

Our study uses information available from the WBES survey rounds conducted in 2016 for Central American countries and survey rounds conducted in 2017 for South American countries, because the survey uses the same set of questions during this period, thus ensuring consistency between waves and countries. In accordance with our research objectives (to know whether there is a relationship between KIBS co-locations and the innovativeness of the manufacturing firms in Latin America), the final sample used consists of 3,029 manufacturing firms across 11 Latin American countries. Cross-sectional surveys conducted in four countries located in Central America (El Salvador, Guatemala, Honduras and Nicaragua) and seven in South America (Argentina, Bolivia, Colombia, Ecuador, Paraguay, Peru and Uruguay). In this respect, it provides a good set of countries in which to analyse the patterns of innovativeness and KIBS co-location in emerging economies. Table 1 summarizes the sample composition by manufacturing firms.

On the other hand, the sample contains 3,092 service firms and differentiates among various service sectors. In this study we consider the technological service firms (T-KIBS) due to these firms designing and maintaining computer systems, software design, programming, engineering services and R&D services. Hence, they are more knowledge-intensive and have the potential to contribute to the manufacturer's business model. With this in mind, we take the total number of service firms in IT (398 observations) as a share of the total number of service firms in each country and city.

3.2. DESCRIPTION OF VARIABLES

The dependent variable, KIBS co-location, is the share of firms in technological services (T-KIBS) as the total service firms in a city where a manufacturing firm is located and is measured at the country-city level using the method first described in Vendrell-Herrero et al. (2019). In deriving our measurement of KIBS, we differentiate between service firms in the IT sector and service firms in other service industries,

TABLE 1.
Sample composition by country (percentage of firms)

| Country | Innovators | Non-innovators | Total |
|--------------|-------------|----------------|------------|
| Argentina | 49.5 | 50.5 | 21.5 |
| Bolivia | 72.9 | 27.1 | 3.9 |
| Colombia | 71.0 | 29.0 | 18.8 |
| Ecuador | 87.4 | 12.6 | 3.4 |
| El Salvador | 42.4 | 57.6 | 14.6 |
| Guatemala | 61.3 | 38.7 | 5.0 |
| Honduras | 50.5 | 49.5 | 3.0 |
| Nicaragua | 65.9 | 34.1 | 4.1 |
| Paraguay | 61.5 | 38.5 | 3.9 |
| Peru | 73.1 | 26.9 | 18.2 |
| Uruguay | 77.2 | 22.8 | 3.8 |
| Total | 61.8 | 38.2 | 100 |

Source: Own elaboration from WBES Database (2016-2017).

including the retail sector. The independent variable ‘innovativeness’ is measured through a dummy variable where the firm reported the carryout innovation over the last three years. Table 2 provides a definition of the variables used in the study and Table 3 presents the summary statistics of those variables and the results of the differences in means tests for innovator and non-innovator firms.

TABLE 2.
Definition of variables

| Variable | Definition |
|------------------|--|
| KIBS co-location | Share of firms in communications and business as total service firms in the city where the manufacturing firm is located. |
| Innovator | Dummy variable. A value of 1 indicates that the firm reported that carryout innovation over the last three years. 0 otherwise. |
| Exporter | Dummy variable. A value of 1 indicates that the firm reported at least 1% of annual sales in exports. 0 otherwise. |
| Firm size | Logarithm of number of workers. |
| Firm age | Time from foundation of the firm. |
| Industry | Industry dummies for each industrial sector. |

TABLE 3.
Summary statistics

| Variable | (1) Innovators | | (2) Non-Innovators | | (3) Difference in Means | |
|-------------|-------------------|-------|-----------------------|-------|----------------------------|--------|
| | Mean | SD | Mean | SD | Diff | t-test |
| Co-location | 0.136 | 0.076 | 0.118 | 0.076 | 0.018 | 0.000 |
| Exporter | 0.399 | 0.489 | 0.241 | 0.427 | 0.158 | 0.000 |
| Firm size | 154.8 | 404.4 | 101.7 | 303.4 | 53.01 | 0.000 |
| Firm age | 21.99 | 21.14 | 20.04 | 19.54 | 1.95 | 0.005 |

3.3. METHOD AND REGRESSION MODEL

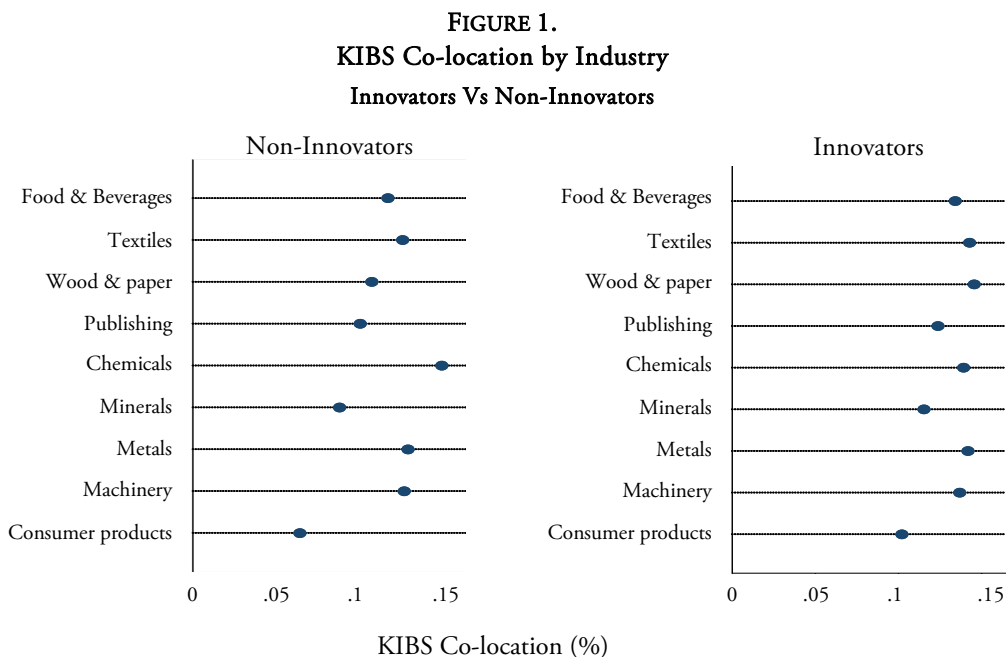
In accordance with our research objectives, we estimate the effects of KIBS co-location and innovativeness using the OLS method. The equation describing this relationship takes the form:

$$KIBS_{i,j} = \beta_0 + \beta_1 Innov_i + \Omega_i + \vartheta_s + \vartheta_c + \varepsilon_{i,j} \quad (1)$$

where the sub-indexes i and j refers to the firm and the city respectively. Ω_i is a vector of firm characteristics including exporting status, size (nº workers), and firm age; ϑ_s and ϑ_c refer to the industry and country dummies respectively, and $\varepsilon_{i,j}$ is the error term. To support hypothesis 1, β_1 needs to be positive.

4. RESULTS AND DISCUSSION

The results indicate that a manufacturing firms' decision about location based on KIBS proximity, is a critical determinant of their innovativeness. If we analyse the total sample (Figure 1), these are some descriptions of the percentage of non-innovative and innovative companies by industries that are close to a KIBS in different countries.

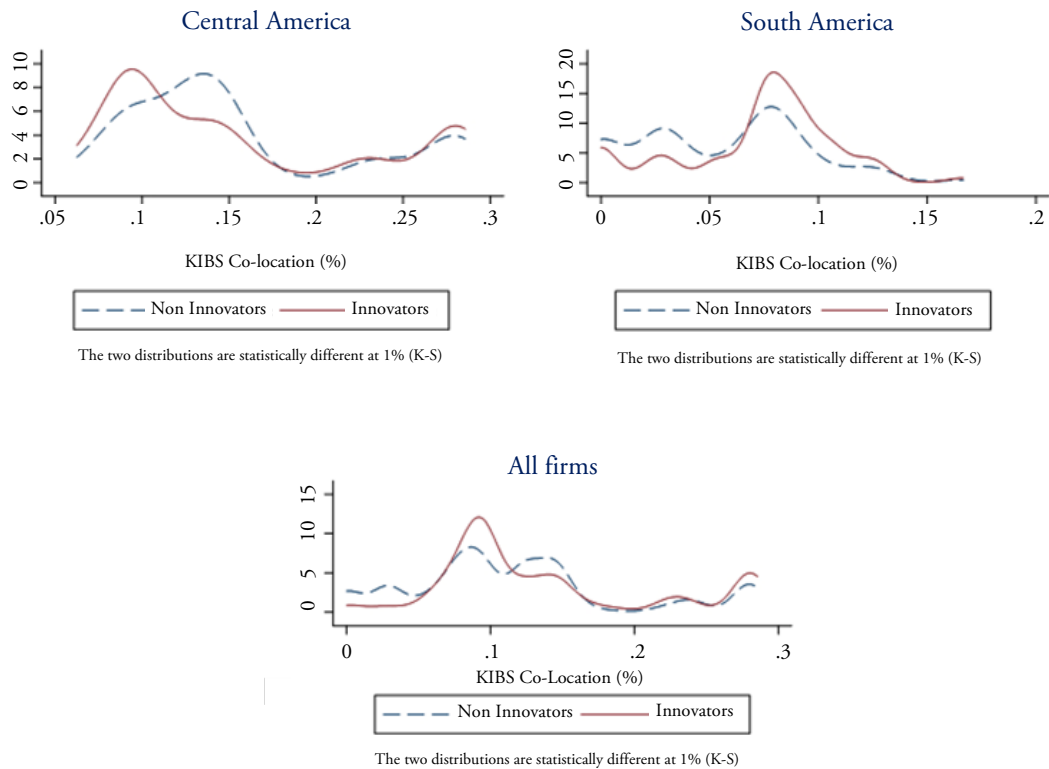


As can be seen in the graph to the right, innovative companies tend to be one percentage point closer to KIBS than non-innovative ones. It is especially innovative firms in the Wood and Paper industry that have the largest share of KIBS proximity. In contrast, firms in the Consumer Products industry have a smaller share of KIBS proximity. Despite these findings, at this level of analysis, we cannot see if these are differences between Central and South American regions. It is important to know these differences because, according to previous studies in Latin America, the characteristics of the productive structure, exports and productivity, are heterogeneous (Pietrobelli & Rabellotti, 2007; Dutrénit, 2016).

Figure 2 represents the distribution of manufacturing companies close to KIBS for Central America, South America, and the complete sample according to whether they are innovative companies or not. As can be seen, Central American countries are closer to KIBS than South American countries, and innovative companies tend to be a percentage point closer to KIBS than non-innovative ones. This shows, firstly, that

there are differences between both regions, i.e. Latin America is heterogeneous (Pietrobelli & Rabellotti, 2007), and second, there is a relationship between KIBS co-location and the innovativeness of the manufacturing firms (Lafuente et al., 2017). Hence, this evidence supports the argument that KIBS contributes to sustaining the competitive advantage of manufacturing firms (Doloreux & Shearmur, 2013; Ciriaci, Montresor & Palma, 2015).

FIGURE 2.
Innovation and KIBS Co-location



In any case, it is visually appreciated that, according to the Kolmogorov-Smirnov test, the distribution of companies close to KIBS differs, as to whether they are innovative companies or not, with a statistical significance of 1%. Therefore, this test justifies the use of different regressions for the sample of innovative and non-innovative companies.

Following the results of the Kolmogorov-Smirnov test reported in Figure 2, equation (1) is also estimated separately for innovator and non-innovator firms, with the same set of independent and control variables. Table 4 presents the results for the effects of KIBS co-location and innovativeness for the full sample and subsamples of innovator and non-innovator firms. Equation (1) is estimated with and without variables that capture firm characteristics contained in vector Ω_i . Furthermore, the control variables shows the significance of the regression models.

More generally, models 1-3 report the results with all explanatory variables included. The results show that the firm' age is relevant in all models, that is, companies with more time on the market tend to look for a close proximity to KIBS. However, firm size (number of workers) is only positive for Central America and is negative for both South America and the full sample, respectively. That is to say, the largest companies from Central America and the smaller ones from South America are more prone to have close proximity to KIBS.

TABLE 4.
Regression models to KIBS Co-location

| Variables | Model 1 Full Sample | Model 2 Central America | Model 3 South America |
|----------------------|---------------------------|----------------------------|--------------------------|
| Innovator | -0.00171 (0.00207) | 0.00590** (0.00238) | -0.00599** (0.00275) |
| Exporter | -0.00175 (0.00238) | -0.00311 (0.00289) | -0.00230 (0.00302) |
| Ln (Workers) | -0.00199** (0.000771) | 0.00262*** (0.000917) | -0.00389*** (0.00102) |
| Firm Age | 0.000121** (0.0000503) | 0.000237*** (0.0000598) | 0.000115* (0.0000650) |
| Constant | 0.139*** (0.00309) | 0.0624*** (0.00517) | 0.149*** (0.00409) |
| <i>Observations</i> | 3029 | 807 | 2222 |
| <i>R²</i> | 0.534 | 0.355 | 0.359 |
| <i>Industry FE</i> | YES | YES | YES |
| <i>Country FE</i> | YES | YES | YES |

Dep Variable: KIBS Co-Location (%).

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

On the other hand, the exporter variable is not significant for all models. One possible explanation for this in some Latin American contexts, the firms have scarce knowledge about foreign markets and institutional differences between countries are an important limitation for the international expansion of firms (Shrader, Oviatt & McDougall, 2000).

Finally, the innovativeness variable shows that, for the full sample, it is not significant and illustrates the complexity of the location of KIBS for innovation. However, when compared to Central and South American regions, the results indicate that the innovation in manufacturing firms from Central America is positively related to proximity to KIBS (coefficient = 0.00590**), while in South America it is negatively related (coefficient = -0.00599**). In this sense, the study contributes to a debate that still exists around the KIBS co-location. In other words, the results for the Central America sample support hypothesis 1 (Model 2). Thus, the analysis of innovator and non-innovator firm subsamples provides a better understanding and enables us to test Hypothesis 1. The results for innovator firms (Model 2) strongly support Hypothesis 1, suggesting that KIBS co-location and innovativeness are positively related for innovator firms. This finding is even more important when we compare these parameters with those estimated for the subsample of non-innovators.

In short, innovation in Central America is positively related to proximity to KIBS (manufacturing must be close to KIBS), while in South America it is negatively related. Therefore, these results support Hypothesis 2, suggesting that, for Central America, the proximity is crucial where firm's location is relatively close to KIBS, and it becomes more likely that such proximity boosts innovation (Simmie, 2003; Simmie & Strambach, 2006). However, for South America, the proximity per se is not a necessary or sufficient condition for innovative processes (Bochma, 2005; Doloreux & Shearmur, 2012). Thus, without contradicting the more widely held view that innovation is associated with local dynamics, these results show that there are wider spatial patterns of innovation. For instance, the spatial scale and proximity for innovation could be explained through different geographical extensions (Shearmur & Doloreux,

2009) of the countries from Central and South America, or that not all KIBS require the same level of geographical proximity (Lafuente et al., 2019).

In any case, these results show that both approaches to understanding the geography of KIBS innovation are valid, and that they are complementary. Whilst our results are suggestive and call for further investigation, we postulate that the decision of KIBS co-location becomes more important when the technological and knowledge intensive services is scarcer, and hence valuable, in the context of national innovation systems in emerging stages with scarce science, technology and innovation capabilities, and with weak links between actors, as in the case of Latin America (Crespi & Zuñiga, 2012; Rubalcaba et al., 2016; Dutrénit, 2016).

5. CONCLUSIONS

5.1. THEORETICAL IMPLICATIONS

Understanding the interplay between KIBS co-location and the innovativeness of manufacturing firms demands a conceptual framework that would help us to understand these relationships in context of emerging countries. The present research examines these relationships in some of Latin America's developing economies to corroborate traditional theories that apply to Western economies on these issues (Hsieh et al., 2015). The evidence presented in this paper provide empirical support to illustrate the complexity of the location of KIBS for innovation, which shows that the Latin American region is heterogeneous (Pietrobelli & Rabellotti, 2007; Dutrénit, 2016; Crespi, Katz & Olivari, 2018). Hence, demands more analysis in different dimensions.

From a theoretical standpoint, this study continues the debate that still exists around the KIBS co-location (Antonietti & Cainelli, 2016), where some arguments affirm that knowledge spillovers are localized and decay across space (Simmie, 2003; Simmie & Strambach, 2006), and other argues that proximity per se is not a necessary or sufficient condition for innovative processes (Bochma, 2005; McCann, 2007). Despite most of the theoretical and empirical insights of this topic being mainly drawn from the experiences of advanced Western countries (Wang, Zhang & Yeh, 2016), we find somewhat similar results in Latin America.

In sum, we believe that innovation varies both in the continuous space in different territories, and decision of KIBS co-location becomes more important when the technological and knowledge intensive services is scarcer, and hence valuable.

5.2. MANAGERIAL AND POLICY IMPLICATIONS

This study contains two main implications; the first is suggesting that KIBS co-location and the innovativeness of the manufacturing firms are positively related. Therefore, KIBS could have a positive impact on their innovation capacity (Ciriaci, Montesor & Palma, 2015; Seclen-Luna & Barrutia-Güenaga; 2018). Furthermore, it can facilitate the adoption of servitization strategies for manufacturing firms and introduce value-adding services into their operations (Visnjic & Van Looy, 2013; Cusumano, Khal & Suarez, 2015; Baines et al., 2017; Bustinza et al., 2018). The second implication suggests that new institutions are needed to support the development of local capabilities and the establishment of KIBS (Crespi, Katz & Olivari, 2018). Hence, it is important for regional and local governments to consider integrating KIBS into manufacturing clusters when designing industrial policies (Vendrell-Herrero & Wilson, 2017; Vendrell-Herrero et al., 2019). This is especially important because these relationships can help to build a process of territorial servitization (Lafuente et al., 2017) which contributes to the consolidation and resistance of the regional industrial fabric creating competitive advantages for companies and leading to an improvement in regional competitiveness (Gomes et al., 2019; Lafuente et al., 2019).

Finally, the contextual domain of this research of Latin American manufacturers presents no obstacles to the arguments described above due to Latin America's business fabric being less developed than those of Western economies. KIBS co-location could help manufacturing firms to design a more advanced strategy of competitiveness by building-up knowledge-service competences. Hence, our contextual findings have the potential to influence managerial and political agendas in Latin America. That is, there is a clear invitation to design an innovation policy for each specific case (institutional and cultural contexts), far from the classic generic 'recipes' and mechanical imitations (Seclen-Luna & Barrutia-Güenaga, 2019).

5.3. LIMITATIONS AND FUTURE RESEARCH

Although the empirical analysis is supported by a large and reliable WBES database, the low number of observations for some of the key variables prohibits analysis at a national level. Therefore, they aggregate countries together for the empirical analysis, allowing only for interpretations at a regional level (Grazzi & Pietrobelli, 2016). Furthermore, as the WBES database does not provide information on how manufacturers and KIBS coordinate and share knowledge, this question remains open for future research.

In the same vein, at a micro level, our study does not evaluate how manufacturing firms internalize professional services into their operations and it does not consider the types of innovation; further research on this issue would therefore be valuable. Besides this, at a meso level, future research on this topic should identify how specific policies on territorial servitization can revitalize manufacturing activities in territories with relatively undeveloped manufacturing industries (Lafuente et al., 2017).

Finally, despite the relationships which are significant in our model, other factors not included in the current model may also play an important role. Thus, future research will need to corroborate the results in specific contexts (at regional and national levels, including size and maturity of the industry), in a long-term analysis, to determine some of the causal mechanisms.

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