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Articles

Panel analysis of the creation of new KIBS in Spain: The role of manufacturing and regional innovation systems (RIS)

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Abstract:

Territorial servitization is a topic of interest due its impact on regional growth and innovation. Considering that the formation of new KIBS is a good indicator of such TS process and with the aim of contributing to the empirical literature on this topic, this study analyses to what extent the 'manufacturing quality' and 'innovation environment' profiles determined the different types of new knowledge intensive business services (KIBS). The research tackles the creation of new KIBS in 17 Spanish regions for the period 2000 to 2016 in the respective regions. The results reveal that new KIBS were deeply affected by economic changes that happened as a result of the great 2008 crisis and some KIBS categories are more affected by the techno-economic environment than others.

Keywords: Servitization; knowledge-intensive business services; innovation; typology.
JEL classification: L80; L26; P25.

Análisis de datos de panel de la creación de nuevas KIBS en España. La importancia de la manufactura y el sistema de innovación.

Resumen:

La servitización territorial es un tema de interés debido a su impacto en el crecimiento regional y en la innovación. Con el objetivo de contribuir a la literatura empírica sobre este tema, este estudio analiza en qué medida los perfiles de 'calidad manufacturera' y 'entorno de innovación' de 17 regiones españolas para el período 2000 a 2016 afectan la creación de los diferentes tipos de nuevos servicios empresariales intensivos en conocimiento en las respectivas regiones, siendo esta creación un buen indicador de las condiciones para la servitización territorial. Los resultados, además del gran impacto de la crisis del 2008, revelan que no todos los KIBS son iguales y que algunas categorías de KIBS están más afectadas por el entorno tecnoeconómico.

Palabras clave: Servitización; servicios avanzados en conocimiento; innovación; tipología.
Clasificación JEL: L80; L26; P25.

1. Introduction

Servitization is a new competitive model in which manufacturing firms create added value by transitioning from products to services with the aim of raising revenues and maintaining a sustainable competitive advantage in global markets (Vandermerwe & Rada, 1988; Bowen, Siehl & Schneider, 1989; Cohen & Whang, 1997; Kamp & Parry, 2017, Belandi & Santini, 2019).

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Academic discussion has acknowledged the role of KIBS in servitization and highlighted how manufacturers can achieve product-service innovation by partnering with KIBS (Bustinza et al. 2017). The recent literature on servitization shows that not only firms but whole territories can benefit from the positive effects of a solid KIBS sector (Lafuente, Vaillant & Vendrell-Herrero, 2017). The advantages of servitization do not apply only to companies but tend to spill over into the surrounding region (Gebauer & Binz, 2019) since territorial servitization "not only enables the upgrading of existing manufacturing competences but also offers an opportunity to develop and anchor new technological capabilities within regions" (Lafuente et. al, 2009). Accordingly, the growth of the KIBS sector is viewed as an indicator of regional modernization and renewal (Corrocher & Cusmano,2014; Horvath&Rabetino,2018) and it is worthy to analyze the factors underlying the formation of new KIBS since the existence of KIBS is considered a good indicator of territorial servitization.

Despite the fact that KIBS have been recognized as successfully achieving technological outcomes, few studies have examined the specific regional factors that cause heterogeneity in the creation of new KIBS. More recently, however, a line of research has examined territory-specific aspects of KIBS formation rates. Noteworthy examples include the studies by Horvath & Rabetino (2018), Wyrwich (2019) and Gomes et al. (2019). Wyrwich (2019) analyses the connection between local manufacturing and KIBS start-ups, while Horvath & Rabetino (2018) also takes the entrepreneurial ecosystem into consideration. Meanwhile, Gomes et al. (2019), who also understand servitization as a response to a demand by regional manufacturing firms for new knowledge with which to innovate the provision of products and services, introduces and defends the idea that a greater knowledge stock leads to greater territorial servitization.

Elsewhere, Koch & Stahlecker (2006) used qualitative methodology to compare Bremen, Munich and Stuttgart (Germany), three powerful socioeconomic, manufacturing regions, and concluded that different economic, technological and institutional (RIS) preconditions affect the creation of new KIBS. Building on Koch & Stahlecker (2006), this article addresses the following research question: Does a stronger manufacturing base and the quality of the Regional Innovation System influence the creation of new KIBS?

It is well known that KIBS are specialized in a range of diverse technological activities such as R&D, management, and IT outsourcing, (Strambach, 2001; Lafuente et al. 2017; Horvarth and Rabetino, 2019). In addition to the "mainstream" differentiation between T-KIBS and P-KIBS adopted by Miles et al. (1995) this paper also includes i) T-KIBS (R&D and other technical services); ii) C-KIBS (computer-related services) and iii) P-KIBS (legal services, consultancy and market services). In order to address the different KIBS branches, this study formulated a second research question: Is the positive correlation between the quality of the Regional Innovation System and the formation of new KIBS equally significant in all the KIBS categories?

For this research, quantitative panel data techniques were applied to a purpose-built data base consisting of 289 observations from 17 Spanish regions over a 16-year period from 2000 to 2016. The data was sourced from the Spanish Statistical Office (INE), Eurostat, and the SABI-Informa database. The results corroborate the positive relation between the strength of the RIS (Regional Innovation Index) and the creation of new KIBS of all kinds. However, the positive relation is not so clear when considering the quality of manufacturing, since only the creation of new C-KIBS are correlated positively to employment in high and medium-high manufacturing firms. It is also remarkable that the foundation of new KIBS was deeply affected by economic changes happened as a result of the 2008 great crisis.

This study offers two main contributions to the scarce empirical research on regional heterogeneity in the creation of new KIBS (Meliciani & Savona, 2015, Lafuente et al. 2017; Horvath & Rabetino 2019). Firstly, a distinction was made between technical KIBS (T-KIBS), computer-related services (C-KIBS), and "traditional" professional services (P-KIBS). Secondly, and an extensive database was created using data from 2000 to 2016 which allows to examine the impact of the economic crisis on the creation of advanced services firms, and to use panel data techniques adding value to the study. Additionally, we believe that this this work reinforces the path undertaken by Castellón-Orozco, Jaría-Chacón & Guitart-

Tarrés (2019) and contributes to a better knowledge of territorial servitization within the Spanish environment.

The paper consists of five parts. The key theoretical considerations regarding the manufacturing and innovation features of the KIBS and the regions are presented in Section 2. Section 3 presents the regional statistical data for Spain. Section 4 explains the data and research method guidelines. The results are presented in Section 5. Finally, some brief conclusions and policy recommendations are discussed in section 6.

2. THEORETICAL APPROACH

The concept of servitization was introduced at the end of the last century to describe an emerging trend where manufacturers introduced combined product-service offers (Vandermerwe and Rada, 1988; Bowen, Siehl, & Schneider, 1989; Cohen and Whang, 1997; Kamp & Parry, 2017; Bustinza et al., 2017). These competitive strategies were either developed in-house or outsourced to knowledge-based services (Vandermerwe & Rada,1988; Wise & Baumgartner, 1999). Bustinza et al. (2017) claim that strategic partnerships between manufacturing and KIBS companies foster servitization and minimize risks inherent to all innovation since these alliances allow manufacturing companies to focus in their unique resources and core competences.

Recently, Lafuente et al. (2017) introduced the concept of territorial servitization as a new economic paradigm to highlight the influence of KIBS on territorial growth dynamics through the formation of a virtuous circle in which manufacturers and KIBS reinforce each other through iterative relationships, stimulating innovation within a territorial boundary (Lafuente et al., 2017). Basically, this means "a symbiotic recoupling between services and manufacturing with a spatial dimension" (De Propis & Storai, 2019) is created which benefits the whole territory (Arnold et al., 2016, Lafuente et al., 2017; Horwarth & Rabetino, 2019; Gomes et al., 2019). In this vein, one of the main features of the literature on the new territorial servitization trend is the recognition of the importance of KIBS firms because growing numbers of KIBS in a region may be indicative of a more vigorous servitization-enhancing regional environment (Gomes et al. 2019).

In assessing the effects of the development of new KIBS on regional outcomes, the debate is based on the assumption that KIBS are agents of knowledge transformation (Strambach, 2008; Muller & Doloreux, 2007). Specifically, KIBS are considered supply vehicles of specialized expertise, providers of high skills resources, and are characterized by their involvement and participation in complex operations (Muller & Doloreux, 2007).

Again, KIBS are specialized in different activities such as R&D, management, and IT outsourcing, (Strambach, 2001; Lafuente et al. 2017; Horvarth and Rabetino, 2019). However, few servitization studies have developed KIBS typologies based on specializations, with the exception of the recent work by Wrywich (2019). Wrywich carried out an empirical analysis of KIBS start-ups in East and West Germany in which he made a distinction between professional P-KIBS services and new technology-based T-KIBS. His study confirms that all KIBS do not behave in the same way when P-KIBS and T-KIBS are considered different dependent variables.

The classification of KIBS firms according to their specializations has also been discussed in the literature (Miles et al., 1995; Haas & Lindemann, 2003; Bhom & Thomi, 2003; Koch & Stahlecker, 2006; Gallego & Maroto, 2013; Wrywich, 2019). According to conventional categorizations, manufacturing firms demand legal services, consultancy, and market services from P-KIBS, and use technical expertise from T-KIBS to improve their product portfolios.

However, due the dynamic nature of the knowledge that flows between KIBS and manufacturing firms, definitions of the boundaries for categorizing KIBS have also been discussed (Koch & Stahlecker, 2006). In this context, it is worth pointing out that digitalization, in particular, has facilitated servitization

by making it easier to create new services, platforms, and intelligent products (Kohtamäki et al., 2019). For this reason, we recommend placing all computer-related C-KIBS services in a separate category from the other technical T-KIBS services.

When discussing the factors that determine the development rate of new KIBS, the literature on territorial servitization mentions the spillover effect that occurs in consolidated manufacturing regions as enhancing the local development of KIBS. Lafuente et al. (2017) also corroborated that manufacturing creates a demand for local KIBS. This is a core idea that has been driven throughout the empirical research into territorial servitization. A recent empirical study by Horváth & Rabetino (2019) highlighted the importance of the regional industrial fabric – apart from the entrepreneurial environment – in developing a competitive KIBS sector. However, these authors stress that the quality of manufacturing should be included in the empirical assessment and propose studying the average size of manufacturing companies. While Horváth & Rabetino (2019) and Wrywich (2019) both point out that manufacturing companies are KIBS' main clients, Wrywich also assesses the quality of manufacturing by focusing on R&D-intensive manufacturing companies.

Hypothesis 1: A strong local manufacturing fabric characterized by higher levels of R&D is conducive to greater numbers of new KIBS.

Another facet to consider in terms of the "host environment" is the combination of a variety of regional determinants which may create an environment which is conducive to innovation (Fernandez de Lucio et al., 2003). In particular, the regional innovation system (RIS) approach focuses on the factors that condition the creation and diffusion of knowledge at a regional level (Cooke et al., 1997; Morgan, 1997; Maskell & Malmberg, 1999; Asheim & Gertler, 2005; Tödtling & Trippl, 2005; Martin & Trippl, 2014). This conceptual framework assumes that innovation activities are based on interactive learning and emphasizes the importance of knowledge flows and networks which require intensive communication and collaboration between different actors (Lundvall 1992, Edquist, 2005). Indeed, when RIS actors, organizations and institutions develop strong communication networks, the result is a continuous flow of knowledge, skills and human resources at the regional level, leading to systemic innovation activities (Martin & Trippl, 2014). Gomes et al. (2019) acknowledge that technological and scientific knowledge is a critical factor in attracting new knowledge-intensive companies to a region and therefore increasing its potential for servitization. However, evidence shows that regions differ markedly in their commitment to developing innovation-related organizations and institutions (Martin&Trippl, 2014), and particularly evolve over time (Edquist, 2005; Isaksen & Trippl, 2016).

Since to induce or manage innovations is a multidimensional, social, interactive and complex task, it needs to be evaluated in a broad sense (Zabala-Iturriagoitia et al. 2007). The Regional Innovation Scoreboard is the most comprehensive database that allows at least basic evolutionary trends to be compared at regional scale (Blažek & Kadlec, 2019). This synthetic indicator is based on 17 indicators covering framework conditions, investments, innovation activities and innovation impacts (Hollanders et al., 2019).

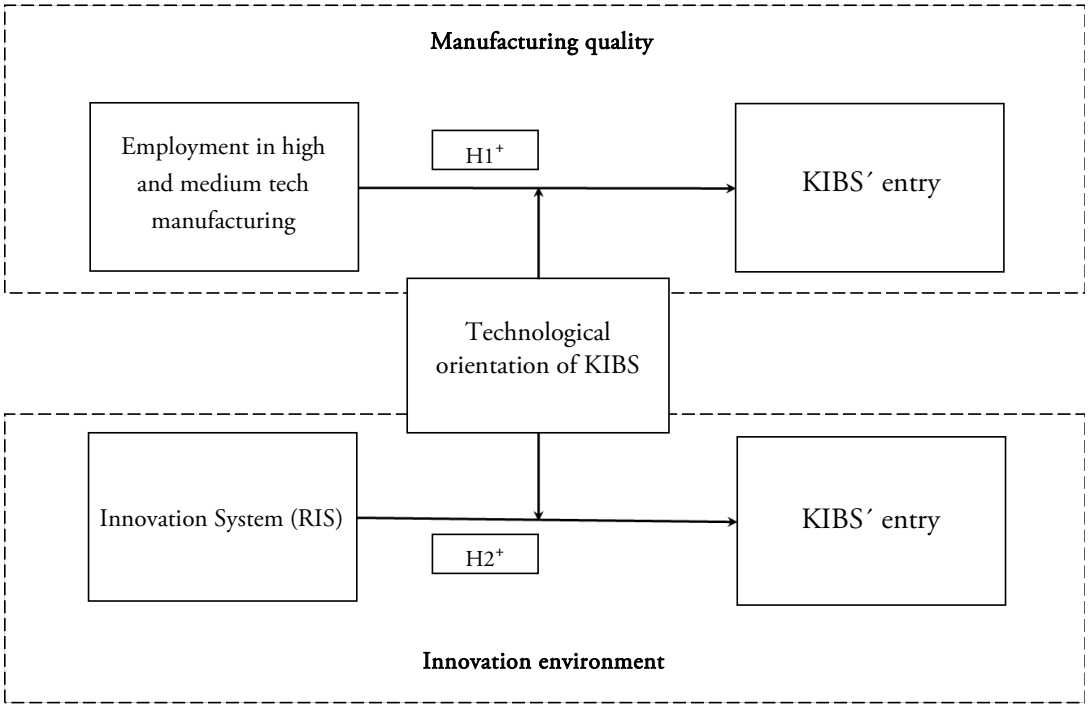
Hypothesis 2.a: The quality of Regional Innovation Systems as characterized by the Regional Innovation Scoreboard affects the entry rate of new KIBS.

When using the Regional Innovation Systems as a framework for understanding innovation, the concept of differentiated knowledge bases (analytical, synthetic and symbolic) are equally important in order to understand the learning process (Asheim et al., 2011) as they contain different combinations of tacit and codified knowledge and require different innovation skills. The evidence shows profound differences between regions in industrial structures and the degree of specialization of the region's KIBS that may be caused by the knowledge and diffusion dynamics, as well as by the innovation patterns and challenges (Isaksen & Trippl 2016).

Hypothesis 2.b: The relationship between the quality of the Regional Innovation System and the entry rate of new KIBS is not the same for all KIBS categories.

In summary, when analyzing determinants of KIBS creation, our conceptual approach (Figure 1) suggests that both regional structure characteristics, manufacturing quality and innovation environment, could determine the emergence of new KIBS. However, we propose that not all KIBS are equally affected by regional factors and we hypothesize that the technological orientation of KIBS could mediate in the creation rate.

FIGURE 1.
Conceptual approach



Source: Researchers' own.

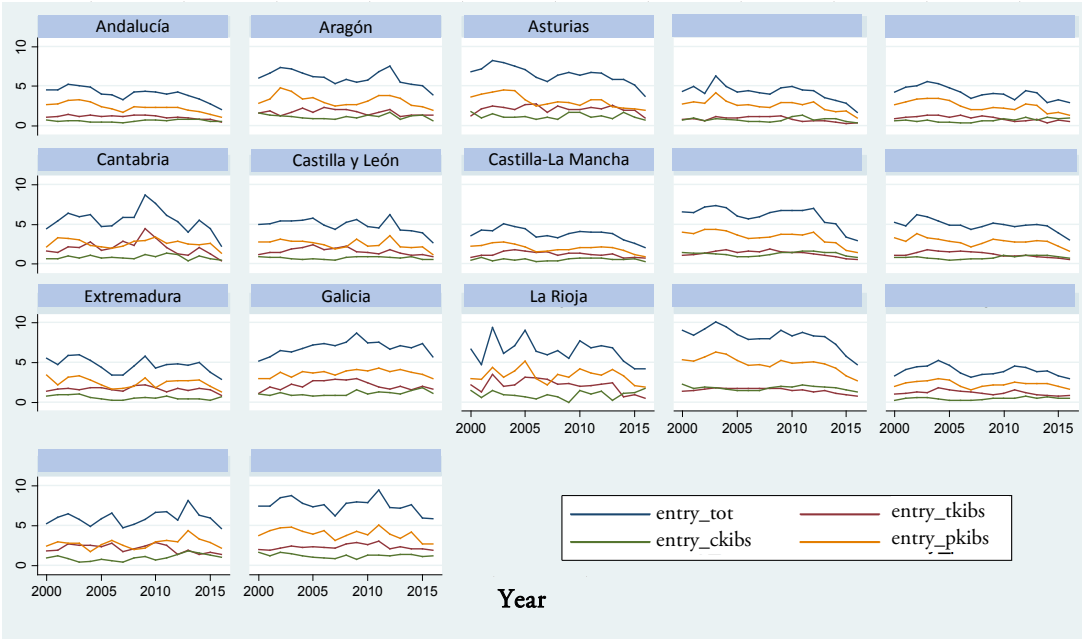
3. THE CREATION OF NEW KIBS IN SPAIN

The data from the Sabi-Informa database indicates that 106.271 new KIBS were created in Spain between 2000 and 2016. 56.9% of the new KIBS were involved in providing professional services (P-KIBS), i.e. legal, accounting and auditing activities, management consultancy, and market services. Technical KIBS (T-KIBS) came second and accounted for 24.7% of the sample. Finally, new computer-related services KIBS (C-KIBS) made up 18.2% of the sample.

Based on these categories, the evolution of the entry index (i.e. new KIBS / total new firms in the region-year) for seventeen Spanish regions is shown in Figure 2. An overall decline in the creation of KIBS in Spanish regions can be observed. This decline was particularly noticeable during the critical years (2008-2010) of the global financial crisis. Finally, the number of new PKIBS and TKIBS dropped following the crisis while the rate of new CKIBS remained stable.

The reasons for this are debatable. It could be argued, for example, that the advanced services sector is one of scale and low margins, explaining the decline in the creation of new KIBS in the sector during the crisis. Also, the economic downturn may have had led to a drop in the number of interesting innovation projects, the introduction of budget restrictions, and a preference for developing knowledge-related capabilities internally.

FIGURE 2.
Evolution of entry index* in the Spanish regions form 2000 to 2016 by KIBS categories



Source: Researchers' own based on Sabi-Informa & INE. *New KIBS / New Firms in the region-year.

In addition, Figure 2 clearly reflects the heterogeneity of the regional evolutionary paths and configuration of new KIBS. Finally, in terms of new KIBS per region, the data shows that in the period 2000-2016, the creation of new KIBS was concentrated in four regions: Madrid (28.2%), Catalonia (19.8%), Andalusia (11.4%), and the Valencian Community (9.8%). This can be explained by the size of their economies and the fact that Spain's biggest cities are located in these regions. Apart from the theoretical reasons, the heterogeneity of these indicators is reason enough to warrant further investigation into the effects of certain regional factors in territorial servitization

4. DATA AND METHODS

The empirical objective of this research was to examine to what extent the emergence of new KIBS in Spain's regions was affected by the techno-economic characteristics of the regions' manufacturing and innovation environment. The heterogeneous trajectories of the regions' industries and the regional differences in the development of innovation systems throughout this considerable period justified an analysis of the factors that determine the creation of new KIBS as a critical measure of territorial servitization (Lafuente et al. 2017; Wyrwich, 2019; Horvath & Rabetino, 2018). As stated before, the geographical context of the study is Spain, and the unit of analysis is the geographical disaggregation at NUTS2 level. The entry rates of three types of new KIBS in seventeen Spanish regions were analysed for the period 2000 to 2016 producing a database with a total of 289 region-year observations.

4.1. DATA

The data comes from the "Sistema de Análisis de Balances Ibéricos" (SABI) database, developed by Informa in collaboration with Bureau Van Dijk. The database contains economic and financial information on the annual accounts of approximately 2.7 million companies domiciled in Spain.

Dependent variable. The dependent variable is the ratio between the new KIBS and the total number of new firms (in all sectors) in each region and year considered as used by Lafuente et al. (2017) and

Horvath & Rabetino (2019). A further three dependent variables were also used based on the three aforementioned KIBS categories: T-KIBS, C-KIBS, and P-KIBS (see ANNANNEX 1 for NACE codes). The ratio was calculated using data from the SABI-Informa dataset as the numerator and data from the Spanish statistical office (INE) as the denominator.

Independent variables. The variables used for measuring the manufacturing quality and innovation environment are explained thus:

Manufacturing quality. This concept was calculated based on the numbers involved in high and medium high-technology manufacturing as a share of the total employment (EMP_HMTECH _MANUF). The data for this variable was taken from Eurostat and is consistent with the figure for employment in R&D-intensive manufacturing used by Wyrwich (2019).

Innovation environment. This measure was calculated using the regional innovation performance (RIS_SCORE) figures from the Regional Innovation Scoreboard for the years 2009, 2011, 2013, 2015, and 2017. The indicator shows the performance of the regions relative to the EU in 2011. The series was completed by assigning the figure for 2009 to the years prior to 2009. The figures for 2010, 2012, 2014 and 2016 were estimated based on the previous available scores. All these figures were obtained from the European Innovation Scoreboards (EIS) project.

TABLE 1.
Description and statistical summary of variables (n=289)

Type	Variable	Variable Description	Code(s)	Aver.	Std. Dev.	Min.	Max	Source
Dependent	Total entry rate	Share of new KIBS firms in total of new firms in the region	entry_tot	5,49	1,62	1,67	10	SABI – INE
	T-KIBS entry rate	Share of new technological KIBS firms in total of new firms in the region	entry_tkibs	1,59	0,64	0,32	1,5	SABI -INE
	C-KIBS entry rate	Share of new computer-based KIBS firms in total of new firms in the region	entry_ckibs	0,93	0,42	0	2,3	SABI -INE
	P-KIBS entry rate	Share of new professional KIBS firms in total of new firms in the region	entry_pkibs	2,96	0,95	0,94	6,3	SABI -INE
Independent	Manufacturing quality	Share of employment in high and medium technology manufacturing sector in total employment	emp_hmtech _manuf	3,97	2,87	0,18	12	Eurostat
	Innovation environment	Regional Innovation Score (relative to EU)	ris_score	73,4	12,67	48,2	99	EU
Control	Size (GDP)	GDP PPP (ln)	gdp_ln	10,62	0,92	8,66	12	Eurostat
	Agglomeration	Inhabitants/km² (in ln)	pop_dens_ln	4,6	0,96	3,08	6,7	INE
	Entrepreunership	Share of new firms in the region in total incumbent firms	Entrep	0,03	0,01	0,01	0,1	INE
	Economic crisis	Dummy (2000-2008: 1, 0 otherwise)	d1	0,52	0,5	0	1	--

Source: Researchers' own.

Control variables. Three control variables were included in the analysis. First, the Gross Domestic Product (GDP_LN) was used as a control for the size differences among regions; the variable was used in logs. Second, the population density (POP_DENS_LN) indicator was used in the same way as other studies on KIBS (Gallego & Maroto, 2015; Horvath & Rabetino, 2018) and also with the creation of new firms (Fotopoulos, 2012) to catch any agglomeration effects. Also, this variable "is included as a catch-all variable of various regional characteristics such as housing and land prices, availability of infrastructure

and other inputs" (Fritsch & Kublina, 2016). Third, an indicator of regional entrepreneurship (ENTREP) was included as a control for the differences in business dynamism among regions. Next, using data from the INE, the share of new firms in the total number of incumbent firms for each region-year was calculated. Finally, to test the effect of the economic crisis on the emergence of new KIBS, a dummy variable (d1) was included. The dummy variable was estimated by assigning a value of 1 to the years before the crisis (2000-2008), and 0 to the other years.

4.2. Method

The empirical analysis used a dataset taken from the sources mentioned previously. The configuration of the sample includes data for seventeen Spanish regions for the period 2000 to 2016 producing 289 observations which could be analysed using data panel econometrics. The hypotheses were tested using a quantitative approach based on a regression of panel data. The functional specification was established as the following equation estimation:

$$Entry_{rt} = \alpha + \beta_1 Manufacturing\ quality_{rt} + \beta_2 RIS_{rt} + \beta_3 Size_{rt} + \beta_4 Entrepreunership_{rt} + \beta_5 Agglomeration_{rt} + \beta_6 Economic\ crisis_{rt} + \sigma_{rt} + \varepsilon_{rt}$$

The dependent variable Entry is the KIBS entry rate in its four formulations for each region r and each year t. With the applied method, Hausman tests were carried out to determine the importance of considering the variations of the variables only over time or whether variations between regions should also be considered. Finally, as a robustness test, Poisson regressions with fixed effects were performed using the number of new KIBS in the year-region as a dependent variable, as used by Wyrwich (2019). Likewise, ordinary least squares (OLS) regressions were performed since the sample includes highly persistent (and / or structural) variables, as used in Bettin et al. (2018). A comparative table of the coefficients is presented in Annex 2.

5. Results

The results of the panel data regression analysis specifications are presented in Table 2. The estimates include the full sample of KIBS and estimates for technical KIBS (T-KIBS), computer-related services (C-KIBS), and "traditional" professional services (P-KIBS), respectively. The analyses support the idea that an innovation prone regional context leads to the creation of new KIBS, and thus, suggesting that influences the probability of bigger collaboration among KIBS and manufacturers and enabling better conditions for territorial servitization. The model reveals a significant positive coefficient in the regional innovation system proxy as measured by the Regional Innovation Scoreboard, revealing a significant statistical influence on the creation of all the KIBS considered. In other words, the regional innovation system may well influence value-creating processes in the territory because product-service innovation increases when the number of new KIBS increases.

The assessment of the local quality of manufacturing, however, did not seem to influence the creation of new KIBS, since no significant changes in the outcome variable were observed when the numbers employed in high and medium-high technology manufacturing environments increased. Despite this general trend, it is worth underlining that a positive correlation was observed between new C-KIBS and increased numbers in high and medium-high manufacturing positions. This corroborates with Wyrwich's findings (2019) which revealed that while TKIBS and PKIBS were already well-developed in Spanish regions, CKIBS were also growing. This could suggest that firms may need to address the challenge of digitalization and industry 4.0.

Regarding the analyses of the control variables, the model did not throw up any statistically significant predictors when the population density logarithm indicator was used to measure the impact of

the degree of agglomeration in each region. Therefore, the results obtained from the model would seem to contradict previous expectations regarding the spill-over effect of large urban centres.

The control variable analyses also supported the relevance of the "wealth" effect, although with the opposite (negative) effect in the case of P-KIBS and C-KIBS. Furthermore, the impact of the overall entrepreneurial environment was statistically relevant in a negative sense. The fact that C-KIBS do not follow this pattern could evidence, once again, the emergence of new C-KIBS in some Spanish regions.

When considering the economic downturn dummy variable, i.e. the influence of the crisis on the creation rates of KIBS, the estimates corroborate a positive trend in all the KIBS, including the T-KIBS and P-KIBS before the crisis and a sharp deceleration afterwards, suggesting a weakness in the long-term commitment to strategic servitization. However, in the C-KIBS column, the significant, negative indicators corroborate a tendency towards growth in the sector.

TABLE 2.
Results of the regression
(Dependent Variable: entry index)

	Total	T-KIBS	C-KIBS	P-KIBS
emp_hmtech_manuf	0,0225	-0,024	0,0485*	-0,00204
	(0,103)	(0,0487)	(0,0271)	(0,0636)
ris_score	0,0830***	0,0223**	-0,00186	0,0626***
	(0,0222)	(0,0106)	(0,00589)	(0,0138)
gdp_ln	-2,404***	0,938***	-0,912***	-2,430***
	(0,642)	(0,305)	(0,17)	(0,398)
Entrep	-38,76***	-13,31**	-9,320***	-16,13**
	(12,71)	(6031)	(3362)	(7877)
pop_dens_ln	1280	-1064	0,502	1842
	(1997)	(0,948)	(0,528)	(1238)
d1	0,802***	0,600***	-0,149***	0,352***
	(0,198)	(0,0942)	(0,0525)	(0,123)
Constant	19,74***	-4900	8,626***	16,02***
	(7146)	(3392)	(1891)	(4431)
Observations	289	289	289	289
R-squared	0,23	0,191	0,267	0,32
Number of regions	17	17	17	17
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Source: Researcher´s own.

6. CONCLUSIONS AND FINAL REMARK

The existence of KIBS is considered a good indicator of territorial servitization. This research attempted to analyse the factors underlying the formation of new KIBS in Spanish regions between 2000 and 2016. As such, it contributes to the debate about the importance of "host" conditions in terms of intermediate demand and more specifically the regional innovation profile and the quality of the manufacturing fabric. The results corroborate the positive relation between the strength of the RIS (Regional Innovation Index) and the creation of new KIBS of all kinds and supports the notion that KIBS are an important source of knowledge-based regional development (Wrywich, 2019).

However, the C-KIBS were the only branch that correlated positively to employment in high and medium-high manufacturing firms. This is mostly likely due to the greater commitment of these advanced sectors to industry 4.0 and digitization. It is also important to note that this study establishes a distinction between the three types of KIBS mentioned in the literature and thus sheds light on the fact that not all KIBS are equal and that some are more sensitive to local demands for innovation.

In addition, another important general observation is that, despite having overcome the toughest periods of the economic crisis, there was an overall decline in the creation of new KIBS. It is also worth noting that the creation of new KIBS was deeply affected by economic changes. Overall, the study supports the notion that although KIBS are considered strategically desirable for servitization, the observed trend reveals how budgetary factors can lead to the prioritization of other less risky projects.

Last but not least, the study does not corroborate that population density and agglomeration economies influence the creation of new KIBS and thus contradicts the broadly-held assumption (Muller & Doloreux, 2007; Shearmur & Doloreux, 2008; Sthalecker, 2014) that other hinterland areas play catch-up when KIBS are prevalent in metropolitan areas (Gallego & Maroto, 2015).

With reference to the practical implications of this study, in order to analyse what drives the creation of new KIBS and thus stimulates servitization, the mechanisms that facilitate interaction between different networks and drive a territory's economy need to be fully understood. In this attempt, it is worth to highlight among the implications for the academic field how the proposition of the presence of KIBS as an indicator of regional growth and innovation is reinforced. Likewise, it is important to consider the importance of creating different types of KIBS in the face of different determining factors of the regional environment.

A deeper understanding of how servitization is materialized in territories can contribute to designing appropriately-targeted industrial and innovation policies at subnational level. Regarding policies aimed at supporting the creation of new KIBS, it would seem advisable to develop a more holistic service sector capable of boosting the innovative capacity of companies and enhancing the demand for their products and services.

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ANNEX 1

KIBS classification by NACE 2009 codes

Type	Activity	NACE	Definition
T-KIBS	Research and Development	7211	Research and experiemntal development on biotechnology
		7219	Other research and experimental develeopment on natural sciences and egineering
		7220	Research and experiemntal development on social sciences and humanities
	Technical services	7111	Architectural activities
		7112	Engineering activities and related technical consultancy
		7120	Technical testing and analysis
C-KIBS	Computer and related services	6201	Computer programming activities
		6202	Computer consultancy activities
		6203	Computer facilities management activities
		6209	Other information technology and computer services
		6311	Data processing, hosting and related activities
		6312	Web portals
P-KIBS	Legal services and auditing	6910	Legal activities
		6920	Accounting, bookkeeping and auditing activities, tax consultancy
	Consultancy and labour recruitment	7020	Business and other management consultancy activities
	Marketing services	7311	Advertising agencies
		7312	Media representation
		7320	Market research and opinion polling

Source: Own elaboration based Böhn & Thomi (2003).

	Total			T-KIBS			C-KIBS			P-KIBS		
	Panel	OLS	Poisson (fe)[a]	Panel	OLS	Poisson (fe)[a]	Panel	OLS	Poisson (fe)[a]	Panel	OLS	Poisson (fe)[a]
emp_hmtech_manuf	0,023	-,174**	-,019**	-0,023	-0,034	-,036**	0,048	-0,006	,040**	-0,002	-,134***	-,031***
ris_score	,083***	,104***	,040***	,022*	,029***	,039***	-0,001	,016***	,016***	,062***	,059***	,048***
gdp_ln	-2,404***	-0,154	-,194***	,938**	-,155***	,756***	-,912***	0,026	-,689***	-2,430***	-0,025	-,519***
entrep	-38,759**	-70,701***	14,861***	-13,312*	-34,866***	16,529***	-9,319**	-11,054***	8,632***	-16,127*	-24,780***	15,782***
pop_dens_ln	1,279	,496***	1,027***	-1,063	0,040	0,434	0,502	,147***	1,242***	1,841	,309***	1,326***
d1	,801***	1,626***	,322***	,599***	,804***	,552***	-,149**	0,027	0,001	,351**	,794***	,328***
Constant	19,744**	-0,781		-4,899	1,727***		8,625***	-,848**		16,018***	-1,661**	

*** p<0.01, ** p<0.05, * p<0.1.

[a] the dependent variable is the number of new KIBS in the region-year.

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