Growth of KIBS and non-KIBS firms: evidences from university spin-offs

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Growth of KIBS and non-KIBS firms. Evidences from university spin-offs in Italy and Spain

Knowledge Intensive Business Services (KIBS) firms are emerging into a knowledge-processing and knowledge-producing industry. Universities contribute to the creation of KIBS firms trough university spin-offs (USOs), which represent an opportunity to boost knowledge spillovers from university to industry thanks to their cutting-edge research knowledge, consolidated research experience and well-developed interactive learning processes. The study of the growth of the KIBS USOs is needed to better understand whether these entrepreneurial ventures represent strategic elements of regional innovation systems and economic growth, distinguishing them from the others USOs in terms of growth. The paper explores whether KIBS firms grow more than non-KIBS firms. Using a sample of 1,394 Italian and Spanish USOs over the period 2005- 2013, the results show that being a KIBS firm has a positive effect on the growth of Spanish USOs, whereas the same does not hold for Italian USOs. Some relevant policies and practical implications are provided.

Keywords: University spin-off; Knowledge Intensive Business Services; firm growth; cross-country analysis; Italy-Spain.

Introduction

In the last decade, public policies aimed at creating and diffusing knowledge have attracted growing attention as a result of claims that knowledge-intensive industries are now at the core of development, and that we are entering in a new type of knowledge-driven economy or even a completely new form of 'knowledge society' (Muller & Zenker, 2001; Ritala, Hyötylä, Blomqvist, & Kosonen, 2013; Byun, Park, & Hong, 2017). In this regard, Knowledge Intensive Business Services (KIBS) firms – such as advertising and market research, accountancy and management consulting, IT services, engineering and technical services - have a critical role in producing and diffusing knowledge, which is crucial for the innovation processes (Muller & Zenker, 2001; Pina & Tether, 2016; Hu, Lin, & Chang, 2013; Ferreira, Raposo, & Fernandes, 2013). Thus,

research on service innovation and systems of innovation has shown that KIBS firms work as knowledge carriers, producers and mediators in national and regional economic systems (Toivonen, 2004; Hipp & Grupp, 2005; Ferreira, Raposo, Fernandes, & Dejardin, 2016; Miozzo, Desyllas, Lee, & Miles, 2016). The issues of to what extent KIBS firms develop and growth, and how this industry differs from others, are nowadays central in view that a great part of the labour force in the industrialized countries is active in service industries (Hertog, 2000). Indeed, KIBS firms are part of one of the most dynamic elements of the service industry in Europe, as well as in most highly developed economies (Strambach, 2001; Hertog, Gallouj, & Segers, 2011). Hence, it is obvious that a better appreciation and understanding of KIBS firms' dynamics are needed.

Conventionally, KIBS firms are private enterprises or organisations, depending greatly on specialised knowledge -namely knowledge or expertise linked to a definite (technical) bailiwick or (technical) functional domain- (Hertog, 2000, Muller & Doloreux, 2009), which "involve economic activities intended to result in the creation, accumulation or dissemination of knowledge' (Miles et al., 1995, p. 18). The type of knowledge could be heterogeneous, such as firm-level practises or 'tool-kits' -a set of methods and approaches aimed at solving specific organizational problems or setting-up strategies-, individual capability and talent, project management methods and support schemes -geared towards guiding the organization in planning, executing and control their entrepreneurial processes-, IT-based information – tools based on information technology to provide enterprises with information management and decision support-, as well as knowledge-sharing schemes (Skjølsvik et al., 2007; Alvesson, 2004).

Universities have also an active role as KIBS providers. In this regard, the universities' 'third mission' of promoting the regions' social and economic

development has made them into providers of knowledge and innovation to the society, companies, and governments (O'Shea, Allen, O'Gorman, & Roche, 2004; Etzkowitz, 2016). Thus, the prominence of technology/knowledge transfer from university to industry calls the need for strong links between scientific research and its practical application, which encourages the generation of several entrepreneurial initiatives (Allen, 1995; del-Palacio, Sole, & Batista-Foguet, 2008). In this regard, universities contribute significantly to the creation of KIBS firms trough university spin-offs (USOs), which are firms started within an university setting and exploiting technology/knowledge generated from university research (Di Gregorio & Shane, 2003; Rasmussen & Borch, 2010). USOs facilitate knowledge-driven entrepreneurship and knowledge spillovers (Fernandes, Ferreira, & Raposo, 2013). This is well remarked by the creation of successful 'high-tech' districts such as Silicon Valley and Cambridge (Kenney & von Burg, 2001; O'Mara, 2005; Mustar & Wright, 2010).

Indeed, thanks to their advanced knowledge and specialized work skills, academics have a prominent human capital and frequent access to superior know-hows and inventions, which could facilitate them the starting of new entrepreneurial projects characterized by large potential of growth and economic value (Wennberg, Wiklund, & Wright, 2011). Thus, most governments are pursuing the foundation and development of KIBS firms and consider USOs more capable for this purpose (Wright, Clarysse, Lockett, & Knockaert, 2008).

Nevertheless, the growth of the KIBS firms has been hardly studied as it reflects the scarce literature on the subject. Particularly, except the research of Fernández-López Rodríguez-Gulías, and Rodeiro-Pazos (2017), literature does not report studies explicitly focused on KIBS USOs' growth. This lack of evidence calls for additional empirical investigation on the field aimed at building a well-defined and more

theoretical framework on the subject.

The paper aims to fill this gap in the literature. Using a sample of 1,394 Italian and Spanish USOs over the period 2005- 2013, we explore whether KIBS firms grow more than non-KIBS firms. Answering this question becomes particularly relevant in countries like Italy and Spain that are included in the group of 'moderate innovators' (Hollanders & Es-Sadki, 2014). Conscious of this acute lack of leading innovator firms, Italian and Spanish governments have relied on the universities as an important source of knowledge-based entrepreneurship. Thus, Italian and Spanish universities have shown a rapid creation and development of KIBS firms. Particularly, in Spain about the 25% of USOs over the decade 2000-2010 are KIBS firms (Fernández-López et al., 2017). Also Italian universities show a wide diffusion of new USOs in the last decade (Galati, Bigliardi, Petroni, & Marolla, 2017), and a significant portion of KIBS firms take the form of spin-off (Bettiol, De Marchi, Di Maria, & Grandinetti, 2013; Muscio, Quaglione, & Ramaciotti, 2016). These policies would make sense if the firms created grew.

This study contributes to literature in several ways. First, it adds to the research aimed at developing both theoretical and empirical studies on the KIBS firms, whose understanding is still limited (Ojanen, Salmi, & Torkkeli, 2007; Castaldi, Faber, & Kishna, 2013; Pina & Tether, 2016). Secondly, cross-national studies may better highlight the differences among institutional context. Although Italy and Spain are characterized by a similar institutional context, cross-national studies extend our knowledge about the within- and between-country differences in the growth of KIBS firms, strengthening the generalizability of the emerging findings. Thirdly, by using a sample of firms over a long period of analysis (2005-2012) we contribute to a better understanding of the long-term role of KIBS firms. Finally, on the basis of the results,

we propose some policies to foster the growth of KIBS firms.

The remainder of the paper is structured as follows. Section 2 reports the theoretical framework and the hypothesis explored in this study. In Section 3 the data and methodology are described, Section 4 reports the results of the empirical analyses, while Section 5 concludes with the discussion of main findings and provides practical/policy recommendations and implications.

Literature review

During the last decades, USOs have increasingly attracted the attention from both scholars and practitioners, chiefly due to their capability to improve commercial application of scientific knowledge and technologies. In particular, several researchers supposed that these ventures were characterized by fast growth after their creation. Nevertheless, in the last years scholars recognise that the fast-growing view assumed was an oversimplification, as a great part of USOs grow slowly or tend to remain small (Galati et al., 2017). Also, in order to improve the efforts aimed at fostering university entrepreneurship, a stream of the studies on USOs growth started exploring whether these companies grow more than other comparable non-USOs (see Rodríguez-Gulías Rodeiro-Pazos, and Fernández-López (2017) for a review). However, these studies have showed mixed results, hampering a better understanding of the relative effectiveness of these two paths to knowledge-intensive firms (USOs and non-USOs).

Less explored are the differences between KIBS USOs and KIBS non-USOs. Only the study of Fernández-López et al. (2017) explicitly addresses this issue. Using a sample of 135 KIBS firms (USOs and non-USOs) from 2000-2010, the authors conclude that KIBS USOs grow more than the KIBS non-USOs. KIBS USOs may gain a superior competitive advantage thanks the early resource endowment of cutting-edge

research knowledge and human capital assets with a relevant research background, compared to KIBS non-USOs. Also, the former might take additional advantage from other accessibilities - such as well-developed relational networks, positive reputation, incubation facilities and access to key/strategic financial sources - thanks to the generally strong relations with their parent organization (Fernández-López et al., 2017).

Furthermore, to the best of our knowledge no study on USOs growth has explored the differences between KIBS USOs and non-KIBS USOs (see Figure 1 for a better clarification of both the terminology used and the focus of the analysis). This is surprising because KIBS firms are a substantial portion of USOs (Calvo, Rodeiro-Pazos, & Fernández-López, 2017), denoting shared characteristics that make them a consistent cluster. Additionally, since KIBS USOs mainly leverage on scientific and technological knowledge it is clear that the same facilitate the technology-knowledge transfer process from university to industry, creating the essential condition to success in the long run (Clarysse, Wright, & Van de Velde, 2011; Fernández-Alles, Camelo-Ordaz, & Franco-Leal, 2015; Ferreira et al., 2016).

[Figure 1 near here]

To an increasing extent, yet, it has been acknowledged that this may be a too narrow understanding of university knowledge spillover (Lockett, Siegel, Wright, & Ensley, 2005; Wennberg et al., 2011), which requires a more deep investigation. This could be interesting for practice too, since according to the European Industrial Research Management Association (EIRMA, 2007), the prominence of the knowledge transfer and interaction between firms and universities acts as a key input into the growth of regional competitive advantage. In this regard, the better understanding of the growth dynamics among KIBS and non-KIBS USOs could be a valuable base for the

support of knowledge intensive activities originated inside universities with many students and researches engaged in projects, which they later implement through new entrepreneurialism (Fernandes & Ferreira, 2013; Steffensen, Rogers, & Speakman, 2000; Feller, Ailes, & Roessner, 2002), potentially improving - in turn - the effective knowledge flow from university to industry.

Scholars remarks that the resource-based view of the firm (RBV) - emphasizing the significance of firms resources for the acquisition and preservation of competitive advantage and firm growth (Penrose, 1959; Sirmon, Hitt, & Ireland, 2007) - is a suitable theoretical framework for analysing the effectiveness of spin-out processes and the growth of academic ventures (O'Shea, Allen, Chevalier, & Roche, 2005; Powers & McDougall, 2005; Vinig & Van Rijsbergen, 2010; Rodeiro-Pazos, Fernández-López, González-Otero, & Rodríguez-Sandiás, 2012; Ortín-Ángel & Vendrell-Herrero, 2014; Visintin & Pittino, 2014). Since KIBS firms "act as knowledge intermediaries and as complementary sources of knowledge vis-à-vis other knowledge provider" (Pinto, Fernandez-Esquinas, & Uyarra, 2015, p. 1876) and they could be perceived as collection of resources and capabilities according with the RBV (Castaldi, Faber, & Kishna, 2011), it could be argued that also KIBS USOs' growth is expected to depend on the firms' resources and capabilities (see Figure 2).

In turn, since knowledge is the main resource for KIBS firms (Zaefarian, Henneberg, & Naudé, 2013; Desmarchelier, Djellal, & Gallouj, 2013) it becomes necessary to integrate the RBV with the knowledge-based view (Grant, 1996), by linking combinative capabilities to the generation of new knowledge (Martín-de Castro, López-Sáez, & Delgado-Verde, 2011; Castaldi et al., 2013; Grant, 2015). Piergiovanni, Santarelli, & Vivarelli (1997) demonstrated that small firms – such a great part of the KIBS USOs - effectively and in large extent exploit the knowledge spillovers from

universities. Further, Colombo, D'Adda, & Piva (2010) remarked that universities generating high-quality scientific knowledge have a positive impact on the growth of local high-tech ventures, but only in the case the ventures - such as KIBS USOs - have the ability to detect and use this knowledge.

Thus, Larsen (2001) suggests a complete knowledge-based view of KIBS firms, defining them as distributed knowledge systems, in which the knowledge embedded in personnel and in their social relationships builds organizational capabilities. Strambach (2008) put the emphasis on the critical role of learning capabilities in developing the knowledge dynamics of KIBS firms. Similarly, Castaldi et al. (2013), using a resource-based model and exploring the capability of KIBS firms to engage in co-innovation with client firms, remark the dominant role played by the learning capabilities.

Essentially, following the theory of knowledge (Knorr-Cetina, 1999) the knowledge resources and capabilities that differentiate KIBS USOs from non-KIBS USOs - that can partially determine their competitive advantage and growth patterns - are englobed in three categories, which can be distinguished by their epistemic content and rules linked to knowledge processes: analytical knowledge, synthetic knowledge and symbolic knowledge (Strambach, 2008).

[Figure 2 near here]

Analytical knowledge is potentially a significant base for KIBS USOs, since the same is diffused in science-based knowledge industries (Pavitt, 1984; Asheim & Gertler, 2005). In this category, knowledge formation is frequently based on rational search processes, structured models and codified science, such as patent descriptions (Asheim & Gertler, 2005). For KIBS USOs, especially for those operating in R&D service, usually means providing research contracts for large multinational

pharmaceutical corporations (Strambach, 2008). This can represents a good chance for KIBS USOs to increase their international strategic alliances and international development and drive their competitive advantage. Indeed, USOs usually show a not well-diffused international orientation, which is strictly dependent from their ability of networking and building relationships with potential foreign customers (Bjørnåli & Aspelund, 2012; Styles & Genua, 2008). Hence, KIBS USOs can positive benefit in term of growth opportunities from analytic knowledge compared to non-KIBS USOs. With regard to the synthetic knowledge - referring to the industrial background, where the innovation occurs chiefly through the application of current knowledge or through novel mix of knowledge - tacit knowledge also plays a critical role. This is because of the inductive process of knowledge formation through the innovative mix of existing knowledge built on learning by doing practices, by means of processes directed at answering the customer's specific needs (Strambach, 2008; Pina & Tether, 2016; Aslesen & Isaksen, 2007). Thus, KIBS firms not only build and acquire knowledge as a crucial firm asset, but they also sell it, acting as specialized suppliers of knowledge for innovation within client organisations (Castaldi et al., 2013). In doing so, KIBS firms are continuously adjusting themselves to the clients' needs (Muller, Zenker, & Héraud, 2009), which requires deep collaboration with clients and interactive learning (Sundbo, 2001; Kohtamäki & Partanen, 2016). In this context, KIBS USOs' founders have an advantage since they have been often involved directly and deeply in in their own learning in a collaborative environment; hence, they are more adapted to interactive learning activities. In particular, the technical capabilities and research know-how of academic entrepreneurs, jointly with their stable interaction with the university environment (Cosh & Hughes, 2010), may rise the quality and significance of the knowledge transferred in the form of service (Colombo & Piva 2005; Rothaermel &

Thursby 2005). Synthetic knowledge is common in KIBS USOs operating in technical engineering and data processing services, also known as technology-based KIBS or t-KIBS (Carmona-Lavado, Cuevas-Rodríguez, & Cabello-Medina, 2013; Rodriguez, Doloreux, & Shearmur, 2017). Therefore, in the collaborative context that characterises the KIBS firms' environment, KIBS USOs are more suitable to benefit from the interactive learning skill of their founders, compared to non-KIBS USOs.

The third knowledge 'base' of KIBS firms, symbolic knowledge, refers to expression and emotion, jointly with their effective assimilation and analysis, and it is more spontaneous and perhaps idiosyncratic compared to the analytical knowledge and synthetic knowledge (Pina & Tether, 2016; Asheim et al., 2007). The prominence of symbolic knowledge, which relates to the capability to inspire/influence the emotions of customers (Martin & Moodysson, 2011), is less rational or functional, referring in a more extent to the social construction (Jahnke, 2013; Verganti & Öberg, 2013). Even though this type of knowledge is less common in KIBS USOs - since it refers mainly to cultural and creative industries such as film making, music or advertising and design (Scott, 1997; Caves, 2002) - the cultural embeddedness of symbolic knowledge lead to a significant and robust tacit component (Mariussen & Asheim, 2003), which usually denotes the exploitation process of knowledge/technology output from the parent university (Clarysse, Wright, & Van de Velde, 2011; Karnani, 2013). Hence, for KIBS USOs symbolic knowledge could be codified in the learning and living at the university (O' Shea et al., 2005), as well as in the access to peoples with professional knowledge and talent that lead to edge innovations (Powers & McDougall, 2005; Di Gregorio & Shane; 2003). From this evidence, it could be argued that KIBS USOs can take benefit from their knowledge base - in this case symbolic knowledge - compared to non-KIBS USOs in order to run better in the competitive and growth race. Furthermore, most

KIBS firms have integrated knowledge bases that associate different knowledge types at different scales, reinforcing the value added (Strambach, 2008).

In addition to the arguments relating to the knowledge-based theory outlined above, the relations between KIBS USOs and their parent organizations may provide a more direct access to further resources. In detail, following the RBV of the firm, USOs success and growth is narrowly related to the financial, human capital, and organizational resources from university (Rodeiro-Pazos et al., 2012; Rasmussen, Mosey, & Wright, 2014). Hence, universities play the role of key intermediaries between these firms and external stakeholders (Cantner & Goethner 2011). Thus, if the RBV holds for USOs - with particularly regard to the supporting and fostering role of the university - this is particularly relevant for KIBS USOs compared to non-KIBS USOs, since the resources provided by the parent organization are consistently directed to develop their knowledge and social-relational base in order to better them to the industry, which is fundamental and critical for an effective firm development (Aguirre, Parellada, & Campos, 2006; Degroof & Roberts, 2004; Perez & Sánchez, 2003; Hayter, 2016). Indeed, universities are particular apt to promote USOs within KIBS industries. Thus, after studying the role of scientific and technologic parks in foster the innovation and creation of USOs in KIBS industry in Spain, Calvo et al. (2017) conclude that KIBS USOs benefit from substantial involvement in incubation and business accelerators activities.

Overall, in view of the above considerations, it could be argued that KIBS USOs have more opportunities to perform better in the long run, improving their growth prospects, compared to non-KIBS USOs. Thus, the following research hypothesis is advanced:

Hypothesis: *Being a KIBS firm would have a positive effect on the growth of USOs in*

Spain and Italy.

Methodology

To test the established hypothesis, the data used is an updated version on the dataset originally constructed by Corsi, Prencipe, Rodríguez-Gulías, Fernández-López, and Rodeiro-Pazos (2017). The final dataset is an unbalanced panel consisting of 1,394 USOs observed between 2005 and 2013. Out of these firms, 516 had been created by 50 Spanish universities and 878 by 57 Italian universities.

Below in the next subsections we present the variables and the methodology used.

Variables

Drawing on the RBV and the knowledge-based view of the firm, we used as dependent variable the firm sales growth. Although the seminal RBV papers of Barney (1991) and Peteraf (1993) claim that the aim of the RBV is to clarify how firms increase competitive advantage and value creation (Sirmon, Hitt, & Ireland, 2007), studies aimed at exploring the differences between firms in term of competitive advantage use sales growth (Bromiley, 2005; Venkatraman, Lee, & Iyer, 2007; Thornhill, 2006).

Additionally, on the base of the knowledge-based theory, Autio, Sapienza, & Almeida (2000) argue that great knowledge intensity, comprising technical knowledge, jointly with the effectiveness by which such knowledge is learned, are the main elements of sales growth, especially for KIBS firms. Similarly, Kaya & Patton (2011) conclude that knowledge-based resources of KIBS firms play an important role in improving growth performance, since they are inherently hard to replicate (McEvily & Chakravarthy, 2002). Applying the previous theoretical arguments, Wiklund &

Shepherd (2003), Shepherd & Wiklund (2009) and Nason & Wiklund (2015) comprised in their empirical analyses only variables of growth that were resource-related, such sales growth.

Finally, despite its limitations[1], sales growth, has been broadly used as a success measure in recent literature about USOs (Colombo & Piva, 2005; Criaco, Minola, Migliorini, & Serarols-Tarrés, 2014; Enseley & Hmieleski, 2005; George, Zahra, & Wood, 2002; Salvador, 2011; Wennberg et al., 2011; Zahra, Van de Velde, & Larraneta, 2007). Table 1 shows how the dependent variable has been constructed.

[Table 1 near here]

To test the effect on being a KIBS firm on the USOs' performance we constructed the main independent variable: KIBS. This is a time-invariant dummy that takes the value 1 if the USO is a KIBS company, and 0 otherwise. In order to determine if a USO is a KIBS firm we followed Fernandes and Ferreira (2013), who identified two types of KIBS firm (technological and professional) based on the firm NACE (REV 2) code[2].

Finally, a set of control variables were included. As we mentioned, the RBV also gives theoretical arguments in the favour of the role played by firms' resources/capabilities other than knowledge-based resources in contributing to firm growth. Indeed, previous studies highlight the role of financial resources , market-based assets and organizational resources and capabilities as key drives of growth, also in term of sales, in several and different industries (Nath, Nachiappan, & Ramanathan, 2010; Lin & Wu, 2014; Qureshi, Aziz, & Mian, 2017). Thus, as proxies of USO-specific characteristics, we employed the natural logarithms of the firm age (LN_AGE) and, also, the natural logarithms of the age squared (LN_AGESQUAR) to capture possible

non-linearities. To approximate the firm financial performance, we included the total asset turnover ratio (TOT_TUR) and the return on assets (ROA). According to the Spanish and Italian accounting legislation, R&D expenditures are included in net income. In so doing, the ROA measure captures the effect of this type of expenses in firms' profitability, which is likely to be significant for KIBS firms. Regarding shareholders, we added a time-invariant dummy that reflects the presence of venture capital partners in the company (VENT_CAP). The measure of independent variables and their expected effect on USOs growth are showed in Table 1.

Model specification

For the purpose of testing if Spanish and Italian KIBS USOs outgrow non-KIBS USOs, we used panel data methodology. Unlike cross-sectional analysis, panel data allows us to control for individual heterogeneity. This is relevant for our research since each firm has its own individual behaviour and consequently they are heterogeneous. Particularly, the decision to operate in KIBS industries is highly related to the USOs' particular specificities and, also, the effect of being a KIBS firm on its growth is related too. In order to control for this heterogeneity and to avoid biased results, we modelled it as an individual effect (α_i). Accordingly, the basic specification of our model is as follows:

$$g\_sales_{it} = \beta_1 kibs + (\beta_2 ln\_age_{it} + \beta_3 ln\_agesquar_{it}) + (\beta_4 roa_{it} + \beta_5 tot\_tur_{it}) + (\beta_6 vent\_cap_i) + \alpha_i + \lambda_t + \varepsilon_{it}$$

Where, the individual unobserved heterogeneity is collected through the individual effect (α_i), time-specific effects are incorporated by a set of dummy variables for years (λ_t), and ε_{it} is the random disturbance.

Given that the central independent variable in our analysis (KIBS) is a time-

invariant dummy variable, we used random effects[3] GLS models.

Results

Descriptive analysis

Figure 3 shows the proportion of USOs that are KIBS firms in the Spanish and Italian subsamples. Out of the 516 Spanish USOs, 109 are KIBS firms (21%). This proportion is higher in the Italian case, since there are 303 KIBS firms out of the 878 sample USOs (35%).

[Figure 3 near here]

Table 2 displays the main descriptive statistics and the differences in means (t-test) for variables used in the empirical analysis between KIBS and non-KIBS USOs. This analysis is replicated for both subsamples, Spain and Italy.

[Table 2 near here]

Regarding the dependent variable, the average annual sales growth rate is about 116% in Spanish non-KIBS and 226% in KIBS USOs, while in the Italian case it is around 157% for non-KIBS and 221% in KIBS USOs. Hence, the mean sales growth is higher in KIBS than in non-KIBS USOs in both countries. However, the t-test shows that these differences are only significant in the Spanish case (Table 2).

In order to analyse the dependent variable in more detail, Figure 4 exhibits the evolution of mean sales growth rates over the period 2006-2013 by sub-samples.

[Figure 4 near here]

In the Spanish case, the mean sales growth rates were higher in the KIBS USOs in most periods, with the exception of 2010 and 2011 when the non-KIBS outgrew

KIBS USOs. Contrary, in the Italian case KIBS USOs only presented higher growth rates in 2009, 2011 and 2013. In general, the evolution of growth rates was similar for Spanish and Italian KIBS firms, showing their highest values in 2009 and descending in the following years until 2013.

Regarding the remaining independent variables (Table 2), the results of the t-test show that the age and total asset turnover ratio are significantly higher in non-KIBS firms in both cases, Spain and Italy. Also, return on assets is significantly upper in the Italian non-KIBS USOs. Conversely, KIBS USOs have greater presence of venture capital than non-KIBS USOs.

Finally, Table 3 shows the correlation matrix by country.

[Table 3 near here]

Multivariate analysis

The results of random effects GLS models on sales growth are presented in Table 4 and Table 5 for Spain and Italy, respectively. In both cases, Model 1 included only the main independent variable (KIBS) and the year's dummies variables (λ_t). The remaining models (Model 2, 3 and 4) added extra independent variables sequentially (i.e. firm-specific characteristics, financial performance and shareholders).

We chose the random effect estimator because the main independent variable (KIBS: 1;0) and also the venture capital variable (VENT_CAP) are time-invariant variables, in this case the fixed effects estimator cannot estimate the β of these time-invariant variables.

Additionally, we ran a Breusch and Pagan Lagrangian multiplier test for random effects

(LM) in order to decide between a random effects regression and a simple OLS regression. The null hypothesis in the LM test is that variances across entities (firms in our case) are zero or, in other words, there is no significant difference across units (i.e. no panel effect). Our results rejected the null hypothesis and conclude that random effects models are appropriate in both Spanish and Italian case.

[Table 4 near here]

[Table 5 near here]

Regarding the main independent variable (KIBS), all the estimated models show a significant positive effect of being a KIBS firm on the sales growth of the Spanish USOs. Nevertheless, in the Italian case, the results are not significant. Therefore, the established hypothesis that being a KIBS firm would have a positive effect on the growth of USOs is only validated in the Spanish case.

Additionally, the results obtained also show a U-shaped relationship between age (LN_AGE and LN_AGESQUAR) and USOs' sales growth, and a positive effect of the profitability of the firm (ROA), the firms' asset efficiency (TOT_TURN) and the presence of venture capital partners (VENT_CAP), both in Spain and in Italy.

Conclusions and discussion

KIBS firms are strongly emerging into a knowledge-processing and knowledge-producing industry (Strambach, 2008). The literature also points out the prominence of KIBS firms as strategic elements of regional innovation systems (Pinto et al., 2015), playing an effective role of knowledge mediators (Aslesen & Isaksen, 2010). In this context, KIBS USOs may represent a great opportunity to boost knowledge spillovers from university to industry thanks to their cutting-edge research knowledge, entrepreneurs with a consolidated research experience and well-developed interactive

learning processes (Fernández-López et al., 2017).

This study explores whether being a KIBS firm has a positive effect on the USOs growth. The results show that being a KIBS firm positively impacts on the growth of the Spanish USOs, whereas the results are not significant in the Italian case. The findings for Spain remarks that USOs may take effective advantages in terms of long-term performance and development opportunities from offering knowledge intensive business services thanks to their ability to build advanced research knowledge, the specialized human capital developed, as well as the habit of interactive learning processes, which improve the eminence of knowledge transferred as services to clients.

Contrary to expected, for Italian USOs operating in KIBS industries does not add a beneficial effect in terms of firm growth, suggesting that KIBS USOs present growth dynamics similar to non-KIBS USOs. This evidence is even more surprising since Italy reports a higher share of KIBS USOs (35%) compared to Spain (21%). The reasons of this counterintuitive result could be several and heterogeneous. If we compare the performance of KIBS USOs in Italy and Spain, similar growth patterns are found over the period 2005-2013. The same does not hold for non-KIBS USOs that grew lesser in Spain than in Italy. Thus, the lack of significant differences in growth rates between Italian KIBS USOs and non-KIBS USOs might be related to the fact that USOs have similar growth opportunities, regardless their nature, rather than to lack of growth opportunities for KIBS USOs. On the contrary, in Spain non-KIBS USOs face more constrains than their KIBS counterparts in terms of long-term growth, giving a major support to our arguments regarding the knowledge advantages and other related ones to being a KIBS firm.

The abovementioned empirical evidence highlights some reflections about why

in Italy KIBS USOs and non-KIBS USOs perform similarly. One reason could be linked to the fact that in Spain the policy actions aimed at fostering academic entrepreneurship are more directed to USOs offering knowledge intensive business services, while in Italy there may not be enough discrimination (KIBS/non-KIBS) in the promoting actions of USOs. This could be reasonable also from another point of view; since in Spain the phenomenon of KIBS USOs is less developed than in Italy, the policy makers could be more oriented to stimulate this type of firm, focusing the majority of their efforts on them.

An alternative reason could be that in Italy non-KIBS USOs have better access to strategic resources, including knowledge-based ones, for the full firm success compared to Spanish non-KIBS USOs. Also in this case, a more deep investigation about the validity of this argument is required.

Additionally, in the estimated models the effect of venture capital is much less significant for Italian firms compared to Spanish ones. Further, in the Spanish case a significant difference emerges in term of the presence of venture capital partners between KIBS USOs and non-KIBS USOs, with a larger presence in the former. This evidence suggests a more active role of venture capital in driving firm growth in KIBS firms and where this firms growth better: Spain. Based on the RBV, venture capital may facilitate the emergence and growth of USOs because they have the essential financial resources and commercial know-how to transfer technologies effectively to the market (Wright, Birley, & Mosey, 2004; Rodríguez-Gulías, Rodeiro-Pazos, & Fernández-López, 2016). In so doing, venture capital firms have been claimed to contribute in solving the so-called equity gap for USOs (Wright et al., 2006; Rasmussen & Sørheim, 2012). Additionally, venture capital helps firms in designing their organizational and growth strategy, improving their capabilities (Ni et al., 2014; Colombo, Cumming, &

Vismara, 2016). These arguments assume a more relevant value for KIBS USOs, since venture capital chiefly rely on applying knowledge resources to select and develop their portfolio firms (Dimov & Shepherd, 2005; Yang, Narayanan, & De Carolis, 2014). Further, venture capital are effective investors to value firms in the case managers have relevant tacit knowledge (Wright, Hoskisson & Busenitz, 2001), such as a large portion of KIBS USOs. Manigart et al. (2002) remark that, in line with the RBV, venture capital with professional expertise can both add value and being effective to control risks related to the monitoring issues of the firm.

In view of these evidences, a more deep understanding of the role of venture capital in the growth dynamics between KIBS USOs and non-KIBS USOs is required. Further studies could address this issue by explicitly exploring the moderating effect of venture capital in the relation among being a KIBS firm and firm growth.

In general and from a theoretical point of view, the results add some new insights to RBV theory of the firm, and in particular to the knowledge-based view of the firm, highlighting as the knowledge resources flow and their combination that potentially characterized KIBS USOs is central in partially determining a superior growth process of the firms compared to non-KIBS USOs. But, being involved in knowledge-based activities is not *per se* sufficient to reach higher performance, which is potentially contextual dependent, with endogenous and exogenous factors that can have a more active role. This evidence could open the way for developing a richer theory of the KIBS firms' growth, one that explicitly addresses both the role of knowledge resources and determining factors acting at firm, local and regional level.

The paper provides some important policy and practical implications. In detail, the good growth performance achieved by KIBS USOs suggests the opportunity and the validity of policy actions aimed at fostering the creation and development of KIBS

firms, revealing that academic entrepreneurship may be effective and promising in this regard. Jointly, since in various countries a great amount of programs and financial resources are targeted to promote university-based entrepreneurship (Wright et al., 2008), the same makes sense if this type of entrepreneurship embodies a successful approach of creating knowledge-intensive companies with high growth prospective.

The study is not free of limitations, which can be addressed in further research. First, the lack of availability of individual information about characteristics of academic entrepreneurs and entrepreneurial team of USOs did not allow a more in-depth investigation over the growth dynamics of KIBS USOs and non-KIBS USOs. Second, external factors related to university and local/national institutional context may have a significant role in explaining performance and growth differences among KIBS USOs and non-KIBS USOs. Since our study lack of these analyses and in view of the emerging differences in results obtained comparing Italy and Spain, future studies are call to better explore the external factors influencing the success determinants of KIBS USOs and non-KIBS USOs. In particular, as also highlighted in our considerations above, it could be interesting study whether policy support schemes to academic entrepreneurship differently affect the growth of KIBS USOs and non-KIBS USOs.

Notes

[1] Thus sales growth does not always capture firm success; such is the case of technological companies that spend long time looking for investors and developing technologies with low or any sales.

[2] Technological KIBS firms are those with NACE code equal to: 721, 722, 723, 724, 725, 729, 731,732, 742 and 743; while professional KIBS firms are those with NACE code equal to: 741, 744, 745 and 748.

[3] The estimator assumes that the individual effects (α_i) are independent (uncorrelated) from the explanatory variables (x_{it}).

References

Aguirre, I. D. P., Parellada, F. S., & Campos, H. M. (2006). University spin-off programmes: How can they support the NTBF creation?. *International Entrepreneurship and Management Journal*, 2(2), 157-172. doi: 10.1007/s11365-006-8682-2.

Allen, T. (1995). *Managing the Flow of Technology Transfer and the Dissemination of Technological Information within the R&D Organization*, *2nd ed*. Cambridge, MA: MIT Press.

Alvesson, M. (2004*). Knowledge Work and Knowledge-Intensive Firms.* Oxford: Oxford University Press.

Asheim, B. T., & Gertler, M. S. (2005). The geography of innovation: regional innovation systems. In J. Fagerberg & D. C. Mowery (Eds), *The Oxford handbook of innovation* (291-317.). Oxford: Oxford University press.

Asheim, B., Coenen, L., Moodysson, J., & Vang, J. (2007). Constructing knowledge-based regional advantage: implications for regional innovation policy. *International Journal of Entrepreneurship and Innovation Management*, 7(2-5), 140-155. doi: 10.1504/IJEIM.2007.012879.

Aslesen, H. W., & Isaksen, A. (2007). New perspectives on knowledge-intensive services and innovation. *Geografiska Annaler: Series B, Human Geography*, 89(s1), 45-58. doi: 10.1111/j.1468-0467.2007.00259.x.

Aslesen, H., & Isaksen, A. (2010). Knowledge-intensive business services as knowledge mediators in different regional contexts: the case of Norway. In D. Doloreux

& M. Freel (Eds.), *Knowledge-Intensive Business Services. Geography and Innovation* (99-121). Farnham: Ashgate Publishing.

Autio, E., Sapienza, H. J., & Almeida, J. G. (2000). Effects of age at entry, knowledge intensity, and imitability on international growth. *Academy of Management Journal*, 43(5), 909-924. doi: 10.2307/1556419.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120. doi: 10.1177/014920639101700108.

Barney, J. B. (1995). Looking inside for competitive advantage. *The Academy of Management Executive*, 9(4), 49-61. doi: 10.5465/AME.1995.9512032192.

Bettiol, M., De Marchi, V., Di Maria, E., & Grandinetti, R. (2013). Determinants of market extension in knowledge-intensive business services: evidence from a regional innovation system. *European planning studies*, 21(4), 498-515. doi: 10.1080/09654313.2012.722930.

Bjørnåli, E. S., & Aspelund, A. (2012). The role of the entrepreneurial team and the board of directors in the internationalization of academic spin-offs. *Journal of International Entrepreneurship*, 10(4), 350–377. doi: 10.1007/s10843-012-0094-5.

Bromiley, P. (2005). *Behavioral foundations of strategic management*. Oxford: Blackwell.

Bromiley, P., & Rau, D. (2014). Towards a practice-based view of strategy. *Strategic Management Journal*, 35(8), 1249-1256. doi: 10.1002/smj.2238.

Byun, J., Park, H. W., & Hong, J. P. (2017). An international comparison of competitiveness in knowledge services. *Technological Forecasting and Social Change*, 114, 203-213. doi: 0.1016/j.techfore.2016.08.014.

Calvo, N., Rodeiro-Pazos, D., & Fernández-López, S. (2017). Science and technology parks as accelerators of knowledge-intensive business services. A case

study. *International Journal of Business and Globalisation*, 18(1), 42-57. doi: 10.1504/IJBG.2017.081025.

Cantner, U., & Goethner, M. (2011, April). *Performance differences between academic spin-offs and non-academic start-ups: A comparative analysis using a non-parametric matching approach*. Paper presented at the DIME Final Conference, Maastricht (Vol. 6, p. 8).

Carmona-Lavado, A., Cuevas-Rodríguez, G., & Cabello-Medina, C. (2013). Service innovativeness and innovation success in technology-based knowledge-intensive business services: an intellectual capital approach. *Industry and Innovation*, 20(2), 133-156. doi: 10.1080/13662716.2013.771482.

Castaldi, C., Faber, J., & Kishna, M. (2011). *Co–innovation by KIBS in environmental services: a resource–based view* (Working Paper No. 10.05). Retrieved from: http://cms.tm.tue.nl/Ecis/Files/papers/wp2010/wp1005.pdf.

Castaldi, C., Faber, J., & Kishna, M. J. (2013). Co-innovation by KIBS in environmental services—A knowledge-based perspective. International Journal of Innovation Management, 17(5), 1-17. doi: 10.1142/S1363919613500205.

Caves, R.E. (2002) *Creative Industries: Contracts Between Art and Commerce*. Cambridge, MA: Harvard University Press.

Clarysse, B., Wright, M., & Van de Velde, E. (2011). Entrepreneurial origin, technological knowledge, and the growth of spin-off companies. *Journal of Management Studies*, 48(6), 1420-1442. doi: 10.1111/j.1467-6486.2010.00991.x.

Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7), 1164-1176. doi: 10.1016/j.respol.2014.04.014.

Colombo, M. G., & Piva, E. (2005). *Are academic start-ups different? A matched pair analysis* (IRIS working paper). Retrieved from: https://www.fep.up.pt/conferences/earie2005/cd_rom/session%20iii/iii.l/piva.pdf.

Colombo, M. G., Cumming, D. J., & Vismara, S. (2016). Governmental venture capital for innovative young firms. *The Journal of Technology Transfer*, 41(1), 10-24. doi: 10.1007/s10961-014-9380-9.

Colombo, M. G., D'Adda, D., & Piva, E. (2010). The contribution of university research to the growth of academic start-ups: an empirical analysis. *The Journal of Technology Transfer*, 35(1), 113-140. doi: 10.1007/s10961-009-9111-9.

Corsi, C., Prencipe, A., Rodríguez-Gulías, M. J., Fernández-López S. & Rodeiro-Pazos, D. (2017). The effect of parent university on firm growth: an analysis of the Spanish and Italian USOs. *Journal of Management Development*, 36(2), 233-249. doi: 10.1108/JMD-06-2016-0108.

Cosh, A., & Hughes, A. (2010). Never mind the quality feel the width: University–industry links and government financial support for innovation in small high-technology businesses in the UK and the USA. *The Journal of Technology Transfer*, 35(1), 66-91. doi: 10.1007/s10961-009-9110-x.

Criaco, G., Minola, T., Migliorini, P., & Serarols-Tarrés, C. (2014). "To have and have not": founders' human capital and university start-up survival. *The Journal of Technology Transfer*, 39(4), 567-593. doi: 10.1007/s10961-013-9312-0.

Degroof, J. J., & Roberts, E. B. (2004). Overcoming weak entrepreneurial infrastructures for academic spin-off ventures. *The Journal of Technology Transfer*, 29(3), 327-352. doi: 10.1023/B:JOTT.0000034126.23592.23.

del-Palacio, I., Sole, F., & Batista-Foguet, J. M. (2008). University entrepreneurship centres as service businesses. *The Service Industries Journal*, 28(7), 939-951. doi: 10.1080/02642060701846812.

Desmarchelier, B., Djellal, F., & Gallouj, F. (2013). Knowledge intensive business services and long term growth. *Structural Change and Economic Dynamics*, 25, 188-205. doi: 10.1016/j.strueco.2012.07.003.

Di Gregorio, D., & Shane, S. (2003). Why do some universities generate more start-ups than others?. *Research policy*, 32(2), 209-227. doi: 10.1016/S0048-7333(02)00097-5.

Dimov, D. P., & Shepherd, D. A. (2005). Human capital theory and venture capital firms: exploring "home runs" and "strike outs". *Journal of Business Venturing*, 20(1), 1-21. doi: 10.1016/j.jbusvent.2003.12.007.

EIRMA (2007). *The European Industrial Research Management Association, European Commission.* Brussels: DG Research.

Ensley, M. D., & Hmieleski, K. M. (2005). A comparative study of new venture top management team composition, dynamics and performance between university-based and independent start-ups. *Research policy*, 34(7), 1091-1105. doi: 10.1016/j.respol.2005.05.008.

Etzkowitz, H. (2016). Innovation Lodestar: The entrepreneurial university in a stellar knowledge firmament. *Technological Forecasting and Social Change*. Advance online publication. doi: 10.1016/j.techfore.2016.04.026.

Feller, I., Ailes, C. P., & Roessner, J. D. (2002). Impacts of research universities on technological innovation in industry: evidence from engineering research centers. *Research policy*, 31(3), 457-474. doi: 10.1016/S0048-7333(01)00119-6.

Fernandes, C. & Ferreira, J. (2013). Knowledge spillovers: Cooperation between university and KIBS. R*&D Management*, 43(5), 461-472. doi: 10.1111/radm.12024.

Fernandes, C. I., Ferreira, J. J., & Raposo, M. L. (2013). Drivers to firm innovation and their effects on performance: an international comparison. *International Entrepreneurship and Management Journal*, 9(4), 557-580. doi: 10.1007/s11365-013-0263-6.

Fernández-Alles, M., Camelo-Ordaz, C., & Franco-Leal, N. (2015). Key resources and actors for the evolution of academic spin-offs. *Journal of Technology Transfer,* 40(6), 976. doi: 10.1007/s10961-014-9387-2.

Fernández-López, S., Rodríguez-Gulías, M. J. & Rodeiro-Pazos, D. (2017). The performance of the academic KIBS firms in a 'moderate innovator' country: a longitudinal analysis. In J. J. Ferreira, V. Ratten, & L. P. Dana (Eds.), *Knowledge spillover-based strategic entrepreneurship* (pp. 130-147). New York, NY: Routledge, Taylor and Francis Group.

Ferreira, J. J., Raposo, M. L., & Fernandes, C. I. (2013). Does innovativeness of knowledge-intensive business services differ from other industries?. *The Service Industries Journal*, 33(7-8), 734-748. doi: 10.1080/02642069.2013.740462.

Ferreira, J. J., Raposo, M. L., Fernandes, C. I., & Dejardin, M. (Eds.) (2016). Knowledge Intensive business services and regional competitiveness. New York, NY: Routledge, Taylor and Francis Group.

Galati, F., Bigliardi, B., Petroni, A., & Marolla, G. (2017). Which factors are perceived as obstacles for the growth of Italian academic spin-offs?. *Technology Analysis & Strategic Management*, 29(1), 84-104. doi: 10.1080/09537325.2016.1199853.

George, G., Zahra, S. A., & Wood, D. R. (2002). The effects of business–university alliances on innovative output and financial performance: a study of publicly traded biotechnology companies. *Journal of Business Venturing*, 17(6), 577-609. doi: 10.1016/S0883-9026(01)00069-6.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109-122. doi: 10.1002/smj.4250171110.

Grant, R. M. (2015). Knowledge Based View. In *Wiley Encyclopedia of Management* (Vol. 12, pp. 1–2). New York, NY: John Wiley & Sons.

Hayter, C. S. (2016). A trajectory of early-stage spinoff success: the role of knowledge intermediaries within an entrepreneurial university ecosystem. *Small Business Economics*, 47(3), 633–656. doi: 10.1007/s11187-016-9756-3.

Hertog, P. D. (2000). Knowledge-intensive business services as co-producers of innovation. *International Journal of Innovation Management*, 4(04), 491-528. doi: 10.1142/S136391960000024X.

Hertog, P. D., Gallouj, F., & Segers, J. (2011). Measuring innovation in a 'low-tech'service industry: the case of the Dutch hospitality industry. *The Service Industries Journal*, 31(9), 1429-1449. doi: 10.1080/02642060903576084.

Hipp, C., & Grupp, H. (2005). Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies. *Research policy*, 34(4), 517-535. doi: 10.1016/j.respol.2005.03.002.

Hollanders, H., & Es-Sadki, N. (2014). Innovation union scoreboard 2014. *Enterprise and Industry, European Union*. European Unión, Belgium.

Hu, T. S., Lin, C. Y., & Chang, S. L. (2013). Knowledge intensive business services and client innovation. *The Service Industries Journal*, 33(15-16), 1435-1455. doi: 10.1080/02642069.2011.634903.

Jahnke, M. (2013) *Meaning in the Making: Introducing a hermeneutic perspective on the contribution of design practice to innovation* (Unpublished doctoral dissertation). HDK - School of Design and Crafts, University of Gothenburg.

Karnani, F. (2013). The university's unknown knowledge: tacit knowledge, technology transfer and university spin-offs findings from an empirical study based on the theory of knowledge. *The Journal of Technology Transfer*, 38(3), 235–250. doi: 10.1007/s10961-012-9251-1.

Kaya, N., & Patton, J. (2011). The effects of knowledge-based resources, market orientation and learning orientation on innovation performance: An empirical study of Turkish firms. *Journal of international development*, 23(2), 204-219. doi: 10.1002/jid.1662.

Kenney, M., & Von Burg, U. (2001). Paths and regions: the creation and growth of Silicon Valley. In R. Garud, & P. Karnoe (Eds.), *Path dependence and creation* (pp-127-148). Hove: Psychology Press.

Knorr-Cetina, K. (1999). *Epistemic Cultures: How the Sciences Make Knowledge*. Cambridge, MA: Harvard University Press.

Kohtamäki, M., & Partanen, J. (2016). Co-creating value from knowledge-intensive business services in manufacturing firms: The moderating role of relationship learning in supplier–customer interactions. *Journal of Business Research*, 69(7), 2498-2506. doi: 10.1016/j.jbusres.2016.02.019.

Larsen, J. N. (2001). Knowledge, human resources and social practice: the knowledge-intensive business service firm as a distributed knowledge system. *Service Industries Journal*, 21(1), 81-102. doi: 10.1080/714004998.

Lin, Y., & Wu, L. Y. (2014). Exploring the role of dynamic capabilities in firm performance under the resource-based view framework. *Journal of business research*, 67(3), 407-413. doi: 10.1016/j.jbusres.2012.12.019.

Lockett, A., Siegel, D., Wright, M., & Ensley, M. D. (2005). The creation of spin-off firms at public research institutions: Managerial and policy implications. *Research Policy*, 34(7), 981-993. doi: 10.1016/j.respol.2005.05.010.

Manigart, S., De Waele, K., Wright, M., Robbie, K., Desbrières, P., Sapienza, H. J., & Beekman, A. (2002). Determinants of required return in venture capital investments: a five-country study. *Journal of Business Venturing*, 17(4), 291-312. doi: 10.1016/S0883-9026(00)00067-7.

Mariussen, Å., & Asheim, B. (2003). Innovation systems, institutions, and space, in B. Asheim, & Å. Mariussen (Eds.), *Innovations, Regions and Projects: Studies in New Forms of Knowledge Governance* (pp.13–40). Stockholm: Nordregio.

Martin, R., & Moodysson, J. (2011). Innovation in symbolic industries: The geography and organization of knowledge sourcing. *European Planning Studies*, 19(7), 1183-1203. doi: 10.1080/09654313.2011.573131.

Martín-de Castro, G., López-Sáez, P., & Delgado-Verde, M. (2011). Towards a knowledge-based view of firm innovation. Theory and empirical research. *Journal of Knowledge Management*, 15(6), 871-874. doi: 10.1108/13673271111179253.

McEvily, S. K., & Chakravarthy, B. (2002). The persistence of knowledge-based advantage: an empirical test for product performance and technological knowledge. *Strategic Management Journal*, 23(4), 285-305. doi: 10.1002/smj.223.

Miles, I., Kastrinos, N., Bilderbeek, R., Den Hertog, P., Flanagan, K., Huntink, W., & Bouman, M. (1995). *Knowledge-intensive business services: users, carriers and*

sources of innovation (Report No. 15). European Innovation Monitoring System (EIMS) Reports. Luxembourg: Innovation Programme, DGXIII.

Miozzo, M., Desyllas, P., Lee, H. F., & Miles, I. (2016). Innovation collaboration and appropriability by knowledge-intensive business services firms. *Research Policy*, 45(7), 1337-1351. doi: 10.1016/j.respol.2016.03.018.

Muller, E., & Doloreux, D. (2009). What we should know about knowledge-intensive business services. *Technology in society*, 31(1), 64-72. doi: 10.1016/j.techsoc.2008.10.001.

Muller, E., & Zenker, A. (2001). Business services as actors of knowledge transformation: the role of KIBS in regional and national innovation systems. *Research policy*, 30(9), 1501-1516. doi: 10.1016/S0048-7333(01)00164-0.

Muller, E., Zenker, A., Héraud, A. (2009): *Entering the KIBS's black box: There must be an angel! (Or is there something like a knowledge angel?)*. (Working Papers Firms and Region No. R7/2009). Karlsruhe: Fraunhofer ISI.

Muscio, A., Quaglione, D., & Ramaciotti, L. (2016). The effects of university rules on spinoff creation: The case of academia in Italy. *Research Policy*, 45(7), 1386-1396. doi: 10.1016/j.respol.2016.04.011.

Mustar, P., & Wright, M. (2010). Convergence or path dependency in policies to foster the creation of university spin-off firms? A comparison of France and the United Kingdom. *The Journal of Technology Transfer*, 35(1), 42-65. doi: 10.1007/s10961-009-9113-7.

Nason, R. S., & Wiklund, J. (2015). An assessment of resource-based theorizing on firm growth and suggestions for the future. *Journal of Management*. doi: 10.1177/0149206315610635.

Nath, P., Nachiappan, S., & Ramanathan, R. (2010). The impact of marketing capability, operations capability and diversification strategy on performance: A resource-based view. *Industrial Marketing Management*, 39(2), 317-329. doi: 10.1016/j.indmarman.2008.09.001.

Newbert, S. L. (2008). Value, rareness, competitive advantage, and performance: a conceptual-level empirical investigation of the resource-based view of the firm. *Strategic Management Journal*, 29(7), 745-768. doi: 10.1002/smj.686.

Ni, H., Luan, T., Cao, Y., & Finlay, D. C. (2014). Can venture capital trigger innovation? New evidence from China. *International Journal of Technology Management*, 65(1-4), 189-214. doi: 10.1504/IJTM.2014.060957.

Ojanen, V., Salmi, P., & Torkkeli, M. (2007, January). *Innovation patterns in kibs organizations: A case study of finnish technical engineering industry*. Paper presented at the System Sciences, 2007. HICSS 2007. 40th Annual Hawaii International Conference on Systems Science, Waikoloa, Big Island, HI, USA.

O'Mara, M. P. (2005). *Cities of knowledge: Cold war science and the search for the next Silicon Valley*. Princeton, NJ: Princeton University Press.

Ortín-Ángel, P., & Vendrell-Herrero, F. (2014). University spin-offs vs. other NTBFs: Total factor productivity differences at outset and evolution. *Technovation*, 34(2), 101-112. doi: 10.1016/j.technovation.2013.09.006.

O'shea, R. P., Allen, T. J., Chevalier, A., & Roche, F. (2005). Entrepreneurial orientation, technology transfer and spinoff performance of US universities. *Research policy*, 34(7), 994-1009. doi: 10.1016/j.respol.2005.05.011.

O'Shea, R., Allen, T. J., O'Gorman, C., & Roche, F. (2004). Universities and technology transfer: A review of academic entrepreneurship literature. *Irish Journal of Management*, 25(2), 11.

Pavitt, K. (1984). Sectoral patterns of technical change: towards a taxonomy and a theory. *Research policy*, 13(6), 343-373. doi: 10.1016/0048-7333(84)90018-0.

Penrose, E. T. (1959). *The theory of the growth of the firm*. Oxford: Basil Blackwell.

Perez, M. P., & Sánchez, A. M. (2003). The development of university spin-offs: early dynamics of technology transfer and networking. *Technovation*, 23(10), 823-831. doi: 10.1016/S0166-4972(02)00034-2.

Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 179-191. doi: 10.1002/smj.4250140303.

Piergiovanni, R., Santarelli, E., & Vivarelli, M. (1997). From which source do small firms derive their innovative inputs? Some evidence from Italian industry. *Review of Industrial Organization*, 12(2), 243-258. doi: 10.1023/A:1007781501147.

Pina, K., & Tether, B. S. (2016). Towards understanding variety in knowledge intensive business services by distinguishing their knowledge bases. *Research Policy*, 45(2), 401-413. doi: 10.1016/j.respol.2015.10.005.

Pinto, H., Fernandez-Esquinas, M., & Uyarra, E. (2015). Universities and knowledge-intensive business services (KIBS) as sources of knowledge for innovative firms in peripheral regions. *Regional Studies*, 49(11), 1873-1891. doi: 10.1080/00343404.2013.857396.

Powers, J. B., & McDougall, P. P. (2005). University start-up formation and technology licensing with firms that go public: a resource-based view of academic entrepreneurship. *Journal of business venturing*, 20(3), 291-311. doi: 10.1016/j.jbusvent.2003.12.008.

Qureshi, M. S., Aziz, N., & Mian, S. A. (2017). How marketing capabilities shape entrepreneurial firm's performance? Evidence from new technology based firms in turkey. *Journal of Global Entrepreneurship Research*, 7(1), 1-15. doi: 10.1186/s40497-017-0071-5.

Rasmussen, E., & Borch, O. J. (2010). University capabilities in facilitating entrepreneurship: A longitudinal study of spin-off ventures at mid-range universities. *Research Policy*, 39(5), 602-612. doi: 10.1016/j.respol.2010.02.002.

Rasmussen, E., & Sørheim, R. (2012). Obtaining early-stage financing for technology entrepreneurship: reassessing the demand-side perspective. Venture Capital, 14(2-3), 77-89. doi: 10.1080/13691066.2012.667908.

Rasmussen, E., Mosey, S., & Wright, M. (2014). The influence of university departments on the evolution of entrepreneurial competencies in spin-off ventures. *Research Policy*, 43(1), 92-106. doi: 10.1016/j.respol.2013.06.007.

Ritala, P., Hyötylä, M., Blomqvist, K., & Kosonen, M. (2013). Key capabilities in knowledge-intensive service business. *The Service Industries Journal*, 33(5), 486-500. doi: 10.1080/02642069.2011.623774.

Rodeiro-Pazos, D., Fernández-López, S., González-Otero, L., & Rodríguez-Sandiás, A. (2012). A resource-based view of university spin-off activity: New evidence from the Spanish case. *Revista Europea de Dirección y Economía de la Empresa*, 21(3), 255-265. doi: 10.1016/j.redee.2012.05.006.

Rodriguez, M., Doloreux, D., & Shearmur, R. (2017). Variety in external knowledge sourcing and innovation novelty: Evidence from the KIBS sector in Spain. *Technovation*. Advance online publication. doi: 10.1016/j.technovation.2017.06.003.

Rodríguez-Gulías, M. J., Rodeiro-Pazos, D., & Fernández-López, S. (2016). Impact of venture capital on the growth of university spin-offs. In M. Peris-Ortiz, J.J.

Ferreira, L Farinha, N.O. Fernandes (Eds.), *Multiple Helix Ecosystems for Sustainable Competitiveness* (pp. 169-183). Cham: Springer International Publishing.

Rodríguez-Gulías, M.J., Rodeiro-Pazos, D. & Fernández-López, S. (2017). The growth of university spin-offs: a dynamic panel data approach. *Technology Analysis & Strategic Management*. Advance online publication. doi:10.1080/09537325.2016.1277580.

Rothaermel, F. T., & Thursby, M. (2005). University–incubator firm knowledge flows: assessing their impact on incubator firm performance. *Research Policy*, 34(3), 305-320. doi: 10.1016/j.respol.2004.11.006.

Salvador, E. (2011). How effective are research spin-off firms in Italy?. *Revue d'économie industrielle*, 133, 99-122. Retrieved from https://rei.revues.org/4972.

Scott, P. (1997). The changing role of the university in the production of new knowledge. *Tertiary education and management*, 3(1), 5-14. doi: 10.1007/BF02679363.

Shepherd, D., & Wiklund, J. (2009). Are we comparing apples with apples or apples with oranges? Appropriateness of knowledge accumulation across growth studies. *Entrepreneurship Theory and Practice*, 33(1), 105-123. doi: 10.1111/j.1540-6520.2008.00282.x.

Sirmon, D. G., Hitt, M. A., & Ireland, R. D. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of management review*, 32(1), 273-292. doi: 10.5465/AMR.2007.23466005.

Skjølsvik, T., Løwendahl, B. R., Kvålshaugen, R., & Fosstenløkken, S. M. (2007). Choosing to learn and learning to choose: Strategies for client co-production and knowledge development. *California Management Review*, 49(3), 110-128. doi: 10.2307/41166397.

Steffensen, M., Rogers, E. M., & Speakman, K. (2000). Spin-offs from research centers at a research university. *Journal of business venturing*, 15(1), 93-111. doi: 10.1016/S0883-9026(98)00006-8.

Strambach, S. (2001). *Innovation processes and the role of knowledge-intensive business services (KIBS). Innovation networks. Concepts and challenges in the European perspective*. Heidelberg: Physica-Verlag.

Strambach, S. (2008). Knowledge-Intensive Business Services (KIBS) as drivers of multilevel knowledge dynamics. *International journal of services technology and management*, 10(2-4), 152-174. doi: 10.1504/IJSTM.2008.022117.

Styles, C., & Genua, T. (2008). The rapid internationalization of high technology firms created through the commercialization of academic research. *Journal of World Business*, 43(2), 146-157. doi: 10.1016/j.jwb.2007.11.011.

Sundbo, J. (2001). *The strategic management of innovation: A Sociological and Economic Theory*. Cheltenham: Edward Elgar Publishing Ltd.

Thornhill, S. (2006). Knowledge, innovation and firm performance in high-and low-technology regimes. *Journal of business venturing*, 21(5), 687-703. doi: 10.1016/j.jbusvent.2005.06.001.

Toivonen, M. (2004). *Expertise as business: Long-term development and future prospects of knowledge-intensive business services (KIBS*) (Doctoral dissertation series 2004/2) Helsinki University of Technology, Laboratory of Industrial Management.

Venkatraman, N., Lee, C.H., & Iyer, B. (2007). *Strategic ambidexterity and sales growth: tA longitudinal test in the software sector*. (Working paper). Boston University.

Verganti, R., & Öberg, Å. (2013). Interpreting and envisioning—A hermeneutic framework to look at radical innovation of meanings. *Industrial Marketing Management*, 42(1), 86-95. doi: 10.1016/j.indmarman.2012.11.012.

Vinig, G. T., & Van Rijsbergen, P. J. (2010). Determinants of university technology transfer—a comparative study of US, European and Australian Universities. In A. Malach-Pines (Ed.), *Handbook of research on high technology entrepreneurship* (pp. 179-209). Cheltenham: Edward Elgar Publishing Ltd.

Visintin, F., & Pittino, D. (2014). Founding team composition and early performance of university—Based spin-off companies. *Technovation*, 34(1), 31-43. doi: 10.1016/j.technovation.2013.09.004.

Wennberg, K., Wiklund, J., & Wright, M. (2011). The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs. *Research Policy*, 40(8), 1128-1143. doi: 10.1016/j.respol.2011.05.014.

Wiklund, J., & Shepherd, D. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal*, 24(13), 1307-1314. doi: 10.1002/smj.360.

Wright, M., Birley, S., & Mosey, S. (2004). Entrepreneurship and university technology transfer. *The Journal of Technology Transfer*, 29(3), 235-246. doi: 10.1023/B:JOTT.0000034121.02507.f3.

Wright, M., Clarysse, B., Lockett, A., & Knockaert, M. (2008). Mid-range universities' linkages with industry: Knowledge types and the role of intermediaries. *Research policy*, 37(8), 1205-1223. doi: 10.1016/j.respol.2008.04.021.

Wright, M., Hoskisson, R. E., & Busenitz, L. W. (2001). Firm rebirth: Buyouts as facilitators of strategic growth and entrepreneurship. *The Academy of Management Executive*, 15(1), 111-125. doi: 10.5465/AME.2001.4251486.

Wright, M., Lockett, A., Clarysse, B., & Binks, M. (2006). University spin-out companies and venture capital. *Research policy*, 35(4), 481-501. doi: 10.1016/j.respol.2006.01.005.

Yang, Y., Narayanan, V. K., & De Carolis, D. M. (2014). The relationship between portfolio diversification and firm value: The evidence from corporate venture capital activity. *Strategic Management Journal*, 35(13), 1993-2011. doi: 10.1002/smj.2190.

Zaefarian, G., Henneberg, S. C., & Naudé, P. (2013). Assessing the strategic fit between business strategies and business relationships in knowledge-intensive business services. *Industrial Marketing Management*, 42(2), 260-272. doi: 10.1016/j.indmarman.2012.08.008.

Zahra, S. A., Van de Velde, E., & Larraneta, B. (2007). Knowledge conversion capability and the performance of corporate and university spin-offs. *Industrial and Corporate Change*, 16(4), 569-608. doi.org/10.1093/icc/dtm018.

Table 1. Definitions of variables and predictions.

	VARIABLE		MEASURES	PRED.
DEPENDENT	Sales growth	g_sales	Natural logarithm of the difference in the sales of the firm: ln ($sales_{i,t}$ /$sales_{i,t-1}$)	
INDEPENDENT	KIBS	kibs	1 if the USO is a KIBS firm	(+)
	Age	ln_age	Natural logarithm of the firm age	(-)
		ln_agesquar	Natural logarithm of the firm age squared	(+)
	Return on assets	roa	Net income divided by total assets	(+)
	Total asset turnover	tot_tur	Sales divided by total assets	(+)
	Venture capital	vent_cap	1 if the USO had venture capital funding	(+)

Table 2. Differences in means between KIBS and non-KIBS USOs by country.

		Non-KIBS USOs					KIBS USOs					*t*-test	
	Variable	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max	t	P>0
SPAIN	g_sales[1]	1,820	1.159	7.858	-0.997	189.287	434	2.263	15.181	-0.999	270.013	-2.129	0.033**
	age[1]	2,445	6.402	3.342	1.000	16.000	653	5.657	3.122	1.000	16.000	5.133	0.000***
	roa	2,422	-0.072	0.565	-12.609	1.995	644	-0.120	1.001	-19.159	0.725	1.609	0.108
	tot_turnover	2,295	1.052	1.208	0.000	14.751	551	0.813	4.089	0.000	94.132	2.406	0.016**
	vent_cap	2,445	0.146	0.354	0.000	1.000	653	0.247	0.431	0.000	1.000	-6.122	0.000***
ITALY	g_sales[1]	2,103	1.569	11.591	-1.148	308.286	867	2.207	21.526	-1.000	564.909	-1.042	0.298
	age[1]	3,296	4.908	3.209	1.000	16.000	1625	4.508	2.926	1.000	16.000	4.239	0.000***
	roa	2,894	-0.009	0.441	-13.300	7.020	1425	-0.038	0.386	-7.300	0.800	2.127	0.034**
	tot_turnover	2,882	0.851	0.702	0.000	4.310	1419	0.648	0.702	0.000	4.440	8.935	0.000***
	vent_cap	3,296	0.029	0.167	0.000	1.000	1625	0.033	0.179	0.000	1.000	-0.849	0.396

Note: [1]Variables are not in logs. *p < 0.1; **p < 0.05; ***p < 0.01. The table also shows the differences in means for the variables between non-KIBS and KIBS USOs. The *t* statistic is used to test the equality of means.

Table 3.. Correlation matrix by country.

		g_sales	ln_age	ln_agesquar	roa	tot_turnover
SPAIN	g_sales	1				
	ln_age	-0.2598*	1			
	ln_agesquar	-0.2367*	0.9600*	1		
	roa	0.1457*	0.0915*	0.0742*	1	
	tot_turnover	0.0795*	-0.0371*	-0.0215	-0.4890*	1
		g_sales	ln_age	ln_agesquar	roa	tot_turnover
ITALY	g_sales	1				
	ln_age	-0.2511*	1			
	ln_agesquar	-0.2232*	0.9515*	1		
	roa	0.1636*	-0.0037	-0.0021	1	
	tot_turnover	0.1869*	0.1589*	0.1196*	0.1832*	1

Notes: Table shows the Pearson correlation coefficients for the continuous variables considered in the empirical analysis. *p< 0.05; **p<0.01; ***p<0.001

Table 4. Panel regressions on sales growth (random effects GLS): Spain.

	Model 1	**Model 2**	**Model 3**	**Model 4**
kibs	0.127*	0.090+	0.125*	0.107*
	(0.054)	(0.052)	(0.054)	(0.054)
yr2006c	0.503***	0.249**	0.177*	0.152+
	(0.089)	(0.090)	(0.089)	(0.089)
yr2007c	0.467***	0.239**	0.164*	0.137+
	(0.086)	(0.085)	(0.083)	(0.083)
yr2008c	0.440***	0.247***	0.181*	0.155*
	(0.075)	(0.075)	(0.074)	(0.074)
yr2009c	0.152+	-0.022	-0.055	-0.069
	(0.077)	(0.077)	(0.074)	(0.074)
yr2010c	0.188**	0.044	0.024	0.014
	(0.062)	(0.064)	(0.061)	(0.061)
yr2011c	0.160**	0.079	0.061	0.057
	(0.062)	(0.061)	(0.058)	(0.058)
yr2012c	-0.050	-0.075	-0.08	-0.081
	(0.066)	(0.067)	(0.065)	(0.064)
ln_age		-2.065***	-2.005***	-2.050***
		(0.286)	(0.284)	(0.286)
ln_agesquar		0.467***	0.443***	0.450***
		(0.077)	(0.077)	(0.077)
roa			0.310***	0.321***
			(0.092)	(0.095)
tot_tur			0.109***	0.124***
			(0.028)	(0.029)
vent_cap				0.293***
				(0.050)
_cons	-0.071	2.164***	2.079***	2.092***
	(0.047)	(0.253)	(0.254)	(0.254)
Firm-year obs.	2254	2254	2254	2254
Unique firms	470	470	470	470
Wald χ^2	117.43***	206.38***	248.02***	274.68***

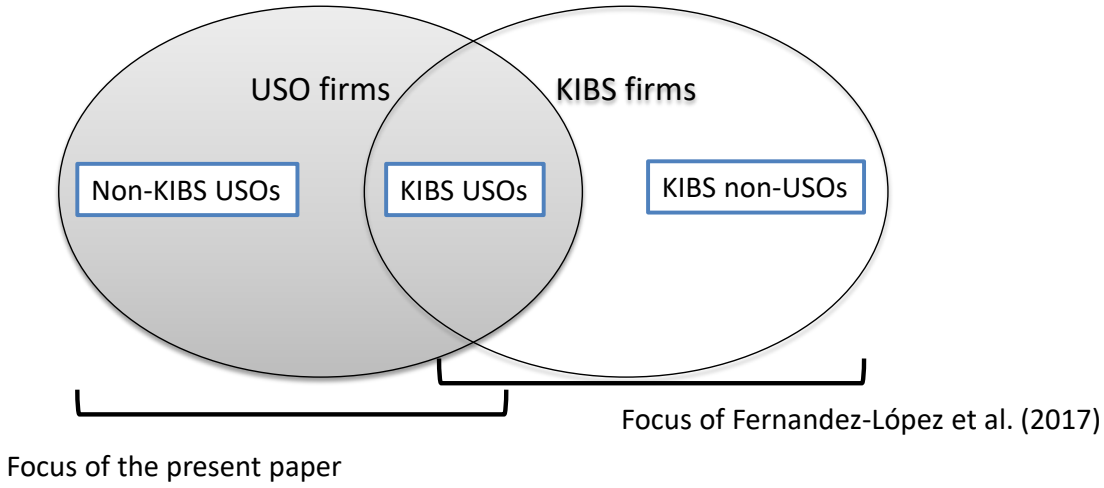
Notes: This table presents the results for random effects GLS models on sales growth for Spain. Robust standard errors are in parenthesis.
+ p < 0.10; * p < 0.05; **p < 0.01; *** p < 0.001

Table 5. Panel regressions on sales growth (random effects GLS): Italy.

	Model 1	**Model 2**	**Model 3**	**Model 4**
kibs	-0.033	-0.031	-0.014	-0.012
	(0.038)	(0.034)	(0.039)	(0.039)
yr2006c	0.122+	0.038	-0.092	-0.094
	(0.067)	(0.069)	(0.066)	(0.066)
yr2007c	0.073	-0.021	-0.131*	-0.134*
	(0.067)	(0.067)	(0.064)	(0.064)
yr2008c	0.351***	0.161*	0.092	0.087
	(0.072)	(0.068)	(0.066)	(0.066)
yr2009c	0.053	-0.066	-0.081	-0.085
	(0.070)	(0.069)	(0.067)	(0.067)
yr2010c	0.118	0.04	0.024	0.021
	(0.074)	(0.072)	(0.068)	(0.068)
yr2011c	0.053	0.007	-0.003	-0.005
	(0.060)	(0.059)	(0.055)	(0.054)
yr2012c	0.088	0.059	0.045	0.044
	(0.066)	(0.064)	(0.061)	(0.060)
ln_age		-2.073***	-1.957***	-1.967***
		(0.232)	(0.229)	(0.229)
ln_agesquar		0.487***	0.460***	0.464***
		(0.067)	(0.067)	(0.067)
roa			0.687***	0.706***
			(0.178)	(0.187)
tot_tur			0.278***	0.285***
			(0.030)	(0.030)
vent_cap				0.265+
				(0.146)
_cons	0.139***	2.169***	1.806***	1.799***
	(0.042)	(0.191)	(0.193)	(0.193)
Firm-year obs.	2854	2854	2846	2846
Unique firms	670	670	670	670
Wald χ^2	25.67**	247.97***	442.90***	452.47***

Notes: This table presents the results for random effects GLS models on sales growth for Italy. Robust standard errors are in parenthesis.
+ p < 0.10; * p < 0.05; **p < 0.01; *** p < 0.001

Figure 1. Focus and terminology used in the analysis.



Notes: Figure 1 graphically summarizes the focus of the analysis, as well as the terminology used. The term KIBS USOs refers to KIBS firms that take the form of university spin-off firms. The term KIBS non-USOs refer to KIBS firms created outside the university entrepreneurship. The term Non-KIBS USOs refers to university spin-offs that are not KIBS firms.

Figure 2. Theoretical framework.

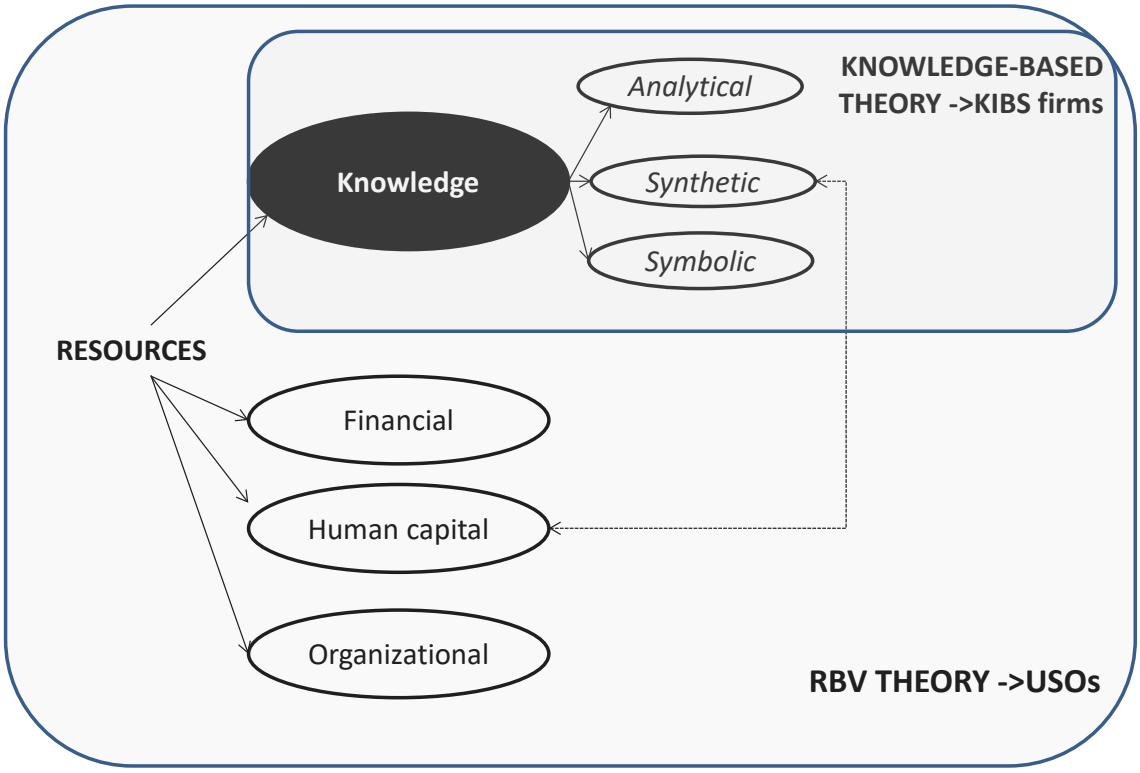


Figure 3. Spanish/Italian KIBS USOs.

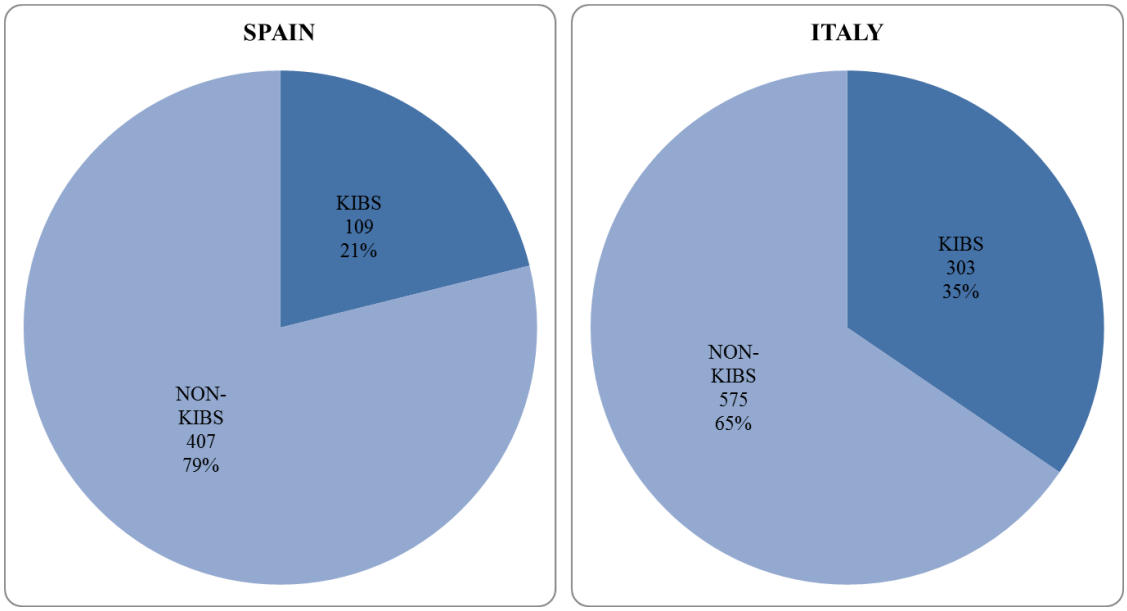


Figure 4. Mean sales growth rates in the KIBS and non-KIBS USOs: by country (2006–2013).