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Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention

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ABSTRACT

Academic entrepreneurship is the process by which an individual or group of individuals linked through their work to a university or research centre use knowledge created in their research to set up business ventures or spin-offs. With the Theory of Planned Behaviour as basis, the influence of attitudes, subjective norms, and perceived control on academics' entrepreneurial intentions was studied. The instrument was a survey conducted of 1178 Spanish university academics in various fields of knowledge, professional categories, and levels of seniority in their institution. A structural equation model identified as the main antecedent of entrepreneurial intention the attitude towards entrepreneurship. This was in turn influenced by creativity, perceived utility, and entrepreneurial experience.

1. Introduction

In the last three decades there has been a significant increase in the generation of spin-offs at a global level, probably due to the generalization of interest in the most efficient and effective use of scientific knowledge, especially that generated through research financed with public funds. Currently, academic spin-offs are considered as an important instrument due to their contribution to the generation of businesses, the creation of jobs, their contribution to maintaining the balance of the economic system, as well as their positive influence on innovative processes.

In parallel to the increase in university financed spin-offs, academics have also been interested in studying these academically to learn more about aspects such as the most effective university policies for promoting them, the business process followed for their creation and the personal characteristics of the academics who have taken the step of creating a company of this type (Abreu & Grinevich, 2013; Guerrero & Urbano, 2014).

According to the theories of planned behaviour (TPB), entrepreneurial intentions (EI) would the key to understanding the entrepreneurial process and the first step in the long and complex process of entrepreneurship (Krueger & Carsrud, 1993; Krueger, Reilly, & Carsrud, 2000; Kolvereid, 2016). Intentions have been proved to be the best predictors of individual behaviours particularly when the behaviour is rare, hard to observe or involves unpredictable time lags (Krueger & Brazeal, 1994). As indicated by Bird (1988), the most proximal predictor of the decision to become an entrepreneur is seen in EI, signalling how intensely one is prepared and how much effort one is planning to commit in order to carry out entrepreneurial behaviour. Even if people may have significant potential, they will refrain from making the transition into entrepreneurship when they lack the intentions (Krueger et al., 2000).

In short, the aim of this study is to test the influence that certain variables, identified as relevant in other studies on entrepreneurship and academic entrepreneurship, have on the intention of academics in Spanish universities to create a spin-off.

The United States has almost 40 years of experience in the development of entrepreneurial universities, with MIT and Stanford University being referents. In Spain, however, it was only at the beginning of the 1990s when governments and universities started to take interest in technology transfer activities, and subsequently in the creation of academic spin-offs (Guerrero & Urbano, 2014). Indeed, according with RedOTRI (2012) by 2000 there had only been

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founded 17 such companies in Spain, but in recent years there has been a significant increase in the phenomenon, to the extent that an estimated total of 1110 spin-offs had been created by 2012. On average, the rate of growth has been more than 100 spin-offs/year for the past 5 years (RedOTRI, 2012).

Unlike the majority of previous studies, this research was aimed at the entirety of the universities in Spain and at academics from all branches of knowledge. Also, following the recommendations of previous studies (Gartner, 2007; Goethner, Obschonka, Silbereisen, & Cantner, 2012), we considered a model which integrates both psychological factors based on the individual characteristics of the academic entrepreneur and factors related to the socioeconomic environment. Few studies have dealt with analysing the interrelationships between the two types of factor (Goethner et al., 2012), and even fewer those whose analysis was based on a sample of all the universities in a given country (Abreu & Grinevich, 2013).

In the next section, we shall review the relevant literature on academic entrepreneurship from the perspective of EI. We then describe the structural model used to relate the academics' entrepreneurial intention with certain explanatory variables. Finally, we present the results of the study, the main conclusions to be drawn, and the implications of the study for university management.

2. Literature review and theoretical framework

In recent years, research on academic entrepreneurship has grown in parallel with the burgeoning of entrepreneurship in the university context. Several literature review studies can also be found within the literature on the subject: Mustar et al. (2006), Rothaermel et al. (2007), Djokovic and Souitaris (2008), Mars and Rios-Aguilar (2010) and Yusof and Jain (2010).

While the early work in this area focussed on measuring the knowledge transfer activity of universities (parents, licences, spin-off) and analysing the initiatives that could influence the effectiveness of this activity (Siegel & Wright, 2015), in recent years there has been an increase in attempts to analyze the factors that lead academics to exhibit entrepreneurial behaviour.

Entrepreneurial behaviour is a type of planned behaviour (Bird, 1988). Models of intentions are therefore appropriate for explanations and predictions of that behaviour. Various models have been developed with the purpose of analysing factors affecting the decision to start an entrepreneurial career. Examples are the Entrepreneurial Event Model (Shapero, 1982), the Theory of Planned Behaviour (TPB) (Ajzen, 1991, 2001), Entrepreneurial Attitude Orientation (Robinson, Stimpson, Huefner, & Hunt, 1991), and the Entrepreneurial Potential Model (Krueger & Brazeal, 1994). EI are the key to understanding the entrepreneurial process, and can be regarded as the first step in the long and complex process of entrepreneurship. If EI are the single strongest predictor of entrepreneurial behaviour, the study of their antecedents and determinants takes on particular relevance for understanding the entrepreneurship process.

In one of the latest reviews, Yusof and Jain (2010) analyze 72 articles on entrepreneurship in the university context, grouping them into three categories: entrepreneurial university, technology transfer in the university and academic entrepreneurship. In this final category they identify 16 works published in the period 1989–2006, and here what stands out are the works that try to analyze the main factors determining the entrepreneurial intention of academics.

In recent years, a number of papers have been published in this line of research which identify different antecedents of the academics EI, both individual factors and contextual factors (see Annex 1). Along with these predecessor variables, different moderating factors of entrepreneurial intention have also been identified such as academic promotion focus (Foo, Knockaert, Chan, & Erikson, 2016), entrepreneurship self-identity (Obschonka, Silbereisen, Cantner, & Goethner, 2015), scientific productivity (Erikson, Knockaert, & Der Foo, 2015) and social identity (Obschonka, Goethner, Silbereisen, & Cantner, 2012).

We have chosen the TPB model as the theoretical framework for our study due to the advantages it has been shown to have when applied in the academic environment (Goethner et al., 2012; Obschonka et al., 2012, 2015). Briefly, in the TPB model the behaviour of a person is immediately determined by the intention of the person to perform (or not perform) that behaviour. In turn, this intention (EI) to perform a behaviour depends on three fundamental elements: firstly, entrepreneurial attitude (EA); secondly, the subjective norm (SN), which is the model's most social component and in turn implies a person's belief about the presence of social pressure on them to perform or not perform the action in question, and the motivation to satisfy these pressures; and thirdly, the perceived behavioural control (PC) that they have in the situation in which they must make a decision and act. Prior applications of the TPB in the entrepreneurship literature suggest that EA, SN, and PC typically explain 30–45% of the variance in intentions (Saeed, Yousafzai, Yani de Soriano, & Muffatto, 2015).

Unlike the above studies, the present work considers that it is especially important to look more deeply into the motivations and psychological characteristics of academic entrepreneurs. Specifically, the aim is to analyze how the EI of academics is formed, bearing in mind that the general literature on entrepreneurship usually identifies individual domains (e.g., personality, motivation, and prior experience) and contextual variables (e.g., social context, markets, and economics) as the two dimensions responsible for the formation of EI (Krueger et al., 2000; Fayolle & Gailly, 2015). We consider it opportune to remark on the results obtained by Clarysse, Tartari, and Salter (2011) who, using a large-scale panel of academics from a variety of UK universities from 2001 to 2009, showed that individual-level attributes and experience are the most important predictors of academic entrepreneurship. The social environment surrounding the academic also plays an influential role, but much less pronounced than individual-level factors. These results are important since, although we have outlined that this study does not analyze the EI but rather real entrepreneurial behaviour, there is a direct relationship between EI and entrepreneurial behaviour.

Therefore, this paper falls within a line of research in which we can observe the need to continue analysing entrepreneurial intention in the university context using a combination of the individual factors of academics and the contextual factors of their working environment (Foo et al., 2016; Miranda, Chamorro, & Rubio, 2017).

3. Hypotheses and conceptual model

In view of the main theoretical and empirical relationships discussed in the previous section and taking into account the literature review work on entrepreneurial intention by Liñán and Fayolle (2015), we propose a model to explain the EI of Spanish academics on the basis of their EA, their PC, and the SN that affect the process of entrepreneurship. As antecedents of the EA construct, we consider three of the individual's psychological variables – creativity (CREA), perceived utility (PU), and self-confidence (SELF) – as well as their previous business experience (BE). Our model is completed with the inclusion of three variables as predictors of the PC construct: the academic's

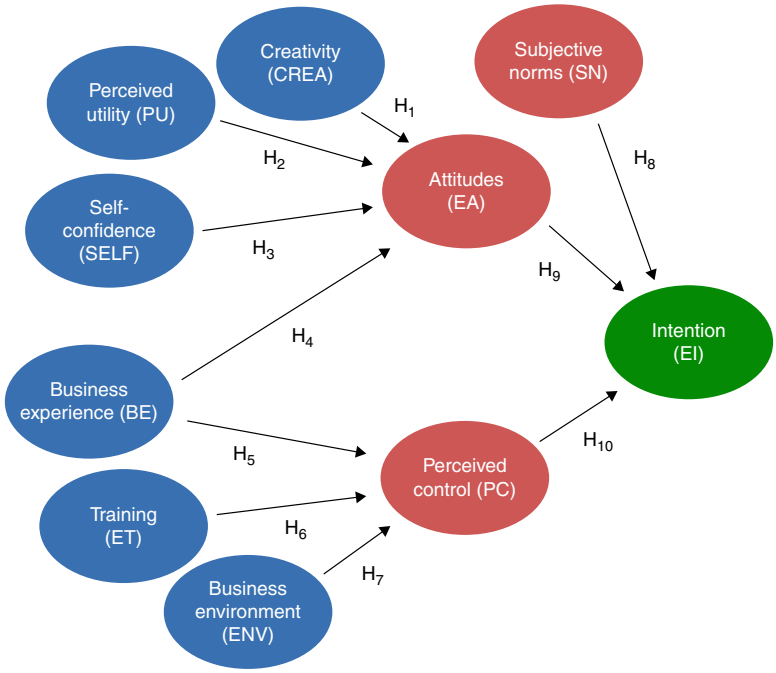

Fig. 1. Structural model.

prior business experience (BE) and two contextual variables, the entrepreneurship training received (ET) and the perception of an enabling environment for entrepreneurship (ENV). In the following paragraphs, we shall analyze each of the variables included in the model (see Fig. 1) and give our reasons for the proposed relationships.

3.1. Creativity (CREA) and entrepreneurial attitude (EA)

On the assumption that an entrepreneur is a person who recognizes an opportunity and creates something new (for example, a new product) and uses different means to exploit this opportunity, there are various authors who highlight a person's creativity as an important, yet understudied antecedent of EI (Ward, 2004; Zampetakis, Gotsi, Andriopoulos, & Moustakis, 2011). Several studies have established a positive relationship between CREA and business opportunity identification (Zampetakis & Moustakis, 2006; Zampetakis, Kafetsios, Bouranta, Dewett, & Moustakis, 2009; Zampetakis et al., 2011). Based on these findings, creativity in this context may be taken to be "the ability to rapidly recognize the association between problems and their purported solutions by identifying non-obvious associations, or by shaping or reforming available resources in a non-obvious way" (Zampetakis & Moustakis, 2006, p. 415). Such creativity can be seen as an essential element of entrepreneurship.

In the academic context, Miranda et al. (2017) argue that there is no direct relationship between CREA and EI, so for this model and following the works of Zampetakis et al. (2009, 2011) and Block, Sandner, and Spiegel (2015) we propose an indirect relationship through EA. We thus posit the following hypothesis:

H1. Academic's CREA positively influences academic's EA.

3.2. Perceived utility (PU) and entrepreneurial attitude (EA)

Many entrepreneurship researchers have offered expectancy-type and subjective expected-utility-type models to describe the factors that influence an individual's choice to pursue an entrepreneurial career (Douglas & Shepherd, 2000; Gatewood, Shaver, Powers, & Gartner, 2002). Douglas and Shepherd (2000) offer a model of EI in which the choice to pursue entrepreneurship is based on a person's utility function. This reflects perceptions about the income anticipated, the amount of work effort anticipated to achieve this income, the risk involved, plus other factors such as the person's attitudes to the desire for independence and perceptions of the anticipated work environment. Adapting this proposal, we posited the following hypothesis:

H2. Academic's PU positively influences the academic's EA.

3.3. Self-confidence (SELF) and entrepreneurial attitude (EA)

In the existing literature on entrepreneurship, self-confidence (SELF) is identified as one of the main antecedents of the entrepreneurial attitude (Ferreira, Raposo, Rodrigues, Dinis, & do Paço, 2012; Do Paço, Ferreira, Raposo, Rodrigues, & Dinis, 2015). Thus, Bénabou and Tirole (2002) argue that this self-confidence makes it easier to convince others and improves individual motivation so that people keep making an effort until the established goals are achieved. In the academic field, the recent work by Miranda et al. (2017) also suggests the existence of this relationship. So, we posited the following hypothesis:

H3. Academic's SELF positively influences the academic's EA.

3.4. Business experience (BE) and entrepreneurial attitude (EA)

The entrepreneurship literature suggests that experienced entrepreneurs are better suited to recognizing business opportunities and (even more so) innovative opportunities than novice entrepreneurs (Goethner et al., 2012; Ruiz-Arroyo, Sanz-Espinosa, & Fuentes-Fuentes, 2015; Ucbasaran, Westhead, & Wright, 2009). This greater ability to identify business opportunities translates into a positive attitude towards entrepreneurial activity.

Therefore, those researchers who have had previous business experience, either at work or when participating in joint research projects, have a positive attitude to commercialize the results of their research (Abreu & Grinevich, 2013; Colyvas & Powell, 2007;

Erikson et al., 2015; Haeussler & Colyvas, 2011). According to the proposed model, experience in the business world will affect the academic's EA. We therefore posit the following hypothesis:

H4. Academic's BE positively influences academic's EA.

3.5. Business experience (BE) and perceived control (PC)

Less experienced entrepreneurs often find it difficult to identify opportunities for commercialization, and struggle to bridge the gap between scientific research and industry networks (Mosey & Wright, 2007). In contrast, individuals with a prior relationship (family, professional, etc.) with the business world show a positive perception of themselves when launching entrepreneurial initiatives (Carr & Sequeira, 2007).

In the academic field, Ding and Choi (2011) show that the previous experience of academics with the business sector (patents, collaborative research projects/contracts, networking, etc.) has a direct influence on their PC. So, according to the proposed model, BE will affect PC. We therefore posit the following hypothesis:

H5. Academic's BE positively influences academic's PC.

3.6. Entrepreneurship training (ET) and perceived control (PC)

Training for entrepreneurship and contact with entities that provide support for entrepreneurs tend to favour the willingness to start a business (Siegel & Phan, 2005). Rauch and Hulsink (2015) demonstrate that ET directly affects PC by allowing access to resources that facilitate the entrepreneur's work and access to the experience of other entrepreneurs thanks to this training. Lockett, Wright, and Franklin (2003) recognized that many academics lack the skills needed to start a business, since those skills are quite different from the ones they use in their academic life. There is, however, little evidence for any impact of ET on the likelihood of academics actually engaging in entrepreneurship (Siegel & Phan, 2005). With the aim of shedding some new light on this context, we examined the effect of ET on the PC when starting out on an entrepreneurial activity in an academic context. We posited the following hypothesis:

H6. Academic's ET increases academic's PC.

3.7. Business environment (ENV) and perceived control (PC)

Entrepreneurial activities may also be explained by the influences of the surrounding business environment. Academics have emphasized that government policies, characteristics of the local context (e.g., availability of logistic infrastructure, financial investors, and externalities), and, more specifically, university support mechanisms influence their entrepreneurial activities (Fini, Lacetera, & Shane, 2010; Goel, Goktepe-Hulten, & Ram, 2015; Moog, Werner, Houweling, & Backes-Gellner, 2015; Foo et al., 2016). We believe that this influence will especially affect the academics' PC of the process of creating a company. We thus posit the following hypothesis:

H7. The perception of a positive ENV implies greater academic's PC.

3.8. Subjective norms (SN) and entrepreneurial intention (EI)

In the field of academic entrepreneurship, it has been observed (Goethner et al., 2012; Huyghe and Knockaert, 2015; Obschonka et al., 2012; Obschonka et al., 2015; Rasmussen, Mosey, & Wright, 2014) that how the academic's social environment (family, friends, and co-workers) perceives entrepreneurship will decisively influence that person's EI. According to Bercovitz and Feldman (2008), scientists' workplace peers can be considered to be normative referents of relevance. In this sense, the decision to engage in founding a firm is to a large extent socially conditioned: previous efforts by faculty members to start their own company make other scientists believe that entrepreneurial activity is acceptable and desirable (Obschonka et al., 2012). Therefore:

H8. SN will have a positive impact on academic's EI.

3.9. Entrepreneurial attitude (EA) and entrepreneurial intention (EI)

The sparse literature on scientists' motivations and EA towards their own engagement in entrepreneurial activities suggests that they allocate effort and time to entrepreneurship if they perceive that activity as positive and professionally stimulating as well as having the potential to provide commercial benefits from their research (Goethner et al., 2012; Owen-Smith & Powell, 2001).

In keeping with Fernández-Pérez et al. (2015) we argue that in recent years this construct has acquired special importance in the Spanish university context, given that there has been an evolution from the mass rejection of business activities to the current situation where academics understand business activities as part of their duties.

Therefore, we believe that if academics have a favourable attitude towards entrepreneurial activities this will imply a greater willingness to dedicate time and effort to creating a new business. Thus, we posit the following hypothesis:

H9. Academic's EA will have a positive impact on academic's EI.

3.10. Perceived control (PC) and entrepreneurial intention (EI)

This construct would include not only the feeling of being able (have the necessary skills to start a business and succeed in it), but also the perception about controllability of the behaviour (Liñán & Chen, 2009). Entrepreneurship research stresses the importance of PC as a mechanism for overcoming perceptions of the greater financial, technological, and legal uncertainties that are often associated with new ventures based on research results (Obschonka, Silbereisen, & Schmitt-Rodermund, 2010; Silveira-Pérez, Cabeza-Pullés, & Fernández-Pérez, 2016). Literature generally tends to agree that controllability perceptions are positively related to the intention to become a founder (Schlaegel & Koenig, 2014).

There was a need, therefore, to check the influence of this variable on the EI in the academic environment (Alonso-Galicia, Fernández-Pérez, Rodríguez-Ariza, & Fuentes-Fuentes, 2015; Fernández-Pérez, Esther Alonso-Galicia, del Mar Fuentes-Fuentes, & Rodriguez-Ariza, 2014; Goethner et al., 2012; Obschonka et al., 2012, 2015; Prodan & Drnovsek, 2010), for which we posited the following hypothesis:

H10. Academic's PC will have a positive impact on academic's EI.

4. Methods

4.1. Sample

We directed our study to all the academics involved in teaching and/or research activities in 82 Spanish universities in 2014.[1] In the absence of a unified list of active academic staff, the sampling frame was constructed from the information available on the universities' websites, covering a total of 1030 centres (faculties and schools)

[1] More information about the Spanish University System can be found in López (2006, 2009) or Sánchez-Barrioluengo (2014).

and 2998 departments. The questionnaire was designed with an on-line format and was distributed via e-mail. When the e-mail addresses were unavailable, we requested the collaboration of the heads of the different faculties and departments to distribute the questionnaire among their teaching and research staff.

We finally obtained a total of 1178 valid responses. This represents a sampling error of 2.8% (see Annex 2). Following on with the line initiated by Abreu and Grinevich (2013) in the UK, the present study is the first in this area to analyze all the scientific fields, institutions, and professional categories within a given country.

Comparison of our sample with the official statistics (MECD, 2014) showed it to be representative[2] in terms of speciality, gender, and academic rank (see Annex 2). In particular, 61.9% of the respondents were men, and 33.4% had been working between 5 and 15 years in the institution. With regard to academic position, 13% are professors, 39.7% are tenured lecturers, and the rest are non-tenured lectures. With regard to speciality, 39.4% were working in the fields of Social and Legal Sciences, 21% in Engineering and Architecture, 15.8% in Experimental Sciences and Mathematics, and another 15.8% in Health Sciences.

4.2. Measures

Annex 3 provides a summary of the variables in our study, including Cronbach alpha for each measure.

Entrepreneurial intention (EI). Four items assessed academics' intentions to engage in entrepreneurial activity to market their own research. Our scale is based in the proposals of Autio, Keeley, Klofsten, Parker, and Hay (2001), Liñán and Chen (2009) and Obschonka et al. (2015).

Creativity (CREA). To measure CREA we used a 5-item, Likert-type scale based on the proposals of Zampetakis and Moustakis (2006) and Zampetakis et al. (2009).

Perceived utility (PU). Adapting the proposal of Douglas and Shepherd (2000), we used a 5-item scale to measure the PU.

Self-confidence (SELF). Adapting the scale used by Ferreira et al. (2012), we constructed a 5-item scale that allows us to measure SELF.

Business experience (BE). To measure the respondents' BE, we used a 4-item scale based on that of Abreu and Grinevich (2013).

Entrepreneurial training (ET). We used a 4-item scale to assess the academics ET, both inside and outside the university context. Our scale is based on the research of Fayolle and Gailly (2015).

Business environment (ENV). A 7-item scale based on Manolova, Eunni, and Gyoshev (2008) was used in order to evaluate the perception respondents have of the current and future business environment, in terms of both funding opportunities for their business projects and the nation's economic situation.

Subjective norms (SN). Consistent with earlier research (Huyghe & Knockaert, 2015; Obschonka et al., 2015), perceived SN was measured by a 7-item scale used by Bercovitz and Feldman (2008).

Entrepreneurial attitude (EA). EA is an independent variable and represents how an individual evaluates a certain behaviour in terms of its consequences. We measured EA using 4 items from Liñán and Chen (2009) and Goethner et al. (2012).

Perceived control (PC). We assessed PC by the extent to which academics rate a business opportunity as feasible and by the extent to which they feel they can influence the outcome. We used nine 7-point items from de Noble, Jung, and Ehrlich (1999) and Liñán and Chen (2009).

[2] We use a probability (also called random) sample. It permits us to calculate how likely it is that a given sample differs from the population on any question of interest, and by how much. In our study the margin of sampling error is plus or minus 2.8 percentage points at the 95 percent level of confidence.

4.3. Data analysis

The method chosen for the data analysis was the technique of partial least squares (PLS) regression (Hair, Hult, Ringle, & Sarstedt, 2016). We selected this technique firstly because it is designed primarily for predictive analysis of problems which present some complexity. In addition, PLS has an advantage over the LISREL linear structural relations software package in those situations where the theory has not been sufficiently validated, as in our case on incorporating various antecedents of the constructs EA and PC that have not been included in previous studies on academic entrepreneurship. The model was estimated using the SmartPLS 3.0 package, and the significance of the parameters was established by bootstrap resampling, employing 500 sub-samples of size equal to that of the original sample (see Sarstedt, Ringle, & Hair, 2014).

5. Results

The measurement model was tested for reliability and validity using SmartPLS 3.0. All the reflective construct loadings exceeded the 0.707 reference value, with the exception of 3 items that we then excluded from further analysis (see Annex 3 for the final list). These were 2 items relating to BE and 1 item to measurement of the ENV. As one can observe in Annex 3, Cronbach's alpha for each construct lay between 0.641 and 0.930, indicative of good reliability among the indicators of each construct. The composite reliability of all the constructs exceeded not only the 0.7 reference value, but even the stricter 0.8 value. Furthermore, the values of the average variance extracted (AVE) were greater than 0.5, thus ensuring the model's convergent validity (Hair et al., 2016).

Finally, to assess the discriminant validity of the constructs we confirmed that no item had higher loadings in other constructs different from those it was intended to measure (Hair et al., 2016). The highest value of heterotrait-monotrait ratio of correlations (HTMT) is 0.84 (see Annex 4), which is below 0.85 and thus supports discriminant validity (Henseler, Ringle, & Sarstedt, 2015).

Fig. 2 shows the results of the estimates made with our structural model. The arrows indicate causal relationships, the number beside each is the respective standardized coefficient, and in parentheses is the product of the standardized coefficient and the correlation coefficient between the two constructs expressed as a percentage (Henseler et al., 2015). The *t*-values and significance of the causal relationships were determined by the bootstrap resampling procedure with 500 sub-samples.

EA is the construct that contributes most (47.56%) towards explaining entrepreneurial intent. The other two constructs – SN and PC – are not significant. EA construct is in turn explained mainly by PU (31.07%), and to a lesser extent by CREA (11.99%) and BE (5.68%). SELF, however, does not contribute to determining EA.

One observes in the figure that the calculated Stone–Geisser Q^2 values were all greater than zero, so that the constructs can be accepted as having predictive relevance. The model's predictive power (R^2) was acceptable since it contributes to explaining 56.8% of the variance of EI, 49% of EA, and 34.2% of the PC. The value of goodness of fit that is generated through the standardized root mean squared residual (SRMR) that is equal to $0.064 < 0.080$, which means that our model fits the empirical data (Henseler et al., 2015).

6. Discussion

On the basis of the Theory of Planned Behaviour, a study was conducted in order to analyze the determinants of the academics

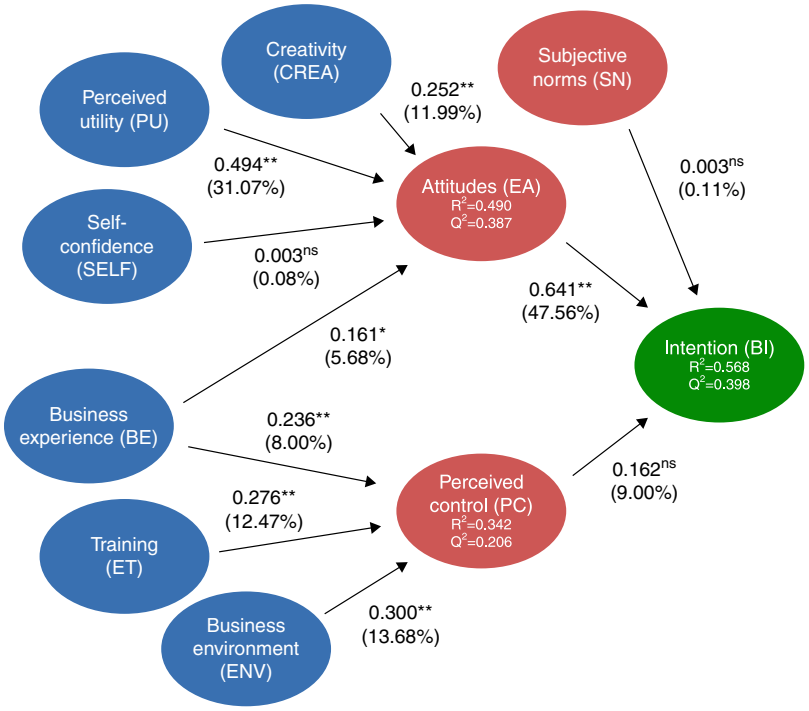

Fig. 2. Structural model estimation. *Significant at 95%. **Significant at 99%. nsNon-significant.

EI in Spanish universities. Our model has proven its capacity as a conceptual framework because it explains 56.8% of the variance of EI, clearly surpassing the 35–45% of variance explained in previous work on academic entrepreneurship (Goethner, Obschonka, Silbereisen, & Cantner, 2009; Fernández-Pérez et al., 2014). The results showed Spanish academics' EI to be explained by EA, and this in turn to be mainly influenced by CREA and PU.

There was insufficient empirical evidence to establish any meaningful relationship of the SN with EI. While this finding contrasts with those of previous studies in the field of academic entrepreneurship (Bercovitz & Feldman, 2008; Ding & Stuart, 2006; Huyghe & Knockaert, 2015; Obschonka et al., 2012, 2015), it is nevertheless in line with the results reported in more general TPB-based work on EI (Krueger et al., 2000).

The recent addition of a third mission led to a reorganization of Spanish university portfolios so Spanish universities' missions are still negotiating their position within universities' strategies (Sánchez-Barrioluengo, 2014). Similarly to the result reported by de Pillis and Reardon (2007) for Ireland, the present study seems to confirm that, in sociocultural and university environments with little entrepreneurial tradition, EI depends less on these SN and more on the personality of the academics themselves. Given this result, we would suggest that university managers might consider fostering a change in this environment by promoting a culture that includes entrepreneurial activities as part of the academic's professional curriculum.

As noted by Fini, Grimaldi, Marzocchi, and Sobrero (2012), it may be possible that awareness of external support comes into play at later stages when individuals are actually implementing entrepreneurial actions. In order to carry out this process better and to achieve success, they might then start looking for (and be more sensitive to) external support.

Another explanation for this result may be the lack of entrepreneurial culture in our context. Spain is a country that historically has not been characterized by having a high rate of entrepreneurial activity. This can be confirmed by considering the data presented in the last editions of the Global Entrepreneurship Monitor. In particular, the 2015/2016 GEM report (Kelley, Singer, & Herrington, 2016) places Spain with a 5.6% entrepreneurial rate well below the mean of European countries (12.8%) or of the USA (12.4%).

Finally, unlike previous studies (Fernández-Pérez et al., 2014; Goethner et al., 2009, 2012; Obschonka et al., 2012, 2015; Prodan & Drnovsek, 2010), PC showed no significant relationship with EI. This effect, the opposite to the TPB model, had already been detected by Piperopoulos and Dimov (2015) and is justified by the fact that in certain contexts (our study demonstrates that the Spanish academic context is one of these), even if individuals show a high level of perceived control this does not translate into a greater entrepreneurial intention, given that although PC suggest that academics perceive themselves as well equipped to enact their entrepreneurial aspirations, framing entrepreneurial behaviour in terms of what can be done versus what ought to be done will affect the degree to which PC can result in EI.

7. Conclusions and implications

Our results have several implications for both academia and for managers in the education sector. First, this work contributes to the literature on EI since the study includes, in the academic context and within the TPB models, individual factors and contextual factors, demonstrating the special importance of EA in the academic field and its relationship with CREA, BE and PU.

Our research also has relevant implications for practitioners. First, for policy makers, who in addition to including research and teaching in many of their processes for evaluating university performance should also include knowledge transfer activities (Etzkowitz et al., 2000), so we believe that it is useful to be able to identify the main determinants of EI in the Spanish university context. Second, the model suggests that intervention by public authorities to improve academics' EA would have a direct effect on their EI, and therefore on the number of spin-offs created. It

seems clear that a favourable EA depends primarily on the academic personality, particularly on their CREA, BE, and PU. So, university managers must be aware that the best way of promoting entrepreneurial activity in their institutions is to create the conditions necessary to increase the EA of their academics. For this, it would be interesting, as outlined by Huyghe and Knockaert (2015), to incorporate new incentive systems for academics that not only look at their teaching and research performance, but also place special emphasis on activity to transfer research results to the production sector (patent licencing, collaborative projects, spin-off creation, etc.).

Moreover, entrepreneurship promotion programmes run by universities must focus on developing the EA of the potential entrepreneurs, conveying the message that, despite all the obstacles that exist when launching a spin-off, the entrepreneurship route can be an interesting alternative for academics and one that complements their teaching and research work, which can also be strengthened thanks to the experience acquired from launching an entrepreneurial initiative. Therefore, it is not about committing to teaching, research or entrepreneurial work, but instead the three paths can be developed in parallel and can become complementary thanks to the important synergies between them.

Despite the effort we put into the design of the present study, it is not without limitations. Firstly, a common limitation of this type of study is that deriving from the self-selection bias. In particular, persons with a prior interest in the subject of study are more likely to be attracted to respond to such a survey. Secondly, the study was exploratory and cross-sectional, which makes it difficult to establish causal relationships between the variables of our model. Thus, we have proposed that the EA, SN, and PC determine the EI. But it could be that the relationship is vice versa, i.e., that the ambition to become an entrepreneur (EI) is what determines the potential EA, SN and PC. It would therefore be recommendable to carry out a longitudinal study that could confirm the causal relationships that suggested themselves. Similarly, it would be interesting for future work to analyze the impact that control variables, such as age, gender, scientific field and professional category, may have on the proposed model. And thirdly, future research will need to analyze the passage from EI to the action of creating a new business. While several studies such as this have analyzed the antecedents of EI, fewer have considered the potential barriers that might hinder subsequent entrepreneurial actions. Again, an analysis of a longitudinal nature of our sample would determine whether EI is eventually transformed into action.

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Annex 1. Main predictors of academic entrepreneur intention in the literature

Individual factors	Entrepreneurial attitude (EA)	Obschonka et al. (2012, 2015); Goethner et al. (2012); Fernández-Pérez et al. (2014); Alonso-Galicia et al. (2015); Huyghe, Knockaert, and Obschonka (2016)
	Knowing cognitive styles	Knockaert, Der Foo, Erikson, and Cools (2015)
	Perceived behavioural control	Prodan and Drnovsek (2010); Goethner et al. (2012); Obschonka et al. (2012, 2015); Fernández-Pérez et al. (2014); Alonso-Galicia et al. (2015)
	Prior experience	Prodan and Drnovsek (2010); Moog et al. (2015); Erikson et al. (2015)
	Scientific productivity	Prodan and Drnovsek (2010); Goel et al. (2015)
	Social networks	Prodan and Drnovsek (2010); Mosey, Noke, and Binks (2012); Fernández-Pérez et al. (2014)
	Working time balance	Moog et al. (2015)
Contextual factors	Family environment	Foo et al. (2016)
	Subjective norms	Obschonka et al. (2012, 2015); Huyghe and Knockaert (2015)
	University reward system	Huyghe and Knockaert (2015)
	Work environment	Guerrero and Urbano (2014); Erikson et al. (2015); Goel et al. (2015); Moog et al. (2015); Foo et al. (2016)

Annex 2. Technical data sheet

Universe	Teaching and research staff of the 82 Spanish universities (115 332 people)
Geographical scope	Spain
Data collection method	Online survey
Sample size	1178 completed questionnaires received
Sampling error	For a confidence level of 95.5% and $p = q$, the error for the total sample is ±2.8%
Field work	November 2014

		Sample	Universe (Spain)
Gender	Men	61.9%	60.7%
	Women	38.1%	39.3%
Academic position	Professor	13%	9.5%
	Tenured lecturers	39.7%	33.1%
	Non-tenured lectures	47.3%	57.4%
Speciality	Social and legal sciences	39.4%	32.3%
	Engineering and arquitecture	21%	21.1%
	Experimental sciences and mathematics	15.8%	23.1%
	Health sciences	15.8%	10.1%
	Arts and humanities	8%	13.4%

Note: For a confidence level of 95.5% and $p = q$, the error for the total sample is ±2.8%.

Annex 3. Evaluation of the measurement model

Construct	Factor loading	Cronbach's alpha	Composite reliability	AVE
Individual factors				
Creativity (CREA)		0.848	0.891	0.622
CREA1: I consider myself a very creative person.	0.755362			
CREA2: I like to start new projects, despite the risk of being wrong.	0.829712			
CREA3: I usually take new itineraries when travelling.	0.743422			
CREA4: To be stimulated, I need constant changes even when those changes involve greater uncertainty.	0.801217			
CREA5: When a change occurs, for me the opportunities that arise are more important than any threats it represents.	0.813113			
Perceived utility (PU)		0.870	0.905	0.658
PU1: Being an entrepreneur would entail a very high degree of autonomy.	0.791416			
PU2: The level of stress entailed in being an entrepreneur would not be too great for me.	0.704194			
PU3: The financial return that I would get by becoming an entrepreneur would be high.	0.827742			
PU4: The personal satisfaction from being an entrepreneur would be very high.	0.859074			
PU5: The quality of life that I would get from being an entrepreneur would be very high.	0.865112			
Self-confidence (SELF)		0.821	0.874	0.582
SELF1: That other people act according to my wishes depends mainly on me.	0.745550			
SELF2: Whether or not a target is reached depends mainly on me and my behaviour.	0.745325			
SELF3: When I make plans, I am sure that they will come to fruition.	0.809673			
SELF4: I can determine most of what will happen in my life.	0.758991			
SELF5: Achieving what I want is the result of my own effort and personal commitment.	0.754228			
Entrepreneurial attitude (EA)		0.916	0.941	0.800
EA1: I find the idea of being an entrepreneur attractive.	0.91550			
EA2: Given the opportunity and resources, I would like to create a spin-off business.	0.906409			
EA 3: Being an entrepreneur would generate in me a feeling of great satisfaction.	0.918153			
EA4: I think if I decide to start a spin-off business then it would succeed.	0.836823			
Business experience (BE)		0.641	0.847	0.735
BE1: I have work experience in the private sector.	0.870118			
BE2: I have experience as proprietor of another firm or other firms.	0.845479			
Contextual factors				
Subjective norms (SN)		0.785	0.853	0.594
SN1: My family would support me in my career as an entrepreneur.	0.826127			
SN2: My friends see entrepreneurship as a logical option.	0.841361			
SN3: The culture of my region encourages entrepreneurship.	0.710334			
SN4: Most people in my region see entrepreneurship as very positive.	0.707749			
Entrepreneurial training (ET)		0.819	0.877	0.642
ET1: The hours of training in entrepreneurship I received during my university studies were adequate.	0.806536			
ET2: The hours of training in entrepreneurship I have received as part of my university's teaching and research staff training programmes have been sufficient.	0.83700			
ET3: The hours of training in entrepreneurship I have received outside the university have been sufficient.	0.816351			
ET4: My university gives good training to its teaching and research staff for them to develop their entrepreneurial potential.	0.742024			
Business environment (ENV)		0.864	0.898	0.595
ENV1: It is easy to obtain a bank loan to start a business.	0.779927			
ENV2: It is easy to find investors for a new business.	0.800375			
ENV3: There are enough grants and subsidies to create businesses.	0.785512			
ENV4: There are sufficient consulting firms that can help start up a business.	0.725073			
ENV6: The country's economic situation will improve notably in the coming years.	0.768403			
ENV7: The conditions for entrepreneurs will improve notably in the coming years.	0.769178			
Perceived control (PC)		0.930	0.942	0.644
PC1: Recognize a business opportunity before others do.	0.818500			
PC2: Make improvements to certain existing products on the market.	0.747557			
PC3: Conduct market research for a new product.	0.817351			
PC4: Design a marketing campaign for my products.	0.803259			
PC5: Organize and maintain my business's financial information.	0.795492			
PC6: Persuade potential investors to fund my business.	0.851113			
PC7: Manage relationships with my employees.	0.777899			
PC8: Manage my business without the counsel of others.	0.791008			
PC9: Develop a strategic plan.	0.816832			
Dependent construct				
Entrepreneurial intention (EI)		0.891	0.924	0.754
EI1: I am determined to create a business in the future.	0.929460			
EI2: I intend to commercialize the results of my research through a spin-off.	0.867548			
EI3: I would very much like to be an entrepreneur.	0.874101			
EI4: I recently searched for information on how to create a spin-off to commercialize the results of my research.	0.797534			

Annex 4. Discriminant validity (heterotrait-monotrait ratio – HTMT)

	BE	CREA	EA	EI	ENV	ET	PC	PU	SELF	SN
BE										
CREA	0.344									
EA	0.485	0.531								
EI	0.378	0.401	0.844							
ENV	0.178	0.123	0.353	0.409						
ET	0.236	0.119	0.242	0.273	0.441					
PC	0.472	0.499	0.683	0.574	0.394	0.388				
PU	0.368	0.394	0.760	0.658	0.378	0.254	0.634			
SELF	0.148	0.437	0.293	0.168	0.196	0.105	0.312	0.302		
SN	0.295	0.302	0.483	0.384	0.298	0.193	0.469	0.540	0.301	

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