

Antecedents of Entrepreneurial Skills and Their Influence on the Entrepreneurial Intention of Academics

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Abstract

The promotion of academic entrepreneurship through the creation of university spin-offs (USOs) as a transfer system has been enhanced during the last two decades. This commitment of universities and public policy makers has been based mainly on the use of investments of public funds in universities and the capacity for such investments to create employment and economic growth. In this sense, entrepreneurial skills are one of the strongest determinants of intention. For this reason, the present study proposes the use of the paradigm known as Big Five, which proposes as personality variables those recognized by the acronym OCEAN (openness, conscientiousness, extraversion, agreeableness, and neuroticism) to recognize if they are determinants of entrepreneurial skills and entrepreneurial intent, all through the application of Theory Planned Behavior (TPB). To study the influence of entrepreneurial skills, a self-administrated questionnaire was sent to more than 33,000 Spanish academics. The responses yielded a sample size of 799. The results show that entrepreneurial skills are the prime determinants of attitude and perceived control, and attitude is the decisive factor that determines the intention to go into business. Therefore, investment in training and the cultivation of skills and attitudes constitute the most relevant factors for achieving an increase in the creation of USOs.

Keywords

academic entrepreneurship, university spin-off, Big Five, TPB, entrepreneurial skills

Introduction

The encouragement of academic entrepreneurship through the creation of university spin-offs (USOs) as a transfer system has been on the increase during the last two decades (Vega-Gomez et al., 2018). An academic entrepreneur

could be viewed as that higher education actor who innovatively leverages internal and external opportunities to not only generate economic resources for their own profit or in support of their academic units and institutions, but also to create within the academy social and political change platforms. (Mars & Rios-Aguilar, 2010, p. 444)

This commitment of universities and public administrations has been based mainly on sizable investments of public money for universities and the use of these investments to stimulate job creation and economic growth (Bienkowska & Klofsten, 2012; Etzkowitz & Klofsten, 2005; Fini et al., 2018; Vac & Fitiu, 2017). This position of support toward USOs has been carried out on different fronts and with several varieties of assistance, with training for acquisition of entrepreneurial skills being one of the ones most used by

all of the administrations involved (Lackéus & Williams Middleton, 2015; Nabi et al., 2017).

Indeed, according to Hmieleski and Powell (2018), personal skills are crucial to the decision to go into business. Not in vain, the study of the individual characteristics of entrepreneurs is one of the three main lines of research on academic entrepreneurship, with 26.9% of articles in that literature referring to this aspect (Miranda et al., 2018). Along the same lines, authors such as Gorgievski and Stephan (2016) consider that it is really the personal psychological characteristics of entrepreneurs that determine their intentions and their success, this being a relatively young and novel subfield in the study of entrepreneurship (Gorgievski & Stephan, 2016). Thus, these authors point out that the most popular topic in this subfield is the investigation of the relationship between entrepreneurial or personal characteristics and entrepreneurial intention (EI).

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For an entrepreneurial venture to be carried out, two fundamental elements are necessary: there must be an opportunity that can be exploited economically and the individual must have the intention and capacity to pursue it (Fayolle et al., 2014; Hannibal et al., 2016). Of these two sine qua non conditions, the main theoretical focus of development has been on the factors that propel the entrepreneurship forward, the “push” factors, those elements that favor and are conducive to the enterprise, all of which are identified with *intention* (Bagozzi, 1992; Bird, 1988; Chen et al., 1998; Fayolle et al., 2014; Krueger et al., 2000; Lin, 2015; Matlay et al., 2012; Prodan & Drnovsek, 2010; Soria-Barreto et al., 2016). This EI is associated with real action (Ajzen, 1991; Sheppard et al., 1988); that is, the intention to go into business is identified with the act of doing so (Delmar & Davidsson, 2000; Kautonen et al., 2015). This owes to the potential entrepreneur’s perception of his or her desire (Bagozzi, 1992; Herman & Stefanescu, 2017), capacity (Ajzen, 1991; Ajzen & Madden, 1986; García-Rodríguez et al., 2016; Krueger et al., 2000), and the viability of the idea (Law & Breznik, 2017; Shapero & Sokol, 1982), factors that clearly determine one’s intention to go into business and initiate the action itself (Ibrahim & Mas’ud, 2016; Liñán, 2007). Given the objective of our work, we will focus on analyzing the literature on those psychological factors that determine EI. For this, the proven and well-known Big Five personal skills study model has been used.

The Big Five is a model for psychological study that seeks to construct a profile of the entrepreneurial personality (Gorgievski & Stephan, 2016). To this end, it focuses on the personal and psychological aspects and the intention to start a business enterprise, in accordance with that profile (Murugesan & Jayavelu, 2017). This article thus attempts to relate the five personality aspects established by the Big Five model—*openness*, *conscientiousness*, *extraversion*, *agreeableness*, and *neuroticism*, commonly called the OCEAN factors (Goldberg, 1981, 1990)—as background for the EI of academics through the variables of *attitude* and *perceived control*. That is, it tries to relate the personality characteristics of the proposed model as precursors of personal skills (Ahmetoglu, 2015) and of academic entrepreneurs’ attitude and perceived control, to try to find the “bottom-up behaviors of individual academic scientists,” as proposed by Hmieleski and Powell (2018). The importance of the present study lies both in the novelty of the application of this model, which to our knowledge has never been applied to the field of academic entrepreneurship before, and in the conclusions drawn from the results.

The present study is divided into six sections. The first section presents a brief review of the literature on the conception and suitability of the use of the proposed model. In the second section, the variables used in the study are stated, as are the hypotheses proposed in accordance with the literature. In the third section, the methodology used in the study is detailed. In the fourth section, the results of the study are

presented. In the fifth section, we present the discussion of this article. And finally, the conclusions derived from the study and the limitations of the study are reflected on.

Literature Review

The scholarship on academic entrepreneurship has studied extensively the influence of personal skills on the entrepreneurial intent of academics, although in most cases it has done so through the Theory of Planned Behavior (TPB) model (Ajzen, 1991, 2005; Ajzen & Madden, 1986). The TPB presents a solid base of investigation (Lortie & Castogiovanni, 2015), because it adds a new concept or value, *perceived control*, understood as a precursor to the behavior. In addition, TPB is a validated theoretical framework for predicting entrepreneurial and behavioral intention (Kautonen et al., 2015; Montano & Kasprzyk, 2015). This variable is identified as the difficulty perceived by an individual for carrying out an action. In this way, if the entrepreneur considers his or her skills adequate to create a business, he or she will try harder than if the perception is the opposite, in line with Bandura and Wessels’ (1997) concept of *perceived self-efficacy*. In addition, this factor becomes the most influential of all in the decision to start a company (Bandura, 2012). Therefore, the TPB considers that there are three determinants of EI. The first, known as *attitude toward entrepreneurship*, is defined as the positive or negative assessment that the person has about entrepreneurship. This variable is so important that some authors, such as Fayolle and Gailly (2015), argue that entrepreneurship education programs should focus on this variable if they want to increase EI. The second of these, the *subjective norms*, considers the individual’s personal values and norms and the pressures exerted by the surrounding society or by persons of influence in the individual’s own circle on the action of going into business. Finally, the aforementioned *perceived control* is a concept very similar to *self-efficacy* (Van Gelderen et al., 2008), a concept coined by Bandura (1982, 1989) referring to the individual’s faith in his or her capacities, aptitudes, and skills to achieve success, according to the information available to the individual and the individual’s capacity to interpret it (Bandura, 1982, 1989, 2012; McGee et al., 2009; Solomon et al., 2008). Of these three elements, it is attitude and perceived control that can relate most directly to personal skills, which is why the Big Five is proposed as the antecedent of these two.

The Big Five personality approach has been widely used and discussed as a valid methodology for characterizing entrepreneurs in contrast to nonentrepreneurs (Antoncic et al., 2015; Şahin et al., 2019). This approach to personality, developed in the 1980s and 1990s (Goldberg, 1981, 1990), establishes that there are five influential factors in entrepreneurship. These five factors, recognized by the acronym OCEAN (*openness*, *conscientiousness*, *extraversion*, *agreeableness*, and *neuroticism*), turn out to be the determinants of EI.

The Big Five model, as proposed, seeks to identify a psychological profile as a prototype of an entrepreneurial profile (Butz et al., 2018). This research approach is relatively recent (Gorgievski & Stephan, 2016) and focuses, fundamentally, on aspects of personality as determinants and indicators of the intention to become a self-employed entrepreneur (Omorede et al., 2015). Thus, the proposed approach is not only useful and validated but perfectly complementary with other approaches (Gorgievski & Stephan, 2016), such as TPB, considering personal psychological characteristics as a background of entrepreneurial attitudes (Brandstätter, 2011). Kolvereid and Isaksen (2006) have already considered the Big Five traits as antecedents of EI, although, to our knowledge, this relationship has not been applied to the field of academic entrepreneurship. Some of them also have studied Big Five as antecedent or determinant of other elements, as risk aversion (Sahinidis et al., 2020)

For these reasons, the Big Five and the Measure of Entrepreneurial Tendencies and Abilities (META) constructs, created by Ahmetoglu, have been used to carry out this study. The META approach (Ahmetoglu, 2015) also considers the Big Five, although it considers personal skills not as antecedents of entrepreneurship, but rather as independent of the other factors and equally affecting entrepreneurship. Specifically, Ahmetoglu takes the constructs of opportunism, creativity, and proactivity. For him, *opportunism* is an entrepreneurial capacity, properly speaking, consisting of the identification and economic use of a business opportunity that has not been developed or has feasibility possibilities. *Creativity* also becomes an entrepreneurial capacity, defined as the ability to innovate, to create something different, or perceived as different. Finally, the third skill, *proactivity*, consists of the entrepreneur's ability to anticipate changes and adapt and take advantage of them. For Ahmetoglu (2015), these three skills determine EI, although they will be influenced by personal skills, which can be measured using the Big Five model.

Hypothesis and Conceptual Framework

Taking into account the main theoretical and empirical relationships highlighted above, and taking into consideration the work of Ahmetoglu (2015), we propose a model to explain the EI of Spanish academics on the basis of their personal skills (OCEAN), their skills related to enterprise (creativity, opportunism, and proactivity), their perceived control, and their attitude (see Table 1). As a background of entrepreneurial skills, the Big Five personality proposal has been considered, while these entrepreneurial skills will be a second-order variable formed by creativity (CREA), opportunity (OPPORT), and proactivity (PROACT). Our model (see Figure 1) is completed with the inclusion of two variables as predictive factors of EI, namely perceived control (PC) and attitude (ATT).

Next, the hypotheses to be contrasted are proposed, starting with an analysis of the five factors that determine the proposed EI (Big Five):

Openness refers to the entrepreneur's intellectual curiosity and ability to seek new experiences and generate new ideas. Normally, an entrepreneur must be artistic, insightful, "creative, innovative, imaginative, reflective, and untraditional" (Zhao & Seibert, 2006, p. 261), that is, be differentiated from the rest of society in terms of ability to look ahead and develop something new. In the case of academic entrepreneurship, this aspect is even more reinforced, as the academic entrepreneur develops goods or services based on research and knowledge, which usually involves products that either are novel or have expansive uses previously unknown (Walter et al., 2006). This characteristic is usually related to intelligence (Zhao & Seibert, 2006), especially with what is known as divergent intelligence (Ames & Runco, 2005). Indeed, this type of innovative thinking is one of the basic requirements for entrepreneurship, insofar as it deals with the ability to explore new solutions to existing problems and develop new ideas, methods, or strategies (Clausen & Rasmussen, 2013; Martin, 1994; Miranda et al., 2018).

Conscientiousness refers to the degree of motivation that must be associated with entrepreneurial behavior. This motivation will lead to aspects such as hard work, the need for achievement, efficiency, accuracy, and perseverance. According to the review carried out by Zhao and Seibert (2006, p. 261), it is precisely this factor that "has been the most consistent personality predictor of job performance across all types of work and occupations," as established by Barrick et al. (2001). Therefore, this is expected to be the case in the field of academic entrepreneurship as well, because it is a demanding job that requires all these qualities.

Extroversion refers to the characteristic of those people who are known as "leaders," that is, those people who are sociable, adventurous, "assertive, dominant, energetic, active, talkative, and enthusiastic" (Costa & McCrae, 1992; Zhao & Seibert, 2006, p. 260). This characteristic is not exclusive to entrepreneurs; it is also a necessary factor for being a good manager. However, it is no less true that the entrepreneur must be a manager in the early stages of the company's birth, a key issue emphasized by the USO (Franklin & Wright, 2000; Grandi & Grimaldi, 2003; Lockett et al., 2005).

Agreeableness, at its best, can be described as the ability to have positive and healthy interpersonal relationships, to be dedicated, generous, and reliable as well as confident and careful. Zhao and Seibert (2006) warn that the overly agreeable person is gullible and overly eager to please and not likely to be the most successful entrepreneur (Zhao and Seibert, 2006). However, an entrepreneur must be able to create networks to launch and grow their company, as well as to work cooperatively to achieve success (Heirman & Clarysse, 2004; Krabel & Mueller, 2009; Vendrell-Herrero & Ortín-Ángel, 2010; Wright, 2007, p. 12). Howard and Howard (1995) show entrepreneur types as scoring average, rather than extremely high or low, on measures of agreeableness. In the case of academic entrepreneurs, this characteristic assumes a double aspect, since the ability to maintain

Table 1. Definition of the Construct.

Construct	Definition of the construct according to John and Srivastava (1999)
Openness	The degree to which an individual is original, curious about many things, and inventive
Conscientiousness	The degree to which an individual does a thorough job, is reliable, and perseveres until a job is finished
Extraversion	The degree to which an individual is talkative, full of energy, and emotionally expressive
Agreeableness	The degree to which an individual is helpful and unselfish with others, has a forgiving nature, and is generally trusting
Neuroticism	The degree to which an individual is tense, worries more than others, and is moody

Source: John and Srivastava (1999).

positive interpersonal relationships and a broad capacity for cooperation must occur both within the aspect of research and development and within commercial–financial relations (Fernandez-Alles et al., 2015; Hayter, 2015).

Neuroticism, finally, involves “individual differences in adjustment and emotional stability” and is characterized by “anxiety, hostility, depression, self-consciousness, impulsiveness, and vulnerability” (Costa & McCrae, 1992; Zhao & Seibert, 2006, p. 260). The entrepreneur must have a low level of neuroticism, that is, be characterized by significant self-confidence (Simon et al., 2000) and strong resistance in the face of stress (Rauch & Frese, 2007).

From all this, we can establish the following hypothesis:

H1: The personal skills described by the Big Five positively influence the acquisition of entrepreneurial personality variables.

With respect to the relationship of these personal factors with entrepreneurship, they have been considered as antecedents of entrepreneurial skills—defined as proactivity, creativity, and opportunism—and, indirectly, as precursors to intention to start a business, following Gorgievski and Stephan (2016). For this, three fundamental entrepreneurial skills have been considered.

The first, *opportunism*, is understood as the propensity to recognize and exploit a business opportunity, a key element for entrepreneurship (Baron & Henry, 2010; Kuratko, 2003; Ozgen & Baron, 2007). Indeed, some authors, such as Shane and Venkataraman (2000), consider opportunism to be the key and central element in entrepreneurial intent, being a skill that not all people possess. The role of this ability is so fundamental and central that authors such as Baron and Henry (2010) consider the identification and use of the

opportunity to be the two most important aspects of entrepreneurship. Although opportunity is an objective aspect, opportunism, understood as identification and use of it, is something personal, a skill, a cognitive process which can be measured and whose effect on entrepreneurship is clear (Baron and Henry, 2010; Shane and Venkataraman, 2000).

Second of the relevant aspects or entrepreneurial skills that motivate EI is *creativity*. Such is its importance that some authors, such as Dess et al. (1999), identify creativity as a synonym for entrepreneurship, as entrepreneurship is nothing more than the activity of generating something new and innovative and obtaining commercial results from it. This aspect is especially interesting and important in the field at hand, because academic entrepreneurship is based precisely on the development of research-based products that are innovative and able to shake up the status quo.

Finally, *proactivity* is defined as the trait which steers a person toward the execution or change of oneself or the environment in which the individual is developing, that behavior which motivates people to “take action to influence their environments” (Bateman & Crant, 1993, p. 103), or in other words, the entrepreneur’s ability to anticipate future demand and anticipate changes in the environment (Fini & Toschi, 2016). According to Lumpkin and Dess (2001), proactivity is a fundamental skill in the process of wealth creation and, therefore, a key aspect in the intention to become an entrepreneur. This proactivity is closely related to entrepreneurship and can be defined as one of the basic characteristics of the entrepreneur (Bakker & Demerouti, 2014; Frese & Gielnik, 2014; Kickul & Gundry, 2002), of the intention to start a business (Crant, 1996), and of professional success (Erdogan & Bauer, 2005; Fuller & Marler, 2009; Ng et al., 2005; Uy et al., 2015).

Apart from this, entrepreneurial skills, such as confidence and the ability to identify an opportunity, are directly related to one’s perceived control in executing that behavior (Carr & Sequeira, 2007), to attitude (Miranda et al., 2017), and to EI, though in this case it may be an indirect relation (Miranda et al., 2017).

H2a: Entrepreneurial skills positively affect perceived control.

H2b: Entrepreneurial skills positively affect attitude.

H2c: Entrepreneurial skills positively affect EI.

To begin with, *perceived control* is defined as confidence in one’s own ability to control both facilitators and barriers to entrepreneurship (Ajzen, 1991). According to the theory, perceived control exerts a positive influence on the intention to be an entrepreneur, although some authors such as Obschonka et al. (2015) have concluded that this effect is insignificant or null. Indeed, perceived control with respect to one’s own entrepreneurial capacities is, according to some previous studies, the most influential aspect for EI (Nishimura & Tristán, 2011).

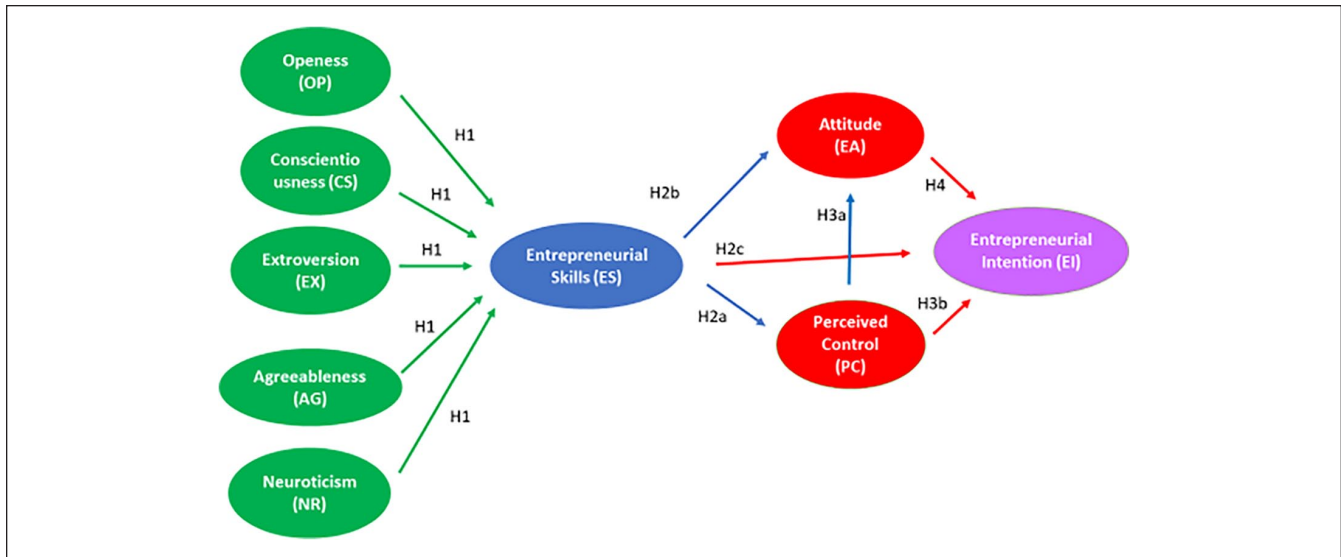


Figure 1. Proposed model.

Likewise, perceived control is also closely related to attitude toward entrepreneurship: the greater the perceived control, the more positive the attitude toward entrepreneurship becomes. As Kautonen et al. (2013) posited in their Hypothesis 1, perceived control positively affects the intention to go into business.

H3a: Perceived control positively affects attitude.

H3b: Perceived control positively affects EI.

Finally, *attitude* refers to the individual evaluation (favorable or unfavorable) made by the person, in this case the academic, about entrepreneurship (Ajzen, 1991). That is, it shows how the academic feels about the option of entrepreneurship. This attitude has a positive influence on EI, according to Obschonka et al. (2015) and to Kautonen et al. (2015). Authors such as Law and Breznik (2017) have also reached conclusions along the same lines in their studies. Specifically, these authors consider attitude to be more important in women than in men, although attitude is paramount and significant for both genders in the case of engineering students.

H4: Attitude positively affects EI.

Methodology

Sample

To carry out the research, a database of almost 33,000 academics from 82 Spanish universities was created. This database was generated over a period of 4 months by taking the email addresses of academics working in Spanish universities one by one. To do this, the email of each academic was taken from the web page of the department to which each academic

belonged. The sample of this study is composed of a total of 799 respondents, all academics who engage in their professional activity in Spain, chosen by random sampling. The questionnaire was sent during the month of January 2019. Of the participants, 47.06% were women and 52.94% were men. These data are close to the representativeness of both genders in the Spanish university, according to the data of the report *La Universidad española en cifras, 2019* (The Spanish University in Figures, 2019) published by the Confederation of Rectors of the Universities of Spain (41% of teaching staff and 49.5% of research staff are women). For number of responses, *Catalonia* occupies first place, representing 20.28% of the total, followed by the *Valencian Community* (11.01%), *Andalusia* (9.76%), and *Madrid* (8.89%). Of the respondents, 55.94% have the status of officials, the rest being faculty. In the breakdown of academic fields, the biomedical field (38%) stands out, followed by the scientific (20%), technical (15%), social science (14%), and humanities (13%) fields.

Measurements

After analyzing the various factors included in the literature on academic entrepreneurship, it is necessary to gauge how the personal psychological characteristics of academics influence their EI.

In this study, the five variables included in the Big Five theory—openness, conscientiousness, extraversion, agreeableness, and neuroticism—have been used as indicators of personality. Each of them was measured with five questions, chosen from among the 10 of each factor proposed by Goldberg (1992) and by Leutner et al. (2014). Each of these items was assessed using a Likert-type scale of 1 to 5, all of them being included in the first- and second-order partial least squares (PLS) analysis to be part of each construct.

Table 2. Heterotrait–Monotrait Ratio (HTMT).

Construct	Actit	Agreeab	Conscient	Control	Entrepre	Extrov	Intent	Neurtoc
Actit								
Agreeab	0.156							
Conscient	0.104	0.149						
Control	0.721	0.155	0.090					
Entrepre	0.749	0.336	0.202	0.837				
Extrov	0.327	0.494	0.244	0.340	0.533			
Intent	0.742	0.110	0.069	0.526	0.532	0.200		
Neurtoc	0.172	0.402	0.242	0.215	0.480	0.341	0.050	
Open	0.390	0.309	0.165	0.472	0.895	0.379	0.288	0.414

For the definition of entrepreneurial skills, three constructs have been used: opportunism (measured by 10 items on a Likert-type scale of 1–5), proactivity (measured on the same Likert-type scale and composed of 10 items), and creativity (measured on the same scale and composed of a total of two items). These three elements were incorporated into the first-order PLS analysis, then purified, and used as latent variables to form the second-order entrepreneurial skills construct.

Perceived control was measured with nine items, on a Likert-type scale of 5, while attitude was calculated through four items, also on a Likert-type scale of five levels.

Finally, EI was measured as a construct composed of four items, measured on the same Likert-type scale as the other variables.

Data Analysis

The method chosen for the data analysis has been the PLS regression technique (Chin, 1998). In this study, PLS has been used, on one hand, because the technique is designed primarily for predictive analysis in which the problems explored show complexity, and on the other hand, because theoretical knowledge has not yet reached a level of critical maturity. In addition, PLS has advantages over linear structural relationships (LISREL) in the initial stages of development and for verification of theories, where the proposed models are of an exploratory and nonconfirmatory nature and few models are empirically validated, as is the case here. In addition, the PLS technique is appropriate for analysis of measurement models that combine formative and reflective indicators (see Diamantopoulos & Winklhofer, 2001). The model was estimated using SmartPLS 3.0, and the significance of the parameters was established using a bootstrap resampling procedure of 500 subsamples of a size equal to the original sample.

For the construction of the entrepreneurial skills variable, a second-order construct has been used, while for the other variables, first-order constructs have been used. The first-order constructs employ a reflective measurement model, while the second-order construct is of a formative nature (see Appendix B). In this case, the second order is composed of the variables opportunism, creativity, and proactivity.

Results

Assessment of the Measurement Model

The measurement model (see Appendix C) has been analyzed taking into account the individual reliability of the items and the discriminant validity of the constructs (Hulland, 1999). Individual reliability, as noted, is evaluated by observing the value of the loadings of each item (λ) that correspond to the correlations of each indicator with its construct. Initially, the value of a loading must be greater than or equal to 0.707 for an indicator not to be rejected (Carmines & Zeller, 1979). Therefore, loadings greater than or equal to 0.707 indicate the individual reliability of the acceptable item. However, several researchers believe that this rule should not be so rigid in the early stages of the development of scales (Chin, 1998; Hair et al., 2014) or when the scales apply to different contexts (Barclay et al., 1995) and that values of 0.50 or 0.60 may be acceptable. Other authors (Bagozzi & Yi, 1988) propose a value of 0.6 as an item-elimination criterion. In this work, the decision adopted has been to make 0.65 the minimum value of the loading of an item to accept its individual reliability. Subsequently, those cases in which an indicator can present a value close to 0.65 will be analyzed individually; when this occurs, it will be decided to keep the item if its removal does not imply significant improvement in the average variance extracted (AVE) of the construct. All loadings of reflective constructs exceed the reference value of 0.67 (Carmines & Zeller, 1979), with the exception of 19 items that have been removed from the analysis (see Appendix A).

Finally, to evaluate the discriminant validity of the constructs, it was established that no item would present higher loadings in other constructs than the one it was intended to measure (Barclay et al., 1995). A construct will have discriminant validity if its AVE is greater than the square of the correlations of its construct with the others (Fornell & Larcker, 1981). All model constructs have discriminant validity, so we can proceed to evaluate the structural model. The highest value of the heterotrait–monotrait ratio of correlations (HTMT) is 0.749 (see Table 2), which is below 0.9 and thus supports discriminant validity (Henseler et al., 2015).

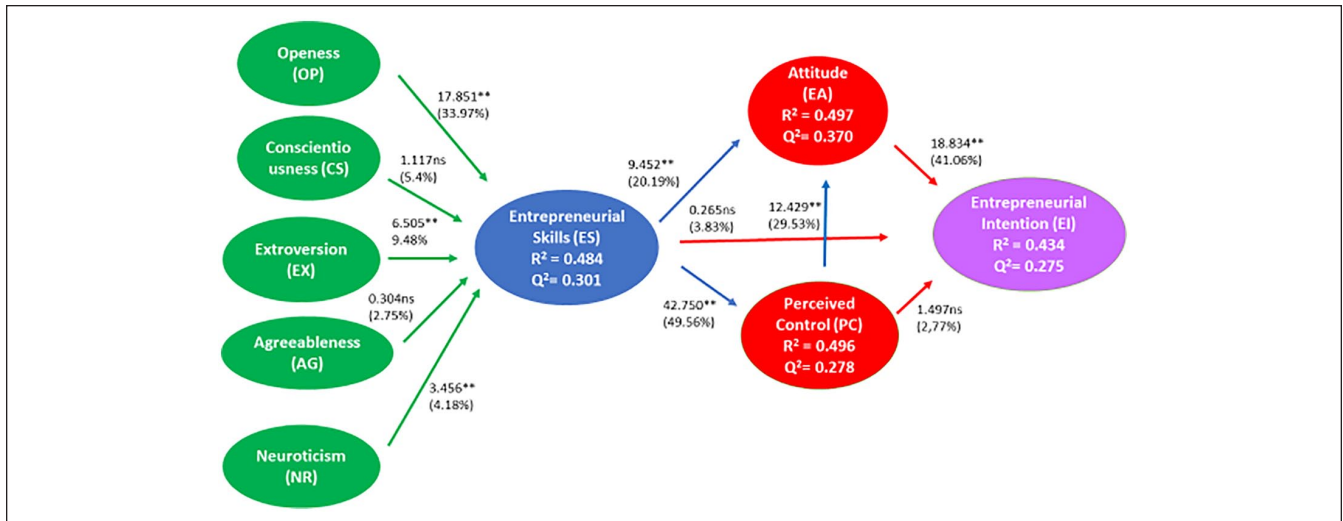


Figure 2. Estimation of the structural model.

Analysis of the Entrepreneurial Skills Formative Measurement Model

Formative indicators are assessed by establishing their indicator validity, the absence of multicollinearity, and nomological validity. The outer loadings of the three indicators of entrepreneurial skills exceeded the recommended cut-off point of 0.5, supporting indicator validity (Hair et al., 2016). Therefore, there is no correlation or bidirectional relationship among the predictor variables, and all the predictor or explanatory variables are suitable to form a causal relationship using regression (Chehimi et al., 2019). Multicollinearity issues were assessed through the variance inflation factor (VIF; see Appendix A). The absence of multicollinearity among the indicators was confirmed as the VIFs of all formative indicators were less than the maximum value of 5 (Hair et al., 2016).

The weights of the three components of perceived quality and their significance were also examined. All weights are significant, which supports the relevance of the three indicators for the construction of the formative, higher order construct of entrepreneurial skills (Hair et al., 2016). Furthermore, all weights are higher than 0.1 and their signs are all positive, consistent with the underlying theory (Andreev et al., 2009).

The nomological validity of the formative entrepreneurial skills construct was supported as the hypothesized relationships between entrepreneurial skills and the other constructs in the model were significant (with the exception of the intention construct) and in the intended direction (see Figure 2), indicating that the construct behaves as it should within a nomological network (Henseler et al., 2009).

Analysis of the Structural Model

Figure 2 shows the results of the estimation of our structural model. The arrows indicate causal relationships, and the number next to each arrow represents its standardized coefficient,

Table 3. Model Fit.

Construct	R ²	R ² adjusted
ACT	0.497	0.496
PC	0.496	0.495
EA	0.484	0.481
EI	0.434	0.432

PC = perceived control; EI = entrepreneurial intention; ACT=attitude; EA=entrepreneurial abilities.

with the product of that standardized coefficient and the correlation coefficient between the two constructs appearing in brackets, expressed as a percentage (Falk & Miller, 1992). Using the bootstrap resampling technique with 500 subsamples, the *t* test values were obtained and the significance of the established causal relationships was verified.

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 as it contributes to explaining 43.4% of the variance of EI, 48.4% of EA, 49.6% of the PC, and 49.7% of the ACT (see Table 3). The value of goodness of fit that is generated through the standardized root mean square residual (RMSR) that is equal to 0.068 is less than 0.080, which means that our model fits the empirical data (Henseler et al., 2015).

Discussion

Of the Big Five components, only three are influential in entrepreneurial skills. Openness, extroversion, and the absence of neuroticism are antecedents of such entrepreneurial skills. This implies that such personal skills enhance the entrepreneurial skills themselves. In this way, we can only accept H1 partially, as not all personal skills positively

influence entrepreneurial skills, but only three do. In the case of these three skills, it can be affirmed that the results are in line with the literature. Thus, according to Zhao and Seibert (2006), the ability to seek new experiences and have new ideas, that is, openness, is a personal skill that ends up enhancing the acquisition or development of entrepreneurial skills. Likewise, the personal ability to be a good leader, capable of being communicative and enthusiastic, positively influences entrepreneurial skills, in line with Costa and McCrae (1992) and with Zhao and Seibert (2006). Finally, self-confidence and endurance in the face of stress-generating situations—that is, the absence of neuroticism—also represent a positive background for entrepreneurial skills (Rauch & Frese, 2007; Simon et al., 2000). However, conscientiousness and agreeableness are not influential in entrepreneurial skills. The first of these results contradicts the result obtained by Zhao and Seibert (2006) and could be explained as a common skill that all people possess, thus not being specific or unique to entrepreneurs. This implies that the degree of motivation and hard work of the entrepreneurial academics is the same as that of those who have no EI, being more focused, perhaps, on academic promotion and relevance, an aspect that also requires high doses of motivation and hard work. Regarding agreeableness, our results also contradict the literature ((Heirman & Clarysse, 2004; Vendrell-Herrero & Ortín-Ángel, 2010; Wright, 2007), as no evidence is found that high rates of agreeableness positively influence entrepreneurial skills. This is congruent with literature.

In turn, entrepreneurial skills act as determinants of intention—not directly, but rather through control and attitude. In this way, attitude and control are the variables that will enhance the intention of starting an academic company. That is, the model shows that H2a and H2b are accepted, while H2c must be rejected. These results are in line with the conclusions of the studies by Crant (1996), Dess et al. (1999), Shane and Venkataraman (2000), and Baron and Henry (2010).

Regarding the influences of the attitude variable, we can affirm that attitude directly influences intention, and decisively so, while control does so indirectly, through attitude. This result, which shows that control does not directly influence intention, is in line with the study by Obschonka et al. (2015). This implies that attitude is the variable that will directly determine EI, according to authors such as Obschonka et al. (2015) and Kautonen et al. (2015). Therefore, we must accept H3a and H4 and reject H3b.

Conclusions and Limitations

The present study offers a series of theoretical and practical conclusions, especially useful for those responsible for

public and university policies. From the theoretical point of view, this research presents as an innovation the application to academic entrepreneurship of the well-known Big Five model, which has not previously been used in this area. In addition to this, the consideration of the Big Five traits as antecedents of the entrepreneurial skills raised by Ahmetoglu (2015) is a contribution in that it is those people who have certain psychological characteristics that, in turn, evolve into entrepreneurial traits or skills. Likewise, entrepreneurial skills are what determine attitude, which is why they must be developed through public policies that result in the improvement of these capacities, as a method to increase EI among academics.

However, from the practical point of view, the results show that it is attitude that directly influences the EI of academics. This implies, both for public policy promoters and for those responsible for promoting university entrepreneurship, that measures must be taken to act on these findings if increasing the entrepreneurship rate of academics is truly desired. Along these lines, those aspects that have to do with the entrepreneur's academic vision and with one's attitude toward entrepreneurship should be encouraged.

By the same token, perceived control, which indirectly influences intention, is another factor to be considered by policy makers. In this sense, activities such as entrepreneurship training and business skills should be promoted, so as to increase the degree of control perceived by academics and, in this manner, boost entrepreneurship.

In sum, entrepreneurial skills are the key element in the EI of Spanish academics, being determinants of attitude and control, which is why it is absolutely necessary to focus public policies on them. Along these lines, entrepreneurial skills become a vitally important element when it comes to developing the intention to become an entrepreneur.

This study has some limitations that must be taken into consideration and must be resolved by future studies. First, the sample, although representative, may not be broad enough to generalize the results and to compare different universities or regions. Second, this study deals with a specific moment in time, so it would be necessary to repeat the research over time, with the aim of discovering the evolution of the different determinants of entrepreneurship and detecting possible changes in them.

Finally, this study can be improved by comparing the effectiveness of the same set of variables *ex ante* and *ex post*, with the purpose of validating the methodology and knowing if, indeed, EI can be influenced through these variables.

Appendix A

Multicollinearity, VIF	Cronbach's alpha	rho_A	Composite reliability	Average variance extracted (AVE)
Actit	0.916	0.918	0.941	0.800
Agreeab	0.802	0.823	0.860	0.551
Conscient	0.761	0.906	0.854	0.663
Control	0.881	0.891	0.909	0.624
Entrepre	0.726	0.750	0.845	0.646
Extrov	0.841	0.845	0.887	0.611
Intent	0.840	0.855	0.894	0.680
Neurtoc	0.649	0.678	0.808	0.586
Open	0.716	0.759	0.840	0.638

Appendix B

Evaluation of the Measurement Model.

Construct	Factor loading	Cronbach's alpha	Composite reliability	AVE
<i>Personal skills</i>				
<i>Extroversion (EXT)</i>		0.841	0.887	0.611
EXT1: I am usually the soul of parties/meetings.	0.805			
EXT2: I feel comfortable surrounded by people.	0.762			
EXT3: I am one of those who always start conversations.	0.832			
EXT4: I speak with very diverse people in different situations.	0.751			
EXT5: I do not mind being the center of attention.	0.755			
<i>Agreeableness (AG)</i>		0.802	0.860	0.551
AG1: I am usually interested in others.	0.688			
AG2: I am empathic with the problems of the people.	0.741			
AG3: I have a "big heart."	0.726			
AG4: I give part of my time to others.	0.775			
AG5: I make people feel comfortable with me.	0.778			
<i>Neuroticism (NEURO)</i>		0.649	0.808	0.586
NEURO1: I usually stay relaxed most of the time.	0.739			
NEURO2: I rarely feel depressed.	0.790			
NEURO3: I do not have mood swings often.	0.905			
<i>Conscientiousness (CONS)</i>		0.761	0.854	0.663
CONS1: I pay attention to details.	0.845			
CONS2: I perform my tasks promptly.	0.764			
CONS3: I usually follow schedules meticulously.	0.679			
<i>Openness (OPEN)</i>		0.716	0.840	0.638
OPEN1: I have a very vivid imagination.	0.820			
OPEN2: I usually have excellent ideas.	0.879			
OPEN3: I understand abstract ideas quickly.	0.685			
<i>Attitude</i>		0.916	0.941	0.800
ATT1: The idea of being an entrepreneur attracts me.	0.894			
ATT2: If I had the resources and the opportunity, I would create a spin-off.	0.928			
ATT3: Being an entrepreneur would generate feelings of satisfaction in me.	0.920			
ATT4: I think if I set up a spin-off I would succeed.	0.832			
<i>Perceived Control</i>		0.881	0.909	0.624
PC1: I would be able to recognize an entrepreneurial opportunity before others.	0.806			
PC2: It would be able to make improvements in existing products in the market.	0.762			
PC3: I would be able to carry out market studies for new products.	0.783			
PC4: I would be able to create a marketing plan for my products.	0.821			
PC5: I would be able to convince future investors to invest in my business.	0.812			
PC6: I would be able to develop a strategic plan.	0.752			

(continued)

Appendix B. (continued)

Construct	Factor loading	Cronbach's alpha	Composite reliability	AVE
Dependent Construct				
<i>Entrepreneurial Intention (EI)</i>		0.840	0.894	0.680
EI1: In the foreseeable future, do you intend to participate in the founding of a spin-off?	0.896			
EI2: In your opinion, in the foreseeable future, what is the probability that a spin-off melts?	0.890			
EI3: I have recently searched for information on ways and means to found a spin-off.	0.785			
EI4: If my research had marketing potential, I would like to participate in the founding of a spin-off to commercialize the research.	0.713			

AVE = average variance extracted.

Appendix C

Determination of the Model.

Variable	Description
X	Exogenous predictive indicators
ξ	Latent exogenous variable (independent)
Y	Indicators of the endogenous variables
η	Endogenous latent variable (dependent)
β	Relationship of exogenous latent variable with exogenous latent variables
γ	Existing relationship of latent variable with endogenous latent variables
ζ	Structural model error
λ	λ_x Loadings of the indicators with the exogenous latent variable λ_y Loadings of the indicators with the endogenous latent variable
δ	Exogenous indicator errors
ε	Endogenous indicator errors

Exogenous indicators

ξ_1 (<i>Openness</i>)	ξ_2 (<i>Conscientiousness</i>)	ξ_3 (<i>Extroversion</i>)	ξ_4 (<i>Agreeableness</i>)	ξ_5 (<i>Neuroticism</i>)
$X_1 = \lambda_1^x \xi_1 \delta_1$	$X_6 = \lambda_6^x \xi_2 \delta_6$	$X_{11} = \lambda_{11}^x \xi_3 \delta_{11}$	$X_{16} = \lambda_{16}^x \xi_4 \delta_{16}$	$X_{21} = \lambda_{21}^x \xi_5 \delta_{21}$
$X_2 = \lambda_2^x \xi_1 \delta_2$	$X_7 = \lambda_7^x \xi_2 \delta_7$	$X_{12} = \lambda_{12}^x \xi_3 \delta_{12}$	$X_{17} = \lambda_{17}^x \xi_4 \delta_{17}$	$X_{22} = \lambda_{22}^x \xi_5 \delta_{22}$
$X_3 = \lambda_3^x \xi_1 \delta_3$	$X_8 = \lambda_8^x \xi_2 \delta_8$	$X_{13} = \lambda_{13}^x \xi_3 \delta_{13}$	$X_{18} = \lambda_{18}^x \xi_4 \delta_{18}$	$X_{23} = \lambda_{23}^x \xi_5 \delta_{23}$
$X_4 = \lambda_4^x \xi_1 \delta_4$	$X_9 = \lambda_9^x \xi_2 \delta_9$	$X_{14} = \lambda_{14}^x \xi_3 \delta_{14}$	$X_{19} = \lambda_{19}^x \xi_4 \delta_{19}$	$X_{24} = \lambda_{24}^x \xi_5 \delta_{24}$
$X_5 = \lambda_5^x \xi_1 \delta_5$	$X_{10} = \lambda_{10}^x \xi_2 \delta_{10}$	$X_{15} = \lambda_{15}^x \xi_3 \delta_{15}$	$X_{20} = \lambda_{20}^x \xi_4 \delta_{20}$	$X_{25} = \lambda_{25}^x \xi_5 \delta_{25}$

Endogenous indicators

η_1 (<i>Entrepreneurial ability</i>)	η_2 (<i>Attitude</i>)	η_3 (<i>Perceived control</i>)	η_4 (<i>Entrepreneurial intent</i>)
$Y_1 = \lambda_1^y \eta_1 \varepsilon_1$	$Y_4 = \lambda_4^y \eta_2 \varepsilon_4$	$Y_8 = \lambda_8^y \eta_3 \varepsilon_8$	$Y_{17} = \lambda_{17}^y \eta_4 \varepsilon_{17}$
$Y_2 = \lambda_2^y \eta_1 \varepsilon_2$	$Y_5 = \lambda_5^y \eta_2 \varepsilon_5$	$Y_9 = \lambda_9^y \eta_3 \varepsilon_9$	$Y_{18} = \lambda_{18}^y \eta_4 \varepsilon_{18}$
$Y_3 = \lambda_3^y \eta_1 \varepsilon_3$	$Y_6 = \lambda_6^y \eta_2 \varepsilon_6$	$Y_{10} = \lambda_{10}^y \eta_3 \varepsilon_{10}$	$Y_{19} = \lambda_{19}^y \eta_4 \varepsilon_{19}$
	$Y_7 = \lambda_7^y \eta_2 \varepsilon_7$	$Y_{11} = \lambda_{11}^y \eta_3 \varepsilon_{11}$	$Y_{20} = \lambda_{20}^y \eta_4 \varepsilon_{20}$
		$Y_{12} = \lambda_{12}^y \eta_3 \varepsilon_{12}$	
		$Y_{13} = \lambda_{13}^y \eta_3 \varepsilon_{13}$	
		$Y_{14} = \lambda_{14}^y \eta_3 \varepsilon_{14}$	
		$Y_{15} = \lambda_{15}^y \eta_3 \varepsilon_{15}$	
		$Y_{16} = \lambda_{16}^y \eta_3 \varepsilon_{16}$	

The relationship between the endogenous and the exogenous latent variables is as follows:

$$\eta_1 = \gamma_1\xi_1 + \gamma_2\xi_2 + \gamma_3\xi_3 + \zeta_1$$

$$\eta_2 = \gamma_4\xi_4 + \zeta_2$$

$$\eta_3 = \gamma_5\xi_5 + \gamma_6\xi_6 + \zeta_3$$

$$\eta_4 = \gamma_4\xi_4 + \gamma_5\xi_5 + \gamma_6\xi_6 + \zeta_4$$

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