THE ROLE OF THE ENTREPRENEUR IN NEW TECHNOLOGY-BASED FIRMS (NTBFs): AN ANALYSIS ACCORDING TO CONTEXT DEVELOPMENT

Guillermo Andrés ZAPATA HUAMANÍ[*]
Sara FERNÁNDEZ LÓPEZ
Isabel NEIRA GÓMEZ
Lucía REY ARES

Abstract

The importance of New Technology-Based Firms' (NTBFs) contribution to economic growth makes it necessary to understand the factors that condition their emergence. We use a logit model to measure the effect of individual characteristics of the entrepreneurial population on NTBF creation. The analysis is performed at global level, using the GEM database and distinguishing three groups of countries based on the country's development level (factor-, efficiency- and innovation-driven economies). Being under 35 years of age, having studied beyond secondary school, having work experience, knowing an entrepreneur personally and believing one has the ability to be an entrepreneur are factors with a positive and significant influence on technological entrepreneurship (TE). The results are similar independently of the context in which they were analysed. However, setting up NTBFs is more complex in factor-driven economies.

JEL Codes: L26, M13, O32

Key words: New Technology-Based Firms (NTBFs), Technological Entrepreneurship (TE), individual determinants, economic development

1. Introduction

Entrepreneurship plays a crucial role in economic development and employment growth (Vázquez-Rozas et al., 2010; Vita et al., 2014; Welsh et al., 2016). The magnitude of these effects is usually associated, however, with the type of business venture established. In the current context, technology-based ventures or new technology-based firms (NTBFs) have awakened growing interest from governments, industry and researchers, due to their tremendous potential to contribute to economic development (Audretsch, 1995; Bertoni, Colombo & Grilli, 2011)—to the point where NTBFs are often considered as a panacea in the attempt to stimulate economic growth (Coad & Reid, 2012). The contributions of NTBFs can be summarized in four important effects: they help to convert innovative ideas into economic opportunities; they generate competitiveness; they create employment; and they increase productivity (Kantis et al., 2002).

[*] Guillermo Andrés Zapata Huamaní (guillermo.zapata@usc.es) Departamento de Economía Financiera y Contabilidad, Sara Fernández López (sara.fernandez.lopez@usc.es), Departamento de Economía Financiera y Contabilidad, Isabel Neira Gómez (isabel.neira@usc.es), Departamento de Economía Cuantitativa, Lucía Rey Ares (lucia.rey@usc.es), Departamento de Economía Financiera y Contabilidad, University of Santiago de Compostela (Spain)

As entrepreneurship gains importance in political agendas as a mechanism to stimulate economic development, especially job creation, the factors that push the individual (entrepreneur) to create new firms are also garnering attention in the economic literature (Colombo & Grilli, 2010). Most empirical studies of determinants of new firm creation focus on more conventional entrepreneurship, and very few analyse the determinants of technological entrepreneurship (TE), considering the characteristics of the entrepreneur at individual level. Further, existing studies focus analysis on a country, region or industry.

Our study seeks to fill this gap in the literature on TE. Using a sample of 244,471 individuals in 70 countries drawn from the 2013 GEM database, we analyse the individual factors that determine founding of an NTBF and the extent to which these factors differ based on the development of the economies in which they are founded. Answering these questions is especially important because public policies to support NTBF creation usually vary according to type of economy. Knowing the individual determinants that drive NTBFs would help politicians to design more precise policies to support TE. From the scholarly perspective, our study also adds to the literature because few prior studies analyse the individual determinants of TE, and the studies that do tend to be descriptive and to focus on only one country, region or activity sector. Our study, in contrast, uses a discrete choice model with a broad sample of individuals in 70 countries classified according to degree of development of their economies.

The structure of this study begins with this introductory section. The second section presents the literature review and proposal of the hypotheses. Next, the third section describes the sample, data, variables and econometric models. In the fourth section, the authors provide the results of the descriptive and econometric analyses. Finally, the fifth section presents the conclusions drawn from the main findings and recommendations.

2. Literature review and proposal of hypotheses

While many studies analyse the individual factors influencing entrepreneurship in general, few focus on TE—the founding of so-called NTBFs or business initiatives based on new technologies, as in the case of academic or non-academic start-ups or spin-offs. Reviewing these empirical studies enables us, however, to identify the most frequently recurring individual factors influencing TE.

Gender

As in conventional entrepreneurship, a higher percentage of entrepreneurial initiatives are founded by men than by women. Studies by Westhead and Storey (1994) and Harvey (1994) provide evidence of this difference in the United Kingdom, and Rodríguez et al. (2013), Zapata et al. (2014a) and Sánchez-Cañizares and Fuentes-García (2013) provide evidence in Spain. According to Rodríguez et al. (2013), the literature attributes the lower presence of women in TE to barriers traditionally associated with women's entrepreneurship but intensified further in the case of TE. Specifically:

1. In addition to having a very small presence of women in leadership, high-technology sectors have been characterized as sectors with an individualistic, competitive character (Mayer, 2008) that discourages women's initiatives, since

women are more likely than men to perceive this environment as more difficult and less appropriate for entrepreneurship (Zhao et al., 2005).

2. Women's motivation for founding a business is explained by the search for harmony between work and family life, which can lead them to orient their initiatives to sectors that demand less intense dedication than the technology sector (Ruiz et al., 2012), where the work hours required and high degree of flexibility expected conflict with workers' family responsibilities (Mayer, 2008).
3. When women create NTBFs, doubts about the firm's novelty threaten its growth and profitability (Morse et al., 2007). This threat occurs because women entrepreneurs usually have fewer resources available (Cliff, 1998) and face greater difficulty when they have to obtain these resources than do their male peers (Carter et al., 2003).
4. The difficulty that initiatives promoted by women have accessing financing is striking (Eurochambres, 2004), and this difficulty becomes more significant in sectors with high demands for investment, such as technology sectors (Ruiz et al., 2012). Hence, financial entities identify the sectors in which women begin their initiatives as less profitable, since they are usually conventional sector characterised by low profit margins (Neergaard et al., 2006). Further, women-owned firms tend to be smaller and to obtain lower profits than those managed by men (Rietz & Henrekson, 2000), factors that do not encourage granting of loans. Even when women set up a business in traditionally masculine sectors, they are considered higher-risk creditors, because banks consider that women have little experience in competitive sectors (Neergaard et al., 2006).

Based on the foregoing arguments, we propose the following hypothesis:

Hypothesis 1*: Being a woman has a negative effect on setting up an NTBF.*

Age: Entrepreneurship generally tends to involve young people, as shown in the empirical study by Reynolds et al. (2003), which finds that people ages 25-34 are more likely to set up a business. Various studies of technology-based entrepreneurship in Europe find that the average age of NTBF entrepreneurs is usually 30-50 years old (Westhead & Storey, 1994; Harvey, 1994; Donckels, 1989; Autio et al., 1989; Ortín et al., 2008, Zapata et al., 2014b). In the case of South America, however, Zapata et al. (2014c) find that technological entrepreneurs are younger (18-35). In a study of 316 women entrepreneurs in high-technology sectors in China, Xie and Lv (2016) find that 31% were under 30 when they established their company and 54.4% were in the 30-35 age range. We thus propose the following hypothesis:

Hypothesis 2*: The individual's age has a negative effect on setting up an NTBF.*

Education: The education level of entrepreneurs is generally high, especially in countries with developed economies, as in the case of the United States and Europe, where entrepreneurship is primarily motivated by exploitation of a business opportunity rather than by the need for subsistence. Such business opportunities involve the practical application of specialized knowledge, which is not acquired until the individual acquires a specific profession or specialization, and such a profession usually requires years of study.

Given its nature, TE is usually loaded with technical-scientific knowledge (Laranja & Fontes, 1998; Rickne & Jacobsson, 1999), knowledge provided by the firm's founders, who must usually have high education levels (Cunha et al., 2013). In reviewing studies

of NTBFs in Europe, Storey and Tether (1998) find that entrepreneurs have high levels of education. In studying gender in relation to TE, Fagenson and Jackson (1993) and Goldin (2006) find that women's education level has spectacularly increased their participation as owners of new businesses in high-technology sectors. Xie and Lv (2016) likewise find that over 90% of women technology entrepreneurs have a university degree. We can thus propose the following hypothesis:

Hypothesis 3*: The individual's education level has a positive effect on setting up an NTBF.*

Work experience: Entrepreneurs' prior work experience plays an important role in setting up a business, and for different reasons. Learning is a first reason. Prior work experience usually serves as a "test laboratory", since it is in doing work that entrepreneurs face diverse learning opportunities that subsequently serve to develop their own business. These opportunities can be found in various work situations that arise from changing workplace roles, problems and dilemmas inherent in work, in overcoming adverse situations (both internal and external) and even in learning from supervisors and colleagues at work (Van Gelderen et al., 2005).

Colombo and Grilli (2005) indicate that what founders of new businesses know and can do is closely related to what they learned in their former job in some organization. Such learning may be related to tasks of organizational management and control of employees' work (that is, giving instructions, delegating authority, designing incentives and monitoring results). The interaction and participation of individuals in prior jobs in other firms has a high impact on their future entrepreneurial intentions (Álvarez & Urbano, 2011).

The second main motive is access to new knowledge. Through their work experience, individuals enter into contact with customers and suppliers who can help them to identify needs that are not covered and can thus drive the entrepreneurial initiative (Forero-Pineda et al., 2010). In the same line of reasoning, the *knowledge spillover theory of entrepreneurship* (Audretsch, 1995; Audretsch & Lehmann, 2005) argues that the knowledge and ideas created in an existing organization in which the individual may be working can serve as a source of business opportunity. This theory also suggests that, because existing organizations are not usually aware of these new opportunities, the birth of a new firm is the "endogenous response" to this opportunity that is generated and not fully exploited (Colombelli, 2016).

The third reason for creating a business is the entrepreneur's social capital. As work brings the individual into contact with other agents, it constructs a social network (*networking*) that can encourage access to more resources in the individual's subsequent job, a crucial element from the perspective of the *resource-based view of the firm* and strategic management (Rougman & Verbeke, 2002). These social networks are especially important when they involve potential investors linked to the area of technology and innovation (Mustar, 1998). Insofar as entrepreneurs' degree of prior experience is fundamental to any business, we propose that:

Hypothesis 4: *Having previous work experience has a positive effect on setting up an NTBF.*

Income: One of the main barriers to new business creation is access to the capital required to set up the business when credit is limited and the initiative requires a significant initial investment. In such cases, individuals with few economic resources tend to have difficulty creating their own business (Ortín et al., 2008), whereas firms

created by wealthier individuals tend to be less affected *by financial constraints,* as wealthier individuals can rely on their personal wealth to finance the firm's operations (Colombo & Grilli, 2005). We thus propose that:

Hypothesis 5: *The individual's income level has a positive effect on setting up an NTBF.*

Entrepreneurship skills: Entrepreneurship is an activity with generally low representation in the population as a whole, although this representation differs from country to country depending on the country's economic development and the capabilities and needs of its population. On the individual level, entrepreneurship requires initiative and optimism, aspects that generally arise as the result of the personal baggage of abilities that the potential entrepreneur believes he/she has. Studies like Almus and Nerlinger (1999) propose the hypothesis that technical and engineering abilities are the skills that influence the growth of NTBFs. We thus propose that:

Hypothesis 6: *Believing one has the skills to set up a business has a positive effect on setting up an NTBF.*

Knowing entrepreneurs: In addition to education and work experience, knowing an entrepreneur personally forms part of learning to be an entrepreneur. Individuals who have carried out entrepreneurial initiatives often become models to follow, showing that success in entrepreneurship is possible. People who socialize often with entrepreneurs are thus more likely to start a business, among other reasons, because they build a perception of entrepreneurship as less uncertain and have greater confidence in their role as entrepreneurs when the occasion to set up business initiatives arrives (Álvarez & Urbano, 2011). Bosma et al. (2012) stress the importance of having models to follow, both before and after setting up a business, showing the relationships and similarity of characteristics between the nascent entrepreneur and the models to follow. In the specific case of university entrepreneurship, Bercovitz and Feldman (2008) and Stuart and Ding (2006) show that having models to follow is a great incentive for academic entrepreneurs. For Latin America, a positive image of the conventional entrepreneur is currently being constructed based on the new Latin American entrepreneur as involved in creative activities that require great effort and are innovative, and the traditional perception of the businessperson as landlord is waning (Kantis et al., 2014). An especially relevant case of the impact of knowing an entrepreneur is that of family antecedents in the area of entrepreneurship. This variable is traditionally analysed in the literature, since it affects the abilities, habits and attitudes toward entrepreneurship in questions such as business management (Gibb, 1997). Mechanisms of social learning theory explain the influence of parents and/or people with some degree of closeness and affective ties to the individual, who are involved in entrepreneurial initiatives (Bandura, 1977), and form part of the entrepreneur's personal baggage when deciding to set up a business. Álvarez and Urbano (2011) indicate that parents who involve their young or adolescent children in their businesses usually project a strong presence in their future entrepreneurial intentions. Specifically, in regions that traditionally have greater economic informality, the likelihood of having family entrepreneurial *background* is very high. The results of high rates of unemployment in past decades led to self-employment as a fairly common alternative, which could be a strong stimulus for new generations to start businesses (Álvarez & Urbano, 2011). We thus propose that:

Hypothesis 7: *Knowing entrepreneurs has a positive effect on setting up an NTBF.*

Table 1 summarizes the empirical results of the studies analysing the individual determinants of TE.

Table 1. Individual determinants of TE: results

Factor	Studies and results	Sign	Geographic area	Type of study
Gender (male)	- Westhead & Storey (1994) - Harvey (1994) - Rodríguez et al. (2013) - Zapata et al. (2014b)	(+) (+) (+) (+)	United Kingdom Spain Spain	Descriptive Econometric
Age	- Westhead & Storey (1994): 30-50 years of age - Harvey (1994): 30-50 years - Donckels (1989) - Autio et al. (1989) 34 years - Ortín et al. (2008) 30-50 years - Zapata et al. (2014b)	(+) (+) (+) (+) (+)	United Kingdom Spain Spain	Descriptive Econometric
Education	- Fagenson & Jackson (1993) - Goldin (2006) - Ortín et al. (2008): % founders with postgraduate, 25%-39% - Colombo & Grilli (2005) - Zapata et al. (2014b)	(+) (+) (+) (+)	United States United States Spain Italy Spain	Exploratory Descriptive Descriptive Econometric Econometric
Work experience	- Colombo & Grilli (2005): same sector and technological functions - Ortín et al. (2008): % founders, work experience (36%-51%); % founders, management experience (41%-95%) - Clarysse & Moray (2004) - Zapata et al. (2014b)	(+) (+) (+)	Italy Spain Europe Spain	Econometric Descriptive Descriptive Econometric
Income	- Colombo & Grilli (2005) - Hurst & Lusardi (2004) - Zapata et al. (2014b)	(+) (+)	Italy United States Spain	Econometric Econometric Econometric
Entrepreneurs hip skills	- Almus & Nerlinger (1999) - Shane & Venkataraman (2000) - Álvarez & Barney (2002) - Storey & Tether (1998) - Zapata et al. (2014b)	(+) (+) (+) (+) (+)	Germany United States Europe Spain	Econometric Exploratory Exploratory Econometric
Knowing entrepreneurs	- Roberts (1991) - Venkataraman (2004) - Zapata et al. (2014b)	(+) (+)	United States United States Spain	Exploratory Econometric

Finally, the context (geographic, economic, etc.) in which people seek to create NTBFs could influence the factors discussed above.

On the macro level, certain factors can have different effects on NTBF creation, depending on the country's degree of development. For entrepreneurship in general, Álvarez and Urbano (2011) show in a frame study that formal institutions can

condition firm creation; they also find that entrepreneurs' skills are only significant in counties with high income. In the field of technology, the entrepreneur's characteristics have not been analysed in the area of NTBFs taking into account countries' degree of development.

3. Research methodology

3.1. Sample and data

The sample used is based on information provided by the *Global Entrepreneurship Monitor* (GEM) project. The GEM project was born in the academic framework that attempts to find links between firm creation and economic growth. The project focuses on the individual and studies the activities of setting up and managing a business. It assumes that firm creation is a process in which the individual passes through different stages, from the business idea to consolidation of the business (Reynolds et al., 2005). The individual's behaviour is recorded in a survey addressed to adults 18-64 years of age (Adult Population Survey or APS), who compose a sample of at least 2,000 individuals per country or region participating in the project.

More specifically, the study data are taken from the 2013 GEM global database[1], in which 70 countries participated and 244,471 individuals were interviewed. The 70 participating countries were classified according to stage of economic development following the GEM methodology, which adopts the World Economic Forum classification (see Table 2).

Table 2. Countries participating in the 2013 GEM project based on stage of economic development

Stage of economic development	Countries
1st stage: factor-driven economies (13)	Philippines*, Vietnam, India, Iran*, Algeria*, Libya*, Ghana, Nigeria, Angola*, Uganda, Zambia, Malawi, Botswana*
2nd stage: efficiency-driven economies (31)	Russia*, South Africa, Hungary*, Romania, Poland*, Peru, Mexico*, Argentina*, Brazil*, Chile*, Colombia, Malaysia*, Indonesia, Thailand, China, Turkey*, Barbados*, Namibia, Lithuania*, Latvia*, Estonia*, Croatia*, Bosnia and Herzegovina, Macedonia, Slovakia*, Guatemala, Panama*, Ecuador, Surinam, Uruguay*, Jamaica
3rd stage: innovation-driven economies (26)	United States, Greece, Holland, Belgium, France, Spain, Italy, Switzerland, United Kingdom, Norway, Sweden, Germany, Singapore, Japan, South Korea, Canada, Portugal, Luxembourg, Ireland, Finland, Slovenia, Czech Republic, Puerto Rico, Trinidad and Tobago, Taiwan, Israel

*Countries in transition to the next stage of economic development.
Source: Developed by the authors from Sánchez-Escobedo (2011).

3.2. Definition of the variables

The dependent variable TE is a *dummy* variable that indicates whether the individual has set up a technology-based entrepreneurial initiative in the last 42 months. We

[1] Most recent database available at time of analysis.

construct this variable from the original GEM variable (*TEAyy*), which distinguishes "entrepreneurs" (1) from "non-entrepreneurs" (0). Within the group of entrepreneurs, we can distinguish TE thanks to the questionnaire, which includes a question on type of business that specifies, among other questions, the technological level of the sector in which the initiative was undertaken. The responses can thus be classified into "high-technology sector", "medium-technology sector" and "low-technology or non-technological sector", following the OECD classification. This is the source of the original dichotomous GEM variable "technology sector" (*TEAyyTEC*), which takes the value one (1) when the initiative undertaken belongs to a medium- or high-technology sector (technological entrepreneur) and zero (0) when the entrepreneur belongs to a non-technological or low-technology sector (non-technological entrepreneur).

Since the goal of our study is to identify the characteristics of technological entrepreneurs, the dependent variable will contrast the group "technological entrepreneur" of the variable *TEAyyTEC* with the group "non-entrepreneurs" of the variable *TEAyy*, taking values of one (1) and zero (0) respectively.

Table 3 summarizes the independent variables.

Table 3. Definition of the independent variables

Factors	Variables in BD GEM 2013		Question in APS survey	Values and coding
	Original	Recoded		
Gender	gender	gender	What is your gender?	Man (0) Woman (1)
Age range	age9c	age_range	What interval best describes your age?	18 - 24 years (1), 25 - 34 years (2), 35 - 44 years (3), 45 - 54 years (4), 55 - 64 years (5)
Highest level of education completed	UNEDUC	educ_level	Highest education level completed to date	No education (1), Primary school (2), Secondary school (3), Vocational training (4), Higher education (5)
Work experience	GEMWORK 3	work_exp	Which of the following situations best describes your current employment status?	Unemployed (0) Employed (1)
Family's national annual income bracket	GEMHHINC	inc_rage	Annual income bracket of your household, including other possible family members	Lowest third in country (1) Middle third in country (2) Highest third in country (3)
Entrepreneurshiip skills	suskill	entrep_skills	Do you have the knowledge, skills and experience required to set up a new business?	No (0) Yes (1)
Knowing entrepreneurs	knowent	know_entrep	Do you personally know anyone who has set up a new business in the last 2 years?	No (0) Yes (1)
Control variable				
Stage of economic development	CAT_GCR2	-	World Economic Forum Classification	Resource-driven countries (1) Competitiveness-driven countries (2) Innovation-driven countries (3)

As indicated above, all independent variables were obtained from the GEM Database and come from the 2013 APS survey. The original variables were modified. Further, the response categories "don't know" and "no answer" were treated as lost values. Finally, the last row of Table 3 includes the control variable "stages of economic development". This variable enables us to establish classifications of countries in the analysis to identify whether individual variables have different effects depending on the group analysed.

3.3. Model specification

The estimations belong to limited dependent variable models, specifically to binary response models, since this is the type of dependent variable in our study. The interest of this model lies principally in the response probability. The results of our dependent variable y , which takes the value 1 in the case of a "technological entrepreneur", and 0 in the case of a "non-entrepreneur", occur with the following probability:

y=1 with probabilityp; 0 with probability (1-p)

These models focus on the determinants of probability p that one result will occur rather than the alternative, which will occur with probability $1-p$. The response probability of interest is thus:

$$p_i = \Pr(y = 1|\mathbf{x}) = \Pr(y = 1|x_1, x_2, \ldots, x_k)$$

where $\mathbf{x}$ is the total number of independent variables. Since our interest is in modelling p as a function of the independent variables x_k, our binary response model is specified as follows:

$$p_i = \Pr(y = 1|\mathbf{x}) = F(\beta_0 + \beta_1 x_{\text{gender}} + \beta_2 x_{\text{age}} + \beta_3 x_{\text{education}} + \beta_4 x_{\text{employmentstatus}} + \beta_5 x_{\text{income}} + \beta_6 x_{\text{skills}} + \beta_7 x_{\text{knowingentrepreneurs}} + \beta_8 x_{\text{stageofdevelopment}}) = F(\mathbf{x}_i'\beta)$$

where $\mathbf{F(\cdot)}$ is a specific parametric function of $\mathbf{x}_i'\beta$ and, as a nonlinear function, ensures that the estimated response probabilities are strictly between zero and one ($\mathbf{0 < "\ F"\ (\cdot) < 1}$) .To analyse our data, we use the *logit* model from among the existing nonlinear models, for which we specify $\mathbf{F(\cdot)}$ as the logistic function:

$$\mathbf{F}(\mathbf{x}_i'\beta) = \frac{e^{\mathbf{x}'\beta}}{(1 + e^{\mathbf{x}'\beta})} = \Lambda(\mathbf{x}'\beta)$$

which is the cumulative distribution function (adf) of the logistic distribution. Further, it is an increasing function, in which $\mathbf{F(\cdot) \to 0}$ as $(\mathbf{x}_i'\beta) \to -\infty$, and $\mathbf{F(\cdot) \to 1}$ as $(\text{"}\mathbf{x}\text{"}_i{}^{\text{"}\prime\text{n}}\beta) \to +\infty$.

4. Research results

4.1. Descriptive analysis

The incipient TEA (*Total Entrepreneurship Activity*) index, which measures percentage of the population in the 18-64 age range that has been involved in a recently created entrepreneurial activity (up to 42 months of activity) within the last 12 months, reached a worldwide level of 12.42% for 2013. The TEA for the initiatives in the medium- and high-technology sectors is relatively low, representing 0.47% of the world population (Table 4). Of the total number of entrepreneurial initiatives begun 2013, 3.81% would then be technology-based. For each independent variable, in addition to using contingency tables as in the previous table, we perform an independent samples test using equality of variances and means, comparing the groups "non-entrepreneur" and "technological entrepreneur", as shown in Table 5.

Table 4. TEA by technology level (%), 2013

	Total population	Total entrepreneurship
Technological entrepreneur	0.47	3.81
Non-technological entrepreneur	11.95	96.19
Total Entrepreneurship Activity: TEA	12.42	100.00

Source: Developed by the authors from 2013 global GEM 2013

Table 5. Profile on non-entrepreneur and technological entrepreneur (% of individuals not involved in entrepreneurial initiatives vs. those involved in high- and medium-tech sectors)

		Non-entrepreneur	Technological entrepreneur
Gender	Male	48.42	78.34
	Female	51.58	21.66
	Equality of variance		*0.0000*
	Equality of means		*0.0000*
Age range	18-24 years	17.64	17.40
	25-34 years	23.89	32.28
	35-44 years	22.41	25.52
	45-54 years	20.03	16.77
	55-64 years	16.03	8.03
	Equality of variance		*0.0000*
	Equality of means		*0.0000*
Highest education level completed	No education	3.26	0.73
	Primary	9.64	3.01
	Secondary	50.22	34.70
	Vocational	12.83	13.84
	Higher education	24.06	47.72
	Equality of variance		*0.0059*
	Equality of means		*0.0000*
Employment status	Employed	52.81	87.30
	Unemployed	47.19	12.70
	Equality of variance		*0.0000*
	Equality of means		*0.0000*
National income bracket	Lowest third	38.37	22.46
	Middle third	31.67	27.95
	Upper third	29.96	49.59
	Equality of variance		*0.0000*
	Equality of means		*0.0000*
Entrepreneurship skills	Skills	46.64	86.17
	No skills	53.36	13.83
	Equality of variance		*0.0000*
	Equality of means		*0.0000*
Knows entrepreneurs	Knows	32.88	66.03
	Does not know	67.12	33.97
	Equality of variance		*0.1265*
	Equality of means		*0.0000*

Source: Developed by the authors from GEM 2013

Based on the descriptive analysis, we can construct a general profile of the technological entrepreneur that includes the following characteristics: male, usually 25-44 years of age, with an education level that primarily includes higher education; works actively and has an annual family income in the highest third of his/her country; believes he/she has the skills and knowledge to be an entrepreneur; and has mentors in his/her family and social environment who are connected to entrepreneurship.

4.2. Econometric analysis

To identify the individual characteristics that determine setting up a TE, we used the logistic regression or *logit*, estimating the probabilities of being or not being a technological entrepreneur. Table 6 shows the results of these estimations. Further, to compare, we performed estimations for each group, controlling for stage of economic development in the individual's country of residence.

Table 6. *Logit* estimation of probability of being or not being a technological entrepreneur

Variables	All countries	Factor-driven countries	Efficiency-driven countries	Innovation-driven countries
Gender - Female	-1.05*** (0.08)	-0.57* (0.27)	-1.27*** (0.13)	-0.89*** (0.13)
Age range (ref.: 35 - 44 years)				
18 - 24 years	0.41*** (0.11)	0.44 (0.35)	0.47** (0.15)	0.41* (0.20)
25 - 34 years	0.27** (0.09)	0.29 (0.32)	0.40*** (0.12)	0.08 (0.14)
45 - 54 years	-0.13(0.10)	-0.05 (0.42)	-0.11 (0.14)	-0.16 (0.15)
55 - 64 years	-0.33*(0.13)	-0.32 (0.63)	-0.33 (0.20)	-0.33 (0.19)
Highest education level completed (ref.: secondary education)				
No education	-0.99* (0.42)	-1.62* (0.73)	-0.61 (0.51)	-
Primary education	-0.42* (0.18)	-1.44* (0.61)	-0.22 (0.20)	-1.48 (1.01)
Vocational training	0.29** (0.11)	0.20 (0.35)	0.10 (0.16)	0.57*** (0.17)
Higher education	0.74*** (0.08)	0.56* (0.28)	0.60*** (0.11)	1.01*** (0.14)
Employment status - employed	1.46*** (0.13)	2.03*** (0.44)	1.63*** (0.19)	1.08*** (0.20)
Family's national annual income bracket (ref.: lowest third in country)				
Middle third in country	-0.01 (0.09)	-0.30 (0.31)	0.14 (0.13)	-0.12 (0.15)
Highest third in country	0.14 (0.09)	-0.11 (0.29)	0.32** (0.12)	-0.01 (0.15)
Entrepreneurship skills	1.37*** (0.09)	1.11** (0.38)	1.16*** (0.12)	1.65*** (0.15)
Knows entrepreneurs	0.88*** (0.07)	0.57* (0.27)	0.67*** (0.10)	1.19*** (0.12)
Stages of economic development (ref.: Innovation-driven economies)				
Factor-driven economies	-0.67*** (0.13)			
Efficiency-driven economies	0.11 (0.07)			
Constant	-7.66*** (0.18)	-8.16*** (0.64)	-7.49*** (0.25)	-7.80*** (0.28)
Observations	*150261*	*19368*	*71323*	*59088*
-2LL	*-4931.04*	*-423.58*	*-2604.40*	*-1873.90*
Chi-2 test of verisimilitude	*1500.90*	*102.22*	*767.86*	*652.68*
Degrees of freedom	*16*	*14*	*14*	*13*
p-value	*0.0000*	*0.0000*	*0.0000*	*0.0000*
Pseudo-R^2	*0.1321*	*0.1077*	*0.1285*	*0.1483*

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Based on the results obtained, we would highlight that most of the hypotheses proposed were confirmed, with the variables significant and taking the expected signs.
Thus, being a woman has a negative and highly significant effect on probability of being a technological entrepreneur (*Hypothesis 1*). In comparative terms, the same result occurs across the groups of countries, independently of their stage of economic development. We thus confirm that there are barriers for women connected to this type of entrepreneurship, as Rodríguez et al. (2013), Mayer (2008) and Zhao et al. (2005) indicate, pointing to the fact that the barriers occur due to lack of women models in this area; perception of highly competitive technological environment and thus greater difficulty, making it less appropriate to start a business, as well as difficulty of reconciling work and family life; and difficulty of accessing resources (Carter et al., 2003) and access to fewer resources than male entrepreneurs (Cliff, 1998), especially financial resources (Neergaard et al., 2006).
On the other hand, the probability of launching a TE is greater among younger individuals (18-34) (compared to those in the 35-44 age range). Being older (55-64) has a significant and negative influence on setting up a TE. In general, the evidence shows that age has an inverse relation to probability of starting a business in technology sectors (*Hypothesis 2*). When we differentiate the sample based on level of economic development, these results are only reproduced for countries whose economies are efficiency- and innovation-driven (and in this case, only in the 18-24 age range). Our results thus differ from those obtained by Westhead and Storey (1994), Harvey (1994), Donckels (1989), Autio et al. (1989), Ortín et al. (2008), Zapata et al. (2014b), and Storey and Tether (1998). Note that these studies focus on European countries, which belong primarily to the group of innovation-driven countries. According to these authors, it is unusual in these countries to find very young technological entrepreneurs (under 25 years of age). Our results confirm the opposite, however, agreeing instead with the findings of Zapata et al. (2014c) for the case of South America and with Xie and Lv (2016) for China, countries that belong to the group of efficiency-based economies. We believe these differences may be due to the fact that a significant part of TE currently belongs to the so-called "digital economy", which, among other issues, does not require large initial investments, in contrast to the high- and medium-technology manufacturing sectors. There would thus be no "financial entry barrier" for young people requiring them to have income prior to setting up the business. Further, it is precisely these entrepreneurs' age that favours their familiarity with the ICTs on which these technological initiatives are based.
The results for the effect of highest education level completed on probability of establishing a TE, taking secondary education as a reference, indicate at global level that not having a secondary education or having only completed primary education has a negative and significant influence. Vocational or higher education, in contrast, encourages the probability of becoming a technological entrepreneur. From these estimations, we deduce that the highest level of education completed generally has a direct connection to probability of setting up an NTBF; the higher the education level, the greater the possibilities (*Hypothesis 3*). These results agree with we expected from the literature, as Storey and Tether (1998), Westhead and Storey (1994) and Ortín et al. (2008) connect NTBF creation to post-secondary education levels (vocational, university and postgraduate). These results are partially replicated in the analysis of

groups of countries, primarily for the positive and significant effect of higher education. Technical education is significant in innovation-driven countries only, and we find evidence for the negative and significant effect of lower education levels in factor-driven countries only.

Regarding work experience, for which the variable employment status served as *proxy*, the results show that being actively employed, whether part- or full-time, has a positive and highly significant influence on probability of setting up technology-based business (*Hypothesis 4*). This result would confirm the arguments, as Colombo and Grilli (2005) affirm, for a positive effect of the learning that the entrepreneur obtained in prior jobs (whether from colleagues and supervisors or from the situations experienced). The individual could also have had access to new knowledge that, from the perspective of the *knowledge spillover theory of entrepreneurship* (Audretsch, 1995; Audretsch & Lehmann, 2005), would help him/her to detect business opportunities that have not yet been exploited. Finally, this experience may have helped individuals to construct social networks in which their subsequent trajectory as business people facilitates access to resources.

Annual family income available shows no significant influence on probability of being a technological entrepreneur, except in the specific case of individuals belonging to countries with efficiency-driven economies, where having a higher income has a positive influence on setting up a TE. Only in this case can we confirm the results of prior studies, which indicate financial restrictions as a barrier to setting up technological businesses, and thus suggest that personal wealth plays a role (Colombo & Grilli, 2005).

Despite this result, our data generally show that income level does not influence probability of becoming a technological entrepreneur. This finding does not permit us to confirm *Hypothesis 5*. The reasons for this result may be various and require further research. First, as discussed, technological businesses emerging in the digital area—an area that has taken off dramatically in the last 5-10 years—do not require large initial investments, such that individuals are not be subject to financial restrictions in their initial stages[2]. Second, financial systems differ greatly, not only among groups of countries but also from one country to another. Countries with innovation-driven economies have a great variety of financing sources for TE, from the traditional banking sector to business angels, family offices, venture capital or stock market alternatives, among others. In countries with this profile, technological entrepreneurs can set up their businesses without being conditioned by their personal income. Third, in most countries with efficiency- and innovation-driven economies, numerous structures have been established in recent years to support NTBFs—incubators, science-technology parks and accelerators, among others (Calvo et al. 2017; Rodríguez-Gulías et al., 2016). These infrastructures significantly reduce the cost of setting up businesses, making them less dependent on the entrepreneur's income.

Entrepreneurs' beliefs that they possess specific skills (and knowledge) to carry out a business initiative have a positive effect on probability of starting a technology-based business (*Hypothesis 6)*. We thus confirm the proposals by Shane and Venkataraman

[2] Note that the dependent variable refers to entrepreneurial initiatives that have been in existence 4 years or less.

(2000) and Álvarez and Barney (2002), who argue that these beliefs in their skills and knowledge permit the value creation that encourages such individuals to make their business initiatives real.

Personally knowing individuals who have been or who are involved in some type of entrepreneurship also has a positive and significant influence on probability that the individual will undertake technology-based initiatives (*Hypothesis 7)*. We thus also confirm the importance for TE of having a "model to follow" (Roberts, 1991; Bosma et al., 2012) when setting up an initiative. The closeness of these models contributes to reducing the perception of uncertainty associated with entrepreneurship and to assuming the role of entrepreneur with greater confidence (Álvarez & Urbano, 2011).

Finally, the stage of economic development of the countries in which the individuals live also influences intention to set up a TE. Living in factor-driven countries (first stage) rather than living in innovation-driven countries (third stage) has a negative influence on the probability of starting a technology-based business. We do not find statistically significant effects in efficiency-driven countries.

Analysis of the factors determining TE by group of countries shows that these factors are nearly identical, with the exception of age and annual family income of the entrepreneur. These results suggest that the individual characteristics determining the TE are usually common to all groups of countries.

Table 7 summarizes the expected signs of the hypotheses proposed vs. the signs found for the different groups analysed.

Table 7. Determinants of TE: summary of hypotheses contrasted

Hypothesis	Sign expected	Sign obtained for country group			
		All	FD	ED	ID
Hypothesis 1*: Being a woman has a negative effect on setting up an NTBF*	-	-	-	-	-
Hypothesis 2*: The individual's age has a negative effect on setting up an NTBF*	-	-		-	-
Hypothesis 3*: The individual's education level has a negative effect on setting up an NTBF*	+	+	+	+	+
Hypothesis 4: *Having prior work experience has a positive effect on setting up an NTBF*	+	+	+	+	+
Hypothesis 5: *The individual's income level has a positive effect on setting up an NTBF*	+			+	
Hypothesis 6: *Believing one has entrepreneurship skills has a positive effect on setting up an NTBF*	+	+	+	+	+
Hypothesis 7: *Knowing entrepreneurs has a positive effect on setting up an NTBF*	+	+	+	+	+

Notes: FD=Factor Driven, EF=Efficiency Driven, ID=Innovation Driven.

5. Conclusions, recommendations and future lines of research

Due to its positive effects on economic development, entrepreneurship is of increasing interest to the government and academics. This interest translates into policies and programmes oriented specifically to promoting and training people for entrepreneurship with the goal of stimulating quality business initiatives in which motivations are connected to perception of opportunities rather than to need. The profile of the TE corresponds to these characteristics, making the NTBF the vehicle

that gives it concrete form, since the NTBF represents business initiatives based on technical-scientific knowledge, adapted to new times and framed within the knowledge economy.

To study the individual determinants of TE, we started from the data gathered in the GEM project at global level for the year 2013. The estimations made show that, at global level, being younger than 35 years old, having completed education levels higher than secondary, having work experience, knowing an entrepreneur personally, and believing one has the skills to become an entrepreneur all have a positive and significant effect on probability of setting up an NTBF. Among the factors that negatively affect entrepreneurship in technological sectors are: being a woman, being over 55 years old, and having completed only primary or up to secondary education; level of income available has no significant influence.

The stage of economic development of the countries in which the individuals live also influences intention to set up a TE. Living in factor-driven (first stage) countries, as opposed to innovation-driven countries (third stage), has a negative influence on probability of launching an NTBF. We find no statistically significant effects for efficiency-driven countries (second stage).

When we repeat the analyses for groups of countries, individual factors determining TE are nearly identical, with the exception of age and annual family income of the entrepreneur. These results suggest that the individual characteristics that determine TE are usually common across all groups of countries.

Taking the two conclusions presented in the foregoing paragraphs (factors determining TE at individual level tend to agree across countries, while significant differences exist in probability of setting up a TE based on country group), we can conclude that some context-level factors condition the country's TE level. We thus believe that future studies in this field should place greater emphasis on the different territories conditioned by the geographic location or level of economic development.

In developing this study, we encountered some limitations. Specifically, the scant literature on specific individual determinants of NTBF creation led us to gather the contributions of studies that analyse factors of NTBF survival and growth—understanding that such factors, which influence these post-creation processes, could also be drivers of creation. One main contribution of this study is its pioneering empirical analysis of the individual characteristics that drive TE. Further, unlike most studies of TE, which focus on specific territories, primarily on those with more developed economies, this study has global reach.

As to measuring the individual factors, more detailed categorization of the variable education would have been interesting to assess the different effects of having pursued college majors related to economics and management, scientific and technical fields, etc. The GEM database only distinguishes education level completed, not field of study. Similarly, only the *proxy* variable employment status was used for the factor work experience, which is quite limited.

As a result of this analysis, we share the recommendation of Storey and Tether (1998), who insist on working to increase the number of individuals prepared to undertake creation of high-quality new businesses, indicating explicitly that we should improve the performance of individuals with higher education in facing challenges of NTBF creation. Quality of doctoral training is usually measured by publication of results in prestigious journals, orienting students' research careers to the academic line. It would

thus be necessary to reorient the doctorate to research more closely connected to industry that could germinate an NTBF in the future.

We must also design measures that counteract the forces that traditionally hinder women's entrepreneurial initiatives (greater risk aversion, assumption of more family responsibilities, less access to financing and absence of models of women in leadership, among others). The negative effect that being a woman has on TE implies that we are not making efficient use of an important quantity of human resources.

References

Almus, M., & Nerlinger, E. A. (1999). Growth of new technology-based firms: which factors matter? *Small Business Economics*, 13(2), 141-154.

Álvarez, C., & Urbano, D. (2011). Environmental factors and entrepreneurial activity in Latin America. *Academia Revista Latinoamericana de Administración*, 48, 126-139.

Álvarez, S., & Barney, J. (2002). Resource-based theory and the entrepreneurial firm. In Hitt, M.A., Ireland, R. D., Camp, S. M., Sexton, D. L. (Eds.), *Strategic Entrepreneurship*. Blackwell Publishers, Oxford, pp. 89-105.

Audretsch, D. B., & Lehmann, E. E. (2005). Does the knowledge spillover theory of entrepreneurship hold for regions? *Research Policy*, 34(8), 1191-1202.

Audretsch, D. B. (1995). *Innovation and Industry Evolution*. Cambridge, MA: MIT Press.

Autio, E., Kanerva, R., Kaila, M., & Kauranen, I., (1989). *Uudet teknologiayritykset*. New Technology-Based Firms, SITRA Publication, Helsinki.

Bandura, A. (1977). *Social Learning Theory*. Prentice Hall, Englewood Cliffs, NJ.

Bercovitz, J., & Feldman, M. (2008). Academic entrepreneurs: organizational change and the individual level. *Organization Science*, 19(1), 69-89.

Bertoni, F., Colombo, M.G., & Grilli, L. (2011). Venture capital financing and the growth of high-tech start-ups: disentangling treatment from selection effects. *Research Policy*, 40(7), 1028-1043.

Bosma, N., Hessels, J., Schutjens, V., Van Praag, M., & Verheul, I. (2012). Entrepreneurship and role models. *Journal of Economic Psychology*, 33(2), 410-424.

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.

Carter, N. M., Brush, C. G., Greene, P. G., Gatewood, E., & Hart, M. M. (2003). Women entrepreneurs who break through to equity financing: the influence of human, social and financial capital. *Venture Capital*, 5(1), 1–28.

Clarysse, B., & Moray, N. (2004). A process study of entrepreneurial team formation: the case of a research-based spin-off. *Journal of Business Venturing*, 19(1), 55-79.

Cliff, J. E. (1998). Does one size fit all? Exploring the relationship between attitudes towards growth, gender, and business size. *Journal of Business Venturing*, 13(6), 523-542.

Coad, A., & Reid, A. (2012). The role of technology and technology-based firms in economic development: rethinking innovation and enterprise policy in Scotland. Technopolis Group, Belgium, August 2012.

Colombelli, A. (2016). The impact of local knowledge bases on the creation of innovative start-ups in Italy. *Small Business Economics*, 1-14.

Colombo, M. G., & Grilli, L. (2005). Founders' human capital and the growth of new technology based firms: a competence-based view. *Research Policy*, 34, 795-816.

Colombo, M.G.,& Grilli, L. (2010). On growth drivers of high-tech start-ups: exploring the role of founders' human capital and venture capital. *Journal of Business Venturing*, 25(6), 610-626.

Cunha, D., Silva, S., & Teixeira, A. A. (2013). Are academic spin-offs necessarily new technology-based firms? (No. 482). Universidade do Porto, Faculdade de Economia do Porto.

Donckels, R. (1989). Tech versus Common Starters: comparison by means of 32 case studies, Small Business Research Institute, Brussels.
Du Rietz, A., & Henrekson, M. (2000). Testing the female underperformance hypothesis. *Small Business Economics*, 14(1), 1-10.
Eurochambres (2004). Women in business and in decision making: a survey of women entrepreneurs. Proyecto de investigación cofinanciado por la Comisión Europea.
Fagenson, E., & Jackson, J. (1993). The status of women managers in the United States. *International Studies of Management & Organization*, 23(2), 93-112.
Forero-Pineda, C., Corredor, S. and Forero, N. (2010). Business networks and innovation in SMEs and large firms of a developing country, *The 5th IEEE International Conference on Management of Innovation and Technology*, June 2010, Singapore.
Gibb, A. (1997). Small firms training and competitiveness: building upon the small business as a learning organisation. *International Small Business Journal*, 15, 12-29.
Goldin, C. (2006). The quiet revolution that transformed women's employment, education, and family. [Working Paper No. 11953], National Bureau of Economic Research, Cambridge, MA.
Harvey, K. (1994). From handicap to nice little earner: a study of academic spin-off enterprise. in Manchester Business School Conference.
Hurst, E., & Lusardi, A. (2004). Liquidity constraints, household wealth, and entrepreneurship. *Journal of Political Economy*, 112(2), 319-347.
Kantis, H., Federico, J., & García, S. I. (2014). Índice de condiciones sistémicas para el emprendimiento dinámico: una herramienta para la acción en América Latina. Asociación Civil Red Pymes Mercosur.
Kantis, H., Ishida, M., & Komori, M. (2002). Empresarialidad en economías emergentes: creación y desarrollo de nuevas empresas en América Latina y el Este de Asia. Inter-American Development Bank.
Laranja, M., & Fontes, M. (1998). Creative adaptation: the role of new technology based firms in Portugal. *Research Policy*, 26(9), 1023-1036.
Mayer, H. (2008). Segmentation and segregation patterns of women-owned high-tech firms in four metropolitan regions in the United States. *Regional Studies*, 42(10), 1357-1383.
Morse, E. A., Fowler, S. W., & Lawrence, T, B. (2007). The impact of virtual embeddedness on new venture survival: overcoming the liabilities of newness. *Entrepreneurship: Theory and Practice*, 31(2), 139-159.
Mustar, P. (1998). Partnerships, configurations and dynamics in the creation and development of SMEs by researchers, *Industry and Higher Education*, 217-221.
Neergaard, H., Nielsen, K., & Kjeldsen, J. (2006). State of the art of women's entrepreneurship, access to financing and financing strategies in Denmark. In *Growth-oriented Women Entrepreneurs and Their Businesses: A Global Research Perspective*, Edward Elgar, Cheltenham, United Kingdom. pp. 88-111.
Ortín, P., Salas, V., Trujillo, M., & Vendrell, F. (2008). La creación de spin-off universitarios en España: características, determinantes y resultados. *Economía Industrial*, 368, 79-95.
Reynolds, P. D., Bygrave, B. & Hay, M. (2003). Global Entrepreneurship Monitor Report, Kansas City. MO: E. M. Kauffmann Foundation.
Reynolds, P., Bosma, N., Autio, E., Hunt, S., De Bono, N., Servais, I., López-García, P., & Chin, N. (2005). Global entrepreneurship monitor: data collection design and implementation 1998–2003. *Small Business Economics*, 24(3), 205-231.
Rickne,A.,&Jacobsson,S.(1999). New technology-based firms in Sweden: a study of their direct impact on industrial renewal. *Economics of Innovation and New Technology*, 8(3), 197-223.
Roberts, E. B. (1991). Entrepreneurs in high technology: lessons from MIT and beyond. Oxford University Press.
Rodríguez, M. J., Fernández, S., Rodeiro, D., & Vivel, M. (2013). Emprendimiento tecnológico: Una cuestión de género también en la universidad? Jornadas Hispanolusas.

Rodríguez-Gulías, M. J., Fernández-López, S., & Rodeiro-Pazos, D. (2016). Growth determinants in entrepreneurship: A longitudinal study of Spanish technology-based university spin-offs. *Journal of International Entrepreneurship*, *14*(3), 323-344.

Rugman, A. M., & Verbeke, A. (2002). Edith Penrose's contribution to the resource ‐ based view of strategic management. *Strategic Management Journal*, 23(8), 769-780.

Ruiz, J., Camelo, M.C., & Coduras, A. (2012). Mujer y desafío emprendedor en España: características y determinantes. *Economía Industrial*, 383, 13-22.

Sánchez-Cañizares S., & Fuentes-García F. (2013). Gender and entrepreneurship analysis of a young university population. *Regional and Sectorial Economic Studies*, 13(1), 65-78.

Sánchez-Escobedo, M. C. (2011). Análisis del género en las distintas fases del proceso de creación de empresas (Doctoral dissertation, Universidad de Extremadura, Departamento de Economía Financiera y Contabilidad).

Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25, 217-226.

Storey, D. J., & Tether, B. S. (1998). New technology-based firms in the European Union: an introduction. *Research Policy*, 26(9), 933-946.

Stuart, T., & Ding, W. (2006). The social structural determinants of academic entrepreneurship: an analysis of University Scientists' participation in commercial ventures. *American Journal of Sociology*, 112(1), 97-144.

Van Gelderen, M., van de Sluis, L., & Jansen, P. (2005). Learning opportunities and learning behaviours of small business starters: relations with goal achievement, skill development and satisfaction. *Small Business Economics*, 25(1), 97-108.

Vázquez-Rozas, E., Gómes, S., & Vieira, E. (2010). Entrepreneurship and economic growth in Spanish and Portuguese regions. *Regional and Sectoral Economics Studies*, 10(2), 110-126.

Venkataraman, S. (2004). Regional transformation through technological entrepreneurship. *Journal of Business Venturing*, 9(1), 153-167.

Vita, L. D., Mari, M., & Poggesi, S. (2014). Women entrepreneurs in and from developing countries: evidences from the literature. *European Management Journal*, 32(3), 451-460.

Welsh,D.H., Memili,E., & Kaciak,E.(2016).An empirical analysis of the impact of family moral support on Turkish women entrepreneurs. *Journal of Innovation & Knowledge*, 1(1), 3-12.

Westhead, P., & Storey, D. J. (1994). *An assessment of firms located on and off science parks in the United Kingdom.* HMSO, London.

Xie, X., & Lv, J. (2016). Social networks of female tech-entrepreneurs and new venture performance: the moderating effects of entrepreneurial alertness and gender discrimination. *International Entrepreneurship and Management Journal*, 12(4), 963-983.

Zapata, G., Fernández, S., Vivel, M., Neira, I., & Rodeiro, D. (2014a). El emprendimiento de base tecnológica: características diferenciales. In Vence, X., & Rodeiro, D. (coord.): Innovación y emprendimiento con base en las ciencias, Servicio de Publicaciones e Intercambio Científico de la Universidad de Santiago de Compostela, Santiago de Compostela, pp. 3-22.

Zapata, G., Fernández, S., Neira I., & Nogueira M. (2014b). *Factores individuales determinantes del emprendimiento tecnológico: un análisis del caso español* en XXIV Jornadas Luso-Espanholas. Gestão Científica. O Contributo da Gestão para a Sustentabilidade das Organizações e da Sociedade. Leiria-Portugal. ISBN: 978-972-8793-66-1.

Zapata, G., Fernández, S., & Neira, I. (2014c). *El emprendimiento tecnológico en Sudamérica: una aproximación a los determinantes individuales y regionales*. VIII Workshop de investigación basada en GEM. Emprender para un territorio próspero. Madrid – España.

Zhao, H., Scott, E. S., & Hills, G. E. (2005). The mediating role of self-efficacy in the development of entrepreneurial intentions. *Journal of Applied Psychology*, 90(6), 1265-1272.