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New technology entrepreneurship initiatives: Which strategic orientations and environmental conditions matter in the new socio-economic landscape?

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Abstract
The transformation of ideas into new technologies depends not only on how knowledge diffuses but also on which context/time this transformation is developed. In the assumption that internal and environmental conditions directly affects the decision of exploiting technological opportunities, this paper explores how some strategic dynamic capabilities (entrepreneurial and export market) and supportive environmental conditions (regulative and normative) influence the configuration of technology entrepreneurship initiatives. A proposed conceptual model is tested with 30,648 ventures in 23 countries participating in the Global Entrepreneurship Monitor for the years 2005 (pre-financial crisis), 2008 (financial crisis), and 2011 (recession). The main findings suggest the positive role of entrepreneurial orientation and export market orientation in the development of new technology entrepreneurship initiatives. Also, environmental conditions influence on the development of initiatives of technology entrepreneurship. Particularly, the study evidences how regulative environmental conditions (property rights and government programs) enhance while other regulative conditions (support for science and technology) and normative conditions (opportunity perception and national culture) simultaneously retard the probability that a new/established venture develops new technology entrepreneurship initiatives. These effects are moderated and intensified by the influence of the economic cycles. The paper provides important insights to the field of entrepreneurship, innovation, and strategic management.

Keywords Strategic orientations · Environmental conditions · Technology entrepreneurship · Dynamic capabilities · Regulative and normative conditions · GEM

JEL Classification L26 · M13 · E00

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1 Introduction

In recent decades, technology entrepreneurship has attracted the interest of researchers and policy makers who have recognized the positive effect on economic progress (Mosey et al. 2017). This phenomenon has been understood as the interface between innovation and entrepreneurship (Ferreira et al. 2015; Schmitz et al. 2017; Shane and Venkataraman 2003). On the one hand, innovation is defined as the generation of ideas, processes, products, or services that, depending on the degree of "newness," could be incremental (minor changes) or breakthrough (novel, unique, or new advances) (Garcia and Calantone 2002; Zhou et al. 2005). On the other hand, entrepreneurship is understood as the identification and exploitation of business opportunities oriented to generate social and economic value (Parker 2011; Shane 2000). Although entrepreneurship and innovation are interrelated in the business world, both are separately analyzed by well-established academic perspectives (Autio et al. 2014). A product, service, or production process does not need to be new to the world to have economic and societal impact, but it is sufficient if the technology is new to the market under scrutiny (Koellinger 2008). The transformation of ideas into new technologies depends not only on how knowledge diffuses through entrepreneurial activities (Guerrero and Urbano 2016) but also on which context/time is developed (Autio et al. 2014). Based on these arguments, there is an academic consensus to consider technology entrepreneurship such as a multi-dimensional process that involves several elements through different levels of analysis (individual, organizational, and environmental) (Autio et al. 2014; Busenitz et al. 2000, 2014; Mosey et al. 2017).

In the assumption that both internal and environmental factors directly affect innovation and entrepreneurship, we identify two academic debates about how/when organizations decide to pursue new technological opportunities. The first academic debate is positioned at the organizational level of analysis. In this debate, previous studies have focused on the influence of resources and capabilities in the development/performance of technologies/innovations (Beckman et al. 2012a, b; Gaba and Bhattacharya 2012; Katila and Shane 2005; Teece et al. 1997; Teece 2007). For example, strategic management literature is focused on the effect of strategic orientations on technology-based innovation practices across countries (Zhou et al. 2005). However, several authors still request more studies to examine types of innovations and the role of diverse strategic orientation (Alotaibi and Zhang 2017; Spyropoulou et al. 2017). Similarly, entrepreneurship literature is more oriented to explain the emergence of new technological opportunities and the transformation into entrepreneurial initiatives (Autio et al. 2014; Guerrero and Urbano 2016). In this perspective, the role of entrepreneurial orientation plays a relevant role (Wang et al. 2017). In fact, Busenitz et al. (2014) evidenced the need to provide a better understanding about how new/established organizations explore/exploit technological opportunities. The second academic debate is positioned at the environmental level. In this academic debate, previous studies have evidenced the influence of the environmental conditions on the development of new technologies, innovation performance (Alotaibi and Zhang 2017; Chung 2012; Spyropoulou et al. 2017), and the subsequent transformation into entrepreneurial initiatives (Autio et al. 2014; Colovic and Lamotte 2015). However, authors highlighted the need to analyze how environmental conditions influence the emergence of new technological opportunities (Busenitz et al. 2014) and innovative growth challenges in a complex socio-economic reality (Congregado et al. 2012; Kuratko et al. 2015; Papaoikonomou et al. 2012). It because environmental conditions represent a strategic game changer for organizations where severe resource constraints and unpredictable market conditions have

generated significant challenges in business models oriented to growth through innovation (Kuratko et al. 2015). Therefore, there is little evidence about the supportive effect of environmental conditions on entrepreneurship and innovation (Autio et al. 2014; Ghio et al. 2017) as well as about the moderating effect of economic cycles on the determinants of technology entrepreneurship (Zahra and Bogner 2000; Fernández-Olmos and Ramírez-Alesón 2017).

Inspired by the two academic debates previously described, the objective of this papers is identify which strategic orientations (entrepreneurial and export market) and environmental conditions (regulative and normative) influence the configuration of technology entrepreneurship initiatives in the current socio-economic landscape. To achieve this objective a proposed conceptual model is tested with 30,648 ventures in 23 countries participating in the Global Entrepreneurship Monitor (GEM) for the years 2005 (pre-financial crisis), 2008 (financial crisis), and 2011 (recession). Based on our results, this research expects three contributions. First, contribute to the strategic management debate about the role of dynamic capabilities in the development of technology entrepreneurship initiatives (Alotaibi and Zhang 2017; Kuratko et al. 2015; Papaoikonomou et al. 2012; Spyropoulou et al. 2017). Second, contributes to the entrepreneurship academic debate about the internal and external determinants of technology entrepreneurship initiatives (Autio et al. 2014; Busenitz et al. 2014; Barasa et al. 2017; Mosey et al. 2017). Third, contributes to the academic debate about the role of innovation and entrepreneurship ecosystems on technology entrepreneurship initiatives (Autio et al. 2014; Mosey et al. 2017) and moderating effect of economic cycles (Congregado et al. 2012; Busenitz et al. 2014).

This paper is organized as follows. Section 2 presents a literature review linking internal and environmental conditions with the development of technology entrepreneurship initiatives. Section 3 describes the methodological design, including data collection and statistical analysis. Section 4 provides results and discussion in light of previous studies. Section 5 presents concluding remarks, limitations, implications, and avenues for further research.

2 Conceptual framework

2.1 Organizational strategies and new technology entrepreneurship initiatives

Sustainable competitive advantage is based on inimitable and (in)tangible resources—assets and capabilities—that an organization has accumulated to deploy advantageously (Barney 1991). In this perspective, an important organizational dynamic capability is its strategic orientation because it reflects the philosophy on how to conduct business through values, beliefs, and guides to achieve objectives and performance (Day 1994; Teece 2007, 2012). Previous studies have explored the influence of different types of strategic orientations (market, exports, technology, and entrepreneurial) on the development and economic performance of innovations (Chung 2012; Spyropoulou et al. 2017; Zhou et al. 2005). Our study focuses on two important types of organizations' strategic orientations: export market orientation and entrepreneurial orientation.

Traditionally, research on export market orientation has been concentrated on domestic operations. Market orientation has been described as an adaptive capability by which organizations react or respond to conditions in the market (Renko et al. 2009). Previous studies have also provided some insights on the positive effect of the market orientation

on technology-based entrepreneurship (Alotaibi and Zhang 2017; Chung 2012). An export market orientation consists of a set of organizational behaviors associated with the generation, dissemination, and expected responses of activities oriented to costumers abroad, considering competitors and environmental influences in each international market (Cadogan et al. 1999). By prioritizing customers, an export market-oriented organization excels in its ability to seek and use information to create and deliver superior customer value (Zhou et al. 2005). The ability to uncover consumers' latent needs can be further enhanced by putting the most advanced technology available into the hands of the "most sophisticated and demanding users," which often "leads to the discovery of new solutions to unexpressed needs" (Slater and Narver 1998, p. 1003). By nature, an innovative organization advocates a commitment to R&D through the generation, acquisition, and application of new technologies as well as promotes openness to entry into new markets (Zhou et al. 2005). Although technology entrepreneurship may be straightforward in terms of disruptive technology as well as entry into new international markets (Autio et al. 2014; Spyropoulou et al. 2017), these type of innovations are extremely risky on the demand side because (intra)entrepreneurs and managers can only guess at the size of the new market, the profitability of the new products, or the desirable product attributes. It could explain why previous studies have found both negative and positive effects of market orientation on technology-based innovations (Chung 2012; Zhou et al. 2005). Several scholars have analyzed the internationalization of new/established organizations and have found that an export orientation in new technology-based sectors is associated with superior profitability, market shares, and sales growth (Alotaibi and Zhang 2017; Filatotchev et al. 2009; Nummela et al. 2005); particularly in uncertainty times when the domestic demand is reduced or affected by socioeconomic conditions. In the assumption that exports market orientation fostering new technology entrepreneurship initiatives, we propose the following hypothesis:

H1a An export market orientation has a positive effect on the development of technology entrepreneurship initiatives.

Entrepreneurial orientation has long been recognized as the key for initiating innovative activities within new and established organizations. In other words, entrepreneurial orientation reflects the propensity to engage in the pursuit of opportunities to renew, rejuvenate, and diversify an existing organization as well as to create new business out of ongoing practices (Covin et al. 2006; Ireland et al. 2009; Su et al. 2015). It promotes behaviors/values that distinguish entrepreneurial organizations, such as being highly proactive toward market opportunities, tolerant of risk, and receptive to innovations. Although some authors consider that the research about the innovativeness dimension of entrepreneurial orientation has remained under-conceptualized, there are diverse types of new product launches, such as the result of internal generation of new knowledge or the adoption of knowledge developed by other organizations (Pérez-Luño et al. 2011). In this regard, entrepreneurial orientation practices highlight the spirit of creating new entrepreneurial initiatives and rejuvenating stagnant organizations, which is often accomplished through the introduction of breakthrough innovations (Zhou et al. 2005). According to Renko et al. (2009, p. 336), in contrast to market orientation, entrepreneurial orientation is a management capability by which organizations embark on proactive initiatives to change the competitive landscape as well as generate, disseminate, and acquire knowledge to build new technologies to meet new and latent needs of customers. Moreover, entrepreneurial organizations are characterized by taking considerable risks and assuming a proactive competitive attitude

to introduce radical and highly unique technology based innovations. For example, Salavou and Lioukas (2003) provided evidence about the positive effect of entrepreneurial orientation on product innovativeness in terms of proactiveness and risk-taking in small business. They suggest that (intra)entrepreneurs behave proactively and be risk-takers in favor of radical as opposed to incremental product innovations. In the assumption that entrepreneurial orientation is positively related to the generation and creation of new technology entrepreneurship initiatives (Autio et al. 2014; Jogaratnam 2017; Matsuno et al. 2002; Mthanti and Ojah 2017), we propose the following hypothesis:

H1b An entrepreneurial orientation has a positive effect on the development of technology entrepreneurship initiatives.

2.2 Environmental conditions and new technology entrepreneurship initiatives

Prior research suggests that environmental conditions such as competition, financial resources, industry, and market size influence the innovation and entrepreneurship processes (Busenitz et al. 2000, 2014; Katila and Shane 2005). Autio et al. (2014) also argue that entrepreneurial innovations are influenced by several contextual dimensions identified, such as institutional, temporal, industry, market, spatial, social/organizational, ownership, and governance. Based on previous research and applying the institutional approach (Baughn et al. 2006; De Clercq et al. 2010; Lim et al. 2016; Ghio et al. 2017), we paid attention to two environmental dimensions that could explain the development of technology entrepreneurship initiatives: regulative and normative conditions.

Applying the institutional approach (North 1990, 2005; Scott 1995), regulative or legal conditions are composed of laws, regulations, and policies that tend to support, reduce risks, and facilitate the development of new technology entrepreneurship initiatives. In this regards, a supportive regulative environment for technology entrepreneurship is characterized by: (a) science and technology policies (Choi and Phan 2006; Eckhardt and Shane 2011; Johnstone et al. 2012) that facilitates the exploration and fostering the exploitation of new technology opportunities across industries (Acs et al. 2009); (b) intellectual property rights that ensure and respect the venture/investor rights and the knowledge spillover/commercialization practices associated with new technology entrepreneurship initiatives (Acs et al. 2004); (c) scientific and technological governmental supports that stimulate the development of new technologies (Block et al. 2012; Bosma et al. 2013; van Stel et al. 2007; Welter and Smallbone 2011) as well as that facilitate the access to subsidies (García-Quevedo 2004; Takalo and Tanayama 2010; Aidis et al. 2012; Estrin et al. 2013; Dimos and Pugh 2016), talent/qualified personnel and infrastructures provided by public organizations (Mosey and Wright 2007; Grimaldi et al. 2011;); and (d) market regulations delights stability/changes in supply/demand participants that determinate the degree of technology intensity and the exploitation of entrepreneurial initiatives (Fleming and Sorenson 2004; Zhou et al. 2005; Autio et al. 2014). In the assumption that favorable perceptions of regulative environment support technology entrepreneurship initiatives, we propose the following hypothesis:

H2a A supportive regulative environment (e.g., favorable perceptions about science and scientific policies, property rights, governmental programs, and market regulations) has a positive effect on the development of technology entrepreneurship initiatives.

Considering the institutional approach (North 1990, 2005; Scott 1995), normative conditions are integrated by culture, values, beliefs and traditions that influence the entrepreneurial and innovative orientation of a population (Busenitz et al. 2000; Yousafzai et al. 2015). In this regards, a supportive normative environment for technology entrepreneurship is characterized by: (a) cultural values that shaping, engaging and determining technological, innovative and entrepreneurial behaviors (Busenitz and Lau 1996; De Clercq et al. 2010; Kwon and Arenius 2010; Stephan and Uhlaner 2010; Hopp and Stephan 2012; Cullen et al. 2014; Thai and Turkian 2014; Stephan et al. 2015); and (b) the degree to which a country's residents recognize and legitimize entrepreneurial, creative, and innovative thinking could reinforce/retard entrepreneurial opportunity perception (Busenitz et al. 2000). In this regards, positive/negative cultural perceptions towards innovativeness will positively/negatively influence the allocation of efforts and resources (Covin et al. 2006; Levie and Autio 2008) and may nurture/hinder technology entrepreneurship behaviors (Hayton et al. 2002). Therefore, a cultural legitimization conveys the degree of importance society attributes to behaviors such as recognition of opportunities, risk taking, and orientations towards growth or innovation (Hayton et al. 2002; Levie and Autio 2008). In the assumption that culture and opportunity perception could foster technology entrepreneurship, we propose the following hypothesis:

H2b A supportive normative environment (e.g., favorable perceptions of cultural values and opportunities that fostering entrepreneurship and innovation) has a positive effect on the development of technology entrepreneurship initiatives.

2.3 Developing new technology entrepreneurship initiatives in the new socio-economic landscape

The development of new technology entrepreneurship initiatives plays a major role in determining the success of organizations. As was explained, the development of these technological initiatives is the result of effectiveness of certain organizational strategies (export and entrepreneurial orientations) as well as supportive environmental conditions for entrepreneurship and innovation (regulations and social norms). However, in the new socio-economic landscape, organizations also faced challenges and uncertainties produced by economic cycles (e.g., crises, recessions, etc.). Nowadays, organizations need to be proactive in their strategies and develop strong dynamic capabilities to match them with the current socio-economic conditions (Zahra and Bogner 2000; Fernández-Olmos and Ramírez-Alesón 2017; Wang et al. 2017). For example, an economic crisis or recession is characterized by uncertainty, demand contraction, declining sales and profits as well as greater competition among organizations (Congregado et al. 2012; Parker 2012; Stuetzer et al. 2014).

Concerning organizational strategies, Grewal and Tansuhaj (2001) analyzed the moderation effect of the Asiatic economic crisis on the role of organizational capabilities and innovation decisions. These authors found a relevant contribution of export market orientation on managing the efficiency of organizations during uncertainty environments. For instance, if the domestic market is contracted, consumers' purchase power declines leading them to purchase commodities rather than more expensive products such as innovative products (Fernández-Olmos and Ramírez-Alesón 2017). Therefore, organizations could be forced to control costs and reduce innovation effort or could be a fertile scenario for looking entry opportunities in new markets to exploit new technology entrepreneurship initiatives. By investing in

technology and innovation during these periods, organizations could be more competitive. In this sense, Srinivasan et al. (2005) found that more innovative organizations with strategic emphasis on export and entrepreneurial orientation respond in proactive manner and achieve superior performance even during a recession. These findings could evidence how certain organizations view uncertain times as opportunities to strengthen their investments and capitalize perceived technology entrepreneurship opportunities. As a consequence, in uncertainty, organizations largely depend on its innovation strategies in order to maintain its competitiveness and its subsequent chance of survival. In the assumption that economic cycle produced a moderating effect on the strategies associated with the development of technology entrepreneurship, we propose the following hypothesis:

H3a The effect of organizational strategies (e.g., export and entrepreneurial orientations) on the development of technology entrepreneurship initiatives is moderated by economic cycles (pre/post crisis and recession).

Concerning supportive environmental conditions, given the nature of certain regulations and social norms, the moderation effect of economic cycles could be less or more intensive. On one hand, environmental conditions as property rights or culture are elements in a supportive ecosystem that could be more stable in uncertainty times. On other hand, weak macroeconomic scenarios mean admittedly that government spending on technology is reduced and consequently policies/support programs are scrutinized for finding an effective response to mitigating the consequences of crisis/recession (Kokkinakos et al. 2017). As a consequence, even than policy makers recognized entrepreneurship and innovation as crisis mitigation enablers, uncertain economic cycles affect some regulative conditions when governments do not have enough resources to fund technological projects or campaigns to encourage the culture of technological innovation in the population (Fernández-Olmos and Ramírez-Alesón 2017). Therefore, under economic cycles, the regulatory uncertainty also delimitates the R&D spending of organisations (Goel 2007). In the assumption that economic cycle produced a moderating effect on the supportive environment with the development of technology entrepreneurship, we propose the following hypothesis:

H3b The effect of supportive environments (e.g., regulations and social norms) on the development of technology entrepreneurship initiatives is moderated by economic cycles (pre/post crisis and recession).

Based on the previous reviewed literature, we propose a conceptual model to understand the effect of organizational strategies and environmental conditions on the development of new technology entrepreneurship initiatives (Fig. 1).

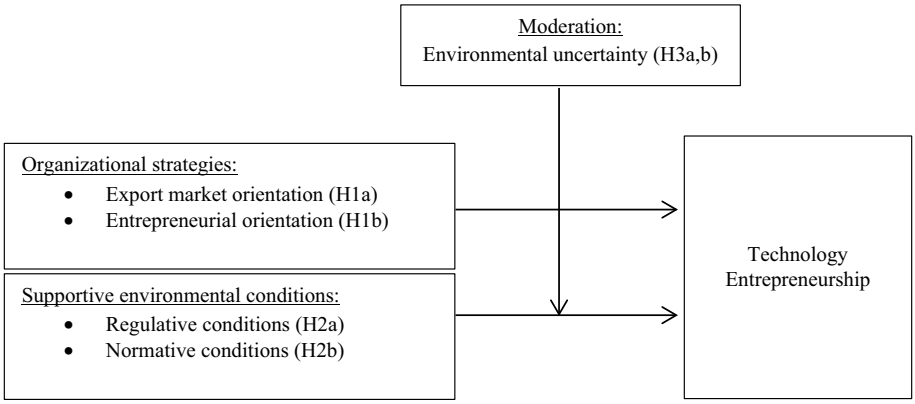

Fig. 1 Proposed conceptual model *Source:* Self-devised based on Zhou et al. (2005), Autio et al. (2014) and Fernández-Olmos and Ramírez-Alesón (2017)

3 Methodology

3.1 Data collection

We use the 2005, 2008, and 2011 GEM datasets.[1] The GEM is currently the largest and most widely recognized cross-country research initiative to study the prevalence, determinants, and consequences of entrepreneurial activity as well as insights on the conditions of the entrepreneurial ecosystem. At the organizational level, our final pooled sample includes 30,533 ventures[2] that were identified in the 23 participating countries[3] of the Adult Population Survey (APS). At the country level, data were obtained from the National Experts Survey (NES) and complemented by the World Bank Database from the participating countries.

3.2 Description of the variables

Table 1 shows the main description of the variables.

[1] Annually, the Adult Population Survey (APS) collects the main indicators of entrepreneurial activity based on a random sample of at least 2000 adults from 18 to 74 years in each of the participating countries. The National Experts Survey (NES) collects the main indicators of the entrepreneurial ecosystem based on a sample of at least 36 experts per country to evaluate the conditions that foster or retard the entrepreneurial activity. For further details about the methodology, see Reynolds et al. (2005).

[2] This sample includes new ventures identified such as total entrepreneurial activity (TEA) that are owner–manager ventures that have been in existence for less than 42 months, as well as established ventures that are owner–manager ventures that have been in existence for at least 42 months (Reynolds et al. 2005).

[3] Argentina, Belgium, Brazil, Chile, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Jamaica, Japan, Latvia, Mexico, the Netherlands, Norway, Slovenia, South Africa, Spain, the United Kingdom, and the United States.

Table 1 Description of variables

Variable	Description	Data source
Dependent		
Technology entrepreneurship initiatives	1 = Ventures that have reported the development of new technologies with less of one year of antiquity; 0 = otherwise	APS Survey (GEM)
Explanatory (at organizational level)		
Export market orientation	Proportion of clients that live abroad: 0%, under 10, 11–25, 26–50, 51–75, 76–90%, more than 90% (reference group is 0%)	
Entrepreneurial orientation	1 = Ventures that have reported that their employees have participated in the development of technology entrepreneurship initiative's such as of their normal work; 0 = otherwise	
Explanatory (at environmental level)		
Regulative environmental conditions	Perception about science and technology, property rights, governmental programs and market regulations associated with the development of new technology entrepreneurship initiatives	NES Survey (GEM)
Normative environmental conditions	Perception of opportunities for launching new ventures or growing established ventures as well as if the national culture encourages creativity, innovativeness and entrepreneurship	
Control variables (at organizational level)		
Ln owners	Logarithm natural of owners of the venture	APS Survey (GEM)
Ln size	Logarithm natural of number of employees	
Sector	1 = business service and costumer oriented; 0 = extractive and transformative	
Age	1 = new venture; 0 = established venture	
Control variables (at environmental level)		
Ln R&D investment	Logarithm natural of R&D investment in each economy	World Bank
Ln researchers	Logarithm natural of the number of researchers involved in R&D activities in each economy	
Ln GINI per capita	Logarithm natural of the distribution of income per capita within an economy	
Economy	1 = emerging economy; 0 = not emerging economy	
Environmental uncertainty	2005 = pre-financial crisis; 2008 = financial crisis; 2011 = recession	

Regarding the dependent variable,[4] technology entrepreneurship initiatives is measured using a binary variable that captures the development of new technological initiatives with less of 1 year of antiquity (Bosma 2013; Koellinger 2008; Reynolds et al. 2005; Wong et al. 2005). Concerning explanatory variables, our main proxies are associated to organizational strategies as well as environmental conditions that fostering technology entrepreneurship initiatives. At the organizational level, we used two proxies that helped us to understand strategic orientations: (i) entrepreneurial orientation, a dichotomous variable that takes a value of 1 when the ventures' employees have confirmed their participation in the development of entrepreneurial initiatives as part of their normal work (Bosma et al. 2010; Hagedoorn and Narula 1996; Bosma 2013; Guerrero and Peña 2013; Urbano and Turró 2013; Turró et al. 2014), and (ii) export market orientation, a categorical variable that captures the proportion of clients that normally live outside of their country (Bosma 2013; Spyropoulou et al. 2017). Given the nature of the APS survey, we were not able to use the scales used in previous studies (Cadogan et al. 1999; Covin et al. 2006; Ireland et al. 2009). However, our proxies represent objective measures that capture and evidence the implementation of those strategic orientations. At the country level, we used two proxies that helped us to understand the environmental conditions: (i) regulative environment, integrated by the GEM experts' perception about the existence of science and technology, property rights, governmental programs, and market dynamism that support and respect inventors/entrepreneurs who develop entrepreneurial innovations (Levie and Autio 2008; Yousafzai et al. 2015); and (ii) normative environment, integrated by the GEM experts' perception of opportunities for launching new ventures or growing established ventures as well as if the national culture encourages creativity, innovativeness, and entrepreneurship (Cullen et al. 2014; Levie and Autio 2008; Yousafzai et al. 2015). These measures represent the average obtained from the opinion of 36 experts interviewed per year in each country using a Likert scale (Reynolds et al. 2005). These variables are built based on confirmatory factor analysis (standardized values); therefore, the mean is 0 and the standard deviation is equal to 1 for these variables.

Concerning control variables, we included several at both the organizational and country levels. At the organizational level, we identified three proxies in the APS GEM dataset that helped us to understand the strategy associated with developing new technology inside organizations (Bosma 2013): (i) the number of owners, measuring the degree of control at the moment of decision making (Christensen 2002); (ii) size, measured by the number of employees; (iii) sector, a binary variable where 1 indicates that the venture develops services for businesses and direct customers (service sectors), and 0 when the entrepreneurial activities are associated to the extractive and transformative sectors; and (iv) age, a binary variable where 1 indicates a new venture with less than 3.5 years (included in the total entrepreneurial activity), and 0 indicates an established venture with more than 3.5 years. At the country level, we introduced variables to control for the logarithm natural of the amount of R&D investment in each economy (LnR&D Investment), the logarithm natural of the number of researchers involved in R&D activities in each economy (LnResearchers), the logarithm natural of the distribution of income per capita within an economy that

[4] The GEM APS survey includes three categorical questions to capture innovation based on: the antiquity of the technologies developed by the venture (less than 1 year, more than a year, no new technology), the number of clients that consider the product new/unfamiliar (none, a few, all), the number of business that offer the same products (none, a few, all) (Bosma 2013; Koellinger 2008; Reynolds et al. 2005; Wong et al. 2005).

deviates from a perfectly equal distribution (LnGINI per capita), and economy as a binary variable that indicates whether the country gets ranked as an emerging economy (Congregado et al. 2012; Parker 2012; Stuetzer et al. 2014). Finally, we used the year of the survey as a proxy of environmental uncertainty (pre-financial crisis 2005, financial crisis 2008, and recession 2011).

3.3 Data analysis

Regarding data analysis, we deployed hierarchical modeling methods in keeping with our having combined organizational-level and country-level measures. Since our dependent variable was dichotomous, we applied a hierarchical logistic regression to estimate the influence of the environmental conditions and organizational strategies on the development of technology entrepreneurship initiatives. Our model was also tested per year in order to identify the effect of environmental uncertainty. As a robustness tests, ambitious entrepreneurship has a higher propensity to develop entrepreneurial innovations. This argument helps us to confirm our proposed model as well as our measures of technology entrepreneurship. In this sense, we run the model splitting the sample into ambitious entrepreneurship[5] and non-ambitious entrepreneurship.

4 Results and discussion

Table 2 presents the main characteristics of the entire sample and the correlation matrix of all variables that confirms how the variables are not highly correlated. In the analyzed years, on average, the sample is integrated by new enterprises (52%) with two owners who manage around 1–5 employees (47%) located in non-emerging economies (72%) who provide services to customers (43%) and businesses (22%), as well as operate in transforming (27%) and extractive (2%) sectors. In general, only 9% of the ventures have developed new technology entrepreneurship initiatives. Interestingly, per year, this percentage decreased from 11.0% in 2005 to 8.3% in 2008 and 8.5% in 2011. Concerning strategic orientations, 11% of ventures evidenced an entrepreneurial orientation and 45.6%[6] of ventures evidenced an export orientation. Regarding the environmental conditions, on average, we observed that the majority of the items that integrate them, obtains lower evaluations from the national experts (e.g., with 2 on a five-point Likert scale) consistently per year.

[5] Based on Global Entrepreneurship Monitor data, this type of entrepreneurs is characterized by the ambition to create substantial organizations with the expectative of growing to a size of 20 employees within 5 years (Stam et al. 2011). In this perspective, having the ambition to grow a business is close to a necessary condition for subsequent growth.

[6] This percentage is distributed as follow: 26.41% has a level of exports under 10%; 5.24% exports 10–25%; 4.77% exports 25–50%; 4.20% exports 50–75%; 2.00% exports 75–90% and 2.97% exports more than 90%.

Table 2 Descriptive statistics and correlation Matrix

	Variables	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	
1	Technology entrepreneurship	0.091	0.288	0.0	1.0	1							
2	Export market orientation	0.456	0.498	0.0	1.0	0.0674*	1						
3	Entrepreneurial orientation	0.115	0.319	0.0	1.0	0.0729*	0.0930*	1					
4	Science and technology	0.000	1.000	−2.7	2.0	−0.1418*	0.0001	−0.0156*	1				
5	Intellectual property rights	0.000	1.000	−1.8	2.6	0.0593*	0.1881*	−0.0144*	0.0017	1			
6	Government programs	0.000	1.000	−2.2	2.4	0.0532*	0.1267*	0.0395*	−0.0002	−0.0018	1		
7	Market dynamism	0.000	1.000	−1.8	2.5	0.0379*	0.0617*	0.0352*	−0.0009	0.0054	0.0009	1	
8	Opportunity perception	0.000	1.000	−2.1	4.0	−0.1033*	0.0289*	−0.0342*	−0.0008	0.0043	0.0006	−0.0039	
9	Culture	0.000	1.000	−1.8	4.3	−0.0351*	0.0230*	−0.0100*	−0.0003	−0.0009	−0.0004	−0.0007	
10	Ln owners	0.386	0.547	0.0	6.9	0.0347*	0.0889*	0.1527*	−0.0034	0.0132*	0.0408*	0.0012	
11	Ln size	0.791	0.407	0.0	1.0	−0.0697*	−0.0630*	−0.2125*	0.0383*	0.0622*	−0.0089*	−0.0443*	
12	Sector: services	0.653	0.476	0.0	1.0	0.0121	0.0434*	0.0278*	0.0110*	−0.001	−0.0019	0.0213*	
13	Age: new ventures	0.521	0.500	0.0	1.0	0.1041*	0.0648*	0.2531*	−0.0455*	−0.0147*	−0.0333*	0.1441*	
14	ln R&D Investment	0.100	0.889	−2.8	1.4	−0.1012*	0.0344*	−0.0315*	0.3585*	0.4150*	0.2777*	−0.0922*	
15	ln researchers	7.642	0.856	5.8	9.0	−0.0942*	0.0236*	−0.0912*	0.4357*	0.3734*	0.0449*	−0.5294*	
16	ln GINI per capita	27.196	1.713	23.1	30.3	−0.0984*	−0.0007	0.0108*	0.5242*	0.0872*	0.1559*	−0.1382*	
17	Economy: emerging economies	0.333	0.471	0.0	1.0	0.0598*	−0.0150*	0.0542*	−0.4710*	−0.3371*	−0.3037*	0.4719*	
18	Environmental uncertainty: year	2008	2.368	2005	2011	−0.0336*	−0.0243*	0.0273*	0.0032	−0.0582*	0.0845*	0.1391*	
19	Ambitious entrepreneurship	0.081	0.272	0	1	0.0232*	0.1414*	0.0694*	−0.0217*	0.0609*	0.0130	0.0578	

	Variables	8	9	10	11	12	13	14	15	16	17	18	19
8	Opportunity perception	1											
9	Culture	0.0004	1										
10	Ln owners	−0.0549*	0.0191*	1									

Table 2 (continued)

	Variables	8	9	10	11	12	13	14	15	16	17	18	19
11	Ln size	0.0671*	0.0066	−0.0926*	1								
12	Sector: services	0.0249*	0.0172*	−0.0089	−0.0759*	1							
13	Age: new ventures	−0.0302*	−0.0225*	0.1368*	−0.4703*	0.1184*	1						
14	ln R&D investment	0.2403*	0.1408*	0.0531*	0.1072*	−0.0099*	−0.1364*	1					
15	ln Researchers	0.0988*	0.2261*	0.0048	0.1160*	−0.0504*	−0.1700*	0.5134*	1				
16	ln GINI per capita	0.2736*	0.0154*	0.0150*	0.0572*	0.0528*	−0.0838*	0.6557*	0.2374*	1			
17	Economy: emerging economies	0.0352*	−0.1210*	−0.0368*	−0.1080*	0.0220*	0.1837*	−0.7070*	−0.7529*	−0.6039*	1		
18	Environmental uncertainty: year	0.0554*	−0.3631*	−0.0031	0.0032	−0.0136*	0.0363*	−0.0716*	−0.1374*	0.0232*	0.1125*	1	
19	Ambitious entrepreneurship	0.0407*	0.0206*	0.1978*	−0.0208*	−0.0384*	0.0337*	0.0301*	−0.0128	−0.0121	0.0173	0.0007	1

Level of statistical significance at 0.100

Table 3 Hierarchical logistic regression [dependent variable: entrepreneurial innovations per economic periods]

Entrepreneurial innovations	Model I: All years			Model IIa: Pre-crisis 2005			Model IIb: Crisis 2008			Model IIc: Recession 2011		
	dy/dx	S.E.	$p>z$	dy/dx	S.E.	$p>z$	dy/dx	S.E.	$p>z$	dy/dx	S.E.	$p>z$
Organizational strategies												
Export market orientation [ref. non export]												
Under 10%	0.211	0.051	***	0.423	0.097	***	0.200	0.091	**	0.086	0.089	
10–25%	0.157	0.078	*	0.922	0.171	***	−0.079	0.165		−0.076	0.158	
26–50%	0.130	0.095		0.181	0.190		0.251	0.153	*	0.085	0.173	
51–75%	0.420	0.093	***	0.388	0.220	*	0.677	0.131	***	0.238	0.188	
76–90%	0.366	0.133	**	0.715	0.257	**	0.373	0.218	*	0.295	0.252	
More than 90%	0.503	0.106	***	0.713	0.212	***	0.434	0.189	**	0.462	0.194	**
Entrepreneurial orientation	0.306	0.060	***	0.324	0.146	**	0.208	0.103	**	0.438	0.093	***
Supportive environmental conditions												
(a) Regulative conditions												
Science and technology	−0.387	0.035	***	−0.228	0.064	***	−0.457	0.064	***	−0.358	0.061	***
Intellectual property rights	0.318	0.034	***	1.649	0.095	***	0.072	0.061		−0.169	0.063	**
Government programs	0.181	0.027	***	0.578	0.073	***	0.346	0.080	***	−0.097	0.063	
Market dynamism	0.050	0.042		−0.557	0.104	***	0.249	0.090	**	0.080	0.059	
(b) Normative conditions												
Opportunity perception	−0.327	0.035	***	−0.282	0.090	***	−0.312	0.059	***	−0.281	0.074	***
Culture	−0.262	0.033	****	0.060	0.059		−0.115	0.088		−0.107	0.065	*
Control variables												
Ln owners	0.069	0.038	*	0.108	0.078		0.022	0.071		0.147	0.058	**
Ln size	−0.074	0.053		−0.134	0.117		0.298	0.099	***	−0.303	0.082	***
Sector: services	0.034	0.045		−0.020	0.088		0.039	0.074		0.063	0.078	
Age: new ventures	0.559	0.048	***	0.389	0.091	***	0.514	0.081	***	1.068	0.090	***
ln R&D investment	−0.506	0.043	***	−0.133	0.095	***	−0.326	0.109	***	−0.219	0.089	**

Table 3 (continued)

Entrepreneurial innovations	Model I: All years			Model IIa: Pre-crisis 2005			Model IIb: Crisis 2008			Model IIc: Recession 2011		
	dy/dx	S.E.	$p>z$	dy/dx	S.E.	$p>z$	dy/dx	S.E.	$p>z$	dy/dx	S.E.	$p>z$
ln researchers	−0.095	0.070		−1.266	0.130	***	0.016	0.119		0.027	0.134	
ln GINI per capita	−0.023	0.034		−0.064	0.055		0.006	0.065		0.065	0.054	
Economy: emerging economies	−0.688	0.118	***	−0.095	0.246		−0.395	0.265		−0.688	0.229	***
Environmental uncertainty: ref. 2005												
2008	−0.265	0.056	***									
2011	−0.639	0.058	***									
Constant	−1.096	1.367		7.785	2.189	***	−3.352	2.456		−4.967	2.386	**
Random−effects: country												
var(_cons)	.008	.003		.002	.000		.000	.000		.000	.000	
var(Residual)	.028	.000		.026	.000		.023	.000		.033	.000	
chibar^2	192.27			361.53			10.65			10.65		
Prob ≥ chibar^2	***			***			***			***		
N	30,533			8398			10,644			11,491		
Groups	23			23			23			23		
Min	349			79			29			122		
Average	1327.5			365.10			483.8			499.6		
Max	9203			2363			4307			2533		
Wald chi^2	992.27			527.41			296.25			360.08		
Prob > chi^2	***			***			***			***		
Log pseudolikelihood	−3662.6			−872.53			−1131.4			−1544.6		
Pseudo R^2	0.168			0.333			0.153			0.182		

Level of statistical significance: ***$p \leq 0.001$; **$p \leq 0.050$; *$p \leq 0.100$

4.1 The influence of organizational strategies on technology entrepreneurship initiatives

Regarding export market orientation (see Table 3), results confirm a positive effect of export market orientations on the development of new technology entrepreneurship. Taking as a reference the ventures that do not export, the positive effect and intensity of this organizational capability on the development of new technological initiatives increases as higher is the portion of abroad clients. These results support H1a, which is aligned with previous studies that have evidenced the positive effect of this organizational capability on the generation and dissemination of new technologies for current and potential customers (Zhou et al. 2005; Renko et al. 2009; Alotaibi and Zhang 2017). Theory predicts that crisis could stimulate exports given the complex conditions of domestic demand and highest costs (Blalock and Roy 2007). However, Model II shows that the highest probability about the effect of export market orientation on the development of new technology entrepreneurship initiatives is observed in expansionary periods while the lowest effect is observed in recessionary periods. Even though market orientation is an adaptive capability to react or respond to environmental uncertainties (Renko et al. 2009), technology based innovations are extremely risky and require strong investment (Filatotchev et al. 2009). Prior studies have also evidenced a decreasing effect of exports during financial crisis (Blalock and Roy 2007; Haddad et al. 2011), particularly during the 2008–2009 crisis. It could explain the decline in trade has been found in Belgium (Behrens et al. 2010), France (Bricongne et al. 2012), and the US (Schott 2009), among other economies. Explanations about this effect were associated with the fall of the intensive margin of large exporters as well as trade collapse in small exporters that reduced the range of destinations served or stopped exporting altogether. Based on our results, economic cycles (crisis and recession) moderate the role of export organizational capabilities on the development of new technology entrepreneurship initiatives (supporting H3a). More concretely, the investing in new technology entrepreneurship during uncertainty periods is linked with a highest intensity of exports to respond in a proactive behavior, be more competitive and survive (Srinivasan et al. 2005). Concerning entrepreneurial orientation (see Table 3), results show a positive and significant effect of this strategic orientation on the development of new technology entrepreneurship initiatives (0.306; $p \leq 0.001$). These results support H1b, which is aligned with previous studies that have recognized the positive effect of this organizational capability on the creation of technology innovations (Zhou et al. 2005; Autio et al. 2014; Jogaratnam 2017; Mthanti and Ojah 2017; Pérez-Luño et al. 2011). Model II evidences the highest effects of entrepreneurial orientation on the development of entrepreneurial innovations in periods of recession (0.493; $p \leq 0.001$). These results are aligned with previous studies that have evidenced that during recession dimensions of entrepreneurial orientation, such as innovativeness and proactiveness, have a positive effect on technology investment because organizations try to be more competitive and survive by the exploitation of new/existent business opportunities (Srinivasan et al. 2005; Soininen et al. 2012). However, Soininen et al. (2012) also found that the effects of economic downturn are stronger on risk-taking organizations than others. Therefore, a highest entrepreneurial orientation is an organizational capability that provides more alternatives to growth/survives in uncertain environments (supporting H3a).

4.2 The influence of environmental conditions on technology entrepreneurship initiatives

Regarding regulative environmental conditions (see Table 3), Model I show a negative effect of science and technology (efficient knowledge transfer processes between research centers and ventures, access to latest research or technological advances, appropriate government subsidiaries, etc.) on new technology entrepreneurship (−0.387; $p \leq 0.001$). In fact, Model II confirms a negative effect that is intensified during financial crisis (−0.457; $p \leq 0.001$). A plausible explanation behind these results could be associated with the lower valuation of GEM experts (NES) about the existence of science and technology in their countries. As a consequence, the probability of developing new technology entrepreneurship initiatives decreases when organizations operate in environments characterized by a poor support in terms of science and technology regulations (Barasa et al. 2017). The uncertainty of the regulative framework plus the societal and economic conditions in recessionary periods (rise in their unemployment rates, limited access to financing, a reduction in the levels of prevailing demand, and the decline in gross domestic product) affect the levels of investments in innovation and affect the government intervention via programs supporting entrepreneurship (OECD 2012). During uncertainty periods, organizations faced several challenges associated with liabilities and entry barriers (Gruber and Henkel 2006; Gruber et al. 2008) and tried to collaborate with others in order to share innovation's risks (Alcalde and Guerrero 2014). Additionally, Model I shows a positive effect of the existence/efficiency of property rights legislation (0.318; $p \leq 0.001$) and supportive government programs for innovation and entrepreneurship (0.181; $p \leq 0.001$) on technology entrepreneurship. We do not find strong evidence about the effect of market regulations on technology entrepreneurship. Based on these results, a general assumption is that a supportive environment characterized by intellectual property rights and government programs increases the probability that organizations investing in new technology entrepreneurship initiatives (supporting H2a). Interestingly, these findings are similar to recent theoretical and empirical studies that evidence the relevance of a supportive environment for the development of new technological initiatives (Png 2017; Fernández-Olmos and Ramírez-Alesón 2017). For instance, Chen and Puttitanun (2005) found empirical evidence on both the positive impact of IPRs on technological based innovation in developing countries and the presence of a U-shaped relationship between IPRs and levels of economic development. This means that stronger intellectual protection as well as reducing spillovers might reduce/raise the development and return of R&D activities. However, our analysis per year evidenced mixed effects. In pre-crisis, we found a positive effect of intellectual property rights (1.649; $p \leq 0.001$) and government programs (0.578; $p \leq 0.001$) on technology entrepreneurship but also a negative effect of market dynamism on technology entrepreneurship (−0.557; $p \leq 0.001$). During the crisis, we found a positive effect of government programs (0.346; $p \leq 0.001$) and market dynamism (0.249; $p \leq 0.001$) on technology entrepreneurship. Therefore, new/established ventures developed breakthrough innovations influenced by market regulations and governmental programs oriented to improve competitiveness and survive (Garcia and Calantone 2002; Renko et al. 2009; Zhou et al. 2005; Papaoikonomou et al. 2012; WIPO 2015). As a result, these mixed effects confirm the moderation effecting produced by economic cycles (pre-, during, and post-crisis) on the supportive environment for technology entrepreneurship initiatives (H3b). Regarding normative conditions (see Table 3), the evidence reveals that the probability of development technology entrepreneurship decreases when there are no positive perceptions about

opportunities in the country for exploiting/exploring new technological/entrepreneurial initiatives (-0.317; $p \leq 0.001$) and the national culture does not encourage creativity and innovativeness (-0.262; $p \leq 0.001$). Therefore, our results show a not supporting environment for technology entrepreneurship when we explore the effect of opportunity perceptions and culture (not supporting H2b). Similarly, in countries with no favorable normative conditions, previous studies have evidenced an increment in the opportunity cost for entrepreneurship and innovation (Cullen et al. 2014; Levie and Autio 2008; Yousafzai et al. 2015). These organizations face several barriers—the cost advantages of incumbent ventures, product differentiation by incumbent ventures, capital requirements, the switching costs of customers, access to distribution channels, and government policy—that decrease the likelihood, scope, and speed with which ventures develop technology and innovation practices (Damanpour 1991). Per socio-economic period, Model II also confirms the negative effect of these normative environmental conditions on technology entrepreneurship. Given the nature of these institutional conditions, the negative effect is not surprising taking into account that culture, values, perceptions and norms are conditions that do not easily change. However, the socio-economic periods moderate the intensity of the negative effect of culture and perceptions on technology entrepreneurship (supporting H3b).

4.3 Robustness tests

Taking into account the nature of our dependent variable, we decide to robust our analysis testing our model splitting the sample by ambitious entrepreneurs that have higher propensity to develop entrepreneurial innovations (Autio et al. 2014). In this regards, Table 4 shows the main results obtained by ambitious entrepreneurship and non-ambitious entrepreneurship. Interestingly, previous findings are confirmed in this additional test. Concerning organizational strategies, results show that intensity of the export market orientation and entrepreneurial orientation have a positive effect on the development of new technology entrepreneurship initiatives when the organizations are more ambitious in terms of organic growth. Regarding the environmental conditions, results confirm the effects of both regulative and normative environmental conditions on technology entrepreneurship.

5 Conclusions

Using data from the GEM, this paper analyzed the influence of strategic orientations (entrepreneurial and export market) and institutional environment (regulative and normative) on the development of technology entrepreneurship initiatives in new socio-economic scenarios.

Based on our results, we identify three main conclusions. First, at the organizational level, we confirm the important role of entrepreneurial orientation and export market orientation to develop breakthrough innovations (e.g., technology entrepreneurship initiatives). Interestingly, in uncertainty, an entrepreneurial orientation is an organizational dynamic capability that has a strong effect on technology entrepreneurship in contrast with an export market orientation that could vary in terms of the intensity and the influence of other international market conditions. In this regard, the paper contributes to the strategic management debate about the relevance of organizational dynamic capabilities such as export market and entrepreneurial orientation in the development of technology entrepreneurship initiatives in the new socio-economic reality as the recent financial crisis and recession

Table 4 Robustness tests [logistic regression; dependent variable: entrepreneurial innovations per level of ambition]

Entrepreneurial innovations	Ambitious entrepreneurs			Non-ambitious entrepreneurs		
	dy/dx	S.E.	$p>z$	dy/dx	S.E.	$p>z$
Organizational strategies						
Export market orientation [ref. non export]						
Under 10%	0.451	0.187	**	0.186	0.052	***
10–25%	0.585	0.233	**	0.099	0.096	
26–50%	0.531	0.257	**	0.072	0.104	
51–75%	0.595	0.270	**	0.404	0.100	***
76–90%	0.641	0.325	**	0.325	0.147	**
More than 90%	0.776	0.271	***	0.465	0.116	***
Entrepreneurial orientation	0.460	0.157	***	0.272	0.064	***
Environmental conditions						
(a) Regulative conditions						
Science and technology	−0.371	0.111	***	−0.386	0.037	***
Intellectual property rights	0.207	0.100	**	0.324	0.035	***
Government programs	0.085	0.088		0.193	0.028	***
Market dynamism	0.311	0.133	**	0.017	0.045	
(b) Normative conditions						
Opportunity perception	−0.191	0.111	*	−0.352	0.037	***
Culture	−0.184	0.088	**	−0.287	0.036	***
Control variables						
Ln owners	−0.009	0.097		0.071	0.042	*
Ln size	−0.193	0.160		−0.058	0.056	
Sector: services	0.185	0.137		0.021	0.047	
Age: new ventures	0.487	0.157	***	0.569	0.050	***
ln R&D investment	−0.692	0.185	***	−0.493	0.046	***
ln researchers	0.237	0.228		−0.129	0.074	*
ln GINI per capita	0.119	0.085		−0.045	0.038	
Economy: emerging economies	−0.342	0.410		−0.724	0.125	***
Environmental uncertainty: ref. 2005						
2008	0.034	0.179		−0.308	0.059	***
2011	−0.467	0.187	**	−0.673	0.061	***
Constant	−7.728	3.781	**	−0.221	1.505	
N			2469			28,064
Wald chi^2			159.91			1507.35
Prob > chi^2			0.0000			0.0000
Log pseudolikelihood			−781.724			−7502.078
Pseudo R^2			0.1981			0.1019

Level of statistical significance: ***$p \leq 0.001$; **$p \leq 0.050$; *$p \leq 0.100$

(Alotaibi and Zhang 2017; Kuratko et al. 2015; Papaoikonomou et al. 2012; Spyropoulou et al. 2017). Moreover, the paper also contributes to the entrepreneurship academic debate about providing a better understanding of the organizational determinants of technology

entrepreneurship initiatives (Autio et al. 2014; Barasa et al. 2017; Mosey et al. 2017). The main implication for organizational managers that emerges from these results is linked with the evidence about the reinforcing and intensity of dynamic capabilities and alternatives that several organizations have adopted to survive and be competitive during complex and uncertain socio-economic conditions. On one hand, organizations could assume a reactive/conservative behavior characterized by avoiding risks in investing on new technologies and surviving by the reduction of costs. On the other hand, organizations could assume a proactive behavior characterized by looking for new technological and entrepreneurial opportunities in domestic/international markets as well as current/different industries. Both alternatives would have a relevant impact on the performance, competitiveness and survival of those organizations. Second, at the country level, we confirm the relevance of a supportive environment for developing breakthrough technology innovations and entrepreneurship. In particular, our insights evidence how some regulative conditions (property rights and government programs) enhance while other regulative conditions (science and technology) and normative conditions (opportunity perception and national culture) simultaneously retard the probability that a new/established venture develops technology entrepreneurship initiatives. These effects are intensified during the economic cycles (pre-crisis, crisis, and recession). In this regard, at the country level, this paper contributes to the literature about the effect of certain components of the innovation and entrepreneurship ecosystems on the development of new technology entrepreneurship initiatives (Autio et al. 2014; Mosey et al. 2017) as well as the moderating effect produced by economic cycles (Congregado et al. 2012; Busenitz et al. 2014). Aligned to these contributions, emerges an implication for policy makers associated with the relevance of regulative environmental conditions (governmental programs and market regulations) that fostering entrepreneurship and innovation during economic crisis/recession. It is compressible that government tends to reduce their budgets in these periods and most of them are linked with the investment in innovation and entrepreneurship. Indirectly or directly, these results confirm the effectiveness of the maintenance of these regulations about entrepreneurship and innovation as crisis mitigation enablers. Finally, concerning the multilevel analysis, our paper provides evidence in two levels -organizational and country- and mixes different approaches -strategy, entrepreneurship, and innovation-. This is relevant because the value of organizational resources and capabilities in terms of increasing the likelihood of innovation could be conditioned by the environmental conditions (Barasa et al. 2017). In this regard, the findings of this paper point out that a supportive environment increases the value of organizational resources and capabilities for technology entrepreneurship, whereas weak environmental conditions diminish the value of those organizational resources and capabilities for technology entrepreneurship (Autio et al. 2014). Based on these findings, some implications for managers and policy makers emerge in terms of promoting the co-evolution of organizations and ecosystems working together for the development of more productive, inclusive and technology initiatives oriented to generate more societal, technological and economic impacts.

This study has several limitations associated with the metrics and the statistical models used in our analysis. First, we use a dichotomous dependent variable –technology entrepreneurship- based on three questions used by the GEM to measure innovation (Reynolds et al. 2005) and conceptual bases (Autio et al. 2014). Traditionally, innovations could be measured by objective/subjective metrics associated with the number of new products, technologies, patents, or outcomes as innovation performance. Second, we used some proxies for our explanatory variables—export market orientation and entrepreneurial orientation—that traditionally are measured by scales (Covin et al. 2006; Garcia and Calantone

2002; Zhou et al. 2005). Third, the GEM APS survey is oriented to an adult population to identify the propensity of entrepreneurial activities as well as some characteristics of the ventures identified. In this regard, the information about the organizational level is limited in terms of size, owners, and aspirations. Therefore, we did not have information about important control variables used in previous studies to predict innovations and new technologies, such as financial resources, R&D spending, external sources of innovation, and assets or revenues. Fourth, the GEM NES survey provides the valuation of environmental conditions that could be complemented by objective measures that capture regulative and normative dimensions that shape the development of entrepreneurial innovations. Finally, another limitation derives from the analysis of economic patterns/uncertainties that those countries have experienced. We introduce such a proxy of different economic periods per year (pre-crisis, crisis, and recession), but this issue requires further and deeper analysis, as countries differed in terms of the actual effects caused by those uncertain external economic conditions. Motivated by those limitations, we identify some natural extensions of this research. First, future studies could analyze the moderation effect of supportive environmental conditions in which organizations extract and appropriate the value of their resources and capabilities (Barasa et al. 2017; Bianchi et al. 2017; Fernández-Olmos and Ramírez-Alesón 2017). For example, it could be important to understand the diverse stages that innovation requires to take place under un/certainty periods; particularly to understand how R&D investments decrease/increase based on regulatory instruments –taxes, grants, subsidy, etc.—as well as the effect of the market (Goel 2007). Second, future studies could extend the analysis and discussion considering the two components of business creation -necessity and opportunity entrepreneurship- in the new economic world (Fairlie 2013; Fairlie and Fossen 2016) as well as the movements of (intra)entrepreneurial activity among countries. Third, future studies could pay more attention to diverse scenarios to generate knowledge, technology entrepreneurship (Su et al. 2015), and the intersection among individual, organizational, and environmental levels (Welter and Smallbone 2011). A general assumption is that is more likely to observe entrepreneurial diversity under uncertainty conditions than certainty conditions. Finally, according to Barasa et al.'s (2017) suggestions, future research could develop robust studies on this topic in emerging economies, contexts characterized with more uncertainty than developed economies.

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