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Innovativeness and internationalization in SMEs: An empirical analysis in European countries

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ABSTRACT

Innovation is essential to the knowledge economy and requires organizations to open to external markets. This paper delves into the influence of product innovation on internationalization in SMEs and elaborates an explanatory model of their innovative behavior. Analysis of the data of 123,395 surveys of firms in 13 European countries demonstrates that product innovation drives the firm's commercial expansion and favors its exportation activity, though with a non-linear relationship and decreasing performances as innovation level increases. It is also demonstrated that, in general terms, risk in geographic market extension does not vary in a relevant way when firms are more innovative. Significant differences were detected between countries in regard to the impact of innovation and its marginal utility, and in the evolution of risk in said market extension with increasing innovation. The comparative analysis reveals differences between more and less technological industries, and, on an aggregate level, between more developed economies in the Western and Eastern European transition economies, with less marked disparities from north to south. Analysis of the model reveals the prominence of internal variables in innovative behavior, as well as a certain disconnect between firms and the institutional context in the set of countries.

1. Introduction

In recent specialized literature, attention has been paid to the positive relationship between innovativeness and firms' level of internationalization in both technological (Doloreux and Laperrière, 2014) and non-technological sectors (Chiarvesio et al., 2015). The study of the relationship between these variables has been tackled in two ways: by observing how innovative organizations tend to be more international (Azar and Ciabuschi, 2017; D'Angelo et al., 2013; Pla-Barber and Alegre, 2007), and by analyzing how firms that expand their markets develop a greater innovative activity (Boermans and Roelfsema, 2015; Castellani and Zanfei, 2007; Kafouros et al., 2008). This complex bidirectional relationship (Boermans and Roelfsema, 2015; Rodil et al., 2016) or relationship of circular causality (Chiva et al., 2014) allows us to consider the existence of a virtuous circle based on the complementarity between both variables and their positive effect on firms' growth and profitability (Filippetti et al., 2011; Golovko and Valentini, 2011).

Various reasons justify the attention paid to small and medium firms (SMEs) in economic literature. From a theoretical point of view, the Schumpeterian process of creative destruction emphasizes the role of small firms in the complex innovative phenomenon (Roper and Hewitt-Dundas, 2017). However, knowledge on innovation in SMEs remains incomplete and discordant in the literature (Amara et al., 2008; Oke et al., 2007; Simon et al., 2002). The research reveals the idiosyncrasy of these organizations' innovative behavior (Battistella et al., 2015; Petter et al., 2014), as well as their general dependency on environment (Antonioli et al., 2014; Freel and Harrison, 2006; Tödtling and Trippl, 2005) and the difficulties that characterize this phenomenon (e.g. Laursen and Salter, 2014). Interest in SMEs has grown following the emphasis of evolutionary economics on micro-level analysis to improve the efficiency and performances of innovation systems (Asheim et al., 2011; Boschma and Frenken, 2006; Lundvall, 2007; Uyarra, 2010) and increase the innovative capability of SMEs in a territory (Kaufmann and Tödtling, 2001, 2002; Martínez–Román et al., 2011; Tödtling and Trippl, 2005; Zenka et al., 2014).

From a practical point of view, SMEs normally make up the largest group in the business system. In the European Union (EU-28), 99.8% of the business population are SMEs that play a fundamental role in economic growth and stability (European Commission, 2018a). Thus, a

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basic objective of economic policy in EU-28 has been the creation of a propitious environment favoring SMEs' competitiveness through innovation. In this sense, it is pertinent to point out the recent role of exportation on the growth of many EU-28 SMEs. In fact, 88.3% of European firms that export goods are SMEs and 36.1% of all goods exported come from SMEs (European Commission, 2018a: 9). However, most exporting SMEs concentrate exclusively on intra-EU trade, whereas only a fourth sell to the European market and the rest of the world (European Commission, 2018a). These numbers justify the growing interest of scholars and policy makers in fostering SMEs' competitiveness and market extension.

The positive relationship between innovation and internationalization could also be fundamental to SMEs (Paul et al., 2017), even in low-tech industries (Booltink and Saka-Helmhout, 2018). The link between innovation and internationalization is more marked in this type of firms (Roper et al., 2017). In fact, innovation has become a key factor in increasing European SME's probability of exporting (European Commission, 2018a). SMEs with innovative experience are more likely to export than non-innovative firms (Love and Roper, 2015), whereas those that operate solely in the local market tend to be less innovative (Crowley and Jordan, 2017). Indeed, innovative behavior is considered a source of global competitive advantage (Cavusgil and Knight, 2015), given its positive influence on firms' exportations (Kafouros et al., 2008; Pla-Barber and Alegre, 2007). Even accepting that this association may be universal or general (D'Angelo et al., 2013), the contradictory results observed in the case of products (Geldres-Weiss et al., 2016; Leonidou et al., 2007; Love et al., 2015; Wang et al., 2008) justify the realization of additional research. In addition, a knowledge gap persists in regard to the organizational foundations of innovative behavior in SMEs belonging to technological and non-technological sectors (Roper and Hewitt-Dundas, 2017; Tödtling and Trippl, 2005). This limitation stymies the drive toward internationalization in the business system, reducing the efficacy of measures adopted by managers and policy makers.

In order to better understand the relationship between innovation and internationalization, innovation's effect on risk in geographic market extension (local, regional, national, and international) may be analyzed. The effect of risk on internationalization is a current research topic (Buckley, 2016). In general, the risk derived from a firm's internationalization is viewed in literature as a result of the lack of information on new markets (Paul and Gupta, 2014) as well as the influence of psychological and environmental factors that affect risk taking (Buckley, 2016), although, on the other hand, it diversifies the firm's market risk (Barkema and Vermeulen, 1998). Variables highly linked to innovative outcomes and innovation itself also affect risk in market extension. Thus, learning and experiential knowledge of international markets appear in the literature as factors that may reduce the risk of a firm's external activity (Eriksson et al., 2000; Wagner, 2007), with recent emphasis on the role of collaboration with foreign partners (Johanson and Vahlne, 2009) and competitive experience in very distant markets (Geldres-Weiss et al., 2016). However, introduction of products to foreign markets may present a greater risk in market extension to the exporting firm (McDermott and O'Connor, 2002; Mu et al., 2009).

The burgeoning field of study of International Entrepreneurship (Zucchella et al., 2018) has paid growing greater attention to the relationship between innovation and internationalization, granting entrepreneurship the status of “trait d'union between the two” (Hagen et al., 2014: 111). It has also provided plausible explanations on the causes of the positive relationship between both variables. Accordingly, co-innovation between the firm and some key clients is a “door opener” facilitating international growth in the SMEs studied Löfgren (2014: 177). These dyadic relationships, along with network relationships, benefit the development of innovation, allowing risks to be shared and easing access to new markets (Chetty and Stangl, 2010). External networks, unstructured, informal and lacking substantial investment, facilitate the acquisition of new knowledge and are an important aspect of open innovation in SMEs (Van de Vrande et al., 2009). Though the relevant and complex relationship between innovation and internationalization has been tackled from different theoretical standpoints, it doubtless merits closer analysis.

Our research pursues the following three objectives. First, we elaborate and test an explanatory model of innovative behavior in European firms. The joint use of external and internal knowledge sources, including institutional ones, the distinction between adoption and generation of innovation, and the predominance of SMEs in the study are contributions of our research that help to overcome current limitations in firm-level innovation research (Buckley, 2016; Roper and Hewitt-Dundas, 2017). The second objective is to study the effect of product innovation level on expected geographic market extension, both at the level of the European Union and in different member countries. Since many internationalized firms emerged on a local or regional level (Love et al., 2015), in order to later geographically extend their markets after accumulating knowledge (Johanson and Vahlne, 1977), three levels of market extension are considered in the empirical analysis: local/regional, national and international. The third objective is to analyze the effect of product innovation level on risk in market extension. Thus, variations in risk in market extension with increased innovation level are analyzed, throughout the European Union as well as in countries and sectors.

The paper is organized in the following manner. Following this introduction, in Section 2, we establish the theoretical framework and formulate the hypotheses to be tested. Section 3 describes the empirical research, specifying data collection, the structure of the sample, the description of the variables and the methods used in the statistical analysis of the data. Section 4 reveals the results obtained, and in Section 5 they are discussed. Finally, Section 6 contains the main conclusions of the research.

2. Theoretical framework

A high level of innovation tends to boost national firms' opportunities to expand (Sahaym et al., 2012), improve their capacity to confront the uncertainties of the international context (Gupta et al., 2006) and even contribute to creating new markets (Porter, 1998). Innovation may drive internationalization, though we know relatively little about the innovative behavior of small firms (Roper and Hewitt-Dundas, 2017), especially in mature and less technological sectors (Tödtling and Trippl, 2005). Some findings attribute singularities to the innovative behavior of these organizations in their relationships with the external environment. Thus, for example, there are results revealing a certain disconnect with the institutional context (e.g. universities), whereas the relationship with agents of the value chain becomes closer when firms attempt to insert their most innovative products into the market (Roper and Hewitt-Dundas, 2017). Other research analyzes the effects of competitive environment and market extension on firms' innovative tendencies, with noteworthy results for policy and management (Crowley and Jordan, 2017; Roper et al., 2017).

The influence of environmental factors is apparent in the literature on innovation. The economic, sociocultural, scientific, technological and business characteristics of countries and regions clearly condition innovation patterns and external knowledge linkages (Blažek et al., 2013; Brown et al., 2016; Isaksen and Trippl, 2017; Tödtling et al., 2013). Organizational and institutional thickness and the wide range of resources available make developed economies the environment most conducive to innovation. On the other hand, peripheral, low-income or transition-stage economies are characterized by organizational e institutional thinness and a dearth of resources to innovate, particularly for small firms (Doloreux and Dionne, 2008; Isaksen and Trippl, 2017; Tödtling and Trippl, 2005). In this manner, differences between national environments affect the acceptance of new technologies and the introduction of products to the market (Ardito et al., 2015). To better

understand the scope of environmental conditions, comparative studies have been carried out between European countries (Clarysse and Muldur, 2001; Tödtling et al., 2013), and within individual countries (Blažek et al., 2013; Gumbau Albert, 2017), with great value for innovation theory and policy, as well as the advancement of research.

The internal processes related to innovation also present singularities affecting the innovative outcomes of SMEs (Martínez–Román et al., 2011). The determinants of innovative behavior in firms have typically been divided into categories of internal and external factors (Keizer et al., 2002; Radas and Božic, 2009; Romijn and Albaladejo, 2002), though the simultaneous analysis of the internal and external spheres of innovation on a firm level is a complex and relatively recent area of research (Keizer et al., 2002; Vega-Jurado et al., 2008). To achieve a global and unifying view, the literature proposes a multi-level perspective in the empirical analysis of enabling factors for each type of innovation (Crossan and Apaydin, 2010; Gupta et al., 2007). The introduction to the market of new products based on a firm's own technology is, from this viewpoint, the result of different determinants operating on different levels of analysis (Ardito et al., 2015). Individual-level analysis refers to the influence of training and previous experience of managers and workers, as well as the composition of the work team. Firm-level analysis focuses on the effect of strategic orientation, formal structure, organizational climate and administrative style, integration and coordination mechanisms, rewarding system and in-house R&D. Network-level analysis studies the effect of types of cooperation among industrial and non-industrial partners and clients, as well as the impact of firm acquisition. Industry-level analysis researches structural characteristics, competitiveness and turbulence of the sector, as well as the effect of regulatory environment and government support (Ardito et al., 2015).

Explanatory models integrating multiple levels of analysis provide a more complete perspective on the innovative phenomenon (Gupta et al., 2007). The strong interrelationships between both firm and environment (Clark and Guy, 1998) the interconnection between macro and micro spheres (Uyarra, 2010) and the effective combination of different levels of empirical analysis of innovative behavior (Romero and Martínez-Román, 2012) have favored the integration of determinants of different levels in explanatory models that associate innovative outcomes with certain organizational and environmental characteristics of firms. The study of this specific literature (e.g. Ar and Baki, 2011; Caloghirou et al., 2004; Castellaci, 2010; Forsman, 2011; Freel, 2003; Hurley and Hult, 1998; Romero and Martínez-Román, 2012; Yam et al., 2011) allows us to identify three conceptual categories of explanatory variables for innovative behavior, linked respectively to the generation of innovative capability in organizations, contextual factors and the institutional support for innovation provided by the environment.

Innovative Capability includes internal variables related to the organization's innovative behavior (firm-level analysis), some referring to knowledge creation and others to an organization's structure or strategy (Ardito et al., 2015). Knowledge is a basic factor in innovation (Nelson and Winter, 1982; Rothwell, 1994; Von Krogh et al., 2001). Said knowledge may be generated in the firm through in-house R&D (Forsman, 2011; Keizer et al., 2002), training and learning (Damanpour, 1991; Hull and Covin, 2010) or through external technology acquisition (Tsai and Wang, 2009) and adaptation of said technology to the organization. Among the variables of organizational structure are factors such as size (Amara et al., 2008; Martínez–Román et al., 2011; Rodil et al., 2016) and membership in a business group (Gómez and Vargas, 2009). This set also includes variables of internal cooperation and information sources (Koschatzky, 1998; Sternberg and Arndt, 2001) that favor a firm's innovative activity, individually or with other firms of the group (Molero and García, 2008). The category likewise encompasses variables dealing with the firm's strategic orientation (Laforet, 2008; Rosenbusch et al., 2011), such as product differentiation (Ar and Baki, 2011; Gatignon and Xuereb, 1997), which shows a clear influence on the internationalization of new products (Frey et al., 2013), market focus (Martínez–Román et al., 2011), and new management strategies (Radas and Božic, 2009). Despite research efforts on this level of analysis, certain deficiencies remain, warranting attention in future studies (Ardito et al., 2015). The results of these investigations allow us to formulate the following hypothesis regarding innovative capability:

Hypothesis 1a. Variables related to innovative capability exert a significant influence on level of product innovation.

Contextual Factors prove to exert a relevant influence on the innovative activity of firms. An abundance of empirical studies analyze the influence of different modalities of cooperation and collaboration within the value chain (network-level analysis) on firms' innovative activity and outcomes (Edler, 2004; Freel, 2003; Tödtling et al., 2009), especially in the case of SMEs, given their greater dependence on the local and regional economic context. Numerous references indicate that innovation is positively influenced by cooperation with clients (Kaufmann and Tödtling, 2001; Rondé and Hussler, 2005), suppliers (Ar and Baki, 2011; Fritsch and Lukas, 2001), competitors (Freel, 2003; Romijn and Albaladejo, 2002) and others (Freel, 2003), and by the participation in business networks (Amara et al., 2008; Romijn and Albaladejo, 2002). Likewise, the literature usually associates cooperation in the value chain with the incorporation of incremental changes in SMEs, product differentiation, and satisfaction of clients' needs (Porter, 1998). In this sense, further research must address such questions as the effect of each type of collaboration, substitution between internal and external knowledge sources, and the different types of agents that influence the level of novelty of products introduced to the market (Ardito et al., 2015). Based on this literature, we propose the following hypothesis regarding the contextual factors:

Hypothesis 1b. Variables related to contextual factors exert a significant influence on level of product innovation.

The category of *Institutional Support* includes relationships with institutional agents and government support (network-level and industry-level analysis). In this category, we find sources of information obtained from universities and other institutions of higher learning, governments or public research institutes, consultancies and commercial laboratories, or private R&D centers (Howells, 2005; Rodríguez-Pose and Crescenzi, 2008), as well as external information sources such as attendance at fairs, conferences, etc. (Caloghirou et al., 2004; Jiménez–Jiménez and Sanz–Valle, 2011). Likewise, this category includes variables of cooperation with universities and other institutions of higher education, governments or public research institutes, consultancies or commercial laboratories or private R&D centers (D'Este et al., 2013; Kaufmann and Tödtling, 2002). Also included in this category are variables referring to public funding sources for innovation (Galasso and Tombak, 2014; Kaufmann and Tödtling, 2002), both nationally and on a European level. However, the favorable effect of subsidies and public financial support for innovation activities (Feldman and Kelley, 2006; Keizer et al., 2002; Kleer, 2010) is at times imperceptible (Radas and Božic, 2009) or only evident in certain circumstances (Santamaría et al., 2010), such that further investigation is needed to clarify the effect of public incentives on product innovation (Ardito et al., 2015). Thus, we can propose the following hypothesis:

Hypothesis 1c. Variables related to institutional support for innovation exert a significant influence on level of product innovation.

Likewise, we study the validity of the complete model encompassing the aforesaid categories of explanatory variables (innovative capability, contextual factors and institutional support). By teasing out implicit relationships among the complete set of internal and external explanatory variables and the level of product innovation, this model should explain the complexity of the innovative phenomenon more effectively than the submodels composing it. To this end, the following hypothesis was formulated in regard to the complete model:

Hypothesis 1. Variables related to innovative capability, contextual factors and institutional support for innovation exert a significant influence on level of product innovation.

The influence of product innovation on market extension in the firm is a relevant topic in the literature (Azar and Ciabuschi, 2017; Geldres-Weiss et al., 2016). In these papers, innovation level or radicality of new products in the market tends to favor a firm's external projection. The literature associates incremental innovation with low levels of internationalization, whereas radical innovation often appears in connection with internationalization on a global level (Chiva et al., 2014).

Measuring the innovation level of a broad and heterogeneous set of firms is not easy. Thus, proxies such as R&D intensity are frequently used (Andersen, 2008; Booltink and Saka-Helmhout, 2018), though this may hinder empirical research (Buckley, 2016). However, innovation level is linked in the literature to the process of knowledge acquisition, and specifically to the internal generation of technological knowledge (Gómez and Vargas, 2009) and the adoption of knowledge and technologies from the market (Gil et al., 2012), two processes which in practice may be easily differentiated. Adoption and generation are common methods of acquiring the necessary knowledge to develop new products (Buckley, 2016) in order to achieve success in external markets (Cavusgil and Knight, 2015; Teece, 2007).

The literature tends to associate knowledge generation with radical innovation and knowledge adoption with incremental innovation (Damanpour and Wischnevsky, 2006; Pérez-Luño et al., 2011) while the effective combination of both, or ambidextrous capability, is associated with greater innovation and better results in international markets (De Visser et al., 2010; Zhou et al., 2016). These so-called ambidextrous capacities play a key role in inserting new products in international markets (Zhou et al., 2016) and increasing the effectiveness of radical and incremental innovation (De Visser et al., 2010). In sum, adoption, generation and ambidextrousness are phases of innovation with a proven influence on internationalization in firm-level analysis.

Given that product innovation may favor firms' exportation (e.g. Azar and Ciabuschi, 2017; Cavusgil and Knight, 2015), it is reasonable to ask whether expected geographic market extension, henceforth market extension, of exporting firms shows meaningful growth with increasing levels of product novelty. In order to empirically test this relationship, we formulated the following hypothesis:

Hypothesis 2. Level of product innovation exerts a significant impact on expected market extension.

Innovation and risk are issues not yet resolved in the literature on internationalization (Buckley, 2016; Hitt et al., 2016). Openness to the outside generates more complex and ambiguous environmental conditions and constitutes a strategic and organizational challenge for the innovative firm. In such situations, risk management is a problem of significant practical interest for exporting firms (Cavusgil and Knight, 2015; Johanson and Vahlne, 2009), which may use the flexibility provided by diversification to cope with risks and foster knowledge transfer and product innovation (Hitt et al., 2016; Wu, 2013). However, innovation's effect on risk in market extension is a complex matter for empirical research.

Strategic Management offers models fundamental to understanding and managing innovation and for the growth of international markets (Zucchella et al., 2018; Zucchella and Magnani, 2016). Strategic flexibility can reduce risks, enabling innovation and the creation of new markets (Brozovic, 2018). It is also worth noting that the concept of open innovation (Chesbrough et al., 2006) can be a useful mechanism for achieving strategic flexibility (Brozovic, 2018) and for market expansion (Van de Vrande et al., 2009). This new paradigm of innovation management is gaining force in many industries (Chesbrough, 2003) as well as in SMEs (Van de Vrande et al., 2009). A firm's business model (Chesbrough et al., 2006), potentially a relevant source of rigidity, can benefit from the implementation of open innovation platforms (Brozovic, 2018). In general, innovation abilities can help firms become more proactive (Brozovic, 2018).

Innovations favor the adaptation of the firm to a global competitive environment characterized by change and uncertainty (Azar and Ciabuschi, 2017). Yet the development of new products also implies a high level of risk for the firm (Mu et al., 2009) that must be controlled through the acquisition and management of new technological and organizational knowledge and the implementation of specific strategies oriented regarding internal risk (Cooper, 2003; Stosic et al., 2017), especially in the most technologically intense sectors (Andersen, 2008; Kim and Vonortas, 2014). Thus, innovative radicality encourages internationalization (Chiva et al., 2014), while also increasing risk in a firm's expected results (McDermott and O'Connor, 2002).

Innovation raises the level of risk when the introduction of new products or processes, the incorporation of substantial organizational improvements and marketing are decisive in positioning a firm in international markets (Johanson and Vahlne, 2009). This type of situations may exert a negative impact on new firms' internationalization when the uncertainty and dynamism of the market are high (Baronchelli and Cassia, 2014; Zhou et al., 2016). This scenario is common in the global competitive environment to which an ever greater number of SMEs aspire, with innovation as their main source of competitive advantage in said context. As these small organizations increase their market extension, it is of vital interest for them to control the risks related to innovation.

In short, the introduction of novel products to new markets may directly affect a firm's risk in market extension. To evaluate the risk of this impact, especially in innovative SMEs, we formulated the following hypothesis for empirical testing:

Hypothesis 3. Level of product innovation influences risk in market extension.

Fig. 1 shows the conceptual model proposed and its research hypotheses.

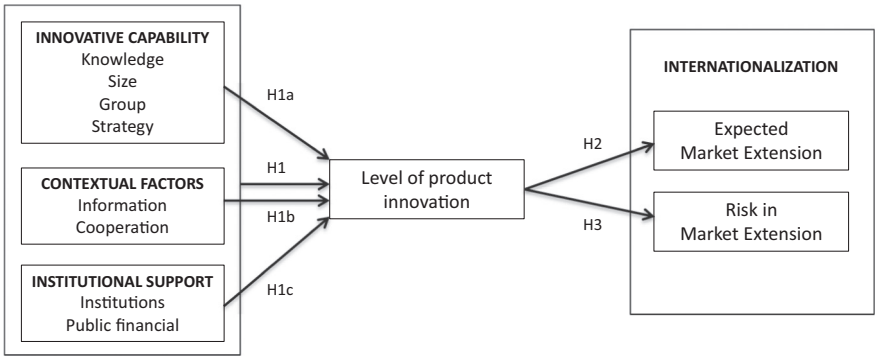


Fig. 1. Conceptual model.

Table 1
Structure of the sample.

Country	Agriculture	Manufacture	Construction	Trade	Hospitality	Services	Total	%
Bulgaria	0	9,412	0	3,555	0	2,892	15,859	12.8%
Czech Republic	0	3,340	453	672	164	2,175	6,804	5.5%
Estonia	0	2,430	0	354	0	1,202	3,986	3.2%
Germany	0	3,818	0	203	0	2,005	6,026	4.9%
Hungary	0	3,140	684	508	0	1,058	5,390	4.4%
Italy	0	7,375	4,368	3,437	1,473	3,251	19,904	16.1%
Lithuania	0	1,063	172	270	0	606	2,111	1.7%
Norway	59	2,070	610	529	0	1,615	4,883	4.0%
Portugal	0	4,069	45	892	0	1,506	6,512	3.3%
Romania	0	5,724	0	2,142	0	1,765	9,631	7.8%
Slovakia	0	1,052	424	421	0	399	2,296	1.9%
Slovenia	0	1,459	0	455	0	679	2,593	2.1%
Spain	947	17,008	2,990	5,430	1,371	9,654	37,400	30.3%
Total	1,006	61,960	9,746	18,868	3,008	28,807	123,395	
%	0.8%	50.2%	8.0%	15.3%	2.4%	23.3%		
					Firm size	Small firms	75,666	61.3%
						Medium firms	35,479	28.8%
						Large firms	12,250	9.9%
							123,395	

3. Empirical research

3.1. Data collection

For the purposes of the empirical study, we used the database of The Community Innovation Survey 2008 –CIS 2008– coordinated by Eurostat, the statistical office of the European Union. CIS-2008 offers official data regarding firms' innovative capability, reporting on innovation objectives and activities, information sources, sphere of cooperation, public funding, innovation costs and market extension of European firms in the 2006–2008 time period. The target population is comprised by firms of > 10 employees in the sectors of the Statistical Classification of Economic Activities in the European Community, -NACE Rev.2- (European Commission, 2008), except for sections O to U.

3.2. Sample and variables

The sample, composed by 123,395 firms from 13 European Union member states, was obtained from CIS-2008. This extensive sample includes the entirety of data provided by Eurostat. For details, see Table 1.

Table 2 shows the description of variables used in the research. Variables explaining level of innovation are broken into three categories: Innovative Capability, Contextual Factors and Institutional Support. The literature associates the level of an innovation's novelty with adoption or generation of innovations and the combination of the two processes with the highest levels of innovation. Thus, the adoption of novelties by a firm is associated with incremental innovation, generation of novelties for the market implies greater newness, and the ability to combine both capacities is related to greater radicality of innovation. Lastly, to measure market extension we use an ordinal scale that assigns higher values as access to broader geographic markets increases.

3.3. Methods

For the test of Hypothesis 1, a multiple linear regression is calculated, whose significance is proven using a F-Snedecor test. Hypotheses 2 and 3 were tested simultaneously comparing the confidence intervals of mean and standard deviation of a conditional expectation function –CEF– (Gujarati, 2004: 40). The graphic representation of the CEF illustrates the evolution of expected value and risk in market extension with progressively increasing product innovation levels. Later, the graphs and correlations between the CEFs and characteristics of sectors or countries are analyzed.

4. Results

4.1. Explanatory model for product innovation

Using a Backwards method, a more adjusted and parsimonious model was obtained for 18 variables from the initial set (Table 2). The procedure consisted in deleting spurious variables whose impact on the model's coefficient of determination could be considered marginal. This procedure implied the elimination of seven variables whose combined impact on R'^2 is < 0.01% of its value using the initial 25 explanatory variables.

Table 3 shows the results of the F-Snedecor test of the adjusted model. As can be observed, the model possesses a high level of signification (p < 0.01%) with a correct explanatory capacity for the level of product innovation (R^2 = 0,529), such that Hypothesis 1 is verified. Likewise, the submodels formed by the three categories of variables also pass the signification test, with the category of Innovative Capability possessing the greatest explanatory capacity. Thus, Hypotheses 1a, 1b and 1c are also verified.

The regression coefficients, their normalized values, and the p-values of the explanatory variables appear in Table 4. The results reveal that all the explanatory variables of the adjusted model are significant (p < 0,01), though some have a negative sign and decrease the radicality of product innovation.

4.2. Relation between product innovation and market extension

Table 5 shows the distribution of frequencies of market extension for firms according to their level of product innovation.

Given the plausible existence of a non-linear relationship between innovation and market extension, a non-linear regression analysis was carried out using the conditional expectation function (CEF), given the large size of the sample. Sample mean of the variable market extension was calculated for each level of innovation, four conditioned means were obtained, along with their respective standard deviations. Risk in market extension was observed to depend little on innovation level. Table 6 shows these calculations.

Using the conditioned means, a CEF was elaborated for market extension, represented in Fig. 2 by a continuous line, along with bands of variation indicating risk, represented by dotted lines which result from adding and subtracting the standard deviation from each mean. The graph reveals the existence of a non-linear relationship between

Table 2
Description of variables.

		Description variables	Scales
Explanatory variables			
Categories and variables			
Innovative capability	Know_int	In-house R&D and Training for personnel for innovative activities	Ordinal (0–3)
	Know_ext	External R&D and Acquisition of external knowledge	Ordinal (0–2)
	Know_other	Market introduction of innovation and other activities	Ordinal (0–2)
	Size_08	Total number of employees 2008 (small, medium, large)	Ordinal (1–3)
	Size_06	Total number of employees 2006 (small, medium, large)	Ordinal (1–3)
	Group	The firm is part of an enterprise group	Dichotomous
	Location	Country of head office national or international	Dichotomous
	Source_group	Information source within your enterprise or enterprise group	Ordinal (0–3)
	Coop_group	Cooperation with other firms within your enterprise group	Ordinal (0–6)
	Prod_strategy	Increase range or improve quality of goods or services	Ordinal (0–6)
	Proc_strategy	Improve flexibility or increase capacity for producing goods or services or reduce labor costs per unit output	Ordinal (0–9)
	Mark_strategy	Enter new markets or increase market share	Ordinal (0–3)
Contextual factors	Source_supplier	Information source suppliers of equipment, materials, components or software	Ordinal (0–3)
	Source_client	Information source clients or customers	Ordinal (0–3)
	Source_compet	Information source competitors or other enterprises in your sector	Ordinal (0–3)
	Coop_supplier	Cooperation with suppliers of equipment, materials, components or software	Ordinal (0–6)
	Coop_client	Cooperation with clients or customers	Ordinal (0–6)
	Coop_compet	Cooperation with competitors or other enterprises in your sector	Ordinal (0–6)
Institutional support	Source_lab	Information source consultancies, commercial labs, or private R&D institutes	Ordinal (0–3)
	Source_univ	Information source universities or higher education institutions or government or public research institutes	Ordinal (0–6)
	Source_other	Other information sources conferences, trade fairs, exhibitions, scientific journals and trade/technical publications, professional and industry associations	Ordinal (0–9)
	Coop_lab	Cooperation with consultancies, commercial labs, or private R&D institutes	Ordinal (0–6)
	Coop_univ	Cooperation with universities or higher education institutions or government or public research institutes	Ordinal (0–6)
	Fin_nat	National public financial support for innovation activities	Ordinal (0–3)
	Fin_eur	European public financial support for innovation activities	Ordinal (0–3)
Explained variables			
Variables			
	Product_innov	Level of radicality in product innovation (no-innovative = 0, adoption = 1, generation = 2, innovative = 3)	Ordinal (0–3)
	Market_exten	Level of market extension (local = 1, national = 2, local + national = 3, international = 4, local + international = 5, national + international = 6, local + national + international = 7)	Ordinal (1–7)

product innovation and expected market extension. It can be observed that the distance between the bands of variation is practically constant, which means that an increase in innovation level does not significantly condition risk in market extension for European firms.

Table 6 also shows the confidence intervals of 95% for conditioned means and standard deviations for market extension. When the corresponding confidence intervals of means (standard deviations) do not overlap, those means (standard deviations) are different with a significance level of 5%. In our case, Hypothesis 2 is validated since all means are significantly different from each other, when compared two by two. In regard to standard deviations, they prove to be significantly different from each other, except between innovation levels of 0 and 1, in which case not only can we observe overlapping of intervals, but indeed a direct test of difference in variances indicates no significant difference between them. Thus, Hypothesis 3 tests positively.

Table 7 shows the coefficients of the total and sectorial CEFs as well as those corresponding to specific countries. The impact of product innovation on market extension is expressed by *b*, coefficient of linear regression, which measures average increase in market extension for each added level of innovation. The coefficient *cc* indicates the curvature of the CEF or decrease in marginal utility with greater innovation. The indicator *bs*, coefficient of linear regression for standard deviation, shows the variation of standard deviations for each added level of

Table 4
Regression coefficients and p-values.

Variables	Coefficients	Normalized coefficients	p-Values
	b_i	b_i^*	x_i
Know_int	0.2010	0.1714	0.000E+00***
Know_ext	0.0457	0.0199	6.936E−18***
Know_other	0.2760	0.1512	0.000E+00***
Size_06	0.0185	0.0123	4.045E−11***
Source_group	0.0325	0.0387	4.133E−29***
Prod_strategy	0.1358	0.3143	0.000E+00***
Proc_strategy	−0.0285	−0.0869	2.919E−124***
Mark_strategy	0.0833	0.0991	1.734E−119***
Source_supplier	−0.0440	−0.0450	8.935E−47***
Source_client	0.0664	0.0680	1.980E−83***
Source_compet	−0.0334	−0.0286	1.317E−19***
Coop_supplier	0.0380	0.0237	7.214E−24***
Coop_client	0.0527	0.0317	8.944E−42***
Source_lab	−0.0111	−0.0083	1.330E−03***
Source_univ	−0.0210	−0.0237	3.090E−18***
Source_other	0.0143	0.0301	6.700E−21***
Coop_univ	0.0520	0.0172	6.565E−14***
Fin_nat	0.0622	0.0350	1.133E−61***

*** p-value ≤ 0.01.

Table 3
F-Snedecor test.

	n	p	R^2	F-Snedecor value	p-value	Result
Complete model	123,395	18	0.52891	7,695.4	< 0.0001	Positive
Innovative capability submodel	123,395	8	0.52176	16,826.8	< 0.0001	Positive
Contextual factors submodel	123,395	5	0.36511	14,191.6	< 0.0001	Positive
Institutional support submodel	123,395	5	0.31612	11,407.2	< 0.0001	Positive

Table 5
Distribution of frequencies.

Market extension	Non-innovative		Adopting		Generating		Innovative		Total	
1	29,323	45.5%	9,539	14.8%	22,410	34.8%	3,170	4.9%	64,442	52.2%
2	2,261	7.3%	6,714	21.8%	19,831	64.4%	1,964	6.4%	30,770	24.9%
3	1,182	25.5%	2,624	56.7%	506	10.9%	315	6.8%	4,627	3.7%
4	1,698	21.4%	5,112	64.4%	667	8.4%	460	5.8%	7,937	6.4%
5	1,337	52.0%	282	11.0%	132	5.1%	820	31.9%	2,571	2.1%
6	3,366	53.4%	754	12.0%	682	10.8%	1,498	23.8%	6,300	5.1%
7	383	5.7%	171	2.5%	1,549	23.0%	4,645	68.8%	6,748	5.5%
Total	39,550	32.1%	25,196	20.4%	45,777	37.1%	12,872	10.4%	123,395	100%

Table 6
Mean and standard deviation.

Product innovation	Market extension			
	m	Interval	SD	Interval
Innov = 0	3.418	(3.395, 3.441)	2.317	(2.301, 2.333)
Innov = 1	4.609	(4.581, 4.638)	2.337	(2.316, 2.357)
Innov = 2	5.078	(5.057, 5.098)	2.216	(2.201, 2.230)
Innov = 3	5.248	(5.211, 5.285)	2.135	(2.108, 2.160)

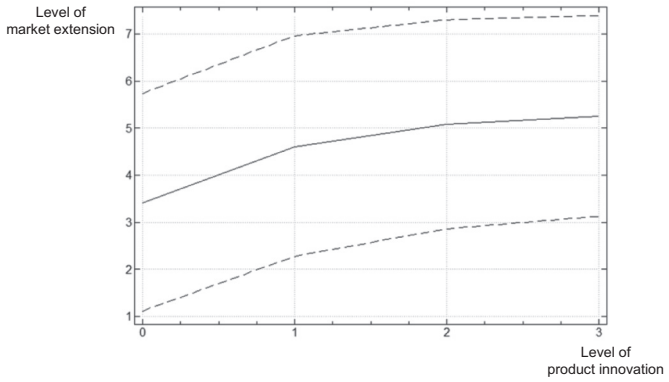


Fig. 2. Conditional expectation function (CEF).

innovation; the line converges when the sign is negative and diverges if it is positive. Coefficient *rs* indicates the level of linearity of risk in regard to innovation. Table 7 shows the analytical results by sectors and countries, which are shown in Figs. 3 and 4. The Agriculture and Hospitality sectors have been eliminated from the analysis given the lack of data for most countries.

Finally, Table 8 shows the correlations of the coefficients of CEFs with the GDP (PPP) per capita and the geographical location of each economy, data which appears in the Appendix. The results show significant relationships whose consequences will be analyzed.

5. Discussion

The adjusted model contributes to knowledge of the innovative behavior of European firms in different sectors, mainly SMEs (Roper and Hewitt-Dundas, 2017; Tödtling and Trippl, 2005), analyzing their internal and external sphere (Keizer et al., 2002; Vega-Jurado et al., 2008). The results of the submodels for both categories reflect a predominance of the internal explanatory variables over the external ones (Koschatzky, 1998; Sternberg and Arndt, 2001), without appreciable differences in this sense between contextual and institutional variables. The analysis of the coefficients of the linear regression highlights the importance of improvement strategies and product differentiation (Ar and Baki, 2011; Frey et al., 2013; Gatignon and Xuereb, 1997), of R&D activities (Keizer et al., 2002, Roper and Love et al., 2015; Vega-Jurado et al., 2008) and of learning (Damanpour, 1991; Hull and Covin, 2010), whereas improvements in processes reduce radicality in products, perhaps because they absorb part of the firm's resources.

Analysis of the sample as a whole shows a positive, non-linear relationship between product innovation level and expected market extension. Fig. 2 indicates that a greater positive impact on market extension occurs when the set of firms is able to adopt novelties or technological improvements (value 1 of axis X), an effect which diminishes progressively with increasing innovative behaviors (value 2 of axis X), until reaching the highest level of product innovation (value 3 of axis X). This decreasing marginal utility of innovation is graphically represented by *parameter cc* of the CEF, whose value is −0.270 points on the scale of market extension (1–7). We could say that the positive impact of innovation is reduced as we reach higher levels of internationalization. On the other hand, the leap from not innovating to achieving the highest levels of innovation has a positive impact of 1.83 points, in other words, 30.5% on the scale of market extension. These results confirm the link between radical innovation and internationalization (Chiva et al., 2014) and acknowledge the importance of ambidextrousness in succeeding in external markets (De Visser et al., 2010; Zhou et al., 2016). Likewise, it is demonstrated that product innovation drives firms' commercial expansion (Azar and Ciabuschi, 2017; Chiarvesio et al., 2015; Doloreux and Laperrière, 2014) and generally fosters exportation activity (Kafouros et al., 2008; Pla-Barber and Alegre, 2007; Roper et al., 2017), albeit in a non-linear manner and with performances decreasing with increases in innovation level.

Also worth mentioning is the fact that risk in market extension does not increase significantly because a firm is more innovative. According to Fig. 2 the bands of variation of market extension show practically no dependence on product innovation level. The value of the coefficients of CEF indicates a linear relationship between product innovation level and risk in market extension ($rs = -0.895$), as well as a slight convergence or reduction of the variability in projected level of extension with added levels of innovation ($bs = -0{,}053$). Thus, the global results of the research suggest that information and experiential knowledge acquired in more diverse markets limit the risk derived from external activity (Eriksson et al., 2000; Wagner, 2007) and innovation (Johanson and Vahlne, 2009; McDermott and O'Connor, 2002), and favor the management of internal and external risks related to product innovation (McDermott and O'Connor, 2002; Mu et al., 2009).

The sectorial analysis reveals differences between activities of production (Fig. 3). Manufacture shows a behavior similar to the total set due to its greater frequency in the sample. Here, the impact of innovation on market extension is higher than in any other sector ($b = 0.711$) and its decreasing marginal utility is evident ($cc = -0.283$). This is the only sector in which the bands of variation of market extension clearly converge, indicating a reduction in standard deviation ($bs = -0{,}173$ and $rs = -0.998$). This effect may be associated with the need for greater innovativeness in more technological sectors (Anderton, 1999; Roper and Love, 2002). Likewise, in Construction a moderate positive effect of product innovation on market extension is confirmed (Martínez–Román et al., 2017), though the bands of variation diverge in this case ($bs = 0.205$ and $rs = 0{,}916$). This amount of risk could result from an uncertain reception of novel

Table 7
Coefficients of conditional expectation function (CEF).

	Coefficients of the CEF								
	a	b	r	aa	bb	cc	as	bs	Rs
Total	3.466	0.698	0.961	3.420	1.414	−0.270	2.323	−0.053	−0.895
Sectors									
Manufacture	3.927	0.711	0.957	3.865	1.465	−0.283	2.379	−0.173	−0.998
Construction	2.201	0.331	0.957	2.192	0.703	−0.143	1.636	0.205	0.916
Trade	3.158	0.507	0.976	3.145	0.926	−0.160	2.268	0.056	0.875
Services	3.325	0.483	0.989	3.307	0.742	−0.097	2.210	0.006	0.335
Country									
Bulgaria	2.846	0.568	0.988	2.838	0.760	−0.085	1.858	0.117	0.966
Czech Republic	3.612	0.682	0.956	3.556	1.479	−0.294	2.382	−0.110	−0.973
Estonia	4.957	0.297	0.927	4.925	0.600	−0.114	2.177	−0.173	−0.941
Germany	3.702	0.661	0.965	3.604	1.225	−0.203	2.332	−0.179	−0.974
Hungary	4.274	0.608	0.933	4.241	1.392	−0.302	2.207	−0.118	−0.944
Italy	3.095	0.693	0.965	3.055	1.392	−0.266	2.330	0.032	0.555
Lithuania	3.858	0.449	0.928	3.833	0.957	−0.183	2.248	−0.046	−0.838
Norway	2.839	0.640	0.948	2.777	1.737	−0.377	2.060	−0.019	−0.536
Portugal	4.393	0.405	0.950	4.341	0.819	−0.156	2.405	−0.104	−0.971
Romania	2.599	0.470	0.977	2.583	0.798	−0.127	1.899	0.084	0.838
Slovakia	4.033	0.540	0.909	3.992	1.437	−0.339	2.312	−0.092	−0.945
Slovenia	4.359	0.579	0.955	4.311	1.294	−0.255	2.511	−0.226	−0.983
Spain	3.699	0.783	0.947	3.643	1.733	−0.357	2.418	−0.132	−0.995

Notes:
a: Intercept term of linear regression for mean.
b: Coefficient of linear regression for mean.
r: Correlation coefficient of the former linear regression for mean.
aa, bb, cc: Coefficients of parabolic regression for mean.
as: Intercept term of linear regression for standard deviation.
bs: Coefficient of linear regression for standard deviation.
rs: Correlation coefficient of the former linear regression for standard deviation.

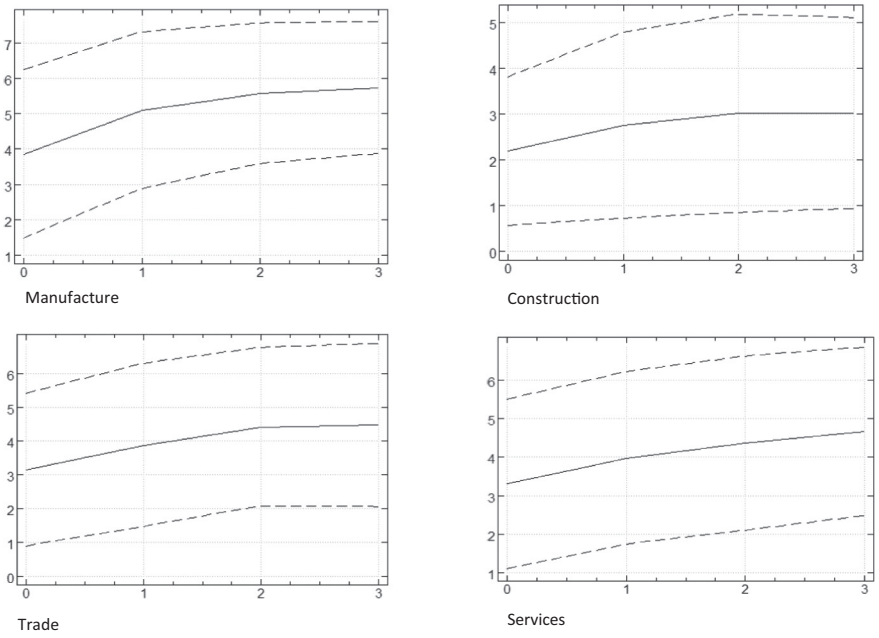
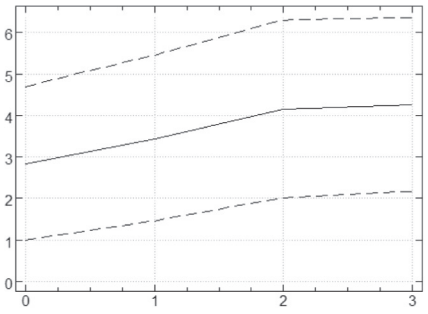


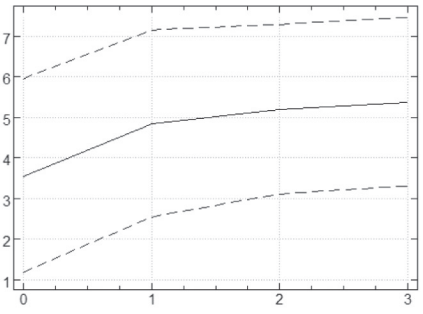
Fig. 3. CEFs by sector.

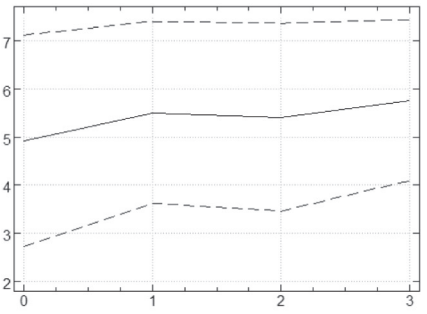
products in this sector. A similar situation occurs in Trade, albeit with only a small divergence (*bs* = 0.056 and *rs* = 0,875). Services has practically parallel bands of variation (*bs* = 0.006) and an especially low *rs* value (0.335) indicating a more complex (non-linear) relationship between innovation and risk in market extension in this sector.

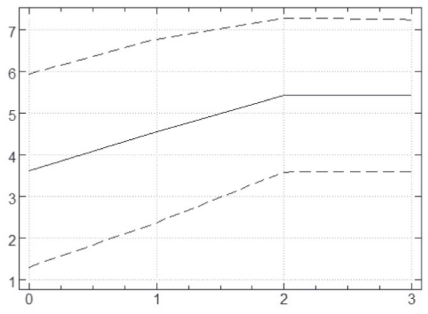
The analysis by countries shows interesting results (Table 7). In Spain, Italy and the Czech Republic, considerable gains in market extension occur with each added level of innovation (*b*), whereas surprisingly little impact may be observed in Estonia. The marginal utility of innovation (*cc*) also shows national disparities, with more intense decreasing performances in innovation in Norway, Spain and Slovakia, whereas this tendency is less pronounced in Bulgaria and Estonia. There are also national differences in the evolution of risk (*bs*). Namely, in Bulgaria, Romania and Italy, the variation is divergent, with increased risk in market extension due to innovation (divergent bands), whereas in other countries the variation is convergent, meaning that increased innovation slightly reduces risk, especially in Slovenia.

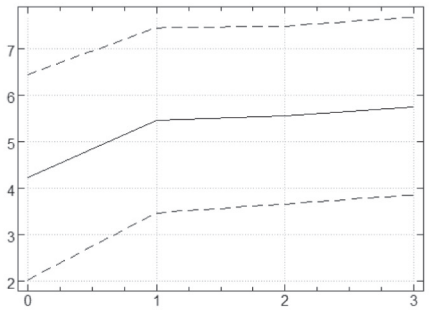
Seeking a pattern in these national disparities, we analyzed the

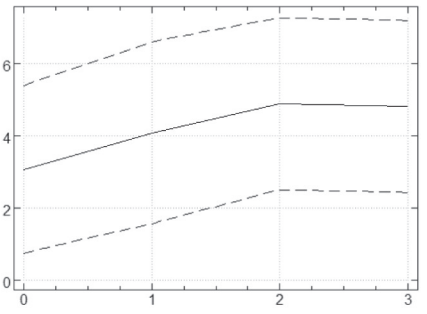

Bulgaria

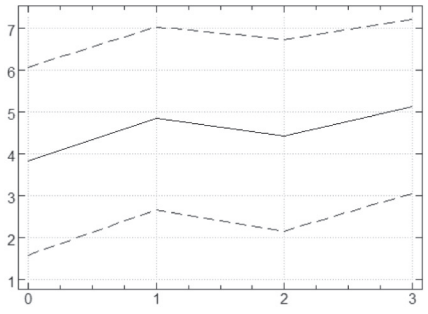

Czech Republic

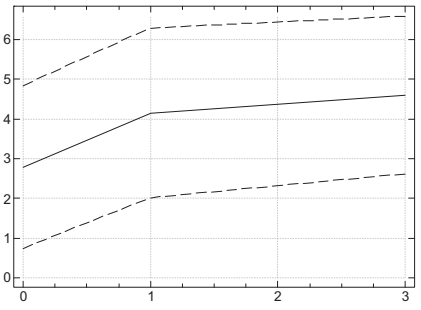

Estonia

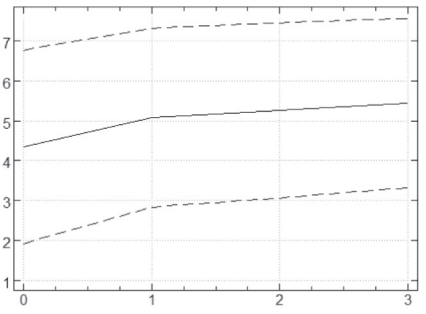

Germany

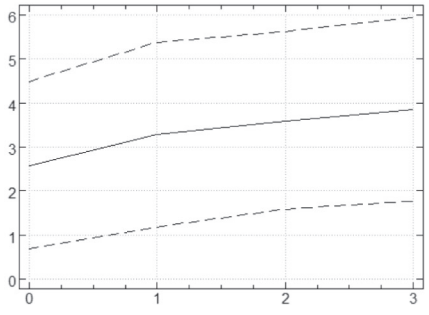

Hungary

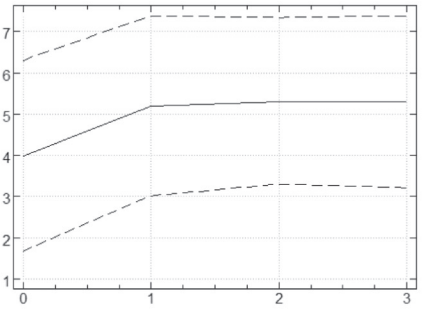

Italy

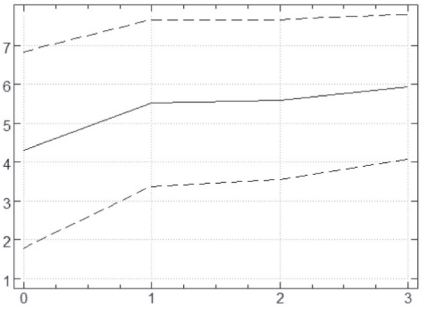

Lithuania


Norway


Portugal


Romania


Slovakia


Slovenia

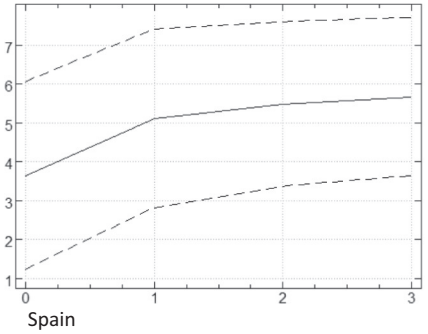

Spain

Fig. 4. CEFs by country.

Table 8
Correlations between CEFs and country characteristics.

	Coefficients of CEFs								
	a	b	r	aa	bb	cc	as	bs	rs
GDP (PPP) pc ordinal	−0.028	0.572**	−0.016	−0.056	0.691**	−0.630**	0.547*	−0.411	−0.360
Latitude ordinal	0.084	−0.202	−0.545*	0.079	0.149	−0.254	−0.156	−0.162	−0.303
Longitude ordinal	−0.021	−0.492*	0.029	0.003	−0.602**	0.568**	−0.614**	0.342	0.418

* 0.05 < p-value ≤ 0.1.
** 0.01 < p-value ≤ 0.05.

correlations of the coefficients of the CEFs with GDP and geographical location of the countries in the sample (Table 8). The results show significant relationships between the GDP (PPP) pc and the positive effect of innovation on market extension (*b*), which is even more marked in countries with a higher GDP (PPP) pc. Moreover, the infinitesimal impact of first acquisitions of innovations (*bb*) is notorious in more developed countries, where beginning to innovate carries more rewards thanks to access to the presence of advanced technological markets, business networks, and specialized suppliers. However, the marginal utility of innovation (*cc*) decreases more rapidly in these economies due to a higher level of technological competence in the market. Correlations with latitude and longitude indicate a clear differentiation between Eastern and Western European countries (*b, bb, cc, as y rs*), revealing different economic contexts in regard to innovation and internationalization. Also worth noting is the negative correlation between longitude and the coefficient as, which indicates that Eastern European countries experience less risk when they do not innovate. North-South differences center on the coefficient *r*, which means that in Northern European countries less linearity exists between innovation and market extension given the greater marginal decrease in the utility of innovation in these countries.

6. Conclusion

This paper explores the impact of product innovation on market extension in European firms, mainly SMEs, analyzing the evolution and expected risk in market extension with growing innovative radicality, and representing the behavior of such organizations in a model. The main conclusions of this research are the following:

First, a model of product innovation was elaborated and tested; three categories of explanatory variables were included: Innovative Capability, Contextual Factors and Institutional Support. The core of innovative behavior is located in the internal organizational sphere, with a key role played by strategic orientation toward product improvement and markets. Contextual Factors and Institutional Support are likewise relevant, though the impact of their explanatory variables is not strong. The scarce weight of cooperation, especially with universities, indicates the need for measures to embed SMEs in their institutional contexts of knowledge generation.

Second, product innovation encourages internationalization in consolidated firms within national markets. The decreasing marginal utility of innovation establishes a non-linear relationship between innovation and market extension, where the positive impact is more intense during the adoption stage than in later phases of developing full innovative capability (ambidextrousness). Thus, access to technological markets fosters internationalization in local and national firms, and reinforces firms' need to develop their own capacities in order to strengthen international expansion. In addition, the positive effect of radicality on market extension is generally not counteracted in a relevant way by the risk inherent to introducing more novel products to markets.

Third, among more technological activities (Manufacture), the positive effect of innovation on internationalization is more pronounced, and risk diminishes among the most innovative organizations, perhaps because they possess ample knowledge and experience accumulated in dynamic and complex contexts. In the least technological sectors, the effect created by innovation is more moderate, and risk remains stable (Services) or experiences a slight increase with rising product innovation (Construction and Trade). The results confirm a relationship between innovation and internationalization, especially in manufacturing firms, and suggest the advisability of entering in technological markets to initiate the commercial expansion of SMEs.

Fourth, significant differences were detected between countries in regard to the impact of innovation and its marginal utility, and in the evolution of risk in market extension with increasing innovation. In countries with greater GDP (PPP) pc the mere adoption of small innovations has an appreciable positive effect on market extension, though the decreasing performances of innovation also intensify due to a greater technological competency. These differences are clear between Western countries and transition economies of Eastern Europe, though less so from north to south.

6.1. Implications for theory and policy

This paper corroborates the positive influence of product innovation on internationalization (Kafouros et al., 2008; Love and Roper, 2015) and makes two contributions to the existing knowledge. Firstly, it quantifies the non-linear influence of innovation on market extension, according to level of product novelty (Chiva et al., 2014). This non-linear nature, along with the marked sectorial effect, could partially explain the contradictions regarding innovation's effect on internationalization (Geldres-Weiss et al., 2016; Hagen et al., 2014; Leonidou et al., 2007). Secondly, in general, we note no significant addition in risk in market extension when innovative radicality in products increases, though sectorial differences can also be observed in this case. Thus, in conditions of low uncertainty and sustained growth, innovation appears to clearly favor internationalization, though the same is not true in conditions of high instability (Baronchelli and Cassia, 2014; Zhou et al., 2016).

This study suggests several implications for policy. Innovation policy pursues two objectives in the European economy: to increase competitiveness and foster economic convergence (European Commission, 2010). One initiative typifying this goal is the Research and Innovation Strategies for Smart Specialization -RIS3- (European Commission, 2013), a potent political instrument for achieving specialized diversification in sectors of intensive technological knowledge. However, we must consider to what extent this structural transformation is possible in the current content of progressive economic deceleration (verging on contraction in certain countries) and the evident increase in midterm uncertainty both within and beyond the EU, “notably relating to the materialization of protectionist trade policy measures” (European Commission, 2018b: 3). Our research elucidates the role of innovation in commercial expansion in a climate of generalized stability and confidence. Currently, with short-term prospects marked by “the further development of Brexit or potential international trade conflicts” (European Commission, 2018a: 9), expectations of the real impact of innovation on exportations should be adjusted to these circumstances. In addition, European innovation policy should adapt to

sectorial traits and maximize access to technological markets in order to foster the adoption of new technologies by firms.

This research also enhances the understanding of innovative behavior in SMEs (Amara et al., 2008; Roper and Hewitt-Dundas, 2017), which form the most numerous subset in the European business population (European Commission, 2018a). The complete model reveals interconnections among internal and external factors that confirm the importance of environmental conditions and public policy on product innovation level (Antonioli et al., 2014; Hewitt-Dundas, 2013). However, our results show a disconnect between institutional knowledge sources (consultancies, commercial labs, private R&D institutes, universities, public research institutes) and those present in the market (suppliers and competitors) that seriously harms learning and product innovation in SMEs (Tödtling and Trippl, 2005; Zenka et al., 2014) and hinders the development of open innovation (Chesbrough et al., 2006). This obstacle could stall the growth of open innovation observed in European SMEs (Van de Vrande et al., 2009). Thus, both innovation policy and the management of firms should remedy this breach, favoring European SMEs' embedment in the innovation system, incorporation into international networks and access to technological markets. Initiatives such as the Enterprise Europe Network, which helps European SMEs to develop business in new markets and to source or license new technologies in > 60 countries, confirm the value of institutional agents in the invigoration of export activity.

6.2. Limitations and suggestions for future research

One limitation of our research is its focus on only European countries, albeit with differing characteristics, and the use of a database encompassing only one time period. The use of the same scale of innovation level in all sectors also limits the research. Specific innovation scales for sectors could describe with greater accuracy the trajectory of the relationship between both variables in different industries. Another limitation is the absence of determinants in the individual-level analysis and their scarcity in the industry-level analysis (Ardito et al., 2015) in our model of innovative behavior, due to the restrictions imposed by the database available.

Finally, the paper opens new lines of inquiry. Incorporation of other European countries and dynamic analysis including a variety of time periods, in different stages of the economic cycle, would surely add theoretical strength to the findings. Likewise, future extensions to the research could be oriented toward a comparison with non-European countries. Regarding the innovation model used, new information sources would allow for a more in-depth treatment of each level of analysis (Ardito et al., 2015) and an expansion of the model's structure incorporating determinants related to the geographic region level (Gupta et al., 2007), including characteristics of innovation systems (Crossan and Apaydin, 2010). On the other hand, a non-linear version of the complete model of innovative behavior would show the effect of interactions and non-linear components of the explanatory variables. Likewise, future research could introduce other types of innovation (processes, marketing, organizational) as variables to be explained and analyze their particular effect on SMEs' market extension.

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Appendix A

Table A.1
Economic and geographic data.

	Bulgaria	Czech rep.	Estonia	Germany	Hungary	Italy	Lithuania	Norway	Portugal	Romania	Slovakia	Slovenia	Spain
GDP (PPP) pc[a]	155	280	243	406	228	361	225	625	263	175	243	300	332
Latitude[b] ordinal	42	50	58	52	48	43	57	61	39	47	59	46	40
Longitude[b] ordinal	28	15	27	11	20	13	25	8	−7	26	19	15	−4

[a] IMF (2008) data in hundreds of $.
[b] Degrees.

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