High-Growth Business Creation and Management: a Multivariate Quantitative Approach Using GEM Data

Vítor Braga[1] · **Maria Queirós**[1] · **Aldina Correia**[1] ·
Alexandra Braga[1]

Abstract Entrepreneurship is defined as the effort to generate and create jobs and innovate leading to economic growth. Despite the importance that has been given to this phenomenon, inequalities regarding the ability to trigger and manage the entrepreneurial activity remain. This research aims to describe and account for the entrepreneurship levels, particularly in order to understand what leads certain countries' individuals to display higher levels of initiative to manage or create a high-growth business. In order to achieve this goal, a research program that includes annual assessments of entrepreneurial activity levels in several countries has been used—The Global Entrepreneurship Monitor (GEM), which is, currently, one of the main international research databases aiming to describe, analyse and compare the entrepreneurial process in a wide range of countries. The database studied in this work is the 2011 NES, containing 144 variables in which 136 are qualitative (97 ordinal qualitative and 39 nominal qualitative). The data were analysed transforming the ordinal qualitative variables in ordinal quantitative, where the answers were given in a Likert scale from 1 to 5. The sample of the database consists of 1852 national and regional

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✉ Vítor Braga
vbraga@estg.ipp.pt

Maria Queirós
8120111@estg.ipp.pt

Aldina Correia
aic@estg.ipp.pt

Alexandra Braga
abraga@estg.ipp.pt

[1] Centre for Innovation and Research on Business Sciences and Information Systems (CIICESI), Polytechnic of Porto, Rua do Curral, Casa do Curral, Margaride, 4610-156 Felgueiras, Portugal

entrepreneurship experts selected on the basis of reputation and experience (through a convenience sample approach). Our research used several multivariate analysis techniques, in particular the multiple linear regression analysis, the cluster analysis and the discriminant analysis. In general, our conclusions suggest that individuals who react quickly to opportunities seem to display better abilities of time management and are more willing to start a business. Our results also show that the national culture does not influence the individual ability of managing the personal life.

Keywords Business · Entrepreneurship · GEM · Management

Introduction

One important aspect of economic and business theory is to understand the conditions that allow individuals to have the initiative to manage or to create business and, in order, to induce higher levels of economic growth, attention to high-growth businesses becomes critical. Despite the obvious relevance of high-growth businesses for the economy, as they are considered as a key force driving economic growth in modern advanced economies (Mason and Brown, High Growth Firms in Scotland Crook et al. 2010), some consider that the research development in the area has been relatively slow (Segarra and Teruel 2014).

Innovation is a process that is also related to the high-growth firms, although, as pointed out by Hölzl and Friesenbichler (2010), R&D and innovation are important features of high-growth firms but only in countries that are adjacent the technological frontier. In high-growth firms located in countries that are located further away from the technological frontier, such features are not commonly present.

The importance of high-growth business can be demonstrated by the fact that it has deserved the attention of public policy measures in Scotland, in line with Mason and Brown (2010), who referred that these policies have a very important focus on technology and they are justified on the basis of the potential impact they have on the local and regional economic growth (Mason and Brown 2010). Despite their importance on the local economy, the literature is not unanimous is establishing such relationship, with Mason et al. (2015a, b) acknowledging that they may be of limited effectiveness in terms of the promotion of economic development and job creation in peripheral economies, as the Scottish experience demonstrates; although, the authors also recognize that their findings differ from the stylized facts in the literature (Mason et al. 2015a, b). Such findings suggest that the impact of high-growth business on the local economy is dependent of the context of such economies. This justifies the study of cross-countries differences on the high-growth business and on how they are perceived by the economic agents.

The economic effect of the proliferation of the high-growth businesses justifies its relevance for the economic decision-making practice and, therefore, it justifies the academic and scientific relevance in an attempt to provide evidence that may further support public policy.

In line with such arguments, the aim of this paper is to explore the entrepreneurial initiative to create or manage high-growth business, with a special emphasis on cross-country perceptions of such economic activity, carrying out a statistical study, using

multivariate analyses, in particular, multiple linear regression, discriminant and cluster analysis, for a database under the GEM project (Global Entrepreneurship Monitor), which allows a deeper understanding of the entrepreneurship environment.

After a brief literature review and the description of the methodology employed in this research, the forth and following section include the three multivariate statistical tools. The findings section refers to a multiple linear regression, which aims to explore how the perception of high business is associated to the perceptions on a number of variables. The cluster analysis allowed grouping countries in terms of the individuals' perception of their countries' national abilities to start and manage high-growth business. Both groups are then subject to a discriminant analysis, and, finally, a linear regression for the two groups is provided. Our paper concludes with a summary of the findings and suggestions for further research in this area.

Brief Literature Review: GEM and Previous Research

Determinants of High-Growth Business: Unveiling the Literature

Many of the studies on firms' growth show a wide dispersion of growth rates. Many factors are not identified and are not observable such as firm specific factors. These are responsible for the large difference in the firms' growth performance. However, according to a study by Jovanovic (1982), the growth of the business has been increasingly modelled as a learning process to explain why small businesses grow faster (Jovanovic 1982).

There are many factors that are not identified or observable when it addresses the issue of sharp growth of some firms, but they are responsible for the business growth and performance. This is strongly recognized in the literature on the growth of firms in relation to "the law of proportional effect" (Gibrat 1931), which states that the growth of companies is completely random. Despite this theory (Gibrat 1931), many studies reject the law of complete randomness growth and provide evidence of observable and systematic factors that justify such growth, as it is the case of size, age, innovation, entrepreneurial characteristics and resources. Therefore, the average growth of the firms is expected to change with the magnitude of such factors. However, the literature does not draw attention to the possible interactions of these factors with the particular characteristics of the firms (Goedhuys and Sleuwaegen 2009). Another perspective is studied by Coad and Rao (2008), who relate innovation with the American high-technology firms and show that, although the innovation returns display a very unequal distribution, innovation is one of the critical factors in the rapid growth of "superstar" firms (Coad and Rao 2008).

The aim of our study is to evaluate a high-growth business on a macroeconomic perspective, looking into the context and national level determinants that may impact on the proliferation of high-growth businesses. To our knowledge, no literature has addresses such issues from the experts' perception perspective. This is particularly important to the extent that using GEM database restricts the analysis to the perceptions of individuals to their countries' conditions that may be conducive and supportive to high-growth firms development. Nonetheless, an analysis of the microeconomic factors impacting on high-growth firms is important, and thus, such analysis is expected to be provided in further research.

Firm Size and Age

There are a significant number of empirical studies showing a significant negative relationship between growth and firm size and between the variability in growth and the firm size (Mansfield 1962) (Mengistae 1999) (Evans 1987) (Dunne and Hughes 1994) (Calvo 2006). However, studies also point out to higher growth rates taking place in small businesses as a consequence of the "minimum efficient scale" (MES), which is the volume of production that minimizes the average cost of production in the long term. This allows firms taking advantage of economies of scale, but avoiding diseconomies of scale. Facing this scale, small businesses grow rapidly to achieve MES (Goedhuys and Sleuwaegen 2009). To Variyam and Kraybill (1992) all corporate growth models are estimated for a production sample, sales and service companies demonstrating that business growth is negatively related to firm size and age of the company (Variyam and Kraybill 1992).

Smaller and younger firms grow faster than larger and older firms; however, the volatility in growth rates is also higher, as well as risk rates (Variyam and Kraybill 1992). This observation supports the study of Jovanovic (1982) that proposes a theory explaining the reason for the smaller firms to display higher growth rates (although more volatile) than larger ones. Based on the heterogeneity of the employers and market selection to generate employers' growth patterns, the model states that efficient firms grow and survive while inefficient firms decline and fail, regardless of the size of the company (Jovanovic 1982).

Similarly, Calvo's (2006) study examines whether small young and innovative businesses display higher growth than their counterparts. Most empirical studies have rejected the law of Gibrat (firm random growth) and support the proposition that small businesses show higher growth. In addition, the results show that older firms grow less than younger ones, and that innovation activities are a strong positive factor in businesses survival.

Characteristics of the Entrepreneur

Many authors have investigated the impact of education and experience on business performance, and this becomes one of the characteristics of entrepreneurs (Sluis et al. 2004). In addition, the literature also suggests that the effect of education that separates workers in "self-employment" and "wage employment" is more critical for women entrepreneurship, stronger in urban areas and stronger in less developed economies, where agriculture is more dominant and literacy rates are lower (Sluis et al. 2004). These results provide evidence that supports the idea that the most qualified entrepreneurs are able to achieve superior business performance. The analysis of the impact of education on entrepreneurship also suggests that higher education not only stimulates the entrepreneurial ability but also impacts on the decision over the trade-off between "wage employment" and "self-employment", assuming that it has an impact on the wage levels. Evidence supporting this discussion is provided by Sleuwaegen and Goedhuys (2000), where lower levels of education and training positively influences the likelihood of becoming entrepreneurs, but higher education seems to support the growth of businesses (Sleuwaegen and Goedhuys 2000).

On the other hand, there is also a considerable amount of the literature examining ethnic entrepreneurship, and how minorities are able to engage in networks, overcoming the constraints of the lack of information, leading to higher levels of success (Evans 1987).

Finally, gender also impacts on entrepreneurship, with a considerable amount of literature on the subject, with some studies linking female entrepreneurship and firm growth. Although the complexity of this issue does not lead to strong conclusions the literature—for example it refers that only a small percentage of entrepreneurs in manufacturing activities are women, and their businesses show lower levels of growth, suggesting additional barriers for women to engage in formal industrial enterprises (Mead and Liedholm 1998).

Innovation

Drucker refers that the common characteristic of successful entrepreneurs not a particular personality, but a personal commitment to a systematic practice of innovation. Innovation is the specific function of the entrepreneur, whether arising in a classic business, a public agency or a newly created company in a garage (Praag and Versloot 2007).

Several authors emphasise the role of innovation as a driver of superior performance of firms (Tidd 2001) (Cobbenhagen 2000) (Chaney et al. 1991). Chaney et al. (1991) add that innovation is responsible for corporate success, while Cobbenhagen (2000) shows that there is little disagreement among economists about the importance of innovation on economic growth.

However, in spite of emphasizing the importance of innovation, the literature also highlights the difficulty in measuring and establishing the relationship between the innovation and the firm performance. So the question turns to the empirical verification of the positive relationship between these constructs. According to both the economic and management literature, there are many different authors that investigated the relationship between innovation and economic and financial performance of companies (Walker et al. 2002) (Gopalakrishnan 2000) and under different perspectives. Studies on the influence of innovation in growth or performance of firms show inconsistent results, which, in many cases, do not confirm the relationship between these two factors, but confirming the difficulties in measuring the actual relationship between innovation and growth or financial performance of firms (Pakes 1985).

Innovation is considered by Praag and Versloot (2007) as supporting firm growth, where statistically significant evidence on the positive impact of innovation, in various forms, for growth of products, productivity and employment is provided (Praag and Versloot 2007). The results of the study (Praag and Versloot 2007) provide a solid support to several attempts of modelling of this phenomenon in the context of the Theory of Economic Growth, in particular with regard to the role of the entrepreneur in the innovation process, which ultimately leads the process of economic growth (Marques 2014a, b).

The GEM and Previous Contributions

According to Alvarez et al. (2013), the GEM has not produced many results yet; however, they have risen in recent years. For an understanding of entrepreneurship, this author, after some research, identified a general perspective including four approaches within this field (Alvarez et al. 2013):

1. The economic approach, in which researchers emphasise aspects of economic rationality and broadly argue that new ventures creation is mainly due to economic issues (Audretsch and Thurik 2001) (Parker 2004) (Wennekers et al. 2005)

2. The psychological approach, where individual or psychological factors are seen as determinants of entrepreneurial activity (Carsrud and Johnson 1989)among others)

3. The organisational or resource-based approach, in which scholars focus on the characteristics of the organisation or, specifically, on the resources and capabilities of the firms (e.g. human, physical, financial, technological) as the main determinants of the entrepreneurial process (e.g. (Álvarez and Busenitz 2001) (Ucbasaran et al. 2008)

4. The sociological or institutional approach, which argues that the sociocultural environment determines an individual's decision to start a business (e.g. Manolova et al. 2008).

Research produced by several researchers resulted in studies that meet the parameters to be studied in this paper, as exemplified by Arenius and Minniti (2005), who investigate the variables related to the individual decision to become an entrepreneur using sociodemographic features (e.g. age, sex, education), economic factors (e.g. household income, employment status) and perceptive variables (e.g. the recognition opportunity, fear of failure and entrepreneurial skills) (Arenius and Kovalainen 2006). Another study from Ramos-Rodríguez et al. (2012) assesses the impact of certain factors (i.e. age, gender, income, perception of opportunities, fear of failure, entrepreneurship, models and business angels) on the probability of becoming an entrepreneur (Ramos-Rodríguez et al. 2012).

Several authors analyse the relationship between entrepreneurship and economic growth, which is a major goal of the GEM project. For example, van Stel et al. (2005) show the influence of entrepreneurship on economic growth, finding that this relationship depends more on the total per capita income of the countries with significant levels of innovation (Stel et al. 2005).

As previously mentioned, the research based on this database has been growing and gradually gaining greater global legitimacy in the field of entrepreneurship as demonstrated in Alvarez et al. (2013) paper analysed the articles using the GEM database that were published in journals indexed by the Social Sciences Citation Index. They concluded that there was no GEM reference project in articles in important journals in the business and management literature, not only in journals with high SSCI impact factors but also in journals the scholar community considered of a high standard, showing a possible challenge regarding consolidation of GEM research (Alvarez et al. 2013).

Another important issue is to understand what are the variables used and how they are analysed. Mueller and Dato-on (2013), aimed to show what these dependent variables are and which are the most widely chosen and investigated, given the substantial number of variables in the set of GEM data. As expected, the vast majority of articles attempt to explain some form of entrepreneurial activity. Only a few contributions used entrepreneurial intentions or business perceptions, attitudes or networks as the dependent variable. However, a closer look at the variables used in such studies reveals that, in most cases, the measures "nascent entrepreneur", "young business owner-manager" and the combination of both—the total early stage entrepreneurial activity (TEA)—are being used. GEM APS database captures all types of entrepreneurial activity including any type of self-employment (full-time and part-time) and being an owner-manager of an established firm.

As Crook et al. (2010) underline, it is important to have a proper fit between design research and methods and measures used in entrepreneurship and a reflection on whether the measures used often defined by business activity and calculated by the

GEM coordination team are suitable for all different research questions is necessary (Bergmann et al. 2013).

In what regards the independent variables, Mueller and Dato-on (2013) agree that there is a substantial amount of variables that were used as independent in the existing research. The variables that are, more often, used as independent are the ones that explain the business activities, entrepreneurial attitudes and perceptions. While there are a growing number of articles based on GEM data that have been published, there is still potential for future research because the issues that are less surveyed are innovation and internationalization (Bergmann et al. 2013).

Methodology

In this study, we apply the multivariate statistical analysis tools, to study the database GEM (Global Entrepreneurship Monitor) which allows a deeper understanding of the entrepreneurship environment (Álvarez et al. 2014). Given the necessity for endogenous development strategies for countries and regions, entrepreneurship has emerged as one of the main mechanisms for social and economic growth (Acs and Armington 2006; van Stel et al. 2005; Wennekers and Thurik 1999; Wennekers et al. 2005). As a result, there is a growing interest in several public and private initiatives for promoting entrepreneurial activity, as well as in the academic community for analysing this phenomenon further (Alvarez et al. 2013).

Seeking to provide internationally comparable data on entrepreneurial activity (Reynolds et al. 1999) created the Global Entrepreneurship Monitor (GEM) in 1999. The purpose of the GEM project is to use empirical data to assess the level of entrepreneurial activity across countries, to understand how entrepreneurial activity varies over time and to understand why some countries are more entrepreneurial than others. In addition, GEM researchers seek to explore the relationship between entrepreneurial activity and economic growth and to identify which public policies boost entrepreneurship (Alvarez et al. 2013).

To analyse these two elements, the database evaluates the opinion of a group of citizens in relation to entrepreneurship through their opinion about the support to new enterprises and growing businesses, the approach to stimulate innovative initiatives, restrictions for starting-up a business, government subsidies and among other factors that help to understand entrepreneurship.

The sample of the database includes 1852 individuals, and it can be considered as objective since it is established for studying entrepreneurship. The database contains 144 variables in which 136 are qualitative (97 ordinal qualitative) and (39 nominal qualitative), based on 5-point Likert scale questions. For the purpose of the multivariate analysis, we will consider that the NES variables in ordinal Likert scale are continuous. This is a common procedure when working with real-world data, such as GEM data, (Correia et al. 2016).

Research Hypothesis

In order to reach the proposed objective, a set of research hypotheses was formulated that relates individuals' perception, in the GEM database, on the ability to starting and managing a high-growth business (dependent variable), with several variables

(independent). The goal is to study if entrepreneurship can be linked to conditions that increase (or inhibit) the creation of new high-growth businesses.

Competencies

The existence of an association between the level of perception of starting or managing a high-growth business and the education system, namely, schooling and experience of business performance, are characteristics that have been identified as essential for an entrepreneur. Sluis et al. (2004) states, in his study, the evidence that supports the idea that the most qualified entrepreneurs show superior business performance (Sluis et al. 2004). Likewise, Sleuwaegen and Goedhuys (2000) have also already shown, in their study, that higher education is necessary for business growth (Sleuwaegen and Goedhuys 2000). Besides that, prior entrepreneurship-related experiences should influence entrepreneurial intentions indirectly through these perceptions. Perceived feasibility was significantly associated with the breadth of prior exposure (Krueger 1993). Then, skills acquired through experience can contribute (positively or not) to the propensity to the creation of new high-growth businesses. Moreover, Dwyer and Kotey (2016) refer to the "key markers" of high-growth business, identifying training and experience in entrepreneurship and management as much as the employee organisational learning. However, the exception is made to postgraduate education in management as, according to the study, it is not effective identifiers of high-growth firms. Nonetheless, Lee (2014) refers that the lack of management skills is perceived by the UK entrepreneurs as holding them back for high-growth levels of businesses.

In light with this discussion, the first research hypothesis is defined as follows:

> **H1**: The initiative level for starting or manage a high-growth business is greater in individuals with higher academic and professional competences.

Size

The existence of a relationship between the level of perception of starting or managing a high-growth business and the size of these businesses has been analysed by several authors, namely Calvo (2006), who in his study analyses whether small innovations have more growth than others. This through its results affirmed the proposition that small businesses have more growth (Calvo 2006).

In the same sense, Goedhuys and Sleuwaegen (2009) have shown that the higher growth rates of small firms are related to the volume of production, since they take advantage of economies of scale, thus proving that smaller and younger companies grow faster than the larger companies (Goedhuys and Sleuwaegen 2009).

Furthermore, like we said before, according with (Krueger 1993), the experience can contribute to the propensity to the creation of new high-growth businesses, even if it has been in small companies.

In this way, the second hypothesis of investigation is defined as follows:

> **H2:** The initiative level for starting or managing a high-growth business is greater when the entrepreneurs hold smaller companies.

Culture

Culture is often related to the growth of enterprises. There are a large number of studies that investigate the performance of entrepreneurs of ethnic minorities and in particular how they manage to use this minority in networks in order to overcome the constraints of lack of information, leading to higher levels of success (Evans 1987). In addition, the literature is, to some extent, unanimous that entrepreneurship is highly context dependent and, thus, culture dependent (Ng and Hamilton 2016). In addition, common languages, common business practices and common areas of economic interest may result in an effect of genetic proximity to high-growth economies and business (Chaudhry and Ikram 2015). In addition, (Chelariu et al. 2008) refer to the differences between the individual cultural values approach that generated weak results regarding the association to high-growth business, while the organisational culture approach showed strong support for the hypotheses defined by the authors.

Thus, the third hypothesis of investigation arises that is defined as follows:

H3: The initiative level for starting or managing a high-growth business is influenced by the culture of individuals.

Resources

There is an obvious relationship between the existence of resources and the growth of firms. However, one very pertinent question is what is the amount of resources necessary for firms to achieve high-growth levels. In addition, as previously mentioned, there is a potential difference between the perception of the resources necessary and the potential for high growth. Lee (2014) analysed what factors UK firms perceive as holding them back from growth. Among these factors, the authors mention several resources, such as access to finance and cash flow and finding suitable permises.

H4: The available resources of the individuals influence the initiative level for starting or managing a high-growth business.

Government Policies

Although culture may foster high-growth firms and entrepreneurship in general, in addition to the cultural environment, it is also critical that governments support such environments designing the appropriate measures for supporting such initiatives. Lee (2014) refers that the way entrepreneurs perceive the problems of high-growth business is very informant for the policy-making (Ng and Hamilton 2016).

H5: Public policies influence the initiative level for starting or managing a high-growth business.

In Table 1, we present a summary of the variables in our study and of the predicted associations with the dependent variable.

Table 1 Independent variables and expected association

Variables	Authors	Expected association	Hypotheses	Statistical technique
Competencies	(Sluis et al. 2004); Sleuwaegen and Goedhuys (2000); Dwyer and Kotey (2016); Krueger (1993)	+	H1	Linear regression
Size	Goedhuys and Sleuwaegen (2009); Calvo (2006); Krueger (1993)	−	H2	Linear regression
Culture	Evans (1987); Ng and Hamilton (2016); Chelariu et al. (2008); Chaudhry and Ikram (2015)	+	H3	Cluster analysis, discriminant analysis, linear regression
Resources	Lee (2014)	+	H4	Linear regression
Government policies	Ng and Hamilton (2016); Lee (2014)	+	H5	Discriminant analysis

Descriptive Analysis

Throughout this paper, the dependent variable "NES_L01" which will be named as "variable y" refers to "In my country, many people know how to start and manage a high-growth business". This variable is measured in a Likert scale, where 1 = completely false, 2 = somewhat false, 3 = neither true nor false and 4 = somewhat true, completely true. The selection of this variable is related to the aims of this paper, allowing a deeper understanding of the contextual factors that are associated to the existence of high-growth business under the perception of national experts. This is an interesting aspect of economics growth, as previously mentioned, and based on the assumption that there are important national and cultural aspects of high-growth business. Therefore, understanding the factors that influence the initiation and management of a high-growth business seems to be critical.

Analysing the frequencies of the variable "NES_L01", from the opinion of 1852 individuals, the highest percentage of answers are "somewhat false" (47.4%), followed by the answer "completely false" (27.3%) and then "neither true nor false" (with 14.4% of answers). On the other hand, the average of the variable "NES_L01" is approximately 2, which shows that in many countries people do not perceive their country's entrepreneurs ability to know how to start and manage a high-growth business. The median is 2; therefore, 50% of the experts consider that in their countries many people do not know how to start and manage a high-growth business. The value that appears most frequently (mode) is 2, confirming the previous analysis. We are in the presence of a symmetric distribution, because the mode and median are the same. The standard deviation is 0.944 showing that the mean distance of the data from the average of the data is, approximately, 1. The distribution of the variable is approximately normal, according to one-sample Kolmogorov-Smirnov normality test, which p value is approximately $0.083 > 0.05$, and then the normality is not rejected, for a 5% significance level.

Linear Regression

Model Analysis

With this multivariate linear regression, it is aimed to observe which variables influence the opinion of 1852 individuals, on their perception on the individuals' ability to initiate or manage a high-growth business. The dependent variable is "NES_L01" ("In my country, many people know how to start and manage a high-growth business"). Initially, all NES variables included in the Entrepreneurial Framework Conditions (EFCs) (from NES_A1 to NES_I05) and the other variables (from NES_K01 to NES_U04) are used as independent variables. The choice of dependent variables to consider in the analysis was made based on an exploratory analysis. Afterwards, it was necessary remove some of them, using a stepwise method, according to the information in Table 2. All of these variables are related with the dimensions under study: competencies, size, culture, resources and government policies are also considered.

Table 2 Dependent variables

Dimensions	Variables	Description
Government policies	NES11_B01	In my country, government policies (e.g. public procurement) consistently favour new firms.
Government policies	NES11_B03	In my country, the support for new and growing firms is a high priority for policy at the local government level.
Competencies	NES11_D02	In my country, teaching in primary and secondary education provides adequate instruction in market economic principles.
Competencies	NES11_E06	In my country, there is good support available for engineers and scientists to have their ideas commercialized through new and growing firms.
Culture	NES11_G02	In my country, the markets for business-to-business goods and services change dramatically from year to year.
Culture	NES11_I05	In my country, the national culture emphasises the responsibility that the individual (rather than the collective) has in managing his or her own life.
Resources	NES11_K05	In my country, there are plenty of good opportunities to create truly high-growth firms.
Size	NES11_L02	In my country, many people know how to start and manage a small business.
Competencies	NES11_L03	In my country, many people have experience in starting a new business.
Competencies	NES11_L04	In my country, many people can react quickly to good opportunities for a new business.
Resources	NES11_L05	In my country, many people have the ability to organise the resources required for a new business.
Culture	NES11_N04	In my country, new and growing firms can trust that their patents, copyrights, and trademarks will be respected.
Culture	NES11_N05	In my country, it is widely recognized that inventors' rights for their inventions should be respected.
Culture	NES11_R05	In my country, established companies are open to using new, entrepreneurial companies as suppliers.
Culture	NES11_R06	In my country, consumers are open to buying products and services from new, entrepreneurial companies.

The coefficients of the final model are presented in Table 3. This model has an adjusted R square of, approximately, 58%, meaning that it is the expected percentage of the total variability in the level of creation and high-growth business management initiative explained by the independent variables included in the adjusted linear regression model (X's). This table also shows the standard coefficients. Such results show that all dimensions considered (competencies, size, culture, resources, government policies) are significant to explain the experts' perception on the individuals' ability to start and manage a high-growth business, because, as shown in Table 2, the dimensions of the significant independent variables are as follows:

The model can be written as below:

$$NES\_L01 = -2,8 + 0,279 \ NES11\_L02 + 0,217 \ NES11\_L05 + 0,141 \ NES11\_L04 + 0,08 \ NES11\_D02$$
$$+0,08 \ NES11\_K05 + 0,076 \ NES11\_L03 + 0,072 \ NES11\_I05 - 0,089 \ NES11\_N05$$
$$+0,063 \ NES11\_E06 - 0,086 \ NES11\_B03 + 0,066 \ NES11\_B01 - 0,086 \ NES11\_R06$$
$$+0,069 \ NES11\_R05 + 0,054 \ NES11\_N04 + 0,054 \ NES11\_G02$$

Although, all dimensions were considered as significant, some variables display more importance in the model than others. The analysis of standardised regression coefficients shows that the variables NES11_L02, NES11_L05 and NES11_L04 are those that show a higher relative contribution to explain the dependent variable. This leads to conclude that experts agree that the variables that are mostly associated with the ability to create or manage high-growth businesses are the knowledge to manage and organise resources for starting-up a small business and the ability to react to good opportunities (dimensions: competencies, size and resources). In this way, **H2: The initiative level for starting or managing a high-growth business is greater when the entrepreneurs hold smaller firms** is validated by the coefficient of the variable NES11_L02. Through analysis to the coefficient of variable NES11_L05, it is possible to show statistic evidence confirming that identifying

Table 3 Coefficients

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	Std. error	Beta		
15	(Constant)	−.280	.123		−2284	.023
	NES11_L02	.279	.029	.310	9542	.000
	NES11_L05	.217	.037	.214	5896	.000
	NES11_L04	.141	.035	.147	4077	.000
	NES11_D02	.080	.027	.080	2933	.003
	NES11_K05	.080	.022	.094	3607	.000
	NES11_L03	.076	.030	.082	2544	.011
	NES11_I05	.072	.022	.088	3224	.001
	NES11_N05	−.089	.023	−.119	−3768	.000
	NES11_E06	.063	.026	.072	2456	.014
	NES11_B03	−.086	.023	−.107	−3742	.000
	NES11_B01	.066	.024	.077	2794	.005
	NES11_R06	−.086	.028	−.086	−3052	.002
	NES11_R05	.069	.028	.074	2436	.015
	NES11_N04	.054	.024	.071	2212	.027
	NES11_G02	.049	.022	.053	2198	.028

Dependent variable: In my country, many people know how to start and manage a high-growth business

opportunities is important to promote the number of people that know how to start and manage a high-growth business. There is also statistics evidence to validate **H1**: The initiative level for starting-up or manage a high-growth business is greater in individuals with higher academic and professional competences. Variable NES11_L04 importance in the model reveals that initiative to initiate or to manage a business of high-growth rate is dependent of the ability to manage resources, validating the **H4:** The available resources of the individuals influence the initiative level for starting or managing a high-growth business.

Validation of Assumptions of the Linear Regression Model

In order to analyse the residues, linear regression assumes that errors display a normal distribution with zero mean and constant variance and that they are independent. Our analysis included normal probability plot, a scatterplot and leverage graphic, and, in order to validate the assumption of normality, the one-sample Kolmogorov test shows that there is statistical evidence not to reject the hypothesis that the residual variable follows a normal distribution, for a significance level of 10% therefore $p = 0.083$.

For the second assumption, the analysis of residues is included in Table 4 "model summary" where the Durbin-Watson test displays 1895, (approximate to 2), and thus, it is expectable that the residuals are not correlated.

Table 4 displays the maximum and minimum values of "residual" and the values of the "std. predicted value" which are approximate suggesting the inexistence of "outliers".

When the independent variables are highly correlated to each other (multicollinearity), the analysis of the adjusted regression model can be confusing. The values of tolerance and VIF for each independent variable show that there is statistical evidence to support the inexistence of multicollinearity. These results validate the coefficients obtained in the regression analysis and presented above.

Cluster analysis

Model analysis

The variables with greater impact on the ability to initiate or manage a high-growth business were studied with a multivariate linear regression based on the opinion of 1852 experts. Cluster analysis is an exploratory data analysis method that allows organising different objects (or variables) into homogeneous groups, using predefined similarity measures. The degree of association between two objects in the same group is maximized and minimized otherwise.

Table 4 Residuals statistics

	Minimum	Maximum	Mean	Std. deviation	N
Predicted value	0.24	4.46	2.13	0.726	1329
Residual	−3.024	2.323	−0.036	0.662	1329
Std. predicted value	−2.625	3.251	0.013	1.011	1329
Std. residual	−4.995	3.836	−0.059	1.094	1329

In this section, the aim is analyse the validity of **H3**: The initiative level for starting or managing a high-growth business is influenced by the culture of individuals, using the 2011 GEM NES AGGREGATED NATIONS dataset. We want to investigate if there are differences between countries, considering the variable "NES_L01—In my country, many people know how to start and manage a high-growth business"—the dependent variable in the analysis above. The aim was to group countries using the K-means clustering method and to discover structures in data separating the countries depending on the variables "NES11_L01_MEAN" and "NES11_L01_SD", the mean and standard deviation of the dependent variable "NES_L01". These measures are dissimilar in the two final clusters, with means 2.43 in cluster 1 and 1.88 in the cluster 2 and standard deviation 0.97 in cluster 1 and 0.83 in cluster 2. The number of clusters used in K-means clustering method (two clusters) is based on the dendrogram that previously resulted of hierarchical cluster analysis.

This study is relevant since it was not possible to confirm the hypothesis of the high relevance of countries and cultures in the perception of experts about the individuals' knowledge of starting and managing a high-growth business.

In Table 5 we present descriptive statistics for NES11_L01—In my country, many people know how to start and manage a high-growth business. LNES11_L01 has mean 2.08, median 2.00, mode 2 and standard deviation 0.944. In order to identify differences between countries about the knowledge of starting and managing a high-growth business, Table 5 shows the means and standard deviations for the two groups of countries, where group I includes countries with a higher propensity for the creation and management of high-growth business, and group II includes countries performing poorly in that perspective.

The composition of both clusters is shown in Table 6. This table displays the results of cluster membership, with 17 countries in the cluster 1 and 32 in the cluster 2:

- Cluster 1 includes, mostly, countries from emerging economies where, in fact, over the last years the growth rate of their economies has been above the average. It also includes northern Europe counties, also known for a particular dynamism on their economies and where the growth has been consolidated.
- Cluster 2 includes central and southern Europe countries that, usually, show a more modest economic growth and some developing economies, but where the growth of the economic activity has not been as impressive as other emerging economies. In fact, the groups of countries are more related to the reputation of growth of the business rather than on the actual growth of their economies and of their firms.

In order to understand the extent to which the division of countries within groups is statistically significant, the table, below, presents the dispersion analysis of clustering results. The differences between the F-ratios (F column in the Table 7) allow drawing general conclusions about the role of the different mean variables in the construction of

Table 5 Final cluster centres		Cluster 1	Cluster 2
	NES11_L01_SD	0.97	0.83
	NES11_L01_MEAN	2.43	1.88

Table 6 Cluster membership

Cluster 1		Cluster 2	
NES participating countries, regions (name of the country, region)	Distance	NES participating countries, regions (name of the country, region)	Distance
Russia	0.213	Netherlands	0.084
South Africa	0.231	Switzerland	0.210
Greece	0.204	Peru	0.180
France	0.294	Argentina	0.101
Spain	0.359	Malaysia	0.084
Hungary	0.115	Thailand	0.208
UK	0.206	Korea SR	0.237
Sweden	0.255	Pakistan	0.328
Norway	0.018	Algeria	0.737
Poland	0.036	Nigeria	0.273
Germany	0.340	Ireland	0.227
Mexico	0.172	Finland	0.215
Brazil	0.076	Slovenia	0.243
Chile	0.283	Slovakia	0.178
Colombia	0.059	Bangladesh	0.253
Australia	0.042	Taiwan	0.238
Singapore	0.237	UAE	0.436
Turkey	0.385		
Iran	0.679		
Portugal	0.121		
Lithuania	0.113		
Latvia	0.058		
Croatia	0.313		
Bosnia and Herzegovina	0.041		
Czech RP	0.127		
Guatemala	0.175		
Panama	0.038		
Venezuela	0.226		
Uruguay	0.052		
Jamaica	0.449		
Barbados	0.154		
Trinidad and Tobago	0.095		

the clusters. The results show that "NES11_L01_MEAN" have the greatest influence on the clusters and "NES11_L01_SD" has the least important influence.

Cluster analysis is a descriptive multivariate technique, but additional validation techniques are required to validate this procedure. In the next section, a discriminant analysis is presented in order to distinguish countries in cluster 1 and cluster 2, allowing

Table 7 ANOVA

	Cluster		Error		F	Sig.
	Mean square	df	Mean square	df		
NES11_L01_SD	0.224	1	0.029	47	7.782	0.008
NES11_L01_MEAN	3.301	1	0.041	47	80.731	0.000

two linear regressions using the same variables as in the previous section on multivariate linear regression.

Discriminant Analysis

This section will explore how the independent variables with greater differentiation capacity used previously are able to classify the sample into two groups based on a dummy variable constructed from the two clusters of countries.

Examining the differences between groups, through the analysis of Table 8, some variables were considered as not contributing for the model, because their difference between the two clusters is not statistically significant. In addition, some values of "Wilks Lambda" are approximately equal to 1, indicating that the average of both groups is identical.

The examination of Table 8 shows that some "F" values are relatively low, indicating that when independent variables are individually considered they do not differentiate the groups. Therefore, some of the included variables do not influence the cluster; therefore, it is interesting to investigate which define both clusters.

There are some assumptions that must be verified before proceeding with the discriminant analysis: the share of observations in each group defined by the dependent variable, normality of independent variables, absence of multicollinearity and multivariate homoscedasticity—Box's M test. The size of the sample is $N = 1852$ cases, being 148 (8%) in cluster of countries 1 and 1704 (92%) in cluster 2, which are clearly greater than the number of independent variables (14).

The absence of multicollinearity was verified in the above Section 6—"Linear Regression" section. The homoscedasticity was also analysed based on the Box's test. A p value of 0.416 was obtained, leading to conclude that no homoscedasticity could be found.

The canonical correlation between discriminant functions is 0.26 meaning that, approximately, 5% of the variance of the clusters is explained by the discriminant function. Table 9, in particular "Wilk's Lambda," shows the test of the significance of the discriminant functions. As the p value is approximately 0, the null hypothesis (the

Table 8 Tests of equality of group means

	Wilks' lambda	F	df1	df2	Sig.
NES11_B01	.986	18,511	1	1331	.000
NES11_B03	1000	.010	1	1331	.920
NES11_D02	.995	6366	1	1331	.012
NES11_E06	.988	15,883	1	1331	.000
NES11_G02	.999	1836	1	1331	.176
NES11_I05	.998	2443	1	1331	.118
NES11_K05	.999	.759	1	1331	.384
NES11_L02	.996	5439	1	1331	.020
NES11_L03	.998	3057	1	1331	.081
NES11_L04	1000	.608	1	1331	.436
NES11_L05	.999	1934	1	1331	.165
NES11_N04	.998	2502	1	1331	.114
NES11_N05	.988	15,942	1	1331	.000
NES11_R05	1000	.053	1	1331	.818
NES11_R06	.999	.877	1	1331	.349

Table 9 Wilks' lambda

Test of function(s)	Wilks' lambda	Chi-square	df	Sig.
1	.932	93,244	15	.000

means in the two groups in the function are equal) is rejected and one can conclude that the discriminant function is highly significant.

Table 10 shows the classification results, with 70.2% of the cases grouped correctly, confirmed by the cross validation.

Table 10 shows the contribution of each variable to the discriminant function, that is, standardised canonical discriminant function coefficients.

The coefficient is relative to the importance of variable. NES11_B01 shows the greater contribution for the discriminant function definition, followed by NES11_L04, NES11_E06 and NES11_N05 (Table 11).

This shows that government policies (e.g. public procurement) consistently favour new firms seem to be the most important factors for distinguishing the group of countries and the hypothesis **H5**: Public policies can positively or negatively influence the initiative level for starting or managing a high-growth business, is verified.

Linear Regression for Two Clusters of Countries

The initial multivariate linear regression allowed observing which variables influence the opinion of 1852 individuals, to initiate or manage a high-growth business. The dependent variable was "NES_L01," as mentioned above (In my country, many people know how to start and manage a high-growth business), in order to validate the **H3**: The initiative level for starting or managing a high-growth business is influenced by the culture of individuals.

The goal of this section is to assess the potential existence of differences between the variables across the two clusters of countries defined above. In light with such aim, two linear regression models were estimated, one for each cluster defined in the previous sections. The independent variables considered for these regressions are the same considered, earlier, in the regression, described in Table 2.

Table 12 presents a summary of the two models. Being R^2 approximately 50% for the two models, the percentage of the total variability in the perceptions level of knowledge about creation of high-growth business management initiative is relatively good, and it is explained by the independent variables. This table also shows the

Table 10 Classification results

		Cluster	Predicted group membership		Total
			1.00	2.00	
Original	Count	1.00	63	35	98
		2.00	362	873	1235
	%	1.00	64.3	35.7	100.0
		2.00	29.3	70.7	100.0

70.2% of original grouped cases correctly classified

Table 11 Classification results—standardised canonical discriminant function coefficients

	Function 1
NES11_B01	−.687
NES11_B03	.061
NES11_D02	.295
NES11_E06	.501
NES11_G02	−.159
NES11_I05	−.307
NES11_K05	.087
NES11_L02	.241
NES11_L03	.266
NES11_L04	−.530
NES11_L05	.177
NES11_N04	−.208
NES11_N05	.465
NES11_R05	−.017
NES11_R06	−.176

standard error of the estimates. These models are significant because the p value of the ANOVA tests is, approximately, 0, which indicates a good fit.

Attending to the tables of coefficients of the models they can be written as:

Global model:

$$
\begin{aligned}
NES\_L01 = &-2,8 + 0,066 \ NES11\_B01 - 0,086 \ NES11\_B03 \\
&+0,08 \ NES11\_D02 + 0,063 \ NES11\_E06 \\
&+0,054 \ NES11\_G02 + 0,072 \ NES11\_I05 \\
&+0,08 \ NES11\_K05 + 0,279 \ NES11\_L02 \\
&+0,076 \ NES11\_L03 + 0,141 \ NES11\_L04 \\
&+0,217 \ NES11\_L05 \\
&+0,054 \ NES11\_N04 - 0,089 \ NES11\_N05 \\
&+0,069 \ NES11\_R05 - 0,086 \ NES11\_R06
\end{aligned}
$$

Model for cluster 1:

$$
\begin{aligned}
NES\_L01 cluster1 = &-0.309 + 0.067 NES11\_B01 - 0.076 \ NES11\_B03 \\
&+0.157 \ NES11\_D02 - 0.089 \ NES11\_E06 \\
&+0.098 \ NES11\_G02 + 0.046 \ NES11\_I05 \\
&-0.038 \ NES11\_K05 + 0.063 \ NES11\_L02 \\
&-0.059 \ NES11\_L03 + 0.487 \ NES11\_L04 \\
&+0.278 \ NES11\_L05 + 0.074 \ NES11\_N04 \\
&-0.145 \ NES11\_N05 - 0.152 \ NES11\_R05 \\
&+0.297 \ NES11\_R06
\end{aligned}
$$

Table 12 Model summary for clusters 1 and 2

R	R square	Adjusted R square	Std. error of the estimate	Durbin-Watson	Cluster
.737	.544	.459	.742	2099	1
.732	.536	.530	.648	1880	2

Model for cluster 2:

$$NES\_L01 cluster2 = -0.275 + 0.042 NES11\_B01 - 0.050\ NES11\_B03$$
$$+0.075\ NES11\_D02 + 0.031\ NES11\_E06$$
$$+0.032\ NES11\_G02 + 0.039\ NES11\_I05$$
$$+0.056\ NES11\_K05 + 0.264\ NES11\_L02$$
$$+0.064\ NES11\_L03 + 0.171\ NES11\_L04$$
$$+0.216\ NES11\_L05 + 0.042\ NES11\_N04$$
$$-0.047\ NES11\_N05 + 0.032\ NES11\_R05$$
$$-0.017\ NES11\_R06$$

The analysis of the absolute values of standardised regression coefficients, for the global model, shows that the variables NES11_L02, NES11_L04 and NES11_L04 are those that have higher relative contributions to explain what makes a country's citizens know how to manage/initiate a high-growth business. Therefore, it is safe to say that experts consider that the ability that mostly contributes to explain the independent variable NES_L01 is the ability to react to good opportunities, wisdom and organise them. However, as it can be seen in the model, the variables that negatively influence the model show have little significance.

The next two equations define the models for cluster 1 and cluster 2, respectively. Note that only the bold variables are significant in the model.

One needs to, however, highlight the main differences found in the two models, as these show the contradictory positions across de different clusters of countries. A few variables show contradictory signs in the two models:

- NES11_E06: In my country, there is good support available for engineers and scientists to have their ideas commercialized through new and growing firms
- NES11_K05: In my country, there are plenty of good opportunities to create truly high-growth firms
- NES11_L03: In my country, many people have experience in starting a new business.
- NES11_R05: In my country, established companies are open to using new, entrepreneurial companies as suppliers.
- NES11_R06: In my country, consumers are open to buying products and services from new, entrepreneurial companies.

This shows that the influence of these variables in the perceptions of experts about the knowledge to manage and create a high-growth business is contradictory in the two clusters of countries.

In cluster 1, experts recognize that consumers are open to buying products and services from new, entrepreneurial companies is important for levels of high-growth business creation ability.

It is important to mention that the significant variables, with greater association with the dependent variable (high-growth business creation and management), for cluster 1 (countries from emerging economies) are variables related with competencies, resources and culture: NES11_L04—In my country, many people can react quickly to good opportunities for a new business; NES11_L05—In my country, many people

have the ability to organise the resources required for a new business and NES11_R06—In my country, consumers are open to buying products and services from new, entrepreneurial companies. Although in the cluster 2 (includes central and southern Europe countries), the significant variables are almost all the dimensions considered in the global model excluding the variables NES11_G02—In my country, the markets for business-to-business goods and services change dramatically from year to year, NES11_R05—In my country, established companies are open to using new, entrepreneurial companies as suppliers and NES11_R06—In my country, consumers are open to buying products and services from new, entrepreneurial companies, all of them variables in the culture dimension, being verified the hypothesis H3. This seems to be coherent with the fact that cluster 1 includes the countries with higher propensity for the creation and management of high-growth business, and the cluster 2 seems that the emphasis is placed on the size of businesses rather than on their levels of growth.

Conclusions

High-growth businesses are a relevant phenomenon for economies as they represent an important driver for economic growth and they represent an efficient allocation of resources that can be inductive of wealth creation.

This paper has highlighted the variables that are associated to the entrepreneurial ability to create and manage high-growth businesses and clustered countries into two groups with different levels of high-growth entrepreneurship. Such clusters were used for the estimation of two linear regression models, highlighting the different contributions of the dependent variables.

It is important to note that our analysis has not been based on the actual existence of high-growth business but rather on the experts' perspective on their countries' entrepreneurial potential to create and manage high-growth business. This represents a limitation of this paper to the extent that it does not explore the real phenomenon, but, in a different standpoint, it offers insights about the experts' perspectives on the conditions of their economies and firms—this is also an interesting analysis. However, as a suggestion for further research, comparing the actual existence of high-growth business proliferation and the experts' perspective could provide interesting insights. Such analysis would allow exploring in which countries the experts underrate their country entrepreneurs' abilities to create and manage high-growth businesses and which ones overrate such skills. This can be the dependent variable of different models, in order to understand what explains such underrating or overrating attitude.

This paper sheds light into an important aspect of economic growth, and it is expected that it raises interests on the academia, in the governmental policy and amongst entrepreneurs.

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