Regional and national results on entrepreneurship using GEM data

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Abstract

In this paper, we use different sources of data from the GEM to show a descriptive and comparative analysis of the different dimensions of the entrepreneurial activity, in the Spanish regions, and at international level. We also study the individual determinants of the entrepreneurial activity in Spain, and Europe, using bootstrapping techniques to avoid overfitted results. The results indicate that entrepreneurial levels in Spain are below the average of European countries, and also below the levels of United States, Canada, and Australia. However, the determinants of entrepreneurship appear to be similar in all the regions studied.

Keywords: Entrepreneurship; GEM data; Spain.

1. Introduction

Since entrepreneurship is a labor career for workers who do not wish to be employees, but also for those who cannot find an employer (i.e., "necessity-driven" entrepreneurs), income levels may have a moderating effect on entrepreneurial decisions. Furthermore, entrepreneurship is a labor and social phenomenon characterized by high levels of complexity, whereby classical linear and quantitative analyses may provide limited empirical evidence (Coduras et al., 2016, 2018). In that context, fsQCA has emerged as a useful statistical tool to study entrepreneurship and other social phenomena (Woodside et al., 2012; Ragin and Stand, 2014; Roig-Tierno et al., 2016). This paper provides an overview about the entrepreneurial activity in Spanish regions, with a focus on the determinants that make individuals more prone to become entrepreneurs.

Entrepreneurship has traditionally been analyzed as a driver of innovation and economic growth (Acs, 1992; Minniti, 2008; Galindo and Mendez, 2013). Furthermore, several dimensions of entrepreneurship have been analyzed in the literature in recent decades, and there have appeared various definitions of and approaches to the study of entrepreneurial behaviors. Among these frameworks, the data and methodology proposed by the Global Entrepreneurship Monitor (GEM) is perhaps the most widespread. The GEM is the "the world's foremost study of entrepreneurship" (http://www.gemconsortium.org), and has studied entrepreneurship in its different dimensions, including global and national contexts, special topics such as gender, policy implications, youth/senior entrepreneurship, developing regions, and microeconomic analyses. See Bosma et al. (2020) for a recent report of the GEM. The GEM databases are elaborated biennially from two sources: the Adult Population Survey (APS), and the National Experts Survey (NES). The

objective of the APS micro-data is to provide information about entrepreneurial decisions of individuals, with a focus on individual motivations to establish and entrepreneurial enterprise. The NES data is centered on aggregated conditions related to entrepreneurship, based on questionnaires completed by experts.

Spain is a country with a high structural unemployment rate (Domenech and Gomez, 2005). In addition, one of the widest outcomes of the recent economic crisis for Spain was in terms of unemployment, especially from 2008 to 2012, when it was achieved an unemployment rate of 24.6% (Rocha and Aragon, 2012). The effect of the crisis on Spanish employment level has been so important that unemployment is the first worry of Spanish inhabitants (CIS, 2016). These data could lead us to conclude that becoming an entrepreneur would be a good labor alternative to being an employee or unemployed, i.e., entrepreneurship due to necessity may be strong in Spain, as unemployment is expected to have a strong impact on entrepreneurship (Gimenez-Nadal and Molina, 2014). However, the relationship between entrepreneurship and unemployment in Spain may depend on regional attributes (Congregado et al., 2010; Cueto et al., 2015), depending on the so-called "entrepreneurial spirit" of individuals. In spite of that, entrepreneurial levels during the recent crisis have been moderately stable in Spain, against the substantial decreases of employment levels (Congregado et al., 2012). Then, the entrepreneurial activity of the Spanish economy is an intriguing topic of research.

Within this framework, the contributions of the paper are twofold. First, we provide a comparative analysis of the different stage of the entrepreneurial activity of Spanish regions, using data from the GEM Adult Population Survey of the year 2015. We observe how some regions, such as Cataluña or the Balearic Islands, are well below the average, while others, as Asturias or the Basque Country, appear to

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be "less entrepreneur". Nonetheless, in general terms, we can observe how the economic crisis had a significant effect on entrepreneurial levels, which decreased in the years 2009 and 2010 to start to increase in 2011. We also compare Spain with other European and developed economies. We find wide differences, where the United States, Canada, Australia, Luxembourg, Estonia, Latvia and Romania domain the scenario with entrepreneurial rates above 10%. In this setting, Spain is below the average, together with Italy. Germany and Belgium also show very low entrepreneurial rates, even lower than Spain and Italy, although the evolution of rates in these two countries are different.

Second, we study the individual determinants of the entrepreneurial activity in Spain using machine-learning techniques based on predictions, rather than on significativity, where overfitting and multi-collinearity issues are dealt. Then, we can study the strongest determinants of entrepreneurial activity in an unbiased framework. We compare results for Spain, and for other developed regions (Western Europe, Europe, United States, Canada, and Australia), to find that peer effects, defined from having help other workers to entrepreneur in the past, the ability to innovate, and the recognition of no local competence are among the strongest determinants of entrepreneurial activity.

2. Entrepreneurship and GEM

For the main objectives proposed in this paper, we use data from the Global Entrepreneurship Monitor (GEM), the world's foremost study of entrepreneurship, which provides high-quality information to study different dimensions of entrepreneurship (Bosma et al., 2020). For instance, GEM looks at two differentiated

elements related to entrepreneurship. First, GEM studies the entrepreneurial behavior and attitudes of individuals (e.g., social characteristics, motivations, ambitions, etc.), which are collected in the Adult Population Surveys (APS) data. Second, GEM analyzes the national context that may determine the entrepreneurial activity in a given region, and this information is collected in the National Expert Surveys (NES).[1]

The APS is conducted and elaborated every year, and consists on a representative national sample of at least 2,000 individuals per country, with a focus on the role of individuals in the entrepreneurial process. These samples constitute a cross-sectional database, as different individuals are interviewed every year. On the other hand, the NES (which is also elaborated yearly as part of the standard GEM methodologies) includes information about nine dimensions of entrepreneurial framework conditions, each containing several items related to the national context towards entrepreneurship, that take values from 1 ("total disagreement") to 9 ("total agreement"). The nine dimensions defined by GEM are: entrepreneurial finance, government policies, entrepreneurial education, government programs, R&D transfer, commercial and legal infrastructure, internal markets, physical infrastructure, and cultural and social norms.[2] In this Project, we focus mainly on the APS data, as we are particularly interested in the individual who is or become an entrepreneur, while the entrepreneurial context at the national level is beyond the main objectives of the Project and therefore left for future research.

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[1] See more information at https://www.gemconsortium.org.

[2] See https://www.gemconsortium.org/wiki/1154 for more information.

The main contribution of the GEM data is the characterization of entrepreneurs, a topic of debate given the heterogeneity in this definition, and the issues that such heterogeneity may produce in applied statistical and econometric analysis. For instance, several authors consider entrepreneurs as those individuals who are self-employed workers, business owners (with or without employees), or all those together (Artz, 2016). In such a context, the GEM methodology disregards the self-reported employment status of individuals, and identifies entrepreneurs as those individuals who contribute to the "Total (early-stage) Entrepreneurial Activity" (TEA) index, i.e., individuals "who are about to start, or have started an entrepreneurial activity in the last 42 months". This definition is standard in the literature of entrepreneurship using GEM data, and may include self-employed workers and business owners who have just start-up (baby business owners), and nascent entrepreneurs (individuals who are about to start-up). See Bosma et al. (2020) for a recent report about GEM's methodology.

3. Conceptual framework

Entrepreneurship is a common labor alternative practice to salaried employment, but far from that, it is a global phenomenon with a range of different dimensions. There is a high degree of consensus in the scientific literature about entrepreneurship being not only a kind of occupation, but also something else. For instance, the complexity of the entrepreneurial activity led to the creation of the Global Entrepreneurship Monitor (GEM), a worldwide consortium of experts and researchers aiming to explore entrepreneurship. As entrepreneurship is not only a labor, or scientific, topic, but also a social process, this idea of complexity has to be

transmitted to society. Public policies and institutions have, consequently, devoted efforts to promote entrepreneurship (Chang and Kozul-Wright, 1994; Minniti, 2008; Shane, 2009), such as the 2020 Entrepreneurship Action Plan, or the "*Programa Emprendedores*" in Spain, aim to promote entrepreneurship. Nonetheless, the efficacy and efficiency of these programs is, at least, questionable (Naudé, 2016). Then, researchers have to shed light on the mechanisms behind the entrepreneurial activity, not only for researching purposes, but also to provide an adequate framework for the whole society to understand the entrepreneurial activity. Within this context, the objective of this Chapter is to provide an overview about the entrepreneurial activity in Spanish regions, with a focus on the determinants that make individuals more prone to become entrepreneurs.

Entrepreneurship is an activity traditionally associated with economic growth, innovation, and development. Furthermore, the recent economic crisis has increased the role of entrepreneurship as a driver of development and economic recovery. It is well-stablished in the literature that institutions and the environment play a major role in determining entrepreneurship (i.e., the institutional theory, North, 1986). Nonetheless, individual attributes may play a more important role in determining what forces workers to become entrepreneur (Campaña et al., 2016, 2017a, 2017b; Gimenez-Nadal et al., 2012, 2018, 2019, 2020, 2021; Molina et al., 2016, 2017). For instance, entrepreneurship is generally associated with young individuals (Schott and Bagger, 2004; Kelley, 2009; Wennekers et al., 2010), but also to formation, entrepreneurial, and managerial skills (Kotsova, 1997; Ramachandran and Shah, 1999; Minniti, 2009; Levie and Autio, 2013; Rostam-Afschar, 2014; Brixiova et al., 2015; Kyrö, 2015; Molina and Velilla, 2016; Velilla et al., 2020), social behaviors and intergenerational and peer effects (Holcomb et al., 2009; Okumura and Usui, 2016;

Gimenez-Nadal et al., 2019; Ferrando-Latorre et al., 2019), or to financial, psychological, and welfare conditions (Sobel, 2008; Dawson et al., 2015; Molina et al., 2016, Schott et al., 2017), among others.

In the study of entrepreneurship, the Global Entrepreneurship Monitor (GEM) is "the world's foremost study of entrepreneurship" (http://www.gemconsortium.org). GEM researchers and experts provide high quality data and reports to the scientific community, in order to analyze, promote, and understand global entrepreneurial activity. GEM develops every year two main databases. First, the GEM National Expert Survey (NES), a national-level database where several experts are interviewed about the Entrepreneurial Framework Conditions (EFCs) to study the dynamics and links of entrepreneurship with the following nine aspects: entrepreneurial finance, government policy, government programs, entrepreneurship education, R&D transfers, commercial and legal infrastructure, entry regulation, physical infrastructure, and culture and social norms. Second, the GEM elaborates a micro-database, where more than 2,000 respondents are interviewed in each participant country. Then, GEM elaborates with these interviews the Adult Population Survey (APS), that allows researcher to explore the role of individual attributes, motivations, and attitudes related to entrepreneurship.

According to GEM frameworks, the social, cultural, and political contexts have three main implications on entrepreneurship. First, the basic perquisites, such as institutions, infrastructures, economic and political stability, pre-college education, or health. Second, the efficiency engines, such as college education, real estate market, labor market, financial market, technologies, and size of market. Third, innovation and entrepreneurship. This third branch of contexts includes financing,

politics, public programs, specific entrepreneurial education, R&D transfers, commercial infrastructures, laws, or culture.

Nonetheless, another range of studies has focused not on the national, or regional, contexts in which the entrepreneurial activity is developed, but on the individual attributes that characterize entrepreneurs. For instance, GEM identifies two types of entrepreneurship. First, the corporate entrepreneurship, that corresponds to those entrepreneurial tasks developed in consolidated firms in the search of innovation and growth. Second, the entrepreneurial activity of individuals that, motivated by the recognition of opportunities, by specific skills, or by necessity, decide to initiate a business. The classification of entrepreneurs according to their motivations, e.g., necessity and opportunity, is consolidated in Reynolds et al. (2003). Once individuals entrepreneur, they may have different aspirations: innovate, growth, or subsistence, among others, and then we may define mainly two types of entrepreneurs: necessity-driven entrepreneurs, and opportunity-driven entrepreneurs. Necessity-driven entrepreneurs are those individuals who cannot find an employer, and then decide to start-up in the search for income. Opportunity-driven entrepreneurs are those individuals who decide to start an entrepreneurial activity because they recognize an opportunity in their background, and may include innovative entrepreneurship, and vocational entrepreneurship.

GEM divides the individual entrepreneurial activity in 3 stages: first, those individuals who are characterized as future, or potential entrepreneurs, i.e., individuals who have the intention to entrepreneur in the future (at the short place). Second, nascent entrepreneurs, which are individuals who are about to start, or have started an entrepreneurial activity in the last three months. Finally, entrepreneurs, that are individuals who are about to start, or have started an entrepreneurial

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activity in the last forty-two months. Using this identification, GEM defines the Total Entrepreneurial Activity (TEA) index, that identifies the percentage of entrepreneurs among the working-age population. Further, different variations of the TEA are derived, such as the TEA-necessity, the TEA-opportunity, or the TEA-nascent, identifying necessity-driven, opportunity-driven, and nascent entrepreneurs, respectively. Afterwards, individuals are assumed to become consolidated business owners, and are no longer characterizes as entrepreneurs. Further, in all of the cases, it must be taken in to account the failure option, i.e., whether entrepreneurs decide to leave their business. There are also different reasons for leaving the entrepreneurial activity: motivational, social, aspirational, or economic.

Within this broad framework provided by GEM, this Chapter first provides a comparative analysis of the different entrepreneurial stages in Spanish regions. We also compare Spain with other European countries. Secondly, the Chapter addresses the question of which are the individual characteristics that make individuals entrepreneur, using machine learning techniques based on resampling and bootstrapping. These techniques are based on minimizing prediction errors of quantitative models, and are designed to deal with overfitting. Then, they will allow to determine, from the wide set of variables provided by GEM, which are the strongest determinants of individual entrepreneurial activity.

4. GEM data for Spain

The data used throughout this Chapter is taken from the GEM database. For instance, two sources of data are used. First, we use data from the GEM online tools (http://www.gem-spain.com/graficos/) to study the evolution of the entrepreneurial

activity in Spain. Second, we use data from the 2015 wave of the GEM APS to study the entrepreneurial activity in Spain, Europe, and other developed countries (e.g., United States, Canada, and Australia). The analysis of the determinants of entrepreneurial participation is also developed using the 2015 wave of the GEM APS.

We restrict the GEM 2015 APS to individuals residing in European countries. We have information for: Greece, the Netherlands, Belgium, Spain, Italy, Switzerland, United Kingdom, Sweden, Norway, Poland, Germany, Portugal, Luxembourg, Ireland, Finland, Hungary, Romania, Bulgaria, Latvia, Estonia, Croatia, Slovenia, Macedonia, and Slovakia; in addition to the United States, Canada, and Australia. These restrictions leave us with a sample of 92,182 individuals, of which 24,300 reside in Spain. Table 1 shows the composition of the sample, by country.

The GEM 2015 APS data contains information about whether individuals are entrepreneurs, nascent entrepreneurs, opportunity-driven entrepreneurs, and necessity-driven entrepreneurs, according to GEM methodologies. According to the sample, 6,591 individuals are entrepreneurs (which corresponds to a rate of 7.15%), of which 3,811 are nascent entrepreneurs (i.e., a rate of 4.13%). Furthermore, the GEM APS data identifies a wide series of attitudes, motivations, and potential determinants of entrepreneurial activity, and also information about socio-demographics (e.g., age, gender, or education). A summary of these variables is shown in Table 2, where it is shown information about the mean value, and standard deviations, for Spain, Western Europe, and the whole sample. (GEM defines variables in a 5-levels scale. In order to make the analysis less susceptible to biases, we follow Gimenez-Nadal et al. (2019) and redefined variables as dummy, taking

value 1 if the answer is an agreement (values 5 as "totally agree" or 4 as "agree"), and value 0 for the remaining categories.)

Table 1. Composition of the sample

Country	N. Individuals	Percentage
United States	3,000	3.25
Greece	2,000	2.17
Netherlands	2,258	2.45
Belgium	2,022	2.19
Spain	24,300	26.36
Hungary	2,000	2.17
Italy	2,000	2.17
Romania	2,001	2.17
Switzerland	2,424	2.63
United Kingdom	9,405	10.20
Sweden	5,020	5.45
Norway	2,000	2.17
Poland	2,000	2.17
Germany	3,842	4.17
Australia	2,000	2.17
Canada	3,561	3.86
Portugal	2,005	2.18
Luxembourg	2,016	2.19
Ireland	2,001	2.17
Finland	2,007	2.18
Bulgaria	2,002	2.17
Latvia	2,004	2.17
Estonia	2,301	2.50
Croatia	2,000	2.17
Slovenia	2,009	2.18
Macedonia	2,001	2.17
Slovakia	2,003	2.17

Note: the sample is taken from the GEM 2015 APS data.

Table 2. Summary statistics

Variables	Spain		Western Europe		Europe, US, Can, Aus	
	Mean	S.Dev.	Mean	S.Dev.	Mean	S.Dev.
Entrepreneur	0.054	0.225	0.062	0.240	0.071	0.258
Nascent entrepreneur	0.020	0.139	0.033	0.180	0.041	0.199
Opportunity entrep.	0.038	0.190	0.046	0.210	0.054	0.226
Necessity entrepreneur	0.015	0.121	0.013	0.112	0.015	0.122
Age	42.567	12.754	43.728	14.575	43.589	14.537
Being male	0.503	0.500	0.498	0.500	0.497	0.500
Family size	3.101	1.219	2.922	1.366	3.002	1.494
Secondary ed.	0.582	0.493	0.610	0.488	0.608	0.488
University ed.	0.144	0.351	0.246	0.431	0.272	0.445
Middle income	0.518	0.500	0.226	0.435	0.233	0.479
High income	0.180	0.384	0.244	0.430	0.253	0.434
Employed	0.354	0.478	0.430	0.495	0.459	0.498
Part-time employed	0.087	0.282	0.110	0.313	0.097	0.297
Self employed	0.139	0.346	0.108	0.310	0.107	0.309
Unemployed	0.174	0.379	0.120	0.325	0.115	0.319
Student	0.070	0.256	0.052	0.223	0.046	0.209
Homemaker	0.082	0.274	0.052	0.223	0.047	0.212
Know other entrepreneurs	0.330	0.470	0.308	0.462	0.313	0.464
Opportunities to entrep.	0.213	0.410	0.275	0.447	0.276	0.447
Skills to entrepreneur	0.432	0.495	0.406	0.491	0.420	0.494
Fear to failure	0.438	0.496	0.431	0.495	0.427	0.495
Desire of equity	0.676	0.468	0.515	0.500	0.510	0.500
Entrep. social status	0.473	0.499	0.478	0.500	0.454	0.498
Success social status	0.446	0.497	0.566	0.496	0.530	0.499
Entrep. In Media	0.426	0.494	0.481	0.500	0.454	0.498
Entrepreneur is easy	0.202	0.401	0.179	0.383	0.188	0.391
Have helped others to entrep.	0.033	0.179	0.049	0.216	0.064	0.245
New product	0.028	0.165	0.043	0.202	0.049	0.216
No competence	0.045	0.207	0.054	0.225	0.060	0.238
New technology	0.025	0.155	0.026	0.160	0.032	0.175
N. Individuals	24,300		65,300		92,182	

Note: the sample is taken from the GEM 2015 APS data. Age is measured in years. Education is defined in three categories, according to the maximum level of formal education reached. Reference category: primary education or lower. Income is defined in three levels (low, middle, high) by GEM. Reference category: low income. Entrep. social status measures whether being an entrepreneur is considered as a positive social status. Success social status measures whether being a successful individual is considered a positive social status. Entrep. in Media measures whether entrepreneurs appear in Media. Family size is measured as the number of individuals residing in the family household.

5. Comparative analysis

Table 3 show TEA rates (i.e., the rates of entrepreneurs to working-age population) of Spanish Autonomous Communities, from 2007 to 2015. We can observe how entrepreneurial rates fall from more than 7% in 2008 to almost 3.5% in 2010, which can be attributed to the recent economic crisis. From 2011, rates have remained stable between 5% and 6%. This trend remains clear among regions, as minimums are reached in all the regions during the years 2009 and 2010. Nonetheless, there are wide differences across communities. For example, entrepreneurial rates have decreases from 8% in 2008 to around 4% between 2011 and 2015 in Aragón. However, in other regions, such as Balearic Islands and Cataluña, entrepreneurial rates have reached the levels of the years 2007 and 2008. Finally, there are other regions, such as Valencia or the Basque Country, where rates have remained considerably low from the crisis. Figure 1 shows a map where entrepreneurial rates of the year 2015 are represented for each of the Spanish Provinces, to see regional differences. This map has been elaborated using the software ArcGIS.

If we compare these rates with rates of other European and developed countries, as shown in Table 4, we may see how among the countries with the highest entrepreneurial rates are Australia, Canada, and the United States, with rates greater than 10%. Although Australia and Canada information are scarce, we can see how entrepreneurial levels increase in the United States especially since 2010, with only a slight decrease during the crisis. Only Estonia, Latvia, Luxembourg and Romania reach entrepreneurial levels similar to that of United States, Australia, and Canada.

Table 3. TEA index, by region

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andalucía	7.17	6.66	6.28	4	5.76	6.1	5.37	5.92	6.35
Aragón	7.18	8.08	4.51	3.74	5.3	4.57	4.22	4.67	4.15
Asturias	7.04	5.79	2.36	2.65	1.49	2.17	4.18	1.5	3.5
Balearic Islands	8.66	6.92	6.56	3.29	4.26	5.31	6.71	8.75	8.77
Canary Islands	8.99	7.16	4.83	3.59	6.94	4.16	6.3	4.01	5
Cantabria	6.22	7.93	5.79	3.47	3.77	4.39	3.92	4.89	6.6
Castilla y León	6.22	5.64	3.22	4.77	6.34	5.59	3.72	4.15	5.8
Castilla-La Mancha	8.52	6.73	3.54	4.27	5.81	5.62	4.92	5.35	7.3
Cataluña	8.39	7.27	6.38	4.04	6.82	7.48	6.61	7.54	6.4
Ceuta	6.38	5.14	2.95	3.03	-	4.71	3.53	4.5	2.25
Com. Valenciana	8.43	7.35	4.93	3.71	6.87	5.83	5.52	4.02	3.7
Extremadura	8.12	7.12	3.27	2.59	6.06	5.06	5.76	7.38	4.7
Galicia	7.64	7.49	4.69	2.6	4.74	5.13	4.11	3.92	5.5
La Rioja	8.79	6.96	4.93	2.23	5	5.4	7.04	4.56	4
Madrid	7.93	8.51	5.06	4.51	5.59	4.45	4.77	5.84	6.4
Melilla	5.66	3.16	3.34	6.57	-	5.92	6	3.04	4.25
Navarra	8.13	6.48	3.85	3.6	5.55	4.41	4.12	3.91	4.5
Basque Country	6.37	7	3.04	2.48	3.85	4.36	2.96	3.65	3.35
Murcia	7.52	6.97	5.58	4.11	6.43	3.86	5.3	6.67	5.8
Spain	7.62	7.03	5.1	3.64	5.81	5.7	5.21	5.47	5.23

Note: Elaborated from GEM-Spain online data (http://www.gem-spain.com/graficos/). The TEA index is measured in percentage.

Among countries of Western Europe, we can observe how the TEA index is nearly half of the TEA of the United States. For instance, Spain shows entrepreneurial levels among the lowest, only greater than levels in Germany and Italy, and similar to Belgium. For instance, Spain, Germany, Belgium and Italy show among the lowest levels of entrepreneurship from 2007 to 2015. However, entrepreneurial rates in Germany and Belgium show an increasing pattern during the analyzed period, and do not suffer a decrease during the beginning of the crisis. Against that, Spain and Italy show a significant decrease of the TEA in the years 2009 and 2010, reaching minimums of 4.31% and 2.35%, respectively. These trends may be due to the different relevance of the crisis in Spain and Italy, compared to

Germany and Belgium. Nonetheless, as entrepreneurship has been promoted as a source of labor and development during the crisis, we may expect that the TEA in Spain and Italy would have reached higher levels than in other countries of Western Europe, but this has not been the case. Hence, as pointed by Naudé (2016), there may be crisis in European entrepreneurship, despite it being strongly supported by politics and government programs. This is a topic that requires further research.

6. The determinants of entrepreneurship

We use the algorithmic method developed by Gimenez-Nadal et al. (2019) to measure the relevance of explanatory variables in regression models from the point of view of predictive capabilities: variables with the highest predictive power will be meaningfully related to the dependent variable (Friedman, 1953). This type of measure is more reliable than the classical significativity (e.g., t-type tests), which is subject to strong hypotheses, and also to artificial inflations due to the rejection of "non-significant" specifications by researchers.

Assume that the sample is formed by N individuals and M explanatory variables. According to this method, it is taken a bootstrap sample from the original sample (e.g., a training set, of size N). A random subsample of M_2 explanatory variables is taken, where $M_2 \approx \sqrt{M}$. Then, it is estimated a logit model of the dependent variable in terms of the M_2 explanatory variables, using individuals from the test set. Once parameters have been estimated, it is estimated the mean absolute error of prediction, but using individuals not included in the training set.

Figure 1. TEA index in Spain (2015), by province
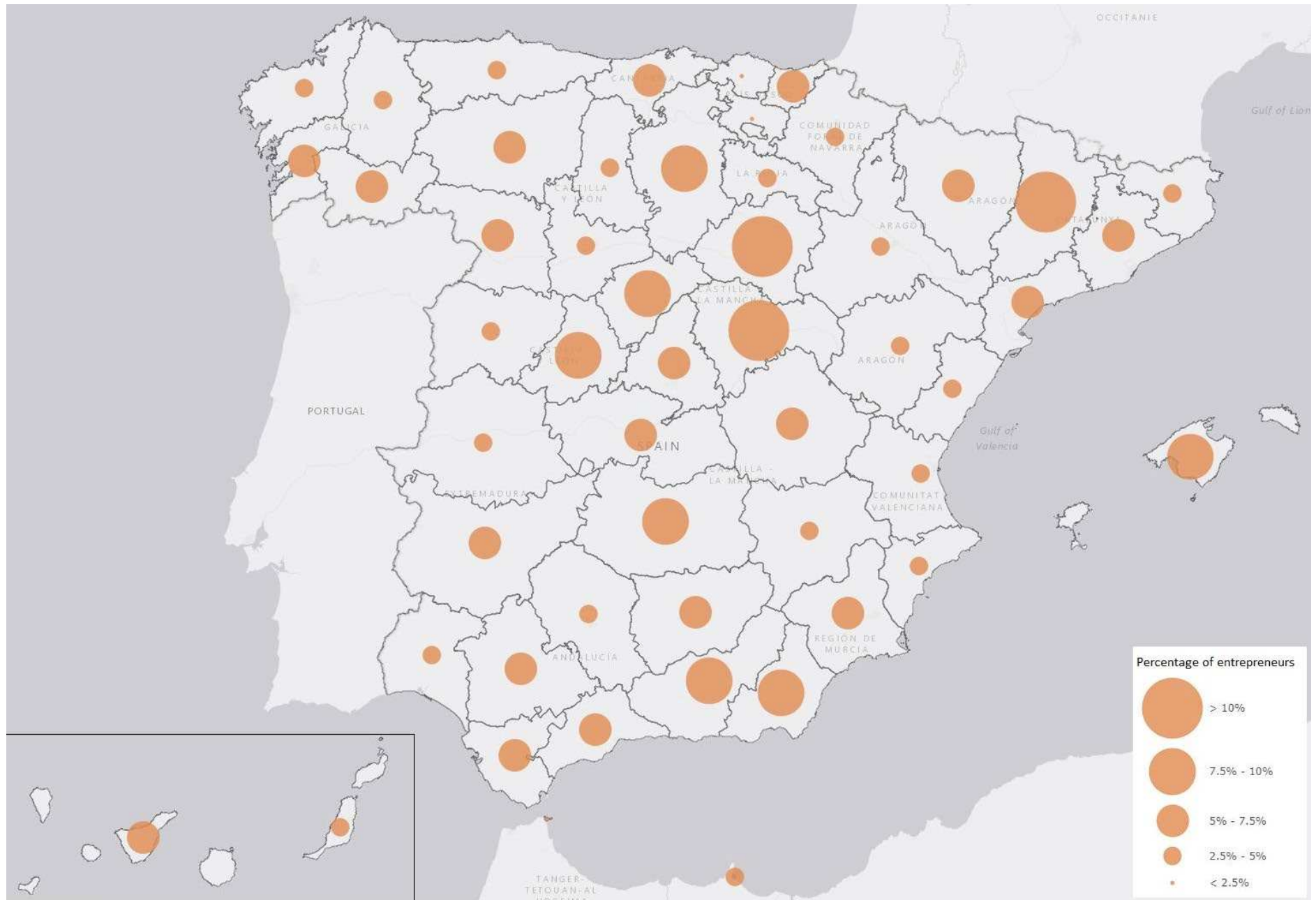
Source: Elaborated by authors from GEM-Spain APS 2015 Data.

Table 4. TEA index, by country

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Australia	-	-	-	7.8	10.5	-	-	13.14	12.79
Belgium	3.15	2.85	3.51	3.67	5.69	5.2	4.92	5.4	6.24
Bulgaria	-	-	-	-	-	-	-	-	3.46
Canada	-	-	-	-	-	-	12.19	13.04	14.72
Croatia	7.27	7.59	5.58	5.52	7.32	8.27	8.27	7.97	7.69
Estonia	-	-	-	-	-	14.26	13.11	9.43	13.14
Finland	6.91	7.34	5.17	5.72	6.25	5.98	5.29	5.63	6.59
Germany	-	3.77	4.1	4.17	5.62	5.34	4.98	5.27	4.7
Greece	5.71	9.86	8.79	5.51	7.95	6.51	5.51	7.85	6.75
Hungary	6.86	6.61	9.13	7.13	6.29	9.22	9.68	9.33	7.92
Ireland	8.22	7.59	-	6.76	7.25	6.15	9.25	6.53	9.33
Italy	5.01	4.62	3.72	2.35	-	4.32	3.43	4.42	4.87
Latvia	4.46	6.53	10.51	9.68	11.85	13.39	13.25	-	14.11
Luxembourg	-	-	-	-	-	-	8.69	7.14	10.19
Macedonia	-	14.47	-	7.88	-	6.97	6.63	-	6.11
Netherlands	5.18	5.2	7.19	7.22	8.21	10.31	9.27	9.46	7.21
Norway	6.18	8.7	8.53	7.72	6.94	6.75	6.25	5.65	5.66
Poland	-	-	-	-	9.03	9.36	9.28	9.21	9.21
Portugal	8.78	-	-	4.4	7.54	7.67	8.25	9.97	9.49
Romania	4.02	3.98	5.02	4.29	9.89	9.22	10.13	11.35	10.83
Slovakia	-	-	-	-	14.2	10.22	9.52	10.9	9.64
Slovenia	4.78	6.4	5.36	4.65	3.65	5.42	6.45	6.33	5.91
Spain	7.62	7.03	5.1	4.31	5.81	5.7	5.21	5.47	5.7
Sweden	4.15	-	-	4.88	5.8	6.44	8.25	6.71	7.16
Switzerland	6.27	-	7.72	5.04	6.58	5.93	8.18	7.12	7.31
United Kingdom	5.53	5.91	5.74	6.42	7.29	8.98	7.14	10.66	6.93
United States	9.61	10.76	7.96	7.59	12.34	12.84	12.73	13.81	11.88

Note: Elaborated from GEM online data. The TEA index is measured in percentage.

The process iterates $K = 5{,}000$ times, and then we may obtain 5,000 mean absolute errors over test sets, each of them associated to a different subset of explanatory variables. Finally, we associate to each explanatory variable the average of the mean absolute errors of the models in which it was included. That way, we obtain a measure of the importance of each of the explanatory variables, that controls for overfitting (by estimating errors over test sets), and also dealing with multi-collinearity (by randomizing the set of explanatory variables of each of the iterations). Furthermore, as this measure depends exclusively on predictions, it does not depend on hypotheses of the model, such as linearity, or properties of residuals. Hence, we may say that this is an unbiased estimation of the importance of the relationships between the variable of interest and each of the explanatory variables.

Results

We repeat the process for the case of Spain, Western Europe (the GEM APS 2015 data contains information for Greece, the Netherlands, Belgium, Spain, Italy, Switzerland, United Kingdom, Sweden, Norway, Poland, Germany, Portugal, Luxembourg, Ireland, and Finland); Western Europe, plus the United States, Canada, and Australia; Europe (Western Europe, Hungary, Romania, Bulgaria, Latvia, Estonia, Croatia, Slovenia, Macedonia, and Slovakia); and Europe, plus United States, Canada, and Australia. Furthermore, we use two different outcomes: first, the probability of being an entrepreneur and, second, the probability of being a nascent entrepreneur. That way, we analyze the determinants of being an entrepreneur, and also the determinants of becoming and entrepreneur. A summary of results is shown in Table 5, where determinants have been selected according to their predictive power. In particular, for each of the analyzed cases, we keep the explanatory variables whose associated error is lower than most of the remaining regressors. See Figures A1 to A5 in the Appendix for a more detailed description of results.

We can see how peer effects, measured through the variable have helped other entrepreneurs, is present in all the cases (for instance, it is the strongest individual determinant both of entrepreneurial and nascent entrepreneurial activity in all the analyzed cases). This indicates that active peer effects (e.g., not only know other entrepreneurs, which is relevant only in three cases, but the fact of have collaborated with them) are very important, and that entrepreneurs are altruistic in the sense that they help each other, and also that workers who help entrepreneurs may be "convinced" and decide to start-up by themselves. The ability of work with new technologies, provide new products, and observe no local competence also appear in all the cases, indicating the strong presence of innovation and opportunity in the start-up process. (It is important to note that, in developing and non-developed countries, innovation and opportunity may be secondary, against necessity-driven entrepreneurship.) These variables may indicate that, even when education is not present as a strong determinant of entrepreneurship, or nascent entrepreneurship, in any of the cases, it appears indirectly in all of them, as the ability to recognize no local competence in a sector, and/or have the ability to innovate, may be especially present in workers with determined technical and managerial abilities, acquired through education.

Despite peer effects, competence, and innovation being present in all the cases, there are also other determinants that appear to be characteristics of some regions, such as entrepreneurial skills in the case of Spain and Europe, being a self-employed in the case of Spain and Western Europe, or being male in the widest sample. This indicate the complexity of the entrepreneurial activity, where other types of approaches may lead to complementary results (Coduras et al., 2016; Velilla and Ortega, 2017; Velilla et al., 2018; Velilla and Ortega, 2020). In addition, despite having used a method that shows the strongest determinants of entrepreneurship according to predictions, this relies on bootstrapping linear models, and then complex and non-linear relationships may be miss leaded. Furthermore, previous evidence has

shown that there are no general trends to reach high levels of entrepreneurship, and that some individuals may pursue the entrepreneurial venture throughout different channels than others. Hence, further research is needed to identify what are the motivations that make individuals entrepreneur.

7. Conclusions

This Chapter reviews the entrepreneurial activity in Spain, using GEM data, with a focus on comparisons of Spanish Autonomous Communities, and with other developed economies. We also study the determinants of entrepreneurship using machine learning algorithmic methods, to compare the motivations to entrepreneur in Spain, and in other regions.

Results show how Spain is among the "less entrepreneurial" regions of the developed world, together with Italia, Belgium, and Germany. Furthermore, there are regions within Spain that show higher levels of entrepreneurship (e.g., some provinces of Cataluña, Castilla y León, and Balearic Islands). Nonetheless, these regions are below the levels of countries such as the United States, Canada, Australia, or Luxembourg. Using resampling techniques, we study what drives individuals to entrepreneur in Spain, and compare these determinants with determinants in other regions, to study whether different rates of entrepreneurship are caused by different motives to start-up. However, we find that, in general terms, there is a common trend behind entrepreneurs: individuals start a new business motivated by experiences helping other entrepreneurs, where entrepreneurial and managerial skills, the ability to innovate, and the recognition of no competence in the local environment also play a major role. These four characteristics are found to characterize both entrepreneurs and nascent entrepreneurs in almost all the studied cases.

Table 5. Determinants of entrepreneurship

Countries	Entrepreneurship	Nascent entrepreneurship
Spain	Have helped other entrepreneurs	Have helped other entrepreneurs
	Being a self-employed	
	Can use new technologies	Can use new technologies
	Can provide a new product	Can provide a new product
	Have skills to entrepreneur	Have skills to entrepreneur
	Observe no competence	Observe no competence
Western Europe	Have helped other entrepreneurs	Have helped other entrepreneurs
	Being a self-employed	
	Can use new technologies	Can use new technologies
	Can provide a new product	Can provide a new product
	Have skills to entrepreneur	
	Observe no competence	Observe no competence
Plus US, Can, Aus	Have helped other entrepreneurs	Have helped other entrepreneurs
	Being a self-employed	
	Can use new technologies	Can use new technologies
	Can provide a new product	Can provide a new product
	Have skills to entrepreneur	
	Observe no competence	Observe no competence
	Know other entrepreneurs	
Europe	Have helped other entrepreneurs	Have helped other entrepreneurs
		Being unemployed
	Can use new technologies	Can use new technologies
	Can provide a new product	Can provide a new product
	Have skills to entrepreneur	Have skills to entrepreneur
	Observe no competence	Observe no competence
	Know other entrepreneurs	Know other entrepreneurs
Plus US, Can, Aus	Have helped other entrepreneurs	Have helped other entrepreneurs
	Being a self-employed	
	Can use new technologies	Can use new technologies
	Can provide a new product	Can provide a new product
	Observe no competence	Observe no competence
	Being male	Being male

Note: The sample is taken from the GEM 2015 APS Data. Figures A1 to A5 in the Appendix show a detailed summary of results.

Entrepreneurship has been seen as an engine of employment, innovativeness and development, especially during the crisis, and governments and institutions have encouraged individuals to start-up. In spite of that, entrepreneurial rates suffered significant decreases during the crisis, and these decreases were especially relevant in countries where consequences of the crisis were deeper, such as Spain or Italy. Hence, the relationship between entrepreneurship and development, and the different causal effects between employment, unemployment, and entrepreneurship, should be studied in details, as it is not clear whether entrepreneurship affects and is affected by unemployment. Finally, it should be addressed whether the different politics aiming to promote entrepreneurship in Spain have been effective, and efficient. Entrepreneurship has increased during the last years, but other dimensions of entrepreneurship (e.g., transitions from entrepreneurs to businessmen, income of entrepreneurs, size of new firms...) may not be beneficiating from the current government programs.

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Appendix: Additional tables and figures

Figure A1. Errors of variables (Spain)

A. Entrepreneurs
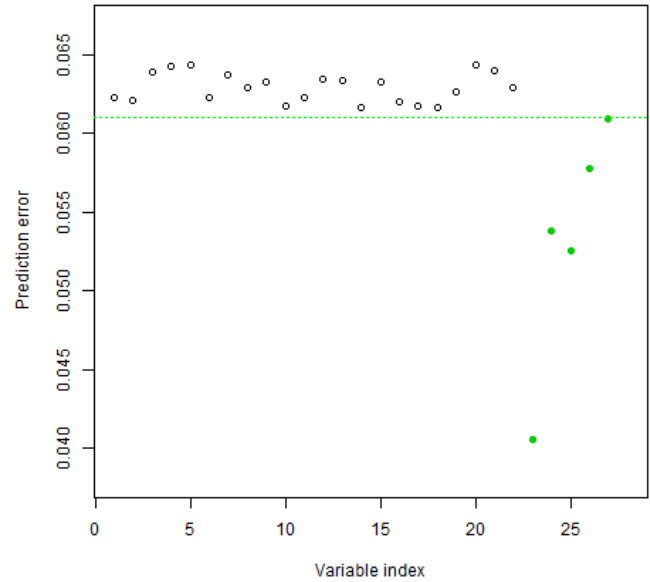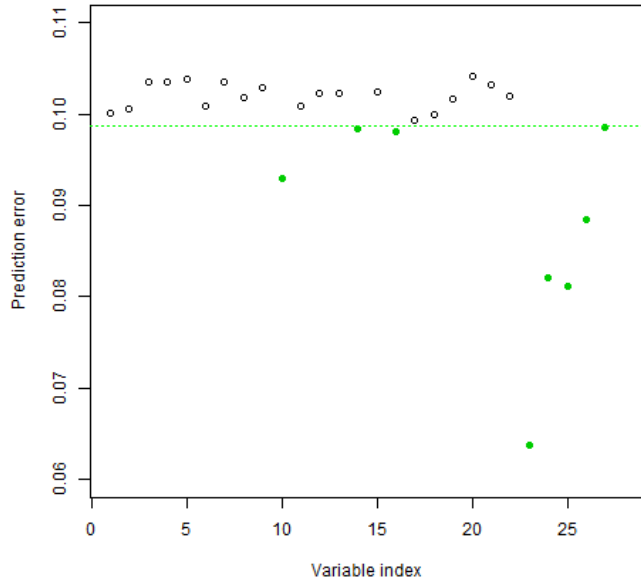
B. Nascent entrepreneurs
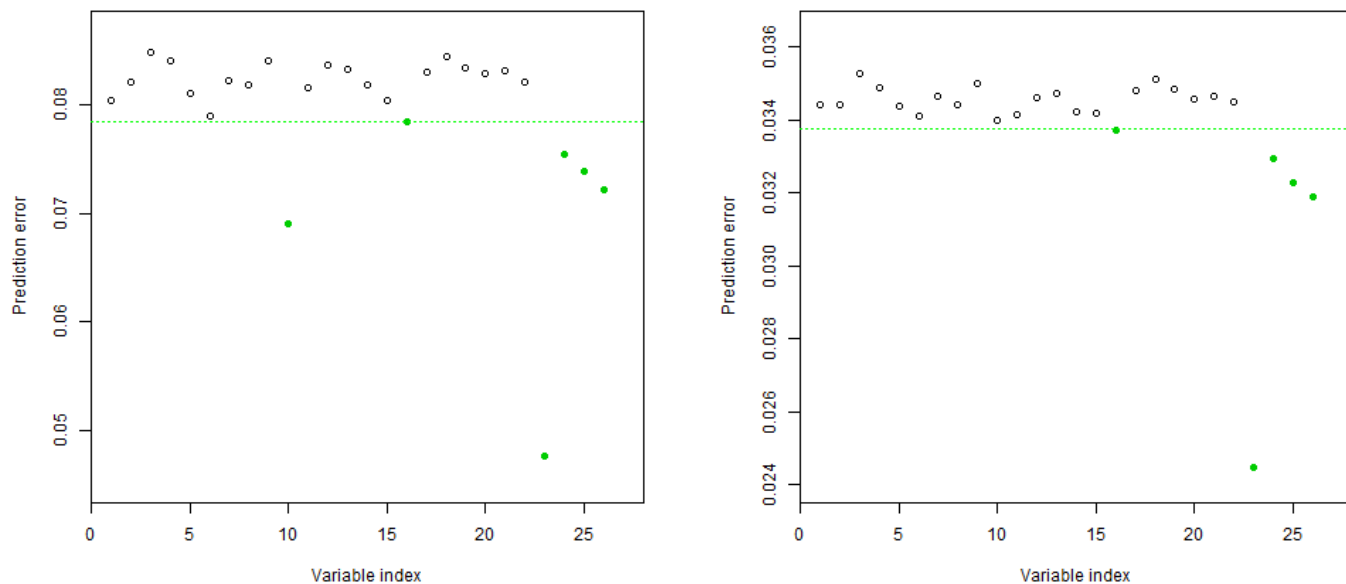
Note: The sample is taken from the GEM 2015 APS Data. The selected regressors are marked in green, below the reference line. In the case of Panel A, selected regressors are, by order of importance (i.e., starting from the lowest error): have helped other entrepreneurs, being a self-employed, can work with new technologies, observe no competence, can provide a new product, and have skills to entrepreneur. In the case of Panel B, selected regressors are: have helped other entrepreneurs, can work with new technologies, observe no competence, can provide a new product, and have skills to entrepreneur.

Figure A2. Errors of variables (Western Europe)
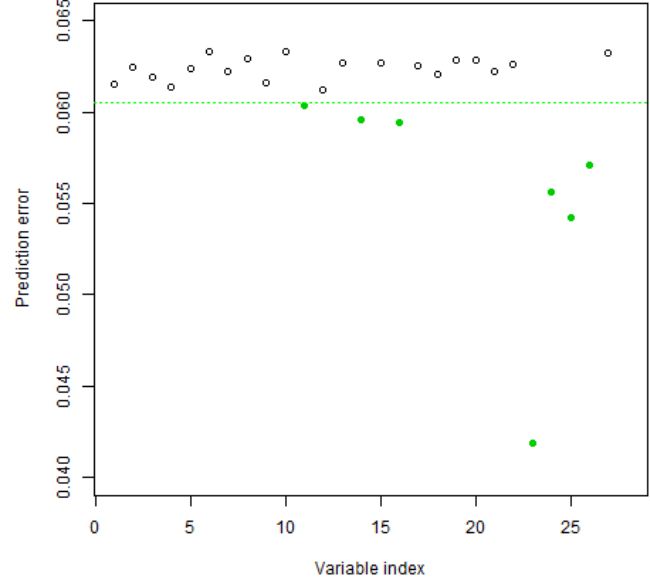
A. Entrepreneurs
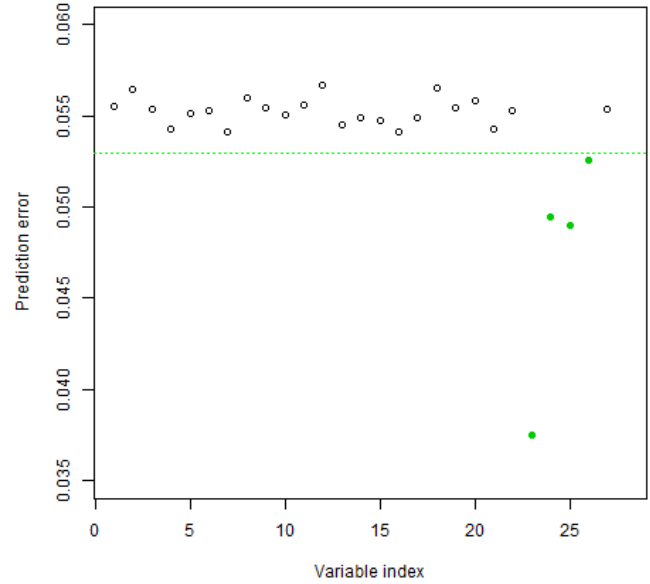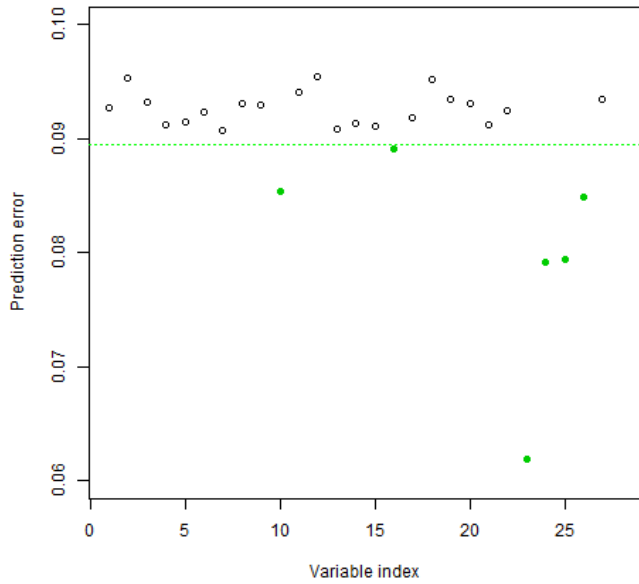
B. Nascent entrepreneurs

Note: The sample is taken from the GEM 2015 APS Data. The selected regressors are marked in green, below the reference line. In the case of Panel A, selected regressors are, by order of importance (i.e., starting from the lowest error): have helped other entrepreneurs, can provide a new product, observe no competence, can work with new technologies, being a self-employed, and have skills to entrepreneur. In the case of Panel B, selected regressors are: have helped other entrepreneurs, observe no competence, can provide a new product, and can work with new technologies.

Figure A3. Errors of variables (Western Europe, US, Can, Aus)
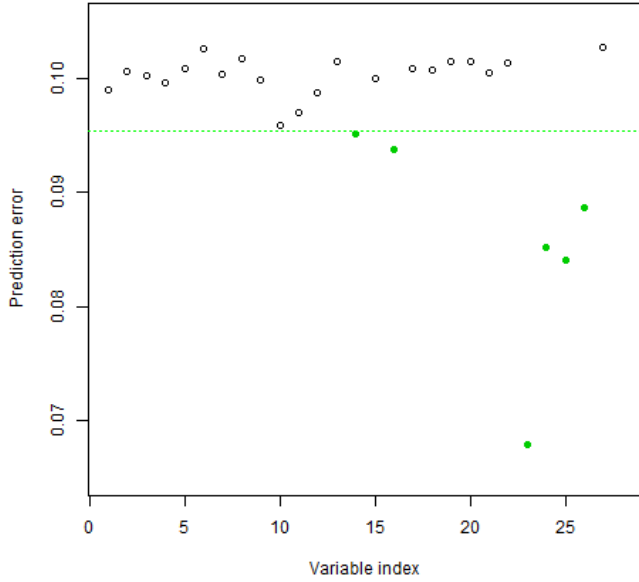
A. Entrepreneurs

B. Nascent entrepreneurs

Note: The sample is taken from the GEM 2015 APS Data. The selected regressors are marked in green, below the reference line. In the case of Panel A, selected regressors are, by order of importance (i.e., starting from the lowest error): have helped other entrepreneurs, observe no competence, can provide a new product, can work with new technologies, being a self-employed, have skills to entrepreneur, and know other entrepreneurs (in addition to country F.E.). In the case of Panel B, selected regressors are: have helped other entrepreneurs, observe no competence, can provide a new product, and can work with new technologies (in addition to country F.E.).

Figure A4. Errors of variables (Europe)

A. Entrepreneurs   B. Nascent entrepreneurs
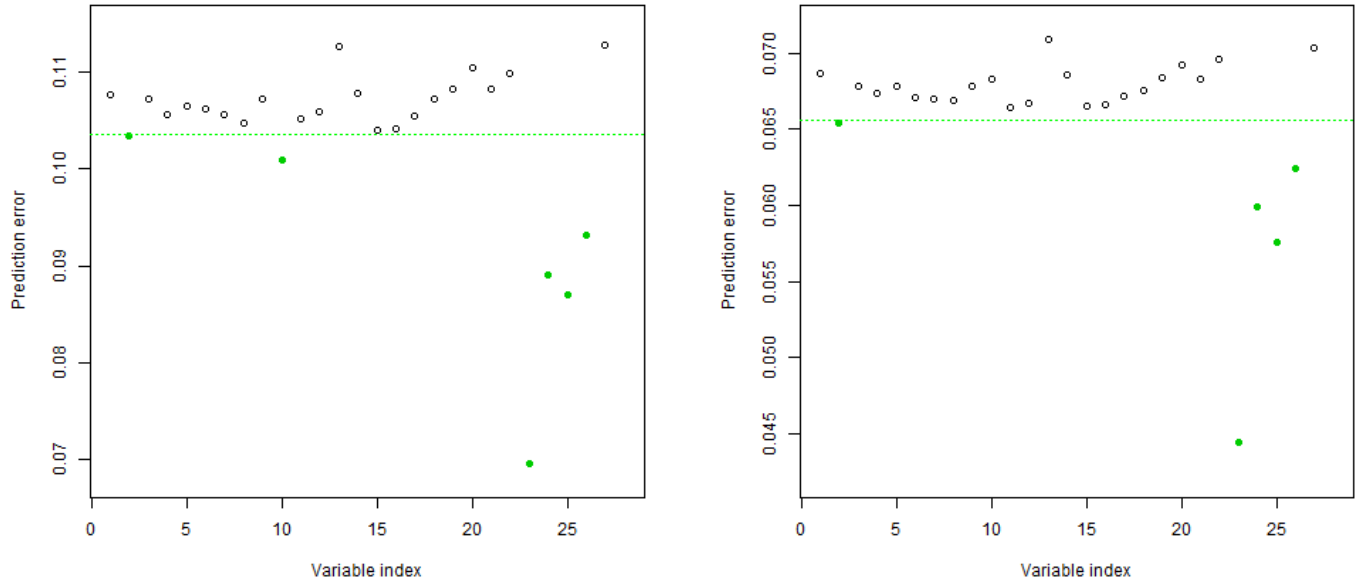

Note: The sample is taken from the GEM 2015 APS Data. The selected regressors are marked in green, below the reference line. In the case of Panel A, selected regressors are, by order of importance (i.e., starting from the lowest error): have helped other entrepreneurs, observe no competence, can provide a new product, can work with new technologies, have skills to entrepreneur, and know other entrepreneurs. In the case of Panel B, selected regressors are: have helped other entrepreneurs, observe no competence, can provide a new product, and can work with new technologies, have skills to entrepreneur, know other entrepreneurs, and being unemployed.

Figure A5. Errors of variables (Europe, US, Can, Aus)

A. Entrepreneurs

B. Nascent entrepreneurs

Note: The sample is taken from the GEM 2015 APS Data. The selected regressors are marked in green, below the reference line. In the case of Panel A, selected regressors are, by order of importance (i.e., starting from the lowest error): have helped other entrepreneurs, observe no competence, can provide a new product, can work with new technologies, being a self-employed, and being male. In the case of Panel B, selected regressors are: have helped other entrepreneurs, observe no competence, can provide a new product, can work with new technologies, and being male.