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Abstract. Nowadays it is believed that entrepreneurship could be a driving force in growth and development. For the achievement of a relevant national entrepreneurship rate the social and economic business environment can be crucial. However, despite the international attention given to entrepreneurship, it is not known if it is a global phenomenon or if there are particular regions where the entrepreneurial activity is specially recognized by society. Applying cluster analysis statistical techniques to a dataset gathered by the Global Entrepreneurship Monitor (GEM) and that includes, in 2010, 59 countries this paper intends to identify groups of countries with the same population attitude and perception regarding entrepreneurship.

Keywords: entrepreneurship, business environment, attitudes, perceptions, cluster analysis, GEM.

Jel classification: L26, C38

1. Introduction

Entrepreneurship is a multidimensional concept that does not generate a consensual definition. An important distinction is made between an occupational and a behavioural notion of entrepreneurship. The former refers to individuals owning and managing a business for their own account and risk, while the latter focuses on entrepreneurial behavior in the sense of seizing an economic opportunity (Wennekers 2006; Sternberg, Wennekers 2005). Following this last notion it is becoming of general agreement that attitudes towards entrepreneurship are determinant factors when deciding to be an entrepreneur (Guerrero *et al*. 2006).

The conviction that entrepreneurship is about people has empirical evidences. Arenius and Minniti (2005) have demonstrated that the perception of opportunities, the confidence about one's own skills and knowing other entrepreneurs are some important individual factors in the explanation of entrepreneurship activities across countries. Also Koellinger *et al*. (2007) found strong evidence that subjective, and often biased, perceptions have a crucial impact on business start-up even if the correlation between the reported level of entrepreneurial confidence and the approximate survival chances of nascent entrepreneurs across countries is negative. These results are important in the context of a set of new definitions of entrepreneurship like the one suggested by Acs and Szerb (2010), which define entrepreneurship as "a dynamic interaction of entrepreneurial attitudes, entrepreneurial activity, and entrepreneurial aspiration that vary across stages of economic development", or the one integrated in a more subjectivist theory of entrepreneurship, which brings together elements of individual creativity, discovery, surprise and learning (Mahoney, Michael 2005; Kor *et al*. 2007). Aditionally, several models

It is sometimes argued that nations differ in their underlying entrepreneurial spirit (Blanchflower *et al*. 2001) so in recent years more researchers start being interested in the behavioural branch of entrepreneurship across countries and regions. According to Bosma and Schutjens (2011), referring some of the international literature on the subject, it is now widely recognized that regional variation in entrepreneurship is significant and persistent, and often even exceeds national differences. This applies to both entrepreneurial attitude and actual entrepreneurial activity. See, for example, Bosma et al. (2009) and Grilo and Thurik (2006) which reached the same conclusion using different data. Data gathered by the Global Entrepreneurship Monitor (GEM) and Eurobarometer, respectively. Freytag and Thurik (2007) emphasize that the relative stability of differences in entrepreneurial activity across countries suggests that other than economic factors are at play.

Following the line of thought presented above, this is, accepting as true that individual attitudes and perceptions regarding entrepreneurship can influence entrepreneurial activity; this research work tries to find groups of countries that share similar entrepreneurship´s attitudes and perceptions. Ap-

plying a cluster analysis statistical methodology to the GEM dataset the main goal is to find some evidence that a regional pattern of attitudes and perceptions exists. Although this methodology is not a common one has been used in entrepreneurship analysis. See the examples of Becker *et al*. (2011), Cordon *et al*. (2008), Gartner (2002) and Barr *et al*. (1980), for several entrepreneurship topics namely the relation between attitudes, perceptions and entrepreneurship.

Note that cluster analysis should be considered an exploratory data-analysis technique (StataCorp 2009). According to Everitt (1993) this methodology is intended largely for generating rater than testing hypothesis. This idea drives its application in the present analysis. The paper aims to show that different world regions present different social contexts and backgrounds to the economic business environment. It is intended to divide the set of analysed countries in groups that share similar attitudes and perceptions regarding entrepreneurship. This is particularly important not only because the achievement of a relevant national entrepreneurship rate depends on the social and economic business environment but also because, despite the international attention given to entrepreneurship, it is not known if it is a global phenomenon or if there are particular regions where the entrepreneurial activity is specially recognized by society.

The paper is presented as follows. Next section presents the GEM dataset and the selection of variables that defines attitudes and perceptions regarding entrepreneurship. The section also presents some variable analysis. In section 3 a brief description of the methodology is presented. The cluster methodology results, and respective discussion, can be observed in section 4. Section 5 concludes.

2. Dataset and variables

The Global Entrepreneurship Monitor (GEM) is a research program, initiated in 1998 as a joint research initiative of Babson College in Wellesley (USA) and the London Business School, that focuses on collecting annual harmonized data on entrepreneurship considered as a major driver of economic growth. The data is gathered to facilitate cross national comparisons, for an increasing number of countries, regarding several entrepreneurship indicators (Reynolds *et al*. 2005; Stenberg, Wennekers 2005). The number of participating countries has risen from 10 in 1999 to consistently above 30 from 2002 onwards. In 2010 is possible to compute entrepreneurship indicator for 59 economies all over the world as can be observed - and collected - in the GEM website (http://www.gemconsortium.org/default.aspx). The ‘‘GEM countries’’ consist on a sample of developed countries – the G8 countries, most OECD countries and almost all of the countries in European Union – and a smaller group of developing countries in Latin America, Africa and Asia.

Nowadays, as referred in the previous section, more economists are attempting to measure entrepreneurial spirit across countries in a regional perspective. Given the possibility to compare indicators across countries all over the world, data from GEM have been used to create indicators on regional entrepreneurial activity. These start being applied in entrepreneurship spatial analysis, namely in the process of mapping entrepreneurial activity and entrepreneurial attitudes across regions (e.g. Bosma, Schutjens 2011, 2009, 2007).

The GEM´s Adult Population Surveys provide standardized data on each country population’s entrepreneurial preferences, capacities and activities since it is believed that a country´s level of entrepreneurial activity is the result of its population’s assessments of entrepreneurial opportunities and entrepreneurial motivations and capacities (Sternberg, Wenneker 2005). This belief assumes a particular importance in an entrepreneurship analysis if emphasis is put is the Kirzner’s (1979) definition of entrepreneur. According to the author, entrepreneur is the one who perceives and pursues economic opportunities in the face of uncertainty.

Five of the most important indicators computed to measure each country perception and attitude regarding entrepreneurship are the following ones (Bosma *et al*. 2009):

- Entrepreneurship as a desirable career choice: percentage of 18-64 population who agree with the statement that in their country, most people consider starting a business as a desirable career choice;
- High status successful entrepreneurship: percentage of 18-64 population who agree with the statement that in their country, successful entrepreneurs receive high status;
- Media attention for entrepreneurship: percentage of 18-64 population who agree with the statement that in their country, you will often see stories in the public media about successful new businesses;
- Perceived capabilities: percentage of 18-64 population who believe to have the required skills and knowledge to start a business;

- Perceived opportunities: percentage of 18-64 who see good opportunities to start a firm in the area where they live.

The 2010 results for the above five indicators, are summarised in Table 1, where the rank of the 10 countries with the highest/lowest values, by indicator, are presented.

Table 1. Rank of the countries with the 10 highest and lowest values for the GEM's indicators of attitudes and perceptions regarding entrepreneurship

Entrepreneurship as Desirable Career Choice		Media Attention for Entrepreneurship		High Status Successful Entrepreneurship		Perceived Opportunities		Perceived Capabilities	
Country	%	Country	%	Country	%	Country	%	Country	%
TOP 10 - HIGHEST VALUES									
Ghana	91	Malaysia	88	Tunisia	93	Uganda	81	Uganda	87
Colombia	89	Uganda	82	Saudi Arabia	92	Zambia	81	Trin. & Tobago	83
Tunisia	89	Brazil	81	Ghana	91	Ghana	76	Jamaica	80
Chile	87	Peru	81	Egypt	89	Saudi Arabia	76	Vanuatu	80
Saudi Arabia	87	Ghana	79	Finland	87	Vanuatu	74	Zambia	78
Jamaica	85	South Africa	79	Uganda	87	Peru	71	Ecuador	77
Netherlands	85	Saudi Arabia	78	Iran	85	Trin. & Tobago	69	Bolivia	76
Palestine	85	Taiwan	78	Jamaica	85	Colombia	68	Peru	76
Ecuador	83	Tunisia	78	Angola	83	Angola	67	Ghana	75
Trin. & Tobago	83	China	77	Palestine	83	Sweden	66	Angola	73
TOP 10 - LOWEST VALUES									
Japan	28	Vanuatu	34	Croatia	50	Japan	6	Japan	14
Finland	46	Greece	35	Belgium	51	Korea (South)	13	Russia	23
Iceland	51	Italy	38	Japan	52	Greece	16	Malaysia	24
United Kingdom	51	Spain	41	Taiwan	58	Romania	18	Taiwan	26
Ireland	52	Croatia	42	Guatemala	60	Spain	19	Korea (South)	29
Germany	53	Uruguay	43	Iceland	61	Portugal	20	France	37
Slovenia	53	Guatemala	44	Uruguay	62	Russia	22	Romania	38
Hungary	55	France	45	Costa Rica	63	Croatia	23	Finland	40
Malaysia	56	Belgium	46	Mexico	63	Ireland	23	Israel	40
Vanuatu	56	Chile	46	Spain	63	Italy	25	Norway	40

Regarding Table 1, entrepreneurship as a career choice ranges from 28 % (Japan) to 91 % (Ghana) for the target population. The conviction that there is a relationship between entrepreneurship and a high social status ranges from 50 % (Croacia) and 93 % (Tunisia). The statement that media pay particular attention to successful business stories ranges from 34 % (Vanuatu) and 88 % (Malaysia). The faith in individual entrepreneurship skills varies from 14 % of the population (Japan) and 87 % (Uganda). Finally, the numbers of individuals who perceive entrepreneurship opportunities in their country vary from 6 % (Japan) and 81 % (Uganda).

To measure entrepreneurship activity the GEM created the Total early-stage Entrepreneurial Activity (TEA) indicator. This indicator measures the percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business. The rank of the 10 countries with the highest and lowest percentages of entrepreneurial activity is presented in Table 2.

Italy (2.3 %) and Japan (3.3 %) are the two countries with the lowest percentage of entrepreneurial activity. In opposition, Vanuatu (52.2 %) and Bolivia (38.6 %) are the countries with the highest values of entrepreneurial activity. Note that, with the exception of Japan, the countries with the lowest entrepreneurial activity rates are developed countries located in Europe. The countries with the highest entrepreneurial activity rates are countries in a development stage.

Table 2. Rank of the countries with the 10 highest and lowest values for the TEA

Total early-stage Entrepreneurial Activity (TEA)			
TOP 10 - HIGHEST VALUES		TOP 10 - LOWEST VALUES	
Country	%	Country	%
Vanuatu	52,2	Italy	2,3
Bolivia	38,6	Japan	3,3
Ghana	33,9	Belgium	3,7
Zambia	32,6	Denmark	3,8
Angola	32,4	Russia	3,9
Uganda	31,3	Germany	4,2
Peru	27,2	Romania	4,3
Ecuador	21,3	Spain	4,3
Colombia	20,6	Portugal	4,5
Brazil	17,5	Slovenia	4,7

Figure 1 presents a scatterplot matrix that shows the relation between the five selected indicators of attitude and perception and the indicator of entrepreneurial activity.

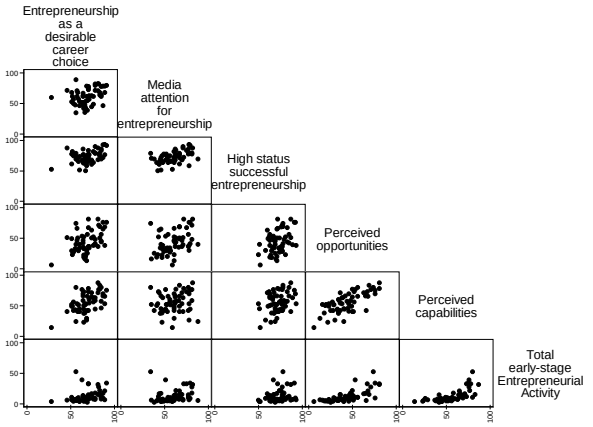

Fig.1. Matrix of GEM´s indicators of attitudes and perceptions regarding entrepreneurship activity, for all considered countries

Depending on the selected pair of variables the relative location of countries seems to change. The countries are not identified however is possible to observe different relative shapes when displaying the relation between each pair of variables. This is particularly visible when the rate of entrepreneurial activity – TEA – is displayed relating each one of the other indicators. Still, the above matrix does not allow verifying the existence of groups characterized by similar characteristics when the indicators of attitudes and perceptions towards entrepreneurship are used altogether. The identification of similar groups when putting together all the five attitude and perception indicators needs a more complex statistical analysis – a cluster analysis, for example.

3. Brief introduction to cluster analysis

The seminal work of Tryon (1939) introduced the cluster analysis. Such methodology is composed by a set of multivariate statistical methods that include different classification and optimization algorithms that intend to organize information concerning multiple variables and shape homogeneous groups.

In other words the cluster analysis develops tools and methods that, given a data matrix containing multivariate measurements on a large number of individuals (or objects); the aim is to build up some natural groups with homogeneous properties out of heterogeneous large samples. The groups or cluster should be as homogeneous as possible and the differences among the various groups as large as possible. The cluster analysis does not make conjectures about the number of groups or its structures - the groups are based on the similarities (or dissimilarities) among the groups characterized by different ways of calculating the "distance".

Several distinct methods can be used to measure the distance (or similarity) among the elements of a data matrix. They propose to infer about (i) the distance among observations coming from the same group and the distance among observations coming from different groups, (ii) the dispersion of observations within the same group and (iii) the density of the observations distribution inside and outside the groups. Being the adopted variables quantitative variables, the application of the Euclidian Distance method is advised (Giudici, Figini 2009). The distance is defined as the square root of the sum of the squared differences between the values of i and j for all the selected variables $(v = 1, 2, ..., p)$:

$$d_{ij} = \sqrt{\sum_{v=1}^{p} \left(X_{iv} - X_{jv} \right)^2} , \qquad (1)$$

where X_{iv} is the value of variable v for country i and X_{jv} is the value of the variable v for country j.

Besides the settlement of the distance among observations, computation method is still necessary to settle the computational method to calculate the distance among groups. Such step is particularly important when applying hierarchical methods for cluster definition. These methods allow obtaining a partition set associated with subsequent levels of aggregation among observations. This partition set can be represented graphically by dendrograms which are hierarchical structures with a shape similar to a tree shape. Indeed they represent partitions which leave from a more disaggregate observation division and come through a process of agglomeration that stops when all observation are joined in a same group.

Dendrograms can be obtained through the adoption of different techniques no one better than the other a priori, since it is not possible to select a best method for a given set of information. It is necessary to try different alternatives and compare the related results. In this research work, there were selected two techniques that could be distinguished by the fact that one of them – the complete linkage method – only demands the computation of the distance matrix among observations, and the other – the Ward method (Ward 1963) – demands both the computation of the distance matrix among observations and the original matrix.

In the complete linkage method the distance between the two groups is defined as the maximum of distances between each observation belonging to the group and each observation belonging to other group:

$$d(\pi_1, \pi_2) = \max_{x \in \pi_1, y \in \pi_2} d(x, y) , \qquad (2)$$

where x is a country belonging to group π_1 and y is a country belonging to group π_2.

In the Ward's method an objective function is minimized to generate groups with a maximum internal cohesion and a maximum external separation. The objective function is defined as the sum of squares of the standard error of individual observations relatively to the mean of the group where they are classified. The distance between the two groups, π_1 and π_2, is difined as:

$$d(\pi_1, \pi_2) = SP(\pi_1 \cup \pi_2) - \left(SP(\pi_1) + SP(\pi_2) \right) , \qquad (3)$$

where,

$$SP(\pi) = \sum_{x \in \pi} \left| x - \overline{x_\pi} \right|^2 .$$

With the help of the dendrogram it is possible to identify the groups that should be considered in the analysis and consequently it is possible to apply optimization methods or non-hierarchical methods. These methods choose in advance the number of groups which will comprise all the observations. Then all the observations could be divided by the predefined groups and the best partition of the observations will be the one that optimizes the chosen criteria. One of the processes that could be applied is the k-means interactive partition method. The method follows the next steps: starts by dividing an initial partition of individuals by the number of clusters previously defined; computes for each cluster the respective centroid and the distances between each individual and the centroid of the various groups; transfers each individual to the cluster relatively to which

presents the minor distance; re-computes the centroids of each cluster and repeats the previous steps until the moment each individual belongs to a stable cluster and, therefore, it is not possible to carry out more individual transfers among cluster. The method presents the disadvantage of limiting the search for an optimal partition of individuals since it restricts the number of predefined clusters. Still, it has the advantage of defining the regions belonging to each cluster as well as the distance of each group.

4. Results of the cluster methodology

The empirical application of the cluster analysis present in this research work follows the methodological steps suggested in the cluster analysis literature. As mentioned in the previous sections it is not know, *a priori*, which is the best classification method to apply. So, were applied two distinct algorithms for the countries´ hierarchical classification – the complete and Ward´s linkage methodology. The dendrograms obtained by the application of the complete and Ward´s hierarchical cluster analysis can be observed in Figure 2 and Figure 3, respectively.

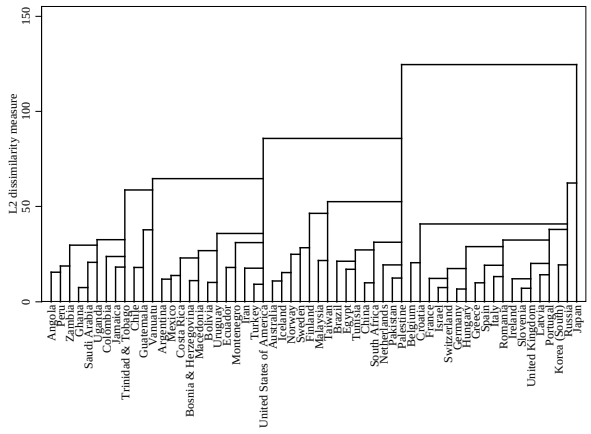

Fig.2. Complete linkage dendrogram

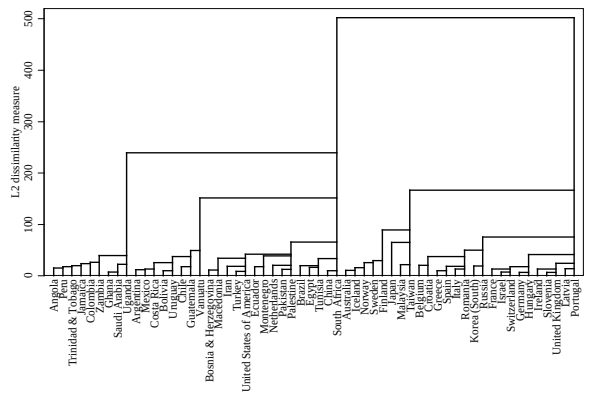

Fig.3. Ward's linkage dendrogram

Note that all indicators are measured with the same scale so there was no need of variable standardization. Denmark, that is the fourth country with the lowest rate of entrepreneurship activity (Table 2), has been withdrawn from the set of countries in analysis since the country presented missing values for some of the selected variables in 2010.

The two hierarchical cluster methods have produced different results, however is possible to understand that some countries present clear similarities with others – in both dendrograms is possible to see that some of the countries are close to each other independently of the method of distance computation. It is also possible to observe, in each dendrogram, the division of the all dataset in 4 or 5 main groups. Dendograms allow a first approach to the definition of the number of clusters expected in the optimization final solution. The visualization of the hypothetical country groups allows anticipating its optimal computational number as well as its composition.

The above results can be compared with the results computed by the non-hierarchical (or optimization) method chosen for the empirical analysis – the k-mean algorithm. This algorithm assumes that the number of groups (clusters) is previously known. However such assumption is rather unrealistic for most analysis problems since, normally, the data properties are not known. Thus the estimation of the number k of clusters is a frequent problem not only when applying the k-means algorithm but also other methods of clusters generation.

The more intuitive and visual approach of the hierarchical methods offers clues to the estimation of a suitable number of clusters but is not totally convincing. The visual observation seems to suggest that the number of clusters should not be inferior to 4. Departing from this intuitive value was applied the Calinski-Harabasz pseudo F-test (Calinski, Harabasz 1974) - considered by Milligan and Cooper (1985) one of the best cluster stopping rules - for 4 or more clusters. The test indicates the division of countries in 4 groups is an adequate partition.

The results for the k-means methodology are presented in Table 3 (cluster´s composition) and Table 4 (cluster´s descriptive statistics).

The first group comprises 9 countries known as development countries. The second cluster contains the biggest number of countries (20). These are countries located, essentially, in Europe and with the highest stage of development. In this second group are some of the G-8 countries, for instance. The third cluster contains 10 countries

characterised by their location – most of them are located in Latin America. The last cluster is the second biggest (19 countries) and seems to be the one that gathers the most distinct economies – located all over the world these countries are also in different stages of development and present different social, political, economical and legal environments. In cluster 4 is possible to find the US and Iran, for instance.

Table 3. Composition of the 4 clusters obtained using the k-means cluster methodology

Cluster 1 9 countries	Cluster 2 20 countries	Cluster 3 10 countries	Cluster 4 19 countries
Trinidad & Tobago	Germany	Ecuador	United States of America
Zambia	Spain	Bosnia & Herzegovina	Sweden
Colombia	Korea (South)	Bolivia	Iran
Angola	Latvia	Chile	Norway
Jamaica	Russia	Mexico	Finland
Saudi Arabia	Taiwan	Argentina	Palestine
Uganda	Slovenia	Costa Rica	Netherlands
Ghana	Croatia	Uruguay	Macedonia
Peru	Romania	Vanuatu	Montenegro
	United Kingdom	Guatemala	Pakistan
	Hungary		Brazil
	Belgium		Iceland
	Switzerland		Australia
	France		Egypt
	Portugal		China
	Ireland		South Africa
	Italy		Malaysia
	Japan		Tunisia
	Israel		Turkey
	Greece		

With the descriptive statistics (minimum, maximum and mean) presented in Table 4, is possible to define a statistical profile of the attitudes and perceptions regarding entrepreneurship, in each cluster. The statistical profiles can be compared with the mean entrepreneurial activity (TEA) computed for each cluster.

Table 4. Statistics for the 4 clusters obtained using the k-means cluster methodology (%)

	Cluster 1			Cluster 2			Cluster 3			Cluster 4		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Entrepreneurship as Desirable Career Choice	70	91	82,0	28	69	60.1	56	87	71.1	46	89	69,2
Media Attention for Entrepreneurship	67	82	75,3	35	78	50.9	34	63	50.6	56	88	69,0
High Status Successful Entrepreneurship	72	92	82,3	50	81	67.5	60	78	66.8	61	93	76,2
Perceived Opportunities	56	81	71,7	6	40	25.1	38	74	54.7	34	66	43,6
Perceived Capabilities	65	87	76,2	14	56	41.9	63	80	70.4	24	71	51,4
Total early-stage Entrepreneurial Activity		23.7			5.35			20.3			9.2	

Cluster 1 presents the highest average values for all the indicators selected to assess attitudes and perceptions regarding entrepreneurship. It is also the cluster with the highest average value for the entrepreneurial activity rate – in this group of countries, on average, 23.7 % of the 18-64 population is either a nascent entrepreneur or owner-manager of a new business. In this group, 76.2 % and 71.7 %, of the same population, perceive entrepreneurship opportunities and capabilities, respectively. The association between entrepreneurship and a high social status and a desired career is made by, approximately 82 % of the target population and 75 % thinks the media give a special attention to the entrepreneurship topic.

The cluster with the second highest entrepreneurial activity rate on an early stage is cluster 3 – 20.3 % of the 18-64 population is engaged in a new business activity. This group presents also the second average rates for some of the attitudes and perceptions indicators – perceived opportunities, perceived capacities and entrepreneurship as a desirable career choice.

The fourth computed cluster (cluster 4) is the more difficult to characterise – its dispersion in terms of characteristics makes the analysis problematic. It seems a group that collects the countries that do not had a place in the other groups than an actual homogeneous group.

The biggest cluster, in terms of the number of countries (cluster 2), presents both the lowest entrepreneurial activity rate (only 5.35 % of the 18-64 population is engaged in a nascent business activity) and the lowest average values for the five selected indicators. For example, on average only 25 % of the 18-64 population perceive entrepreneurship opportunities and less than half perceive entrepreneurship capabilities. Remember that this group gathers, with only few exceptions, developed countries located in Europe.

5. Conclusions

Rhie (2009) referring Markham *et al*. (2002) stress the idea that are the perceptions of self-efficacy rather than objective ability that motivate individuals to demonstrate entrepreneurial behavior. As mentioned in the paper, the attitude towards entrepreneurship and the perception of capabilities and opportunities, for example, can drive the entrepreneurial activity in a particular economy. Morris (2011) in a report about high-growth entrepreneurs, using GEM data, found that they have little fear of failure and are among the most likely of those surveyed to start a business because they perceive that there is an opportunity to be exploited. However, despite the studies relating attitudes and perceptions to entrepreneurial activity, few are known about the spatial distribution of that attitudes and perceptions.

Using comparable cross-national data, covering a set of distinct world economies in 2010, and applying a cluster analysis has been possible to divide 58 countries in 4 similar groups of countries. A higher perception of opportunities and ca-

pabilities is found mostly in non European and non high-income economies. Entrepreneurship as a career choice and associated to a high social status or the perception of a special attention given by the media to the entrepreneurship phenomena are also less likely to found in this segment of countries. These attitudes and perceptions towards entrepreneurship are most likely to be found in low and middle income countries located in Latin America, Africa and Asia.

As assumed this research work did not intended to test hypothesis but rather generate it, so even if it has been observed a positive relation between high positive rates for the five attitude and perception indicators and high entrepreneurial early-stage activity has not been tested any causal relationship.

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