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Working Paper

The global entrepreneurship index (GEINDEX)

Jena Economic Research Papers, No. 2009,028

Provided in Cooperation with:
Max Planck Institute of Economics

Suggested Citation: Ács, Zoltán J.; Szerb, László (2009) : The global entrepreneurship index (GEINDEX), Jena Economic Research Papers, No. 2009,028, Friedrich Schiller University Jena and Max Planck Institute of Economics, Jena

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JENA ECONOMIC RESEARCH PAPERS



2009 – 028

The global entrepreneurship index (GEINDEX)

by

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www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

Max Planck Institute of Economics
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D-07745 Jena
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The global entrepreneurship index (GEINDEX)

April 2009

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Abstract

This paper constructs a Global Entrepreneurship Index (GEINDEX) that captures the contextual feature of entrepreneurship across countries. We find the relationship between entrepreneurship and economic development to be mildly S-shaped not U-shaped or L-shaped. Our findings suggest moving away from simple measures of entrepreneurship across countries illustrating a U-shaped or L-shaped relationship to more complex measures, which are positively related to economic development. Implications for public policy suggest that institutions need to be strengthened before entrepreneurial resource can be deployed to drive innovation.

JEL-classification: L26, O1, O3

Keywords: Entrepreneurship, Development, Stages of Growth, Globalization, Innovation, Index, Knowledge, Institutions.

Acknowledgement: László Szerb would like to thank the OTKA Research Foundation (NK 69283) for financial support and Zoltan J. Ács thanks Imperial College Business School for supporting his study leave. Elaine Allen, Niels Bosma, Erko Autio, Paul Reynolds, Sander Wennekers, Jolanda Hessels, Alicia Coduras, Jose Ernesto Amorós, Attila Varga, David B. Audretsch, Saul Estrin, David Storey, Thomas Mickiewicz, Samee Desai, Hezekiah Agwara, Roy Thurik, Mick Hancock, Pekka Stenholm, Leora Klapper, Peter Smith and Lois Stevenson provided valuable comments on earlier drafts. Alex Ács and Jonathan Levie edited the entire manuscript while providing valuable comments and Jonathan Levie and Niels Bosma programmed the policy guide. We also thank seminar participants at the University of Pécs, Max Planck Institute of Economics, London School of Economics and Imperial College Business School for valuable comments. We would also like to thank the national teams for permission to use the data. All errors and omissions are our responsibility.

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1. Introduction

Joseph Alois Schumpeter pointed out over one hundred years ago that entrepreneurship is crucial for understanding economic development.¹ Today, despite the global downturn, entrepreneurs are enjoying a renaissance the world over according to a recent survey in the *Economist* magazine (2009). The dynamics of the process can be vastly different depending on the institutional context and level of development within an economy. Therefore, if one is interested in studying entrepreneurship within or across countries, the broad nexus between entrepreneurship, institutions and economic development is a critical area of inquiry. This nexus is especially important in helping understand why the relative contributions of entrepreneurship can vary significantly across countries and regions.

Baumol (1990) observes that historically all societies have a constant supply of entrepreneurial activity, but that entrepreneurial activity is distributed unevenly between productive, unproductive and destructive entrepreneurship. As institutions are strengthened, and the incentive structure changes, more and more entrepreneurial activity is shifted towards productive entrepreneurship strengthening economic development (Acemoglu and Johnson, 2005). This entrepreneurial activity explodes through the efficiency-driven stage and culminates in a high level of innovation with entrepreneurship leveling out as institutions are fully developed (Fukuyama, 1989).

Of course the interdependence of economic development and socio-political change is generally recognized by social scientists (Adelman and Morris 1965). This environment is marked by interdependencies between economic development and institutions, which affect other characteristics such as quality of governance, access to capital and other resources, and the perceptions of entrepreneurs. Institutions are critical determinants of economic behavior and economic transactions in general, and they can impose direct and indirect effects on both the supply and demand of entrepreneurs.

Over the past two decades the role played by institutions in economic development has become increasingly clear to economists and policymakers alike (Acemoglu, Johnson and Robinson, 2001). At least three large research projects at the World Bank, The Heritage Foundation and the World Economic Forum are actively involved in measuring the quality of institutions across countries and over time. However, none of these indices measure the *business formation process* in any detail. While the measurement of institutions has been an ongoing activity for decades, the measurement of entrepreneurial activity is a relatively new subject that represents a gap in our understanding of why countries are rich and poor.

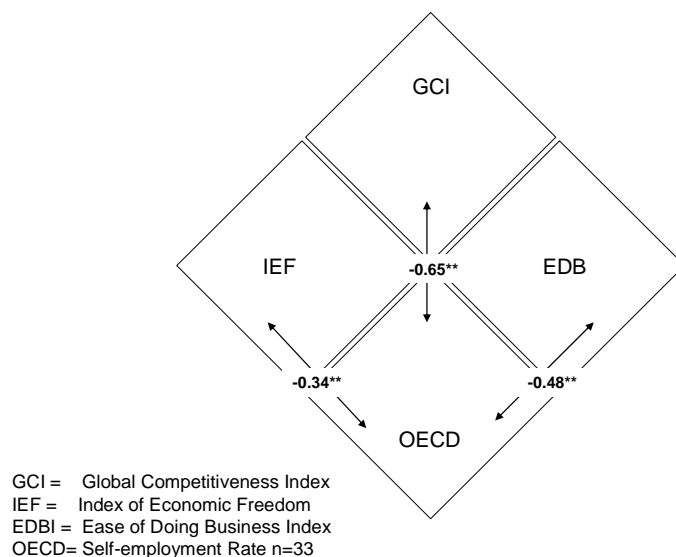
For the past ten years an international research project has been underway that has had as its explicit mission *the measurement of the business formation process across countries*. The Global Entrepreneurship Monitor (GEM) project is similar to the projects at the above institutions in that it is a large research project that is interested in understanding economic development albeit from a slightly different perspective. The business formation process is an important aspect of how technology and institutions interact to produce innovations and

¹ For a review of the literature see Acs and Virgill (2009).

deliver new goods and services to society. However, how successful different countries are at this process is not easily discernable from either the GEM project or from several other projects that try to measure the business formation process.

The figure below shows three major international research projects that track data on global institutions in most countries. However, not only do these research projects not track the firm formation process, but most do not correlate with measures of the firm formation process. For example, the self employment rate published by the OECD correlates *negatively* with the Global Competitiveness Index, the Index of Economic Freedom and the Ease of Doing Business. What does this *negative* relationship mean? Does less economic freedom mean more entrepreneurship? What about the difficulty of starting a business?

Figure 1: Correlation between OECD and major institutional indicators.



This paper addresses this paradox in the economic development literature. Building on previous measures of entrepreneurship, we define the basic requirements for construction of an entrepreneurship index. First, the index should be sufficiently complex to capture the multidimensional feature of entrepreneurship. Second, besides the quantity, or level-related measures, there should be indicators referring to quality-related differences. Third, the index should incorporate individual level as well as institutional variables. Entrepreneurship depends on the mutual interplay of the individual level and institutional variables (Busenitz and Spencer, 2000).

The purpose of this paper is to contribute to our understanding of economic development by constructing a global entrepreneurship index (GEINDEX) that captures the essence of the contextual features of entrepreneurship and fills a gap in the measure of development. *We develop a Global Entrepreneurship Index that offers a measure of the quality and quantity of*

the business formation process in 65 of the most important countries in the world (see Table 4). The GEINDEX captures the contextual feature of entrepreneurship by focusing on entrepreneurial attitudes, entrepreneurial activity and entrepreneurial aspirations. These data and their contribution to the business formation process are supported by three decades of research into entrepreneurship across a host of countries. The index construction integrates 31 variables, 17 from GEM, and 14 from other data sources, into 14 pillars, three sub indexes and a 'super index'.

This project is not without its challenges. Some of the other global indices have been thirty years in the making and our understanding of them is rather advanced. The role of economic freedom, for example, is now well established as being indispensable to economic development. In the following section we lay out the rationale for entrepreneurship and economic development. In section 3 we show the history of entrepreneurship index building. Section 4 develops the methodology of index building introducing two novel methods: the first is the application of the environmental variables as weighting elements, and second, the penalizing for bottleneck problems incorporates dynamism into the index building. A potential connection of the three sub-indexes, entrepreneurial Attitudes, entrepreneurial Activity, and entrepreneurial Aspiration, are presented. Section 5 presents the building of the sub-indexes. Section 6 contains the results as well as the analysis of the 28 variables,² 14 indicators, the three sub-indexes. Section 7 analyses the results of the GEINDEX. Section 8 presents the policy guide and the paper concludes with a summary.

We find that the relationship between entrepreneurship and economic development appears to be mildly S-shaped. Our findings suggest moving away from simple measures of entrepreneurship across countries illustrating a U-shaped or L-shaped relationship to more complex measures, which are positively related to economic development. The interaction between institutions and entrepreneurs varies with the stages of economic development. Institutional change is more important at lower levels of development and entrepreneurial activity becomes more important at higher levels of development. The model has important implications for development policy.

² In two cases the basic individual GEM data are used to construct combined individual variables.

2. *The Theoretical Setting*

In order to understand the role that entrepreneurship and innovation plays in economic development it is important to review some economic theory. Technical change and economic development for most of the first part of the twentieth century was assumed to be a function of capital and labor inputs. Paul Douglas in 1934 at the University of Chicago compiled a time series of U.S. labor supply (L) and a series of 'capital'-plant and equipment (K) for the time period 1899-1922. The results suggested that labor received about 0.75 percent of output and capital 0.25 percent, and that K/L ratio deepening (more capital per worker) was important to technological change. Of course the static interpretation was subject to much criticism.

In 1957 Robert Solow at MIT updated the data, wages and capital returns, and improved on Douglas's simple estimation regressions by bringing in yearly data on profit/wages sharing. Now for the 1909-1949 time-span Solow modified Douglas's earlier findings by a kind of exponential growth factor suggested by Schumpeter early on in the Century. As the Nobel Lauriat Paul Samuelson (2009, 76) recently pointed out, "This 'residual' Solow proclaimed, demonstrated that much of post-Newtonian enhanced real income had to be attributed to innovational change (rather than, as Douglas believed, being due to 'deepening' of the capital/labor K/L ratio)."

In other words, Solow found that 87 percent of economic growth was not accounted for by the accumulation of traditional factors of capital and labor. The increase in productivity not accounted for by existing factors (capital and labor) is today called total factor productivity. How does the latter growth come about? It comes about when people acquire new knowledge or use existing knowledge better. This is why economist often refers to total factor productivity as technical progress.³

Total factor productivity is a function of creating new knowledge and improving existing institutions. Over the centuries rich countries have devised institutions that allow the accumulation of capital, have healthier lives and better education. The Oxford dictionary defines institutions as an established law, custom, usage, practice, organization or other element of the political and social life of a people. By institutions we shall mean very loosely the arrangements that govern collective undertakings. The effectiveness of an institution depends on the rules governing it and on whether its members obey the rules.

This suggests that total factor productivity is dependent on the quality of knowledge and institutions. Knowledge and institutions however have to be combined as Schumpeter himself pointed out to produce what Schumpeter called 'new combinations' of economic activity. Successful entrepreneurs are, by definition, a builder of new production functions that take the form of new approaches to providing goods and services to society—that are innovation.

³ While total factor productivity increased by 87 percent in the United States, according to the Harvard Economist Martin Weitzman, who studies the Soviet Union, between 1950 and 1969 found that only 15-20 percent of growth in that country could be attributed to technical change and organizational innovation. In other words, the Soviet Union was good at equipping its workers with capital goods (factories) but once that process ran its course it was not very good at creating new knowledge, improving its institutions, or fostering entrepreneurship. Communism collapsed under its own weight and the Berlin Wall tumbled down.

All countries in the global economy now faced a period of transition from a more or less planned economy to a market economy. In other words all countries needed to worry about the level of their technology and the quality of their institutions. Again it is worthwhile to go back in time to get a better handle on this. In his classic text W.W. Rostow (1960) suggested that countries go through five stages of economic growth: (1) the traditional society (2) the preconditions for take-off (3) the take-off (4) the drive to maturity and (5) the age of high mass-consumption. While these stages are a simplified way of looking at the development of modern economies, they identify critical events. When the Soviet Union did not develop into a mass consumption society (in part due to a lack of total factor productivity) the stages approach to economic growth went out of fashion.

However, growth is not an end in itself as Rostow thought. The beginning and the end of growth is opportunity. A generation's worth of work on the determinants of growth has put the cart before the horse, focusing on the factors that result in growth rather than on the dynamics of the societies within which growth occurs. As a consequence, for a generation, political leaders and policy-makers alike have systematically neglected the vital role of entrepreneurship in capitalist development. As Schumpeter described over a century ago, entrepreneurs are vital to economic development not because they take risks (as we have seen recently in financial markets, risk-taking does in itself not correlate with the creation of social value), but rather because they create "new combinations" of economic activity.

Influenced by recent developments in economics, Michael Porter (2002) has provided a modern rendition of this approach by identifying three stages of development as opposed to growth: (1) a factor-driven stage, (2) an efficiency-driven stage and (3) an innovation-driven stage and two transitions. While Rostow focused on the *age of high mass-consumption*, Porter following recent developments in the economics of innovation focuses on the *innovation-driven stage*. Historically, an elite entrepreneurial class appears to have played a leading role in economic development. Today we believe that they are also crucial for the *innovation-driven stage*.

The factor-driven stage is marked by high rates of agricultural self-employment. Countries in this stage compete through low-cost efficiencies in the production of commodities or low value-added products. Sole proprietorships—i.e. the self-employed—probably account for most small manufacturing firms and service firms. Almost all economies experience this stage of economic development. These countries neither create knowledge for innovation nor use knowledge for exporting. To move into the second stage, the efficiency-driven stage, countries must increase their production efficiency and educate the workforce to be able to adapt in the subsequent technological development phase: the preconditions for take-off plays a crucial role. The drive to efficiency describes the first transition that is predominantly institutional in nature.

To compete in the efficiency-driven stage, countries must have efficient productive practices in large markets, which allow companies to exploit economies of scale. Industries in this stage are manufacturers that provide basic services. The efficiency-driven stage is marked by decreasing rates of self-employment. When capital and labor are substitutes, an increase in the

capital stock increases returns from working and lowers returns from managing.⁴ For over a century there has been a trend in economic activity—exhibited in virtually every developing country—toward larger firms. The transition to the innovation driven stage is characterized by increased activity by individual agents.

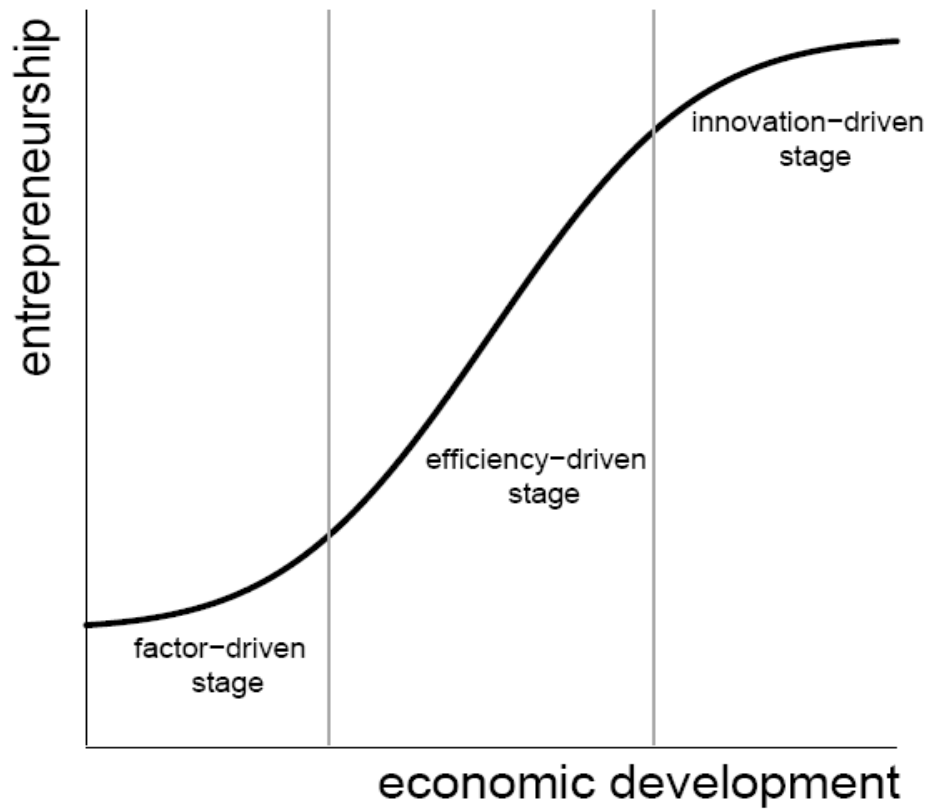
The innovation-driven stage is marked by an increase in knowledge-intensive activities (Romer, 1990). In the efficiency-driven economy capital and labor play a crucial role in productivity the firm is exogenous to our analysis and the focus is on technology, in the decision making process. In the innovation-driven stage knowledge provides the key input. In this stage the focus shifts from firms to agents in possession of new knowledge (Acs et al 2009). The agent decides to start a new firm based on expected net returns from a new product. The innovation-driven stage is biased towards high value added industries in which entrepreneurial activity is important (Jorgenson, 2001). Aquilina, Klump and Pietrobelli (2004) suggest that the easier it is to substitute capital for labor, the easier it is to become an entrepreneur.

According to Sala-I-Martin et al (2007) the first two stages of development are dominated by institutions. In fact, innovation accounts for only about 5 percent of economic activity in factor-driven economies and rises to 10 percent in the efficiency driven stage. However, in the innovation-driven stage when opportunities have been exhausted in factors and efficiency, innovation accounts for 30 percent of economic activity in the innovation driven stage. We see an S-shaped relationship between entrepreneurship and economic development because in the first transition stage entrepreneurship plays a role but it increases at a decreasing rate as the efficiency stage takes over. However, as we move from the efficiency driven stage to the innovation driven stage (the knowledge driven stage) entrepreneurship plays a more important role increasing at an increasing rate.

Figure 1 shows the relationship between entrepreneurship and economic development. The intersection of the S-curve on the vertical axis is consistent with Baumol's (1990) observation that entrepreneurship is also a resource, and that all societies have similar amount of entrepreneurial activity, but that activity is distributed between productive, unproductive and destructive entrepreneurship. As institutions are strengthened more and more entrepreneurial activity is shifted towards productive entrepreneurship strengthening economic development (Acemoglu and Johnson, 2005). Schumpeter provided an early statement on this. In recent years, economists have come to recognize what Leibenstein (1968) termed the "input-competing" and "gap-filling" capacities of potential entrepreneurial activity in innovation and development. This entrepreneurial activity explodes through the efficiency driven stage and culminates in a high level of innovation with entrepreneurial activity leveling out once institutions are fully developed. Entrepreneurship is considered to be an important mechanism for economic development through innovation, employment and welfare.

⁴ There are other, more simplistic, explanations for why self employment may decline as economies develop. Improvements in the economy's infrastructure such as transportation, telecommunications, and credit markets probably increase the advantages of larger firms over smaller firms. Improvements in transportation and telecommunications make it cheaper to distribute goods and services over larger areas. Assuming there are scale economies up to a point, better distribution systems enable firms to operate larger production units that can serve larger markets.

Figure 1 shows the s-shaped relationship between entrepreneurship and economic development and the corresponding stages of developed as found in Porter (2002).



3. The history of entrepreneurship index building

It was the discovery of the importance of knowledge in economic growth that led to new insights. First, if knowledge is important for growth, how is it turned into innovation? Endogenous growth theory suggested that knowledge in the hands of agents is endogenously exploited through the firm formation process and turned into innovations. Therefore, entrepreneurship is most important for the *innovation-driven stage* of economic development. In order to better understand the role of entrepreneurship, scholars have been searching for measures to compare the entrepreneurship performances of different countries, regions or cities, and policymakers require a proper benchmarking criterion for entrepreneurship development. This is a relatively recent effort and to date there has been no acceptance of a dominant variable or index to measure entrepreneurship across countries. In fact, some researchers are skeptical about the feasibility of constructing such an index and describe it as a “search for heffalump” (Carland 2001) or looking for a “Holy Grail” (Hindle 2006). Both of these researchers refer to the difficulty of constructing a definition and/or index of entrepreneurship.

3.1 Measures of entrepreneurship

Over the last decade several entrepreneurship indexes and proxies have been constructed. One of the most frequently sought-after relationships is the connection between economic growth and entrepreneurship.⁵ In this respect, Caree and Thurik (2002) identify four measures of entrepreneurship: (1) turbulence (the sum of entries and exit) (2) the change of the size distribution of firms (3) the number of market participants and (4) self employment.

In the late 1990s, the OECD initiated self-employment attitude research (Blanchflower 2000; Blanchflower et al 2001). Now, the Flash Euro barometer conducts self-employment surveys mainly for EU member countries (Entrepreneurship Survey 2007). While the preference for being self employed over being a paid employee indicates an important positive attitude toward entrepreneurship, it is not equal to entrepreneurship, it is only a proxy. An improvement of the pure self-employment indicator is provided by Grilo and Thurik (2007). They applied the 2002-2003 Flash Euro barometer survey data to estimate the level of entrepreneurial engagement ranging from “never thought about starting a business” to “thinking about it”, “taking steps for starting up”, “having a young business”, “having an older business” and “no longer being an entrepreneur”(p.1).

In 2006, the OECD organized a steering group aimed at constructing an entrepreneurship indicator. The indicator project sought to capture the multidimensional nature of entrepreneurship, as well as to consider the distinctive features of entrepreneurship, i.e. difference between ubiquitous small businesses, self-employment, and growth enterprises etc. The conceptual framework of the entrepreneurship indicators project incorporates: 1) *determinants of entrepreneurship* – regulation, R&D, entrepreneurial capabilities, culture, access to finance and market conditions, 2) *entrepreneurial performance* – firms, employment, wealth - , and 3) *Impact of entrepreneurship* – employment, economic growth,

⁵ The first attempt to measure self-employment as a proxy for entrepreneurship in the global economy was performed by Acs, Audretsch and Evans (1994).

poverty reduction (Ahmad and Hoffman 2007).⁶ While the construction of the indicators is relatively easy, finding available and comparable cross-country data is a more serious problem.

Recently, the OECD reported the first results of data collection from 18 countries. While the report is rich in different entrepreneurship related data, there is no sign how these, sometimes highly correlated, indicators should construct a useful index. Another drawback is that most data are at least three years old – mainly from 2005 and even earlier years. Therefore they are of little value to policymakers looking for current data and solutions. Whereas most developed countries have the data required by the OECD, it is uncertain how long will it take to collect the data from other OECD countries, not to mention non-members.

New venture creation (new firm entry) data are available from lots of countries; the Eurostat regularly reports business start-up as well as entry-and-exit statistics. The EU also collects other entrepreneurship related data too. The European Observatory on SME survey identifies the specialties, the performance and the problems of SMEs in countries participating in the Multiannual Programme for Enterprise and Entrepreneurship (The Observatory of European SMEs 2007). In addition, the World Bank has also started to collect data on new registration of limited liability companies (Klapper and Delgado 2007).

In a summary statistical report Román (2006) presents a collection of entrepreneurship related data from several countries. The reported variables include measures of entrepreneurial attitudes (latent entrepreneurship motives), self-employment, business demography (firm entry and exit turbulence), business density and size structure, business performance and innovation data. From an examination of all of the above entrepreneurship-related data collected across countries, time periods, and surveys, we find that a comprehensive, uniformly accepted, regularly assessed data collection for entrepreneurship does not yet exist. We agree with Ahmad and Hoffman (2007) that none of the existing measures are able to capture fully the essence of entrepreneurship, “neither empirically, nor conceptually” (p. 3).

Basically all self-employment, new venture creation, or business ownership, registered business data are from the same vein; they refer to the level and/or the dynamics of entrepreneurship and identify the percentage of the working-age population is engaged or willing to engage in “entrepreneurial” activity. One shortcoming with incorporating these measures into an entrepreneurship index is that they do not capture *quality* differences across entrepreneurial activity, such as opportunity recognition, skills, creativity, or innovation and high growth. Therefore, such an index would give policymakers guidance on the quantity of “entrepreneurship” rather than its quality. Moreover, these measures do not take into account differences in environmental factors; the efficiency and level of the institutional setup could have a major influence on the quality of entrepreneurship.

3.2 The Global Entrepreneurship Monitor and the TEA index

Since 1999, the Global Entrepreneurship Monitor (GEM) research consortium has worked to measure and to compare entrepreneurial activity across countries. The most well known entrepreneurship measure used by GEM researchers is the Total Early-stage Entrepreneurial Activity (TEA) index, which measures the percentage of a country’s working-age population

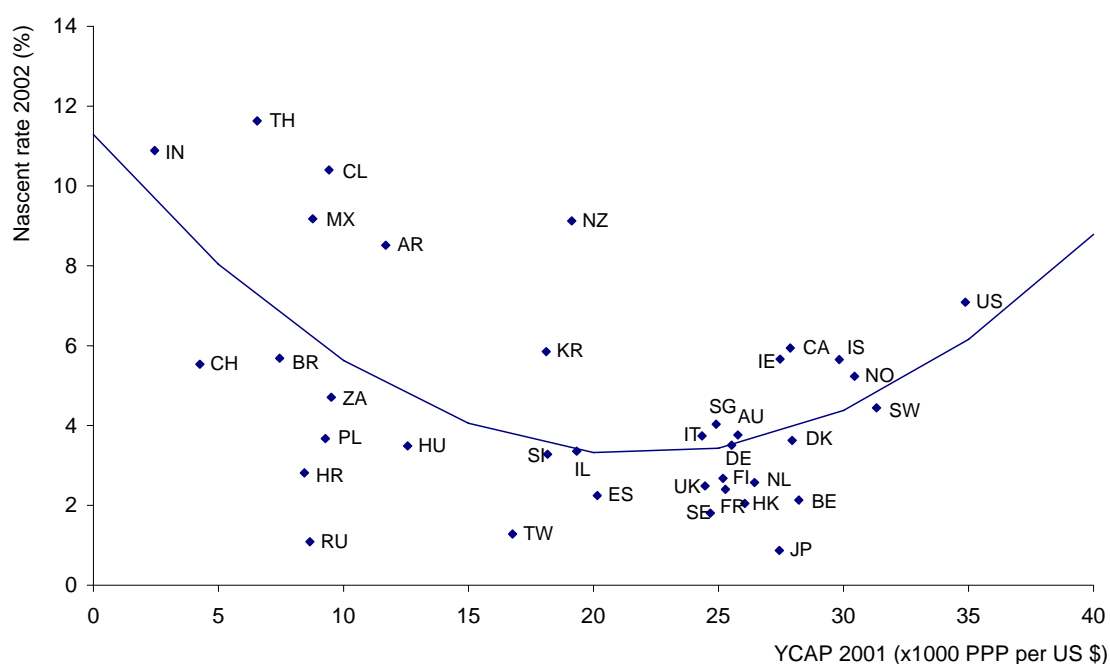
⁶ The programme now has even an independent webpage that contains detailed information about the whole project (<http://www.entrepreneurship-indicators.net/>)

that are actively trying to start a new business (nascent entrepreneurs) and those who at least partially own and manage a young business aged less than 3.5 years (baby businesses). The application of the TEA index as a measure of entrepreneurship has several limitations for cross country comparisons (Hindle, 2006). Others criticize the TEA for not capturing entrepreneurship in existing businesses, data inconsistency and the potentially different interpretation of the questions over countries (Audretsch 2002, OECD 2006, Baumol et al 2007, Godin et al 2008). Perhaps the most troubling finding from the TEA index is that developing countries lead the rank of nations, which implies that the economies of Peru, Thailand or Uganda, for example, are more entrepreneurial than those of the US, Australia or the Nordic countries, which from a qualitative perspective may be the case but from a quality perspective may not be.

In 2005 the Global Entrepreneurship Monitor reinterpreted the TEA index and examined it in terms of economic development (Acs et al 2005, Acs 2006). The U-shape phenomenon suggests that entrepreneurship (still measured by the TEA index) changes as the country develops. Countries at the lower level of development have a high rate of mainly necessity entrepreneurs. As countries move from the factor-driven stage to the efficiency-driven stage, necessity-driven entrepreneurial activity declines. Finally, in the innovation driven stage, entrepreneurial activity increases again, this time led by opportunity and high impact motivated startups. Examining 23 OECD country business ownership rate changes over time, Caree et al (2007) did not find support for the U-shape theory and instead found evidence for an L-shaped development theory.

In a second important paper, Wennekers et al (2005) for the first time regressed GEM data for nascent entrepreneurship on the level of economic development. They also found support for the U-shaped relationship between countries at different stages of development (see figure 2).

Figure 2: Nascent entrepreneurship versus per capita income, the U-curve

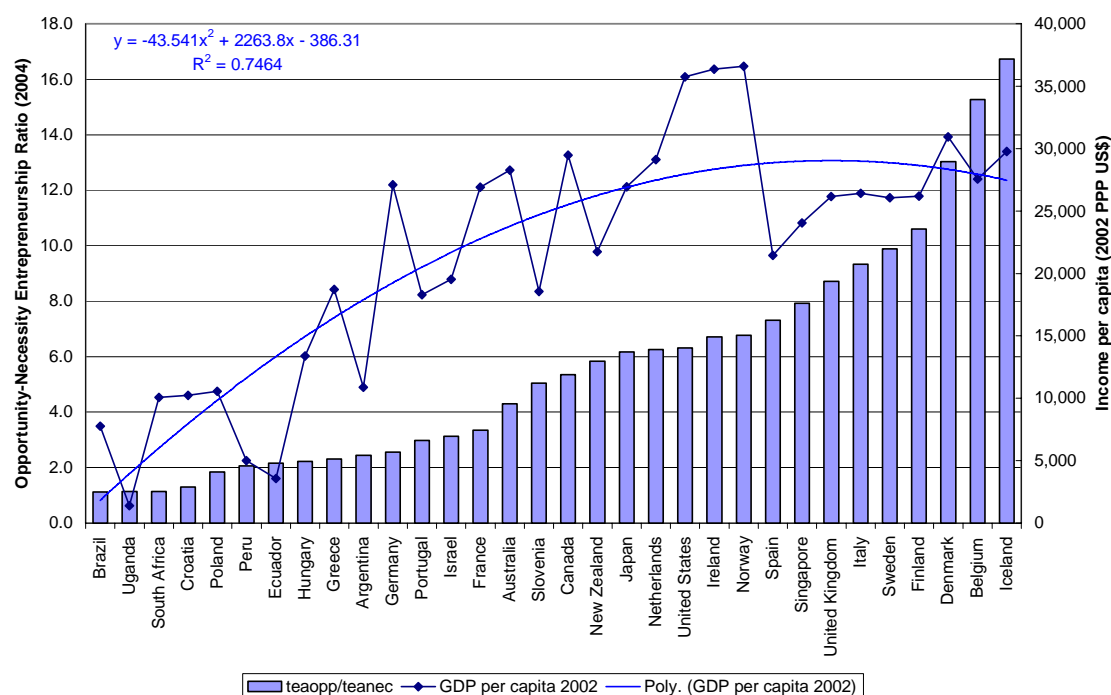


Source: Wennekers et al, 2005

However, this literature is not without limitations for the study of entrepreneurship and development.⁷ Three observations may be made. First, the U-shaped approach is useful in understanding the decline in the self-employment rate both across countries and over time. Second, it is not useful or at least less useful, in explaining entrepreneurship (broadly defined). Third, the U-shaped approach is not very useful in explaining the role of entrepreneurship in developed countries.

A simple way to think about this is to look at the ratio of opportunity to necessity entrepreneurship. Reproduced below is a diagram from the GEM Executive Report 2004 (Acs et al, 2005) in which a polynomial regression line is fitted to estimate the relationship between the opportunity-necessity entrepreneurship (Opp/Nec) ratio and country income. While some fluctuations occur, a positive relationship appears between income level and the entrepreneurship ratio. In other words, the higher a country's per capita income, the more entrepreneurship is motivated by recognition of an economic opportunity instead of necessity. Immediately, the ranking of countries looks more reasonable. Brazil with an Opp/Nec ratio of 1.1 is at the bottom, Japan is in the middle next to New Zealand and Denmark is near the top.

Figure 3: Opportunity-Necessity Entrepreneurship Ratio and Income per capita



Note: Entrepreneurship data are for 2004, income data for 2002 (the latest available). The sample of countries is defined by the Global Entrepreneurship Monitor database.

Source: entrepreneurship data *GEM 2004 Global Report*, accessible at

http://www.gemconsortium.org/category_list.asp?cid=163; income data United Nations Development Program, *Human Development Report 2004*, Table 13.

Source: Acs, 2006.

⁷ Acs and Amoros (2008) provide a critical analysis of Latin American countries.

The latest two GEM executive reports (Bosma et al 2008, Bosma et al 2009) are a clear indication that GEM is moving beyond the quantity-related TEA index. Besides the prevalence rate of activity, the report puts more emphasis on other quality-related characteristics of the early phase activity, such as innovation, high growth potential, business discontinuation and the environmental factors of entrepreneurship perception (Bosma et al 2008). The 2009 report contains a major revision of the original GEM conceptual model, distinguishing between entrepreneurial attitudes, activity and aspiration following the Global Competitiveness Index categorization (Bosma et al, 2009). However, even these major improvements could not handle the contradiction between the pressure to construct a single index of entrepreneurship and the inability of present GEM entrepreneurship measures to meet with this requirement.

3.3 Entrepreneurship-related institutional/environmental factors

Over the years, increasing attention has been paid to investigating the contextual nature of entrepreneurship. Besides the GEM expert-based entrepreneurial framework condition measures, the World Bank publishes annually the “*Ease of doing business*” index, which serves to capture the influence of regulations on firm startup. The index comprises 12 measures of the different regulatory aspects of startup and existing businesses. Interestingly, the ranking of countries on the TEA is almost the reverse of country ranking on the “Doing business index”: Developed countries dominating the first places on the TEA index and the last places on the Doing Business index.

Another widely applied and recognized index is Michael E. Porter’s competitiveness index reported yearly by the World Economic Forum (WEF). The *Global Competitiveness Index* (GCI) aims to capture the institutional and political factors, among other related measures, that influence country productivity and competitiveness. The index is built from twelve component “pillars” that comprise different measures of productivity. The basic requirement pillars (institutions, infrastructure, macroeconomic stability, health and primary education) are important for the factor-driven countries. The efficiency enhancer pillars (higher education and training, labor and goods markets efficiency, financial market sophistication, technology readiness and market size) are the key elements for efficiency-driven middle-income countries. The innovation and sophistication pillar (business sophistication and innovation) are central to the competitiveness of the highly developed innovation-driven economies (Porter and Schwab 2008). This innovation related factors in particular have a close connection to entrepreneurship.

The three main groups of pillars are weighted differently according to the development of the countries: higher weights are assigned to basic requirements in least developed countries, efficiency drivers in the middle developed countries, and innovation-related factors in the highly developed countries. Earlier versions of the GCI applied a rather arbitrarily determined weighting (Squalli et al 2006). Over the last two years scholars have developed more sophisticated weighting methods, which involve principal component analysis and regression techniques (see Porter and Schwab 2008, particularly chapter 1.2). While competitiveness and entrepreneurship are different conceptually, they are closely correlated (Geroski, 1994).

The *Index of Economic Freedom* is one of the oldest commonly recognized global indexes in operation since 1995. Data in ten freedom categories – business, trade, fiscal, monetary, investment, financial, labor, corruption, government size, and property rights, corruption and

freedom - are available from 1995. Over the last two years the index has developed and scholars have identified new ways to interpret the index. Schramm (2008) introduced the fluidity of institutions concept, which refers to the mixing of boundaries, idea testing, learning, and adaptation of institutions. According to Schramm, the degree of economic fluidity has a direct effect on innovation and entrepreneurship. The positive connection between productive entrepreneurship and properly developed institutions is examined by Sobel, Clark and Lee (2007). The close connection between the different elements of economic freedom and that of GEM TEA index is provided in a recent study by McMullen et al (2008).

Innovation-related surveys have been around longer than entrepreneurship surveys and have often benefited from more sophisticated design techniques. The OECD's Oslo Manual (2005) and the Frascati Manual (2002) provide detailed definitions, measures and example questions for innovation and R&D related surveys, respectively. While it has been argued since Schumpeter (1934) that innovation and entrepreneurship are mutually dependent concepts, the incorporation of innovation measures in an entrepreneurship index is still lacking. On the policy level, the European consortium, Innovative Policy Research for Economic Growth (IPREG), is aiming to construct an innovation and entrepreneurship policy measure index (Lundström et al 2008).

Focusing only on the most widely applied indexes, the Ease of doing business, the Global Competitiveness Index, and the Index of Economic Freedom, we can conclude that all three try to capture the institutional features of the participating countries. While institutions are vital for development they just provide only a part of the picture. The most important drawback of these indexes is the lack of microeconomic foundation. As criticized previously, the widely applied indicators of entrepreneurship (self employment, TEA, new venture creation etc.) focus purely on individual or firm level aggregates, now we have seen the other part of the story, the measure of the quality of the (institutional) environment.

4. Index building

Index building is a complex task that faces several potential pitfalls. In the following, we discuss the three most important steps of index building process starting with: (1) defining the building blocks and structure of the index, (2) developing a procedure that incorporates individual level as well as institutional variables, and (3) using a new method called “penalizing for bottleneck” that allows us to dovetail the elements of the index into three sub-indexes and finally a super-index.

4.1 Defining entrepreneurship and the building blocks of the index

All index building should start with a definition. While the generally accepted definition of entrepreneurship is lacking there is agreement that the concept comprises numerous dimensions. For example, Gartner (1990) describes eight elements of entrepreneurship, while Davidsson (2004) lists seven, Wennekers and Thurik (1999) outline thirteen and Godin et al (2008) identify six. We also believe that any entrepreneurship index should be a complex creature⁸, yet recognize that entrepreneurship is distinct from small businesses, self-employment, craftsmanship, usual businesses, or not associated as a phenomenon with buyouts, change of ownership or management succession. Following from Davidsson (2004), our index takes into account the degrees of contribution from entrepreneurship, in that some businesses have a larger impact on markets, create more new jobs and grow faster and larger than others. Finally, like other indexes, we consider the availability of the data.

Taking into account all of these possibilities and limitations, *we define entrepreneurship as a dynamic interaction of entrepreneurial attitudes, entrepreneurial activity, and entrepreneurial aspiration that vary across stages of economic development*. This approach is consistent with the revised version of the GEM conceptual model (Bosma et al 2009). According to this definition we propose four steps to build the index: (1) selection of variables and weights, (2) indicators, (3) sub-indexes and finally (4) the super-index. All three sub-indexes contain several indicators; therefore they can be interpreted as quasi-independent building blocks of this entrepreneurship index. In this section we describe the sub-indexes, indicators, and weights. In a later section, we describe the variables. The three sub-indexes of activity, aspiration and attitudes constitute the entrepreneurship super-index, which we call the Global Entrepreneurship Index.

Entrepreneurial attitudes are defined as the general attitude of a country’s population toward recognizing opportunities, knowing entrepreneurs personally, attaching high status to entrepreneurs, accepting the risk associated with business startup, and possessing the skills required to successfully launching businesses. Entrepreneurial attitudes are important because they express the general feelings of the population toward entrepreneurs and entrepreneurship. The benchmark individuals are those that can recognize valuable business opportunities, have the necessary skills to exploit these opportunities, attach high status to entrepreneurs, can bear and handle startup risk, know entrepreneurs personally (i.e. have a network or role-models)

⁸ Others may think that this statement is generally not true and a complex phenomenon can be described by a simple indicator or an index that contains only a few variables. Our three level index building logic allows the application of a simple entrepreneurship measure by analyzing one of the three sub-indexes (see later).

and can generate future entrepreneurial activity. Moreover these people can provide the cultural support, help, financial resources, and networking potential to those who are already entrepreneurs or want to start a business.

One weakness of this sub-index is that it incorporates only a few of the factors relevant for measuring entrepreneurial attitudes. While we do believe that the core essence of entrepreneurship influences is captured, some variables are not in the model. This is particularly true for the entrepreneurial traits and motives where only a few factors, risk aversion, opportunity exploitation, startup skills and opportunity motivation (in the activity sub-index) are included. In this case, data is not available for alternative measures of, for example, (judgmental) decision making, need for achievement, or locus of control to mention just three from the endless lists of potential variable candidates. Based on our present knowledge, there is no such an index or indicator that could provide a wide range of entrepreneurial trait variables for the examined countries in a consistent way. In addition, the literature on trait theory has not turned up anything very conclusive regarding propensity to become an entrepreneur.

Entrepreneurial activity is defined as the startup activity in the medium or high technology sector, initiated by educated entrepreneurs and launched because of opportunity motivations in a not too highly competitive environment. In order to calculate the opportunity startup rate, we use the GEM TEA Opportunity index. TEA captures new startups not only as new venture creation but also as a startup within existing businesses like spin-offs and other entrepreneurial activity. Quality differences in startups are quantified by the education level of the entrepreneur, i.e. participated in post secondary education and the uniqueness of the product/service measured by the level of competition. Moreover, it is generally maintained that opportunity motivation is a sign of better planning, sophisticated strategy, and higher growth expectations when compared to “necessity startups.”

A major weakness of the activity sub-index is that the potential entrepreneurial activity of the established businesses seems to be missing. However, TEA involves not only independent new venture creation but also new businesses started by existing businesses. Moreover, we do know that most entrepreneurial activity is associated with startups; therefore the index captures the majority of entrepreneurial activity. Because our aim is to calculate the entrepreneurship index on the country level, it is logical to expect that the level of entrepreneurship from start-ups and expanding existing businesses is highly correlated, therefore it should not cause a major interference. Future research could provide evidence for this claim.

Entrepreneurial aspiration is defined as the effort of the early-stage entrepreneur to introduce new products/services, develop new production processes, penetrate foreign markets, substantially increase the number of firm employees substantially and finance the business with formal and/or informal venture capital. Product and process innovation, internationalization as well as high growth are considered as characteristic of entrepreneurship. The benchmark entrepreneurs are those whose businesses (1) produce and sell products/services considered to be new to at least some customers (2) use a technology less than five years old (3) have sales from foreign markets and (4) plan to employ at least ten persons and over 50% growth over the next five years. Here we added a finance variable that serves to capture the informal and formal venture capital potential vital for innovative startups and high growth firms.

One weakness of the aspiration sub-index is that it involves only a few aspects of business strategy; the quality of human resources, potential training, co-operation, investment and operational efficiency, and business culture are missing. However, it is reasonable to expect these variables have a high correlation with our existing variables. Regarding innovation, GEM does not collect firm-level data about innovation expenses and R&D activities, therefore the real new innovative creators are mixed with those who just absorb and apply innovation that somebody else has created. This problem can be solved by weighting the component variables in the index (see the following part 3.2). Regarding finance, we included data for only venture capital and bank finance is missing. While bank debt is an important source of external finance, formal and informal venture capital is the main and most important source for both high-growth potential startups and growing firms.

One could also ask about the selection of the particular variables for the sub-index construction. Attitude index variables are from those survey questions that are answered by the total population, and activity and strategy variables are limited to those who are nascent or baby business owners and managers. A potential problem can be the high growth and the finance measures; they could be in the activity sub-index too, but it is more realistic to view finance and growth together with innovation and internationalization. However, the involvement of these two variables in the activity sub-index causes a minor change in the overall rank of the countries.

4.2 The incorporation of the institutional variables and the weighting method

As mentioned previously, an entrepreneurship index should incorporate individual level as well as environmental, institutional variables. Another crucial point about building an index is the application of proper weights. To avoid the accusation of using arbitrary methodology, most indexes do not use weighting. Without weights, the calculation is relatively easy, and it can also be interpreted in a straightforward fashion by non-professionals. This approach is followed by the doing business index and the index of economic freedom. However, weighting is very useful when the different components of the index have different influences. A previous version of the global competitiveness index (GCI) assigned different weights to the indicators based on the stages of development of the country. Nevertheless, this approach had several shortcomings, including the arbitrary choice of the weights and the negation of the potential country differences. The latest version of the GCI uses a sophisticated methodology and econometric techniques to merge together the indicators and determine the appropriate weights. The new weighting method avoids the arbitrary selection problem, but does not handle country differences.

In order to solve the problem of country level weighting a different technique should be developed. Another reason for developing a new method has to do with the need to work with the potentially different interpretations of entrepreneurship across countries. Moreover, we should incorporate the institutional variables into the index. Since most of these environmental data are not in the GEM survey we have to rely on other, outside sources.⁹ This practice is not unique; all previously mentioned indexes use data from other sources.

⁹ To be fair, the GEM expert survey serves to provide measures of these variables, however it is not conducted in every country. Moreover, it is based on a small sample (18-36) of local experts who might not consider international, comparative aspect of the particular environmental variable.

The novelty of our approach is that we consider the institutional variables as interaction variables, not as independent indicators. The interaction variable approach is used in regression analysis, where two independent variables are multiplied by each other to demonstrate their conditional effect on the dependent variable (Acs and Varga 2005). Here, institutional variables enter into the index as a part of a particular indicator. A key task is to find the appropriate institutional variable for a particular entrepreneurship variable. We believe that this methodology can clarify interpretation of the questions in the GEM survey.

Another potential perception of the institutional variables is to view them as weighting variables. A major advantage of this proposed approach is the capability to assign the proper weight to a particular variable on a variable basis; therefore country differences can be incorporated in the index. Moreover, the arbitrary selection of the weight can also be eliminated.

An alternative solution of the incorporation of the environmental variables could have been to involve these variables as independent factors. We have tested several version of the model involving this latter alternative. While the overall rank of the countries are not really sensitive to a few variable changes and rearrangements in the system, the use of the pure measures enlarges the effect of the individual level as opposed to institutions and thus could provide a potentially false policy implication. Similarly, if institutional variables are entered independently then they become more dominant factors. While individual level measures favor lower developed countries, quality and institutional factors favor developed countries. Therefore, the applied interaction method seems to provide a good balance to these opposing development effects.

A further potential criticism of our method—as with any other indexes—might be the apparently arbitrary selection of institutional variables. In all cases, we aimed to collect and to test alternative environmental factors. Choice was constrained by limited data availability in many countries. This was the reason for omitting the World Bank new business registration data set, for example. The selection criteria for a particular institutional/environmental variable were (1) the potential to logically link to the particular entrepreneurship variable and (2) the interpretation and explanatory power of the selected variable. The exact description of the indicators can be found in the following section.

4.3. Dynamism in the index

We have defined entrepreneurship as the *dynamic* interaction of entrepreneurial activity, aspiration and attitudes across different levels of development. One issue this definition raises is how to bring dynamism into the model. Configuration theory provides a useful way of thinking about this issue. Following the original contribution of Miller (1987, 1996), Dess et al (1993) define “configurations” as such “...represent(ing) a number of specific and separate attributes which are meaningful collectively rather than individually... configurations are finite in number and represent a unique, tightly integrated, and therefore relatively long-lived set of dynamics” (pp. 775-776). An innovative application of the configuration theory to entrepreneurship is presented by Korunka et al (2003). These authors analyze the entrepreneurial personality in the context of resources, the environment and the organizing activities in order to present a typology of start-up process configurations. A novel way of addressing dynamism, using the lens of configuration theory, is presented here as the “penalizing for bottleneck” (PFB) approaches.

Bottlenecks can be found in many aspect of a business from production to strategy. With respect to entrepreneurship, by “bottleneck” we mean a shortage or low level of a particular entrepreneurial indicator as compared to other indicators of the sub-index. This notion of bottleneck is important for policy purposes. Our model suggests that attitudes, activity and aspiration interact; if they are out of balance, entrepreneurship is inhibited. The sub-indices are composed of four or five components, defined as indicators that should be adjusted in a way that takes this notion of balance into account. After normalizing the scores of all the indicators, the value of each indicator of a sub-index in a country is penalized by linking it to the score of the indicator with the weakest performance in that country. This simulates the notion of a bottleneck; if the weakest indicator were improved, the overall sub-index would show a significant improvement. Moreover, the penalty should be higher if differences are higher. Looking from the configuration perspective it implies that stable and efficient sub-index configurations are those that are balanced (have about the same level) in all indicators.

Technically, equation (1) describes the PFB methodology:

$$x_{i,j} = \min y_i(j) + \ln(1 + y_{i,j} - \min y_i(j)) \quad (1)$$

where $x_{i,j}$ is the modified, after penalty value of the entrepreneurship feature j of country i
 $y_{i,j}$ is the normalized value of the original entrepreneurship feature j of country i
 $i = 1, 2, \dots, m$, (the number of countries)
 $j = 1, 2, \dots, n$ (the number of entrepreneurial features)

The bottleneck is achieved for each indicator by adding one plus the natural logarithm of the difference between that indicator's country value and the value for the weakest indicator for that country. Thus improving the score of the weakest indicator will have a greater effect on the index than improving the score of stronger indicators. For example, assume the normalized score of a particular indicator in a country is 0.60, and the lowest value of the indicators of a certain sub-index is 0.40. The difference is 0.20. The natural logarithm of 1.2 is equal to 0.18. Therefore the final adjusted value of the indicator is $0.40 + 0.18 = 0.58$ instead of 0.60. The largest potential difference between two indicators can be 1, when a particular country has the highest value in one indicator and the lowest values in another. In this case the natural logarithm of 2 = 0.693, so the maximum penalty is $1 - 0.693 = 0.307$.

We suggest that this dynamic index construction is particularly useful for enhancing entrepreneurship in a particular country. Although one could argue that entrepreneurship is a horizontal policy concept with relevance to across a number of traditional policy domains (e.g., trade policy, regulatory policy, fiscal policy), the application of the dynamic index construction would enable the effectiveness of different policy steps toward entrepreneurship to be measured. This method could rearrange the rank order of the countries in a particular feature. The level of the rearrangement depends on the relative position of a country in terms of bottlenecks compared to the others. If every country has similar differences in terms of the features, then the rank order does not change too much; if one country is very unbalanced compared to the others then a lower rank for that particular country can be expected. The policy message is that weak performances in a particular feature, i.e. a bottleneck, should be handled first because it has the most negative effect on all the other features.

There are two potential drawbacks of the PFB method. One is the arbitrary selection of the magnitude of the penalty. There is no research that can underline how big the penalty should be. This is the reason why we applied a conservative estimation of the penalty. The other

problem is that we cannot exclude fully the potential that a particularly good feature can have a positive effect on the weaker performing features. While this could also happen, most of the entrepreneurship policy experts hold that policy should focus on improving the weakest link in the system.

5. *The building of the sub-indexes*

In this part of the paper we put together the pieces and present how to build the index. We start with the variables that are directly coming from the original data sources for each country involved in the analysis. The variables can be individual (personal or business) level or institutional (environmental). All individual level variables are from the GEM Adult Population Survey. The institutional variables are obtained from various sources, reported below. We calculate all indicators from the variables using the interaction variable method. The indicators are the basic building blocks of the sub-index. The PFB method serves to calculate the three sub-indexes from the indicators. Finally, the super-index, the Global Entrepreneurship Index, is simply the average of the three sub-indexes. All variable and indicator summary descriptions can be found in appendices A1 to A3.

5.1. Data description and the creation of the variables

Nineteen out of the 31 variables are from the master data sets of the GEM annual adult population surveys. Data for 53 of the 64 countries are from the 2006-2007 years survey; four countries, Jordan, New Zealand, Poland and Uganda are from the 2004-2005, and eight countries (Bolivia, Bosnia and Herzegovina, Ecuador, Egypt, Iran, Korea, and Macedonia) are from the 2008 survey. Original yearly data are averaged amongst those countries who participated in both years; single year data point is applied if the country participated only in one year. Since GEM lacks the necessary institutional weighting variables, we substitute the index with other widely used relevant data from World Bank (GDP PPP, Ease of doing business, post-education enrolment), Transparency International (corruption index), UNESCO (GERD), World Economic Forum (market size, business sophistication, innovation, availability of the latest technology, venture capital availability), International Telecommunication Union (internet usage) Heritage Foundation (economic freedom), United Nations (human development index), KOF Swiss Economic Institute (globalization) and Coface (country risk rating).

In some country cases there are a few variables missing. Since we did not want to lose any countries from the sample, we estimated the missing data by expert estimation technique as follows: The GERD measure lacked data for Puerto Rico, Dominican Republic and the United Arab Emirates. In these cases, other government sources and data from nearby, similar countries served to give estimation. Venture capital availability data for Serbia is estimated to be the same as Croatia. KOF globalization index data for Puerto Rico, Kazakhstan, Hong Kong, and Serbia are estimated similar to GERD, applying nearby country data points. Economic freedom data is missing only for Puerto Rico that is set below the US data. Moreover, the 2009 data point is applied in the case of Serbia. The World Economic Forum data are missing for Iran that is estimated the same as Syria. All the other data are available for all countries therefore we do believe that these rough estimations do not influence our results noticeably.¹⁰

A frequent problem of any data set is the existence of outliers. Since extreme values could influence the results in an unsatisfactory way, a proper handling is necessary. To address this

¹⁰ In order to check potential biasness the index was calculated without these countries but the GEINDEX values and the rank order of the involved countries were basically unchanged.

potential problem we used a capping method. The value of the cap is set to decrease the difference between the first and the second country and the second and third country in a particular entrepreneurial feature indicator to 5%. This method preserves the rank order of the countries in a particular entrepreneurial feature but decreases the relative differences between the leading country and the other nations. The following countries and indicators are capped: Denmark (QUALITY OF HUMAN RESOURCES), New Zealand (OPPORTUNITY STARTUP, STARTUP SKILLS), Hong Kong and India (OPPORTUNITY PERCEPTION), Iceland (NETWORKING), Israel (NEW PRODUCT), Puerto Rico and United Arab Emirates (HIGH GROWTH), Czech Republic (NEW TECH), Canada and Czech Republic (INTERNATIONALIZATION).

In the following we report the results of the index construction independently for the three sub-indexes and for the GEINDEX super-index. The analysis involves investigating the 14 indicators as well as the building blocks of the indexes. We apply the following method in all three sub-indexes and the GEINDEX:

1. Indicator values (capped if relevant) are normalized to 0 as the lowest and 1 as the highest value. Other normalization methods such as a mean of 0 and variance of 1 cannot be applied because we need all variables in the same range for the PFB technique. This approach has the disadvantage of increasing the differences even if real deviations are minimal. However, other indexes such as global competitiveness index, the index of economic freedom, KOF globalization index, corruption perception index etc. rely on this technique even if the range of the index varies from 1-7, 1-10, or 0-100. Others (such as doing business) apply the ranking order to the index building, but it is an ordinal rather than a cardinal scale. Since we want to measure quality differences amongst countries, the ordinal scale is not appropriate for us.
2. The PFB is applied as outlined in section 3.3 to get the indicator adjusted PFB values.
3. The value of a sub-index for any country is the simple average of its PFB-adjusted indicators for that sub-index. The maximum value of the sub-indexes is 1 and the potential minimum is 0, which both reflect the relative position of a country in a particular indicator.
4. The global entrepreneurship index is the simple average of the three sub-indexes.

5.2. The Entrepreneurial Attitudes Sub-index (ATT)

While the activity and aspiration sub-indexes (outlined below) captures actual entrepreneurship activity and aspiration that relates to nascent and startup business activities, the entrepreneurial attitude (ATT) sub-index aims to identify entrepreneurial attitudes associated with the entrepreneurship-related behavior of a country's population. The opportunity perception potential is essential to recognize and explore novel business opportunities. In addition, it is necessary to have proper startup skills and personal networks to be able to exploit these opportunities. Fear of failure to start a business can have a negative effect on entrepreneurial attitudes even when opportunity recognition as well as startup skills exist. Entrepreneurial attitudes are believed to be influenced by the crucial institutional factors of market size, education, the riskiness of a country in general, the usage rate of the internet in

population, and culture that enter to the indicator as interaction variables (Reynolds 2007, Schramm 2008, Uhlaner and Thurik 2007).

The ATT sub-index contains the following five indicators:

- **OPPORTUNITY PERCEPTION** – The opportunity perception capability of the population is an essential ingredient of entrepreneurial startups (Sørensen and Sorenson 2003). **OPPORTUNITY** is defined as the percentage of the 18-64 aged population identifying good opportunities to start a business in the area where they live. The size of the market (**MARKETSIZE**) seems to be a proper environmental variable influencing the opportunities: larger countries with higher purchasing power provide better opportunities than smaller and poorer countries. The **MARKETSIZE** that is a seven point Likert scale measure variable, received from the Global Competitiveness Index as reported by the World Economic Forum. This measure takes into consideration domestic as well as foreign markets (export) therefore avoids discriminating against certain geographic areas (such as the European Union) that are broken into many countries but have one common market (Sala-I-Martin et al 2007). **OPPORTUNITY PERCEPTION** is obtained by multiplying **OPPORTUNITY** by **MARKETSIZE**.

OPPORTUNITY PERCEPTION captures the opportunity perception potential of a country population taking into consideration the size of the domestic and export markets of a country.

- **STARTUP SKILLS** – Successful venture launching requires the potential entrepreneur to have the necessary level start-up skills (Papagiannidis and. Li 2005). **SKILL** measures the percentage of the population aged 18-64 that believe they possess adequate startup skills. Most people in developing countries think that they have the necessary skills to start a business. However, these skills relate to relatively simple business activities that are generally acquired through workplace trial and error. In developed countries, business formation, operation, management and strategy creation, etc. require skills that are acquired through formal education and training. Hence education, especially post-secondary education, plays a vital role in teaching and developing entrepreneurial skills. The selected institutional interaction variable, **EDUC**, was chosen to capture the effect of education on startup skills. **EDUC** is defined as the percentage of population enrolled in post-secondary education as reported by the World Bank latest year, 2005 or 2006. **STARTUP SKILLS** are calculated by multiplying **SKILL** and **EDUC**.

STARTUP SKILLS generates higher scores for countries with not just high start-up skills perception but also high post-secondary education participation rates. It is logical to expect that educated potential entrepreneurs can handle the start-up difficulties better than non-educated people. Moreover, start-up skills and education can have a potentially positive influence on supporting other people's start-ups including the provision of vital informal finance and networking connections.

- **NONFEAR OF FAILURE** – Out of the personal entrepreneurial traits, fear of failure is one of the most important obstacles preventing start-ups (Caliendo, Fossen and Kritikos 2009, Wagner 2002). High risk aversion can retard nascent entrepreneurship. **NONFEAR** is defined as the percentage of the population aged 18-

64 who do not believe that fear of failure would prevent them from starting a business. The associated institutional variable is CRR, the Coface Country Risk Rate that refers to the general financial macroeconomic and business climate of the business in a given country¹¹. The alphabetical rating is turned to a seven point Likert scale to fit to our data set. NONFEAR OF FAILURE is calculated as multiplying NONFEAR and CRR

Altogether NONFEAR OF FAILURE can be interpreted as the degree of not having a personal fear of failure to start a business taking into consideration of the overall riskiness of the financial, macroeconomic climate influencing business operation.

- **NETWORKING** – Networking is important for potential and also for existing entrepreneurs. Better networked entrepreneurs are more successful, can identify more viable opportunities, access more and better resources (Minniti 2005, Shane and Cable 2003). Here the basic networking possibility of a potential entrepreneur is measured by KNOWENT that is the percentage of the 18-64 aged population who knows an entrepreneur personally who started a business in two years. However, connection through cyber-space with the rest of the world adds another dimension to networking, opening up much greater opportunities than before. The appropriate institutional variable applied here is a measure of the internet usage. INTERNETUSAGE is the number of internet users per 100 inhabitants is the part of World Telecommunication Indicator as reported by the International Telecommunication Union. NETWORKING is calculated as the product of KNOWENT and INTERNETUSAGE.

NETWORKING combines the personal knowledge of an entrepreneur with the ability to apply the internet for business purposes. This combination serves as a proxy for potential networking that is also an important ingredient of successful venture creation and entrepreneurship.

- **CULTURAL SUPPORT** – Without strong cultural support, the best and the brightest ones do not want to be entrepreneurs and decide to enter some other profession. (Davidsson, 2004; Guiso et al, 2006). Moreover, culture can influence even entrepreneurial potential and traits (Mueller and Thomas 2001). CARSTAT is the average of the percentages of the population aged 18-64 who say that entrepreneurship is a good career choice and enjoys high status. The associated institutional variable measures the level of corruption. High corruption can undermine high status and good career drives of productive entrepreneurship in favor of rent-seeking (Baumol, 1990; Murphy et al, 1991). CPI, the corruption perception index is collected by Transparency International. The CPI values the countries in terms of perceived levels of corruption, as determined by expert assessments and opinion surveys on a seven point Likert scale. CULTURAL SUPPORT is calculated as CARSTAT multiplied by CPI.

CULTURAL SUPPORT is a combined measure of how a country's inhabitants view entrepreneurs in term of status and career choice and how this is affected by the level of corruption.

Altogether eleven variables are used to construct ATT indicator.

¹¹ For more information about the rating see <http://www.trading-safely.com/>

5.3 The Entrepreneurial Activity Sub-index (ACT)

The entrepreneurial activity (ACT) sub-index is principally concerned with measuring high growth potential start-up activity. This high growth potential is approached by quality measures, including opportunity start-up motives, belonging to a technology intensive sector, the level of education as well as the uniqueness of the offered product/service. The institutional variables used include the ease of doing business, the availability of the latest technology, the level of human development, and the freedom of business operation.

The ACT sub-index involves the following indicators:

- **OPPORTUNITY STARTUP** – An entrepreneur's motivation for starting a business is an important quality signal. Opportunity entrepreneurs are believed to be better prepared and to possess superior skills, and earn more over necessity entrepreneurs (Bhola et al, 2006; Block and Wagner, 2006). TEAOPPORT is defined as the percentage of TEA businesses started to exploit a good opportunity or increase income or fulfill personal aims as opposed to those who have no other options to work. The institutional variable applied here is the ease of startup is measured by the World Bank Doing business (DB). The DB variable is appropriate to capture the effect of government policy, particularly the regulatory environment and the non-physical infrastructure on start-ups in a country. Since DB list the countries in ordinal rank, we had to turn it to a cardinal scale by normalizing the rank order. OPPORTUNITY STARTUP is obtained by multiplying TEAOPPORT and DB together.

OPPORTUNITY STARTUP is a measure of opportunity motivated startups under regulatory constraints.

- **TECH SECTOR** – Not all sectors provide the same chances for business survival and potential growth (Klepper 2001). The high rates of startups in most factor-driven countries are mainly in the traditional sectors and do not represent high potential (Acs and Varga 2005). The TECHSECT variable here is a measure of the sector of these businesses that are in technology sectors. By definition, TECHSECT is the percentage of those early-phase start-ups (TEA) that are in those sectors that apply medium or high technology. However, high and medium technology sectors can be different for factor-, efficiency-, or innovation driven economies. The institutional variable, TECHAVAILABLE, is a measure of the availability of the latest (world class) technology in a country, as reported by the World Economic Forum. This variable is the part of the Network Readiness Index. TECH STARTUP indicator is calculated by multiplying these two variables, TECHSECT and TECHAVAILABLE

The combined effect of the TECH SECTOR indicator basically combines together the medium or high technology sector startup with the potential to apply world class technology.

- **QUALITY OF HUMAN RESOURCES** – An important feature of a high growth potential venture is the level of education possessed by the entrepreneur (Bates 1990). HIGHEDUC is defined as the percentage of TEA businesses established by entrepreneurs with participated in at least a post-secondary education. Here, the

HIGHEDUC variable serves to capture the quality of entrepreneurs; it is widely held that entrepreneurs with higher education degrees are more capable and willing to start and manage high-growth businesses (Autio 2005, Davidsson and Honig 2003). The other institutional variable applied here is the human development index (HDI). HDI is a measure of the United Nations Development Programme and is considered as combined variables of life expectancy, educational attainment and income. QUALITY OF HUMAN RESOURCES is simply the multiplication of HIGHEDUC and HDI.

The QUALITY OF HUMAN RESOURCES indicator combines the effect of the prevalence of highly educated entrepreneurs together with the general quality of human capital in a particular country. The prevalence of high quality human capital is vitally important for those ventures that are highly innovative and require an educated, experienced and healthy workforce to grow further.

- **COMPETITION** – Cut-throat competition may hinder business existence and growth, so a lower number of competitors provide better surviving future development prospects (Baumol, Litan, and Schramm 2007). COMPET is defined as the percentage of TEA businesses where only a few competitors offer the same product/service. Moreover, COMPET can serve as a proxy to measure the uniqueness of the product/service. A proper associated institutional variable here is a variable of business freedom. FREEDOM is a part of the index of Economic Freedom reported by the Heritage Foundation. “Business freedom is a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation, as well as the efficiency of government in the regulatory process. The business freedom score for each country is a number between 0 and 100, with 100 equaling the freest business environment.” (http://www.heritage.org/Index/pdf/Index09_Methodology.pdf). COMPETITION is a result of multiplying COMPET with FREEDOM.

Basically COMPETITION is a measure of the level of business product/market uniqueness combined with the freedom of the business

Altogether, nine variables serve to build the ACT sub-index.

5.4. The Entrepreneurial Aspiration Sub-index (ASP)

The entrepreneurial aspiration (ASP) sub-index refers to the distinctive, qualitative nature of entrepreneurial activity.¹² Entrepreneurial businesses are different from the regularly managed business. In this respect it is particularly important to be able to identify the most relevant institutional and other quality-related interaction variables. The newness of the product and of technology, internationalization, high growth ambitions and finance variables are included in this sub-index. The institutional variables measure the R&D potential, the sophistication of business and of innovation, the level of globalization, and the availability of risk capital

The ASP sub-index involves the following indicators

¹² For a review of the literature see Acs (2008).

- **NEW PRODUCT** – One of Schumpeter's forms of "new combination" was the capability to produce or sell products that customers consider to be new (Schumpeter 1934). NEWP is calculated as the percentage of those TEA businesses where entrepreneurs think that their product is new to at least some customers. In order to measure the new product innovation potential a research and development (R&D) related institutional variable seems to be relevant. GERD is the R&D percentage of GDP as reported by OECD. Many products that have existed for some time in developed countries are new to developing country inhabitants. Many entrepreneurs in countries like India or Indonesia report that their products are unknown to customers. However, these new products are not supported by systematic R&D activity within the country. GERD helps to correct for this. NEW PRODUCT is simply calculated by multiplying NEWP by GERD.

We see NEW PRODUCT as measuring the original new production generation potential of a country, not product adoption or imitation.

- **NEW TECH** – Applying and/or creating new technology is another important feature of high growth potential businesses (Acs and Varga 2005). NEWT is defined as the percentage of those TEA businesses whose principal underlying technology is less than 5 year old. However, the most entrepreneurial businesses do not just apply but create new technology. This is another of Schumpeter's "new combinations". The problem is similar to the previous NEW PRODUCT indicator: while many developing country businesses may apply the latest technology, they tend to buy in or copy it. An appropriate institutional variable applied here is INNOV, which is a complex measure of whether a business environment allows cutting-edge innovations. INNOV is reported by World Economic Forum, and forms part of the GCI index.

NEW TECH is calculated by multiplying NEWT by INNOV, and interpreted as the cutting-edge new technology creation potential of a country's businesses.

- **HIGH GROWTH** – Since David Birch's seminal research on high growth businesses, "gazelles" have been a focus of interest amongst entrepreneurship scholars (Acs, Parsons and Tracy 2008; Birch and Medoff 1994). Several other empirical studies including (Autio 2005, 2007) support Birch's finding that only a few, perhaps 2-4%, of businesses are responsible for the vast majority (60-80%) of new job creation. GAZELLE measures the percentage of high-growth businesses in TEA who intend to employ at least 10 plus persons and plan to grow over 50 percent in 5 years. It might be argued that a shortcoming of this variable that growth is not an actual but expected rate. On the contrary, a measure of growth expectation is a more appropriate measure of aspiration than a measure of realized growth. The institutional variable applied here is a measure of business strategy sophistication (BSS) taken from the global competitiveness index reported by WEF and measured by a 7-point Likert scale. According to Porter et al (2007) BSS refers to "... the ability of companies to pursue distinctive strategies, which involves differentiated positioning and innovative means of production and service delivery" (Porter et al 2007, 53-54). HIGH GROWTH is the result of multiplying GAZELLE and BSS.

HIGH GROWTH combines together high growth potential with strategy sophistication.

- **INTERNATIONALIZATION** – Internationalization is believed to be a major determinant of growth (De Clercq, Sapienza, and Crijns 2005). A widely applied proxy of internationalization is exporting. Exporting demands extra capabilities beyond those needed by regular businesses that produce only to domestic markets. EXPORT is defined as the percentage of TEA businesses exporting at least 10% of the product of the business. However, the institutional dimension is also important: The openness of a country for international entrepreneurs, that is the potential of internationalization, can be estimated by the degree of globalization of that country. We apply the KOF Index of Globalization (GLOB) that measures three main dimensions of globalization: economic, social, and political including the actual economic flows, economic restrictions, information flows, personal contacts, and cultural proximity (Dreher 2006; Dreher et al 2008). INTERNATIONALIZATION is equal to EXPORT multiplied by GLOB.

The INTERNATIONALIZATION indicator is designed to capture the degree of internationalization of a country's entrepreneurs as measured by the exporting potential of the businesses, controlling for the extent to which the country is globalized.

- **RISK CAPITAL** - The availability of risk finance, in particular equity rather than debt - is an essential precondition for the accomplishment of significant entrepreneurial aspirations that are beyond the personal financial resources of individual entrepreneurs (Bygrave, Hay, Ng and Reynolds 2003, Gompers and Lerner 2004). Here we combine two kinds of finance, the informal investment (INFINV) and institutional venture capital (VENTCAP). INFINV is defined as the percentage of informal investors in the population aged 18-64, multiplied by the average size of investment by individuals in other people's new business. While the informal investor prevalence rate is high in factor driven economies, the amount of informal investment is considerably larger in the efficiency and innovation driven countries; combining them balances these two effects. Our institutional variable here is VENTCAP that is a measure of national venture capital availability on a 7-point Likert scale as reported by the World Economic Forum.

Overall, RISK CAPITAL involves two financial ingredients: informal venture capital is vital for startups and formal venture capital is important for high-growth potential businesses.

Altogether eleven variables are applied to construct the ASP sub-index.

Two observations are in order. First, three entrepreneurial sub indexes are not of equal importance. We would suspect that aspirations sub index (a proxy for strategy) is more important than either the attitudes sub index or the activity sub index. Activity should be more important than attitudes. Second, the temporal aspect of these in development is also important. Attitudes are essential and must come before either activity or aspirations. This is in part cultural as societies (read communism and feudalism) outlawed entrepreneurship. This is followed by activity and after activity aspirations become important. In some sense this process is cumulative over time.

6. Analysis of the three entrepreneurship sub-indexes

The figures and tables presented below show the relationship between post-PFB values of indicators and national wealth per capita, based on purchasing power parity GDP (GDP PPP). The per capita GDP PPP values are from the World Bank; 2006-2007 averages are calculated for the 53 countries who participated in the 2006-2007 years and 2004-2005 values for those four countries who participated in the 2004-2005 surveys. 2008 country GDP data are used for countries drawn from the 2008 survey. The GDP of the UAE (which is an outlier in GDP) is set as the average of 2005-2006. In all figures, we provide the associated trend line and R^2 values. All the trend lines are based on third-degree polynomial equations.

6.1. Analysis of the ATT sub-index

The entrepreneurial attitudes (ATT) sub-index refers to various attitudes of the population towards entrepreneurship, controlling for appropriate environmental effects. Figure 4 shows the relationship between each of the indicators that comprise the sub-index and per capita GDP.

The entrepreneurial attitudes that associate most strongly with economic development are the respect and the status of being an entrepreneur (CULTURAL SUPPORT) the non-fear of failure to start a business (NONFEAR OF FAILURE), and networking (NETWORKING). Education and startup skills perception (STARTUP SKILLS) shows an S-shaped association with development. The relationship between opportunity perception (OPPORTUNITY PERCEPTION) and GDP per capita is U-shaped. The reason of this phenomenon is that many large but lower developed countries can counterbalance the high purchasing power of the wealthier countries by the size of the country, i.e. the number of inhabitants. India leads the rank with poor but numerous populations combined with a high proportion of the population who see good opportunities. Many rich countries cannot provide valuable opportunities for future entrepreneurs even if they can see good potential, because of their relatively smaller size market (domestic and export together).

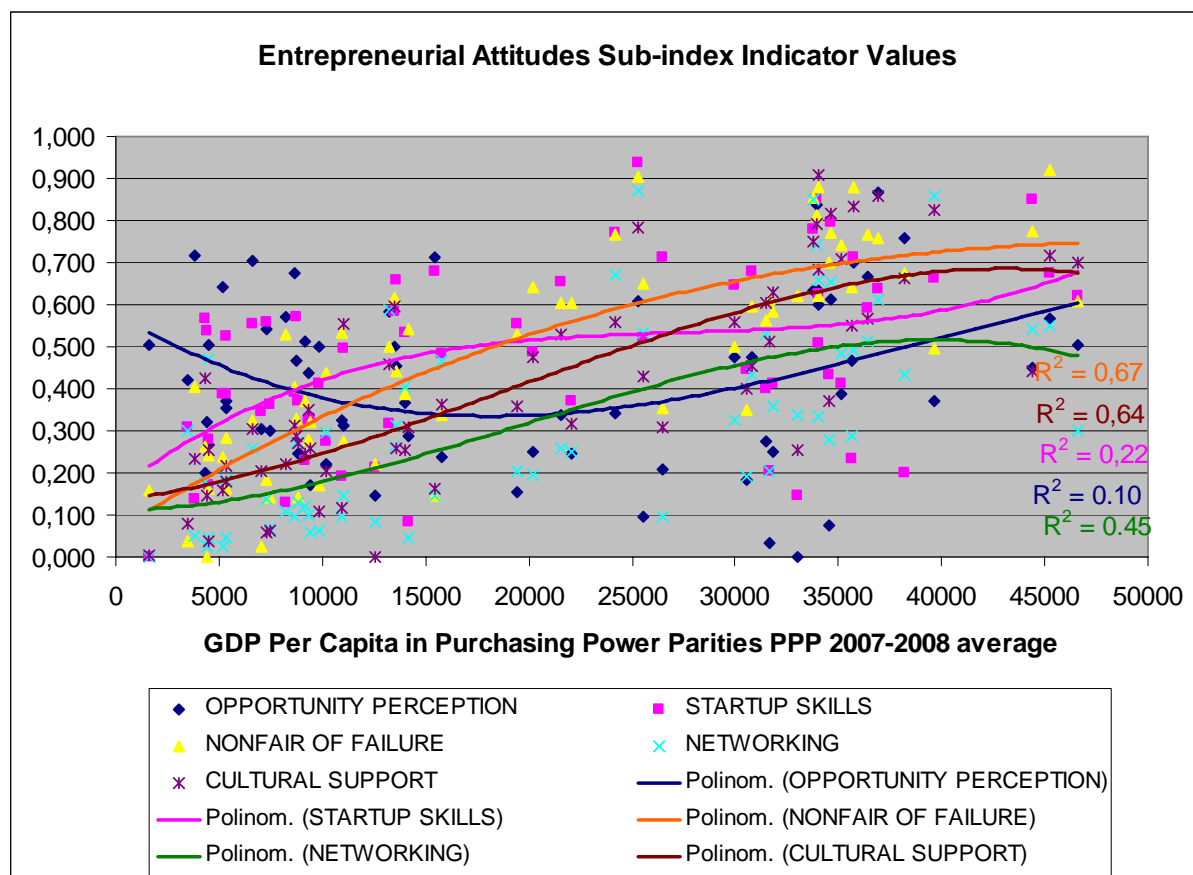
Figure 4: The Entrepreneurial Attitude Sub-index Indicator Values

Figure 5 shows the relationship between the Entrepreneurial Attitude Sub-index, calculated as the average of the attitudes-related indicator values for each country after applying the PFB, and country-level per capita GDP. The relationship is almost linear implying that overall entrepreneurship attitudes increase as the country develops. The explanatory power based on the $R^2 = 0.56$ shows a significant, moderately strong correlation between ATT and per capita GDP.

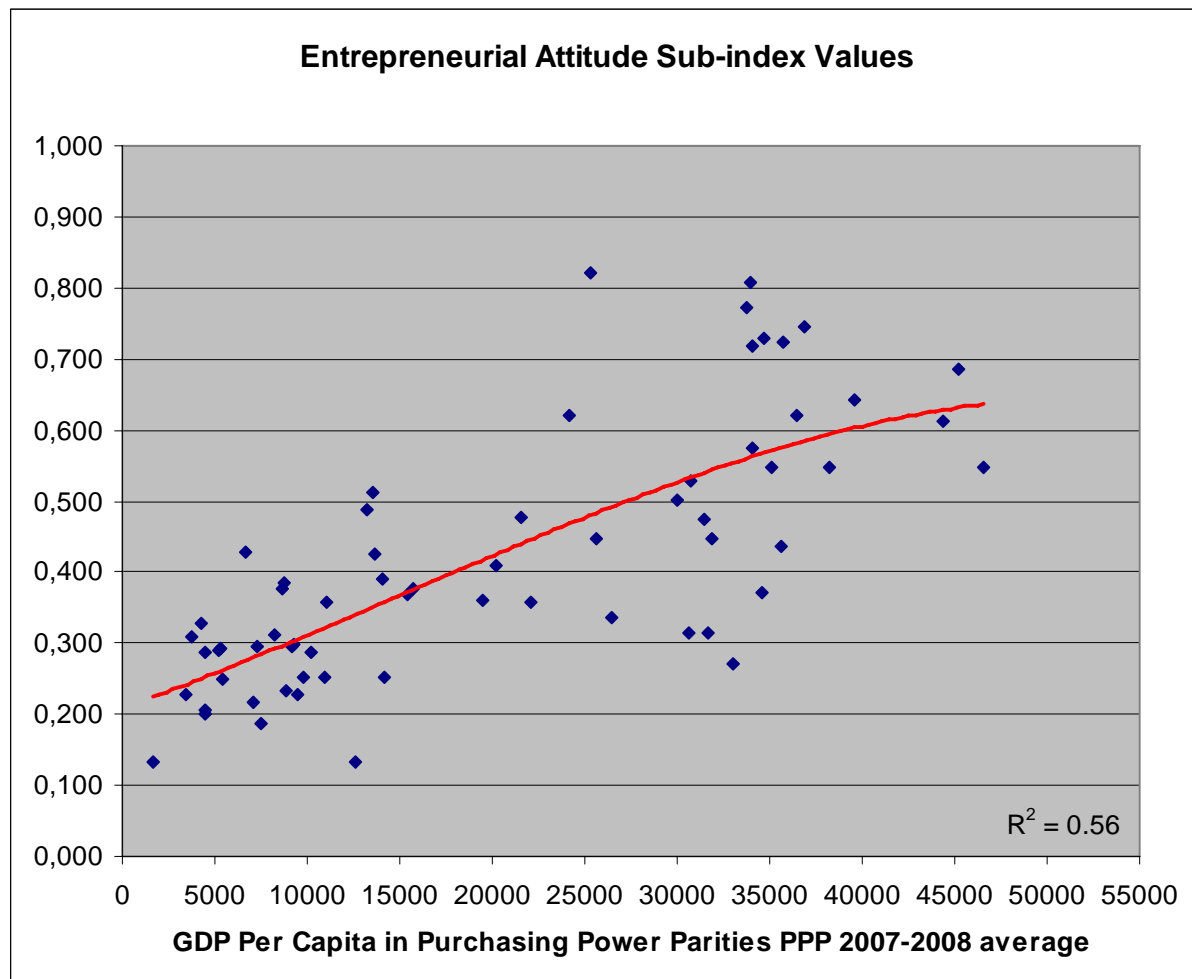
Figure 5: The Entrepreneurial Attitude Sub-index Value and Trendline

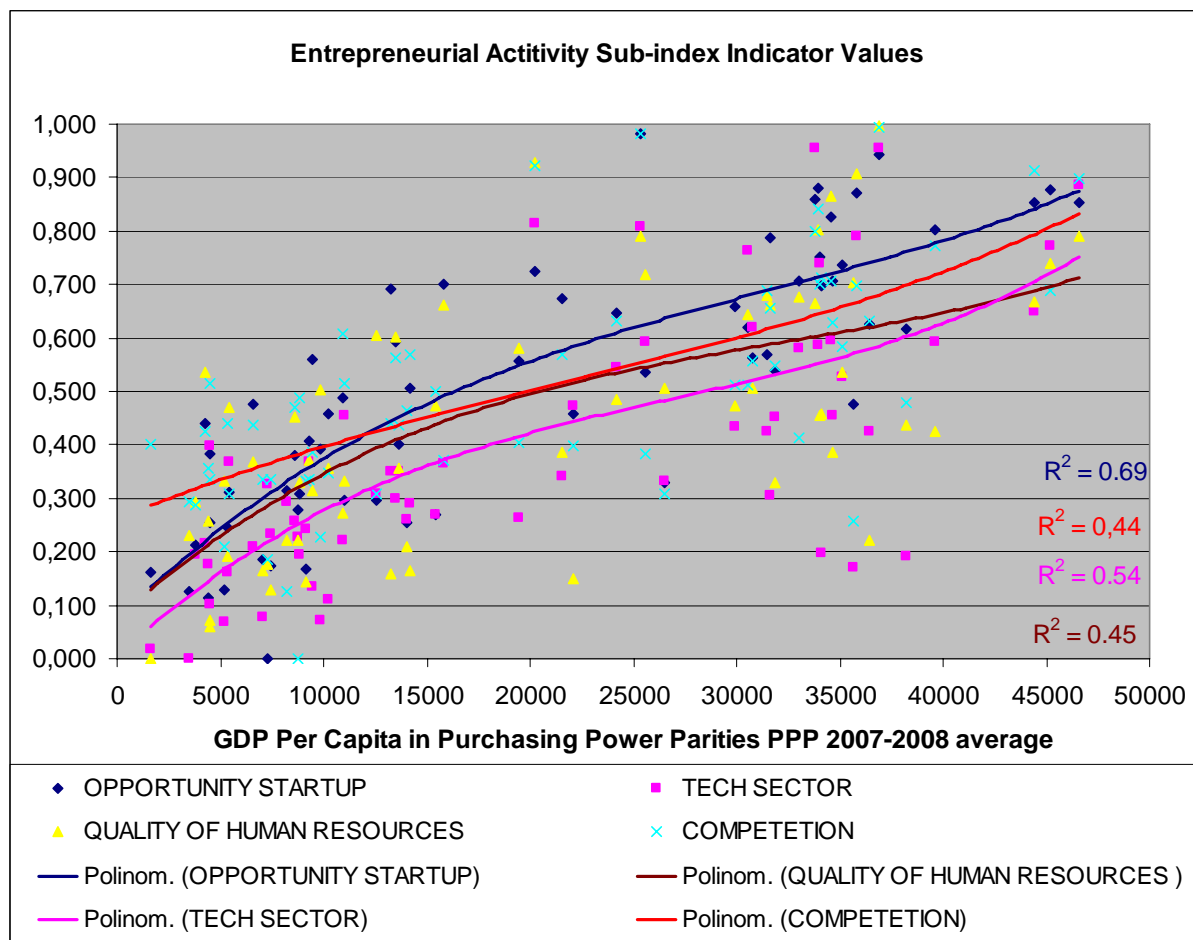
Table 1 shows the country-level values of the ATT sub-index. After the two Anglo-Saxon countries, New Zealand, and Australia, Nordic countries lead the attitude sub-index rank followed by Canada and the Netherlands. Slovenia's performance is very good but the 12th rank of the US is surprising. The US values in terms of opportunity perception, networking and good status/carrier potential are low—well below the trend line and these weaknesses could not be counterbalanced by the excellent rank in skills and risk perception. At the bottom, Japan's entrepreneurial attitudes look very low as compared to its economic development.

Table 1: The Entrepreneurial Attitudes Sub-index

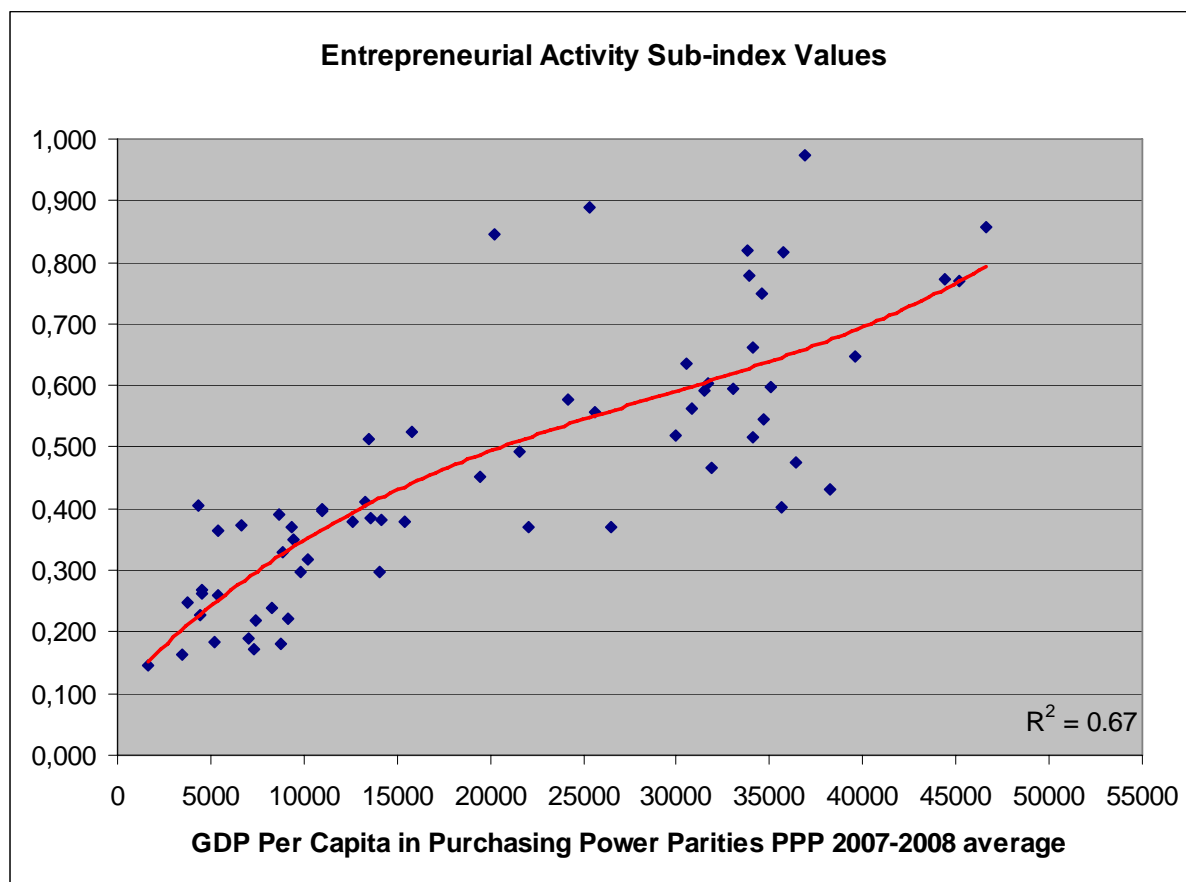
Rank	Country	GDPpc	ACTINDEX	Rank	Country	GDPpc	ACTINDEX
1	New Zealand	25320	0.82	33	Belgium	34580	0.37
2	Australia	33947	0.81	34	Argentina	15437	0.37
3	Sweden	33799	0.77	35	Hungary	19451	0.36
4	Denmark	36903	0.75	36	Uruguay	11028	0.36
5	Finland	34654	0.73	37	Czech Republic	22077	0.36
6	Canada	35776	0.72	38	Greece	26483	0.34
7	Netherlands	34059	0.72	39	Jordan	4287	0.33
8	Norway	45206	0.69	40	Singapore	31652	0.31
9	Iceland	39603	0.64	41	Israel	30578	0.31
10	Slovenia	24172	0.62	42	China	8242	0.31
11	Austria	36445	0.62	43	India	3789	0.31
12	United States	44384	0.61	44	Turkey	9307	0.30
13	United Kingdom	34075	0.57	45	Venezuela	7315	0.30
14	Switzerland	35106	0.55	46	Brazil	9176	0.30
15	Hong Kong	38227	0.55	47	Serbia	5351	0.29
16	Ireland	46587	0.55	48	Philippines	5207	0.29
17	Italy	30777	0.53	49	Romania	10206	0.29
18	Chile	13494	0.51	50	Jamaica	4503	0.29
19	Spain	29951	0.50	51	Japan	33014	0.27
20	Malaysia	13251	0.49	52	South Africa	14159	0.25
21	Portugal	21555	0.48	53	Mexico	10963	0.25
22	France	31458	0.47	54	Kazakhstan	9841	0.25
23	Germany	31855	0.45	55	Egypt	5388	0.25
24	Korea	25574	0.45	56	Macedonia	8822	0.23
25	United Arab Emirates	35661	0.44	57	Iran	3456	0.23
26	Peru	6617	0.43	58	Thailand	9435	0.23
27	Poland	13615	0.42	59	Bosnia and Herzegovina	7048	0.22
28	Puerto Rico	20223	0.41	60	Bolivia	4453	0.21
29	Croatia	14040	0.39	61	Indonesia	4488	0.20
30	Dominican Republic	8760	0.38	62	Ecuador	7456	0.19
31	Latvia	15781	0.38	63	Uganda	1648	0.13
32	Colombia	8631	0.38	64	Russia	12595	0.13

6.2. Analysis of the ACT sub-index

The entrepreneurial activity (ACT) sub-index is a configuration of four entrepreneurship indicators. These four indicator values (after PFB adjustment) can be seen in figure 6.

Figure 6: The Entrepreneurial Activity Sub-index Indicator Values

The relationship between the four activity related indicators and economic development is more markedly S-shaped than is the case for the attitudes indicators. Unlike previous GEM reports where the declining trend of TEA was much more prominent than the upward trend (Bosma et al 2008), highly developed countries score high in every case. The main reason of this finding is that ACT reflects rather the average quality of start-ups than the quantity of businesses. So a lower number of high quality potential start-up businesses (efficiency driven economies) can outperform a large number of marginal firms (resource based countries).

Figure 7: The Entrepreneurship Activity Sub-index

As shown in Figure 7 the mild S-shaped trend line of ACT fits the stages model of economic development much better than the U-shape relationship. It seems that from a low level of development first the ACT improves and then remains relatively steady at about the same level until it reaches \$30,000 GDP per capita when it begins to increase. A moderate increase of ACT in the \$15,000- \$30,000 GDP per capita range hides the structural changes of the indicators constructing the sub-index. At first, even high individual entrepreneurial activity cannot counterbalance the low level of institutions (resource-driven countries). Then, as the country develops, institutions improve but individual initiations decline (efficiency driven phase). After about \$30,000 GDP per capita, both institutions and individual variables improve (innovation-driven stage) causing an accelerated increase of the ACT sub-index.

Table 2: The Entrepreneurial Activity Sub-index

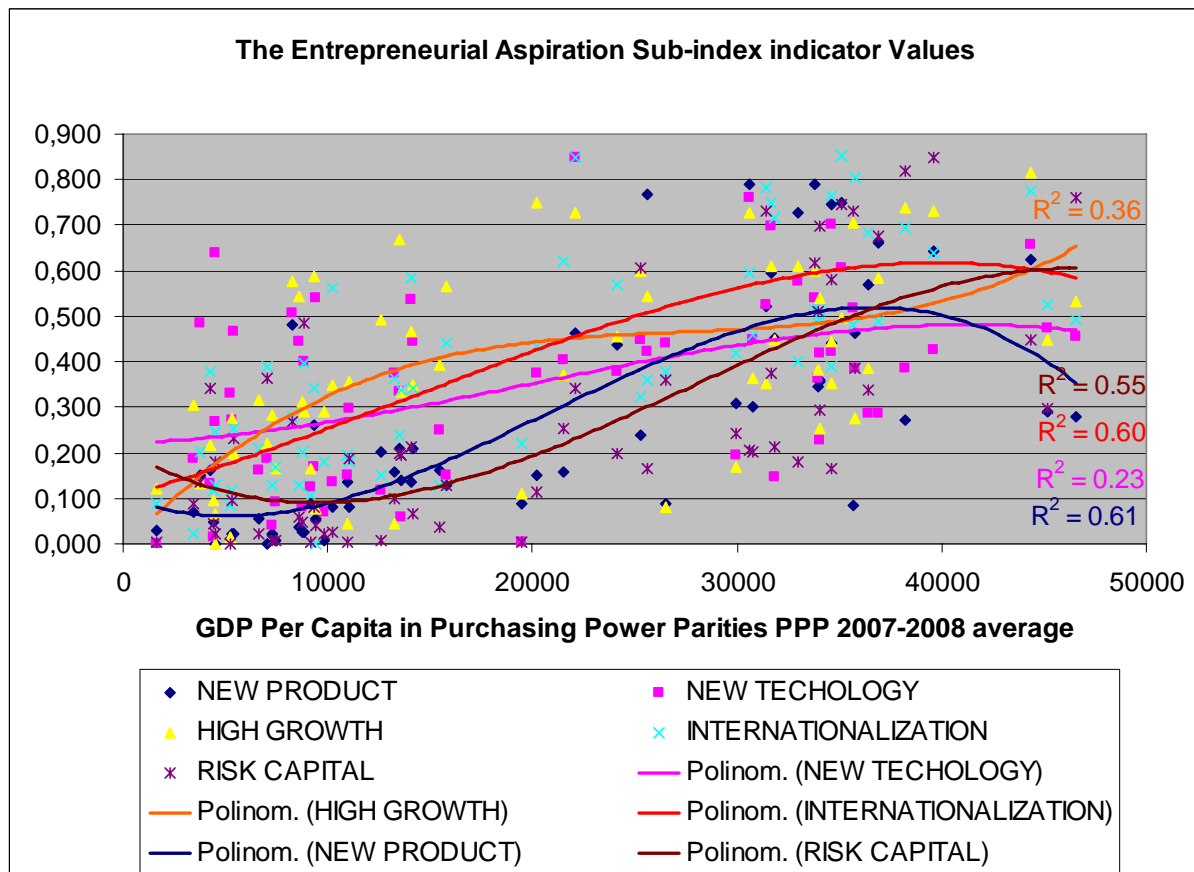
Rank	Country	GDPpc	ACTINDEX	Rank	Country	GDPpc	ACTINDEX
1	Denmark	36903	0.97	33	United Arab Emirates	35661	0.40
2	New Zealand	25320	0.89	34	Uruguay	11028	0.40
3	Ireland	46587	0.86	35	Mexico	10963	0.40
4	Puerto Rico	20223	0.85	36	Colombia	8631	0.39
5	Sweden	33799	0.82	37	Poland	13615	0.39
6	Canada	35776	0.82	38	South Africa	14159	0.38
7	Australia	33947	0.78	39	Russia	12595	0.38
8	United States	44384	0.77	40	Argentina	15437	0.38
9	Norway	45206	0.77	41	Peru	6617	0.37
10	Belgium	34580	0.75	42	Turkey	9307	0.37
11	Netherlands	34059	0.66	43	Czech Republic	22077	0.37
12	Iceland	39603	0.65	44	Greece	26483	0.37
13	Israel	30578	0.63	45	Egypt	5388	0.36
14	Singapore	31652	0.60	46	Thailand	9435	0.35
15	Switzerland	35106	0.60	47	Macedonia	8822	0.33
16	Japan	33014	0.59	48	Romania	10206	0.32
17	France	31458	0.59	49	Kazakhstan	9841	0.30
18	Slovenia	24172	0.58	50	Croatia	14040	0.30
19	Italy	30777	0.56	51	Jamaica	4503	0.27
20	Korea	25574	0.56	52	Indonesia	4488	0.26
21	Finland	34654	0.54	53	Serbia	5351	0.26
22	Latvia	15781	0.52	54	India	3789	0.25
23	Spain	29951	0.52	55	China	8242	0.24
24	United Kingdom	34075	0.52	56	Bolivia	4453	0.23
25	Chile	13494	0.51	57	Brazil	9176	0.22
26	Portugal	21555	0.49	58	Ecuador	7456	0.22
27	Austria	36445	0.48	59	Bosnia and Herzegovina	7048	0.19
28	Germany	31855	0.47	60	Philippines	5207	0.18
29	Hungary	19451	0.45	61	Dominican Republic	8760	0.18
30	Hong Kong	38227	0.43	62	Venezuela	7315	0.17
31	Malaysia	13251	0.41	63	Iran	3456	0.16
32	Jordan	4287	0.40	64	Uganda	1648	0.14

As Table 2 shows, two groups of developed countries dominate the rank of ACT: Anglo-Saxon countries, such as New Zealand, Australia, Ireland, the US (Puerto Rico), and Canada, and Nordic countries, such as Denmark Norway and Iceland. There are some large developed countries mainly from the EU (Germany, Spain, UK) that are below the trend line. Puerto Rico is the best performer amongst the medium developed countries (4th place). Uganda, which has the highest TEA rate in the examined time period, ranks the last. At the bottom of the rank order, predominately less-developed countries are found; the performance of Uganda, Iran, Venezuela, India, Bosnia Herzegovina, Philippines, Jamaica, Serbia, and Brazil, fits well to their relative economic development. Other moderately developed former socialist countries such as Croatia, Romani, the Czech Republic are below the implied trend-line, while others, such as Latvia, Hungary or Poland perform relatively well.

6.3. Analysis of the ASP sub-index

While attitudes reflects to the size of the potential army of entrepreneurs, activity shows the quality of the army, but aspiration is required to make the army move in the desired direction and apply the armory properly. The five indicators of the entrepreneurial aspiration (ASP) sub-index are shown in Figure 8.

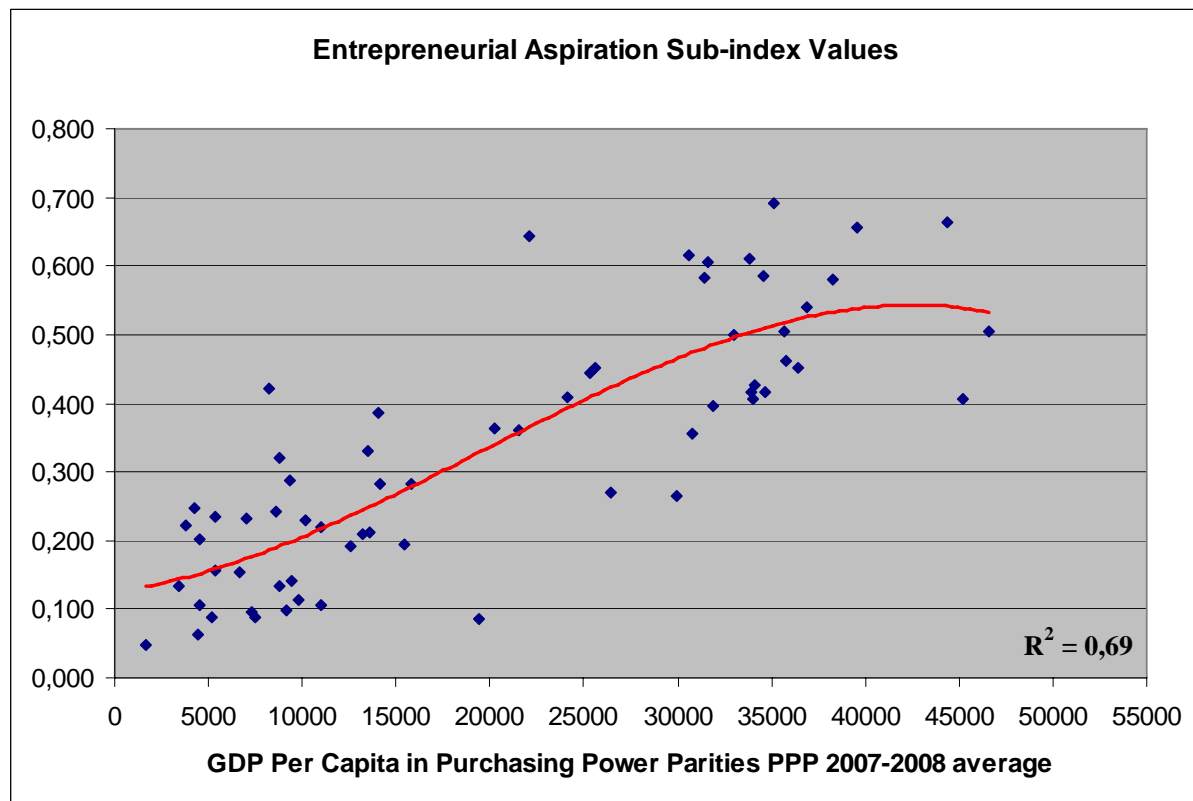
Figure 8: The Entrepreneurial Aspiration Sub-index



Four indicators out of five increase in a linear (NEW TECH, INTERNATIONALIZATION) or S-shaped (HIGH GROWTH, RISK CAPITAL,) relationship with economic development, implying that new technology creation, internationalization, high growth businesses and adequate formal and informal venture capital finance tend to be higher in more wealthy countries. This finding fits well to our existing knowledge about innovation and financial development. The exception is the indicator of new product (NEW PRODUCT) that has a declining trend at the highest level of development, primarily accounted for by two outliers, the United Arab Emirates and Ireland, countries which spend relatively very little on R&D. Without these two countries, the trend line would be more horizontal at the higher levels of economic development

The overall shape of the relationship between entrepreneurial aspiration sub-index and economic development can be seen in figure 9.

Figure 9: The Entrepreneurial Aspiration Sub-index



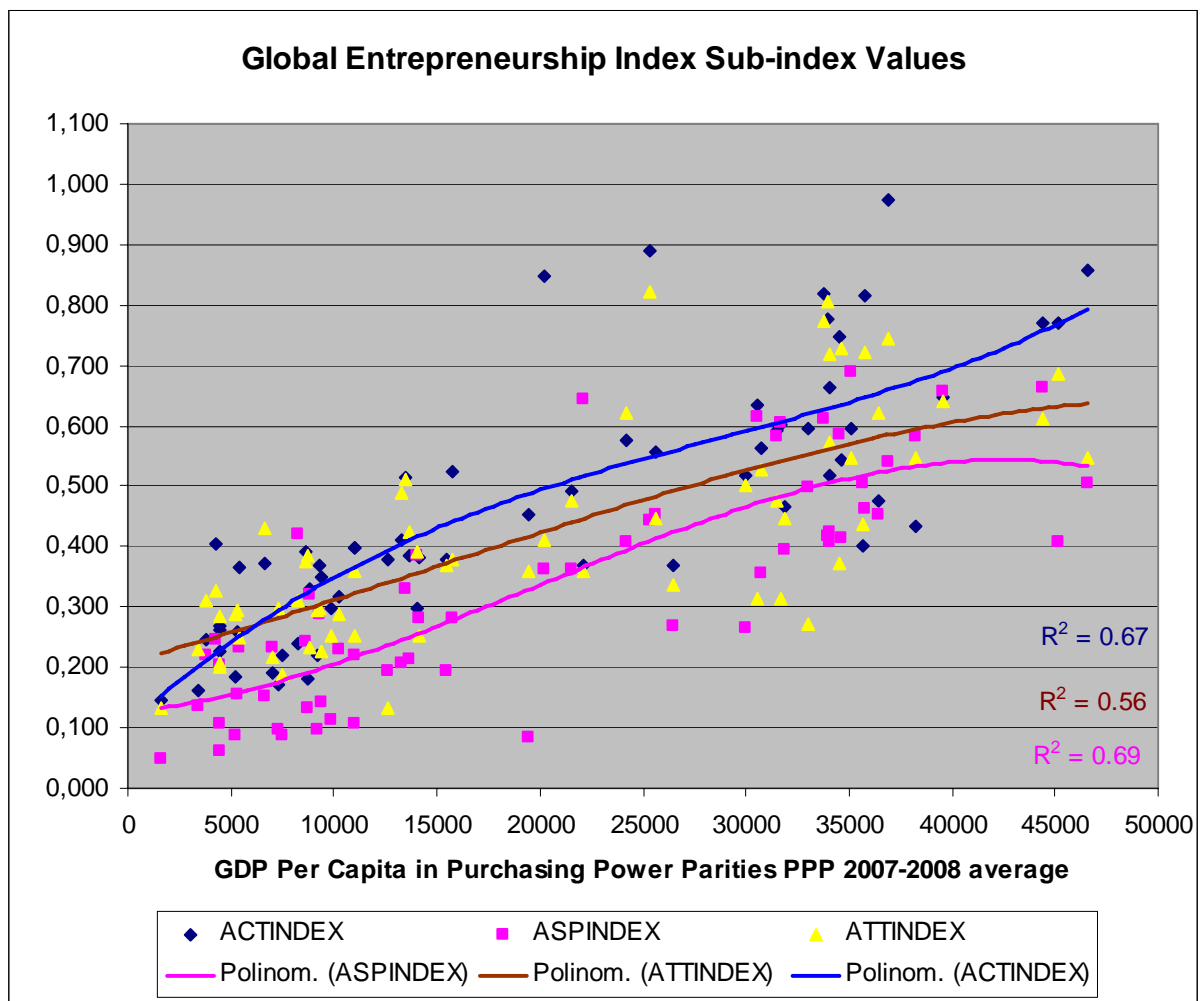
The mild inverse S-shape trend of the ASP sub-index is probably no surprise and the variance of the data points is much lower in terms of economic development than in the ACT index case. The explanatory power of $R^2 = 0.69$ is the highest implying a close relationship between entrepreneurial aspirations and development.

Table 3: The Entrepreneurial Aspiration Sub-index

Rank	Country	GDPpc	ACTINDEX	Rank	Country	GDPpc	ACTINDEX
1	Switzerland	35106	0.69	33	Turkey	9307	0.29
2	United States	44384	0.66	34	Latvia	15781	0.28
3	Iceland	39603	0.66	35	South Africa	14159	0.28
4	Czech Republic	22077	0.65	36	Greece	26483	0.27
5	Israel	30578	0.62	37	Spain	29951	0.27
6	Sweden	33799	0.61	38	Jordan	4287	0.25
7	Singapore	31652	0.61	39	Colombia	8631	0.24
8	Belgium	34580	0.59	40	Egypt	5388	0.23
9	France	31458	0.58	41	Bosnia and Herzegovina	7048	0.23
10	Hong Kong	38227	0.58	42	Romania	10206	0.23
11	Denmark	36903	0.54	43	India	3789	0.22
12	Ireland	46587	0.50	44	Uruguay	11028	0.22
13	United Arab Emirates	35661	0.50	45	Poland	13615	0.21
14	Japan	33014	0.50	46	Malaysia	13251	0.21
15	Canada	35776	0.46	47	Indonesia	4488	0.20
16	Austria	36445	0.45	48	Argentina	15437	0.20
17	Korea	25574	0.45	49	Russia	12595	0.19
18	New Zealand	25320	0.44	50	Serbia	5351	0.16
19	United Kingdom	34075	0.43	51	Peru	6617	0.15
20	China	8242	0.42	52	Thailand	9435	0.14
21	Australia	33947	0.42	53	Iran	3456	0.14
22	Finland	34654	0.42	54	Dominican Republic	8760	0.13
23	Slovenia	24172	0.41	55	Kazakhstan	9841	0.12
24	Norway	45206	0.41	56	Jamaica	4503	0.11
25	Netherlands	34059	0.41	57	Mexico	10963	0.11
26	Germany	31855	0.40	58	Brazil	9176	0.10
27	Croatia	14040	0.39	59	Venezuela	7315	0.10
28	Puerto Rico	20223	0.36	60	Philippines	5207	0.09
29	Portugal	21555	0.36	61	Ecuador	7456	0.09
30	Italy	30777	0.36	62	Hungary	19451	0.09
31	Chile	13494	0.33	63	Bolivia	4453	0.07
32	Macedonia	8822	0.32	64	Uganda	1648	0.05

Table 3 shows the country-level estimates of ASP. It is probably no surprise that a developed country, Switzerland, leads the country rank of entrepreneurial aspiration followed by the US and the Nordic countries. In the first ten countries there is one surprise: the performance of the Czech Republic (4th place), which is puzzling, especially considering that Hungary, another similar, former socialist country, is a negative outlier with extremely low entrepreneurial aspiration achievement. There are no countries with more than \$10,000 GDP per capita in the last 14 countries in the rank other than Hungary, although Mexico (in 57th place) barely exceeds the \$10,000 GDP per capita limit. Out of the former EU 15 countries, the three South European countries: Spain, Greece and Italy are the weakest performers. Finally, we combine together the three entrepreneurial sub-indexes in Figure 10.

Figure 10: The Three Entrepreneurship Sub-indices



7. Analysis of the Global Entrepreneurship Index

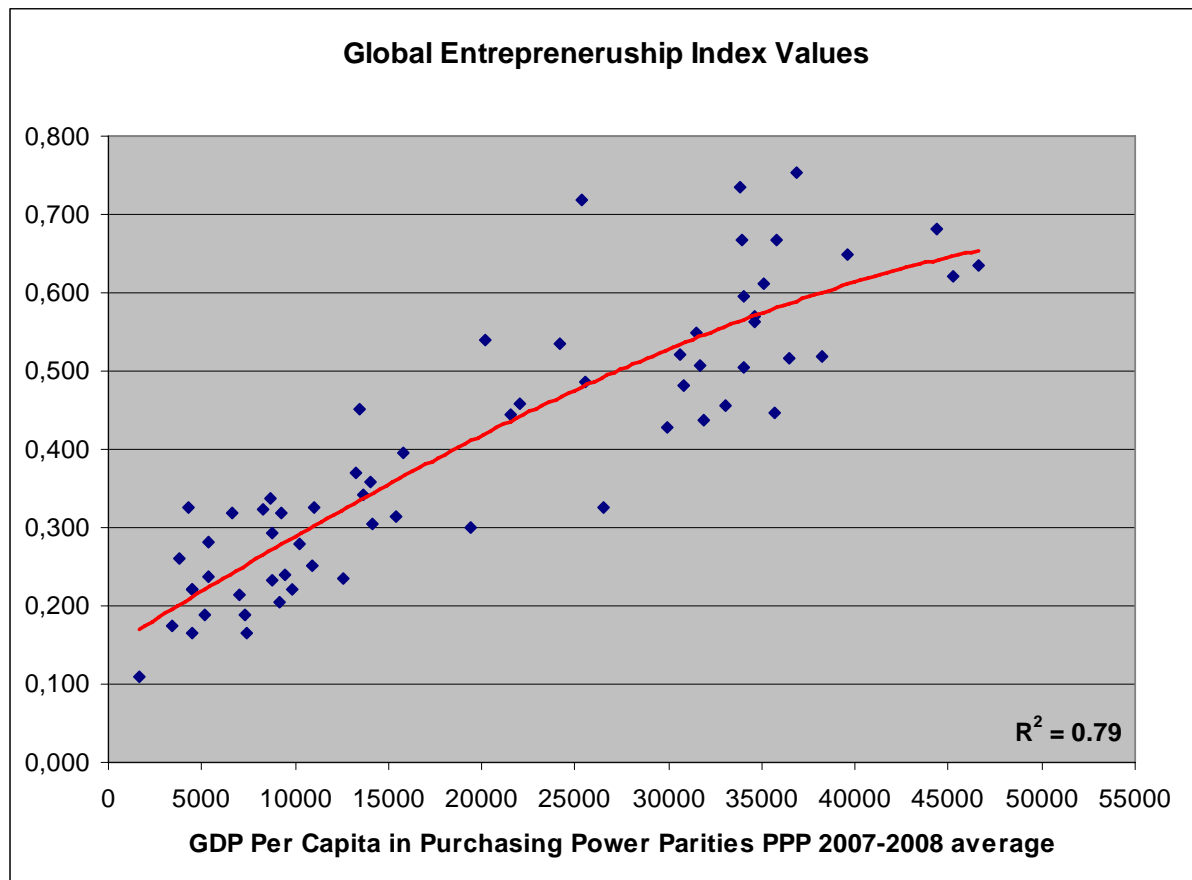
Figure 11 shows the GEINDEX results as averaged over the three sub-indexes and plotted against GDP. The GEINDEX overall rank of the countries, shown in Table 4, is consistent with overall expectations. Nordic and Anglo-Saxon countries in the innovation driven stage of development are in the front ranks. The two Scandinavian countries Denmark and Sweden lead the rank with very balanced performance in all three sub-indices. New Zealand, an outlier with about \$26,000 GDP is at the third place of the index due to its excellent performance in attitudes that counterbalance its relatively weak performance in aspiration. Four of the five Nordic countries, Denmark, Sweden, Iceland, and Norway, are in the top ten and Finland is 13th still with a good performance.

The US lost the first three places because of its weaknesses in attitude measures¹³. Australia, Ireland, Canada, and Switzerland are all good performers, but possess weaknesses in at least one of the sub-indexes. The most populous EU countries are in the middle part of the ranking list; France is 14th, UK 21st, Italy is 23rd, Germany is 29th, followed by Spain in the 30th place. A likely explanation of the relatively weak economic performance of the EU countries over the last decade (as well as Japan 25th place) is low levels of entrepreneurship. All of these countries are below the trend line in Figure 10. Low GDP-level factor-driven countries, such as Jamaica, Bosnia-Herzegovina, Venezuela, Brazil, Philippines, Iran, Bolivia, Ecuador, and Uganda are on the bottom of entrepreneurship ranking, as expected. Two former socialist countries Hungary and Russia, however, should have higher level of entrepreneurship as implied by the trend-line.

The robustness of the model has been tested by examining several variations, which included various changes to the variables and the sub-indexes. The construction of the institutional weighting variables proved to be relatively the most sensitive factors in the model. Capping also caused a minor rearrangement of the countries. Overall, the rank order of the countries did not change too much. In all versions, the first ten countries were in the top 15. The first four countries led most rank orders, with some exchange in relative order. For example, New Zealand's rank changed from 1 to 3, the US rank changed from 2-5, Denmark in the 1-3 and Sweden is 3-6. In the middle, where the differences amongst the countries are minimal, the overall rank in entrepreneurship moved from 4 to 7.

¹³ This may be a temporary aberration. Opportunity perception, for example, was much higher in the US in the early 2000's, according to GEM executive reports for those years.

Figure 11: The Global Entrepreneurship Index (GEINDEX)



The overall fit of the trend line is good with an R^2 0.79, which implies close and strong relationship between entrepreneurship and economic development. In the middle-income group countries there are two outliers: New Zealand entrepreneurial performance is well above the implied trend line, while Greece is negative exception.

Table 4: The Global Entrepreneurship Index Rank of the Countries

Rank	Country	GDPpc	GEINDEX	Rank	Country	GDPpc	GEINDEX
1	Denmark	36903	0.75	33	Croatia	14040	0.36
2	Sweden	33799	0.73	34	Poland	13615	0.34
3	New Zealand	25320	0.72	35	Colombia	8631	0.34
4	United States	44384	0.68	36	Jordan	4287	0.33
5	Australia	33947	0.67	37	Uruguay	11028	0.33
6	Canada	35776	0.67	38	Greece	26483	0.32
7	Iceland	39603	0.65	39	China	8242	0.32
8	Ireland	46587	0.64	40	Turkey	9307	0.32
9	Norway	45206	0.62	41	Peru	6617	0.32
10	Switzerland	35106	0.61	42	Argentina	15437	0.31
11	Netherlands	34059	0.60	43	South Africa	14159	0.31
12	Belgium	34580	0.57	44	Hungary	19451	0.30
13	Finland	34654	0.56	45	Macedonia	8822	0.29
14	France	31458	0.55	46	Egypt	5388	0.28
15	Puerto Rico	20223	0.54	47	Romania	10206	0.28
16	Slovenia	24172	0.54	48	India	3789	0.26
17	Israel	30578	0.52	49	Mexico	10963	0.25
18	Hong Kong	38227	0.52	50	Thailand	9435	0.24
19	Austria	36445	0.52	51	Serbia	5351	0.24
20	Singapore	31652	0.51	52	Russia	12595	0.24
21	United Kingdom	34075	0.51	53	Dominican Republic	8760	0.23
22	Korea	25574	0.49	54	Indonesia	4488	0.22
23	Italy	30777	0.48	55	Kazakhstan	9841	0.22
24	Czech Republic	22077	0.46	56	Jamaica	4503	0.22
25	Japan	33014	0.45	57	Bosnia and Herzegovina	7048	0.21
26	Chile	13494	0.45	58	Brazil	9176	0.20
27	United Arab Emirates	35661	0.45	59	Venezuela	7315	0.19
28	Portugal	21555	0.44	60	Philippines	5207	0.19
29	Germany	31855	0.44	61	Iran	3456	0.18
30	Spain	29951	0.43	62	Bolivia	4453	0.17
31	Latvia	15781	0.39	63	Ecuador	7456	0.16
32	Malaysia	13251	0.37	64	Uganda	1648	0.11

7.1. The correlation of the indicators and sub-indexes

In this section we report correlations between the original indicators, shown in Table 5, and the correlations between the normalized indicators after applying the PFB methodology in Table 6.

Table 5: The correlation matrix between the original indicators (non normalized, non-adjusted)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 OPPORTUNITY PERCEPTION	1,00	0,10	0,02	0,08	0,13	-0,05	0,00	-0,10	0,05	-0,16	-0,15	-0,08	-0,22	0,09
2 STARTUP SKILLS		1,00	0,21	0,46	0,41	<u>0,32</u>	0,44	0,38	0,38	0,16	-0,09	0,10	0,15	0,17
3 NONFEAR OF FAILURE			1,00	0,60	0,74	0,81	0,67	0,58	0,60	0,59	0,40	0,43	0,61	0,50
4 NETWORKING				1,00	0,72	0,70	0,59	0,37	0,59	0,53	0,12	<u>0,30</u>	0,46	0,54
5 CULTURAL SUPPORT					1,00	0,80	0,65	0,55	0,69	0,53	0,21	0,38	0,58	0,70
6 OPPORTUNITY STARTUP						1,00	0,66	0,64	0,74	0,56	0,33	0,41	0,59	0,53
7 TECHNOLOGY SECTOR							1,00	0,59	0,62	0,63	0,36	0,42	0,45	0,46
8 QUALITY OF HUMAN RESOURCES								1,00	0,46	0,42	0,21	0,51	0,36	0,46
9 COMPETITION									1,00	0,40	0,23	<u>0,30</u>	0,44	0,49
10 NEW PRODUCT										1,00	0,45	0,49	0,53	0,35
11 NEW TECHNOLOGY											1,00	0,35	0,41	0,34
12 HIGH GROWTH												1,00	0,43	0,39
13 INTERNATIONALIZATION													1,00	0,56
14 RISK CAPITAL														1,00

Correlation is significant at the 0.01 level (2-tailed).

Correlation is significant at the 0.05 level (2-tailed).

Table 6: The correlation matrix between the indicators, sub-indexes and the super-index after normalizing and applying the PFB method

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 OPPORTUNITY PERCEPTION	1	<u>0.29</u>	0.24	<u>0.28</u>	<u>0.33</u>	0.53	0.11	0.14	0.01	0.19	0.12	-0.02	-0.11	-0.01	-0.09	0.18	-0.01	0.23
2 STARTUP SKILLS		1.00	0.41	0.60	0.56	0.73	0.47	0.53	0.46	0.52	0.56	<u>0.27</u>	0.02	0.20	<u>0.26</u>	<u>0.28</u>	<u>0.27</u>	0.58
3 NONFEAR OF FAILURE			1.00	0.70	0.81	0.83	0.85	0.72	0.60	0.67	0.80	0.67	0.46	0.49	0.66	0.57	0.72	0.88
4 NETWORKING				1.00	0.78	0.87	0.72	0.61	0.42	0.63	0.68	0.60	0.22	0.38	0.54	0.58	0.60	0.79
5 CULTURAL SUPPORT					1.00	0.91	0.82	0.68	0.58	0.73	0.79	0.61	<u>0.31</u>	0.44	0.63	0.71	0.69	0.89
6 ATTINDEX						1.00	0.79	0.70	0.55	0.72	0.78	0.56	<u>0.25</u>	0.40	0.54	0.61	0.60	0.88
7 OPPORTUNITY STARTUP							1.00	0.75	0.73	0.81	0.93	0.66	0.43	0.51	0.66	0.60	0.72	0.91
8 TECHNOLOGY SECTOR QUALITY OF HUMAN								1.00	0.68	0.72	0.89	0.66	0.42	0.49	0.51	0.52	0.66	0.85
9 RESOURCES									1.00	0.60	0.85	0.48	<u>0.30</u>	0.53	0.44	0.50	0.57	0.74
10 COMPETITION										1.00	0.87	0.51	<u>0.34</u>	0.41	0.53	0.56	0.59	0.82
11 ACTINDEX											1.00	0.65	0.42	0.55	0.60	0.61	0.72	0.94
12 NEW PRODUCT												1.00	0.53	0.58	0.67	0.50	0.83	0.76
13 NEW TECHNOLOGY													1.00	0.46	0.53	0.46	0.73	0.52
14 HIGH GROWTH														1.00	0.55	0.47	0.76	0.64
15 INTERNATIONALIZATION															1.00	0.67	0.86	0.74
16 RISK CAPITAL																1.00	0.79	0.75
17 ASPIRINDEX																	1.00	0.86
18 GEINDEX																		1.00

Correlation is significant at the 0.01 level (2-tailed).Correlation is significant at the 0.05 level (2-tailed).

In general, there are significant and high correlations between the indicators in both cases. However, the PFB, as can be expected, improved the correlation, implying a closer relationship between the entrepreneurial features. The variable OPPORTUNITY PERCEPTION shows the lowest correlation with the other indicators. The correlation is negative especially between variable OPPORTUNITY PERCEPTION and the aspiration indicators, implying that the quantity and quality aspects to entrepreneurship do not necessary move in the same direction.

7.2 Correlation with other global measures of development

We presented the GEINDEX in terms of country development measured by the purchasing power parity GDP per capita. It is also worthwhile to examine the connection between GEINDEX and other major widely applied indexes. In Table 7 we report the correlation coefficients between GEINDEX, the global competitiveness index, the doing business index, the economic freedom index, the corruption index, and GDP per capita.

Table 7: The correlation coefficients between GEINDEX and other major indexes

	1	2	3	4	5	6
1 Global Entrepreneurship Index	1.00	0.86	0.82	0.79	0.92	0.89
2 Global Competitiveness Index		1.00	0.84	0.76	0.88	0.85
3 Doing Business Rank (normalized)			1.00	0.86	0.83	0.76
4 Index of Economic Freedom				1.00	0.85	0.74
5 Corruption Perception Index					1.00	0.86
6 Per capita GDP in PPP 2008 World Bank						1.00

All coefficients are significant at a level better than 0.001

In all cases the indexes show significant and high correlations with one another and with the GDP PPP per capita values. While measures of competitiveness, red tape, economic freedom, and corruption are available, a vital aspect of wealth creation and development, entrepreneurship, has been missing from the picture. It seems that our global entrepreneurship index fits into the picture and may be capable of providing valuable insight to understand entrepreneurship and its components and their role in economic development. It is to the possible value-in-use of the index that we now turn.

7.3 Test of the stages of economic development hypothesis.

Table 8 below shows the average values of the normalized value of the indicators for countries grouped according to the Global Competitiveness Index (GCI) categorization of factor-driven (stage 1), efficiency-driven (stage 2) and innovation driven (stage 3). The indicator values are normalized but not adjusted according to the PFB method, hence the real differences are shown. The significance of the differences between stages 1 and 2 and stages 2 and 3 are also presented

Table 8: The entrepreneurship indicator values in the different stages of development (normalized scores)

	Stage 1	2-tailed t-test stages 1-2	Stage 2	2-tailed t test stages 2-3	Stage 3	All
OPPORTUNITY PERCEPTION	0,604	<u>0,035</u>	0,424	0,772	0,443	0,464
STARTUP SKILLS	0,388	0,424	0,452	<u>0,019</u>	0,606	0,513
NONFEAR OF FAILURE	0,254	0,123	0,361	0,000	0,751	0,525
NETWORKING	0,093	<u>0,018</u>	0,225	0,000	0,480	0,322
CULTURAL SUPPORT	0,158	<u>0,017</u>	0,294	0,000	0,646	0,436
OPPORTUNITY STARTUP	0,237	0,007	0,428	0,000	0,745	0,544
TECHNOLOGY SECTOR	0,207	0,291	0,254	0,000	0,576	0,397
QUALITY OF HUMAN RESOURCES	0,306	0,595	0,343	0,000	0,620	0,466
COMPETITION	0,313	0,009	0,451	0,000	0,673	0,531
NEW PRODUCT	0,093	0,789	0,104	0,000	0,497	0,287
NEW TECHNOLOGY	0,312	0,688	0,277	0,000	0,495	0,385
HIGH GROWTH	0,229	0,101	0,364	0,005	0,556	0,430
INTERNATIONALIZATION	0,180	0,059	0,300	0,000	0,639	0,438
RISK CAPITAL	0,126	0,806	0,114	0,000	0,476	0,286
Number of countries	11		23		30	64

Bold: Statistically different at the 1 % level

Underlined Statistically different at the 5 % level

According to Table 8, the entrepreneurial performance of the innovation driven countries is significantly different from the efficiency-driven countries in all indicators but one. The exception is the opportunity perception potential (OPPORTUNITY PERCEPTION). Factor-driven and efficiency-driven countries are more similar regarding entrepreneurship indicators, but the differences are the highest in the cases of the attitude indicators of OPPORTUNITY PERCEPTION, NETWORKING, and CULTURAL SUPPORT. It implies that attitude development is vital for those countries that transit from the factor-driven stage to the efficiency-driven stage. While a further complex development of all of the indicators is necessary to be able to successfully transit to the innovation stage, aspiration indicators play the key role. The improvement of all NEW PRODUCT, NEW TECHNOLOGY, HIGH GOWTH, INTERNATIONALIZATION and RISK CAPITAL is inevitable. The largest differences between the stage 2 and 3 countries are in NEW PRODUCT, NONFEAR OF FAILURE, INTERNATIONALIZATION, and RISK CAPITAL.

A further examination of the fourth, variable level of the index provides a deeper understanding about the relative importance of the individual and the institutional variables play in the different stages of development. Table 9 contains all the normalized values of the original variables.

Table 9: The entrepreneurship variable values in the different stages of development (normalized, PFB non-adjusted scores)

Variable	Stage 1	2-tailed t-test stages 1-2	Stage 2	2-tailed t-test stages 2-3	Stage 3	All
MARKETSIZE	0.49	0.28	0.40	<u>0.05</u>	0.51	0.47
EDUC	0.30	0.08	0.42	0.00	0.67	0.52
CRR	0.30	0.13	0.43	0.00	0.92	0.64
INTERNETUSAGE	0.09	0.00	0.25	0.00	0.59	0.38
CPI	0.12	0.01	0.27	0.00	0.75	0.47
DB	0.32	0.00	0.59	0.00	0.87	0.67
TECHAVAILABLE	0.35	0.92	0.35	0.00	0.78	0.55
HDI	0.46	0.00	0.65	0.00	0.94	0.76
FREEDOM	0.12	0.00	0.34	0.00	0.72	0.48
GERD	0.08	0.47	0.10	0.00	0.44	0.25
INNOVCAT	0.28	0.69	0.30	0.00	0.67	0.47
BSS	0.30	0.46	0.35	0.00	0.73	0.52
GLOB	0.33	0.00	0.50	0.00	0.78	0.60
VENTCAP	0.27	0.97	0.28	0.00	0.71	0.48
INSTITUTIONAL AVERAGE	0.27	0.01	0.37	0.00	0.72	0.52
OPPORTUNITY	0.55	0.13	0.44	0.53	0.41	0.44
SKILL	0.70	0.15	0.58	0.00	0.41	0.52
NONFEAR	0.65	0.94	0.66	0.71	0.64	0.65
KNOWENT	0.61	0.00	0.36	<u>0.06</u>	0.26	0.36
CARSTAT	0.62	0.96	0.62	0.01	0.48	0.55
TEAOPPORT	0.47	0.44	0.40	0.00	0.70	0.55
TECHSECT	0.29	0.23	0.36	0.00	0.58	0.45
HIGHEDUC	0.38	0.99	0.38	0.00	0.61	0.48
COMPET	0.36	<u>0.02</u>	0.52	0.27	0.58	0.52
NEWP	0.34	0.60	0.38	0.19	0.45	0.40
NEWT	0.35	0.70	0.32	0.56	0.35	0.34
GAZELLE	0.20	0.12	0.30	0.30	0.35	0.31
EXPORT	0.24	0.14	0.34	0.00	0.59	0.44
INFINV	0.18	0.85	0.17	0.00	0.48	0.31
INDIVIDUAL AVERAGE	0.42	0.75	0.42	0.00	0.49	0.45
Number of countries	11		23		30	64

Bold: Statistically different at the 1 % level

Underlined Statistically different at the 5 % level

It can be hypnotized that institutional variables play an important role in stepping from stage 1 to stage 2 and, besides further institutional development, the importance of the individual factors increases during the transition to stage 3. Regarding institutional improvement, the hypothesis seems to be valid. Ease of doing business (DB), business freedom (FREEDOM), the usage of internet (INTERNETUSAGE), corruption (CPI), human development (HDI), and globalization (GLOB) are all significantly better in the efficiency driven countries than in the factor-driven countries. To step to stage 3, further institutional developments are required. Besides the previously sorted factors, higher education (EDUC), the availability of the latest technology (TECHAVAILABLE) innovation environment, (INNOV), R&D (GERD), strategy sophistication (BSS), risk of failure (CRR), and venture capital (VENTCAP) play a major role in improving the level of entrepreneurship.

The role of the individual variables is contradictory: As expected, the factor-driven and efficiency driven countries are very similar, out of the 16 individual variables only two – the

personal knowledge of an entrepreneur (KNOWENT) and the uniqueness of the product (COMPET) – shows statistically significant differences. While stage 2 and stage 3 countries are statistically different in terms of the overall average of the individual variables (INDIVIDUAL AVERAGE), improvement can only be noticed in five cases: opportunity motivated start-ups (TEAOPPORT), the technology sector start-up (TECHSECT), highly educated start-up (HIGHEDUC), export activity (EXPORT) and informal investment finance (INFINV). However, efficiency-driven countries perform better in start-up skills (SKILL), personal acquaintance with an entrepreneur (KNOWENT), entrepreneurship cultural recognition (CARSTAT), and the early phase entrepreneurial activity (TEA). It is really one surprise that is the SKILL variable: It seems that developed country population cannot fully exploit the advantages of the more sophisticated institutional setup, or individuals do not possess enough start-up skills to cope with cumbersome environmental factors such as regulation or red tape.

When the developed countries are split into two parts as above the GEINDEX trend line and below the GEINDEX trend line countries, we find no statistical difference regarding the level of institution development (INSTITUTION AVERAGE). However, the overall level of the individual variables (INDIVIDUAL AVERAGE) is found to be significantly ($p=0.029$) higher in group of countries where GEINDEX values are above the trendline as opposed to the below the trendline countries. It seems that developed countries in stage 3, especially those who are below the trendline like United Kingdom, Spain, Italy, Germany, or Japan, should focus more on individual development rather than institutional improvement to increase entrepreneurship. A more precise policy suggestion can be made on an individual country level.

8. The Global Entrepreneurship Index Policy Guide

This section examines three countries in some detail to demonstrate the use of the index for policy purposes. We have chosen for illustrative purposes one country from each stage of economic development. They are Iran, China and the United States the represent a factor-driven economy, an efficiency driven-economy and an innovation-driven economy respectively.

Total Early-Stage Entrepreneurial Activity (TEA) is a combined measure of the proportion of working age adults who are starting or running a new business. This activity-based measure is one way of measuring entrepreneurship in a country, but GEM generates many other measures as well, including measures of aspiration, such as the proportion of TEA that is innovative, technology-based and high growth. GEM also collects a wide range of data on attitudes to entrepreneurship. Entrepreneurship has greater impact on economic development if it takes place in a favorable environment.

The Global Entrepreneurship Index (GEINDEX) harnesses the information in GEM measures to create a wider measure of productive entrepreneurship in general in a nation. The GEINDEX combines measures of activity, aspiration and attitudes with relevant measures of the favorability of the environment for entrepreneurship. The GEINDEX is simply the average of three sub-indices, one for attitudes, one for activity and one for aspiration. Similarly, each sub-index is the average of four or five normalized indicator scores, after adjustment for “bottlenecks”, or the weakest indicator in a country (see section 3.3.).

The GEINDEX correlates strongly with economic development, and so it can be used to highlight strong and weak aspects of entrepreneurship in a nation, by showing how its nation ranks on the overall index and its three sub-indices (attitudes, activity and aspiration). Moreover, it is easy to demonstrate where the nation stands on the indicators of each of the sub-indices. Finally, the tool is helpful to identify weather the weak performance of a certain indicator is due to the low institutional development of the nation or the unsatisfactory level of aggregated individual factors.

We now illustrate the practical application of GEINDEX, its three sub-indices, the fourteen indicators and the twenty-eight variables with the example of three countries in different stages of their economic development. The charts and tables below can serve as visual aids to capture the attention of policymakers, GEM team members, the public or the media. One can investigate which components are relatively good or bad in relation to other nations by examining the tables below the charts. By showing how each component contributes to the overall link between entrepreneurship, environment and economic growth, nations can demonstrate the relevance of policies designed to change the weak component.

The investigation is conducted in three levels, (1) the sub-indexes, (2) the indicators, and (3) the variables (individual and institutional).

(1) On the *sub-indicator level* we present the relative position of the particular nation in comparison to other nations. The associated trend line of the attitudes, activity, and aspiration sub-indexes makes possible to see if the nation sits above or below the associated trend line.

(2) On the *indicator level* we display the normalized measures of each indicators within the sub-indexes, and are color coded using a traffic light system to show the relative position of a

country on each indicators, ranked from highest to lowest and split into top (green, favorable), middle (amber, neutral) and bottom (red, unfavorable).

(3) On the *variable level* we demonstrate how the normalized values of the institutional and the individual variables contribute to the performance of the indicators. Similar to the previous cases we apply the traffic light system but in this case not on the indicator but on the variable level. By comparing the colors of the individual and the institutional variables to the indicators one can quickly figure out how these variables contribute to the overall level of the indicator.

8.1 The case of Iran

Iran is a low-income country with a per capita GDP below \$5,000. This factor-driven economy relying mostly on oil exports for revenue has a relatively low level of entrepreneurship. It ranks 61st on the GEINDEX out of 64 countries. Figure 12 shows that Iran scores relatively low on the GEINDEX, and that it is close to the trend line. Looking at the three sub indexes it is clear that Iran is very close to the trend line for both entrepreneurial activity and aspiration.

Figure 12: The relative position of Iran in terms of the entrepreneurial sub-indexes and the GEINDEX

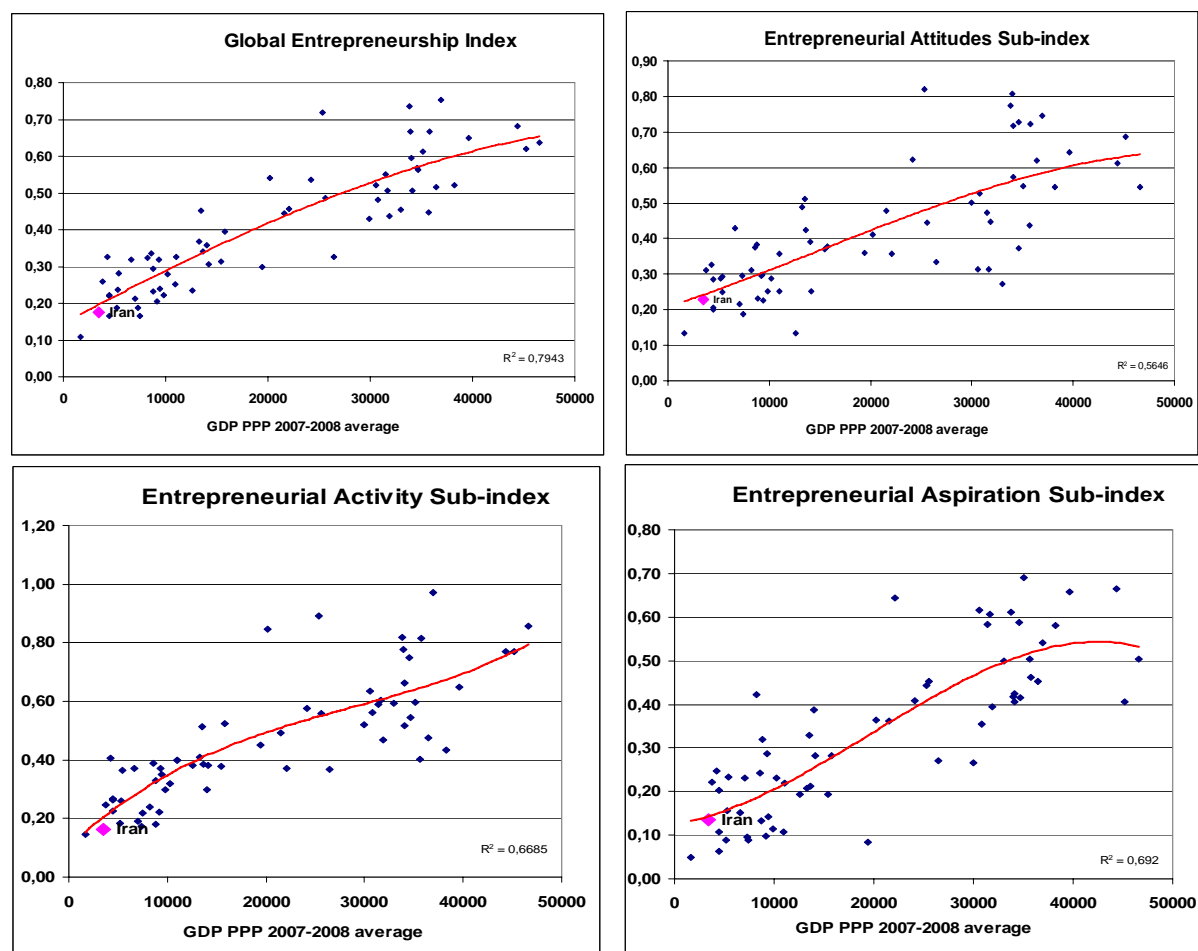


Table 10 shows the components of the sub-indexes for Iran. Iran appears to have a particular problem with the component of the ACT indicators, meaning that entrepreneurial activity is too low in Iran. This can be deduced from the table because the cells for STARTUP is red in color, and the number in the cell is considerably below the 33rd percentile (the point at which the bottom third of nations ranked on this component meet the middle third). Moreover, all of the four ACT indicators are red. All four of the indicators of ACT should be improved. In the ASP indicators STARTUP SKILLS, NONFEAR OF FAILURE and CULTURAL SUPPORT should all be strengthened to improve the perception of attitudes. A similar analysis could be conducted for each of the other components that should give cause for concern, particularly those that are color-coded red.

Table 10: The relative position of Iran in the indicator level

Components of Entrepreneurial Attitudes Sub-index (normalized scores)

	OPPORTUNITY PERCEPTION	STARTUP SKILLS	NONFEAR OF FAILURE	NETWORKING	CULTURAL SUPPORT
Iran	0,50	0,35	0,04	0,34	0,08
33% percentile	0,34	0,41	0,35	0,17	0,28
67% percentile	0,60	0,64	0,68	0,40	0,57

Components of Entrepreneurial Activity Sub-index (normalized scores)

	OPPORTUNITY STARTUP	TECH SECTOR	QUALITY OF HUMAN RESOURCE	COMPETITION
Iran	0,14	0,00	0,26	0,34
33% percentile	0,40	0,26	0,33	0,42
67% percentile	0,72	0,46	0,60	0,60

Components of Entrepreneurial Aspirations Sub-index (normalized scores)

	NEW PRODUCT	NEW TECHNOLOGY	HIGH GROWTH	INTERNATIONALIZATION	RISK CAPITAL
Iran	0,07	0,20	0,35	0,02	0,09
33% percentile	0,09	0,26	0,33	0,27	0,10
67% percentile	0,32	0,48	0,53	0,51	0,31

Color coding: Green: country score lies in top third of all countries by rank, amber: second third, red: last third

Table 11 shows the relative position of Iran with respect to the institutional variables, individual variables and the indicators. Iran has made some progress in the institutional variables including INTERNETUSAGE, TECHAVAILABLE, GERD, INNOVCAT and MARKET SIZE but the country risk rate (CRR), the level of globalization (GLOB) and the availability of venture capital (VENTCAP) should be strengthened. While the attitude related individual variables of Iran fits to the level of an efficiency-driven economy, the activity as well as most of the aspiration related individual variables are in the red zone. Particularly, the technology sector related start-up (TECH) and export orientation (EXPORT) an product as well as technology innovation (NEWP, NEWT) needs major improvement.

Table 11: The relative position of Iran in the variable level

Institutional variables		Individual variables		Indicators	
MARKETSIZE	0,69	OPPORTUNITY	0,34	OPPORTUNITY PERCEPTION	0,50
EDUC	0,27	SKILL	0,68	STARTUP SKILLS	0,35
CRR	0,00	NONFEAR	0,95	NONFEAR OF FAILURE	0,04
INTERNETUSAGE	0,35	KNOWENT	0,45	NETWORKING	0,40
CPI	0,04	CARSTAT	0,59	CULTURAL SUPPORT	0,079
DB	0,19	TEAOPPORT	0,38	OPPORTUNITY STARTUP	0,13
TECHAVAILABLE	0,40	TECHSECT	0,00	TECH SECTOR	0,00
HDI	0,55	HIGHEDUC	0,31	QUALITY OF HUMAN RESOURCE	0,26
FREEDOM	0,14	COMPET	0,41	COMPETITION	0,34
GERD	0,12	NEWP	0,16	NEW PRODUCT	0,07
INNOVCAT	0,33	NEWT	0,23	NEW TECHNOLOGY	0,20
BSS	0,42	GAZELLE	0,26	HIGH GROWTH	0,35
GLOB	0,00	EXPORT	0,08	INTERNATIONALIZATION	0,02
VENTCAP	0,00	INFINV	0,18	RISK CAPITAL	0,90
INSTITUTIONS	0,25	INDIVIDUAL	0,36	GEI	0,18

8.2 The case of China

China is a middle income country with per capita GDP close to \$10,000. It is an efficiency driven economy with a large manufacturing sector and ranks 39th on the GEINDEX and has a moderate level of entrepreneurship. As shown in Figure 13 China is above the trend line. While China is below the entrepreneurial activity sub-index it is significantly above the inspirational Sub-index. This drives entrepreneurial activity in China. China could increase its activity sub index to boost economic development.

Figure 13: The relative position of China in terms of the entrepreneurial sub-indexes and the GEINDEX

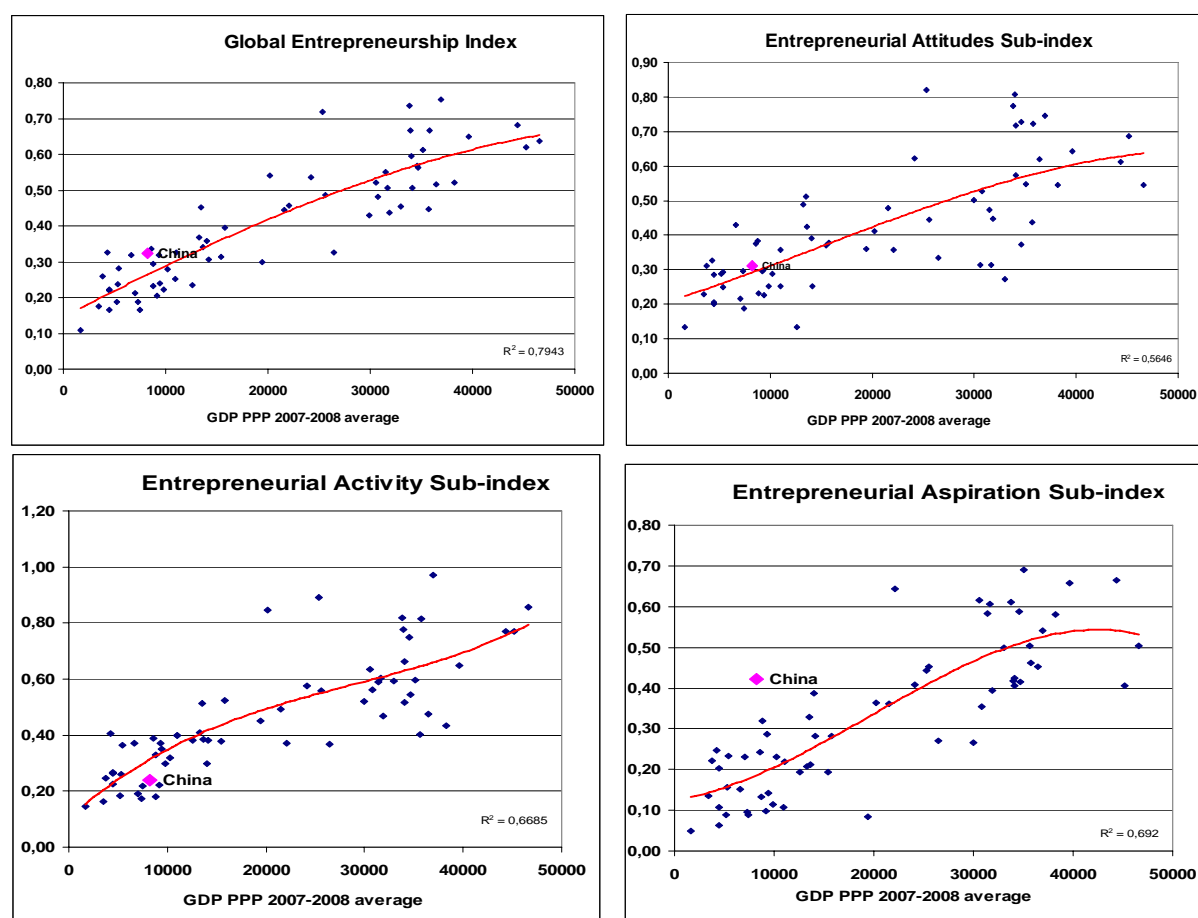


Table 12 shows the components of the sub-indexes. In the case of aspiration (ASP), that is the highest value out of the three sub-indexes, China appears to have a particular problem with the component RISK CAPITAL, meaning that risk capital investment is too low in China. This can be deduced from the table because the cell for RISK CAPITAL is amber in color, and the number in the cell is considerably below the 67th percentile (the point at which the middle third of nations ranked on this component meet the top third). Moreover, RISK CAPITAL is the lowest value out of the four ASP indicators. According to the PFB methodology, china should improve its performance in aspirations by raising the value of RISK CAPITAL. This would have positive effects on all the other for indicators in the ASP sub-index.

Table 12: The relative position of China in the indicator level

Components of Entrepreneurial Attitudes Sub-index (normalized scores)

	OPPORTUNITY PERCEPTION	STARTUP SKILLS	NONFEAR OF FAILURE	NETWORKING	CULTURAL SUPPORT
China	0,70	0,13	0,63	0,11	0,23
33% percentile	0,34	0,41	0,35	0,17	0,28
67% percentile	0,60	0,64	0,68	0,40	0,57

Components of Entrepreneurial Activity Sub-index (normalized scores)

	OPPORTUNITY STARTUP	TECH SECTOR	QUALITY OF HUMAN RESOURCE	COMPETITION
China	0,33	0,31	0,23	0,12
33% percentile	0,40	0,26	0,33	0,42
67% percentile	0,72	0,46	0,60	0,60

Components of Entrepreneurial Aspirations Sub-index (normalized scores)

	NEW PRODUCT	NEW TECHNOLOGY	HIGH GROWTH	INTERNATIONALIZATION	RISK CAPITAL
China	0,50	0,54	0,63	0,28	0,27
33% percentile	0,09	0,26	0,33	0,27	0,10
67% percentile	0,32	0,48	0,53	0,51	0,31

Color coding: Green: country score lies in top third of all countries by rank, amber: second third, red: last third

The next step would be to check whether the issue is the low level of the informal investment or the institutional part in this component by analyzing the two variables of the indicator in Table 13. In this case the institutional VENTCAP variable representing the availability of formal venture capital is relatively low (normalized score of VETCAP = 0.25) as opposed to the informal investment value (INFINV=0.40), hence RISK CAPITAL should be raised by improving the availability of venture capital.

Table 13: The relative position of China in the variable level

Institutional variables		Individual variables		Indicators	
MARKETSIZE	0,99	OPPORTUNITY	0,35	OPPORTUNITY PERCEPTION	0,70
EDUC	0,19	SKILL	0,32	STARTUP SKILLS	0,13
CRR	0,67	NONFEAR	0,86	NONFEAR OF FAILURE	0,63
INTERNETUSAGE	0,09	KNOWENT	0,67	NETWORKING	0,11
CPI	0,20	CARSTAT	0,59	CULTURAL SUPPORT	0,23
DB	0,52	TEAOPPORT	0,28	OPPORTUNITY STARTUP	0,33
TECHAVAILABLE	0,30	TECHSECT	0,45	TECH SECTOR	0,31
HDI	0,59	HIGHEDUC	0,25	QUALITY OF HUMAN RESOURCE	0,22
FREEDOM	0,04	COMPET	0,00	COMPETITION	0,12
GERD	0,31	NEWP	0,66	NEW PRODUCT	0,50
INNOVCAT	0,34	NEWT	0,56	NEW TECHNOLOGY	0,54
BSS	0,32	GAZELLE	0,52	HIGH GROWTH	0,63
GLOB	0,52	EXPORT	0,314	INTERNATIONALIZATION	0,28
VENTCAP	0,25	INFINV	0,40	RISK CAPITAL	0,27
INSTITUTIONS	0,38	INDIVIDUAL	0,44	GEI	0,32

8.3 The case of the US

The United States is the largest economy in the world with a per capita GDP over \$30,000. It is the largest innovation-driven economy in the world with a very high level of entrepreneurship. Figure 14 shows the relative position of the United States as 4th on the GEINDEX. While the United States is at the very end of the linear curve it sits slightly above the trend line. The United States is well above the trend line on the Aspiration Sub-index. Its position appears to be strong from a policy perspective.

Figure 14: The relative position of the US in terms of the entrepreneurial sub-indexes and the GEINDEX

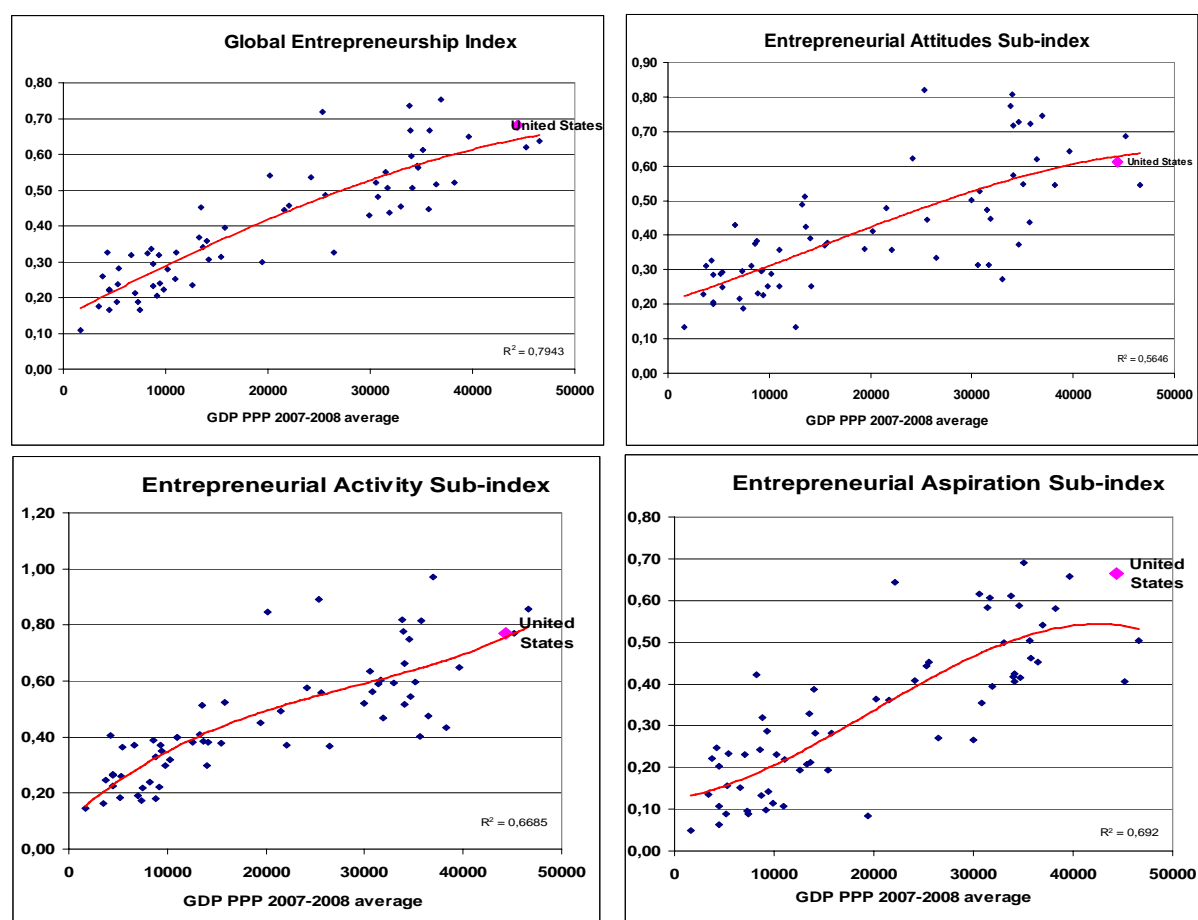


Table 14 shows the components of the entrepreneurial sub-indexes. The United States, while strong in almost all categories, appears to have a particular problem in the aspirations (ASP) with the components OPPORTUNITY PERCEPTION AND CULTURAL SUPPORT, meaning that OPPORTUNITY PERCEPTION is too low in the United States. This can be deduced from the table because the cell for OPPORTUNITY PERCEPTION is amber in color, and the number in the cell is considerably below the 67th percentile (the point at which the middle third of nations ranked on this component meet the top third). Moreover, OPPORTUNITY PERCEPTION is the second lowest value out of the five ASP indicators (0.45). According to the PFB methodology, the United States should improve its performance in attitudes by raising the value of OPPORTUNITY PERCEPTION. This would have positive effects on all the other five indicators in the ATT sub-index.

Table 14: The relative position of the US in the indicator level

	OPPORTUNITY PERCEPTION	STARTUP SKILLS	NONFEAR OF FAILURE	NETWORKING	CULTURAL SUPPORT
United States	0,45	0,95	0,84	0,55	0,44
33% percentile	0,34	0,41	0,35	0,17	0,28
67% percentile	0,60	0,64	0,68	0,40	0,57

Components of Entrepreneurial Activity Sub-index (normalized scores)

	OPPORTUNITY STARTUP	TECH SECTOR	QUALITY OF HUMAN RESOURCE	COMPETITION
United States	0,88	0,65	0,67	0,95
33% percentile	0,40	0,26	0,33	0,42
67% percentile	0,72	0,46	0,60	0,60

Components of Entrepreneurial Aspirations Sub-index (normalized scores)

	NEW PRODUCT	NEW TECHNOLOGY	HIGH GROWTH	INTERNATIONALIZATION	RISK CAPITAL
United States	0,64	0,68	0,90	0,84	0,45
33% percentile	0,09	0,26	0,33	0,27	0,10
67% percentile	0,32	0,48	0,53	0,51	0,31

Color coding: Green: country score lies in top third of all countries by rank, amber: second third, red: last third

Table 15 analyzes the two variables of the indicator in Table 14. In this case the institutional OPPORTUNITY variable representing the OPPORTUNITY is relatively low (normalized score of opportunity = 0.21) as opposed to the market size value (MARKETSIZE=1.00), hence OPPORTUNITY PERCEPTION should be raised by improving entrepreneurial opportunity. Two similar weaknesses exist in NETWORKING where knowing an entrepreneur who stated a business in the last two years is (KNOWENT=0.17) and career choice of entrepreneurship is also low (CARSTAT=0.24). The reason that the United States ranks below Denmark, Sweden and New Zealand is because of the individual variables with respect to culture and opportunity. This is most likely the result of large numbers of individuals living in poverty or near poverty. Improving the position of these groups would lift the United States to a higher level.

Table 15: The relative position of the US in the variable level

Institutional variables		Individual variables		Indicators	
MARKETSIZE	1,00	OPPORTUNITY	0,22	OPPORTUNITY PERCEPTION	0,45
EDUC	0,89	SKILL	0,50	STARTUP SKILLS	0,95
CRR	0,83	NONFEAR	0,98	NONFEAR OF FAILURE	0,84
INTERNETUSAGE	0,77	KNOWENT	0,17	NETWORKING	0,549
CPI	0,70	CARSTAT	0,24	CULTURAL SUPPORT	0,44
DB	0,99	TEAOPPORT	0,76	OPPORTUNITY STARTUP	0,88
TECHAVAILABLE	0,94	TECHSECT	0,59	TECH SECTOR	0,65
HDI	0,96	HIGHEDUC	0,65	QUALITY OF HUMAN	0,67
FREEDOM	0,84	COMPET	0,86	RESOURCE	0,95
GERD	0,57	NEWP	0,41	COMPETITION	0,64
INNOVCAT	0,95	NEWT	0,35	NEW PRODUCT	0,68
BSS	0,85	GAZELLE	0,50	NEW TECHNOLOGY	0,89
GLOB	0,73	EXPORT	0,79	HIGH GROWTH	0,83
VENTCAP	1,00	INFINV	0,37	INTERNATIONALIZATION	0,45
INSTITUTIONS	0,86	INDIVIDUAL	0,53	RISK CAPITAL	0,68
				GEI	

A similar analysis could be conducted for each of the other components that should give cause for concern, particularly those that are color-coded red.

9. Summary and Conclusion

In his classic text W.W. Rostow suggested that countries go through five stages of growth. Michael Porter provides a modern rendition of this approach. While Rostow focused on achieving the *age of high mass-consumption*, Porter focuses on achieving the *innovation-driven stage*. This focus on knowledge and endogenous growth shifts the analysis from consumption to production. Today we know that innovation is crucial for economic growth and that entrepreneurship plays an important role in innovation as suggested by Schumpeter over a century ago.

The *factor-driven stage* is marked by high rates of agricultural self-employment. Countries in this stage compete through low-cost efficiencies in the production of commodities or low value-added products. Almost all economies experience this stage. These countries neither create knowledge for innovation nor use knowledge for exporting. To move into the second stage, the *efficiency-driven stage*, countries must increase their production efficiency and educate the workforce to be able to adapt in the subsequent technological development phase. The preconditions for take-off describe the first transition.

To compete in this *efficiency-driven stage*, countries must have efficient productive practices on large markets, which allow companies to exploit economies of scale. Industries in this stage are manufacturers that provide basic services. The efficiency-driven stage is marked by decreasing rates of self-employment where capital and labor are substitutes, an increase in the capital stock increases returns from working and lowers returns from managing. The drive to maturity describes the second transition.

The *innovation-driven stage* is marked by an increase in knowledge-intensive activities; knowledge provides the key input and the focus shifts from exogenously given firms to agents in possession of new knowledge. The agent decides to start a new firm based on expected net returns from a new product. High value of the elasticity of factor substitution not only leads to more capital per capita, but makes it easier for an individual to become an entrepreneur if the aggregate elasticity of substitution is also negative.

Over the last decade, one major direction of entrepreneurship research has been to construct an entrepreneurship index. Despite enormous effort, scholars have struggled to develop a theoretically grounded and empirically proven index that can be widely accepted. One of the reasons for the failure is the inability to empirically capture the multidimensional feature of entrepreneurship. While recent theories suggest a complex definition of entrepreneurship, empirics-based indexes are still one-dimensional. All of these indexes were blinded by the quantity-connected pure activity measures such as self-employment or start-up activity, or business ownership ratios. Without quality the comparison of the entrepreneurial activity of the different countries or of the same countries in different time periods is the same as valuing armies based on the number of soldiers and not on the quality of armory. Moreover, these entrepreneurship measures lack to incorporate the institutional-environmental variables that greatly influence the level of entrepreneurship.

There are several novelties in the Global Entrepreneurship Index design. First, the construction of the indicators combines together the individual and the institutional variables similar to the interaction variable methodology. In this case institutional-environmental variables can also be interpreted as country-level weights of the individual variables. Second, we created the first dynamic index that meets with the requirements of configuration theory.

This approach is particularly useful in addressing the bottleneck problem of the low development of one or a few factors in entrepreneurship indicators and sub-indexes. According to the “penalizing for bottleneck method,” entrepreneurship policy can most efficiently remove barriers to entrepreneurship development by focusing on the bottleneck that is the “weakest link” amongst the indicators.

The Global Entrepreneurship Index compares the entrepreneurial performances of different countries at different stages of development. We analyzed the 28 variables, the 14 indicators, the three sub-indexes and the main GEINDEX. The relationship between Index values and development, measured by GDP per capita, were shown. While previous studies found that entrepreneurship, mainly measured in terms of activity, has a U shape or an L-shape relationship with national income per capita, we noticed a linear relationship: entrepreneurship is higher among richer countries. This finding fits much more to our present knowledge about the nature of economic development than U or L shaped relationships between the variables. The final ranking of the countries places Nordic and Anglo-Saxon countries at the top and developing countries at the bottom, which is a finding that also reflects what we expect development trends to look like.

While we listed a few potential caveats of the model design, such as the lack of variables in some cases, we suggest that the construction of the first complex entrepreneurship index is useful for policy purposes. It has been a continuous problem in GEM research to create a uniformly designed country report. Here, the analysis of the 28 variables, the 14 indicators and three sub-indexes make possible not just for a solid entrepreneurship analysis of a country compared to the leading countries and other similar nations, but also to provide tailor-made entrepreneurship policy recommendations. This latter issue has been the top priority of policy makers in several countries, particularly in Denmark, Singapore and Australia. As an example of a tailor-made policy recommendation we presented the case of Argentina. It very easy to apply the same method to construct the entrepreneurship ranks of different regions in one country, or sub-regions of a global region such as the EU. Further applications are the subject of future research.

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A-1 APPENDIX: The description of the applied variables and indicators of the Entrepreneurial Attitude (ATT) sub-index

Individual variable	Institutional variable	Source	Calculation	Indicator
OPPORTUNITY is defined as the percentage of the 18-64 population identifying good opportunity in the area they live.	MARKETSIZE is defined as the size of the market on a seven point Likert scale.	World Economic Forum	OPPORTUNITY x MARKETSIZE	OPPORTUNITY PERCEPTION
SKILL is defined as the percentage of the 18-64 population possessing adequate startup skills	EDUC is the percentage of the population enrolled in post-secondary education.	World Bank	SKILL x EDUC	STARTUP SKILLS
NONFEAR is defined as the percentage of the 18-64 population who do not fear failure starting a business.	CRR is the Country Risk Rate that refers to the financial, macroeconomic and business climate. The alphabetical rating is turned to a seven point Likert scale to fit to our data set.	Coface	NONFEAR x CRR	NONFEAR OF FAILURE
KNOWENT is defined as the percentage of the 18-64 population who knows an entrepreneur personally who started a business in two years.	INTERNETUSAGE is the Internet users per 100 inhabitants.	International Telecommunication Union	KNOWENT x INTERNETUSAGE	NETWORKING
CARSTAT is the average of the percentages of the 18-64 population who say that entrepreneurship is a good carrier choice and has social high status.	CPI is the perceived levels of corruption, as determined by expert assessments and opinion surveys on a seven point Likert scale.	Transparency International	CARSTAT x CPI	CULTURAL SUPPORT

A-2 APPENDIX: The description of the applied variables and indicators of the Entrepreneurial Activity (ACT) sub-index

Individual variable	Institutional variable	Source	Calculation	Indicator
TEAOPPORT is the percentage of the 18-64 population who are nascent entrepreneurs or who own and manage a business aged less than 3,5 years and started the business because of opportunity motivation divided by the TEA	DB is the normalized value of the Ease of doing business, reflecting how the regulatory environment is conducive to the operation of business.	World Bank	TEAOPPORT x DB	OPPORTUNITY STARTUP
TECHSECT is the percentages of TEA that are in the medium- or high-tech sector	TECHAVAILABLE is the availability of the latest technology on a seven point Likert scale.	World Economic Forum,	TECHSECT x TECHAVAILABLE	TECHNOLOGY SECTOR
HIGHEDUC is the percentage of TEA entrepreneurs having at least a post-secondary education.	HDI is a measure of the quality of human resource combining life expectancy, educational attainment and income.	United Nations	HIGHEDUC x HDI	QUALITY OF HUMAN RESOURCES
COMPET is the percentage of TEA where few competitors offer the same product.	FREEDOM is the freedom of the economy is one sub-index of the overall economic freedom score for each country, where 100 represents the maximum freedom	Heritage Foundation	COMPET x FREEDOM	COMPETITION

A-3 APPENDIX: The description of the applied variables and indicators of the Entrepreneurial Aspiration (ASP) sub-index

Individual variable	Institutional variable	Source	Calculation	Indicator
NEWP is the percentage of TEA business where entrepreneurs think that the product is new to at least some customers	GERD is the R&D percentage of GDP	OECD	NEWPROD x GERD	NEW PRODUCT
NEWT is defined as the percentage of TEA business where the technology is less than 5 year old	INNOVCAT is a measure of whether a business environment allows cutting edge innovations	World Economic Forum (GCI)	NEWT x INNOVCAT	NEW TECH
GAZELLE is defined as the percentage of high-growth TEA business (employing 10 plus persons and over 50 percent growth in 5 years)	BSS refers to the ability of companies to pursue distinctive strategies, which involves differentiated positioning and innovative means of production and service delivery	World Economic Forum GCI	GAZELLE x BSS	HIGH GROWTH
EXPORT is the percentage of TEA business exporting at least 1% of product	GLOB is the Index of Globalization measuring the economic, social, and political dimensions of globalization.	KOF Swiss Economic Institute	EXPORT x GLOB	INTERNATIONALIZATION
INFINV is defined as the percentage of informal investors in the 18-64 aged population multiplied by the average amount of informal investment.	VENTCAP is a measure of the venture capital availability on a 7-point Likert scale	World Economic Forum	INFINV x VENTCAP	RISK CAPITAL