



Extension of GEDI indicators

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Document Identifier

D4.1 A review paper on the extension of the GEDI-indicator with additional indicators on financial, labour and knowledge institutions

Version

1.0

Date Due

M9

Submission date

30 March 2016

Work Package

4

Lead Beneficiary

LSE, UU



Grant Agreement Number 649378

Change log

Version	Date	Amended by	Changes
0.1	08/02/2016	Mark Sanders	1 st review, internal review procedure
0.2	24/02/2016	Zoltan Acs, László Szerb	Review incorporated
0.3	20/03/2016	Erik Stam	2 nd review, internal review procedure
1.0	29/03/2016	Zoltan Acs, László Szerb	Final version for submission

Partners involved

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Table of Contents

1. Executive summary	4
2. Introduction.....	5
3. The Framing of National Systems of Entrepreneurship	6
4. The Logic of National System of Entrepreneurship	9
5. The Re-composition of the GEI by Introducing Additional Institutional Variables	11
5.1 Finance	12
5.2 Labour Markets	14
5.3 Taxes	16
5.4 Knowledge Institutions	18
5.5 A Summary of what we have proposed.....	18
5.6 What a new GEI looks like.....	20
6. Conclusions.....	22
7. References.....	23
8. Appendix.....	29

List of Abbreviations:

REDI: Regional Entrepreneurship and Development Index
 GEDI: Global Entrepreneurship and Development Index
 GEDI: Global Entrepreneurship and Index
 NSI: National System of Innovation
 NSE: National Systems of Entrepreneurship
 RSE: Regional Systems of Entrepreneurship
 KSTE: Knowledge Spillover Theory of Entrepreneurship

1. Executive summary

Research on entrepreneurship is mainly focused on the individual and research on innovation has been mainly focused on institutions even though we know that both agency and context matter. To better integrate the two approaches we introduce the National Systems of Entrepreneurship (NSE) as a framework for a resource allocation system driven by individual-level opportunity pursuit through the creation of new ventures and its outcomes regulated by country-specific institutional characteristics.

NSE relies on integrating both framework conditions and agency into a system. The structure is composed of 14 pillars, 3 sub-indices and a super index. The first index focuses on opportunity at the economy level. The second index focuses on the actions taken by the agent and the abilities of the agent. The third sub index focuses on the aspirations of the agent to create organizations that both are scalable and create wealth.

The NSE approach is an important tool for policy makers to identify weaknesses in the entrepreneurial ecosystem. Because entrepreneurial ecosystem services created through a myriad of localised interactions between ecosystem stakeholders, it is not easy to trace gaps in ecosystem performance back to specific, well-defined market failures that are addressed in top down modes. Earlier versions of NSE left out important topics like Finance, Taxes, Labour Markets and Knowledge Institutions because of data limitations. This paper will address how to include taxes, labour markets and knowledge institutions in NSE. Since we are only looking at EU countries a richer set of data exists to explore these avenues in the ecosystem.

2. Introduction

The central questions in the scholarly field of entrepreneurship are addressing (1) why an individual chooses to become an entrepreneur while others do not and (2) why entrepreneurial activities differ across countries. While academic research has mostly focused on characteristic variation across individuals there is much less evidence about measurement of entrepreneurship at the country level. Entrepreneurship is without doubt important for economic development (Schumpeter, 1934), but there is still relatively little agreement “on what entrepreneurship fundamentally means as a country-level phenomenon” (Acs, Autio, & Szerb, 2014, p. 477).

Recognizing the literature on entrepreneurial activism and performance reveals that most of the findings have been presented as though they are general and valid across countries. Evidence on the country level, however, is still largely missing and a number of crucial questions and answers remain unanswered. Countries cover a range of different institutional settings, formal and informal, different cultures, norms and values and attitudes toward entrepreneurship that effects entrepreneurial performance (Autio et al 2015).

To better understand entrepreneurship at the national level Acs, Autio and Szerb (2014) introduced National Systems of Entrepreneurship (NSE) as a framework for a resource allocation system driven by individual-level opportunity pursuit through the creation of new ventures and its outcomes, regulated by country-specific institutional characteristics.¹ They argued that entrepreneurship scholars have focused myopically on the individual and tended to ignore the regulating effect of context on individual action. The majority of the trade-offs and opportunity costs faced by entrepreneurs are regulated by context – for example national policies, resource distribution mechanisms, market access, social norms, and so on. For example the research whether entrepreneurs are born or created has led to a dead end. Because entrepreneurship researchers have focused on the individual and ignored the context, we have missed at least three important points:

- (1) that it is the context that regulates who decides to start a new firm;
- (2) it is the context that regulates what kind of firm they will start;
- (3) that the context also decides how aggressively the firm will pursue growth and with what outcomes.

As it is the explicit aim of the FIRES project and more specifically its 4th work package to map the entrepreneurial ecosystems in Europe, that is the national and regional systems of entrepreneurship, the proposed National Systems of Entrepreneurship serves as a natural starting point. In this report we present this approach and critically evaluate its suitability for this purpose before identifying where existing measures and methods need further elaboration. The next section presents the NSE approach and section 4 will elaborate on its underlying logic. We then turn to the three main pillars in the FIRES project, finance, labour,

¹ We use the term national Systems of Entrepreneurship (NSE) and Entrepreneurial Ecosystem approaches as two labels interchangeably.

knowledge and also zoom in on taxes and digital skills to show to what extent these are already covered in the framework and where additional work will be required. The report then concludes with a more specific agenda for future research in work package 4.

3. The Framing of National Systems of Entrepreneurship

If one is interested in country level outcomes—innovation, competitiveness, growth—(Audretsch, Karatko and Link, 2015) there are at least three approaches to understanding what makes countries and regions perform better over the past quarter century: National System of Innovation (Nelson, 1993); The Competitive Advantage of Nations (Porter, 1990); Competition and Entrepreneurship (Kirzner, 1973).

The broadest approach to economic performance at the economy level is the concept of National Systems of Innovation (NSI) (Nelson, 1993; Lundvall, 1992; Edquist, 1997). The main theoretical underpinnings are that knowledge is a fundamental resource in the economy, that knowledge is produced and accumulates through an interactive and cumulative process of innovation that is embedded in a national institutional context, and that the context therefore matters for innovation outcomes. The term ‘system’ connotes a set of institutions whose interactions determine the innovative performance of national firms. It is important to understand what the system means in the NSI literature. According to Rosenberg and Nelson (1993: 4-5) the system concept, “...is that of a set of institutional actors that, together, plays the major role in influencing innovative performance.” Systems constitute of multiple components that work together to produce system performance. In the NSI literature, systems are *not* created. Rather, they are inherited, evolving structures, and the key task of the researcher is to understand this structure so the system could be rigged to deliver improved performance.

The NSI concept is mostly about context, how institutions drive knowledge production and application and how countries differ according to their “..set of institutions...” but totally overlooks the individual agency (Acs, Autio, & Szerb, 2014, p. 477). In the NSI literature, individuals are almost treated as exogenously given and contextual variables and settings were in the focus of academic research and policy makers (Acs, Autio, Szerb, 2015). In other words, NSI helped us understand where we were as nations but not how to improve our position. It is perhaps a little surprising, if not ironic, that although the NSI literature was heavily influenced by the Schumpeterian tradition, the entrepreneur remained conspicuously absent in this literature.

The second approach to national economic outcomes is associated with Michael Porter’s (1990) work on the Competitive Advantage of Nations. While Porter was also interested in Nations and Innovation like Nelson, he took the analysis one step further. The central question to answer according to Porter is, “Why do firms in some industries achieve international success and others do not”? In addition to understanding the role of institutions, Porter argued that firm strategy is an important aspect of global competitiveness. To understand the environment Porter introduced the “Diamond”: a concept that tied together factor conditions, demand conditions, related and supplier

industries and firm strategy, structure and rivalry. Porter argued that productivity and competitive advantage in an economy requires specialization. In the *Competitive Advantage of Nations* he “introduced the concept of a cluster, or group of interconnected firms, suppliers, related industries, and specialized institutions in particular fields that are present in particular locations. “ Porter offered a sophisticated view among agglomeration economics and competition and strategy by focusing on clusters.

Clusters provided case study evidence of regions and industries that led to better performance. Porter’s Diamond model and cluster evidence became the model for thinking about policy at the economy level. The Diamond identified the institutional context and clusters showed how they might be improved. If one set of institutions was missing, performance would be sub optimal and could be fixed in a relatively short period of time. Porter’s approach was an improvement over NSI because clusters were able to provide a policy perspective. However, they were similar in at least one respect. They both took the number of firms as given, providing no role for new firms or entrepreneurs in the commercialization of knowledge and both left entrepreneurship out of the analysis. ²

The third approach to national economic outcome focuses on entrepreneurship (Baumol, Litan and Schramm, 2009). It helps to start out with a clear statement of what we mean by entrepreneurship as a national phenomenon. Entrepreneurship is about human action: what they do and what outcomes emerge from their actions. The outcome of entrepreneurship for many is opportunity recognition or the individual-opportunity nexus (Shane and Venkataraman, 2000). However, the nexus is simply a first step into the unknown.

There are two prominent approaches in the entrepreneurship literature on national performance. While the two approaches are similar in many respects they differ fundamentally on the role they assign to the entrepreneur. The first approach is that of Israel M. Kirzner (1973). The Kirznarian approach stresses the importance of market processes over equilibrium analysis. The focus is on competition and entrepreneurship. The second approach is due to Joseph A. Schumpeter. The Schumpeterian system [1911(1934)] stresses the role of evolution and innovation in the market mechanism by shifting the production function. For Schumpeter, entrepreneurship is important primarily in sparking economic development by creating disequilibrium. For Kirzner entrepreneurship is important primarily in enabling the market process to work itself out in all contexts. For Kirzner (1973, p. 81 emphasis original), “ the function of the entrepreneur consists not of shifting the curves of cost or revenues which face him, *but of noticing that they have in fact shifted.*” In essence the Schumpeterian entrepreneur is about creating a new production function—one that did not exist before—and the Kirznerian entrepreneur is about operating

² We would argue that Porter does not include entrepreneurship in clusters nor does he really even hint at this. It is simply left out. Moreover, much of the cluster ignores the role of entrepreneurship.

in the context of the existing production function.³ The latter does not necessarily lead to improved national performance. Of course we could argue that the Kirznerian entrepreneur moves us closer to the existing frontier by eliminating slack and inefficiency, but only technology can be a long run source of growth as efficiency runs into strong diminishing returns. If the production function is not shifted, and shifted often, after a while there will be nothing for Kirznerian entrepreneurs to do as *the market will equilibrate, and long run stagnation will set in. What is missing from the Austrian story is a way to connect agency with institutions that tie together the entrepreneur with a set of modern institutions along the lines of NSI and/or Clusters that improved national performance.*

In a seminal paper, Baumol (1990) took a unique way to explain the effect of entrepreneurship on economic performance. Unlike other predecessors, Baumol asserted that entrepreneurship was not necessarily effective. He made the assumption that the supply of entrepreneurs is constant over time and the effectiveness of entrepreneurship is determined by the quality of institutions. Under suitable institutional setup agents are engaged in value creating entrepreneurial activity. Ineffective or even destructive entrepreneurship could emerge if institutions improperly induce agents to start a (productive) business. The importance of institutions to economic development has been reinforced by institutional economists (North 1990, Acemoglu et al 2005, Rodrik). However, institutionalists - similar to NSI scholars - assume that agents are automatically reacting to institutional incentives. In other words, they ignore agency. Baumol, on the other hand, put the nexus between individual agency and national level institutions centre stage. In his approach the (given supply of) entrepreneurs *choose* to act in one way or another in response to and interaction with the local institutional arrangements in which they find themselves.

In order to operationalize the theoretical literature on entrepreneurship at the economy level and fill this hole in the entrepreneurship literature a group of scholars in 2004 set out to integrate agency and outcome in a coherent framework.⁴ Knowledge spillover entrepreneurship provided a bridge between entrepreneurship and national performance, not just on why some people choose to become entrepreneurs while others do not, but also how and why entrepreneurship is a critical factor in improving economic performance (Acs, et al. 2009; Acs, Audretsch, & Lehmann, 2013; Acs and Sanders, 2013; Ghio et al, 2015). According to the Knowledge Spillover Theory of Entrepreneurship (KSTE), the context in which decision-making is derived can influence one's determination to become an entrepreneur (Minola, Criaco, & Obschonka, 2015). By commercializing the ideas that evolved from an incumbent organization but commercialized independent of this organization via the creation of a new firm, the entrepreneurs not only serve as a conduit for

³ While the Kirznerian framework makes no attempt whatsoever to include national level aggregate it does focus on the methodology of the individual entrepreneur and that is our aim here.

⁴ Acs, Audretsch, Brauenhelm and Carlsson in 2004-2005 produces a set of working papers published by CEPP, The Royal Institute of Technology and the Max Planck Institute of Economics.

the spillover of knowledge, but also for the ensuing innovative activity and enhanced economic performance (Acs, et al, 2009; Acs and Sanders, 2012,2013). The KSTE is consistent with the Schumpeterian view of entrepreneurship that the role of the entrepreneur is to create a new production function.

The KSTE also introduced the concept of the Knowledge Filter (Carlsson et al. (2009). The Knowledge Filter is a subset of institutions that hinder the commercialization of knowledge by entrepreneurs. However, the theory fell short in one important respect. While identifying the importance of the knowledge filter in the commercialization of technology, the KSTE never produced the detailed working of the institutional system that either NSI or Clusters provided. What is still missing here is an explanation of the interaction of agency and institutions in a coherent system at the national (or regional) level.

With the introduction of national system of entrepreneurship (NSE), Acs, Autio, and Szerb (2014, 2015) develop an approach that integrates the importance of agency along the lines of the KSTE and institutions as an alternative perspective to NSI, explaining not just why some people choose to become entrepreneurs while others do not, but also how and why their performance differs in the aggregate across countries. They develop a new index methodology characterizing national systems of entrepreneurship recognizing interactions between different components and in particular identifying bottleneck factors that hold back entrepreneurial performance. The systemic approach of national systems of entrepreneurship considers institutional arrangements beyond geographical proximity and location specific endowments and thus provides a more realistic representation of the phenomenon of entrepreneurship at the country level. The approach also forces researchers and policy makers to think in systemic terms, which widens the perspective when considering both individual- and country-level indicators.

4. The Logic of National System of Entrepreneurship

It is widely accepted that an 'entrepreneurial' country does not simply mean that there are more entrepreneurs. While Uganda has the highest self-employment rate on the planet, followed closely by countries such as Peru, even if these two countries have many merits, they are hardly leading examples of economic productivity and dynamism. In the NSE perspective, the fundamental aspect of entrepreneurship is not the pure number of entrepreneurial firms, but that entrepreneurship drives productive resource allocation in countries. At the country or national level, this dynamic resource reallocation drives total factor productivity, and therefore, economic growth (Acs, Autio & Szerb, 2015, p. 17).

They define a NSE as “..the dynamic, institutionally embedded interaction between entrepreneurial attitudes, activities, and aspirations, by individuals, which drives the allocation of resources through the creation and operation of new ventures” (p.479). The central idea in the entrepreneurial process is not the pure existence of opportunities or supply of entrepreneurial talent, but how entrepreneurs get access to resources and mobilize them in order to pursue the opportunities. The dual services created by NSE are resource allocation towards productive uses and the innovative, high-growth ventures that

drive this process. Because NSE services are created through a myriad of localized interactions between stakeholders, it is not easy to trace gaps in system performance back to specific, well-defined market and structural failures that could be addressed in a top-down mode (Autio and Levie, 2015).

The entrepreneurial process is embedded action—both the individual and the context matter. What is needed, therefore, is a systemic understanding of the entrepreneurial process. The NSE approach seeks to address this gap. To achieve this outcome the Global Entrepreneurship and Development Index (GEDI) draws on the Global Entrepreneurship Monitor (GEM) data and the NSE philosophy to compile a multi-item index for profiling NSEs in different countries. The index is made up of ‘pillars’, which reflect ‘attitudes’, ‘abilities’, and ‘aspirations’, respectively. Each pillar combines an individual-level aggregate from the GEM data (for example, national percentage of individuals who perceive skills for entrepreneurship) with a matching measure of a national descriptor (for example, gross enrolment in tertiary education).

The key idea behind NSE is the complementarity across the pillars and sub pillars of variables: abilities, attitudes, and aspirations, non-convexity in the set of available choices, and non-concavity in the relationships between choice and performance (Roberts, 2004, p. 34f). The concept of complementarity in its simplest way is the interaction of two variables. Two choice variables are complements, when doing more of one of them increases the returns to doing the other. In contrast, activities are substitutes if doing more of one reduces the attractiveness of the other. While there may be multiple coherent patterns for complementary features, what typically does not work is a “mix and match” (Roberts, 2004, p. 39) among elements of different pillars and sub pillars.

The GEI applies a ‘Penalty for Bottleneck’ algorithm: if there are poorly performing pillars, other pillar values are ‘penalized’ to reflect the notion that the poorly performing pillar may constitute a bottleneck for system performance. With this Penalty for Bottleneck algorithm, it is possible to start ‘optimizing’ policy portfolios – that is determine how policy resources should be allocated as policies should always seek to address the most weakly performing pillars first.

Therefore, the main emphasis of policy should be on identifying system-level bottlenecks and alleviating them. A corollary of the above is that we may be able to improve system-level performance by smart (re)allocation of resources. However, to do this successfully, one needs to understand the complementarity, the relative strengths and weaknesses of the multiple factors that make up the system.

The NSE provides a framework for policy makers identifying coherent patterns and relationships among key variables. NSE is complex socioeconomic structures that are brought to life by individual level action. This action is embedded in multipolar interactions between individual and organizational stakeholders that make up the system, and it is expressed through the creation and operation of new ventures. Table 1 presents structure of the index. The full list of both the individual and institutional variables is provided in the Appendix.

Table 1: The structure of the Global Entrepreneurship Index

The Global Entrepreneurship Index (GEI)																																					
Attitudes Sub-Index					Abilities Sub-Index					Aspirations Sub-Index																											
MARKET AGGLOMERATION	OPPORTUNITY PERCEPTION	POST-SEC EDUCATION	STARTUP SKILLS	BUSINESS RISK	RISK ACCEPTANCE	INTERNET USAGE	NETWORKING	CORRUPTION	CAREER STATUS	CULTURAL SUPPORT	FREEDOM	OPPORTUNITY STARTUP	TECH ABSORPTION	TECH SECTOR	TECHNOLOGY ABSORPTION	STAFF TRAINING	HUMAN CAPITAL	HIGH EDUCATION	MARKET DOMINANCE	COMPETITION	TECH TRANSFER	PRODUCT INNOVATION	NEW PRODUCT	PROCESS INNOVATION	GERD	PROCESS INNOVATION	NEW TECHNOLOGY	BUSINESS STRATEGY	HIGH GROWTH	GAZELLE	INTERNATIONALIZATION	GLOBALIZATION	EXPORT	INTERNATIONALIZATION	DEPTH OF CAPITAL MARKET	RISK CAPITAL	INFORMAL INVESTMENT

Source: Acs, Szerb Autio 2015 p. 101

These pillars and variables were assembled from the best research at the time the GEI was compiled. They were constrained by two issues: one, if the variables were correlated and two, if data was available for all countries. In the past decade the world of entrepreneurship has evolved and new approaches to entrepreneurship have emerged that make an update of the GEI necessary.

5. The Re-composition of the GEI by Introducing Additional Institutional Variables

The aim of the FIRES project is to better understand the financial and institutional structure that leads to a more robust economy. Therefore the creation of a more robust composite indicator measuring NSE is an important part of this project. The main purpose of this section is to think through how to expand the institutional variables for a more robust index. The main targets according to the FIRES Project are financial variables, taxation, labor markets and knowledge institutions that affect its quality of entrepreneurship. In the FIRES project we will only focus on 39 EU countries and other OECD countries for benchmarking purposes (except New Zealand and Malta). This will make data collection much easier as we are not constrained by emerging economies.

One might ask why we have not included finance, labor markets and taxes in the GEI up to now. There are at least three reasons. First, the theoretical literature has been mixed on this subject. For example on the role of finance some argue that finance is never a

problem (too much money changing too few ideas) or asymmetric information so there is always a shortage of finance. Some have argued that if the U.S. had the Swedish tax structure it would not have any Unicorns. On the question of labor markets there has also been conflicting results about the question of tight vs lax labor regulation. In part this depends on the type of goal that the economy has. On the question of taxes similar conflicting results have been found. Finally, if the goal of the economy is just to mop up the unemployed none of these questions are very relevant. We will now review the highlights of the literature in finance, labor markets and taxes. This literature is not meant to be exhaustive by any means. It is simply illustrative of the issues involved.

5.1 Finance

If NSE is about creating an ecosystem where the outcome is high growth firms, and allocating resources to them, then financial markets are a key institutional variable.

Viewed from the other side, the lack of finance for firm growth is found to be the most important factor impeding growth and innovation in many countries (Lee et al 2015, Levine 2005, Fraser et al 2015).

Starting a new business is highly risky by itself and non-diversifiable uncertainty exponentially increases as innovation and growth are involved (Chen et al 2010, Lerner et al 2011). At the same time, the outside financing needs of these high growth firms also rise as self-financing resources are quickly exhausted due to rapid growth. Since risk fundamentally influences the type of financing high growth innovative ventures require entrepreneurial firms require different finance than other businesses (Denis 2004, Mitter and Kraus 2011). Entrepreneurial finance is influenced by information asymmetries and moral hazard issues (Nofsinger and Wang 2011). Here, we are looking for primarily those financial institutions and instruments that are proper for high growth firms but taking into account the whole spectrum of financing over the life cycle of the business.

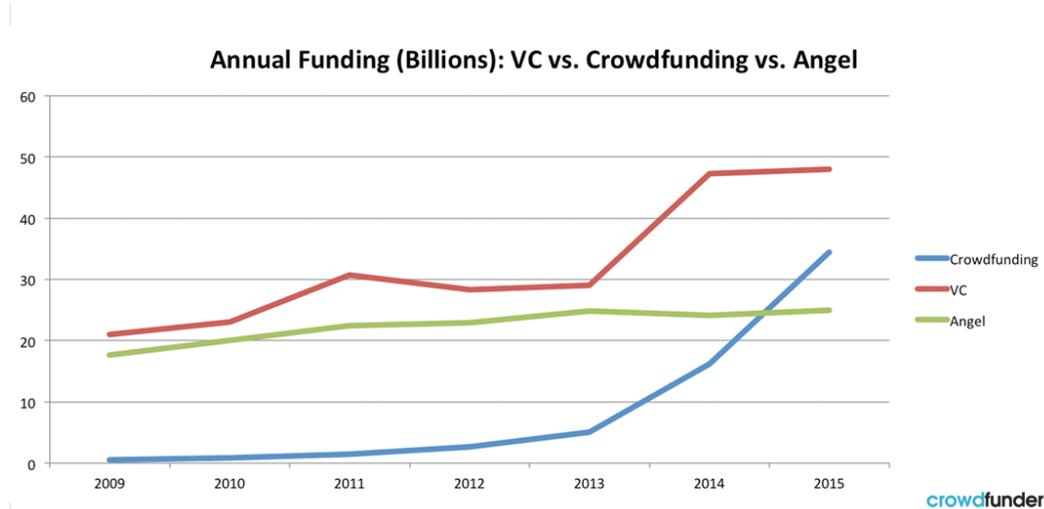
Contrary to general beliefs, recent researches found bank related lending sources as an important source of finance for small businesses and start-ups. Even amongst start-ups receiving informal and formal venture capital there was a considerable share of debt related sources (Hirsh and Walz 2011; Much and Wolken 2012, Robb and Robinson 2012). However, equity stakeholders like business angels and venture capitalists have different investment and risk alleviating strategies as compared to debtors (Berger and Udell 1998, Ewens et al 2013). Besides additional finance these experienced investors provide useful, valuable assistance and help for start-ups to avoid common pitfalls and decrease risk associated with innovation and growth. While most empirical studies reinforce the additional positive effect of venture capital investment on the portfolio venture the magnitude of value added varies over countries, industries and venture capital funds (Arthurs and Busenitz 2006, Croce et al 2013, Davila et al 2003). Similar positive but varying degree effects exist in the case of business angel investment (Kerr et al 2014, Politis 2008, Wiltbank et al 2009).

So how will that be made part of the indicator? At the very least you should attempt to include something on the composition of available equity and debt in the national

financial system. One of the main directions in our project is to argue that EU financial markets are being pushed in the wrong direction. Bigger bank debt finance is not what an experimental healthy entrepreneurial ecosystem requires. If you want to argue that bank debt is important for start-up finance you need much more evidence, as that goes against everything we think we know. Banks do not finance high-risk start-ups. The owners of those start-ups may draw on bank credit, but they have to put up collateral and private security. Banks do not take risks. Neither do pension funds and insurance companies.

Over the last decade, globalization and technological innovation have had a major effect on the widely interpreted entrepreneurial finance. The venture capital market became more globalized and the importance of angel investor groups able to provide higher amount of finance has also grown (Chemmanur and Fulghieri 2014). Internet related technologies have provided additional opportunities to venture capitalist and business angels to monitor closely their portfolio firms even from larger distances. The most important new financial innovation, crowdfunding is also imbedded in the internet related technology where startups can raise private equity in small amounts from large number investors via internet platforms (Ordanini et al 2011).

The latest Massolution report (Massolution 2015) points out that crowdfunding platforms raised \$16.2 billion all around the world in 2014. This amount is believed to be \$34.4 billion in 2015. The relative size of the venture capital, business angel and crowdfunding is pictured in Figure 1. While angel financing was marginally below venture capital in the 2009-2013 time period, venture capital investment grown up to almost \$50 billion by 2013. Starting from a very low level in 2009, crowdfunding exceeded the amount of angel financing in 2015 and expected to overcome venture capital investment in 2016-2017. According to the World Bank estimates crowdfunding hits \$93 billion by 2025, being almost two times larger than all the other venture capital related markets together (World Bank 2013).



Source: Barnett, C. (2015):

Figure 1: The size of venture capital, business angels and crowdfunding in the world 2009-2015

Based on the above short analysis about the financial trends, markets and institutions we can draw some important lessons in terms of selecting finance institutional variables for our index:

- Financial markets are complex, so we should select a composite variable that reflect the richness of financing. There is the debt equity mix, the size of the financial market and the institutional vs private investors in Europe.
- Bank related debt is an important source of finance even for high growth innovative businesses; therefore our variables should contain a component that reflects to lending.
- Both venture capital and business angel investment should be included in the finance variable. Mergers and acquisitions and PE should be disregarded.
- We should add components that reflect the access to and size of crowdfunding in a country.
- Internet technologies should be closely monitored to be able to identify further changes in the financial markets.

We will include finance in more than one pillar as indicated above:

- In Pillar 12 high growth we will replace business strategy with an equity finance variable perhaps a mix of VC, Angel and Crowdfunding.
- In Pillar 14 Equity Finance we will try and untangle the depth of capital markets variable to better reflect entrepreneurial finance.

Potential, but not yet tested indicators:

For Taxation and Finance

- Paying taxes distance to frontier – composite indicator about taxation provided by Doing Business project (Authors: World Bank Group and PWC); data are available from 2006 to 2016
- Economic Complexity Index – indicator introduced by Hidalgo and Hausmann (2009), indicates the interactions and network of a country's economy (Author: MIT Media Lab Macro Connections group); data are av. from 1964 to 2013
- Financial literacy of adult population or financial literacy of 15-34 year old population – Standard & Poor's Global Finlit research, supported by World Bank, conducted by Klapper, Lusardi and van Oudheusden (2015); data were collected only for 2014
- ICRG Indicator for Quality of government – The mean value of the ICRG variables "Corruption", "Law and Order" and "Bureaucracy Quality", scaled 0-1. Higher values indicate higher quality of government; data are av. from 2000 to 2012

5.2 Labour Markets

If NSE is about creating an ecosystem where the outcome is high growth firms, and allocating resources to them, then labor markets are a key institutional variables.

The focus should be on the ease with which entrepreneurs can get the human resources they need and what risks and barriers they face in doing so. Furthermore, the different regulations and national frameworks related to the labor market may affect the human capital of firms. The essential fact is that countries that have highly regulated labor markets have a harder time hiring and firing people and therefore they are not conducive to innovative entrepreneurship. The U.S. and other Anglo Saxon are structured for radical innovation while continental European countries are more focused on incremental innovation. Here strong labor market regulation does not hurt performance.

The mobility of labor, especially the high-qualified labor plays an important role in founding new firms. Frederiksen, Wennberg and Balachandran (2016) studied the effect of labor mobility for the entrepreneurial entry rate. They found that there is a positive link among the mobility and founding of new ventures, but it does not affect the entrepreneurial performance. These processes are driven not only by the accumulation of knowledge from mobility, but alternative mechanisms also, such as an individual's "taste for variety" or individuals being ill matched to jobs in the formal labor market.

Labor market regulations also have an impact on entrepreneurship. Henrekson and Dan (2008) investigated their effects on high-growth firms from three aspects: regulations in general, the wages and social insurance. According to their points, regulations give a framework for creating new firms, but they may also hinder foundation of new ventures. They may go a long way towards explaining differences in the rate of self-employment among the countries. Firms that are located in a country with relatively few regulations grow faster than ventures that can be found in countries that have more strict regulations in tax rates or income. For the self-employed, compensation and working hours are totally unregulated and no labor security is mandated. The smallest firms may be able to benefit from greater freedom of contracting, since they do not have to sign a collective agreement within a given sector. This flexibility is likely to be lost once the firm grows over a certain threshold.

Beside regulations, wages have also an important role, as the start-ups have to attract the high-qualified workforce. According to Henrekson and Dan (2008) the established firms may pay higher wages than new entrepreneurship or those which operate in low-technology sectors. The growth of wages depends on the performance of the firm. Regulation of social security plays a crucial role within labor market institutions. A generous welfare system may make less costly to bear uncertainty as an entrepreneur or transfer to a risky job in an entrepreneurial firm. The opportunity cost has an important role, since it is the cost that employee gives up if she or he changes to a job in entrepreneurial firm or being an entrepreneur. In effect this question is about whether one has a radical entrepreneurial society or an incremental one. Before WWII Germany and Japan had economies that were radical entrepreneurial society. The Germans invented rockets and jet engines! After WWII the allies reduced these countries economic role to incremental innovative societies. So they in effect are no longer able to create billion dollar companies: unicorns.

Labor market issues, especially the skills and knowledge of employees are in close relationship with the knowledge institutions. New products and innovations may stimulate the foundation of entrepreneurs and generate new firms (Feldman 2001, Audretsch–Keilbach 2004, Stam 2010). The knowledge that induces the decision to start new firms is generated by investments. Therefore, the start-up serves as the mechanism through which knowledge spills over from sources that produced it (such as a university or research laboratory in an incumbent firm) to a new organizational form where it is actually commercialized (Acs et al. 2009).

We have the following suggestion labor markets.

- We will replace Pillar 8 human Capital with an institutional variable that measures labor market efficiency.
- We will replace Pillar 4 Networking internet usage with a measure of social media abilities.

Further suggested indicators that we have not investigated and tested yet in the report:

For Human capital (Labour markets)

- Availability of scientists and engineers – categorical indicator of Global Competitiveness Index; it measures the availability of scientists and engineers in a given country; 1= not at all, 7= widely available; data are av. from 2006 to 2015.
- Employment protection legislation index from the OECD and the World Bank as an indicator of institutions enabling/constraining labour mobility.

For Digital skills

- Different variables of ITU Database –, Percentage of the population covered by at least a 3G mobile network (other variables can be added later); data av. depends on the country

5.3 Taxes

If NSE is about creating an ecosystem where the outcome is high growth firms, and allocating resources to them, then public finance is a key institutional variables. Taxes in general can be a great deterrent to entrepreneurial startups. The difficulty of measurement taxation starts with the fact that taxation constitutes a system by itself. Besides tax rates, tax regulation, the number of taxes, the compliance to tax authorities, the frequency of payment and red tape in general heavily affect entrepreneurship. Furthermore, we should take into account some other negative effects of taxation on entrepreneurship that is the potential that legal economic activity decreases and illegal, shadow economy activities emerge.

Previous attempts to incorporate taxation into GEI were limited by poor data availability especially for lower developed countries. Moreover, taxation related variables correlated positively but weakly with the development measure per capita GDP. Below, we

provide the most important issues affecting the incorporation of taxation variables into the next version of GEI.

First, most studies examine the influence of the general level of taxation on entrepreneurial activity (Bruce and Mohsin 2006). It is well-known that the different elements of the NSE influence innovative, high growth potential ventures as compared to other startups based on non-innovative replicated business idea and minimum growth prospective in different ways. Here, we are interested in the high growth gazelles and do not benchmark business startups per se. Unfortunately, the connection between taxation and the other quality aspects of entrepreneurship like high growth, innovation, internationalization, have remained understudied (For exemptions see Davidsson and Henrekson 2002; Egger and Loretz 2010, Haufler et al 2014).

Second, it is well-known that there is a connection between taxation and the so called shadow economy. High tax rates hinder startups and increase the propensity to involve in the informal or illegal shadow economy (Gordon and Li 2009; Munk 2008). In addition, starting and operating a business in the legal sectors involves obeying to formal rules and regulations. This compliance could involve considerable cost and time from business owners. As a consequence, business startup rates are hindered or the business launches in the informal, illegal sector (Auriol 2013; Davis and Henrekson 2004).

Third, taxation can have a different effect on the different stages of business life cycle. Here, we are interested mainly in startups and the financing of these startups. Since starting a business is highly risky the capital structure of these startups different from other established ventures (Cassar 2004; Gregory et al 2005; Robb and Robinson 2012; Stam and Verbeeten 2016). Besides usual business risk newly launched ventures are exposed to higher uncertainties and probability of failure mainly because the innovative business idea is unproven, the markets are unknown, and the startup business owners' managerial skills are not proven (Mann and Sanyal 2010). Financing these startups from outside sources raises additional problems of information asymmetries and associated moral hazard problems (Nofsinger and Wang 2011). Hence, self-finance from the founders constitutes a lions-share in the financial sources of startups. Financial constraints are found to be a major obstacle of business startup and the success of startup (Kerr and Nanda 2011). In this case taxation can have two indirect effects on startups by (1) influencing the wealth accumulated by potential founders and their financiers from the private sector (2) providing tax incentives to ease the liquidity constraints of startups.

Fourth, numerous taxes influence the various aspects of entrepreneurship in different ways and different degrees. These effects are very complex and difficult to measure: Some of them have direct and others have indirect, leveraged influence. Henrekson and Jansson (2008) examined the influence of different taxes on the incentives to set up high growth potential startups. While high taxes levied on labor income, corporate profit, capital gains, stock market options, savings, or asset holdings are found to negatively influence selection into self-employment, the overall effect on those who plan high growth startups is mixed. The practical operation of the taxation system, the rules of exemptions

and provisions make it difficult to identify the ultimate effect of taxation and provide solid cross country comparison.

Zero tax rates cannot be optimal since public services must be financed somehow. Altogether, building taxation related variable or variables into GEI would be a difficult task. Based on the literature survey we should take into account the followings: We should apply a complex taxation variable that contains the overall tax rate but also reflect to the administrative costs. The PWC and World Bank common project paying taxes project makes it possible to collect these variables (Paying Taxes 2015).

- We will include a measure of taxes in Pillar 6 Opportunity Startups that includes a measure of taxation multiplied by government efficiency.
- We will more economic freedom to Pillar 1 Opportunity Recognition.
- We will drop both the country size and agglomeration variables.

5.4 Knowledge Institutions

Knowledge institutions are about those institutions that are involved in the creation of knowledge (basic, applied and developmental), the transfer of knowledge and the diffusion of knowledge. In the GEI set up we include both the creation of knowledge through the research and development and the transfer of knowledge through the universities and other institutions. We also focus on the role of technology absorption as well as the development of new technologies through high growth firms. So in sum the topic is rather well covered in the GEI. What are not covered are the diffusion of knowledge and the role that digital technologies play in this process as well as the role of digital technology itself in entrepreneurship both as cause and as an effect.

To better measure education we will do the following.

- In Pillar 2 Start-up Skills we will replace or add secondary education with a measure of the quality of management education.
- We may also include some measure of expenditures on education.
- On Pillar 13 Internationalization we will replace the globalization pillar with a measure of Complexity.

For Knowledge institutions

- Quality of management schools – categorical indicator of Global Competitiveness Index; it measures the quality of business schools [1 = extremely poor—among the worst in the world; 7 = excellent—among the best in the world]; data are av. from 2006 to 2016
- Expenditure on education as % of total government expenditure – UN Statistics Data; data availability is relatively different among countries

5.5 A Summary of what we have proposed

- **Opportunity recognition:** Replace size of country and agglomerations of economic activity with economic freedom.
- **Start-up skills:** Replace secondary education with quality of management education.

- **Risk acceptance:** The institutional variable is business risk. This variable could be updated to an OECD measure of risk perception.
- **Networking:** Replace internet usage with a broader measure of social media.
- **Cultural support:** The institutional variable is corruption.
- **Opportunity start-ups:** replace economic freedom with taxation and government efficiency.
- **Tech sector:** the institutional pillar is technology absorption.
- **Human capital.** Replace staff training with labor markets and regulation.
- **Competition.** The institutional variable is market dominance.
- **Product Innovation:** The institutional variable is technology transfer.
- **Process innovation.** The institutional expenditure on research and development. We could also introduce the quality of educational institutions here.
- **High growth.** Replace business strategy. Equity finance as an institutional variable to include crown, angels and venture capital.
- **Internationalization.** Replace globalization with a measure of complexity. The variable is old and does not change much.
- **Finance.** The institutional variable for finance is of depth of capital markets. The variable can be adjusted to reflect the way in which the financial system assists start-ups.

5.6 What a new GEI looks like

THE STRUCTURE OF THE GLOBAL ENTREPRENEURSHIP INDEX													
Attitudes Sub-Index				Abilities Sub-Index				Aspirations Sub-Index					
OPPORTUNITY PERCEPTION	STARTUP SKILLS	RISK PERCEPTION	NETWORKING	CULTURAL SUPPORT	OPPORTUNITY STARTUP	TECHNOLOGY ABSORPTION	HUMAN CAPITAL	COMPETITION	PRODUCT INNOVATION	PROCESS INNOVATION	HIGH GROWTH	INTERNATIONALIZATION	RISK CAPITAL
OPPORTUNITY FREEDOM	EDUCATION QUALITY	BUSINESS RISK	DIGITAL CONNECTIVITY	CORRUPTION	TEAOPPORT TAXATION	TECHABSORP	LABOR MARKET	MARKDOM	TECHTRANSFER	GERD/QUALITY OF SCIENTIST	VENTURE CAPITAL	COMPLEXITY	DEPTH OF CAPITAL MARKET EXPORT
	SKILL		KNOWENT	CARSTAT						NEW/T	GAZELLE		IN/INV

Table 2: The New GEDI Structure

Changes with red letters

Table 2 shows what the new GEI would look like and below we list the potential institutional variables that we would use. The description of the new potential institutional variables is: FREEDOM: removed from the OPPORTUNITY STARTUP pillar and move to OPPORTUNITY PILLAR

EDUCATION QUALITY: besides the enrolment in post-secondary education we could include a measure of the quality of management education.

- potential variable: Quality of the education system or the quality of management schools from World Economic Forum, or expenditure on education
 - Quality of the education system: In your country, how well does the education system meet the needs of a competitive economy? [1 = not well at all; 7 = extremely well]
 - Quality of management schools In your country, how do you assess the quality of business schools? [1 = extremely poor—among the worst in the world; 7 = excellent—among the best in the world]
 - Expenditure on education as % of total government expenditure – UN Statistics Data; data availability is relatively different among countries

DIGITAL CONNECTIVITY: instead of only the use of the internet we could use a more sophisticated variable from the ITU Database like the Percentage of the population covered by at least a 3G mobile network, or some social networking data

TAXATION: We plan to combine two variables on that reflect to the cost of paying taxes and the other that reflect to the quality of government services

- Paying taxes distance to frontier – composite indicator about taxation provided by Doing Business project (Authors: World Bank Group and PWC); data are available from 2006 to 2016
- ICRG Indicator for Quality of government – The mean value of the ICRG variables "Corruption", "Law and Order" and "Bureaucracy Quality", scaled 0-1. Higher values indicate higher quality of government; data are av. from 2000 to 2012

QUALITY OF SCIENTISTS: besides GERD we could introduce another variable that measures the quality of math and science education and/or the availability of scientists and engineers

- Quality of math and science education in your country, how do you assess the quality of math and science education? [1 = extremely poor—among the worst in the world; 7 = excellent—among the best in the world] |
- Availability of scientists and engineers In your country, to what extent are scientists and engineers available? [1 = not at all; 7 = widely available] | 2014–15 weighted average

LABOR MARKET: The staff training just only partially captures labor market characteristics, so we will to replace staff training with an institutional variable that measures labor market efficiency.

VENTURE CAPITAL: instead of business strategy variable we could use a measure of venture capital crowdfunding and angels.

COMPLEXITY: instead of globalization we could use a more reliable data that is the economic complexity index.

- Economic Complexity Index – indicator introduced by Hidalgo and Hausmann (2009), indicates the interactions and network of a country's economy (Author: MIT Media Lab Macro Connections group); data are av. from 1964 to 2013

6. Conclusions

Research on entrepreneurship is mainly focused on the individual and research on innovation has been mainly focused on institutions even though we know that both agency and context matter. National Systems of Entrepreneurship (NSE) is a framework for resource allocation driven by individual-level opportunity pursuit through the creation of new ventures and its outcomes regulated by country-specific institutional characteristics.

This paper has further explored Finance, Taxes, Labour Markets and Knowledge Institutions as pillars that might impact entrepreneurship that have not been included in the GEI approach up until now. We will further explore the role of the digital economy as it pertains to digital skills. Since we are only looking at EU countries a richer set of data exists to explore these avenues in the ecosystem. This paper draws on the NSE framework, set it in a larger context, examines the logic of the approach and discussed how the approach can be improved. However, building these institutional variables into the Global Entrepreneurship Index (GEI) are limited by data availability and the fit of the new potential variables to existing ones.

What we have here is some ideas on how to proceed with expanding the NSE ecosystem to include what seems obviously important to start ups: finance, taxes, labor market regulation, knowledge institutions and digital skills. Which variables to pick and if they actually work is part of the next phase of the project.

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8. Appendix

Table A1: The description of the individual variables used in the GEI

Individual variable	Description
Opportunity Recognition	The percentage of the 18-64 aged population recognizing good conditions to start business next 6 months in area he/she lives,
Skill Perception	The percentage of the 18-64 aged population claiming to possess the required knowledge/skills to start business
Risk Acceptance	The percentage of the 18-64 aged population stating that the fear of failure would not prevent starting a business
Know Entrepreneurs	The percentage of the 18-64 aged population knowing someone who started a business in the past 2 years
Carrier	The percentage of the 18-64 aged population saying that people consider starting business as good carrier choice
Status	The percentage of the 18-64 aged population thinking that people attach high status to successful entrepreneurs
Career Status	The status and respect of entrepreneurs calculated as the average of Carrier and Status
Opportunity Motivation	Percentage of the TEA businesses initiated because of opportunity start-up motive
Technology Level	Percentage of the TEA businesses that are active in technology sectors (high or medium)
Educational Level	Percentage of the TEA businesses owner/managers having participated over secondary education
Competitors	Percentage of the TEA businesses started in those markets where not many businesses offer the same product
New Product	Percentage of the TEA businesses offering products that are new to at least some of the customers
New Tech	Percentage of the TEA businesses using new technology that is less than 5 years old average (including 1 year)
Gazelle	Percentage of the TEA businesses having high job expectation average (over 10 more employees and 50% in 5 years)
Export	Percentage of the TEA businesses where at least some customers are outside country (over 1%)
Informal Investment Mean	The mean amount of 3 year informal investment
Business Angel	The percentage of the 18-64 aged population who provided funds for new business in past 3 years excluding stocks & funds, average
Informal Investment	The amount of informal investment calculated as $INFINVMEAN * BUSANG$

Table A2: The description and source of the institutional variables used in the GEI

Institutional Variable	Description	Source of Data	Data Availability
Domestic Market	Domestic market size that is the sum of gross domestic product plus value of imports of goods and services, minus value of exports of goods and services, normalized on a 1–7 (best) scale data are from the World Economic Forum Competitiveness	World Economic Forum	The Global Competitiveness Report 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010,
Urbanization	Urbanization that is the percentage of the population living in urban areas, data are from the Population Division of the United Nations, 2011	United Nations	http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS/countries
Market Agglomeration	The size of the market: a combined measure of the domestic market size and the urbanization that later measures the potential agglomeration effect. Calculated as domestic market urbanization*	Own calculation	-
Tertiary Education	Gross enrolment ratio in tertiary education, 2011 or latest available data.	UNESCO	http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=167
Business Risk	The business climate rate “assesses the overall business environment quality in a country...It reflects whether corporate financial information is available and reliable, whether the legal system provides fair and efficient creditor protection, and whether a country’s institutional framework is favorable to intercompany transactions” (http://www.trading-safely.com/). It is a part of the country risk rate. The alphabetical rating is turned to a seven-point Likert scale from 1 (D rating) to 7 (A1 rating). December 30, 2012 data	Coface	http://www.coface.com/CofacePortal/COM_en_EN/pages/home/risks_home/business_climate/rating_table?geoarea-country=&crating=&brating=
Internet Usage	The number of Internet users in a particular country per 100 inhabitants, 2012 data	International Telecommunication Union	http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
Corruption	The Corruption Perceptions Index (CPI) measures the perceived level of public-sector corruption in a country. “The CPI is a ‘survey of surveys’, based on 13 different expert and business surveys.” (http://www.transparency.org/policy_research/surveys_indices/cpi/2009) Overall	Transparency International	http://cpi.transparency.org/

	performance is measured on a ten-point Likert scale. Data are from 2012.		
Economic Freedom	“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. The score is based on 10 factors, all weighted equally, using data from the World Bank’s <i>Doing Business</i> study.” (http://www.heritage.org/Index/pdf/Index09_Methodology.pdf). Data are from 2011.	Heritage Foundation/ World Bank	http://www.heritage.org/index/explore.aspx
Tech Absorption	Firm-level technology absorption capability: “Companies in your country are (1 = not able to absorb new technology, 7 = aggressive in absorbing new technology)”	World Economic Forum	The Global Competitiveness Report 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010,
Staff Training	The extent of staff training: “To what extent do companies in your country invest in training and employee development? (1 = hardly at all; 7 = to a great extent)”	World Economic Forum	The Global Competitiveness Report 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010,
Market Dominance	Extent of market dominance: “Corporate activity in your country is (1 = dominated by a few business groups, 7 = spread among many firms)”	World Economic Forum	The Global Competitiveness Report 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010,
Technology Transfer	These are the innovation index points from GCI: a complex measure of innovation, including investment in research and development (R&D) by the private sector, the presence of high-quality scientific research institutions, the collaboration in research between universities and industry, and the protection of intellectual property	World Economic Forum	The Global Competitiveness Report 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010,
GERD	Gross domestic expenditure on R&D (GERD) as a percentage of GDP, year 2011 or latest available data; Puerto Rico, Dominican Republic, United Arab Emirates, and some African countries are estimated	UNESCO	http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=2656
Business Strategy	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	The Global Competitiveness Report 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010,

Globalization	A part of the Globalization Index measuring the economic dimension of globalization. The variable involves the actual flows of trade, foreign direct investment, portfolio investment, and income payments to foreign nationals, as well as restrictions of hidden import barriers, mean tariff rate, taxes on international trade, and capital account restrictions. Data are from the 2013 report and based on the 2010 survey. http://globalization.kof.ethz.ch/media/filer_public/2013/03/25/rankings_2013.pdf	KOF Swiss Economic Institute	Dreher, A. (2006). Does Globalization Affect Growth? Evidence from a new Index of Globalization, <i>Applied Economics</i> 38, 10: 1091-1110.
Depth of Capital Market	The depth of capital market is one of the six sub-indices of the Venture Capital and Private Equity Index. This variable is a complex measure of the size and liquidity of the stock market, level of IPO, M&A, and debt and credit market activity. Note that there were some methodological changes over the 2002-2012 time period, so comparison to previous years is not perfect. The dataset is provided by Alexander Groh.*	EMLYON Business School, France and IESE Business School, Barcelona, Spain	Groh, A, H. Liechtenstein and K. Lieser. (2012). The Global Venture Capital and Private Equity Country Attractiveness Index 2012 Annual, http://blog.iese.edu/vcpeindex/about/