Entrepreneurship in Hungary in 2006-2010 based on the Global Entrepreneurship and Development Index (GEDI) methodology

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Abstract: Building on the Ács-Szerb Global Entrepreneurship and Development Index (GEDI) methodology this paper aims to show the public policy applicability of GEDI. GEDI is a complex measure of entrepreneurship involving three sub-indices, 14 pillars and 28 variables. By answering four research questions we present Hungary's entrepreneurial profile, show the change of the entrepreneurship over the 2006-2010 time period, and identify the strengths and the weaknesses. Hungary is compared to three important country groups. GEDI is a useful tool for policy-oriented analysis. Unlike other research projects that provide rather general and uniform policy suggestions, GEDI offers individual country level, tailor-made policy recommendations. Based on the principle of the weakest link, we present an optimal policy mix for Hungary involving the eight weakest performing pillars to improve Hungary's GEDI score.

1 Introduction

Increasing the "wealth of the nations" has been at the centre of economic and public policy for centuries. Capital accumulation played an important role in economic development in the 19th and most of the 20th century. However, the increase of the stock of capital and labour explains only a fraction of total factor

productivity and long term economic growth according to the empirical implications of the famous neo-classical Solow model [1]. Over the last decades, economists have developed many alternative models for clarifying economic development by incorporating other factors like technological change, knowledge, human resource (capital), and institutions [2] [3] [4].

A common feature of the approaches mentioned above is the attempt to limit and identify the most important factors for growth to only a few variables. However, less attention was paid to examining the underlying, micro-economic structure that for the most part remained in the 1black box'. In the 1980s another approach, the development of a system of complex, multifaceted factors began to emerge. Since the inception of the first complex measure, the Human Development Index, there have been over 200 composite indices created [5]. One of the most popular indicators, the Global Competitiveness Index (GCI) is constructed from hundreds of factors aiming to explain competitiveness and ultimately economic development [6].

While entrepreneurship is widely believed to play an important role in economic development through "creative destruction" [7] the incorporation of entrepreneurship in formal economic models has not met any real success. A major reason for this failure is the inappropriate identification of the proper measure of entrepreneurship. Whilst entrepreneurship is considered to be a multidimensional concept associated with factors such as innovation, new venture creation, specific entrepreneurial features, traits, attitudes, behaviours or decision making, the most widely used measures of entrepreneurship are single-dimensional variables [8]. Even more importantly, dominant entrepreneurship indicators such as the rate of new business creation, the Global Entrepreneurship Monitor's (GEM) Total Early-Phased Entrepreneurial Activity (TEA) index, or business ownership rates, correlate negatively with economic development. Since these self employment type of rates are the highest in the mainly agricultural, lower developed countries, it could imply that, for example, Uganda is more entrepreneurial than the US [9]. The self employment based public policy suggestions are even more ridiculous: In order to develop, entrepreneurship should be decreased, contrary to common sense and to dominant economic development theories.

The clarification of the role of entrepreneurship in economic development has been a major aim of the Global Entrepreneurship and Development Index (GEDI) research [8] Presently, the GEDI index is the only comprehensive measure consistently explaining the role of entrepreneurship in economic development. While the GEDI methodology has been available since 2009, the policy application of GEDI has received only limited attention [10] This paper aims to analyze the entrepreneurial performance of Hungary, a small, EU member country, Hungary using the GEDI methodology.

Hungary is a small landlocked Central-Eastern European country. Its GDP per capita was approximately 20 000 (in international dollars) in 2010 which places it in the efficiency driven economy category. After forty years of a Socialist, planned economy system, Hungary embarked on a full transition to a market economy in 1988. Within a few years, Hungary built an effectively working economy with market-oriented institutions. However, by the 2000s, Hungary gradually began losing speed at the same time that other nations accelerated their transition process. By 2004, when Hungary became a member of the European Union, it was experiencing worsening macroeconomic and fiscal balances. Despite the increasing amount of EU funds and a favorable, growing world economy, Hungary was unable to capitalize on the advantages of EU accession. In 2008, Hungary was hit by the economic crisis and became the first European Union member ever to receive IMF assistance in order to avert an economic meltdown [11] The new Hungarian "crisis government" stabilized the fiscal balance mainly through short run restrictive tools leaving the problems of structural reforms to the newly elected parliament and government in 2010. Hungary's deteriorating economic situation can be seen in its relative ranking in four major indices from 2005 -2010 (Table 1).

Over a six year period (2005-2010), Hungary's rank fell in the Index of Economic Freedom (from 45th to 51st place out of 179 countries), the Global Competitiveness Index (from 35th to 52nd place out of 139 countries), the Corruption Perception Index (from 40th place to 50th place out of 179 countries) and improved only slightly in the World Bank's Ease of Doing Business Index (from 52nd to 46th place out of 183 countries). The most dramatic decrease occurred in 2008 when Hungary's ranking in the Global Competitiveness Index fell by 27 places (as compared to 2005). The ultimate question of this paper is how Hungary's level of entrepreneurship changed over the 2006-2010 time period?

	2005	2006	2007	2008	2009	2010
Ease of Doing Business - *World Bank*	52	60	66	50	41	46
Global Competitiveness Index - *World Economic Forum*	35	41	47	62	58	52
Corruption Perception Index - *Transparency International*	40	41	39	48-51	46	50
Index of Economic Freedom - *Heritage Foundation*	45	47	42	44	51	51

Key: Index sources shown in italics

Table 1:

Hungary's relative position in the four major index ranking over 2005-2010

The rest of this paper is structured as follows: It starts off with a description of the GEDI index and the Penalty for Bottleneck methodology. Next, we introduce four major research questions regarding Hungary's entrepreneurial performance. After a short description of the data set used, we use a GEDI based analysis to answer our four research questions. This is followed by the formulation of public policy suggestions that would enhance Hungary's level of entrepreneurship and spur continued economic development. This paper finishes with a summary.

2 The GEDI methodology

Different forms of entrepreneurship can be examined from various perspectives, stages and levels. The Global Entrepreneurship and Development Index (GEDI) created in 2008 measures country level entrepreneurship using a contextual perspective based on a National system of entrepreneurship perspective. A National System of Entrepreneurship can be defined 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" ([12] p. 11).

Acs and Szerb [8] summarizes the main features of the GEDI approach as follows:

- Entrepreneurship is a multidimensional concept. The GEDI incorporates three sub-indices, 14 pillars and 28 variables reflecting to the different aspects of entrepreneurship.
- Each pillar consists of an individual and an institutional component.
- The components of entrepreneurship constitute a system.

A useful theoretical approach for incorporating the dynamic interaction of entrepreneurial attitudes, activities, aspirations and context is offered by Configuration Theory [13]. Configurations are defined as *"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."*([14] pp. 775-776.)

The Penalty for Bottleneck (PFB) methodology used by the GEDI provides a practical application of configuration theory by claiming that entrepreneurship pillars interact. According to the PFB, the optimal configuration consists of the equal values of all the 14 pillars of entrepreneurship; if they are out of balance, entrepreneurship is inhibited.[1] A bottleneck is defined as the worst performing

1 The actual values of a particular pillar are calculated by normalizing all the country values to the (0,1) interval in such a way that the best country receives 1 and the worst country receives 0 value. All the other countries receive a score somewhere between 0

pillar or binding constraint in the system. With respect to entrepreneurship, a bottleneck refers to a shortage or the lowest level of a particular entrepreneurial pillar, relative to other pillars. The PFB is based on the assumption that the pillars of entrepreneurship can only be partially substitutable with one another. Hence, the good performance in one particular pillar does not fully compensate for another bad performing pillar. In other words, the bad performing pillars constrain the good performing pillars and ultimately the whole GEDI index score.[2]

Technically the six basic steps for creating the GEDI Index scores using PFB are the following:

1. Individual level variables and institutional level variables collected from a variety of internationally recognized data sources are matched to form 14 pillars;
2. Pillar values are calculated using the interaction variable method; i.e. by multiplying the individual variable with the corresponding institutional variable;
3. Pillar values for each of the 14 pillars are normalized to 0 as the lowest and 1 as the highest value;
4. The PFB is applied to get the PFB adjusted values for all of the 14 pillars;
5. Pillar values form the overall scores for the three sub-indices Entrepreneurial Attitudes, Entrepreneurial Activity, and Entrepreneurial Aspirations. The value of a sub-index for any country is the arithmetic average of its PFB-adjusted pillars for that sub-index. The maximum value of the sub-indices is 1 and the potential minimum is 0, both of which reflect the relative position of a country for a particular sub-index;
6. Finally, the overall GEDI value is simply the average of the three sub-indices.

The GEDI index is based on three sub indices. According to the GEDI approach, E*ntrepreneurial Attitudes* are attitudes associated with the entrepreneurship-related behavior of a country's population including opportunity perception, startup skills, risk aversion, networking potential and cultural support. E*ntrepreneurial Activity* is principally concerned with measuring high growth potential start-up abilities amongst the nascent and startup business owners. High growth potential is assessed using quality measures including opportunity start-up motives, active in a technology intensive sector, the level of education as well as the uniqueness of the offered product/service in relation to competitors. *Entrepreneurial Aspiration* refers to the distinctive, qualitative, market expanding, wealth enhancing entrepreneurial activity such as the newness of the product and technology used by a venture, internationalization, high growth ambitions as well as the availability of risk capital.

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and 1. In a similar way we can calculate the normalized scores for all the 14 pillars and all the countries. A country's entrepreneurship is considered to be optimal if all the 14 pillars have the same normalized values.

2 For more details about the PFB methodology see [15].

3 The research questions

While a scientific paper generally involves hypothesis testing, this approach is not really suitable to examine Hungary's entrepreneurial performance. Here, we apply the GEDI methodology to answer four research questions.

3.1 First research question: How entrepreneurial is Hungary?

A major advantage of the GEDI analysis is the capability to express the overall entrepreneurial performance of a country in one number. According to Baumol [16] the supply of entrepreneurship is constant over time and development. However, not all entrepreneurship is equally useful. Besides productive forms of entrepreneurship, there are also unproductive or destructive forms of entrepreneurship. The actual overall GEDI score represents a country's productive entrepreneurship. Since this number is between zero and one, it is possible to examine how far Hungary is from the theoretical maximum value one. Entrepreneurial performance can also be analyzed through relative comparisons. A more reasonable comparison is to evaluate how far Hungary's GEDI score is from the development implied trend-line. Below trend-line score means lower while above trend-line score means higher entrepreneurial performance than implied by economic development. Another evaluation can be done by comparing Hungary to relevant countries and country groups. The proper selection of the benchmarking countries and groups could provide valuable insights into the relative performance of the examined country to similarly developed countries and regions.

3.2 Second research question: How has the level of Hungary's entrepreneurship changed over time?

In addition to the actual level of entrepreneurship in Hungary, it is also interesting to examine the changes to entrepreneurship over time. The GEDI scores are available for the 2006-2010 time period, so it is possible to make a time-trend comparison of the GEDI index and the three sub-indices. The 2006-2010 period is particularly interesting because of the global economic crisis. In order to capture the possible effects of the crisis, these five years are divided into two distinct periods: before the economic crisis (2006-2008) and after the economic crisis (2009-2010). While the overall level of entrepreneurship decreased from 2006-2008 to 2009-2010, the decline was not evenly distributed among countries. It is interesting to see how Hungary's entrepreneurial performance changed as compared to other countries and country groups.

We also examine the change of Hungary's entrepreneurial performance in terms of the three sub-indices, Entrepreneurial Attitudes (ATT), Entrepreneurial Actions (ACT) and Entrepreneurial Aspirations (ASP). Further we also compare these three sub-indices to other relevant country groups.

3.3 Third research question: What are Hungary's entrepreneurial strengths and weaknesses?

An analysis of GEDI's 14 pillars including both individual and institutional aspects provides a more detailed and deeper understanding of the entrepreneurial performance in a particular country. The main focus of the GEDI analysis is the identification of the weak factors, called bottlenecks for entrepreneurship. This implies that if a country performs weakly in some pillars, these weaknesses spill over to the other pillars, thereby holding back overall entrepreneurial performance. According to domestic experts and researchers, Hungary is particularly weak in innovation [17], finance [18] networking [19], and internationalization [20]. In addition, there is a lack in high growth, high impact ventures [21], and cultural support [22]. Entrepreneurial opinion surveys regarding the most impeding factors for business growth provide a different picture highlighting institutional limitations such as high taxes, the unpredictability of regulations and high administrative burdens [19]. Contrasting these impeding factors with the GEDI implied weaknesses could present an interesting picture regarding Hungary's problematic areas. A unique feature of the GEDI analysis is the capability to measure and rank these problematic areas.

It is also possible to calculate the magnitude of a bottleneck. The Average Bottleneck Gap (ABG) demonstrates how much a particular country's GEDI pillar values lag behind, on average, its best performing pillar. Low ABG implies unbalanced entrepreneurship configuration of the fourteen pillars. When configuration is optimal, and all the pillar values are the same then ABG is equal to 100 percent. Hungary's ABG score will be compared and analyzed in relation to the other three country groups.

3.4 Fourth research question: What can be done to improve Hungary's entrepreneurial performance?

The perspectives of entrepreneurship policy have changed over the last several decades. Departing from the traditional focus on small business, entrepreneurship policy has become a multifaceted tool that has been applied not only to support the creation and growth of new firms (micro level) and to change the institutional setup but also to promote economic growth and development in general (macro view) [23], [24]. The GEDI index construction is a particularly useful tool for policies aiming to enhance entrepreneurship in a particular country. Unlike other research projects that intend to identify the single most important factor of entrepreneurship GEDI looks for an optimal balance of all the fourteen pillars of entrepreneurship. Moreover, these other research projects propose rather general and uniform policy suggestions, while GEDI offers individual, country level, tailor-made policy recommendations. Here we provide public/entrepreneurship policy suggestions to improve Hungary's GEDI score and ultimately enhance economic development.

The optimal allocation of the additional resources is a core problem of any policy recommendations. The PFB methodology implies that a country should improve its weakest pillar to improve its GEDI score the most. After alleviating the first bottleneck, the country should eliminate the second bottleneck and so forth, until the optimum solution is achieved. For Hungary, we present an entrepreneurship policy package including a portfolio of variables from eight pillars that need to be improved in order to attain a 0.1 increase in Hungary's GEDI score. This would result in a ranking for Hungary on par with the Czech Republic (ranked in 24th place).

4 Data and variable description

In the 2006-2010 time period, there were 83 countries that participated at least once in the GEM survey, 42 in 2006 and 2007, 43 in 2008, 54 in 2009 and 59 in 2010. Out of these 83 countries, we calculated the GEDI scores for 79 nations. The GEDI index consists of a total of fourteen pillars of entrepreneurial attitudes, activities, and aspirations. Each of the pillars is made up of national-level aggregates of individual data, combined by data reflecting to national institutional conditions. All of the individual-level data are derived from the GEM adult population survey results, as published in annual GEM executive reports. National institutional variables are derived from different sources, including the World Bank, World Economic Forum, UNESCO, Coface, KOF Swiss Economic Institute and the Heritage Foundation. For an exact description of the variables used see the Appendix.

The 2009-2010 pillar calculations are based on the average of the 2009-2010 or the latest available single year individual variables and the 2010 institutional variables for all the 79 countries. For time-trend comparison, we calculate the pillars based on the two year moving average of the individual variables and the actual year institutional variables. In the absence of two year data single year data are applied. While this second methodology provides a more accurate method of calculation, the first one makes it possible to examine all the 79 countries together.

In this paper, we compare Hungary to three country groups. The first country group includes 11 countries that make up the group called 'Transitional countries'. This group is one of the five country groups formed by using cluster analysis to match up countries with similar entrepreneurial features in the GEDI Index [8] except four Central and Eastern European (CEE) members (Croatia, Latvia, Montenegro and Poland). These countries are Greece, Hong Kong, Italy, Japan, Korea, Portugal, Saudi Arabia, South Africa, Spain, Turkey and Uruguay. The second, CEE country group contains members that share a socialist past and that introduced new market oriented system s in the 1990's. The countries in this group include Bosnia and Herzegovina, Croatia, Czech Republic, Latvia, Macedonia, Montenegro, Romania, Russia, Serbia and Slovenia. The third comparison group

is the European Innovation Leaders, part of the Innovation Leader group from the cluster analysis. All five country members of this group: Belgium, Denmark, Iceland, Sweden and United Kingdom, are ranked within the top 15 countries in the GEDI Index.

5 Entrepreneurship in Hungary 2006-2010: The analysis

In this part of the paper we are examining and analyzing Hungary by answering three of the four research questions raised in the Research questions section. The fourth question pertaining to entrepreneurship policy suggestions will be addressed in the following section.

In order to answer the first research question: *"How entrepreneurial is Hungary?"*we present the GEDI country rankings in table 2.

Hungary's overall GEDI score of 0.31 places it slightly below the development implied trend-line value of 0.33 shown in Table 2 indicating that Hungary's overall entrepreneurial performance is somewhat lower than would be expected given its level of GDP. Compared to other Transitional country group (Greece, Hong Kong, Italy, Japan, Korea, Portugal, Saudi Arabia, South Africa, Spain, Turkey and Uruguay), Hungary's overall GEDI rank is on the 32nd -33th place, together with Poland, out of 79 included countries. Six Transitional countries have a higher score and five countries have a lower score.

Within the European context, Hungary's score was similar to most other European Transitional countries. It was only marginally better than Italy, Portugal and Greece. Spain was the highest ranking European Transitional country (0.33) though Korea was the highest ranking Transitional country (0.37). All five of the European Innovation Leader countries (Belgium, Denmark, Iceland, Sweden and United Kingdom) have much higher scores than Hungary and are within the top 13 ranked countries. Southern European Transitional countries including Greece, Italy and Portugal have similar entrepreneurial performance as Hungary and they tend to be the worst performing European countries in the GEDI index. By no coincidence, these countries were also most affected by the global economic crisis.

Hungary also ranks about in the middle when compared to the other 10 CEE countries included in the GEDI index[3]. Three CEE countries have higher overall GEDI scores: Slovenia (0.42) and the Czech Republic (0.41) which are also classified in the more advanced 'Innovation Follower' country group and Latvia

[3] The data used for Poland is from 2004 which is rather old. Therefore even though Poland is a CEE country, we do not include it in our analysis.

(0.32), a Transitional country. Croatia (0.30) received a marginally lower score than Hungary and Montenegro's overall score was lower (0.26). Romania and Macedonia both averaged a lower final score of 0.23 while Russia and Serbia received much lower final scores of 0.18 and 0.17, respectively. The lowest performing CEE country in the GEDI index was Bosnia and Herzegovina at 0.15 which is not surprisingly since this country is recovering after the ravages of war. In terms of the development implied trend-line, the Czech Republic, Latvia, Montenegro and Slovenia are above the trend-line, Hungary and Macedonia are slightly below the trend line, the remaining countries, Bosnia and Herzegovina, Croatia, Romania, Russia, and Serbia are below the trend-line. The largest gap can be noticed in the case of Russia.

Rank	Country	GEDI	Trend	Rank	Country	GEDI	Trend
1	United States	0.63	0.55	41	South Africa	0.26	0.22
2	Australia	0.58	0.52	42	Peru	0.26	0.20
3	Sweden	0.58	0.52	43	Lebanon	0.25	0.25
4	Canada	0.57	0.52	44	Mexico	0.25	0.26
5	Denmark	0.56	0.51	45	Argentina	0.24	0.26
6	Switzerland	0.56	0.51	46	Malaysia	0.24	0.26
7	Iceland	0.56	0.51	47	Tunisia	0.24	0.20
8	Belgium	0.53	0.50	48	Romania	0.23	0.26
9	Norway	0.51	0.53	49	Macedonia	0.23	0.22
10	Netherlands	0.50	0.53	50	Jamaica	0.21	0.19
11	Singapore	0.50	0.55	51	Panama	0.21	0.25
12	Taiwan	0.49	0.46	52	Trinidad and Tobago	0.21	0.40
13	United Kingdom	0.49	0.50	53	Jordan	0.21	0.17
14	Germany	0.48	0.50	54	Dominican Republic	0.20	0.20
15	Austria	0.47	0.52	55	Costa Rica	0.20	0.23
16	Ireland	0.47	0.54	56	Brazil	0.20	0.22
17	Finland	0.47	0.49	57	Indonesia	0.20	0.16
18	France	0.47	0.48	58	Algeria	0.20	0.20
19	Puerto Rico	0.46	0.28	59	Venezuela	0.20	0.24
20	United Arab Emirates	0.46	0.51	60	China	0.19	0.18
21	Israel	0.46	0.42	61	Morocco	0.19	0.16
22	Slovenia	0.42	0.41	62	Russia	0.18	0.32
23	Chile	0.42	0.26	63	Thailand	0.18	0.19
24	Czech Republic	0.41	0.39	64	Syria	0.18	0.16
25	Korea	0.37	0.41	65	Kazakhstan	0.17	0.23
26	Japan	0.37	0.47	66	Serbia	0.17	0.23
27	Saudi Arabia	0.36	0.37	67	Iran	0.17	0.23
28	Spain	0.35	0.47	68	Egypt	0.16	0.17
29	Uruguay	0.34	0.25	69	Bolivia	0.16	0.16
30	Hong Kong	0.33	0.55	70	Bosnia and Herzegovina	0.15	0.20
31	Latvia	0.32	0.27	71	Ecuador	0.15	0.20
32	Poland	0.31	0.32	72	Philippines	0.15	0.15
33	Hungary	0.31	0.33	73	Pakistan	0.14	0.15

34	Italy	0.30	0.46	74	Ghana	0.13	0.14
35	Portugal	0.30	0.38	75	India	0.13	0.15
36	Croatia	0.30	0.33	76	Zambia	0.13	0.14
37	Turkey	0.29	0.26	77	Guatemala	0.13	0.16
38	Greece	0.29	0.44	78	Angola	0.12	0.17
39	Colombia	0.27	0.20	79	Uganda	0.08	0.14
40	Montenegro	0.26	0.25				

Key: Transitional country group are shaded in gray.
Trend: The trend value is the GEDI value according to development implied trend-line.

Table 2:
The Global Entrepreneurship and Development Index overall rank of the countries, 2009 – 2010

Now let's turn to answering the second research question: "*How has the level of Hungary's entrepreneurship changed over time?*"

According to Figure 1, the overall level of entrepreneurship, measured by the GEDI scores was in the 0.23-0.25 range before the crisis, in 2006-2008. The GEDI score increased to 0.26 by 2009 followed by a further 28% increase by 2010. Having a closer look at to the three sub-indices, it seems that Entrepreneurial Aspirations (ASP) experienced the greatest increase from 0.10 in 2008 to 0.23 in2010. Even with this improvement, Hungary's ASP was still 35% below the development implied trend line. Entrepreneurial Attitudes (ATT) increased significantly from 2006 to 2007, but it basically remained unchanged from 2008-2010. Entrepreneurial Activity (ACT) did not change much from 2006-2009. However, ACT went up by 18% from 2009 to 2010. With this improvement Hungary's ACT is exactly on the development implied trend-line.

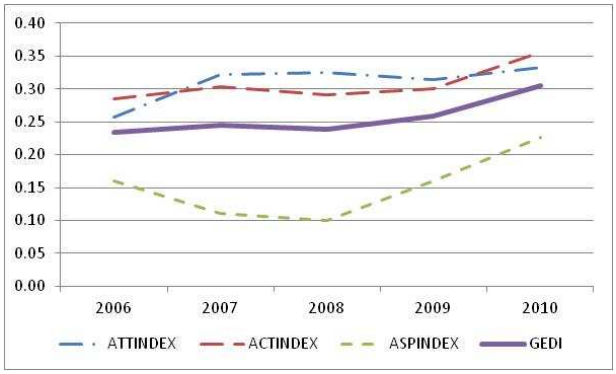

Figure 1
The change of GEDI and the three sub-indices in Hungary, 2006-2010

Altogether, Hungary's entrepreneurial position improved over the 2006-2010 time period mainly due to the increase in the pillars of the ASP sub-index. Hungary is

in a unique position with this progress, since the GEDI index and the three sub-index values declined in the case of the three comparable country groups (Table 3). In Hungary, official statistics reported record numbers of business closeouts in 2010 (27,433 closeouts), but there were even more new startups (47,455 startups).[4] An important finding in the current GEDI (2012) is that these new start-ups are more entrepreneurial than the previously founded businesses. While these changes are welcome, Hungary's GEDI score is still 7% below the development implied trend line.

	Hungary		Transitional countries		CEE countries		European innovation leader countries	
Time period	2006-2008	2009-2010	2006-2008	2009-2010	2006-2008	2009-2010	2006-2008	2009-2010
Entrepreneurial Attitudes	0.30	0.36	0.36	0.37	0.30	0.30	0.58	0.56
Entrepreneurial Activity	0.29	0.35	0.35	0.33	0.32	0.28	0.63	0.58
Entrepreneurial Aspirations	0.12	0.21	0.27	0.26	0.28	0.25	0.51	0.49
GEDI	0.24	0.31	0.33	0.32	0.30	0.28	0.57	0.54

Table 3

The change of the three sub-indices and GEDI scores in Hungary and in the three country groups from 2006-2008 to 2009-2010

We obtain a more detailed picture regarding Hungary's entrepreneurial position by answering the question '*What are Hungary's entrepreneurial strengths and weaknesses?'* An analysis of GEDI's 14 pillars including both individual and institutional aspects provides a deeper understanding Hungary's entrepreneurial profile and performance. Similar to the previous cases, we provide both a comparative and a Hungary-focused analysis. Table 4 shows the comparative situation of Hungary in relation to the three country groups.

European Innovation Leader countries score the highest on 13 out of the 14 pillars in both time periods. While the differences are marginal, Transitional countries score the highest for the Startup Skills pillar in 2009-2010. The fact that the Opportunity Perception pillar is weak in the former socialist, CEE countries is not surprising. These countries share a long history of state-controlled economic activity. Private businesses were not only restricted but in many cases prohibited for decades. On the one hand, it is surprising that Hungary, a leading and early reformer, exhibits a critically low level of Opportunity Perception (0.12) even below the CEE country average. Cultural Support and Networking are also pillars that seem affected by the Socialist past shared by Hungary and CEE countries

[4] For more details see: http://www.feketelista.hu/ketszer-annyi-ceget-alapitottak-mint-amennyit-toroltek/

where the belief that entrepreneurs can only create wealth through exploitative, illegal and corrupt means is deeply rooted. Hungary and the CEE countries differ the most from Nonfear of Failure that is the lowest pillar in the CEE country group. Nonfear of Failure is traditionally Hungary's best pillar even better than the Transitional country average.

	Hungary		Transitional countries		CEE countries		European innovation leader countries	
	2006-2008	2009-2010	2006-2008	2009-2010	2006-2008	2009-2010	2006-2008	2009-2010
Entrepreneurial Attitudes								
Opportunity Perception	0.12	0.12	0.35	0.34	0.20	0.14	0.51	0.41
Start-up Skills	0.46	0.53	0.51	0.56	0.44	0.50	0.51	0.51
Nonfear of Failure	0.60	0.62	0.46	0.50	0.43	0.36	0.73	0.80
Networking	0.28	0.49	0.23	0.30	0.35	0.42	0.64	0.67
Cultural Support	0.33	0.32	0.47	0.42	0.28	0.27	0.75	0.72
Entrepreneurial Activity								
Opportunity Startup	0.46	0.52	0.47	0.50	0.38	0.34	0.88	0.86
Tech Sector	0.18	0.33	0.29	0.19	0.27	0.17	0.49	0.50
Quality of Human Resource	0.39	0.41	0.29	0.25	0.36	0.32	0.66	0.53
Competition	0.34	0.28	0.50	0.54	0.45	0.43	0.77	0.74
Entrepreneurial Aspirations								
Product Innovation	0.13	0.23	0.47	0.45	0.31	0.27	0.61	0.64
Process Innovation	0.10	0.09	0.18	0.20	0.21	0.16	0.51	0.48
High Growth	0.15	0.24	0.28	0.22	0.37	0.29	0.41	0.37
Internationalization	0.30	0.46	0.40	0.44	0.55	0.52	0.63	0.72
Risk Capital	0.01	0.10	0.17	0.12	0.13	0.16	0.57	0.43

Table 4

GEDI's fourteen pillars in 2006 - 2008 and 2009-2010 for Hungary and three country groups

Entrepreneurial Activity is relatively the strongest GEDI sub-index for Hungary. In fact in 2009 - 2010, Hungary outperforms the CEE and transitional country averages for 3 out of 4 pillars. The strong and improving score for the Opportunity Startup pillar contradicts the notion that most Hungarians only start businesses out of necessity. Instead, the majority of Hungarians are starting businesses motivated

by the identification of a good opportunity or increasing income. Another noteworthy finding is the greatly improved score for Technology Sector which almost doubled from 2006-2008 to 2009-2010. In Hungary's case this increase is related to the improved ability of Hungarian firms to absorb new technology. In both time periods, Hungary also performs well for Quality of Human Resources, with a relatively modest lag of 22 percent less than European innovation leader countries. This result is largely due to the fact that similar to European Innovation Leader countries; most Hungarian business owners have participated in post secondary education. However, Hungary's score for the Competition pillar is far below the three country group averages for both time periods. To a large extent, this low score is influenced by the large dominance of several business groups in the Hungarian market.

Comparing the two time periods, Hungary clearly has improved its performance in four pillars of Entrepreneurial Aspirations but its performance decreased marginally for Process Innovation. The weakness for Process Innovation indicates that research and development (R&D) and the application frequency of new technology are at relatively low levels. Risk Capital is a weak pillar for Hungary but also for Transitional countries and CEE countries. Even though Hungary's score for Risk Capital improved in 2009 - 2010, its score is still very weak reinforces the widely shared belief that business financing and undercapitalization is a critical weakness of Hungarian start-ups ad new ventures. Similarly, Hungary significantly improved its performance for the Product Innovation (by 57%) and High Growth (40%) pillars yet both overall pillar values are still lower than those for CEE country averages. Product Innovation seems to be a weakness not only for Hungary but also for other CEE countries which indicates lower levels of new product development. In the initial period of the market economy, businesses in these countries could easily profit from simply introducing existing products into their domestic markets. However further innovation and development of new products is critical to maintain country competitiveness in the later phases of economic transition. In both periods, Hungary performs best on the Internationalization pillar. Hungary, unlike many other Transitional countries, has one of the most open economies in the world. However, exporting is largely driven by multinationals and large businesses: exporting activities by smaller sized firms and new firms in Hungary is actually below the international average. So even though Hungary scores well on this pillar, it needs to focus on increasing export behavior and competitiveness among its smaller firms. In spite of improvements, Entrepreneurial Aspirations remains Hungary's weakest sub-index.

The 14 pillars that make up GEDI's three entrepreneurial sub-indices can be further subdivided into 28 variables. Each pillar is made up of an institutional and an individual variable. Delving into the most basic variable level allows for an even more specific analysis of Hungary's entrepreneurial performance. Table 5 presents the 28 normalized variable score values for Hungary in 2009 - 2010. The cells are color coded to indicate Hungary's relative position to the other 79 countries included in the GEDI index.

	INSTITUTIONAL VARIABLES		INDVIDUAL VARIABLES		PILLARS	
ENTREPRENEURIAL ATTITUDES	Market Agglomeration	0.45	Opportunity Recognition	0.15	Opportunity Perception	0.12
	Tertiary Education	0.65	Skill Perception	0.40	Start-up Skills	0.53
	Business Risk	0.83	Risk Acceptance	0.55	Nonfear of Failure	0.62
	Internet Usage	0.65	Know Entrepreneurs	0.25	Networking	0.49
	Corruption	0.37	Career Status	0.41	Cultural Support	0.32
ENTREPRENEURIAL ACTION	Economic Freedom	0.64	Opportunity Motivation	0.71	Opportunity Startup	0.52
	Tech Absorption	0.50	Technology Level	0.47	Tech Sector	0.33
	Staff Training	0.36	Educational Level	0.53	Quality of Human Resources	0.41
	Market Dominance	0.45	Competitors	0.44	Competition	0.28
ENTREPRENEURIAL ASPIRATIONS	Technology Transfer	0.37	New Product	0.23	Product Innovation	0.23
	GERD	0.22	New Tech	0.21	Process Innovation	0.09
	Business Strategy	0.34	Gazelle	0.30	High Growth	0.24
	Globalization	0.91	Export	0.44	Internationalization	0.46
	Venture Capital	0.11	Informal Investment	0.18	Risk Capital	0.10
	INSTITUTIONS	0.49	INDIVIDUAL	0.38	GEDI	0.31

Key: Light grey colored cell = Hungary's score belongs to the upper 33.3% of countries; Middle grey colored cell = Hungary belongs to the middle 33.3% of countries; Dark grey colored cell = Hungary belongs to the bottom 33.3% of countries.

Table 5

The relative position of Hungary at the variable level, 2009-2010 (normalized institutional and individual variable values)

As the final row in table 5 indicates the overall level of institutional variables places Hungary in the second third of the GEDI Index indicating that Hungary has a relatively well developed institutional environment for productive entrepreneurial development. This is especially true for six institutional variables which receive a score of over 0.50: Tertiary Education, Business Risk, Internet

Usage, Economic Freedom, Tech Absorption, and Globalization. Six other institutional variables receive a score of over 0.3: Market Agglomeration, Corruption, Staff Training, Market Dominance, Technology Transfer and Business strategy. However, even with the relatively high values for Market Dominance Hungary belongs to the lowest third of GEDI countries as indicated by their dark grey colored cell. The remaining two institutional variables, GERD and Venture Capital receive very low scores (0.22 and 0.11).

The scores for Hungary's individual variables exhibit opposing extremes: Opportunity Motivation, Technology Level, Educational Level, and Gazelle are light grey color-colored, indicating they belong to the top level (33.3% of all GEDI countries). At the same time eight variables – Opportunity Recognition, Skill Perception, Risk acceptance, Know Entrepreneurs, Carrier Status, New Product, and New Tech are coded dark-grey indicating they score in the lowest third of GEDI countries. All the five individual variables of the Entrepreneurial Aspirations sub-index belong to this category. The remaining two variables Export and Informal Investment are in the middle-grey zone indicating that they place Hungary in the middle third of GEDI countries. Despite the moderate position of Hungary the variable for Informal Investment is Hungary's second worst performing variable following Opportunity Recognition that is Hungary's worst individual variable. it is noteworthy that Opportunity Motivation is Hungary's third best performing variable. This indicates an interesting paradox: Even though most people begin businesses in Hungary motivated by opportunity (Opportunity Motivation) very few individuals actually recognize these business opportunities in the first place (Opportunity Recognition).

Now we are turn to calculating the magnitude of the bottleneck. The Average Bottleneck Gap (ABG) measures the balance of the 14 pillars. Hungary’s best pillar is Nonfear of Failure with 0.62 score. The ABG methodology implies that the remaining 13 pillars of Hungary, on the average, are only 51% of this best performing pillar value. The ABG value of the transitional and the CEE countries are even worse, 45% and 39%, respectively. The European innovation leader countries have higher GEDI scores and better balance: The average ABG score is 11% higher as compared to Hungary.

6 Entrepreneurship policy suggestions for Hungary

The GEDI analysis is useful as a policy tool to identify the weak areas hindering entrepreneurship development in a given country. GEDI is particularly suited for prioritizing areas that need to be addressed. Unlike other methodologies, the GEDI provides a comprehensive analysis of individual and institutional aspects of entrepreneurship based on the systems approach perspective. The resulting tailor-made, country specific entrepreneurship policy recommendations apply the following four underlying principles:

1. The best policy will increase a country's GEDI Index value the most.
2. Entrepreneurship policy recommendations are based on the pillar level, however as needed, policy recommendations include suggestions based on specific institutional or individual aspects.
3. Policy priorities begin with the weakest link, i.e. the lowest pillar value, followed by the second weakest pillar and so forth, in ascending order.
4. A GEDI sensitivity analysis provides an optimal policy mix of the pillars to improve the GEDI by 0.1. Assuming that the improvement of the pillars requires about the same additional new effort, it is possible to determine policy priorities and the distribution of the new efforts.

In this section, by answering our fourth research question: *'What can be done to improve Hungary's entrepreneurial performance?'*, we are also presenting our public policy suggestions on how to improve entrepreneurial performance in Hungary. Table 6 identifies the policy priority areas for Hungary by ranking pillars and corresponding individual and institutional variable scores from lowest to highest scores. We included two additional columns. The fifth column contains the required increase in the pillar values to reach a 0,1 raise of GEDI from 0.31 to 0.41. The sixth column shows how the new effort is divided in percentages to reach this 0.1 increase in GEDI. This analysis is based on the assumption that additional resource costs roughly the same for all the fourteen pillars Actually these two tables serve to present an optimal policy mix for Hungary including policy priorities. Other existing methodologies are unable to provide such policy recommendations. Policy priorities are divided into four categories ranging from the highest to the lowest priority.

	Pillars	Pillar values	Institutional values	Individual values	Required increase in pillar for 0,1 increase in GEDI	Percentage of total new effort	Policy priority
1	Process Innovation	0.09	**0.22**	**0.21**	0.25	24%	Top priority
2	Risk Capital	0.10	**0.11**	**0.18**	0.25	24%	
3	Opportunity Perception	0.12	0.45	**0.15**	0.23	22%	
4	Product Innovation	0.23	0.37	**0.23**	0.11	11%	Medium priority
5	High Growth	0.24	**0.34**	**0.30**	0.10	10%	
6	Competition	0.28	**0.45**	**0.44**	0.07	7%	
7	Cultural Support	0.32	**0.37**	**0.41**	0.02	2%	Low priority
8	Technology Sector	0.33	**0.50**	**0.47**	0.01	1%	
9	Quality of Human Resources	0.41	**0.36**	0.53	0.00	1%	No Priority
10	Internationalization	0.46	0.91	**0.44**	0.00	0%	
1	Networking	0.49	0.65	**0.25**	0.00	0%	

1							
12	Opportunity Startup	0.52	**0.64**	**0.71**	0.00	0%	
13	Startup Skills	0.53	0.65	**0.40**	0.00	0%	
14	Nonfear of Failure	0.62	0.83	**0.55**	0.00	0%	

Key: Bold letters in the Individual and Institutional variables denote which one of the variables should change to improve the pillar value. If both variables are bold then all two should be changed at the same time.
Top priority areas shown in dark grey; medium priority areas shown in middle grey; low priority areas shown in light grey and no priority areas shown in white.

Table 6

Policy priorities for Hungary's fourteen GEDI pillars its institutional and individual variables and the suggested distribution of the resources for a 0.1 GEDI increase, 2009-2010

Top policy priorities are defined as GEDI pillars that receive normalized value of less than 0.20. For Hungary, three pillars are classified as top priority: Process Innovation, Risk capital, and Opportunity Perception. In the cases of Process Innovation and Risk Capital both the individual and the institutional variables should be improved parallel to increase the particular pillar as well as the GEDI the most. The best way to upgrade the Opportunity Perception pillar is to increase its individual variable, the opportunity recognition capacity of the population. The GEDI methodology implies that around 70% of all the new effort should be turned for improving the three weakest pillar values; 24%-24% for Process Innovation and Risk Capital and 22% for Opportunity Perception.

The next category of policy priorities is Medium Priority defined as GEDI pillars that receive a normalized value of less than 0.30. For Hungary, three pillars: Product Innovation, High Growth and Competition belong to this category. The individual and institutional component values for High Growth and Competition pillars are relatively close to each other implying the need to strengthen both aspects. However, for the Product Innovation pillar, the individual variable New Product, has a much lower value than the corresponding institutional variable, Technology Transfer. Therefore, the policy priorities for improving Product Innovation should focus on New Product, i.e. the need to enhance new products and services. Since these three pillars show a more favorable situation than the top policy priority pillars, less effort is necessary to upgrade them. For optimizing the improvement, we suggest to allocate 11% of the new effort to improve Product Innovation, 10% to improve High Growth, and 7% to improve Competition.

The Low Priority group is categorized by normalized values that are between 0.30-0.40. Improving the performance of these pillars will only have a moderate effect on GEDI results. However, for optimum entrepreneurial performance in Hungary, it is important to maintain the level of these pillars. For Hungary, two pillars fall into this category: Technology Sector and Cultural Support. Both of these variables exhibit relatively small differences between their corresponding

individual and institutional variables. According to the GEDI methodology we suggest to turn only about 2% and 1% of the total new effort to improve Technology Sector and Cultural Support, respectively.

The final category contains GEDI pillars that received a normalized value of more than 0.40. For Hungary this includes the remaining six pillars: Quality of Human Resources, Internationalization, Networking, Opportunity Startup, Startup Skills, and Nonfear of Failure. It is not recommended to take any further actions to improve these pillar scores. In fact allocating resources to improve these pillars at the cost of improving weaker pillars may result in greater imbalance and only marginally higher entrepreneurial performance.

Summary and conclusion

Previous GEDI publications have focused on describing the methodological issues including the unique PFB method (Acs and Szerb 2012, Acs et al 2012). In this paper the focus turns to exploring the applicability of the GEDI for public policy purposes aiming to enhance economic development. The selected case country is Hungary, a small, moderately developed European Union member country.

In this study, we examined Hungary's GEDI score and the three sub-indices in relation to the country's development, to all the other 78 countries participating in the GEDI, and specifically to three country groups for two time periods. With its 0.31 overall GEDI score, Hungary ranked 32-33 and tied with Poland. Unlike other countries, Hungary's GEDI score improved by 30% over the 2006-2010 time period but is still slightly below the development implied trend-line. It can be said that Hungary's entrepreneurial position is average as compared to the other Transitional country and the CEE country groups. At the same time Hungary is well behind the European innovation leader country group. Hungary's position is similar in other well-known indices such as the World Bank's 'Ease of Doing Business' Index, the World Economic Forum's Global Competitiveness Index, The Heritage Foundation's Index of Economic Freedom, and Transparency International's Corruption Perceptions Index.

The pillar and variable level analysis provides an in-depth detailed view of the entrepreneurial profile, the strengths and the weaknesses for a particular country. While Hungary is relatively strong in risk taking (Nonfear of Failure), Startup Skills, and opportunity startup motivation (Opportunity Motivation), it has serious weaknesses in Process Innovation, Risk Capital and Opportunity Perception. Backwardness in innovation seems to be as problematic as formal and informal venture capital financing. Although opportunity perception is also weak for other former Socialist, CEE countries, Hungary's position is disappointing considering that it used to be the forerunner in economic reforms.

GEDI makes it possible to pinpoint performance based on either the individual or the institutional component of a particular pillar. In the case of Hungary, the weak

entrepreneurial performance is associated mainly with the shortcomings of specific individual variables. Inadequate scores in Opportunity Recognition, New Product, Export and Know Entrepreneurs are restraining the high scores in Opportunity Recognition, Product Innovation, Internationalization and Networking, respectively.

Unlike other research projects that provide rather general and uniform policy suggestions, GEDI offers individual country level, tailor-made policy recommendations. GEDI makes is possible to calculate how additional efforts should be distributed in order to provide the greatest increase to entrepreneurship performance. Based on the principle of the weakest link, we have presented an optimal policy mix for Hungary involving the eight weakest performing pillars to attain a 0.1 increase in the GEDI score resulting in a ranking for Hungary on par with the Czech Republic (24^{th} place). Our analysis shows that approximately 70% of new effort is needed in order to improve Hungary's three weakest pillars: Process Innovation, Risk Capital, and Opportunity Perception. While 27% of new effort is necessary for addressing the weaknesses in Product Innovation, High Growth, and Competition. Only 3% of new effort is required to enhance Cultural Support and Technology Sector.

While most of the elements of the GEDI suggested entrepreneurship policy mix appear in other relevant government programs such as in 'The SME strategy 2007' and 'The New Széchenyi plan', there are some notable differences [25], [26]. Both government programs list many aims without a clear determination of priorities. Prioritizing aims is a major strength of the GEDI methodology. Moreover, GEDI identifies individual characteristics as the main impediments for entrepreneurship while the other two strategic programs view institutional barriers as major obstacles. A striking difference is that Opportunity Perception, one of the top three policy priorities identified by GEDI, is not even mentioned in the SME strategy 2007 and it is mentioned but not emphasized, in the New Széchenyi plan 2011. In contrast inadequate financial resources for businesses are highlighted by both Hungarian SME programs as well as GEDI's policy suggestions. However, the types of financial resources addressed are different: while GEDI emphasizes the need to improve formal and informal venture capital, the two Hungarian SME initiatives stress the importance of debt financing or credit possibilities and consider venture capital barriers as relatively less important. In the first decade of 2000s, the ease of financial burdens was the main priority of Hungarian SME policy, and innovation was considered as a less retardant factor. According to GEDI, Process Innovation is the first, and Product Innovation is the fourth weakest factor of entrepreneurship requires putting most of the new effort to increase GEDI score and enhance economic development.

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Appendices

Individual variable	Description
Opportunity Recognition	The percentage of the population aged 18-64 yrs. that recognize good conditions for starting a business in the next 6 months in the area he/she lives,
Skill Perception	The percentage of the 18-64 aged population claiming to posses the required knowledge/skills to start business
Risk Acceptance	The percentage of the population aged 18-64 yrs. stating that the fear of failure would not prevent them from starting a business
Know Entrepreneurs	The percentage of the population aged 18-64 yrs. who personally know someone who started a business in the past 2 years
Carrier	The percentage of the population aged 18-64 yrs. that say that people consider starting business as good carrier choice
Status	The percentage of the population aged 18-64 yrs. that think 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 TEA businesses initiated because of opportunity start-up motive
Technology Level	Percentage of TEA businesses that are active in technology sectors (high or medium)
Educational Level	Percentage of TEA businesses owner/managers who have post secondary education
Competitors	Percentage of TEA businesses started in those markets where not many businesses offer the same product (i.e. low level of competition)
New Product	Percentage of TEA businesses offering products that are new to at least some of their customers
New Tech	Percentage of TEA businesses using new technology that is less than 5 years old.
Gazelle	Percentage of the TEA businesses having high job expectation (over 10 more employees and 50% in 5 years)
Export	Percentage of the TEA businesses where at least some customers are outside their country (over 1%)
Informal investment mean	The mean amount of informal investment where informal investment has been provided over the last three years
Business Angel	The percentage of the population aged 18-64 yrs. who provided funds to new businesses in the past 3 years (excluding stocks & funds)
Informal Investment	The amount of informal investment calculated as Informal investment mean* Business Angel

Appendix 1:
A description of GEDI's individual variables

Institutional variable	Description	Source of data
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.	WEF
Urbanization	Urbanization that is the percentage of the population living in urban areas, data are from the Population Division of the United Nations, 2010 estimate	United Nations
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 MARKETDOM*URBANIZATION	Own calculation
Tertiary Education	Gross enrolment ratio in tertiary education, 2009 or latest available data.	UNESCO
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). 30 December 2010 data.	Coface
Internet Usage	The number Internet users in a particular country per 100 inhabitants, 2009 data	ITU
Corruption	The Corruption Perceptions Index (CPI) measures the perceived level of public-sector corruption in a country. "Data are from 2010.	Transparency Int.
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. Data are from 2010.	Heritage Foundation World Bank
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)".	WEF
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)".	WEF
Market Dominance	Extent of market dominance: "Corporate activity in your country is (1 = dominated by a few business groups, 7 = spread among many firms)".	WEF
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,	WEF

	the presence of high-quality scientific research institutions, the collaboration in research between universities and industry, and the protection of intellectual property.	
GERD	Gross domestic expenditure on Research & Development (GERD) as a percentage of GDP, year 2009 or latest available data Puerto Rico, Dominican Republic, and United Arab Emirates are estimated	UNESCO
Business Strategy	Refers to the ability of companies to pursue distinctive strategies, which involves differentiated positioning and innovative means of production and service delivery.	WEF
Globalization	A part of the Globalization Index measuring the economic dimension of globalization. Data are from the 2010 report and based on the 2007 survey.	KOF
Venture Capital	A measure of the venture capital availability on a 7-point Likert scale generating from a statement: Entrepreneurs with innovative but risky projects can generally find venture capital in your country (1 = not true, 7 = true)".	WEF

Appendix 2

Data sources used for GEDI's institutional variables

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