

Entrepreneurial Profile of the UK in the Light of the Global Entrepreneurship and Development Index

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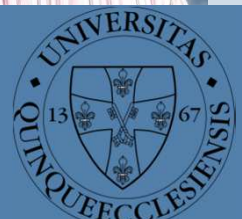
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Introduction

Year 2012 will be a challenging year for the UK economy. Although weak signs of economic recovery are starting to appear in North America, the EU economy continues to feel the effects of the financial turmoil that started in 2008. In the UK, the government faces the complex challenge of reducing debt and the share of the public sector in the economy while simultaneously promoting growth in the private sector. This set of conditions emphasises the potential of entrepreneurship as a mechanism to both restore the balance between public and private sectors as well as kick-start economic growth. In this situation, therefore, it is timely and important to review the health of the entrepreneurial process in the UK and how it can be stimulated to contribute to future economic growth.

In this research summary, we provide a novel look into the entrepreneurial profile of the UK in an international context. We use a new method – the Global Entrepreneurship and Development Index GEDI [1] – to identify the entrepreneurial strengths and weaknesses of the UK economy, as well as to identify potential bottlenecks that hold back the performance of the UK relative to other advanced economies. We begin by providing an overview of the main findings.

The 2012 edition of the GEDI index uses mid-2010 data to compare the entrepreneurial profile of 79 countries. The 10 most entrepreneurial countries in the GEDI Index are shown in Table 1 and compared to the rankings of the previous year (i.e., 2009) [1]¹. During this period, the drivers of productive entrepreneurship deteriorated across countries, as the financial turmoil progressed. On a scale of 0.0 to 1.0, the quality of the drivers of productive entrepreneurship receded from 0.67 to 0.60, about a 10% drop. Tellingly, this drop was larger in the developed countries than in the emerging countries, reflecting the deteriorating institutional conditions in the rich world. While the levels of necessity entrepreneurship increased during the recession, deteriorating institutional conditions meant that the global potential to produce productivity-enhancing entrepreneurs fell over the world.

Table 1 **GEDI Rankings in 2010 – Top Countries**

Country	GEDI 2009	Rank 2009	GEDI 2010	Rank 2010
United States	0.64	3	0.60	1
Australia	0.51	11	0.57	2
Sweden	0.59	5	0.56	3
Canada	0.65	2	0.56	3
Switzerland	0.56	7	0.56	3
Iceland	0.57	6	0.55	6
Denmark	0.67	1	0.55	6
Belgium	0.50	12	0.52	8
Netherlands	0.54	8	0.49	9
Taiwan	-	-	0.49	9
Norway	0.53	10	0.49	9
Singapore	0.48	15	0.47	12
Austria	0.39	24	0.46	13
United Kingdom	0.49	14	0.45	14

The economic downturn hurt productive entrepreneurship in most countries. The impact was uneven, however. Although the index reflecting the conditions for productive entrepreneurship in the United States fell by 6% from 0.64 to 0.60, this relatively mild drop meant that United States was

¹ The Global Entrepreneurship and Development Index is a joint project between George Mason University, University of Pécs, and Imperial College Business School

propelled into the first place in 2010 from 3rd in 2009. The well-established entrepreneurial traditions and institutions thus enabled United States to hold up better during the economic downturn. The other countries in the top ten are Australia, Sweden, Canada, Switzerland, Iceland, Denmark, Belgium, the Netherlands and Taiwan.

In the United Kingdom, the conditions for productive entrepreneurship exhibited a mild deterioration during the period. This is in line with most other countries, and the ranking of the UK remained stable, at 14th. UK shared this rank with Ireland, Finland, France, United Arab Emirates, Israel and Austria.

The GEDI Index is composed of 14 'pillars' that form three sub-indices: for Attitudes, Aspirations and Activities, respectively (see Appendix 2 for a description of the GEDI method). Together, the 14 pillars define the profile of a country's National System of Entrepreneurship. In the light of the GEDI Index, UK's weaknesses are found in Aspirations and Attitudes, and UK's strengths are found in Activities. We also find that UK's Aspirations and Attitudes appear to have suffered from the financial crisis than in other countries.

Looking at individual pillars, our analysis finds that the UK's weakest GEDI pillars in 2010 were: (1) Risk Capital; (2) Process Innovation and (3) High Growth. A closer analysis suggests that UK's performance in Risk Capital may have improved subsequently, however. UK's strongest GEDI pillars in 2010 were: (1) Opportunity Startup; (2) Competition and (3) NonFear of Failure.

A Penalty for Bottleneck analysis suggests that UK's National System of Entrepreneurship may be suffering more from bottlenecks than those of its peers. This suggests that UK may stand to gain more than peer countries if it alleviates its bottlenecks. An 'optimal' policy portfolio analysis suggests that, in the light of 2010 data, UK should prioritise Risk Capital, Process Innovation, High Growth, Product Innovation and Internationalisation when allocating its policy effort. Recent announcements by the UK Government of new policy initiatives are to be welcomed based on this analysis of the UK National System of Entrepreneurship. The policy initiatives are designed to provide greater access to finance for start-up and business growth, and they include the new Business Coaching for Growth (BCG) programme aimed at existing small businesses.

The GEDI Approach to Measuring National Systems of Entrepreneurship

Measuring a country's entrepreneurial profile is not a straightforward endeavour. Even when looking at the phenomenon of entrepreneurship at the individual level, people disagree on, e.g., whether self-employment should be classified as 'entrepreneurship' and whether 'intrapreneurship' (a form of entrepreneurial action that may result in the creation of new corporate subsidiaries) qualifies as 'entrepreneurship'. At the national level, many more layers of complexity are added due to the inherent complexity of economic systems. This, however, has not prevented researchers from attempting to estimate the 'entrepreneurial character' of different national economies. We provide a brief review of existing approaches to measuring 'national entrepreneurship' in Appendix 2. Here, we provide a brief overview of the distinctive aspects of the GEDI approach.

Existing attempts to measure 'national entrepreneurship' tend to focus either at the level of the individual (use national averages of individual-level data to represent 'countries') or at the level of the country (e.g., describe a given country's policy framework to represent that country). Although both approaches have their merits, they fail to reflect the important point that country-level performance is produced by the *interaction* between individual actions and national contexts. Although entrepreneurial action is ultimately driven by individuals, the outcomes and impact of those actions are regulated by the context within which those actions are taken.

The GEDI method is designed to capture the dynamics of National Systems of Entrepreneurship [1, 2]. It is distinguished by other approaches by: (1) its contextualisation of individual-level data by weighting it with data describing broader institutional conditions that prevail in the country; (2) its use of 14 context-weighted measures of entrepreneurial Attitudes, Aspirations and Activities, which are further organised into three sub-indices; (3) its recognition that different pillars combine to produce system-level performance; and (4) its consequent recognition that national entrepreneurial performance may be held back by *bottleneck factors* – i.e., poorly-performing pillars that may constrain system performance (see Appendix 3 for a description of the Penalty for Bottleneck method).

The GEDI Index consists of a total of fourteen indicators of entrepreneurial attitudes, activities, and aspirations. Each of the indicators – or pillars, as we call them – is made up by national-level aggregates of individual data, weighted by data describing national institutional conditions. All of the individual-level data is derived from the Global Entrepreneurship Monitor (GEM) survey, as published in annual GEM executive reports. In the current edition of the GEDI index, 2010 GEM data is used, which was collected in May-June 2010. The descriptors of national institutional conditions are derived from different sources, including the World Bank, World Economic Forum, and the Heritage Foundation. The national aggregates of individual-level data are listed in Table 6 (page 26) [1, 2]. The data used as institutional weights are listed in Table 7 (page 27). Please also see Appendix 1 for description of the 14 pillars.

GEDI Analysis of the UK Entrepreneurial Profile

UK Summary Statistics

Overall, the UK ranked 14th globally out of 78 countries and 6th in the EU in terms of its overall GEDI score in 2012. With this score, UK is behind the Nordic countries, Belgium, The Netherlands and Austria and on par with Ireland, Finland, France and Germany. In terms of overall performance, the EU benchmark for the UK is provided by Sweden and Denmark, which outperform the UK by 20-25%. See Table 1. For summary of UK statistics, see Table 2.

Table 2 Summary of UK Statistics

Population	62 Million
Per Capita GDP	\$35,974 (PPP, international dollars)
Doing Business Index 2012 ²	7
Global Competitiveness Index 2012 ³	10
Index of Economic Freedom 2012 ⁴	14
GEDI Rank (78 countries) ⁵	14
Attitudes Sub-Index Rank	13
Activities Sub-Index Rank	5
Aspirations Sub-Index Rank	30
Weakest Pillar	Risk Capital
Weakest Sub-index	Aspirations

The UK's GEDI index score is 0.45 on a normalised scale from 0 to 1. The score of the leading country – the US – is 0.60. This means that UK's National System of Entrepreneurship was operating in 2010 at 45% 'efficiency' in the light of the GEDI index, as the UK could, in theory, obtain the score 1 if it were to post the best-in-class performance for all 14 index pillars. A more realistic portrayal could be to state that the UK's National System of Entrepreneurship operated, in the light of the GEDI index, at 75% efficiency relative to the US.

The UK performance difference relative to leading countries was mostly due to its relatively weak performance in Aspirations, and, to some degree, in Attitudes⁶ - see Figure 1. The UK scored only 23rd amongst the similarly developed economies of the OECD (30 countries) for Aspirations and 30th globally (78 countries). Although the UK scored 13th in OECD for Attitudes, it lagged 26% behind Sweden in this regard.

A closer examination reveals that UK's low aspiration score was mostly due to its relatively weak performance in individual-level activity. The UK ranked only 28th (out of 30 countries) in the OECD for Product Innovation by nascent and new entrepreneurs. It ranked only 24th for the adult-population prevalence of Informal Investment activity, 22nd for export-oriented entrepreneurship prevalence, 16th for high-growth aspirations and 14th for the use of new technologies by start-ups (see Figure 1). Whereas all but one UK institutional variables for the Aspirations sub-index ranked in the second quartile within the OECD, only one individual-level variable did the same. As a result, UK ranked in the 3rd or 4th quarter within the OECD for all Aspiration pillars.

² Source: World Bank 2012

³ Source: World Economic Forum 2012

⁴ Source: Heritage Foundation 2011

⁵ All GEDI index values relate to year 2010

⁶ See Appendix 1 for description of the different GEDI index pillars.

Figure 1 UK Ranking Against OECD (30 Countries)

	Institutional Variable		Individual Variable		Pillars		UK Rank (30 OECD countries)
Attitudes	Market Agglomeration	0.886	Opportunity Perception	0.265	Opportunity Production	0.396	11
	Education PostSec	0.575	Skill Perception	0.500	Start-up Skills	0.469	18
	Business Risk	1.000	Nonfear of Failure	0.460	NonFear of Failure	0.613	14
	Internet Usage	0.891	Know Entrepreneurs	0.187	Networking	0.430	18
	Corruption	0.744	Career Status	0.462	Cultural Support	0.541	14
Activities	Economic Freedom	0.912	TEA_Opportunity	0.892	Opportunity Startup	0.717	5
	Tech_Absorption	0.756	TEA_Technology	0.600	Tech Sector	0.498	4
	Staff Training	0.631	TEA_Education	0.531	Quality of HR	0.446	12
	Domestic Market	0.730	TEA_Competition	0.751	Competition	0.640	8
Aspirations	Technology Transfer	0.666	TEA_NewProduct	0.282	Product Innovation	0.359	23
	GERD	0.383	TEA_NewTech	0.246	Process Innovation	0.299	16
	Business Strategy	0.740	TEA_Gazelle	0.249	High Growth	0.316	16
	Globalisation	0.745	TEA_Export	0.439	Internationalisation	0.393	22
	Venture Capital	0.316	Informal Investment	0.098	Risk Capital	0.127	23

1st quartile
2nd quartile
3rd quartile
4th quartile

The situation was somewhat similar for the Attitudes sub-index. Again, UK's weaknesses appeared to be mostly related to individual-level attitudes, where only the Skill Perception ranked UK in the 2nd quartile. However, for the institutional variables linked to Attitude pillars the UK performance was better, with three out of five institutional measures ranking in the top quartile.

Thus, the relative weaknesses in the UK National System of Entrepreneurship appear to relate to Aspirations and Attitudes, and for both, the weaknesses appear to be mostly due to weaknesses in individual-level aspirations and attitudes. The good news is that UK performance was significantly better for institutional variables.

UK's entrepreneurial strengths are found squarely in the Activity domain. Globally, the UK ranked in the top quartile for each of the Activity pillars: Opportunity Startups, Technology Sector activity, Quality of Human Resources flowing into start-up firms; and Competition. Compared against the other OECD countries, UK ranked in the top half for all pillars and in the top quartile for Opportunity Startups and Tech Sector activity. Here, the UK's performance appeared equally solid for both institutional and individual-level variables.

Summarising, the overall impression that arises from this comparison gives rise to cautious optimism. Although weaknesses can be found in UK's entrepreneurial profile, these are tempered by UK's solid performance in terms of Entrepreneurial Activity. Even a closer examination of the UK's relative weaknesses did not highlight any glaring gaps in terms of UK's institutional and policy frameworks, as most of the weaknesses appear to be driven by weaknesses in individual-level attitudes and aspirations of entrepreneurs. The question, therefore, arises whether the UK could exhibit even better-quality activity if the entrepreneurial attitudes and aspirations of its adult-age and start-up population could be enhanced.

To assess this question, we compared four aspirations of UK opportunity-driven nascent and new entrepreneurs against those of their counterparts in the other OECD countries. The results are shown in Table 3. We can see that UK opportunity-driven nascent and new entrepreneurs (or Opportunity TEAs⁷, as we call them) rank 23rd among their peers in 25 OECD countries for Product Innovation, 20th for Internationalisation, 19th for Process Innovation and 12th for High Growth. Although the tails are long in each distribution, these are nevertheless quite mediocre rankings⁸. Thus, the low aspirations appear to spill over from the general population of nascent and new entrepreneurs to the population of opportunity-driven and technology-sector entrepreneurs.

**Table 3 Aspiration Levels of UK-Based Opportunity-Driven Start-Ups:
UK Ranking Amongst OECD Countries**

	UK Rank (25 OECD Countries)
Product Innovation	23
Process Innovation	19
High Growth	12
Internationalisation	20

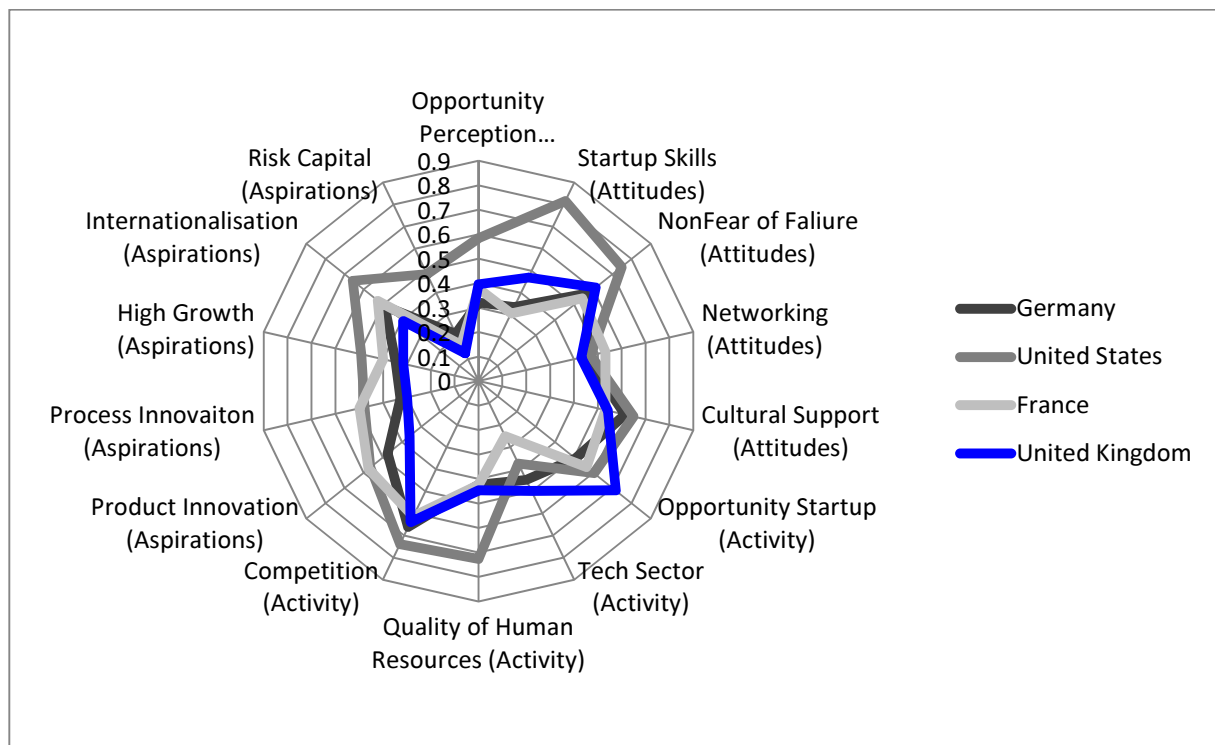
In Figure 2, we compare UK's entrepreneurial profile against the US, France and Germany. This comparison shows that, overall, the profile of the US is stronger and more rounded than for European

⁷ That is, Total early-stage Entrepreneurial Activity (TEA).

⁸ Note: 2010 data was used, where we had 25 OECD countries. We could not compute the same comparison for Technology Sector TEAs due to small sample sizes.

countries. For Aspirations, UK tended to lag behind all three countries in the light of GEDI data⁹. The biggest bottleneck for the UK performance appears to be in Risk Capital – although this bottleneck may have been subsequently alleviated to some degree (see below). The UK also lagged behind the three other countries in terms of Internationalisation, High Growth, and Product and Process Innovation. The UK's relative strong points are found in Opportunity Start-Ups, Technology Sector activity, in Non-fear of Failure, and, to some degree, in Start-up Skills perception, although all three European countries lagged significantly behind the US for this pillar.

Figure 2 UK Entrepreneurial Profile: Comparison with the US, Germany and France

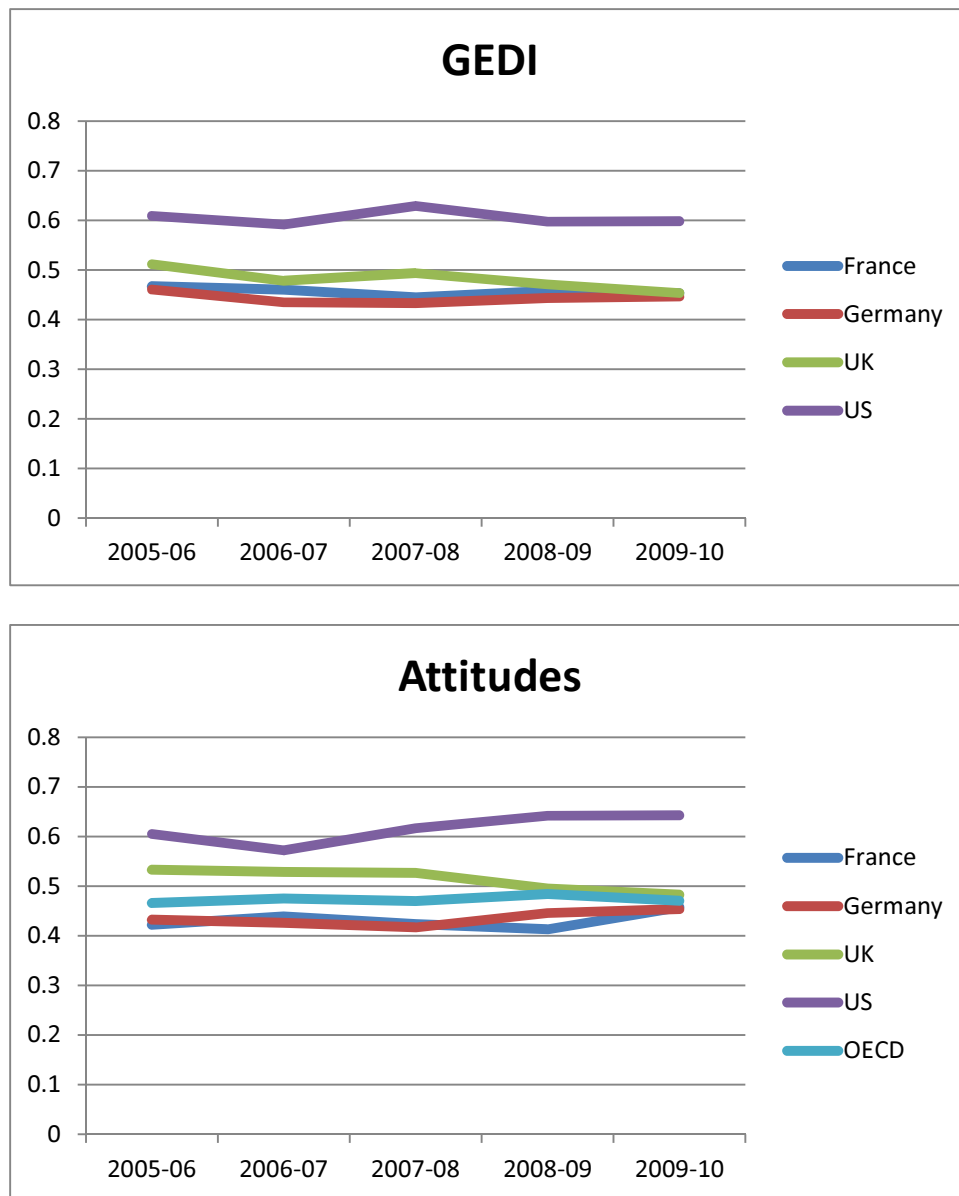


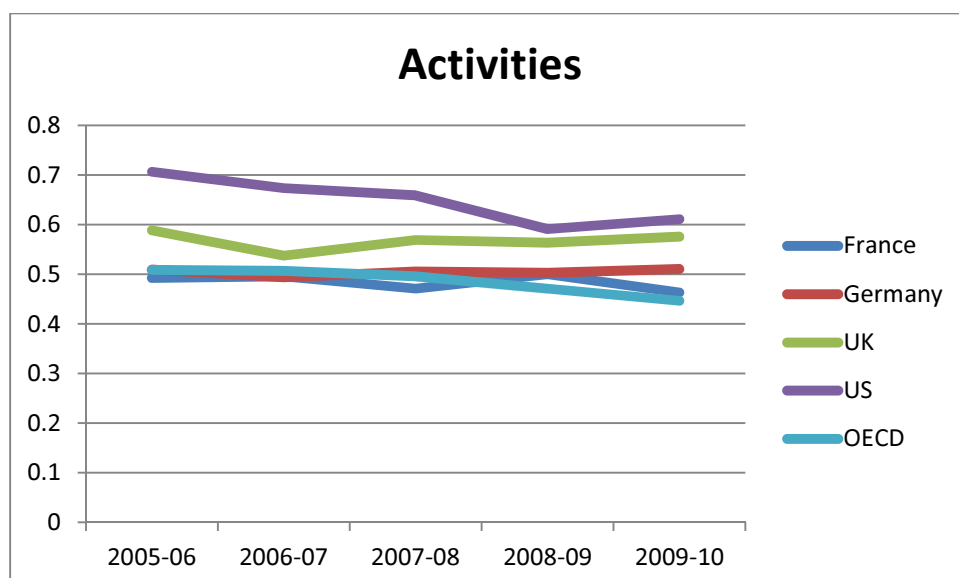
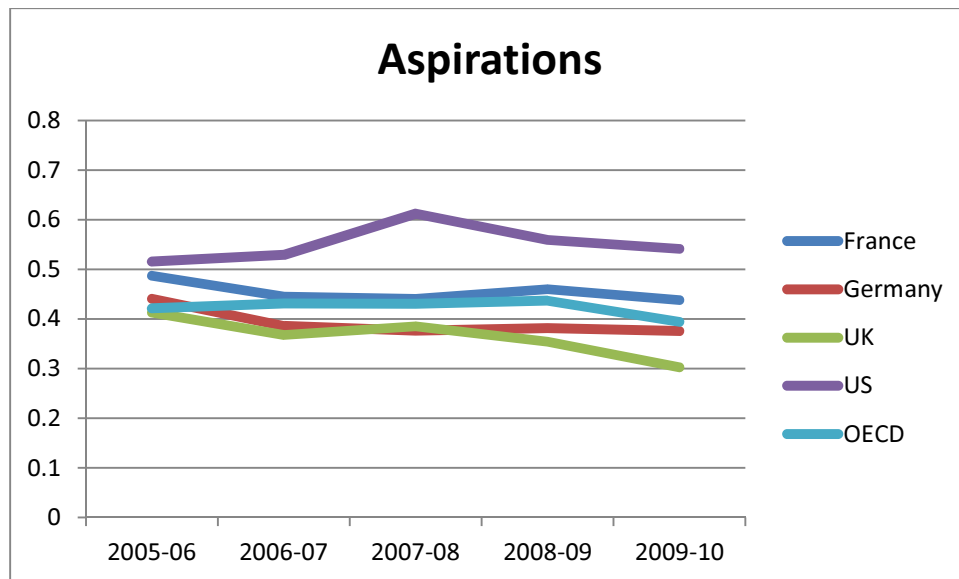
Development Trends

Figure 3 shows the development trends for GEDI and its sub-indices over time. The figure shows the trends for the UK, USA, France, Germany and the OECD average for years 2006 – 2010.

⁹ Note that GEDI pillars are computed as aggregates of individual-level data, as derived from GEM, weighted by data describing institutional conditions. Also, GEDI uses 2-year moving averages to smooth random fluctuations in the data.

Figure 3 **Development Trends in GEDI and its Sub-Indices**





The trend charts offer a number of interesting observations. First, in the UK, the overall GEDI index value receded slightly since the onset of the on-going financial crisis in 2008, bringing about a convergence with the trends of France and Germany. Although the UK was pulling ahead of France and Germany in 2008, these countries caught up with the UK by 2010. In contrast, the US index value has shown itself to be surprisingly resistant to the economic downturn.

A closer examination reveals that the slight drop in the UK's overall GEDI index value is due to a significant extent a fall in Aspirations, and, to a smaller extent, a fall in Attitudes. Although most countries in the Figure except Germany excepted have experienced a fall in Aspirations, this drop appears particularly acute in the case of the UK. Interestingly, where the UK's Attitude index has experienced a slight drop, the index value improved for the US, France and Germany from 2008 to 2010.

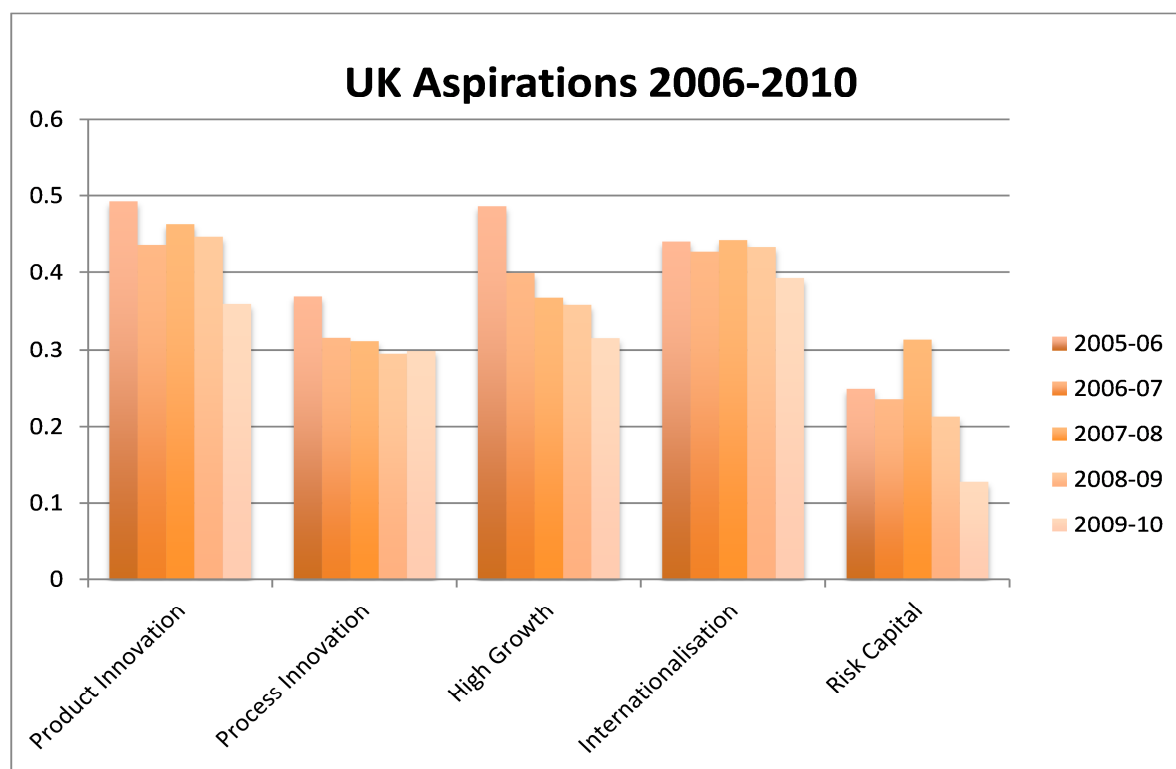
In contrast, UK's Activity trend appears quite resistant to the financial crisis, and it remained stable since 2008¹⁰. In the US, there appear to be faint signs of recovery in 2010 in terms of Entrepreneurial Activity after the sharp drop experienced from 2007 – 2008.

Overall, the development trends exhibit different reactions across countries to the financial crisis, and the UK has experienced a sharper drop in Aspirations and Attitudes relative to its competitors. The reasons for this drop remain unclear, though. To shed more light on this question, we next examine UK trends for individual index pillars.

UK Trends – Index Pillars

Of the GEDI sub-indices for the UK, the Aspirations sub-index exhibited the sharpest decline post-2008, relative to other countries and the OECD average. Figure 4 shows the trends for the constituent pillars for the Aspirations sub-index. We can see that while the trend from 2008 to 2010 was at least mildly declining for all pillars, the drop from 2008 was sharpest for the Risk Capital pillar. This decline was driven by the decline in informal investment *flows* (i.e., the product of the prevalence rate of informal investors in the UK population multiplied by average amounts invested and weighted by the World Economic Forum assessment of Venture Capital availability in the UK). Note, however, that this trend is computed as a 2-year moving average, which likely masks an increase in the *prevalence* of informal investors in the UK population since 2009, as reported in the GEM UK country report [3]. It may thus be that this bottleneck has been subsequently alleviated, at least in part. Also the High Growth pillar exhibits a sharp declining trend from 2008 to 2010, especially when compared to year 2006. Furthermore, the Product Innovation pillar exhibits a mild decline, while the trend is somewhat less clear for Process Innovation and Internationalisation pillars.

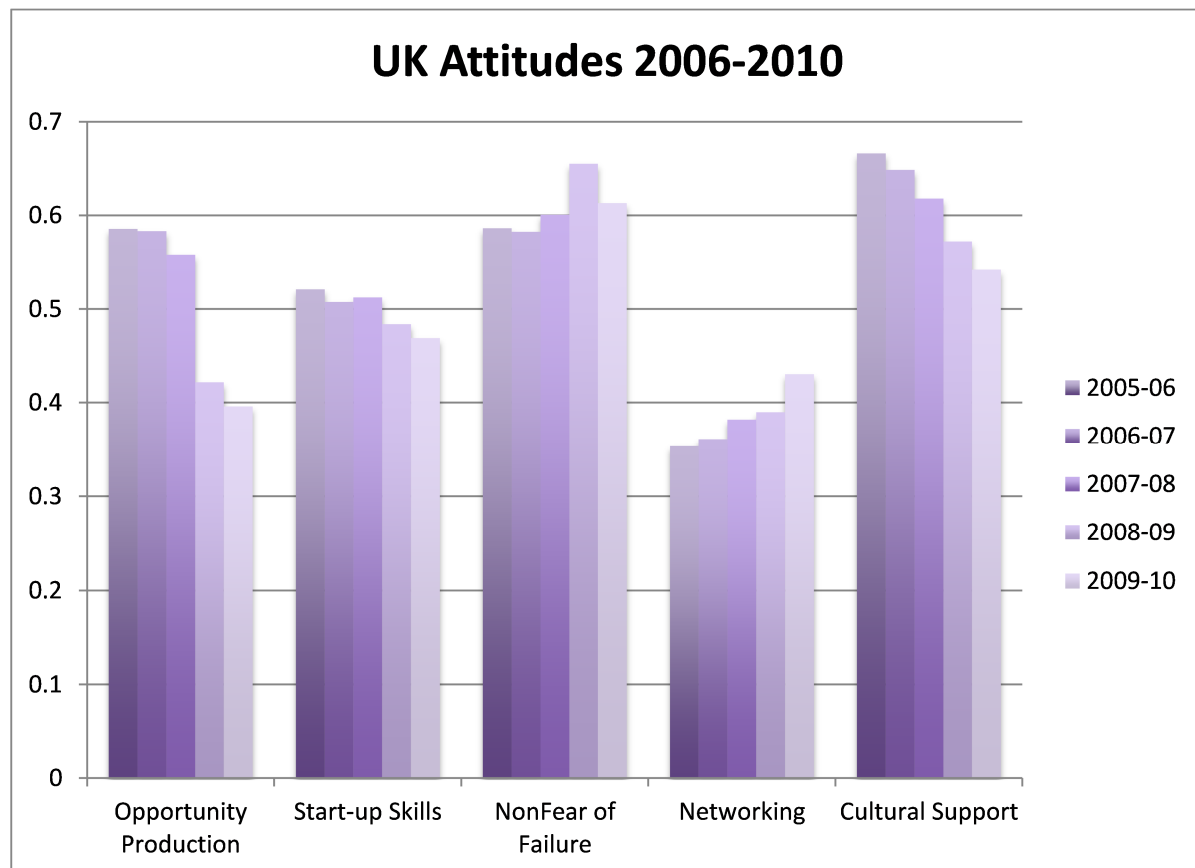
Figure 4 Trends in UK Aspirations Pillars



¹⁰ Note that the UK GEM data reports a sharp increase in necessity-driven entrepreneurship since 2010 (Levie & Hart, forthcoming). This rise is not captured in this report's GEDI data, which extends to 2010 only.

For the UK Attitudes sub-index pillars, the picture is somewhat mixed (see Figure 5). There was a sharp drop in Opportunity Perception from 2009 to 2010, as one might expect. There was also a decline in Cultural Support for entrepreneurship. However, for Networking and Non-fear of Failure pillars, there appears to be a positive trend from 2008 to 2010¹¹. One may speculate that the Networking pillar is driven by more people being forced to become self-employed or start new firms since 2008, but the trend for Non-fear of Failure appears to have started prior to the financial turmoil.

Figure 5 Trends in UK Attitudes Pillars

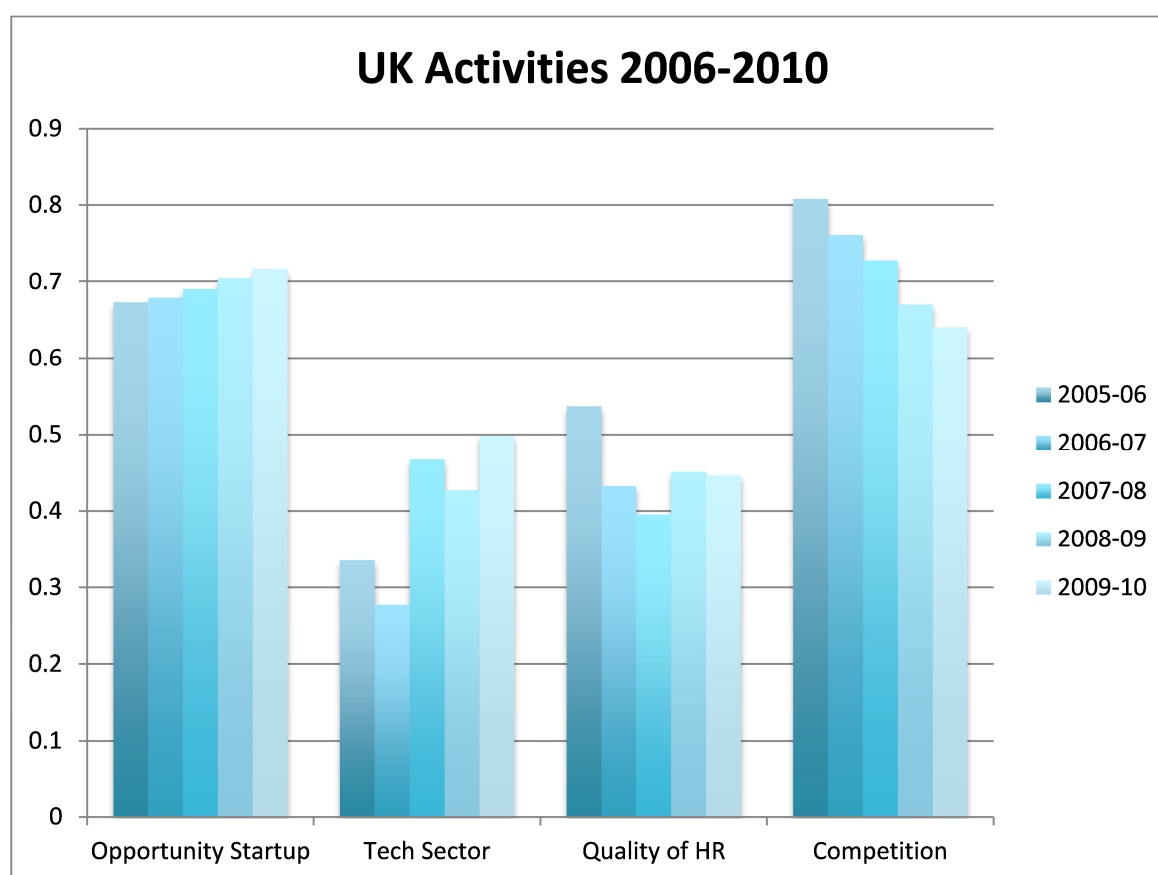


The UK Activity pillars exhibited similarly mixed trends (see Figure 6). There appears to be a clearly rising trend for Tech Sector start-up activity, which started already prior to 2008. There was also a rising trend in Opportunity Start-Ups, possibly due to more people being forced into self-employment in the post-2008 economy¹². Interestingly, the Quality of Human Resources pillar shows a U-curve trend which bottoms out in 2008. This trend could echo the trends reported by Moscarini and Postel-Vinay, who argued that the large firm sector inevitably outcompetes the start-up sector close to the peak of the economic cycle [4]. When the economy falls into recession, however, the large firm sector starts cutting jobs, and the start-up sector starts to gradually pick up the resulting slack. The bottoming-out trend exhibited by the Competition pillar could be partly driven by firm exits due to the economic downturn.

¹¹ It is likely that the 2-year moving average used by GEDI partly masks the pick-up in these areas, as reported in the 2010 UK GEM report (Levie & Hart, 2011).

¹² Note again that UK GEM data indicates an increase in necessity-driven start-up activity since 2010.

Figure 6 Trends in UK Activities Pillars



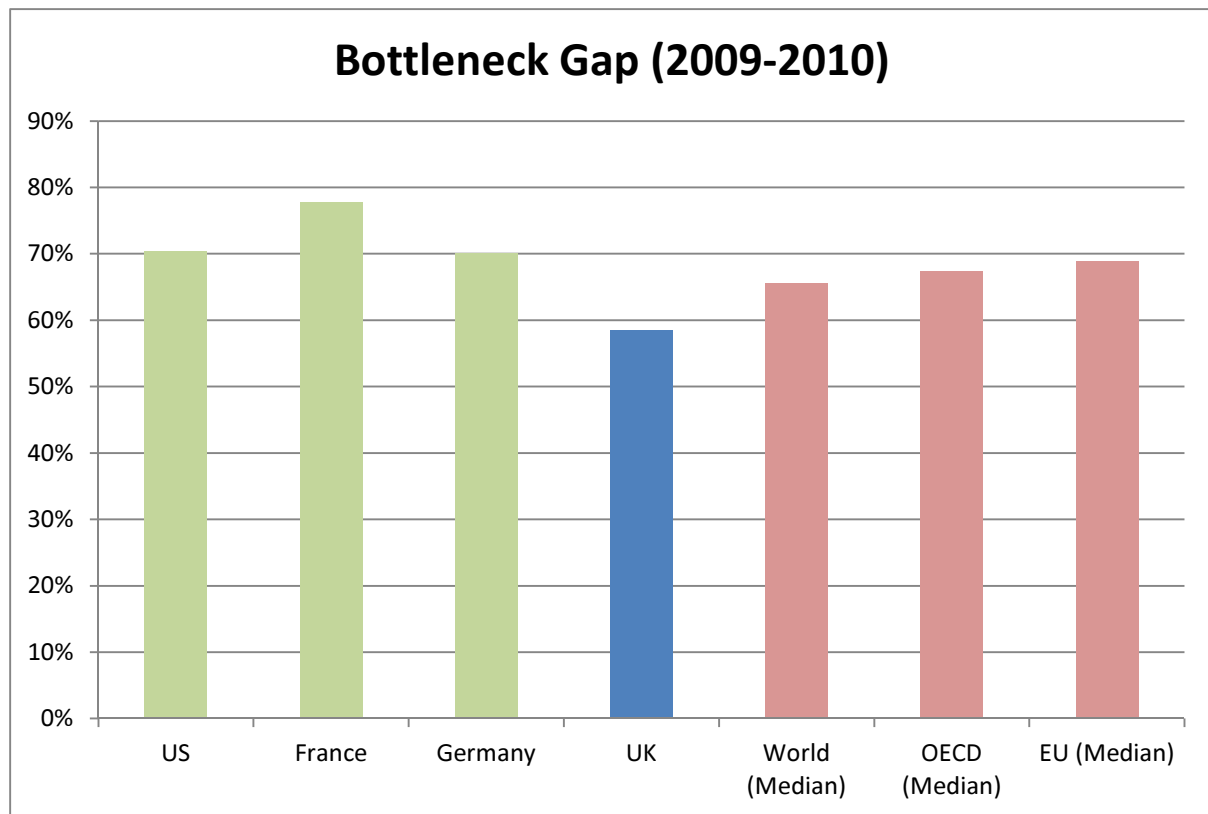
Overall, thus, a closer inspection of the constituent pillars of the UK GEDI index highlights mixed reactions of different pillars to the economic downturn of 2008. Whereas the Aspirations pillars generally exhibit a decline, the picture is mixed for Attitudes and Activities. One may speculate that the Activities trends represent, in part, the general resilience of entrepreneurial activities during economic downturn and, in part, forced entries into self-employment due to job cuts in more established public- and private-sector organisations.

Penalty for Bottleneck: Sensitivity Analysis

The above comparisons have highlighted UK's relative strengths in Activities and relative weakness in Aspirations and Attitudes in the post-2008 economy. UK's biggest bottleneck during years 2008-2010 appeared to be in Risk Capital. But just how serious are these bottlenecks? And how much performance improvement can we expect, if we were to allocate our policy effort 'optimally', by addressing bottlenecks first? To address these questions, we next perform a sensitivity analysis by looking at how much the bottleneck factors of the UK's National System of Entrepreneurship penalised UK's overall entrepreneurial performance, as portrayed by the GEDI index, and how much UK can expect its performance to improve if it addresses its bottlenecks first.

First, we estimated how much of the UK's National System of Entrepreneurship suffered from bottlenecks relative to important competitors. We did this by computing how much UK's GEDI pillar values lagged behind, on average, UK's best performing pillar. A big gap indicates that the pillar values are imbalanced – suggesting more severe bottleneck. The analysis is shown in Figure 7.

Figure 7 UK Average Bottleneck Gap – International Comparison



We can see that UK's 13 remaining GEDI index pillars represented, on average, only 59% of the value of its best performing index pillar in 2010 (Opportunity Start-Up activity). This is over 10% less than the corresponding values for France, the US and Germany and suggests that UK's entrepreneurial profile was imbalanced.

From a policy perspective, this is actually fertile ground for action, because it also suggests that UK's bottlenecks are more severe than for competitors – meaning that the UK can expect relatively larger overall performance improvements from bottleneck alleviation. To obtain a better understanding of UK's bottleneck pillars, we then identified UK's 'weakest' and 'strongest' GEDI pillars by comparing normalised pillar values. The UK's weakest GEDI pillars are shown in Figure 8. UK's strongest GEDI pillars are shown in Figure 9.

Figure 8 confirms that UK's weakest GEDI pillars in 2010 were Risk Capital, Process Innovation and High Growth. Figure 8 also indicates the normalised value for each pillar (maximum value being 1). Similarly, Figure 9 shows that UK's strongest GEDI pillars were Non-fear of Failure, Competition and Opportunity Start-ups. As both figures exhibit normalised pillar values (with maximum value set to 1 and minimum to 0), we can see that the differences between strongest and weakest pillars were quite significant.

Figure 8 UK's Weakest GEDI Pillars

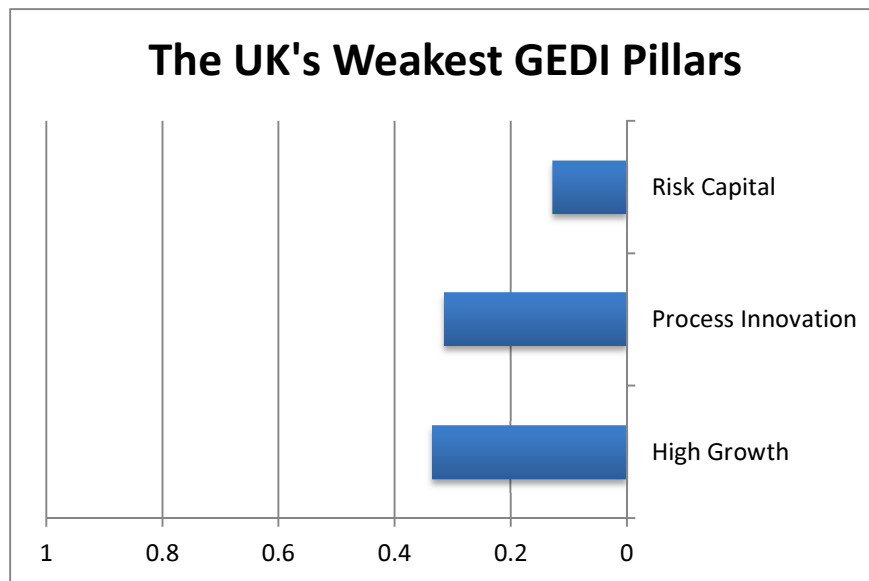
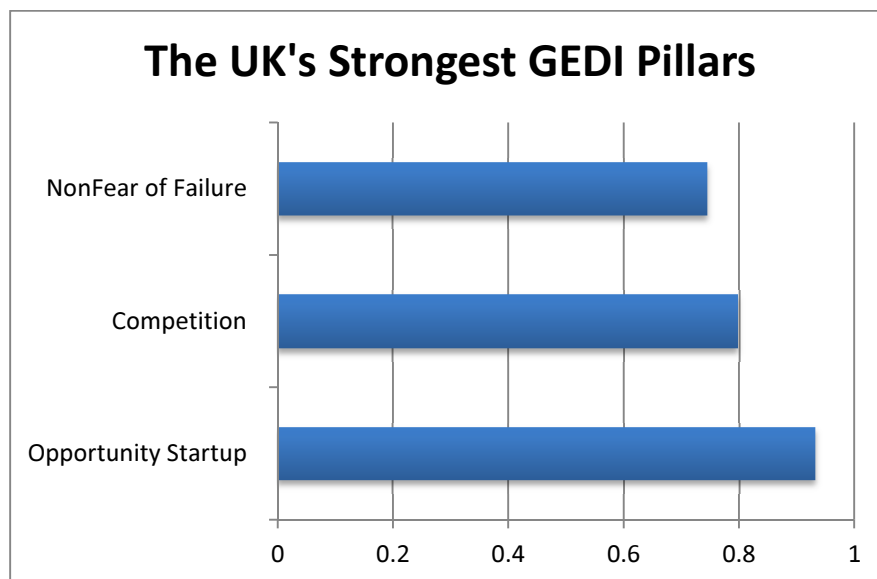


Figure 9 UK's Strongest GEDI Pillars



What do the above imply for the allocation of policy effort? Remember that the GEDI uses the Penalty for Bottleneck approach (see Appendix 1) which assumes that the constituent elements of the UK's National System of Entrepreneurship interact and complement one another. This implies that if the UK performs poorly in some areas, these weaknesses spill over to other areas, thereby holding back overall system performance. Although this method carries important assumptions, it nevertheless permits us to simulate how much the UK's GEDI index value would improve if the performance of any given pillar should increase by a given amount. In Table 4, we show the sensitivity of UK's GEDI index value to performance improvements in individual pillars. Specifically, we have estimated how much UK's overall GEDI index value might improve, if the UK were to close its performance gap by 20% relative to best-in-class performance.

The sensitivity analysis in Table 4 suggests that the UK can expect the strongest improvement in performance if it catches up to the best Risk Capital performer by 20%. A 20% catch-up relative to best-in-class performer would produce a 12.6% improvement in the overall GEDI index value for the UK. Relative to this, expected gains from other bottlenecks are more modest: 5.1% for Process Innovation, 5.0% for High Growth, 4.9% for Product Innovation and 4.7% for Internationalisation.

Table 4 Bottleneck Sensitivity Analysis – UK

Pillar	Pillar Increase	GEDI %	GEDI Incr.
Risk Capital	0.175	12.6%	0.057
Process Innovation	0.117	5.1%	0.023
High Growth	0.113	5.0%	0.023
Product Innovation	0.102	4.9%	0.022
Internationalisation	0.094	4.7%	0.022
Opportunity Production	0.083	1.9%	0.008
Networking	0.074	1.8%	0.008
Quality of HR	0.070	1.6%	0.007
Start-up Skills	0.064	1.6%	0.007
Tech Sector	0.057	1.4%	0.007
Cultural Support	0.046	1.4%	0.006
NonFear of Failure	0.030	1.2%	0.006
Competition	0.024	0.9%	0.004
Opportunity Startup	0.008	0.7%	0.003

In the light of this analysis, it seems like UK would gain more by prioritising Risk Capital, Process Innovation, High Growth, Product Innovation and Internationalisation in the allocation of its policy resources. However, we should remember that the UK National System of Entrepreneurship is a dynamic system: if you alleviate one bottleneck, another factor soon becomes the most binding constraint for system performance. This raises the question of 'optimal' allocation of policy effort. In other words, if the UK were to allocate additional resources to improving its GEDI Index performance, how should this additional effort be allocated to achieve an optimal outcome?

To consider this question, we simulated a situation in which the UK were to increase its allocation of entrepreneurship policy resources in an effort to gain a 25% improvement in its entrepreneurial performance, as captured by the GEDI Index. The Penalty for Bottleneck method used in the GEDI index calculation implies that the greatest performance enhancement will be achieved when additional resources are always allocated to alleviating the most constraining bottleneck. Once the bottleneck pillar has improved sufficiently so as to no longer constitute the most important constraint to system performance, further resource additions need to be allocated to the next most severe bottleneck. We iterated this procedure until an overall GEDI Index performance of 25% had been achieved. In the simulation shown in Table 5, we have targeted an overall improvement of 25% in the GEDI Index by sequencing successive policy interventions in such a way that they always addressed the least well performing pillar in consecutive iterations¹³. This increase would bring UK performance to the level of that of the US.

¹³ This simulation makes two important assumptions: (1) We allocate *additional* resources over current resource allocation; (2) The cost of improving performance is equal for *all* pillars.

Table 5 Simulation of 'Optimal' Policy Allocation for the UK

Targeted GEDI Change	25%	
	Required Increase in Pillar	% of Additional Effort¹⁴
<i>Opportunity Perception</i>	0.09	7%
<i>Start-up Skills</i>	0.00	0%
<i>Networking</i>	0.09	7%
<i>NonFear of Failure</i>	0.00	0%
<i>Cultural Support</i>	0.00	0%
<i>Opportunity Startup</i>	0.00	0%
<i>Tech Sector</i>	0.00	0%
<i>Quality of HR</i>	0.02	2%
<i>Competition</i>	0.00	0%
<i>Product Innovation</i>	0.11	9%
<i>Process Innovation</i>	0.21	17%
<i>High Growth</i>	0.19	16%
<i>Internationalisation</i>	0.09	8%
<i>Risk Capital</i>	0.40	33%

This simulation produces a more nuanced picture of the required allocation of policy effort, if policy were to be optimised to maximise the GEDI index value. We can see that to improve the GEDI index score by 25 percentage points, an 'optimal' effort allocation would call for a 40% improvement in the Risk Capital pillar – or 33% of the total effort. Of the remaining effort, our simulation suggests that 17% should be allocated to Process Innovation, 16% to High Growth, 9% to Product Innovation and 8 % to Internationalisation.

Because the UK GEDI index score is afflicted more by bottlenecks than most other countries, this 'optimal' (in the sense of the GEDI index) allocation of effort produced a significant improvement over the 'passive' policy option of simply dividing additional resource allocations equally across all 14 pillars. Compared to the 'optimal' strategy, allocating resources to increase the performance of each pillar by 25% would require 69% more resources. In other words, an 'optimal' resource allocation in this simulation is 59% more efficient than a 'passive' resource allocation.

In terms of sub-indices, the 'optimal' allocation of would require 83% of the additional resources to be invested in Aspiration pillars, 15% in Attitudes pillars, and only 2% in Activity pillars. Note that this allocation is 'optimal' for a GEDI index gain of 25%. Greater gains would require progressively greater additional resource allocations to Attitudes and Activities in our simulation.

This simulation exercise is based on important restrictive assumptions and should not be read as a policy prescription. We assumed that the cost of improving the performance of any given pillar is equal across pillars. This assumption obviously does not hold in reality. Furthermore, we have assumed that all pillars are amenable to policy action. For some pillars, however, it is more realistic to talk about the allocation of *economic effort* (which may or may not be amenable to policy action) rather than the allocation of *policy resources*. These limitations notwithstanding, the simulation pro-

¹⁴ Note that these figures indicate allocation of *additional* effort to enhance pillar performance, not total effort.

vides three important insights into the UK's National System of Entrepreneurship. First, our analysis suggests that an 'optimal' allocation of policy effort may exist for the UK NSE – although our simulation should not be read as representing one, due to the restrictive assumptions made. Second, our analysis suggests that the UK NSE may be particularly subject to bottlenecks. This would mean that there may be scope for achieving efficiency gains through resource allocations that focus on bottleneck areas. Third, our analysis hints that potential bottlenecks may be found in Aspirations and some Attitude pillars.

Summarising, therefore, this analysis highlights the potential usefulness of the GEDI method in analysing the entrepreneurial profiles of countries. First, in addition to highlighting bottleneck factors, the index also provides rough indications on how much a country should seek to alleviate a given bottleneck. While the Penalty for Bottleneck method does not prove that a bottleneck exists, it nevertheless should prompt further investigation to determine the true nature of a given bottleneck – in the UK's case, Risk Capital, Process Innovation and High Growth. In addition, the index provides some indication as to how much a given country should aspire to improve its performance in this area. Closer investigations of these bottleneck candidates, their underlying drivers and potential spill-over effects would likely encourage a systemic and coordinated approach to entrepreneurship policy analysis and design.

In addition to highlighting bottlenecks, additional insight can be gained by comparing the UK against relevant peers. Above, we have compared UK's entrepreneurial profile against France, Germany and the US. The next step in the bottleneck analysis would be to take a deeper look into the performance of these countries in the UK's bottleneck areas. Parallel with this analysis, an inspection of specific policy measures in relevant peer countries might help identify policies that have worked elsewhere. A detailed inspection of such policy measures would then help illuminate transferable good practices that could be implemented within the country in question. Summarising, the above discussion suggests the following heuristic for using the Penalty for Bottleneck approach for policy analysis, design, and implementation:

- 1 Identify bottleneck factors in the country's National System of Entrepreneurship and compare these against relevant peers (i.e., countries at a similar level of economic development, with similar demographic conditions and with similar levels of market size and market openness).
- 2 Examine the bottleneck factors more closely, complementing GEDI indicators with alternative proxies.
- 3 Conduct policy comparisons in bottleneck areas against relevant peers, with a focus on analysing the anatomy of individual policy measures as well as identifying transferable good practices
- 4 Design and implement policy programs designed to alleviate bottleneck factors in the country, using GEDI to help set targets for performance improvement

Used this way, GEDI could provide a helpful platform for implementing a systemic approach to entrepreneurship policy analysis, design, and implementation, one that focuses on improving the performance of National Systems of Entrepreneurship.

Policy Conclusions

We now turn our attention to the current enterprise policy landscape in the UK and an assessment of how government may already be addressing some of the bottlenecks identified by GEDI – in particular, those concerning Risk Capital. Since the formation of the UK Coalition Government in May 2010, entrepreneurship and enterprise policy has undergone a major transformation against a background of flat economic growth and severe public sector cuts affecting business support products and services. In the GEM UK report for year 2010, it was reported that the proportion of nascent entrepreneurs who tried but failed to secure funding from friends and family and other individuals was three times less than in 2009 [3]. However, the proportion of nascent entrepreneurs reporting failure to secure unsecured bank loans, overdrafts and credit cards continued to increase for the fourth year running. In a recent report from the Department for Business, Innovation and Skills (BIS) the scale of the debt and equity gap for start-ups and for SMEs to fund growth through innovation and internationalisation activities was identified once again as a major constraint in the UK lending market place holding back growth in the private sector [5]. So, as the GEDI has identified, the Risk Capital pillar is a matter of concern for policymakers in the UK and Government in response has been developing initiatives designed to address these weaknesses and in so doing stimulate growth in the private sector.

In an effort to prioritise a diminished budget for the SME sector there has been a focus on access to capital and the stimulation of high growth firms. For example, a £21bn package of “Credit Easing” measures was announced in the Pre-Budget statement of Autumn 2011 to ease the flow of credit to businesses that do not have ready access to capital markets. These measures include:

- **A National Loan Guarantee Scheme (NLGS)**, which will allow participating banks to raise up to £20bn of cheaper funding over the next two years, and pass this lower cost of funding through to businesses with a turnover of up to £50m.
- **A Business Finance Partnership (BFP)**, which will make available an initial £1bn of funding to businesses with a turnover of up to around £500m through non-bank channels.

The objective of these measures is to help smaller and mid-sized businesses, in both the short and longer term, by increasing and diversifying their supply of credit. Both these schemes will be operational in April 2012. In addition, the **Seed Enterprise Investment Scheme (SEIS)** was announced. The SEIS will provide income tax relief of 50% for individuals who invest in shares in qualifying companies, with an annual investment limit for individuals of £100,000 and cumulative investment limit for companies of £150,000. In addition, the Government will offer a capital gains tax holiday for investments made into the new scheme. This will provide for a capital gains tax exemption on gains realised on disposal of an asset in 2012-13 and invested through SEIS in the same year. The seed scheme will be operational from April 2012; the CGT holiday is time-limited to the tax year 2012-13 to 2013-14.

These new schemes sit alongside existing schemes such as the Enterprise Finance Guarantee (EFG) designed to facilitate additional lending to viable SMEs lacking the security or proven track record for a commercial loan; the Export Enterprise Finance Guarantee (ExEFG) which facilitates the provision of short term export finance to viable SMEs which lack the security necessary to obtain such facilities commercially; Enterprise Capital Funds (ECFs) to address the ‘equity gap’. The ECF uses government funding alongside private sector investment to bridge this gap. Nine such funds have been launched since 2006; Business Angel Co-Investment Fund which is a £50m fund to support angel investments into high growth potential early stage SMEs, particularly in areas worst affected by public spending cuts. The fund has been created with a grant from the Regional Growth Fund and is able to make initial equity investments of between £100K and £1M in to SMEs alongside syndicates of business angels (subject to geographical restrictions and upper limit of 49% of any investment round); Enterprise Investment Scheme (EIS) and Venture Capital Trusts (VCTs) which were reformed in the March 2011 Budget and from April 2012 the Government will increase the annual EIS investment limit for individ-

uals to £1 million, increase the qualifying company limits to 250 employees and gross assets of £15 million (EIS and VCT), and increase the annual investment limit for qualifying companies to £10 million (EIS and VCT).

In May 2012 the official launch of the Business Coaching for Growth (BCG) initiative will take place designed to provide a £175m package of support to ~26,000 small businesses with growth potential over 3 years. Again this in recognition of the need to ensure that business owners with ambitions to grow are able to access appropriate support to engage in actions designed to develop their innovative and export behaviours which GEDI has identified as weak on the Aspirations dimension of the index.

This brief overview of the most recent policy announcements¹⁵ reinforces one of the findings of the GEDI analysis shown in Figure 1, namely that the UK institutional variables (or framework conditions) are strong with respect to the 5 pillars of Aspirations, but the UK individual variables are weak, particularly in relation to informal investment rates. Recent policy initiatives seem designed to address these weaknesses, for example through incentives for ordinary individuals to invest in other people's new businesses, and the up-skilling of growth-oriented entrepreneurs. What is of crucial importance is the effectiveness of recent policy initiatives and their ability to impact upon the individual-level dimensions of the GEDI in order to reduce the bottlenecks in the UK's National System of Entrepreneurship. One obvious and perhaps over simplistic observation is that previous policy interventions in this area, which have been considerable, have not yet impacted on the bottleneck and that the new policy initiatives are indeed warranted. So getting the detail right to address the deficiencies in the access to finance seems to be of utmost importance and remains the matter of much discussion.

¹⁵ These new initiatives sit alongside a wide range of other public sector business support products and services

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**Table 6 Description of the Individual-Level Variables Used in GEDI
(National Aggregates)**

Individual variable	Description
Opportunity Perception	Percentage of the 18-64 year old population who perceive good opportunities to start a new business during the next 6 months in the area where they live
Skill Perception	Percentage of the 18-64 year old population who believe that they possess the required knowledge and skills to start a new business
Nonfear of Failure	Percentage of the 18-64 year old population stating that fear of failure would prevent them from starting a business (reverse coded)
Know Entrepreneurs	Percentage of the 18-64 year old population who personally know someone who has started a business during the previous 2 years
Career Choice	Percentage of the 18-64 year old population indicating that people consider starting a new business as a good career choice
Success Status	Percentage of the 18-64 year old population thinking that people attach a high status to successful entrepreneurs
Career Status	Status and respect of entrepreneurs calculated as the average of NBGOODAV and NBSTATAV
TEA Opportunity	Percentage of nascent and new (TEA ¹⁶) businesses initiated because of opportunity start-up motive
TEA Technology	Percentage of TEA businesses that are active in technology sectors (high or medium)
TEA Education	Percentage of TEA business owner-managers who have participated in higher than secondary education
TEA Competition	Percentage of TEA businesses started in markets where not many businesses offer the same product
TEA NewProduct	Percentage of TEA businesses offering products that are new to at least some of their customers
TEA NewTech	Percentage of TEA businesses using new technology that is less than 5 years old
TEA Gazelle	Percentage of TEA businesses who expect to employ more than 10 employees in 5 years' time
TEA Export	Percentage of TEA businesses for whom at least some customers are located outside their own country
Informal Investors	Percentage of the 18-64 year old population who have invested their own funds into start-ups started by someone else (excluding investments in IPOs and through stocks exchanges)
Informal Investment	Average amount of funds invested per informal investor (see above).
Informal Investment Flows	The overall amount of informal investment calculated as 'Informal Investors' * Informal Investment

¹⁶ TEA refers to Total Early-Stage Activity, or the combined adult-population prevalence rate of nascent and new business owner-managers in the country's population

Table 7 Description of the Institutional Variables Used in GEDI

Institutional variable	Description	Source of data	Data availability
Domestic Market	Domestic market size is the sum of gross domestic product plus value of imports of goods and services, minus value of exports of goods and services, normalised on a 1–7 (best) scale data are from the World Economic Forum Competitiveness.	World Economic Forum	The Global Competitiveness Report 2010-2011, p. 472
Urbanisation	Urbanisation is the percentage of the population living in urban areas, data are from the Population Division of the United Nations, 2010 estimate.	United Nations	http://esa.un.org/unup/index.asp?panel=1
Market Agglomeration	The size of the market: A combined measure of the domestic market size and the urbanisation that later measures the potential agglomeration effect. Calculated as [Domestic Market] *[Urbanisation].	Own calculation	-
Education PostSec	Gross enrolment ratio in tertiary education, 2009 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 favourable 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	http://www.trading-safely.com/
Internet Usage	The number Internet users in a particular country per 100 inhabitants, 2009 data	International Telecommunication Union	http://www.itu.int/ITU-D/ict/statistics/index.html
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 performance is measured on a ten point Likert scale. Data are from 2010.	Transparency International	http://www.transparency.org/policy_research/surveys_indices/cpi/2010/results

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 equalling 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 2010.	Heritage Foundation/ World Bank	http://www.heritage.org/index/expl ore?view=by-region-country-year
Technology 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 2010-2011, p. 465
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 2010-2011, p. 425
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 2010-2011, p. 429
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 2010-2011, p. 22
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	http://stats.uis.unesco.org/unesco/tableView-er/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 2010-2011, p. 22
Globalisation	A part of the Globalisation Index measuring the economic dimension of globalisation. 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. (http://globalization.kof.ethz.ch/static/pdf/variables_2009.pdf) . Data are from the 2010 report and based on the 2007 survey.	KOF Swiss Economic Institute	Dreher, Axel (2006): Does Globalization Affect Growth? Evidence from a new Index of Globalization, <i>Applied Economics</i> 38, 10: 1091-1110.
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)”.	World Economic Forum	The Global Competitiveness Report 2010-2011, p. 458

Appendix 1 Description of GEDI Index Pillars¹⁷

The Opportunity Perception pillar captures opportunity perception – an essential precondition of entrepreneurial action [6] – and combines it with the economic potential associated with those opportunities. Opportunity perception is measured as weighted percentage of the adult-age population perceiving good opportunities to start a firm [for GEM-based indicators, see 7]. The value of perceived opportunities depends on the size of the market. We therefore weight this variable with two variables describing the domestic market: the size of the domestic market and the degree of urbanisation (combined here to reflect market agglomeration). Urbanisation is used to capture the idea that opportunity pursuit is easier in urban areas, where customers tend to be closer and more affluent than in poorer rural areas.¹⁸

The Start-up Skills pillar captures the perception of start-up skills in the population and weights this aspect with the quality of human resources available for entrepreneurial processes in the country. Perceived self-efficacy is a major determinant of entrepreneurial action [8], and action will be more effective, the higher the quality of human resources available for this action [9]. We therefore weighted the start-up skills perceptions with the gross-enrolment ratio in tertiary education, as obtained from UNESCO statistics.

The Nonfear of Failure pillar captures the important inhibiting effect of fear of failure on entrepreneurial action [10]. It is measured as the weighted percentage (reversed) of the population who do believe that fear of failure would prevent them from starting a business. As weight, we used a measure of business risk, which reflects the availability and reliability of corporate financial information, the protection of creditors by law, and the institutional support for inter-company transactions.

The Networking pillar provides a proxy of the ability of potential and active entrepreneurs to access and mobilise opportunities and resources. Networks are an important determinant of prospective entrepreneurs' resource acquisition ability [11, 12] and the ability of entrepreneurs to discover opportunities [13]. We operationalised the Networking pillar by weighting the population average of individuals who personally know at least one entrepreneur with the number of internet uses per 100 inhabitants in the country. This weight captures the enhancing effect of the internet on social networking.

The Cultural Support pillar combines how positively a given country's inhabitants view entrepreneurs in terms of status and career choice and how the level of corruption in that country affects this view. Cultural support regulates entrepreneurial action by influencing its perceived desirability [6, 14]. High levels of corruption can undermine the perceived status of entrepreneurs and dampen entrepreneurial aspirations [15-17].

The Opportunity Startup pillar captures the prevalence of individuals who pursue opportunity-driven start-ups and weights this against regulatory constraints. An entrepreneur's motivation for starting a business is an important signal of new venture quality [18]. Opportunity entrepreneurs are believed to be better prepared, to have superior skills, and to generate more value than what we call necessity entrepreneurs [19]. However, regulatory burden may inhibit this pursuit [20]. We used GEM's measure of the prevalence of opportunity start-ups and weighted this with the Heritage Foundation's Index of Economic Freedom.

¹⁷ This section has been adapted from Acs, Autio & Szerb (2012)

¹⁸ Acs and Varga 2005

The Technology Sector pillar reflects the technology-intensity of a country's start-up activity. This measure provides an indication of the potential of start-up activity to drive productivity [21, 22]. To form this pillar, we weighted the relative prevalence of technology-sector start-ups with a country's capacity for firm-level technology absorption, as reported by the World Economic Forum.

The Quality of Human Resources pillar captures the quality of entrepreneurs. It is widely held that entrepreneurs with higher education degrees are more capable and willing to start and manage high-growth businesses [9, 19]. This pillar was formed by weighing the percentage of start-ups founded by individuals with higher than secondary education with a qualitative measure of the propensity of firms in a given country to train their staff, as measured by the World Economic Forum.

The Competition pillar measures the level of the product or market uniqueness of start-ups (GEM weighted average), combined with the market power of existing businesses and business groups. The uniqueness aspect seeks to capture the Schumpeterian 'creative destruction' process [23], whereas the market power aspect captures the degree to which incumbents are able to prevent entry and the rules of the game are distorted to favour incumbents [24].

The Product Innovation pillar captures the tendency of entrepreneurial firms to create new products and to adopt or imitate existing ones. This is another indicator of the potential of entrepreneurial firms to undermine incumbents and drive waves of creative destruction. This pillar was created by weighting the percentage of firms that offer products that are new to at least some of their customers [7] with a measure that combines private-sector R&D investment, the presence of high-quality research institutions, quality of technology transfer, and the protection of intellectual property.

The Process Innovation pillar captures the use of new technologies by start-ups. This is an important regulator of new firms' ability to add value [25]. To create this pillar, we combined the percentage of businesses whose principal underlying technology is less than five years old [7] with the Gross Domestic Expenditure on Research and Development (GERD), as reported by OECD. While R&D alone does not guarantee successful growth, it is clear that without systematic research activity, the development and the implementation of new technologies—and therefore future growth—will be inhibited [26].

The High Growth pillar is a combined measure of the percentage of high-growth businesses that intend to employ at least ten people and plan to grow more than 50% in five years and business strategy sophistication [27]. Business strategy sophistication refers to "the ability of companies to pursue distinctive strategies, which involves differentiated positioning and innovative means of production and service delivery". This measure was obtained from the World Economic Forum.

The Internationalisation pillar captures the degree to which a country's entrepreneurs are internationalised, as measured by businesses' exporting potential. Internationalisation is believed to be a major determinant of entrepreneurial firm growth [28, 29]. To compute the pillar, this measure was weighted with the extent to which the country is economically globalised. This latter measure was obtained from KOF, the Swiss Economic Institute.

The Risk Capital pillar combines two measures of finance: informal investment in start-ups [7] and a measure of institutional venture capital, obtained from the World Economic Forum. Availability of risk capital is considered an important precondition of the ability of new firms to fulfil their growth aspirations [30]. The Risk Capital measure combines the percentage of informal investors in the population aged 18-64, multiplied by the average size of individuals' investment in other people's new businesses.

Appendix 2 Measuring Entrepreneurship in Countries¹⁹

Measuring a country's entrepreneurial potential is tricky. In spite of increasing interest in entrepreneurship as a country-level phenomenon, relatively little is still known about what makes a country 'entrepreneurial'. Although the link between entrepreneurship and economic growth is widely assumed, there is surprisingly little empirical guidance on how to design policies that effectively foster economic growth country-level through the recognition and pursuit of opportunities for entrepreneurship by individuals. This is largely because there is little agreement as to what 'entrepreneurship' actually means as a country-level phenomenon [2].

The existing initiatives to estimate country-level entrepreneurship can be assigned to three categories: output, attitude and framework indicators. The different approaches imply different conceptions of country-level entrepreneurship.

Output Measures

Output indicators track the emergence or registration of new self-employment or new firms within a country. Aggregated at the national level and normalized by population size, these are essentially density measures. The most widely referred output indicator is the Global Entrepreneurship Monitor (GEM), which records the self-employment and new firm entry rates annually in an annually changing sample of 50 to 70 countries [7]. Other output measures include OECD-Eurostat's Entrepreneurship Indicators Programme [31, 32], World Bank's Entrepreneurship Survey [33], and the Flash Eurobarometer survey [34].

The best known of these, the Global Entrepreneurship Monitor estimates national entry rates to self-employment and entrepreneurship with representative random samples of at least 2 000 adult-age individuals within a country (for comparison, the Eurobarometer survey only samples 500 individuals per country). Personal interviews and randomised cluster sampling techniques are used to ensure population representativeness. In contrast, the OECD and World Bank indices draw on data from national registries. The OECD high-growth firm indicator draws on business registries, central chamber of commerce registries, and other such public registries to create an index of the prevalence (relative to the overall population of registered companies) of high-growth firms. A 'high-growth firm' is a registered firm that has achieved at least 60% employment growth during a period of three years, with at least 20% annual growth in each, and which employed at least 10 employees at the beginning of the period [31].

Similarly to OECD, the World Bank Entrepreneurship Survey relies on business registry data to monitor the birth of new business entities in the formal sector. This survey is based on national registries to monitor new firm entries, defined as registrations of private companies with limited liability.

The GEM method has two strengths relative to the OECD and the World Bank approaches. First, the harmonized data collection methods allow comparability across countries, whereas firm registration procedures tend to vary. Also, the GEM approach does not miss out on new firms that do not register. The non-registration problem is particularly relevant in developing economies, where firms often choose not to register so as to avoid coercion by civic officials.

Attitude Measures

A number of global opinion and value surveys track opinions, values, and attitudes that are relevant for entrepreneurship. Perhaps the best known of these is the Eurobarometer survey, which has been conducted since 2000 [34]. Other sources of entrepreneurial attitudes include the GEM survey (which also tracks attitudes) and the International Social Survey [35]. Of these, the Eurobarometer

¹⁹ This section has been adapted from Acs, Autio & Szerb (2012)

survey is clearly the most extensive, and it has been extended in recent years also to cover entrepreneurial activity.

Depending on survey, attitude surveys monitor a range of attitudes relating to entrepreneurship. These include: preference for being self-employed; reasons for preferring self-employment (or not); attitudes toward entrepreneurs (including success and failure); and self-efficacy perceptions. Combined, such measures provide valuable evidence on the feasibility, desirability, and legitimacy considerations associated with the decision to enter into entrepreneurship.

Framework Measures

Framework measures do not track entrepreneurial activity per se, but rather, national framework and policy conditions for entrepreneurship. Three types of framework measures exist. The GEM Expert Survey surveys national experts with a questionnaire to construct multi-item scales that reflect entrepreneurial framework conditions [7]. The World Bank 'Ease of Doing Business Index' compares national regulatory frameworks for new business entry [20]. Partly building on this effort, the OECD Entrepreneurship Indicators Programme (EIP) has developed a more comprehensive framework measure that distinguishes between framework conditions, entrepreneurship performance and economic impact [36].

The World Bank 'Ease of Doing Business' (EDB) database collects data on the regulatory framework relevant for the registration of new limited liability companies. Here, the focus is on highly tangible indicators of the regulatory environment, such as the number of procedures required to register a new business; the number of days required to complete a new business registration; minimum capital requirement for new limited liability companies (as % of GDP per capita); procedures and cost to build a warehouse; creditor recovery rate in bankruptcy events; and so on. On the other hand, the EDB does not inform on actual new firm creation activity. Another limitation is that the data is restricted to a 'standardised' company that, among others, is registered, employs from 5 to 50 employees within the first month of operation, and has sales turnover of up to 10 times start-up capital [20]. This means that the EDB framework conditions may or may not apply to well over 90% of the new firm population in any given country.

Perhaps the most systematic and comprehensive approach to measuring entrepreneurship policy frameworks thus far was undertaken by the OECD through its Entrepreneurship Indicators Programme (EIP). At the heart of the EIP approach is the framework conditions – entrepreneurship performance – (economic) impact model developed by Ahmad and Hoffmann [2008; see also 37]. In this model, entrepreneurship performance (i.e., the registration and growth of new limited liability companies) is regulated by entrepreneurship framework conditions. However, the link between framework conditions and entrepreneurship performance remains a conjecture rather than a statistically established relationship. Demonstrating this link statistically may prove challenging, given the all-encompassing definitions employed [36: 8].

Summarising, while framework indicators provide useful benchmarks of the institutional and regulatory conditions that prevail in the economy, they lack connectivity with actual activity. In this perspective, an entrepreneurial country is one where the regulations and broader institutional conditions are supportive of entrepreneurial actions, regardless of whether such activity occurs and in which form. The reliance on national registries also causes problems, especially in developing countries where large numbers of new businesses avoid registration.

The National Systems of Entrepreneurship Approach

All of the reviewed approaches – output, attitude and framework indicators – have their own merits, and they have been designed for different purposes. We note that, in particular, the GEM approach is valuable, since it is the only indicator to provide primary, globally harmonized data on entrepre-

neurial activities, attitudes and aspirations that is comparable across countries. Relying on primary survey data (at least 2,000 randomly chosen adult-age individuals are interviewed in each participating country every year) provides an advantage over trade registry data, which may not capture all start-ups, and which may also capture, e.g., restructurings of established firms that have little to do with entrepreneurship.

However, in spite of their merits, we note that all reviewed approaches are limited to one level of analysis only. National activity and attitude surveys aggregate individual-level data (e.g., new business registrations, attitudes of individuals) to the national level to represent the 'entrepreneurial character' of a country. Framework indicators, for their part, focus on country-level phenomena and ignore individual action.

The GEDI approach recognises that entrepreneurship is fundamentally an individual-level phenomenon: if opportunities were not recognised and pursued by individuals, there would be no entrepreneurship. However, the GEDI approach also recognises that the outcomes of entrepreneurial action are regulated by the context within which the individuals find themselves. If the context does not support entrepreneurial growth, individual-level efforts will be stymied. Therefore, when evaluating the entrepreneurial potential of countries, one has to consider *both* individual-level action *and* how well the context supports the translation of the outcomes of this action into productivity gains. In other words, the GEDI method recognises that, at the country level, entrepreneurship is a *systemic* phenomenon: individual-level action is required for entrepreneurship to happen, but the outcomes of this action are regulated by context. On this principle, GEDI defines country-level entrepreneurship as [2: 11]:

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

Appendix 3 Penalty for Bottleneck Method²⁰

We noted above that at the country level, entrepreneurship is a systemic phenomenon. What we mean by this is that a country's entrepreneurial performance is the product of a number of inter-related factors, such as entrepreneurial attitudes, activities and aspirations, each weighted by contextual factors. Simple aggregates of, say, individual-level entries to business formation or self-employment do not necessarily reflect the potential of any given economy to engender entrepreneurial action and translate this into economic performance. As an example, mere aggregates of entries to self-employment and entrepreneurship tell us little about the quality of new entries, nor do they inform us about the potential of new entries to drive productivity-enhancing resource allocations in the economy. To capture this complex dynamic, the GEDI Index uses the Penalty for Bottleneck approach.

In the Penalty for Bottleneck (PFB) methodology, a bottleneck is defined as the weakest link or binding constraint in the national entrepreneurial dynamic. Mathematically, a bottleneck is represented by the lowest value within a given set of index components. After normalising the scores of all index components, the value of each component is 'penalised' by linking it to the score of the indicator with the weakest performance in a given country. This simulates the notion of a bottleneck: if the bottleneck component is improved, the particular sub-index and ultimately the entire GEDI index would show a significant improvement.

The Penalty for Bottleneck method offers several benefits over traditional, additive index methods. The most important benefit is that it draws attention to bottleneck factors that hold back national system-level performance. Not only does the GEDI method highlight potential bottleneck factors, the normalisation process helps illustrate how much a given country could stand to improve its performance, if the bottleneck factor is alleviated. This feature can be illustrated using an analogy from cooking. Suppose one wants to bake a cake for 6 persons. The basic ingredients are flour (one kilo-gram required), eggs (6 eggs required – i.e., 300 grams of egg), and sugar (200 grams required) – a total of 1,500 grams of ingredients. Now suppose we only have 100 grams of sugar – a bottleneck ingredient. In a traditional index method, we now would have 1 400 grams of ingredients – a deterioration of some 9%. In the GEDI method, it is recognised that sugar is a bottleneck factor, and 100 grams of sugar only allows us to effectively use only 500 grams of flour and 150 grams of egg (3 eggs) – for a total of 750 grams of ingredients – a deterioration of 50%, as opposed to 9% drop in a traditional additive index. Conversely, by only adding 100 more grams of sugar, we can now utilise all ingredients effectively, and we would get 1 500 grams (50%) more cake.

The illustration above is simplifying, as GEDI's Penalty for Bottleneck approach allows some substitutability between index components. The example nevertheless highlights the problem with the assumption of full substitutability between index components. This is an untenable assumption for a systemic phenomenon such as National Entrepreneurship. Because the Penalty for Bottleneck method helps draw attention to bottleneck factors, it provides a potentially potent platform for the analysis of National Systems of Entrepreneurship, as well as for the design of policies geared to alleviating system-level bottlenecks.

This bottleneck approach is formalised in equation 1:

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

where $x_{i,j}$ is the modified, post-penalty value of index component j in country i
 $y_{i,j}$ is the original, normalised value of index component j in country i

²⁰ This section has been adapted from Acs, Autio & Szerb (2012)

$i = 1, 2, \dots, m$ = the number of countries
 $j = 1, 2, \dots, n$ = the number of index components

The bottleneck is achieved for each indicator by adding one plus the natural logarithm of the difference between a given index component's value in country i and the lowest normalised value of any index component for that country. Thus, improving the score of the weakest index component will have a greater effect on the index than improving the country's overall GEDI index score than will improving the score of stronger index components. For example, assume that the normalised score of a particular index component in a country is 0.60, and the lowest value of all components is 0.40. The difference is 0.20. The natural logarithm of 1.2 is 0.18. Therefore, the final adjusted value of the index component is $0.40 + 0.18 = 0.58$, instead of 0.60. The largest potential difference between two index components is 1, when a particular country exhibits the highest value for one index component (across all countries) and the lowest value for another index component, again across all countries. In this case, the natural logarithm of $[(1+1) = 2] = 0.693$, so the maximum penalty is $1 - 0.693 = 0.307$.

We suggest that this Penalty for Bottleneck approach is particularly useful for portraying the dynamic of National Systems of Entrepreneurship. There is a strong argument that entrepreneurship policy cannot be 'siloed', but rather, requires coordination across policy domains because of interdependencies that exist among policy actions [38, 39]. Traditional cumulative indices are unable to capture and appropriately account for such interdependencies. For example, if a given country exhibits very strong performance in some domains but very weak in others, traditional additive index methods would still represent the country's overall performance as average to strong. In the bottleneck approach, that country would be penalised more for its weaknesses, and its overall index score would be represented as weaker than average.