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PIN - Productivity Projects Fund

Pioner Project Report

Analysing Resilience in High Growth Firms at the Onset of COVID-19 Crisis

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About PIN

The Productivity Insights Network was established in January 2018 and is funded by the Economic and Social Research Council. As a multi-disciplinary network of social science researchers engaged with public, private, and third sector partners, our aim is to change the tone of the productivity debate in theory and practice. It is led by the University of Sheffield, with co-investigators at Cambridge Econometrics, Cardiff University, Durham University, University of Sunderland, SQW, University of Cambridge, University of Essex, University of Glasgow, University of Leeds and University of Stirling. The support of the funder is acknowledged. The views expressed in this report are those of the authors and do not necessarily represent those of the funders.

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1. Introductory Notes

A high growth firm (HGF) is a company that experiences significant employee and turnover growth rates for a number of years. Over the past decade, HGFs - also known as scale-ups - have progressively become an established feature of the UK economic policy landscape. An empirical study conducted by Anadyke et al found that HGFs represented only 6% of all start-ups but created over 50% of jobs[1]. Audretsch reported similar results for all OECD countries[2]. The contribution of HGFs appears to be particularly pronounced during economic crises, when HGFs showed higher levels of resilience than other companies[3].

In 2017, the then Small Business Minister created a 'scale-up task force', bringing together entrepreneurs, investors and local industrial entities from across the country, as part of the Government's commitment to a successful Industrial Strategy. The goal was to help an increasing number of small-to-medium-sized enterprises (SMEs) with high-growth potential to thrive.

But while we know something about the characteristics of these companies - about their age, size, sector and location - relatively little is known about the dynamics of the HGF population as they evolve over time. The focus of most empirical analyses has been on annual counts (e.g. employees, turnover) to track population change, which may not reveal how these firms operate and adapt to changing environment, maximising on available opportunities or dealing with emerging threats. Authors such as Anadyke and Hart suggest that even the growth of HGF may be characterised by random episodes rather than being a systematic feature of particular SMEs with certain characteristics[4]. Predicting instances of growth, and in particular those that push SMEs towards higher productivity levels, remains a major conceptual challenge.

The original aim of our project proposal was to co-produce with a variety of stakeholders new insights into whether and why scale-ups in four peripheral areas of the UK (Northern England, Wales, Northern Ireland and Scotland) fail to reach their productivity potential. As of February 2020, our research team had managed to build a comprehensive database of nearly approximately 5,500 high-growth SMEs by collecting and combining data from various databases, including Beauhurst and FAME [5]. Simultaneously, we had conceived a conceptual model anticipating that innovators and exporters with extensive intra- and inter-regional networks were more likely to grow faster by means of productivity improvements. Along these lines, we developed a questionnaire to gather data regarding the effects of the above factors in shaping productivity trends in high-growth SMEs.

Unfortunately, the feedback received from a small pilot study conducted in late February clearly revealed that for most firms in our sample, the strategic priority had quickly shifted from ‘growing’ to ‘surviving’ the impending economic crisis.

Thus, the focus of our analysis shifted towards an investigation of the resilience of SMEs with high-growth potential in response to the economic downturn caused by COVID-19. COVID-19 has been predicted to cause more serious economic damage to the UK economy than the last financial crisis and in a shorter period of time. The Government has so far responded with an array of different measures to smooth the impact of the downturn on the economy and mitigate its effects on individual

[1] Anyadike-Danes, M., Bonner, K., Hart, M. and Mason, C., 2009. Measuring business growth: high-growth firms and their contribution to employment in the UK. London: NESTA

[2] Audretsch, D.B., 2012, March. Determinants of high-growth entrepreneurship. In *Report prepared for the OECD/DBA International Workshop on High-Growth Firms: local policies and local determinants*. Paris: OECD

[3] Anyadike-Danes, M., Bonner, K. and Hart, M., 2013. *Exploring the incidence and spatial distribution of high growth firms in the UK and their contribution to job creation*. NESTA working paper No. 13/05.

[4] Anyadike-Danes, M. and Hart, M., 2017. The UK’s high growth firms and their resilience over the Great Recession. *Research Paper*, (62).

[5] The team gratefully acknowledge the additional financial support secured from the University of Edinburgh’s Data-Driven Innovation Programme COVID-19 Small Grant Funding, which allowed for the successful adaption and delivery of this project.

actors. We focus on the impact of COVID-19 on HGFs in terms of turnover, cash flow and ability to retain their workforce. We assess the challenges they currently face as the economic landscape deteriorates, in terms of domestic market and supply chain disruptions, more challenging access to finance, and growing difficult to export. We control for the effects of geographical location and sectoral domain. We seek to unveil the strategies adopted by high-growth SMEs to adapt and respond to these challenges and ask whether the measures put in place by the Government are having the desired effect.

In April we conducted an initial survey involving 565 firms. We collected valuable information about changes in demand and their financial implications, supply chains disruption, human resources management, export trends, levels of stress experienced by individual entrepreneurs and managers, and their assessment regarding future business prospects.

Furthermore, we conducted 12 interviews with a subset of the firms in our sample, with a view to understanding better the form(s) of organisational resilience within SMEs during the early stages, as well as being an opportunity to investigate existing (and competing) hypotheses about its sources. We selected firms displaying a sounder financial position and planning capacity and focused our questionnaire on the interplay between a firm's agile structure and strategic planning as a source of resilience.

Overall, these findings suggest that, on the one hand, COVID-19 has increased the stress level of majority of entrepreneurs and negatively affected their businesses. On the other hand, similar to other studies conducted in the US, firms with deteriorating financial capacity are less likely to preserve their teams and go out of business or see it shrink during COVID-19 crisis.

However, the combined findings from the survey and follow-up interviews indicate a significant degree of resilience amongst the firms we interviewed, including a slightly better (or at least more optimistic) prognosis than the overall sample of high growth SMEs. The reasons for this could perhaps be found in the patterns of organisational learning and value chain configuration, leading to a degree of both strategic planning as well as agility[6]. We found some of these firms adopting models of open innovation, reliance on a deep and complex supply chain, covering anything from advance manufacturing to consumer or data applications, makes emerging SMEs far more strategically minded and resourceful. Some had positioned themselves as part of a larger consortium of players and the latter makes them far more attuned to operating in an unpredictable environment.

In the fourth quarter of 2020, we will conduct the survey for the second time, in order to collect longitudinal data and develop a more in-depth knowledge through a dynamic model of the factors that influence the resilience of high growth SMES, comparing the conditions of presence and absence of public support.

2. COVID-19, Economic Downturn and SMEs

The outbreak of the novel coronavirus, named as COVID-19, has been declared as a pandemic by the World Health Organisation (WHO). First reported in December 2019 in Wuhan-China, the virus has now become truly globalised. At the time of writing this report, COVID-19 has infected more than 19.6 million people and caused about 0.72 million deaths all over the world[7]. In addition to dire health consequences, the COVID-19 outbreak is producing massive and far-reaching economic cost burdens for all nations.

While COVID-19 has severely affected the global economy, it is predicted that COVID-19 is likely to cause a more serious economic damage to the UK economy than the last financial crisis and in a

[6] Vidmar, M., Golra, O., Rosiello, A., Greene, F. 2020. Resilience of New Space Firms in the UK during the Early Stages of Covid-19 Crisis: The Case for Strategic Agility [draft]

[7] (https://www.worldometers.info/coronavirus/)

shorter period. The UK has already started seeing the biggest economic shock that it has experienced in centuries. The UK office of national statistics (ONS) reported that only in April 2020, the GDP fell by 20.4%[8]. Similarly, the Bank of England has expected the UK economy to shrink by 14 per cent in the year 2020[9].

As such COVID-19 pandemic has negatively impacted the whole economy, it has also created challenges for the existing small and medium-sized enterprises (SMEs). Recent empirical work on the impact of COVID-19 shows that as many as half of all small firms have temporarily ceased trading since the lockdown and as many as 60% of SMEs are at risk of running out of their cash reserves[10]. However, prior studies on the performance of SMEs during the global financial crisis suggest that some small firms are better at adapting to changing environments than others[11,12]. High-growth firms (HGFs) appear to be pronounced during economic crises, because they show higher levels of resilience than other companies[13]. However, the extent to which they will prove resilient may depend upon their capability and resource availability[14].

In this study, we investigate the resilience of SMEs with high-growth potential in response to the economic downturn caused by COVID-19. We focus on these ambitious businesses because they are critical to the country's economy. They represent just 6 per cent of UK firms but generate about 50 per cent of all new jobs and provide much of the country's export and productivity growth[15]. If they do not survive the COVID-19 pandemic, this will have very damaging consequences for our future economic prosperity.

One interesting aspect of this debate that we investigate is whether geography has an impact on resilience. In other words, are HGFs in the UK periphery (Scotland, Northern Ireland, Wales, North-East England) at more of a disadvantage than firms from the South-East England? Evidence from the last financial crisis showed that HGFs in peripheral areas of the UK were less resilient because they had fewer sources of available finance and lacked the business support infrastructure to successfully navigate their way through a crisis[16,17,18,19]. Furthermore, recent empirical evidence clearly shows that whilst innovative SMEs play an important role in shaping the medium- and the long-term ability of

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OECD economies to grow and generate new employment, many of them in some key industrial sectors (such as retail, leisure, entertainment and transport) have been disproportionally affected by the economic downturn caused by COVID-19[20].

The UK Government has so far responded with an array of different measures to smooth the impact of the downturn on the economy and mitigate its effects on individual actors[21]. For instance, a *Job Retention Scheme*, to pay the wages of employees who were temporarily furloughed; a *Self-Employment Income Support Scheme*, to give grants to established self-employed people whose businesses had been affected; coronavirus *small business grant funds*, to provide support to small businesses; and business interruption loan schemes for SMEs along with other financial support packages.

We focus on the impact of COVID-19 on HGFs in terms of turnover, cash flow and ability to retain their workforce. We assess the challenges they currently face as the economic landscape deteriorates, in terms of domestic market and supply chain disruptions, more challenging access to finance, and growing difficult to export. We consider the individual profile of the entrepreneurs and managers who started and manage these firms, focusing on their age, professional and educations background, and level of sectoral knowledge and experience. Furthermore, we are interested in their personal experiences during the pandemic, especially the level of stress they have been experiencing. Finally, we seek to unveil their individual strategies to adapt and respond to these challenges, and whether the measures put in place by the Government are having the desired effect.

2.1 *High Growth Firms*

Beauhurst define a scale-up and high-growth firm as a company which employ more than 10 employees and has had an annualised average growth rate of at least 20% in either turnover or headcount over three accounting years. In this work, we also include firms with 1-9 employees.

2.2 *High Growth Firms – The New "Motor" of Economy?*

The topic of firm growth has attracted considerable attention from entrepreneurship and management scholars over the past several decades[22,23,24]. In particular, high-growth entrepreneurship and HGFs have become the focus of academic research as well as enterprise policy in recent years[25,26,27]. This is because these HGFs have a remarkable ability to create jobs, their potential to create wealth, and their substantial contributions to creative destruction and productivity growth[28].

Studies surrounding HGF have investigated a variety of topics. Primary topics include but not limited to understanding the drivers of high productivity and rapid growth, characteristics of HGFs, predicting HGFs and their growth patterns, persistent HGFs, and support policy/programmes for

[20] http://www.oecd.org/sdd/business-stats/statistical-insights-small-medium-and-vulnerable.htm
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HGF[29,30,31,32,33,34,35] . Some scholars also have attempted to investigate whether persistent HGFs- those firms who are persistently achieving annual high growth for a number of years, differ in characteristics from non-persistent HGFs[36,37]. There are also studies that focus on the geography of HGFs with a focus on peripheral regions[38,39]. Most broadly, HGFs' growth is determined by expanding employment and improving financial position.

In this project, we investigate what characteristics of HGFs make them more resilient to the economic downturn caused by COVID-19. Are those with experience of sustained growth, innovation, able to avoid disruption to their supply chain, and exporting better placed to deal with the effects of the pandemic? The research team anticipated innovators and exporters relying on more robust of adaptable supply chains are more likely to be entrepreneurially resilient since to scale their business, such firms should have been agile, have developed competencies such as emergent improvisational planning that allows them to respond to changing market conditions, and have the dynamism to rapidly deploy new and existing resources such as human and financial capital.

Two further aspects we examined are: *Human Capital and Growth*: it has long been recognised that superior human resources enhance a venture's ability to attain, sustain, and even enhance its competitive advantage during various growth stages[40]. The literature on HGF addresses various forms of human capital including education, skills, industry experience, cognitive abilities, prior start-up experience and domain experience etc[41]. General findings regarding human capital and high growth indicate that education and skills of key employees, manager/founder's prior experience, cognitive abilities and domain experience of manager/founder are strong driver of firm growth.

Finance and growth: HGFs find it no harder than non-high growth SMEs to access external finance. The vast majority of high growth SMEs rely strongly on debt-based finance for their funding, not equity finance. High growth SMEs are much less likely to seek finance for working capital purposes but are no more likely to seek finance to invest in R&D than less rapidly growing SMEs[42]. Prior work demonstrates that entrepreneurs with business education and entrepreneurs with experience in accountancy or finance have a broader knowledge of finance alternatives, which affects firm financial

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behaviour and ultimately growth[43]. Moreover, the capability to access finance is more important than finance itself[44]. Similarly, entrepreneurial financial literacy is crucial for venture success[45]. Scholars find a positive and significant relationship between financial capabilities and market expansion[46]. Research also shows that constructive informal financing such as trade credits and family borrowing that relies on information advantages or an altruistic relationship is associated with good firm performance[47]. Underground financing such as money lenders who use violence for enforcement is not.

2.3 *Developing Resilience in HGFs*

The literature has identified that dynamic capabilities (organisations), entrepreneurial bricolage (individuals), and dynamic capabilities[48] promote resilience in fast-growth SMEs (business survival and subsequent performance). This is important as fast growth SMEs play a key role in job creation in the UK[49], as noted in the UK Government's Industrial Strategy[50]. The last financial crises took a negative toll on them[51], albeit on average they were more resilient than slower-growing firms[52].

Organizational resilience is the ability to foresee opportunities and threats from emerging trends, adapting and changing constantly, surviving in a turbulent environment and recovering from crises[53,54,55,56]. It entails the capacity to quickly re-deploy technical, organisational, financial and human resources to respond to unpredictable changes within the operating environment[57,58,59], which resonates with the concept of dynamic capability[60]. Firms perform better in or post-crisis if they can gain access to, re-organise and re-deploy existing and new resources, allowing them to deal with threats or exploit opportunities that are transient, changing and temporary. Resource recombination

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to serve changing purposes as well as learning how to achieve such recombination affect chances of survival and recovery[61,62.]

The resource base and business models of SMEs tend to go under excessive strain when experiencing crisis conditions[63,64]. This has negative effects on their ability to adapt, survive and bounce back. Dynamic capabilities for survival depend on managerial judgment and strategic planning for instances of discontinuity within the economic, social or technical environment. There is little evidence of how SMEs respond to extreme events[65]. However, there is a general consensus that SMEs have less formal strategic plans contemplating such events. Their style of management tends to be more reactive than proactive[66].

Moreover, SMEs are more vulnerable to external shocks because of restricted access to key resources such as finance, material assets, consumables. They depend on less reliable technical systems and supply chains[67]. They have less bargaining power, target smaller markets, and tend to be less diversified, i.e. less able to edge risks. They struggle to build redundancy, excess capacity and reliability into their managerial and operational systems and routines[68]. Consequently, they can be overwhelmed by the magnitude of the changes they get exposed to – e.g. massive drops in demand/prices, the collapse of supply chains or infrastructure[69].

Empirical studies corroborate spontaneous adaptation and 'wayfinding'[70] rather than strategically planned responses[71, 72]. This is symptomatic of leaner and more flexible structures: easier and quicker to reconfigure whenever needed, favouring agile adaptation to changing conditions. Flexibility and agility are embodied in entrepreneurial skills and dynamic capabilities and help SMEs to absorb and adapt to external shocks. Their agility in rapid geographic relocation[73] and rapid diversification[74], and the innovation capacity, make them more resilient[75]. Thus, while some now see lean start-up principles

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as an 'anathema to organisations that put true resilience at their heart'[76], others perceive the superior agility and flexibility of entrepreneurial SMEs as an advantage.

Strategic planning, in particular, has been shown as a critical asset in improving knowledge management, innovation and competitive capabilities of SMEs [77,78,79]. However, in addition to an uneven uptake of these tools amongst SMEs[80,81,82,] some studies point to little effect of strategic planning on actual SMEs' performance[83]. However, international comparison showed that flexible strategic planning proved successful in "unstable" environments[84]. Could here be a lesson for the need for both (some degree of) planning and management agility in times of uncertainty and crisis?

During crisis and recovery times policymakers shift their attention from high growth to resilience. Following the last financial crisis, the entrepreneurial dynamism of growth-oriented SMEs has been regarded as a powerful force to build robustness and flexibility into struggling economies[85,86]. However, empirical evidence remains sparse. In conjunction with the economic turmoil being caused by COVID-19: *if* and *how the dynamic capabilities of fast-growth SMEs promote business survival* and *subsequent performance*. Alternatively, *are SMEs the victims of their limited planning ability* and *less reliable organisational routines*?

Moreover, even if entrepreneurial mind-sets lead to resilience[87,88], so far little conceptual clarity and empirical evidence has been produced to understand how entrepreneurial traits (such as optimism; growth orientation; leadership drive) generates organisation resilience[89,90,91].

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Location is a key factor in determining vulnerability or resilience; the last financial crisis impacted on different UK regions differently[92]. SMEs in peripheral UK regions suffered more acutely from lack of finance[93]; performance in/post-crisis was affected by access to formal and informal business (support) associations, local inter-firm networks and knowledge spillovers[94]; damaged infrastructure - such as telecommunications, power and water but also incubators or accelerators[95] – can induce disruption to production and operational activities[96]. Moreover, SMEs' resilience can depend on rural vs urban location[97]. Thus: *is SMEs' resilience affected by location*? If so, *how*? Does it relate to access to resources; infrastructure; networks; markets?

Finally, of interest is the *impact of governmental support on growth-oriented SMEs survival and bounce back capacity*, investigating the effectiveness of specific measures during and post-crisis.

3. Methodology

Overall, this study examined the impact of COVID-19 on UK HGFs (SMEs). In particular, the study focused on the two key determinants of HGFs – human resources and financials. Through a large survey (with 565 participants) we quantitatively examined in detail both employment, skills (retention) and management strain; as well as changes in investment, cash flow and relationships with suppliers and customers. We combine these survey-data with information obtained from two databases (FAME and Beauhurst) to start building our own comprehensive database about HGFs in the UK and their response to COVID-19. From these data, we extrapolate key descriptive statistics and conduct some econometric runs. These runs test the relationship between, on the one hand, the current level of financial fragility among HGF SMEs, the level of disruption they are experiencing and entrepreneurial characteristics and, on the other hand, the extent to which some small businesses may have already temporarily closed and laid off employees, expectations about whether they expect their business to grow or remain unchanged vs shrink or close permanently, and decisions on whether to seek financial support from the government or other sources.

Furthermore, we used a small set of (12) semi-structured interviews to look for qualitative evidence that strategic planning and entrepreneurial mind-set played a significant role in the firms' response and resilience, and analysed if and how the geographical location (periphery) and government interventions featured in these narratives.

Moving forward, we will use the survey results of the survey data and qualitative data analysis to improve our questionnaire and conduct a second survey with the 565 companies in our sample in the fourth quarter of 2020; that is when most of the support measures put in place by the British government have ceased. This will generate valuable longitudinal data that considers the long-term impact on the pandemic and structural effect of public support schemes.

4. Survey Findings

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4.1 *Descriptive Statistics*

At the beginning of April, we conducted a survey asking questions about the performance of HGFs before the outbreak of the COVID-19 in December 2019 and what has happened to these businesses subsequently. We have collected 565 responses.

Most firms have retained their employees and self-employed professionals. However, the most significant losses are recorded among the latter category. On average the HGFs in our sample moved from employing 3.5 FTE contractors to 1.9FTE (a reduction of almost 50%).

When it comes to managing their human resources, HGFs have resorted to a number of different measures to obviate the negative consequences of COVID-19. Some had to lay their employees off temporarily, some let them go permanently, others to reduce their shifts. However, the largest group used the *Government Furlough Scheme* to retain their staff. More are planning to use it, although they were not sure how this was going to operate in practice.

Roughly two-thirds of the firms in our sample have a turnover of less than £1m per annum, suggesting they are of potential (rather than realised) high growth. Since the start of the current economic downturn, most of these firms have seen their revenues decrease (59%; on average by 58%) and cash flow (68%) position deteriorate. Some 47 firms (8% of the sample) have seen their revenues increase, on average by 39%.

Entrepreneurs and business managers have responded to COVID-19 following different strategies. Most notably, aside from reducing their personnel some have discontinued strategic investments or used their own funds to support current activities.

Overall, respondents tended to think that the Govt support was going to be helpful and the majority of respondents took advantage of some form of financial support, with a significant proportion of them deferring payments to HMRC and using the Small Grant Schemes.

In terms of the potential impact of COVID-19 on their business, more than half of the firms we surveyed anticipate that their business will shrink. However, despite the dramatic decline in financial performance, many entrepreneurs are upbeat about their survival prospects. Less than one in ten (6%) of them think that they will have to close their business. Fifteen per cent expect they will continue to grow while a quarter will stay the same.

This optimism needs to come with an understanding of the financial and emotional costs for the entrepreneur struggling to survive the economic tsunami caused by the pandemic. Around 40% of entrepreneurs have used personal savings or retained earnings to keep their business afloat during the financial crisis. We also asked entrepreneurs about their levels of stress before COVID-19 and their current levels of stress. The baseline reflects the fact entrepreneurship is intrinsically stressful as entrepreneurs seek to juggle competing and difficult tasks, often with limited information and resources. Before the outbreak, the average score was 5.7 (on a 10-point scale). However, since COVID-19, the average score rose to 7.8, an increase of 37 per cent. This points to the wider – often uncosted – challenges entrepreneurs face in running a business in a time of crisis.

4.2 *Econometric Model Results*

We study the impact of entrepreneurial characteristics and firm-level attributes to understand resilience. Moreover, we examine the sectoral and regional factors in explaining resilience behaviour. We run a binary logistic regression model to study these effects as shown in Appendix 1: Data. Preliminary results show that entrepreneurs' increasing stress-level during the crisis has a negative and significant (β=-0.288, p-value=0.000) impact on resilience. We also find that the firms with deteriorating cash flow positions are more pessimistic about their future business prospects, as they expect their business activities will either shrink or cease before the end of the crisis (β= 0.374, p-value=0.000). Our results further indicate that resilient firms are more likely to retain their most

valuable employees during the crisis as compared to non-resilient firms. The coefficient for the difference in employment before and after the crisis is positive and significant (β= 0.077, p-value=0.026).

Overall, these findings suggest that, on the one hand, COVID-19 has increased the stress level of the majority of entrepreneurs and negatively affected their businesses. On the other hand, entrepreneurs who have strong financial capability are more likely to preserve their teams and be more resilient during COVID-19 crisis.

Regarding our analysis of regional and sectoral factors, we do not find statistically significant differences in resilience between firms located in different regions, although the coefficient associated with Northern Ireland suggests that this area may have suffered relatively more than other parts of the UK. However, some sectors show a difference in their resilience. Our results suggest that businesses operating in craft industries, trading firms, and, in particular, technology/IP firms are more resilient than firms in other sectors. These findings suggest that the sectoral dimension play a significant role during the crisis.

While we find a significant relationship between resilience and entrepreneurs' management and financial capabilities, at this stage we do not find any significant association between resilience, and entrepreneurial as well as firm-level characteristics. Neither entrepreneurs' education or past industry experience, nor their personal traits (e.g., age, gender) show a significant relationship with resilience. Similarly, we do not find any significant relationship among firm-level characteristics (e.g. size, age) and resilience.

4.3 *Follow-up Interviews*

We have followed the survey with a small number of scoping interviews to understand better the decision-making process and the firms' perspective on the studied parameter dimensions. We interviewed 12 HGFs across sectors ranging from high-end engineering and smart agriculture to medical diagnostics and satellite data analysis. In relative terms, our survey-data show these are sectors less disrupted by the pandemics than others – such as hospitality, retail, and transportation. The firms interviewed are located across the country, six in England, five in Scotland and one in Wales.

These HGFs are doing quite well financially. Most have had investment or cash reserves to last them through the year, as they often operate in funding cycles, rather than based on immediate cash flow. These selection criteria allowed us to focus on their strategic responses to the pandemic since they were not under immediate financial threat.

We find that most have kept all their staff (occasionally one or two people in support roles in office or production line have been furloughed) and many have even recruited during this time. The reason for such decisions was that most of the active R&D projects and sales continued unabated, though data companies were particularly advantaged, as the staff could more easily move to home working.

Manufacturers had a bit more disruption (in operations of their labs/workshops and in the value chain), whilst all have seen paused investment and difficulties forming new customer relationships. These were seen as operational issues and plans have been made to readjust development schedules and value chain relationships.

Many have used this time to reflect on their business model and develop additional resilience (both in remote working as well as updated processes and back up plans). Of particular importance is the development of new skills in (social media) on-line networking and sales, though the latter is seen as an issue (many believe to "close a sale" physical contact is much preferable).

Most easily transitioned to homeworking, and many are now thinking to remain that way for the foreseeable future (which is a problem for commercial services!). Many have developed and tested

plans for this ahead of the official lockdown announcement and most have found the infrastructure (i.e. internet) adequate.

UK Government schemes (apart from furlough) were used but sparingly (and their advice is regarded as inconsistent and late), whilst Scottish Government (and Scottish Enterprise) have been commended for 1-to-1 support and continuity grant funding.

5. Discussion

These findings are particularly significant as the quality of strategic planning has been suggested to rely heavily on the development of alternatives and integration of information[98]. This seems to be born out in our study as well.

Overall, these findings suggest that, on the one hand, COVID-19 has increased the stress level of the majority of entrepreneurs and negatively affected their businesses. On the other hand, similar to other studies conducted in the US[99], firms with deteriorating financial capacity are less likely to preserve their teams and go out of business or see it shrink during COVID-19 crisis.

At this stage, peripheral regions (Scotland, North-East England, Wales and Scotland) do in comparison to South-East England) not seem to be less resilient as the limiting factors for growth does not appear to make them less sustainable[100]. This may be due to the fact that some peripheral firms have near-monopolistic market position[101]. Empirical evidence suggests that during the previous financial crisis, SMEs were hit evenly in (global) centre and periphery, though in different ways – the centre has higher credit crunch and demand slump problem; the periphery is more susceptible to value chain breakdown due to exposure to failure of (larger) firms downstream[102]. We have not found similar evidence, although a more detailed picture might suggest otherwise when we are able to collect and analyse the longitudinal data.

In terms of the organisational profile of the firms that appear to be more resilient, a mixture firms' agility – being flexible in organisational and product terms – and capacity - in particular having the financial backing to deal with any immediate cash-flow issues - appears to be particularly useful in times of crisis[103]. This is particularly true when firms perceive public policy response inadequate or unsuitable to meet the challenges they are facing. Many of the interviewees have highlighted this as a persistent challenge and have put in place measures to develop strategic plans for the future on the basis of self-reliance. Entrepreneurial traits and access to finance support sales growth but not employment[104].

The combined findings from the survey and follow-up interviews indicate a significant degree of resilience amongst the firms we interviewed, including a slightly better (or at least more optimistic) prognosis than the overall sample of high growth SMEs. The reasons for this could perhaps be found in the patterns of organisational learning and value chain configuration, leading to a degree of both strategic planning as well as agility. We found some of these firms adopting models of open innovation, relying on a deep and complex supply chain, covering anything from advance (heavy) manufacturing

[98] Meissner, P., 2014. A process-based perspective on strategic planning: the role of alternative generation and information integration. *Bus. Res.* 7, pp. 105–124. https://doi.org/10.1007/s40685-014-0005-9
[99] Bartik Alexander W., Marianne Bertrand, Zoë B. Cullen, Edward L. Glaeser, Michael Luca, Christopher T. Stanton (2020), How Are Small Businesses Adjusting to COVID-19? Early Evidence from a Survey NBER Working Paper No. 26989.
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[101] Cowling, M. and Nadeem, S.P., 2020. Entrepreneurial Firms: With Whom Do They Compete, and Where??. *Review of Industrial Organization*, pp.1-19.
[102] Chowdhury, S.R., 2011. Impact of global crisis on small and medium enterprises. *Global Business Review*, *12*(3), pp.377-399.
[103] Cowling et al. 2015. *ibid*.
[104] Cowling et al. 2015. *ibid*.

to consumer (data) applications. This makes HGFs far more strategically minded and resourceful. For instance, some SMEs had positioned themselves as part of larger loosely-integrated groups and clusters of players, which makes them far more attuned to operating in an unpredictable environment, which we explored further in the case of the New Space sector[105].

Our survey was conducted and dynamically (re-)position themselves into new markets and exploit flexibility in April 2020. To obtain a operational configurations. Hence, operating in these fast-paced and well-networked sectors allows and requires HGFs to develop a degree of strategic agility, which we explored in more accurate assessment of the factors shaping the resilience of high-growth SMEs in different parts of the UK, in Q4-2020 we plan to conduct the survey detail for the second time, in order to collect longitudinal data and test a dynamic model of the factors that influence the resilience of high growth SMEs in different parts of the UK, comparing the conditions of presence and absence of public support.

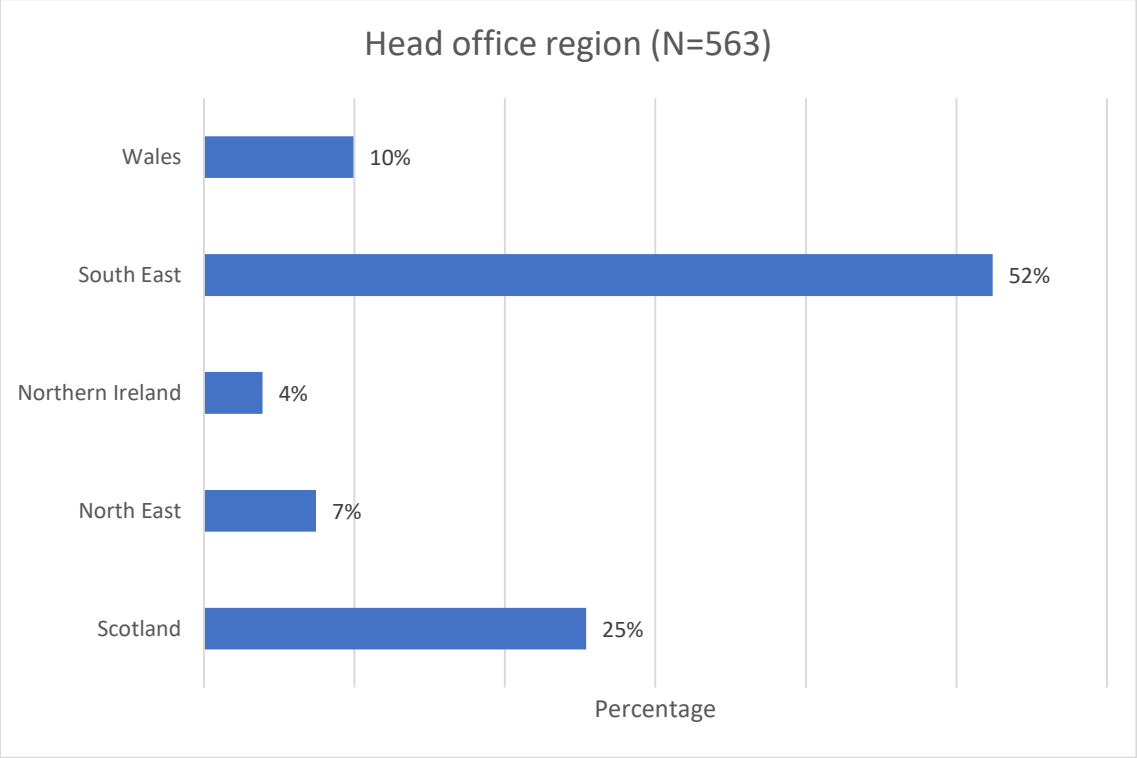
[105] Vidmar et al. 2020 *ibid*.

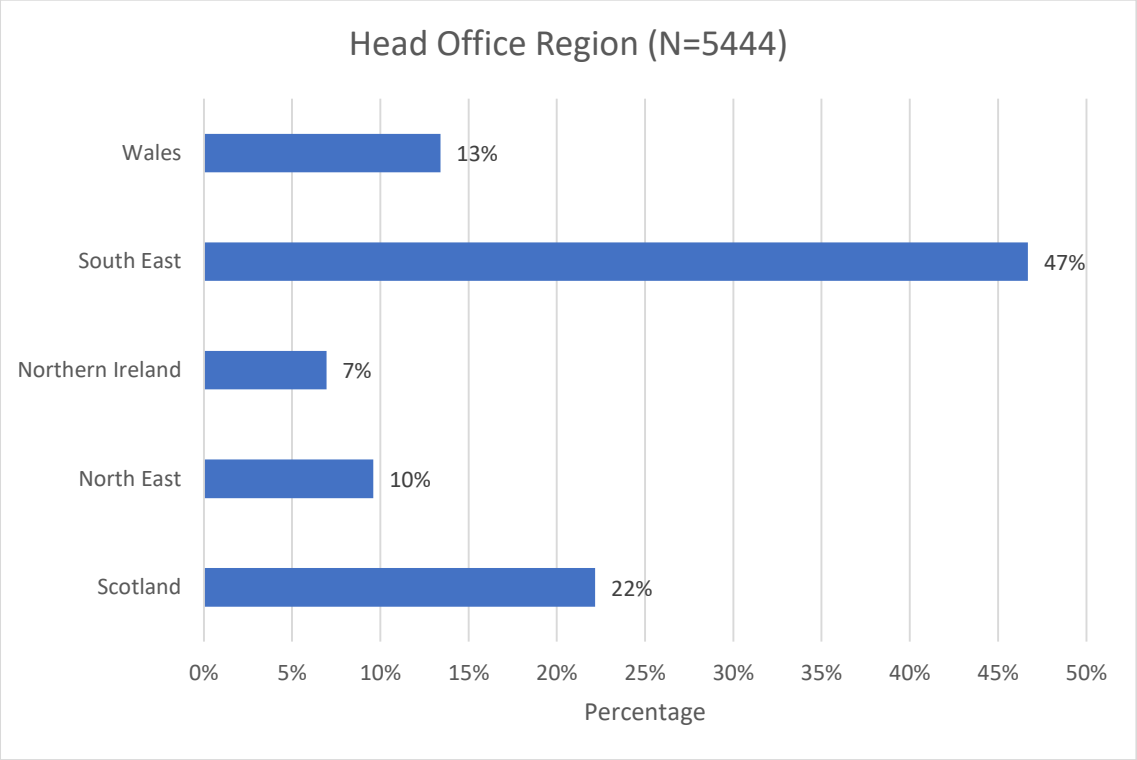
Appendix 1: Data

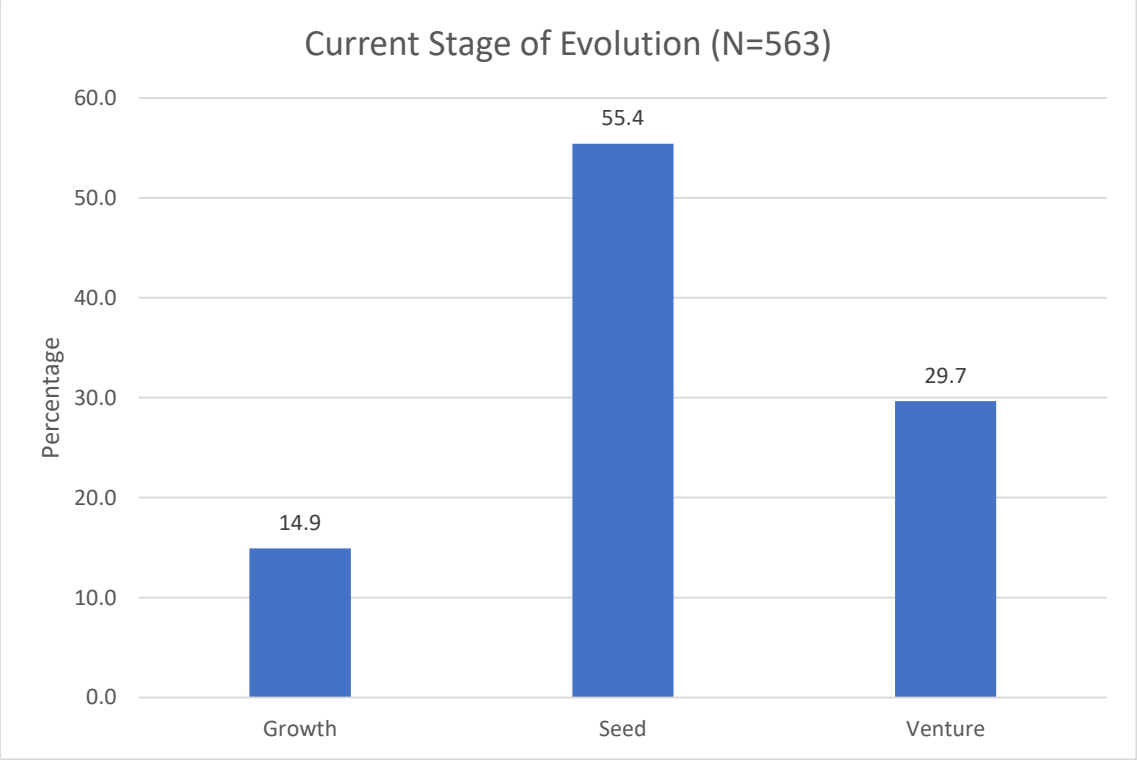
Descriptive Statistics

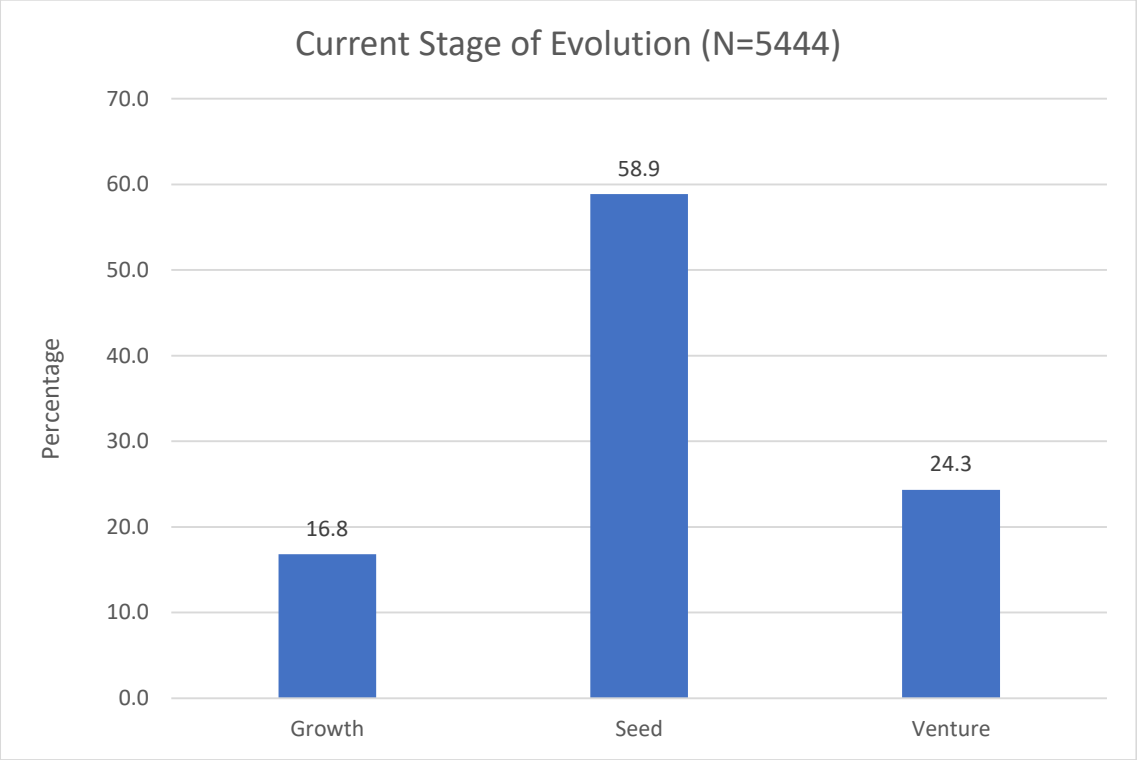
Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
SMEAN(Age)	5148	0	166	8.49	6.079
Valid N (listwise)	5148				

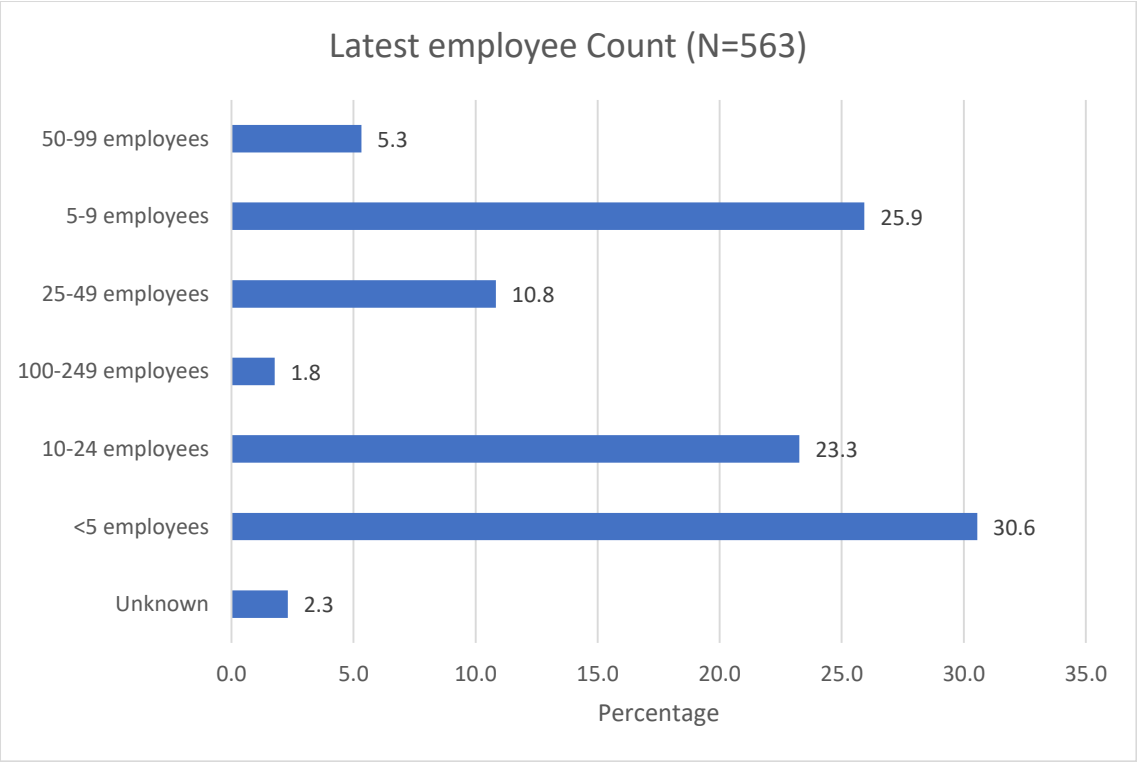
Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
age	543	1	32	8.06	4.692
Valid N (listwise)	543				

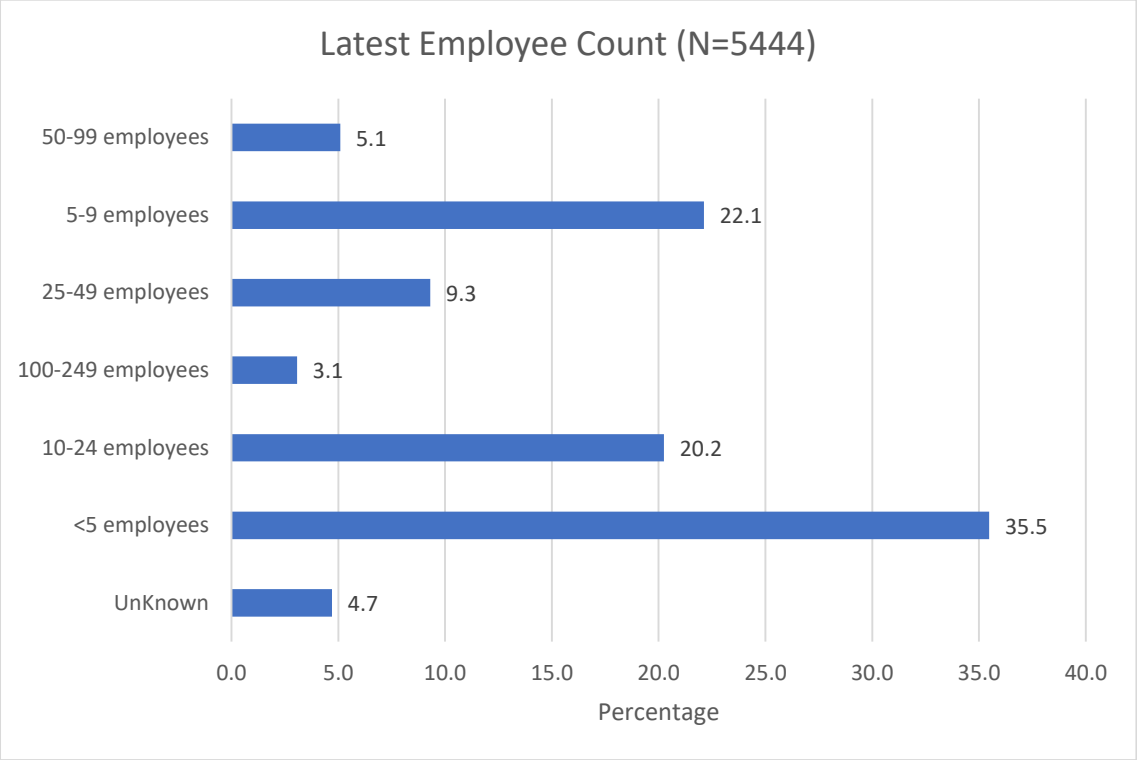


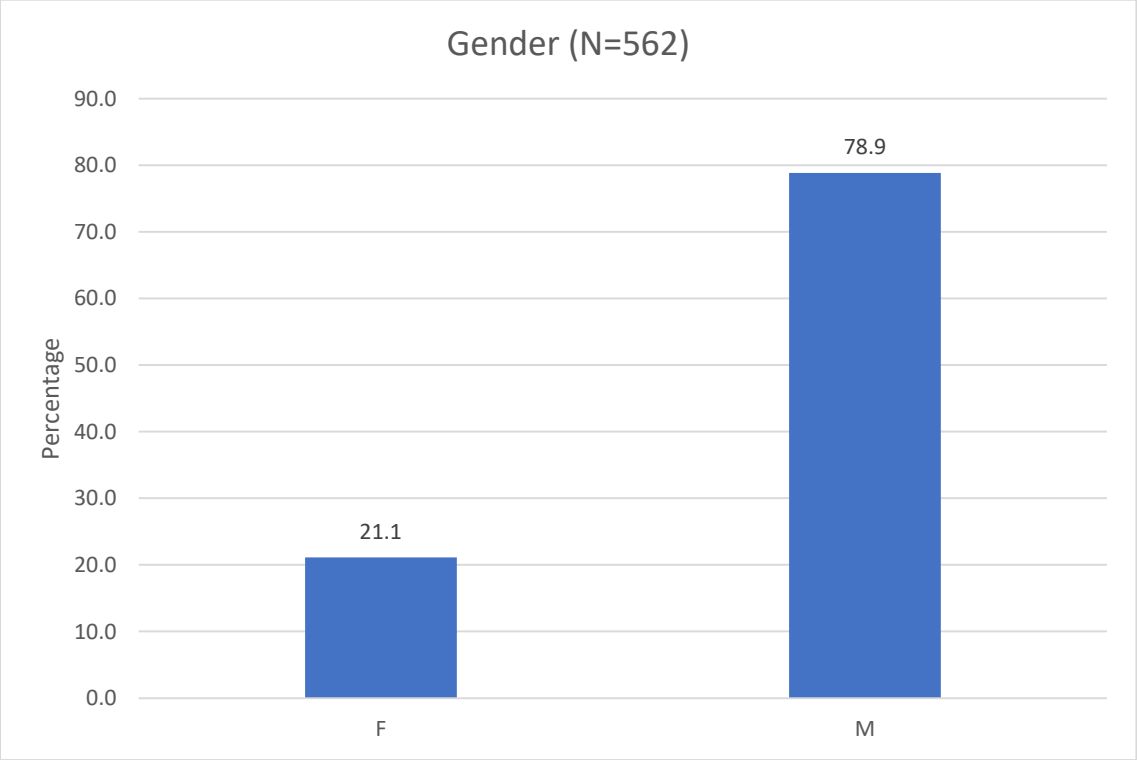

Head Office Region (N=5444)
Wales
13%
South East
47%
Northern Ireland
7%
North East
10%
Scotland
22%
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
Percentage

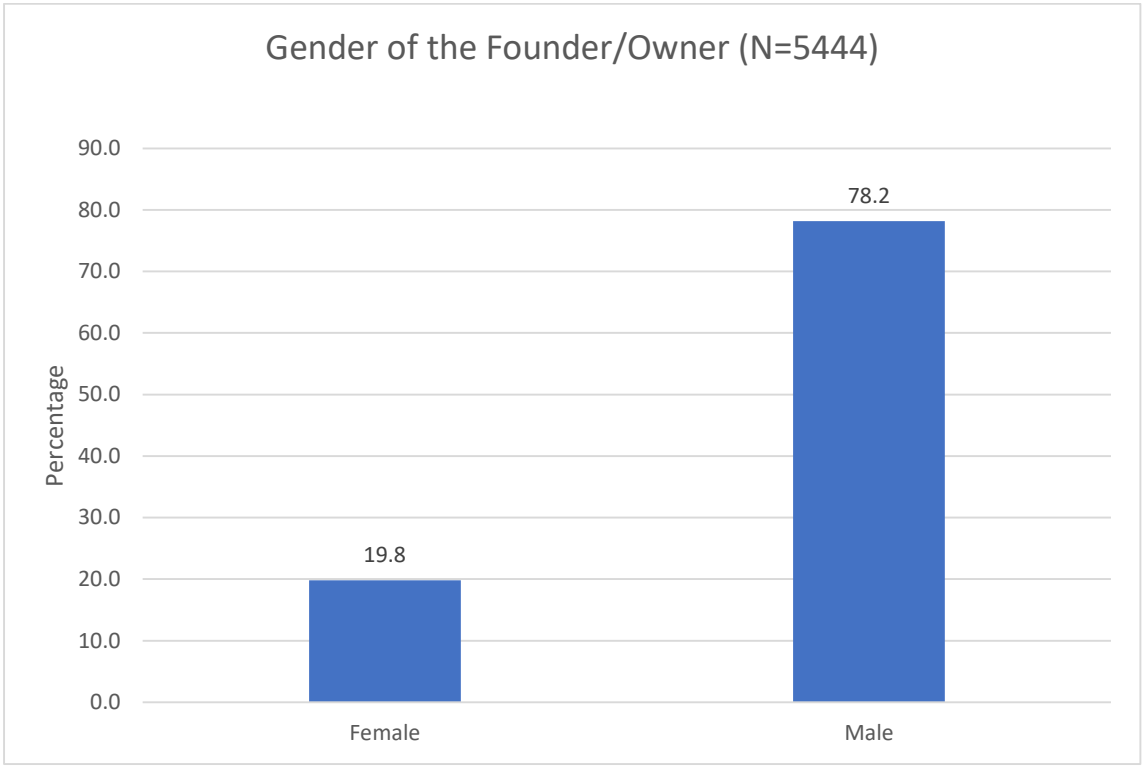

Current Stage of Evolution (N=563)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percentage
14.9
55.4
29.7
Growth
Seed
Venture

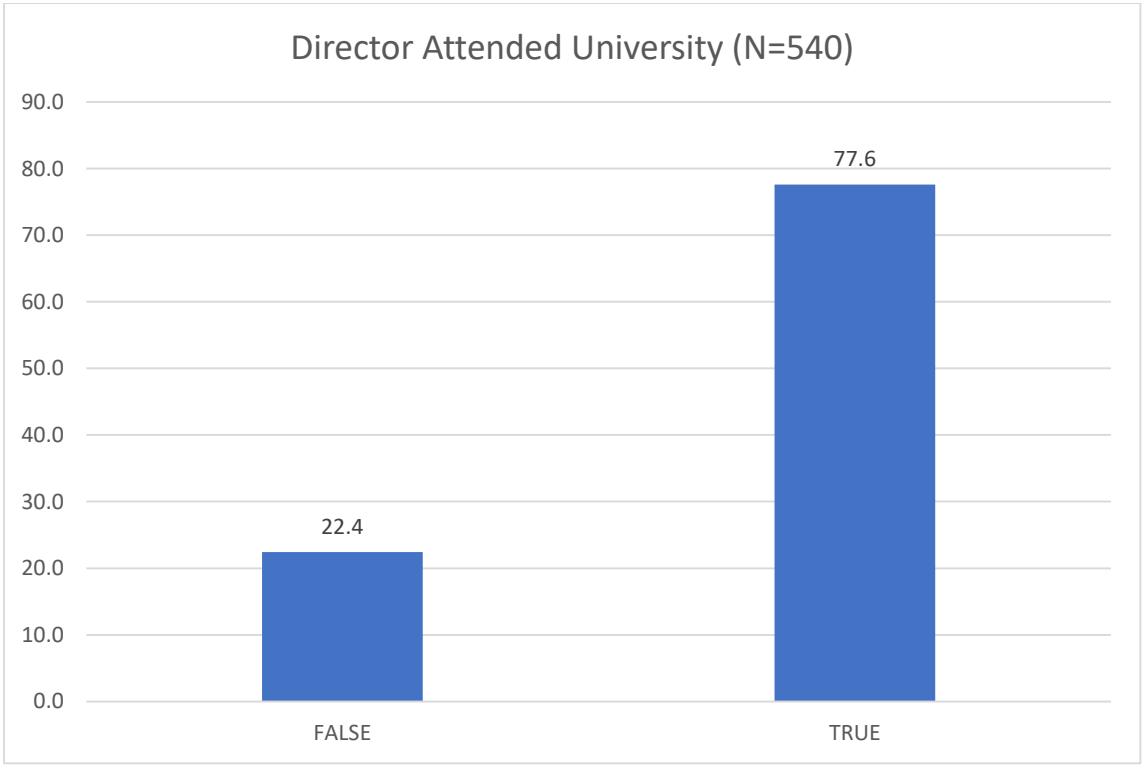

Current Stage of Evolution (N=5444)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percentage
58.9
16.8
24.3
Growth
Seed
Venture

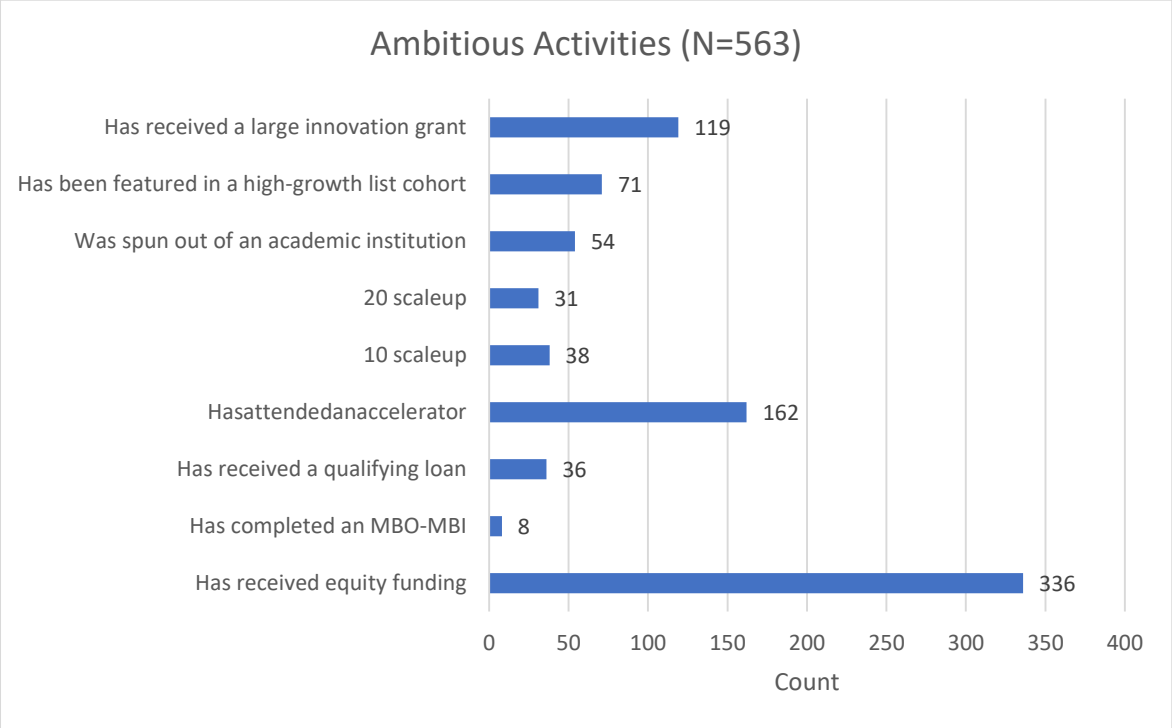

Latest employee Count (N=563)
50-99 employees
5.3
5-9 employees
25.9
25-49 employees
10.8
100-249 employees
1.8
10-24 employees
23.3
<5 employees
30.6
Unknown
2.3
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
Percentage

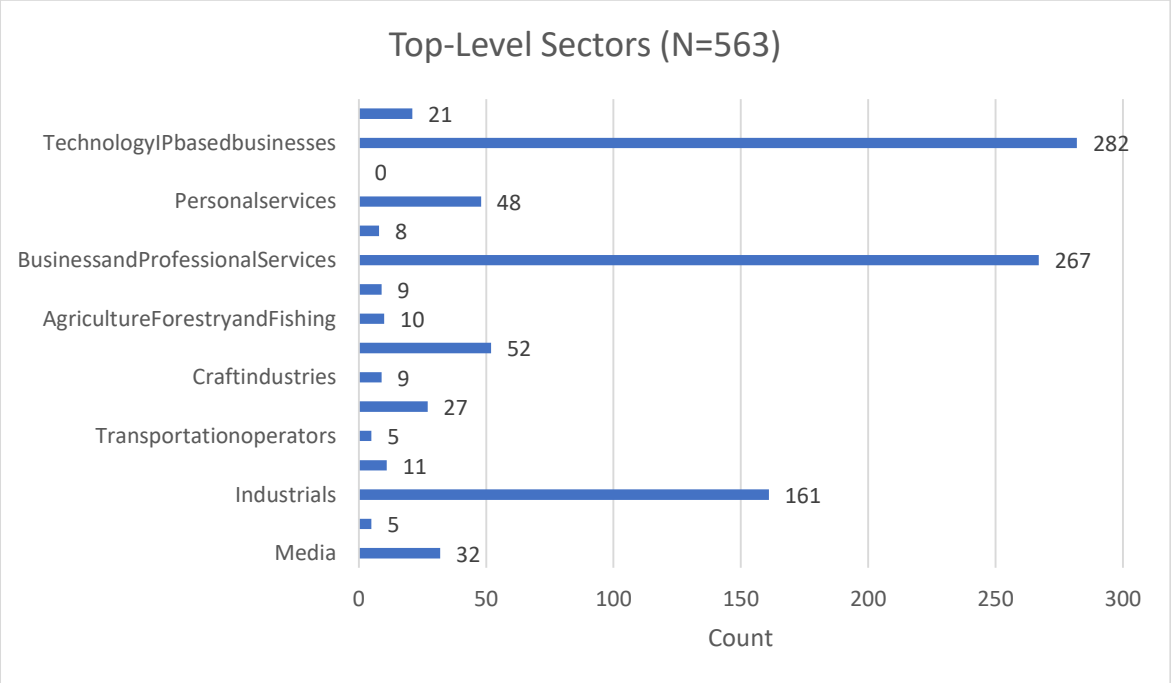

Latest Employee Count (N=5444)
50-99 employees
5.1
5-9 employees
22.1
25-49 employees
9.3
100-249 employees
3.1
10-24 employees
20.2
<5 employees
35.5
UnKnown
4.7
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Percentage

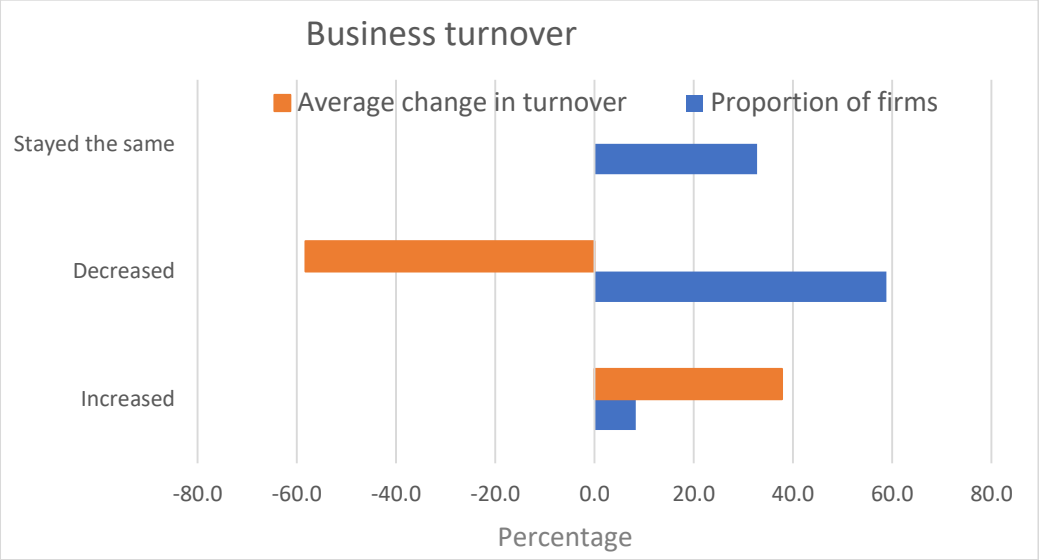

Gender (N=562)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percentage
78.9
21.1
F
M

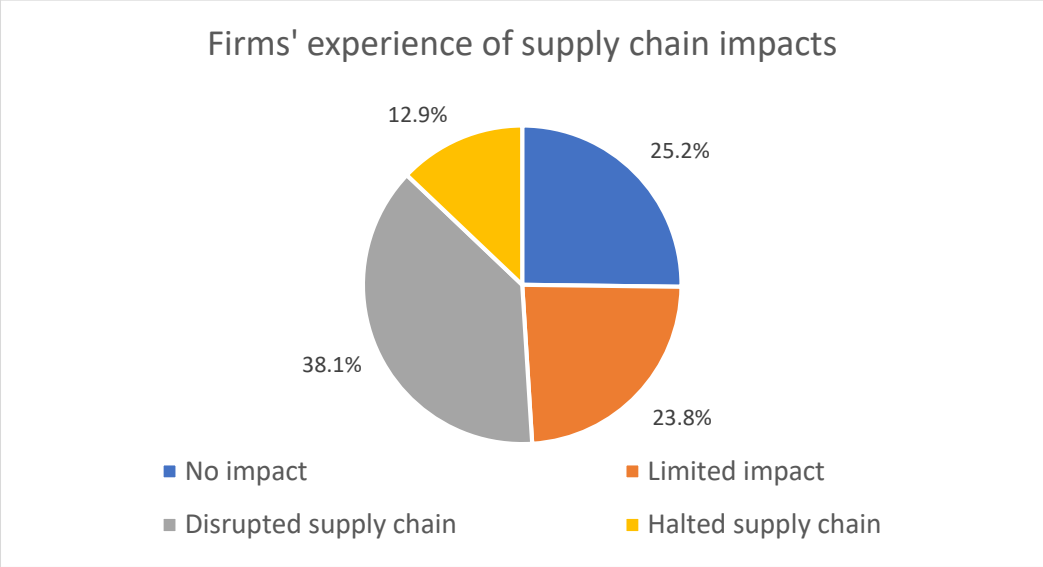

Gender of the Founder/Owner (N=5444)
Percentage
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
78.2
19.8
Female
Male

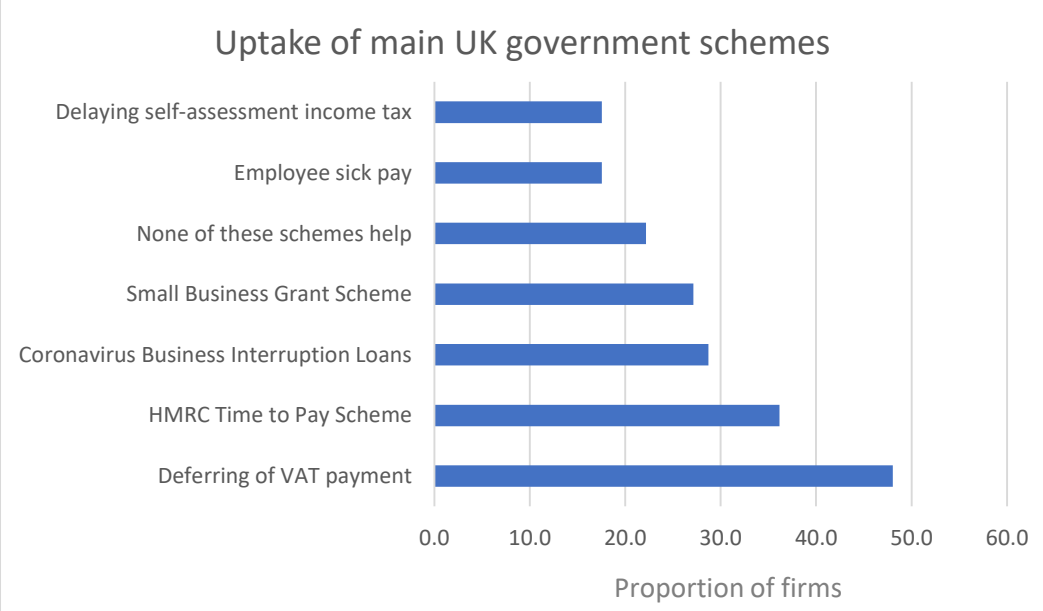

Director Attended University (N=540)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
77.6
22.4
FALSE
TRUE


Ambitious Activities (N=563)
Has received a large innovation grant
119
Has been featured in a high-growth list cohort
71
Was spun out of an academic institution
54
20 scaleup
31
10 scaleup
38
Hasattendedanaccelerator
162
Has received a qualifying loan
36
Has completed an MBO-MBI
8
Has received equity funding
336
0
50
100
150
200
250
300
350
400
Count


Top-Level Sectors (N=563)
TechnologyIPbasedbusinesses
21
Personalservices
282
BusinessandProfessionalServices
0
48
AgricultureForestryandFishing
8
267
Craftindustries
9
10
Transportationoperators
52
Industrials
9
27
Media
5
11
161
5
32
0
50
100
150
200
250
300
Count


Business turnover
Average change in turnover
Proportion of firms
Stayed the same
Decreased
Increased
-80.0
-60.0
-40.0
-20.0
0.0
20.0
40.0
60.0
80.0
Percentage


Firms' experience of supply chain impacts
12.9%
25.2%
38.1%
23.8%
No impact
Limited impact
Disrupted supply chain
Halted supply chain


Uptake of main UK government schemes
Delaying self-assessment income tax
Employee sick pay
None of these schemes help
Small Business Grant Scheme
Coronavirus Business Interruption Loans
HMRC Time to Pay Scheme
Deferring of VAT payment
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Proportion of firms

Econometric Model

Factors Affecting Resilience						
	B	S.E.	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Entrepreneurial Characteristics						
Age	0.006	0.013	0.651	1.006	0.981	1.031
Past industry experience	0.201	0.244	0.409	1.223	0.758	1.973
Gender (Male)	-0.079	0.294	0.788	0.924	0.519	1.645
Has attended a university	-0.027	0.275	0.922	0.973	0.568	1.670
Firm-level Characteristics						
Size	0.056	0.099	0.572	1.058	0.871	1.285
Age	-0.028	0.027	0.308	0.973	0.922	1.026
Employment difference (Before/After COVID-19)	0.077	0.035	0.026	1.080	1.009	1.156
Entrepreneurial Perception						
Cash Flow position during COVID19 Vs before	0.374	0.061	0.000	1.453	1.291	1.636
Level of Stress during COVID19 Vs before	-0.288	0.066	0.000	0.750	0.659	0.854
Top-Level Sectors - Media	-0.168	0.520	0.746	0.845	0.305	2.343
Sectoral Characteristics						
Top-Level Sectors - Telecommunications services	1.040	1.218	0.393	2.829	0.260	30.780
Top-Level Sectors – Industrials	-0.008	0.300	0.978	0.992	0.551	1.786
Top-Level Sectors - Built environment and infrastructure	1.131	0.904	0.211	3.097	0.527	18.220
Top-Level Sectors - Retail	0.436	0.563	0.439	1.546	0.513	4.664
Top-Level Sectors - Craft industries	1.976	0.865	0.022	7.210	1.323	39.285
Top-Level Sectors - Leisure and Entertainment	-0.166	0.457	0.717	0.847	0.346	2.076

Top-Level Sectors - Agriculture, Forestry and Fishing	1.017	0.849	0.231	2.766	0.524	14.593
Top-Level Sectors - Supply chain	-0.125	0.996	0.900	0.882	0.125	6.217
Top-Level Sectors - Business and Professional Services	-0.015	0.257	0.953	0.985	0.595	1.631
Top-Level Sectors – Tradespeople	1.914	0.922	0.038	6.779	1.113	41.302
Top-Level Sectors - Personal services	0.452	0.425	0.288	1.571	0.683	3.615
Top-Level Sectors - Technology/IP-based businesses	0.924	0.251	0.000	2.520	1.540	4.121
Top-Level Sectors – Energy	0.067	0.549	0.903	1.070	0.364	3.138
Regional Characteristics						
North East	0.242	0.469	0.606	1.273	0.508	3.194
Scotland	-0.167	0.261	0.521	0.846	0.508	1.410
Wales	-0.046	0.393	0.906	0.955	0.442	2.063
Northern Ireland	-0.877	0.694	0.207	0.416	0.107	1.623
Constant	0.118	0.796	0.882	1.125		

Model Summary

	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
	523.719[a]	.274	.369