Analysis and Benchmarking of Business High-Growth Performance in Scotland

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Executive Summary

Background

High-growth firms (HGFs) have attracted an increasing amount of attention in the last decade as economies begin to emerge from a period of deep recession and policymakers take a renewed interest in firms which generate jobs on a large scale**.** Currently, as flagged in the UK's Industrial Strategy, the Scale-up agenda is to have a prominent role in driving local growth, with the focus on the importance of identifying, targeting and supporting more HGFs or scale-ups.

The stimulation of high-growth firms continues to be considered as a key element of enterprise policy and performance framework measure in the UK and throughout the OECD countries. As well as a major source of new jobs they tend to be more innovative, which is a key driver of productivity growth. The major challenge is not only to accurately identify potential high-growth firms in the wider business population but also to fine-tune the nature of business support and policy interventions to answer specific needs of these particular businesses. It is now well established that high-growth firms represent a heterogeneous group of businesses of different sectors, ages and sizes and that makes the task of developing a 'single offer' particularly difficult.

Scottish Enterprise (SE) sought to commission data analysis which explores further the high-growth dynamics of Scotland's business base, benchmarking this against other regions of the UK and, where possible, other countries. The objective is to focus on the level to which Scottish businesses achieve and then sustain levels of high-growth, ultimately reaching the definition of becoming a High-Growth Firm (HGF) as defined by the OECD, and how this compares with elsewhere. The analysis also presents a critique of the definition of a HGF and sets out some alternatives definitions and methodologies to allow policymakers to more accurately focus on business growth over time.

High-Growth Firms in Scotland

Scotland has a 'high-growth deficit' according to the descriptive analysis presented in this report based on the OECD definition of a high-growth firm. We can crudely estimate this 'deficit' in Scotland by calculating the number of HGFs there would have been in 2015-18 if the UK incidence rate of 6.2% is applied. There would have been an additional 128 HGFs (20% employment definition) in Scotland (or 81 if London excluded from the analysis).

We need to mindful of course that this simplistic 'closing the gap' type of analysis ignores the obvious fact that having more of these firms may well have negative effects on the performance of other established firms, including HGFs – a potential zero-sum game.

Further, irrespective of the HGF metric used in this analysis it is clear that Scotland under-performs when compared to other parts of the UK in terms of the proportion of its business base that can be categorised as a high-growth.

Explaining Scotland's High-Growth Incidence Rate

Though high-growth firms received a considerable amount of attention of the researchers lately, little is known about the determinants and predictors of high-growth incidence. It is now often argued - and the previous section confirms it – high-growth is episodic and discontinuous. Firm-specific, location-specific and macroeconomic explanations of high-growth should be addressed when attempting to explain relatively low HGF incidence rate in Scotland.

The results of some simple regressions at Government Office Region (GOR) level to understand what factors might affect the HGF incidence rate show that labour availability and education level exert a positive influence on HGFs incidence rate. Other possible determinants, such as investment level, human capital estimates, R&D expenses by business and government do not appear to be significant at this level of analysis.

As an initial step we present a series of simple correlations between the Scottish HGF incidence rate and the range of variables that have been previously modeled to explain the spatial differences in small business growth:

- HGF incidence in Scotland can be, at least in part, explained by macroeconomic conditions. Indeed, HGF incidence rate is correlated with real growth rate in the UK.
- It is also correlated with oil prices fluctuation which arguably was one of the most important factors affecting business dynamics in the Aberdeen area during the last ten years.
- As it has been noticed before, the rise and fall of the number of HGFs in Scotland throughout 2010-2018 period is driven mostly by the trends of HGFs in Aberdeen City & Shire and Glasgow City regions.

With a mature and effective business support policy in place in Scotland, which has had a demonstrable impact on firm performance and seeks to mitigate these effects, the answer must also lie in the following three areas: an 'entrepreneurial growth mind-set', supply side constraints such as staff and premises sitting alongside external macroeconomic and political events. These potential explanations are, of course, intrinsically connected. With respect to recent macro-economic and political events or 'shocks' there are a number of plausible reasons why the Scottish HGF rate is relatively low:

- The Scottish independence referendum in 2014 which created some uncertainty and investment caution.

- The oil and gas recession following a dramatic price drop in the price of oil from $112pb in June 2014 to $36pb in January 2016 which affected economic activity in the Aberdeen area and Shetlands in particular, but which was also visible in a slower pace of growth in business starts in the east of Scotland than in the west of Scotland. Before this period, Aberdeen was a start-up hotspot in Scotland.

- The UK Brexit referendum in 2016 and the associated continuing uncertainty made Scots even more cautious than they otherwise would be, especially as 2 in 3 Scots voted to stay in and feared the consequences of Brexit rather than, as in England, the majority welcomed or ignored it.

There is some empirical evidence to support these possible reasons. Entrepreneurial growth is a function of overall business activity in a region and where this is subdued due to consumer and business caution, entrepreneurial growth will be lower. The Scots were much slower to start and grow businesses than the English were after the great recession, and in the north-east and more rural areas of Scotland, start-up rates declined against the trend across the UK.

In the 2014 to 2017 period, Scottish production of scaling start-ups (start-ups that at least doubled sales to £1million or more in sales within 3 years of founding) was just under half (49%) the average production rate for the UK. The North East and Highlands and Islands combined had around half the yield and production of scaling start-ups as South Western Scotland, despite a higher new firm birth rate than South West Scotland in 2014.

To better understand Scotland's high-growth puzzle we might also ask the following question: is the relatively low HGF incidence rate in Scotland due mostly to some location-specific barriers and business environment or is it due to more firm-specific characteristics of Scottish entrepreneurs, such as their ambition to grow?

The analysis shows the relationship between growth ambition (which is measured as the percentage of small and medium-sized businesses[1] aiming to grow sales over the next three years) and the high-growth firm incidence rate using the standard OECD definition (20% growth each year for three years).

There is a clear positive trend between growth ambition and the HGF incidence rate. In 2015, Scottish businesses showed the least ambition to grow sales and, as we discussed previously, it resulted in one of the lowest HGF incidence rate when compared with the rest of the UK (London being the clear outlier). Thus, a lack of ambition could directly impact the performance of firms and could help explain why we see low levels of HGFs in Scotland. This perhaps can be explained by a culturally embedded cautiousness of Scottish entrepreneurs or indeed a reluctance in recent years to grow their businesses as a result of external events such as the uncertainty surrounding Scottish independence and Brexit.

High-Growth Episodes – a cohort perspective

The OECD HGF definitions and its variants are less than optimum and we urge Scottish Enterprise not to base a scale-up strategy upon this sub-optimal metric. New analysis of a cohort of start-ups in 2008 over the next 10 years attempts to place the concept of 'high-growth' within the life cycle of the business and it showed quite clearly that 'high-growth' can occur at any stage over that period. Further, it demonstrated the weakness of the arbitrary OECD definition, which measures growth over three years, by rendering invisible many firms as 'high-growth' because their rapid growth was not consistent year on year and took place in discrete one or two-year episodes over the decade.

Towards an explanation of High-Growth Episodes

Building upon these simple associations a more detailed econometric model to provide a more robust explanation of spatial differences in the HGF incidence rate across the UK was constructed at the level of the 9 English regions and the three Home nations. Significant determinants of a high-growth episode are:

1. Age (younger) and size (larger)
2. Prior growth (employment and turnover)
3. Higher levels of total early-stage entrepreneurial activity (TEA)
4. Sector (ICT; Business and Professional Services)
5. Time – i.e., early years after recession (i.e., 2011-13) and most recently in 2018

A closer look at the regional dummies in the model and particularly that for Scotland reveals only very weak evidence that it suffers from an overall 'high-growth' deficit. Only in the full model for the high-growth episode of 20% in one year dependent variable as well as the model which includes micro-businesses is the dummy for Scotland negative and significant. In all the other three models the dummy for Scotland is not significant.

In some of the reduced form models across all 5 variations on the dependent high-growth variable the Scottish dummy actually shows a small positive and significant effect on the likelihood of a business experiencing a high-growth episode.

[1] That is, businesses with less than 250 employees.

Conclusions

Overall, despite the compelling evidence throughout the descriptive analysis of Scotland having a lower proportion of high-growth firms as defined by the OECDs, this econometric analysis indicates that when we control for the nature of the business population (size, age, sector, prior growth), together with environmental variables such as education, ethnicity and other macro variables such as growth and new venture formation **then the case for a 'high-growth deficit' in Scotland is severely weakened.**

Finally, we would urge Scottish Enterprise to adopt a more nuanced view about business growth and high-growth in particular. Reliance upon a single definition (i.e., the OCED HGF) is less than optimal and as we have shown renders invisible much of the growth and indeed high-growth we observe in businesses across the Scottish economy. It is well past its sell-by date and there needs to be a move towards a more sensible understanding of growth and to recognize that it is episodic for the majority of businesses experiencing growth. Research into the triggers of these episodes and to examine the role of the various interventions associated with the Account Managed system in Scotland would be an invaluable next steps project.

1. Introduction

High-growth firms (HGFs) have attracted an increasing amount of attention in the last decade as economies begin to emerge from a period of deep recession and policymakers take a renewed interest in firms which generate jobs on a large scale**.** Currently, as flagged in the UK's Industrial Strategy, the Scale-up agenda is to have a prominent role in driving local growth, with the focus on the importance of identifying, targeting and supporting more HGFs or scale-ups.

The stimulation of high-growth firms continues to be considered as a key element of enterprise policy and performance framework measure in the UK and throughout the OECD countries. As well as a major source of new jobs these firms tend to be more innovative, which is a key driver of productivity growth. The major challenge is not only to accurately identify potential high-growth firms in the wider business population but also to fine-tune the nature of business support and policy interventions to answer specific needs of these particular businesses. It is now well established that high-growth firms represent a heterogeneous group of businesses of different sectors, ages and sizes and that makes the task of developing a 'single offer' particularly difficult.

Scottish Enterprise (SE) sought to commission data analysis which explores further the high-growth dynamics of Scotland's business base, benchmarking this against other regions of the UK and, where possible, other countries. The objective is to focus on the level to which Scottish businesses achieve and then sustain levels of high-growth, ultimately reaching the definition of becoming a High-Growth Firm (HGF) as defined by the OECD, and how this compares with elsewhere.

Many policymakers have been very enthusiastic about the scope for intervention which HGF research might uncover. Whilst that hope continues, we should perhaps take more seriously the rather more sanguine view expressed by the 'father' of HGF studies,

> *"We know that smaller, volatile firms are the major replacers of lost jobs, but we have no experience in identifying and assisting them in large numbers. Because they are small, we must reach many of them to have a measurable effect. Because they are volatile, we must monitor each individual firm's performance carefully if we are to gain maximum benefit from our invested dollars (on the high side) and avoid scandal (on the low side). From this researchers viewpoint it seems like a very difficult problem to solve administratively. A massive bureaucracy would be required to monitor individual small businesses on the scale required ..." Birch [1979, p. 4]*[2]

A more productive approach to HGF research might be to regard it not as an end itself, but rather as a means of making some progress on the broader question of understanding firm growth and the creation of more quality jobs, innovation, internationalisation and hence a key driver of productivity. For example, as we have shown, the average growth of the cohort slows with age, not only because faster growing firms in their early years grow very much more slowly over time, but because the proportion of firms recording exceptional growth declines. It is clear that from a policy perspective in Scotland these firms are crucial to achieving many of the economic objectives set out by the Scottish Government for the economy as a whole.

[2] Birch, D (1979) "The Job Generation Process," research report, MIT Program on Neighborhood and Regional Change, Cambridge, MA.

We also need to recognise that these firms can have disruptive effects in the wider economy. For example, previous research by Du and Vanino (2019)[3] demonstrated that the externalities of fast growth firms in the manufacturing sectors in the UK seem to show that in the short run, more fast-productivity-growth firms are beneficial to other firms, potentially due to competition effects and knowledge spillovers, while more fast-employment-growth firms may put a strain on other firms' abilities to attract skills and labour.

As we build on the required descriptive analysis these considerations will inform further analysis of the episodic nature of fast-growth as well as understanding some of the challenges they face by using other ONS business surveys datasets which are linked to the ONS BSD such as the Longitudinal Small Business Survey (LSBS).

The Enterprise Research Centre (ERC) based at Aston Business School were appointed to undertake this analysis due to our extensive experience working on business demography, firm growth and productivity since providing the first analysis of HGFs in the UK in our work for NESTA published in 2009 which led to the notion of the 'Vital 6%'.

The structure of this report is as follows. First, the approach to HGFs measurement and data sources are described followed by an in-depth discussion of the OECD definition of HGFs. Then, the number of HGFs and the HGFs incidence rate in Scotland are compared to other UK regions for the period from 2010 to 2018. A closer look on differences in terms of HGFs incidence among Scotland sub-regions and across sectors is given. Then, alternative measures of HGFs are explored. Finally, using the cohort perspective, we track the number of High Growth Episodes (HGE) that Scottish start-ups born in 2010 experience during the course of 2010-2018. In the last section, we provide insights into possible explanations of the regional differences in HGFs incidence rates and focus on the characteristics of firms experiencing high-growth.

2. Approach and Data

There are three main topics of analysis required by Scottish Enterprise using a range of high-growth definitions:

1. Analysis of high-growth performance in Scotland for a number of 3-year periods since 2010. We focus on a post-recession period with an emphasis on geography and sector. The level of detail of our analysis is constrained by the normal disclosure rules of the ONS.

2. Analysis of the wider business population to present data on those businesses meeting the one-year and two-year definition of high-growth. In addition, we adopt and adapt our existing methodology to examine 'high-growth' episodes over the life cycle of a firm and we can do this with work on cohorts of start-ups from 1998 onwards.

3. Comparison to other regions in the UK and other comparator economies[4]. Here the emphasis is on understanding spatial trends over time since 2010 and to seek to understand these trends in the context of sectoral mix and levels of trade and innovation.

[3] Du, J and Vanino, E (201) "Fast-growth firms and their wider economic impact: UK evidence". ERC Research Paper No 73 https://www.enterpriseresearch.ac.uk/our-work/publications/?type=research-paper

[4] We are still seeking to obtain the most recent international data from the OECD and will provide this to Scottish Enterprise when it becomes available.

We use the UK Business Structure Database[5] (compiled by the Office for National Statistics[6]) which records annual data on employees for the entire population of firms in the UK. This data is compiled from a series of annual 'snapshots' of the Inter-Departmental Business Register (IDBR), an administrative database which captures information from a range of sources, amongst them VAT returns and employer Pay As You Earn (PAYE) tax and social security records. The unit of analysis is an "employer enterprise" – a business with at least one employee[7] – which we refer to as a firm. Firms may comprise a number of distinct local units (establishments or plants) but our data refer to firm-level employee numbers.

We have linked together the annual 'snapshots' from the BSD using firm-level identifiers to form a longitudinal firm-level database for the UK and have devised algorithms to produce firm-level demographic markers for 'birth' and 'death'. The birth of a firm is dated by the first appearance of non-zero employment and its death is treated symmetrically and dated by the disappearance of the last employee. The data do not distinguish between a totally new business venture and those 'new firms' which result from the break-up of an existing firm, similarly the data do not distinguish between the closure of a firm and its disappearance due to merger. However, after a detailed look at the Belgian data the OCED Dynemp project[8], which examined the dynamics of job creation across 18 countries, concluded that this was a negligible impact on categorizing firms as 'births' and 'deaths'. Although the data start in 1997, firms alive in 1997 could have been born in any previous year, so the first birth year we can identify with certainty is 1998.[9]

Firms are classified as either 'private' or 'public' sectors and we make this split using the classification by industrial sector. All employees in public administration and defense; education; and health and social work are classified as public sector. Of course, some firms in these sectors (in health and/or education for example) are private, and some firms in our private sector are public, but ours is a reasonable approximation and ensures that most typically longer lived public entities (like schools and hospitals) do not distort our age-related calculations. For the purpose of this study we focus only on the 'private' sector.

The BEIS analytical team have spent considerable resources in 2017 and 2018 validating the IDBR data upon which the BSD is based and researchers are now able to establish which data are 'good' in that they refer to the year in which they are associated in the dataset. In particular, lags in the employment and turnover data necessitates caution when dealing with very short time periods such as the official OECD definition of a HGF. This version of the IDBR is not yet available to the ERC research team but when it becomes available we can revisit the analysis in this report and provide an update for Scottish Enterprise outside the current contract and pro bono.

[5] For a full, official, account of the Business Structure Database (BSD) and its compilation, see Evans, Peter and Richard Welpton (2009) "Methods explained – Business Structure Database," *Economic and Labour Market Review*, Vol. 3, No. 6, pp. 71–75. https://link.springer.com/article/10.1057/elmr.2009.94

[6] The statistical data used here is from the Office of National Statistics (ONS) and is Crown copyright and reproduced with the permission of the controller of HMSO and Queens Printer for Scotland. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. The analysis upon which this report is based uses research datasets which may not exactly reproduce National Statistics aggregates.

[7] Since an employee can work for more than one firm summing over firms produces an estimate of jobs rather than employment, we ignore this distinction here and use the terms employment and jobs interchangeably.

[8] Criscuolo, Gal and Menon (2014), "The Dynamics of Employment Growth: New Evidence from 18 Countries", http://dx.doi.org/10.1787/5jz417hj6hg6-en.

[9] The database which underpins this study – the Longitudinal Business Structure Database – can be accessed by approved researchers through the ONS Virtual Microdata Laboratory or the UK Data Service Secure Lab. **Citation: Office for National Statistics (2018) *Business Structure Database, 1997-2018: Secure Access* [Data collection]. *9th Edition.* UK Data Service. SN: 6697,** http://doi.org/10.5255/UKDA-SN-6697-9

3. High-Growth Firms – Some Definitional Issues

The ERC team were responsible for one of the preliminary analyses of HGFs in the UK[10]. This report showed that a small minority of high growth businesses in the UK, in fact 6 per cent, generated half of the net new jobs created by existing businesses with at least 10 employees between 2002 and 2008. The finding attracted the attention of policymakers and commentators, and became an important part of the debate on economic growth in the UK. This led to a closer involvement with the micro-level data work of the OECD on, for example, the 'Dynemp' project where the UK data was provided by the ERC team.

Subsequent analyses dealt with various aspects of HGFs including their characteristics and spatial distribution including work on Scotland.[11][12][13] The disproportionate contribution to employment made by HGFs was confirmed by these reports, as was their heterogeneous nature in terms of size, age and sector. What is clear from the evidence is that there are a very small number of firms in the UK which can be classified as HGFs using the OECD definition which is broadly similar to that observed in other similar economies. Further, the HGF prevalence rates have remained largely unchanged since the late 1990s[14]. Focussing specifically on SMEs we find that although high growth SMEs represent less than 1% of established businesses, they generate 20% of all job growth amongst established businesses which grow. Again this proportion has remained virtually unchanged since the late 1990s and was not affected by the Great Recession and again this consistency over time is something we can observe in other economies as well.

HGFs were found to be located across Great Britain, with the highest incidence rates reported in London and the Home Counties. The follow-up study focused more specifically on the local economic areas, as defined by the English Local Enterprise Partnerships (LEPs), and also identified London as having the highest incidence rate of HGFs.

Broadening the research to take account of other types of job-creating firm (i.e., those not meeting the definition of an OECD HGF), and the subsequent policy implications, the ERC White Paper[15] uncovered the relative employment contributions of various firm types. It suggested a more nuanced policy approach which took account of the high growth *potential* of both new and existing firms[16] – in other words avoiding a singular focus on the OECD definition of a HGF. This will be a central feature of the analysis for Scottish Enterprise.

[10] 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. NESTA https://www.nesta.org.uk/report/measuring-business-growth/

[11] 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 13/05 https://www.nesta.org.uk/report/exploring-the-incidence-and-spatial-distribution-of-high-growth-firms-in-the-uk/

[12] Anyadike-Danes, M., Bonner, K., Hart, M. and Hathaway, K., (2016), Spatial Incidence of High Growth Firms, ERC Insight Paper Feb 2016 https://www.enterpriseresearch.ac.uk/our-work/publications/?type=insight

[13] Mason, C., Brown, R., Hart, M., and Anyadike-Danes, M (2015) "High growth firms, jobs and peripheral regions: the case of Scotland", Cambridge Journal of Regions, Economy and Society, February 2015 https://academic.oup.com/cjres/article-abstract/8/2/343/332698; Anyadike-Danes, M., Hart, M., and Du, J (2015) "Firm dynamics and job creation in the United Kingdom: 1998–2013", International Small Business Journal, 33:1 pp12-27. https://journals.sagepub.com/doi/10.1177/0266242614552334

[14] Anyadike-Danes, M and Hart, M (2015) "Contribution to Job Creation by High Growth SMEs", ERC Insight Paper, July 2015. https://www.enterpriseresearch.ac.uk/our-work/publications/?type=insight

[15] Anyadike-Danes, M., Hart, M. and Du, J., (2013), Firm Dynamics and Job Creation in the UK: Taking Stock and Developing New Perspectives, ERC White Paper No. 6. https://www.enterpriseresearch.ac.uk/?s=white+paper

[16] Here, high-growth potential firms are defined as rapidly expanding firms by way of their supposed or actual potential to generate jobs. While HGFs are widely recognised as the most prolific category of job creating firms, their closest comparators – the larger non-HGFs – are quite prolific too.

A single-minded preoccupation with HGFs and indeed Small-HGFs[17] (ensuring that micro-businesses of less than 10 employees can be accommodated in the analysis of fast growing firms in Scotland), whatever definition the OECD decide to use, may not be a sensible focus for policy-makers as they seek to address the growth and productivity problems confronting the UK and Scottish economy. Not only are these measures somewhat artificially defined, they also have the disadvantage of rendering invisible the reality of growth for the majority of businesses which is usually episodic and not constrained by an arbitrary 3-year period. This is crucial for policy as it avoids the focus on only a very small proportion of the business base in that the vast majority of firms in Scotland and the UK for that matter are defined as micro-businesses (i.e., employing less than 10 employees). We also know from a cohort study of micro-businesses that a very small proportion of them achieved exceptional growth in terms of jobs and/or turnover over a 10-15 year period (Anyadike-Danes and Hart, 2014).

A reminder of the official OECD definition of a HGF is perhaps timely before we embark upon our new analysis for Scotland. Here we investigate HGFs using the recommended three year growth period. The Eurostat-OECD metric for identifying an HGF (see EUROSTAT-OECD [2007, Chapter 8]) requires that we count firms which,

- are born before the beginning of the period
- are alive at the end of the period
- have at least 10 employees at the beginning of the period (the OECD prefer employees to turnover as it makes for a more robust comparison between countries)
- **record an annual average growth of 20% in employment[18] over the period[19]**

Note: taken together the first two conditions imply that in each period we will have a 'balanced panel' of firms – the same firms are always present throughout the period.

A little later on, and in a rarely noticed section, **The Manual of Business Demography** continues,

> *"The identification of high-growth enterprises on an annual basis may lead to the inclusion of an enterprise in the population of high-growth enterprises in several years. The question arises whether a high-growth enterprise ... should be counted in more than one reference year if it fulfils the given definition. The recommendation is to do so." EUROSTAT-OECD [2007, p.63][20]*

So what we have here is an explicit recognition that when HGFs are to be counted over successive annual – and, therefore, necessarily overlapping – growth periods a firm may be counted more than once.

[17] There has been growing criticism of the OECD HGF measure in recent years and in the US the Bureau of Labor Statistics (BLS) argued that the OECD measure was too narrow and excluded firms with less than ten employees in the first year of the three year growth period. The BLS developed an alternative measure which extended the definition of a high-growth firm to include firms with less than ten employees if the firm added eight or more employees during the three year growth period. Here we adopt this measure and refer to these as Small High Growth Firms (SHGFs).

[18] Alternatively, an annual average growth of 20% in turnover over the period can be used as the criterion, but only employment is used here.

[19] In 2014 EUROSTAT changed the growth criterion used to define HGFs from 20% per year over three years, to 10% per year over three years. Although there does not seem to be any published rationale for this change, the Statistics Directorate of the OECD confirmed that the HGF threshold was lowered to suit the data requirements of an innovation indicator (OECD[2018]). EUROSTAT still collects data on the 20% criterion, but Member States supply it on a voluntary basis. The OECD publishes data on both definitions, see OECD [2017, pp. 90-93]. OECD(2017) "Entrepreneurship at a Glance", OECD Publishing, Paris https://www.oecd-ilibrary.org/employment/entrepreneurship-at-a-glance-2017_entrepreneur_aag-2017-en

[20] https://www.oecd.org/sdd/business-stats/eurostat-oecdmanualonbusinessdemographystatistics.htm

It would perhaps be more informative to concentrate on the importance of creating a growth pipeline at local level and monitoring its development over time. Tracking cohorts of start-ups over time as they begin to engage in a range of activity which prepares them for future growth, would be a more meaningful focus for business support policy. We address this issue in Section 7 where we present such an analysis for a cohort of start-ups in Scotland for the period 2008-18.

Recent work by the ERC has highlighted the following key findings on business growth and high-growth firms. The ERC research team have turned their attention to the geography of 'high-growth' episodes in the life of a business[21]. Our research shows that a failure to recognize the distinction between 'growth episodes' and 'firms' gives a misleading picture of HGFs, their numbers and their contribution to job creation and potentially confuses the policy debate on scale-ups. Results on the size distribution of HGFs, their age distribution and their fertility (whether or not they are 'one hit wonders'), all depend on where in a firm's life cycle HGFs are being identified and how long they are being followed. In other words, reporting statistics for a 3-year period which average over different birth cohorts may not provide unbiased answers to questions about HGF characteristics.

The research suggests that approach focusing on strict HGFs OECD metric only, while being analytically useful, may be not solely appropriate in policy terms. Apart from previous considerations, it leaves self-employed and micro-businesses of less than 10 employees as well as fast but episodically growing or growing at a slower pace firms outside the scope of the analysis. It is our view that Scottish Enterprise needs to recognise this in future policy formulation. Thus, in the following sections we start by looking on high-growth firms in Scotland, first, through the prism of the OECD definition, then, at the second step, by relaxing this strict definition to obtain a larger perspective of growth dynamism in Scotland as compared to other UK regions.

4. High-Growth Firms in Scotland and the UK Regions: OECD employment definition

This section provides comparative analysis of HGFs in Scotland and other UK regions based on the official OECD definition of a HGF (firm born before the beginning and alive at the end of the period, having at least *10 employees* at the beginning of the period and recording an annual average *growth of 20% in employment over three year period*) and small HGFs based on BLS definition discussed further. We use the employment-based definition as the ONS have stated that it is more reliable than the turnover-based definition in the UK as they are unable to independently verify its reliability as easily as the employment-based one.

Between 2013 and 2015 the number of HGFs in Scotland rose by 21% from 667 firms to 807 firms and with a stable business base of firms with more than 10 employees the incidence rate in Scotland rose from 5.8% to 6.9%. This increase can be related to the recovery after the Great Recession in the UK in 2008-9 as firms began to recruit employees again (*Table 1*). However, since 2015 there has been a reversal of that trend with the number of HGFs falling in number (from 807 to 697) and the HGF incidence rate falling from 6.9% to 5.2%. The fall in the incidence rate is a function of the decline in the number of HGFs combined with an increase in the number of firms in Scotland with more than 10 employees (*Figure 1*).

[21] Anyadike-Danes, M and Hart, M (2018) "Fecundity, fertility, survival and growth: high-growth firms in the UK and their contribution to job creation, a demographic perspective", ERC Research Paper 74, January 2019. https://www.enterpriseresearch.ac.uk/our-work/publications/?type=research-paper

We can crudely estimate the HGF 'deficit' in Scotland by calculating the number of HGFs there would have been in 2015-18 if the UK incidence rate of 6.2% is applied. There would have been an additional 128 HGFs (20% employment definition) in Scotland (or 81 if London excluded from the analysis). We need to mindful of course that this simplistic 'closing the gap' type of analysis ignores the obvious fact that having more of these firms may well have negative effects on the performance of other established firms, including HGFs – a potential zero-sum game.

Table 1: Number and Incidence Rate of HGFs in Scotland and other UK regions

(OECD employment definition: average 20%+ employment growth per year over 3 year period and 10+ employees in base year)

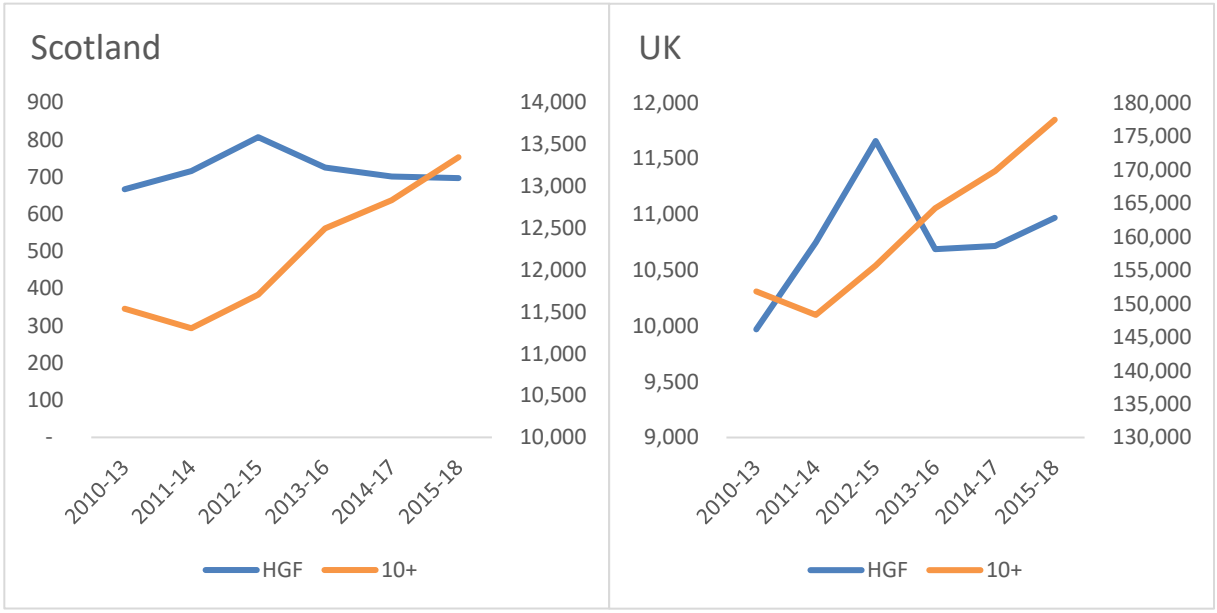
Region	2010-13			2011-14			2012-15		
	HGF	10+	%HGF	HGF	10+	%HGF	HGF	10+	%HGF
North East	291	4,826	6.0	330	4,645	7.1	356	4,828	7.4
North West	1036	15,745	6.6	1,123	15,355	7.3	1,256	16,251	7.7
Yorkshire and The Humber	673	12,202	5.5	777	11,863	6.5	884	12,288	7.2
East Midlands	642	10,849	5.9	717	10,597	6.8	800	11,140	7.2
West Midlands	785	12,831	6.1	871	12,467	7.0	875	13,012	6.7
East of England	862	14,514	5.9	965	14,205	6.8	1,027	14,899	6.9
London	2207	22,664	9.7	2,243	22,577	9.9	2,362	24,763	9.5
South East	1489	22,196	6.7	1,623	21,836	7.4	1,706	22,756	7.5
South West	789	13,260	6.0	857	12,996	6.6	967	13,592	7.1
Wales	340	6,049	5.6	343	5,898	5.8	394	5,976	6.6
Scotland	**667**	**11,539**	**5.8**	**716**	**11,304**	**6.3**	**807**	**11,707**	**6.9**
Northern Ireland	188	5,149	3.7	182	4,569	4.0	223	4,486	5.0
UK	9,969	151,824	6.6	10,747	148,312	7.2	11,657	155,698	7.5
UK (excluding London)	7,762	129,160	6.0	8,504	125,735	6.8	9,295	130,935	7.1
Region	2013-16			2014-17			2015-18		
	HGF	10+	%HGF	HGF	10+	%HGF	HGF	10+	%HGF
North East	315	5,073	6.2	301	5,276	5.7	296	5,489	5.4
North West	1,136	17,127	6.6	1,112	17,788	6.3	1,129	18,436	6.1
Yorkshire and The Humber	831	12,906	6.4	775	13,383	5.8	776	14,004	5.5
East Midlands	724	11,699	6.2	717	12,072	5.9	699	12,541	5.6
West Midlands	784	13,826	5.7	816	14,248	5.7	845	14,809	5.7
East of England	923	15,703	5.9	978	16,310	6.0	1,075	16,944	6.3
London	2,197	26,445	8.3	2,208	27,192	8.1	2,313	28,901	8.0
South East	1,576	23,866	6.6	1,560	24,670	6.3	1,606	25,836	6.2
South West	902	14,332	6.3	885	14,967	5.9	895	15,612	5.7
Wales	367	6,310	5.8	393	6,565	6.0	402	6,943	5.8
Scotland	**725**	**12,496**	**5.8**	**701**	**12,833**	**5.5**	**697**	**13,347**	**5.2**

Northern Ireland	209	4,476	4.7	271	4,489	6.0	235	4,596	5.1
UK	10,689	164,259	6.5	10,717	169,793	6.3	10,968	177,458	6.2
UK (excluding London)	8,492	137,814	6.2	8,509	142,601	6.0	8,655	148,557	5.8

Source: ONS BSD (2010-2018)

Figure 1: Trends in the number of HGFs (lhs) and of the overall population of firms with more than 10 employees (rhs) in Scotland and in the UK

(OECD employment definition: average 20%+ employment growth per year over 3 year period and 10+ employees in base year)



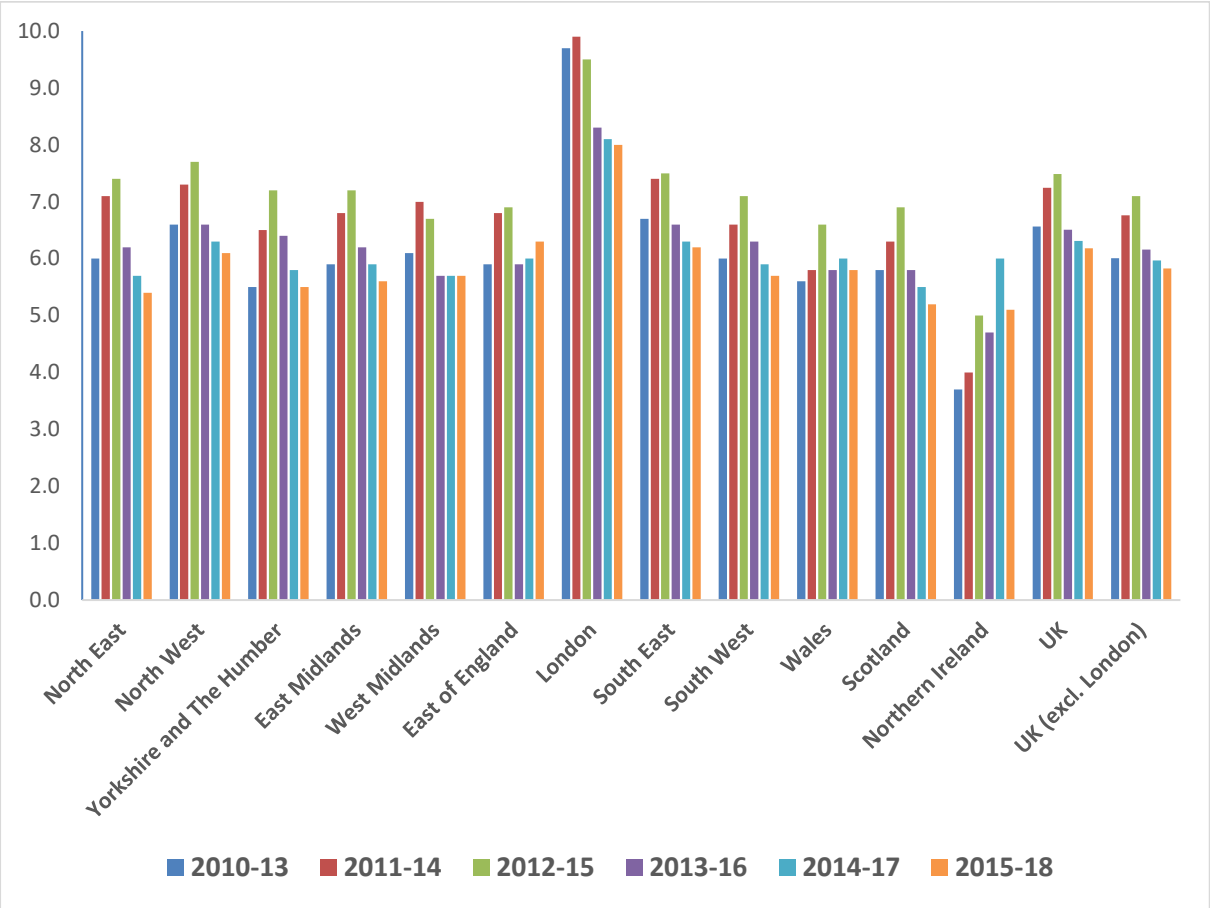
Source: ONS BSD (2010-2018)

The dynamic of the overall population of firms with more than 10 employees in Scotland followed the same pattern as the UK numbers. The number of HGF in Scotland, however, started to diverge from the UK trend as it continued to stagnate while the overall UK number of HGFs slightly improved during the last three year period (*Figure 1*).

The HGF incidence rate in Scotland mirrored the dynamic of other regions: an increase in the first three 3-year periods and the decline/stabilisation in the last three periods (*Figure 2*). There are two exceptions: London and Northern Ireland. In London, the HGF incidence rate continued to decrease from 9.9% in 2011-2014 to 8.0% in 2015-2018 driven by a fast increase in number of firms with more than 10 employees and relatively stable number of HGFs. And in the Northern Ireland, the HGF incidence rate was unstable driven by a significant increase of the number of HGFs in the 3rd (2012-15) and 5th period (2014-17) while the number of firms with more than 10 employees remained stable if not stagnant.

Figure 2: HGFs incidence rate (%) across time and regions

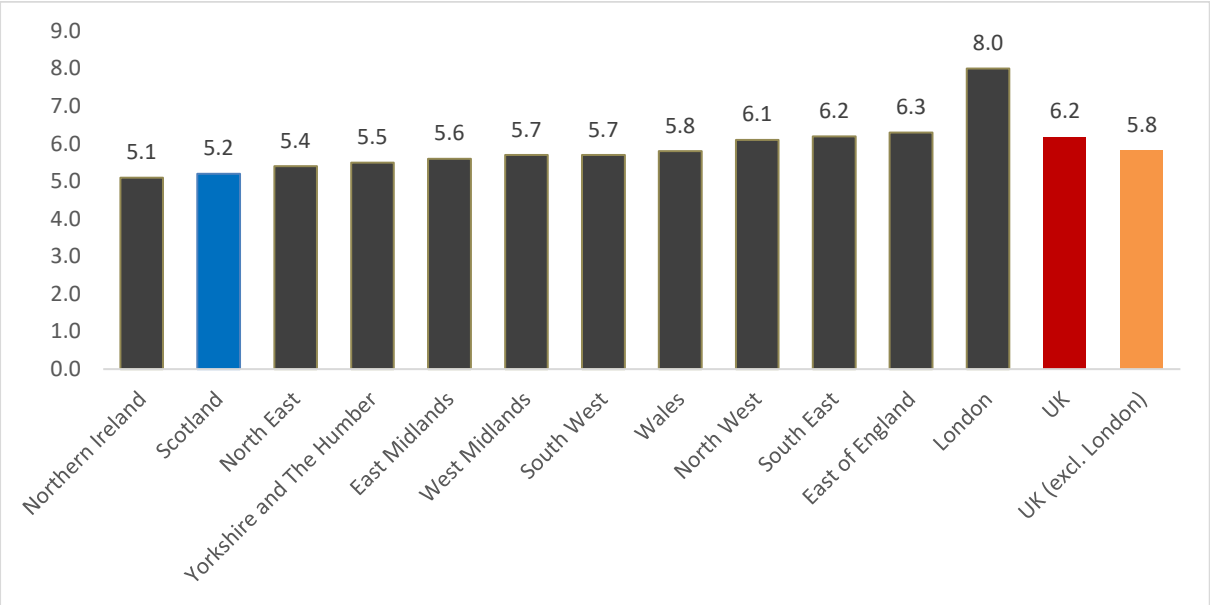
(OECD employment definition: average 20%+ employment growth per year over 3 year period and 10+ employees in base year)



Source: ONS BSD (2010-2018)

Compared to other parts of the UK, Scotland now occupies the bottom spot with Northern Ireland as having the lowest HGF incidence rate – 5.2% and 5.1% respectively (*Figure 3*). In the first three periods Scotland's incidence rate out-performed Wales while in the last three periods the situation has reversed. We set out some the possible reasons for this in the conclusion of the report.

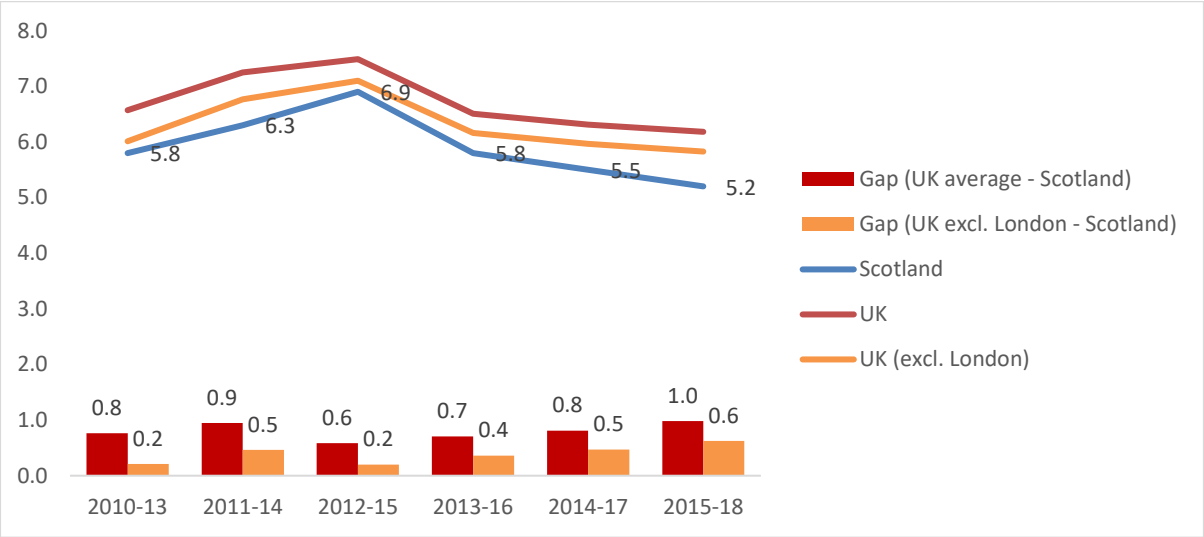
Figure 3: HGFs incidence rate (%) across UK regions/nations, 2015-2018



Source: ONS BSD (2010-2018)

Figure 4 shows that Scotland's HGFs incidence rate followed quite closely the evolution of the UK average. If we exclude London, which outperforms all other regions, the gap between Scotland's incidence rate and UK's average was about 0.2% in the best years and increased up to 0.6% in the latest period. While a gap attracts the attention of policy makers given the issues with this metric we set out earlier and also the potential negative implications for other businesses in the local economy it should not necessarily be seen as a 'weakness' to be addressed.

Figure 4: HGFs incidence rate (%) in Scotland and gap to UK average

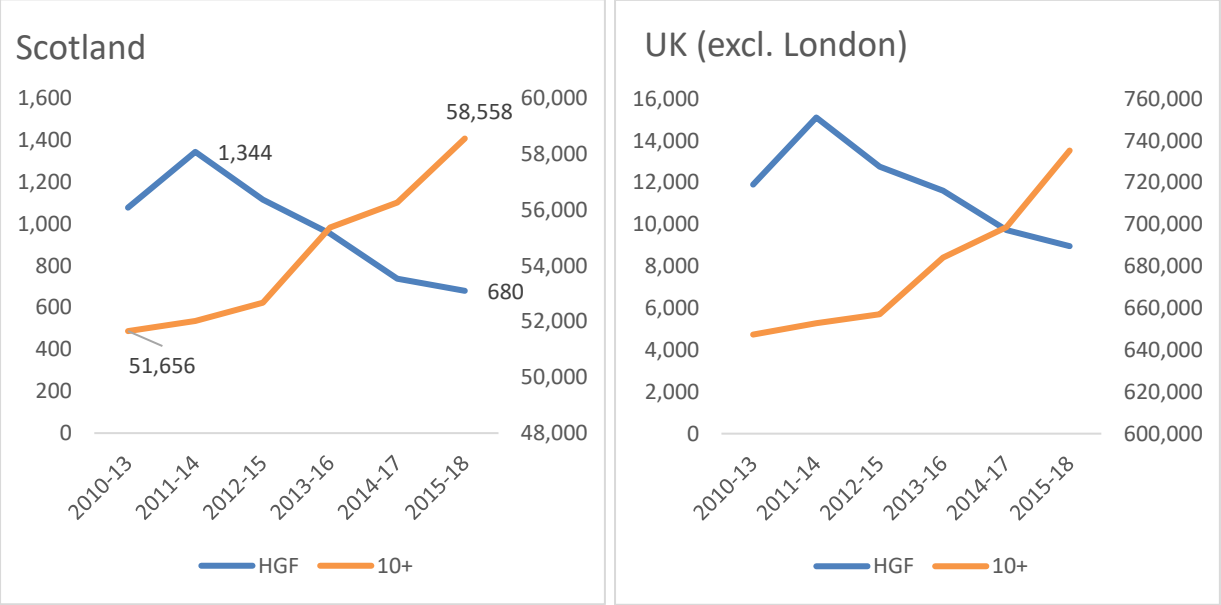


Source: ONS BSD (2010-2018)

However, the US Bureau of Labor Statistics (BLS) has argued that the OECD measure was too narrow and were concerned with the exclusion of firms with fewer than ten employees in the first year of the three year growth period. The BLS alternative measure extended the

definition of a high-growth firm to include firms with less than ten employees if the firm added eight or more employees during the three year growth period. Here we refer to these as **Small High Growth Firms (SHGFs)**. The 'eight or more' figure in the BLS definition was arrived at by multiplying the lower threshold of the OECD measure, ten employees, by the compound growth ratio, 1.728: if a firm with less than 10 employees added eight jobs, it would have contributed about the same amount to job creation as would a firm with ten jobs which grew by a factor of 1.728 and therefore satisfied the OECD criterion [Clayton, Sadeghi, Spletzer and Talan, "High-employment-growth firms: defining and counting them", Monthly Labor Review, June 2013].[22]

Figure 5: Trend in the number of SHGFs (lhs) and of the overall population of firms with less than 10 employees (rhs) in Scotland and in the UK



Source: ONS BSD (2010-2018)

Table 2 provides the results which relax the official OECD definition to include micro-businesses (less than 10 employees). High-growth incidence is lower among micro- firms than among firms with more than 10 employees. Overall, the trends are the same as before with an increase in the number of SHGFs in Scotland over the 2010-14 period and then a subsequent decline (from 1,344 SHGFs in 2011-14 to 680 in 2015-18) (*Figure 5*). As previously, the fall in the incidence rate is a function of the decline in the number of HGFs combined with an increase in the number of firms in Scotland with less than 10 employees. SHGFs in Scotland show the same trend as in most other regions (except for Northern Ireland) and as in the UK on average (*Figure 6*). Put simply, there are more firms entering the market but fewer are achieving high-growth.

As before, we can calculate the number of SHGFs foregone in Scotland by applying the UK incidence rate of 1.3% compared to 1.2%. In this case there would have been an additional 78 SHGFs in Scotland (or 33 if London excluded from the analysis).

[22] https://www.bls.gov/opub/mlr/2013/article/clayton.htm

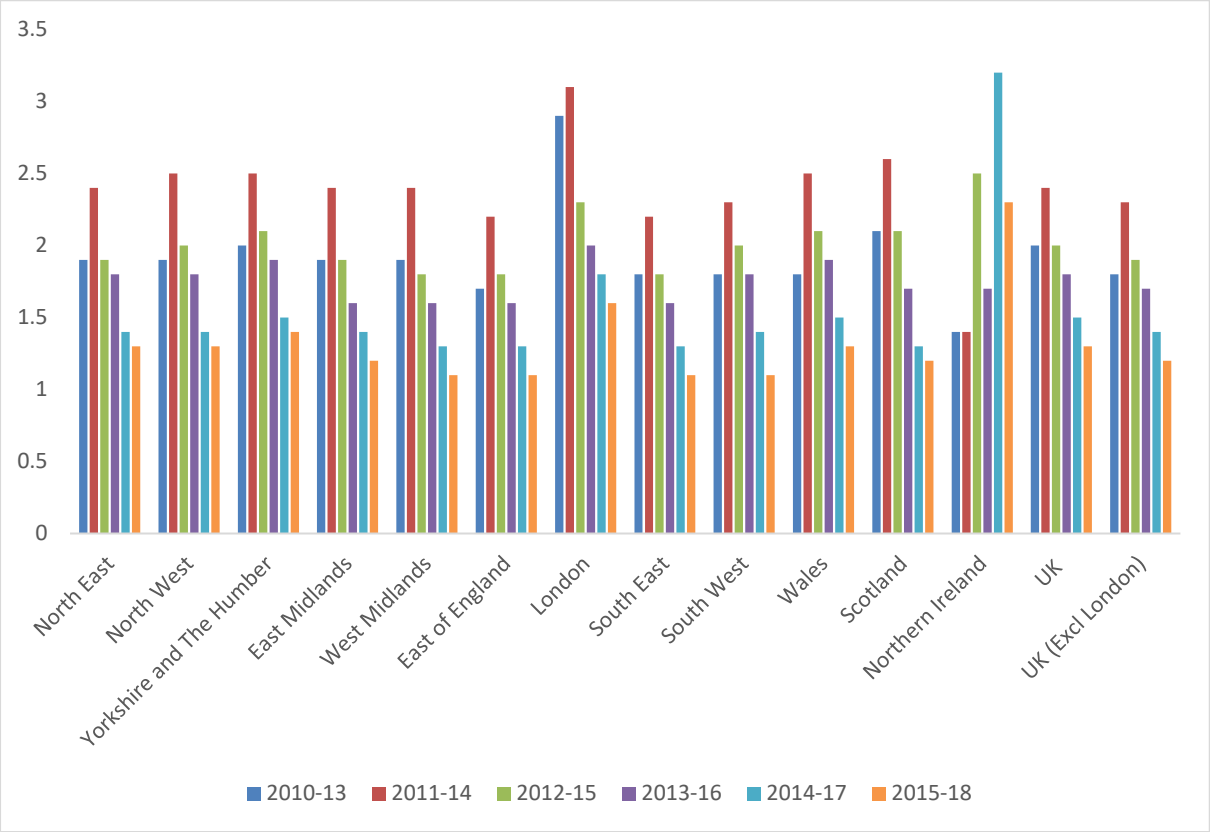
Table 2: Number and Incidence Rate of Small High-Growth Firms

BLS SHGF definition: add 8+ employees over 3 year period and < 10 employees in base year

	2010-13			2011-14			2012-15		
Region	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	387	20,255	1.9	494	20,481	2.4	385	20,404	1.9
North West	1,516	81,097	1.9	1,990	80,992	2.5	1,604	80,448	2.0
Yorkshire and The Humber	1,062	53,781	2.0	1,346	54,550	2.5	1,153	54,955	2.1
East Midlands	970	52,397	1.9	1,284	52,998	2.4	996	53,253	1.9
West Midlands	1,197	63,023	1.9	1,491	63,325	2.4	1,167	63,487	1.8
East of England	1,408	80,752	1.7	1,770	81,611	2.2	1,488	82,502	1.8
London	3,794	129,213	2.9	4,105	131,409	3.1	3,151	134,895	2.3
South East	2,263	128,862	1.8	2,835	130,632	2.2	2,421	132,911	1.8
South West	1,275	70,242	1.8	1,615	70,616	2.3	1,397	70,816	2.0
Wales	522	28,950	1.8	715	29,081	2.5	621	29,047	2.1
Scotland	**1,078**	**51,656**	**2.1**	**1,344**	**52,021**	**2.6**	**1,116**	**52,676**	**2.1**
Northern Ireland	230	16,327	1.4	223	16,497	1.4	411	16,540	2.5
UK	15,702	776,555	2.0	19212	784,213	2.4	15,910	791,934	2.0
UK (Excl London)	11,908	647,342	1.8	15107	652,804	2.3	12,759	657,039	1.9
	2013-16			**2014-17**			**2015-18**		
Region	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	387	21,373	1.8	306	21,781	1.4	293	23,205	1.3
North West	1,462	83,322	1.8	1184	84,890	1.4	1195	89,612	1.3
Yorkshire and The Humber	1,097	57,164	1.9	893	58,579	1.5	840	61,783	1.4
East Midlands	906	55,573	1.6	786	57,061	1.4	725	60,077	1.2
West Midlands	1,055	65,966	1.6	861	67,581	1.3	780	71,431	1.1
East of England	1,358	85,996	1.6	1,133	88,309	1.3	1,059	93,366	1.1
London	2,928	145,607	2.0	2,695	152,713	1.8	2,705	166,255	1.6
South East	2,210	139,256	1.6	1,813	142,614	1.3	1,692	150,294	1.1
South West	1,328	73,409	1.8	1,027	74,528	1.4	884	78,040	1.1
Wales	571	29,966	1.9	463	30,346	1.5	413	31,560	1.3
Scotland	**954**	**55,366**	**1.7**	**738**	**56,260**	**1.3**	**680**	**58,558**	**1.2**
Northern Ireland	277	16,676	1.7	532	16,745	3.2	398	17,371	2.3
UK	14,533	829,674	1.8	12,431	851,407	1.5	11,664	901,552	1.3
UK (Excl London)	11,605	684,067	1.7	9,736	698,694	1.4	8,959	735,297	1.2

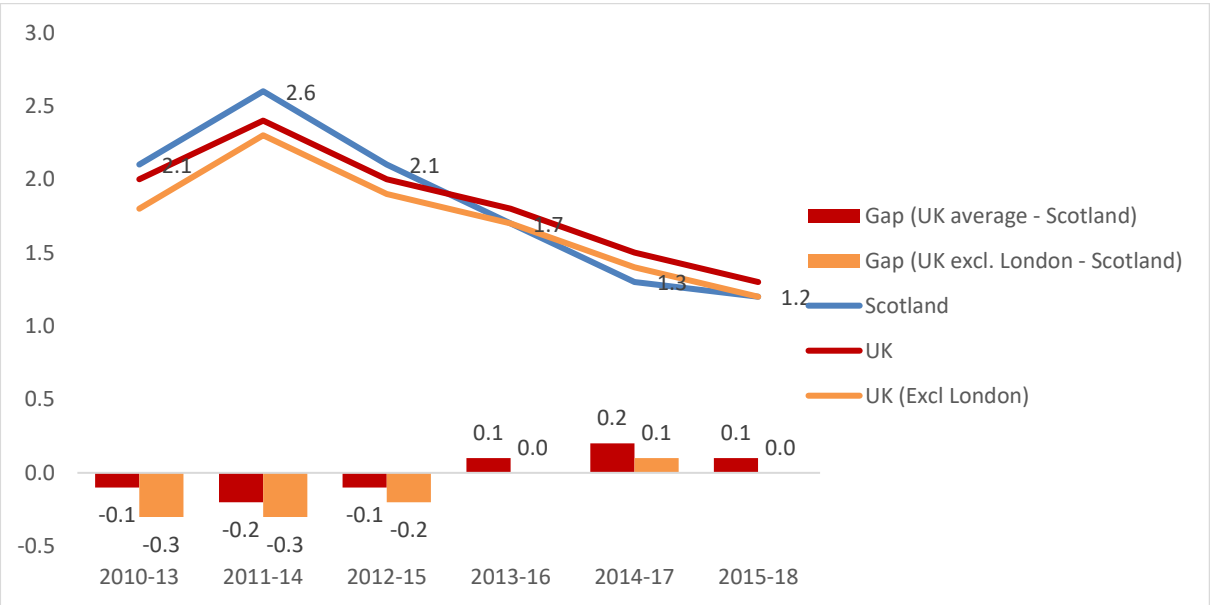
Source: ONS BSD (2010-2018)

Figure 6: SHGFs incidence rate (%) across time and regions



In contrast to the widely used OECD HGF definition (i.e., with more than 10 employees), there is no improvement in the number and incidence rate of the SHGFs in the UK in the whole during the last years. Scotland was outperforming UK average in terms of SHGFs during the first three periods. The situation reversed in 2013-16 period but the gap between Scotland's SHGFs incidence rate and UK's average remains low. We suggest in the conclusion that this may have something to do with the uncertainty for business created around the 2014 referendum.

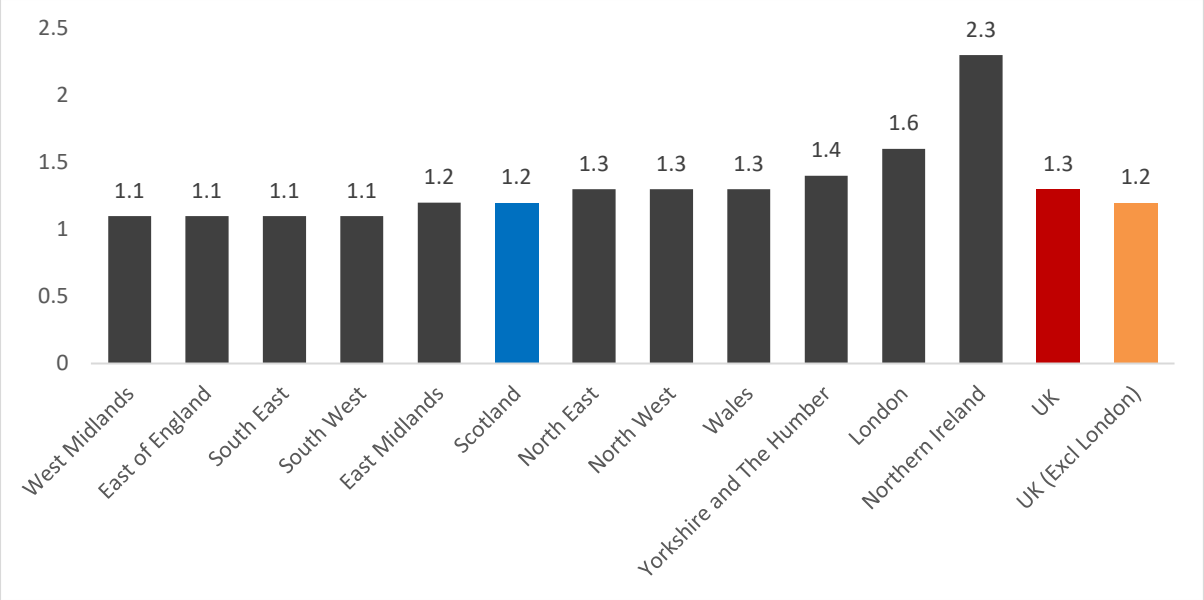
Figure 7: SHGFs incidence rate (%) in Scotland and gap to UK average



Source: ONS BSD (2010-2018)

In 2015-18, the SHGFs incidence rate in Scotland was in the middle of the range outperforming West and East Midlands, South East and South West and East of England but underperforming comparing to North East and West, Wales, Yorkshire and the Humber, London and Northern Ireland. The Northern Ireland comparison seems related to border regions and, therefore, there is perhaps a uniqueness about this data point.

Figure 8: SHGFs incidence rate (%) across regions, 2015-2018



Source: ONS BSD (2010-2018)

5. High-Growth Firms in Scottish Sub-Regions

Looking at the spatial distribution of HGFs across the Scottish sub-regions is an important dimension in the delivery of inclusive growth for the Scottish Government. Immediately, we can see that there is a great deal of variation in the HGF incidence rate across the sub-regions in Scotland and, indeed, over time there have been some important shifts (*Table 3*).

Table 3: Number and Incidence Rate of High-Growth Firms by Scottish Region
OECD employment definition: 20%+ employment growth per year over 3 year period and 10+ employees in base year

	2010-13			2011-14			2012-15		
Region	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
Aberdeen City and Shire	113	1,499	7.5	120	1,518	7.9	149	1,582	9.4
Ayrshires	33	625	5.3	31	576	5.4	33	600	5.5
Glasgow City Region	214	3,481	6.1	232	3,418	6.8	248	3,501	7.1
Edinburgh & SE	108	1,828	5.9	113	1,779	6.4	140	1,901	7.4
South of Scotland	25	619	4.0	28	608	4.6	32	638	5.0
Stirling, Clackmannan & Falkirk	27	558	4.8	29	542	5.4	29	563	5.2

Tay Cities	85	1,530	5.6	85	1,488	5.7	93	1,518	6.1
Highlands and Islands	61	1,300	4.7	74	1,283	5.8	76	1,313	5.8
Total	**666**	**11,440**	**5.8**	**712**	**11,212**	**6.4**	**800**	**11,616**	**6.9**
	2013-16			**2014-17**			**2015-18**		
Region	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
Aberdeen City and Shire	110	1,708	6.4	80	1,741	4.6	63	1,743	3.6
Ayrshires	32	644	5.0	32	665	4.8	25	689	3.6
Glasgow City Region	232	3,727	6.2	229	3,855	5.9	218	4,008	5.4
Edinburgh & SE	136	2,000	6.8	151	2,049	7.4	162	2,175	7.4
South of Scotland	27	673	4.0	30	686	4.4	32	719	4.5
Stirling, Clackmannan & Falkirk	31	599	5.2	22	622	3.5	27	656	4.1
Tay Cities	94	1,613	5.8	93	1,639	5.7	94	1,703	5.5
Highlands and Islands	57	1,441	4.0	62	1,484	4.2	73	1,569	4.7
Total	**719**	**12,405**	**5.8**	**699**	**12,741**	**5.5**	**694**	**13,262**	**5.2**

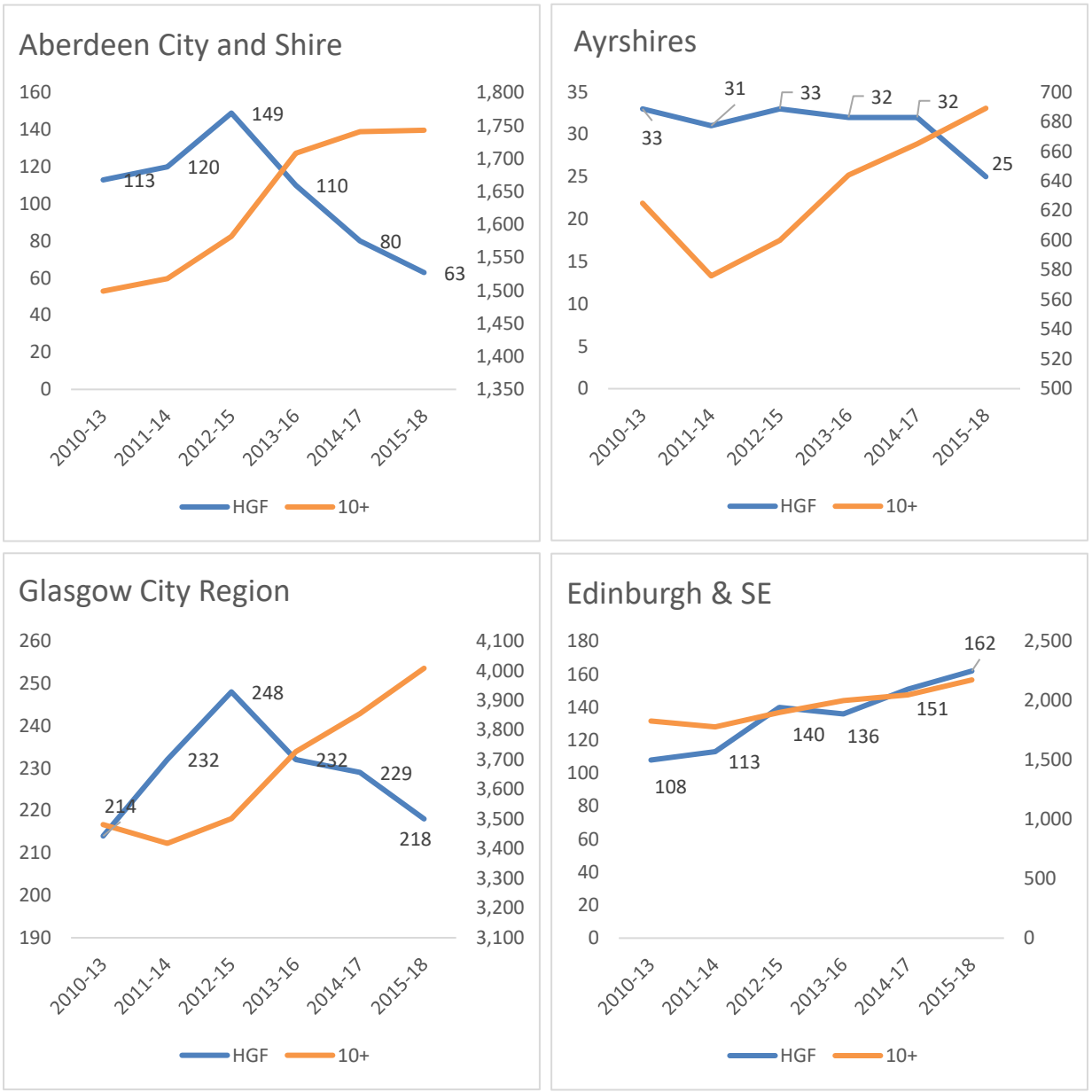
Source: ONS BSD (2010-2018)
Note: These sub-regional geographies were based on matching postcodes to the postcode directory. There are a number of cases where the postcodes could not be matched therefore the totals will not match those in Table 1.

The rise and fall of the number of HGFs that we observe in Scotland throughout 2010-2018 period is driven mostly by the dynamic of HGFs in Aberdeen City & Shire and Glasgow City regions (*Figure 9*). The most dramatic decrease in the number of HGFs is observed in Aberdeen City & Shire: from 149 in 2012-15 to 63 in 2015-18 – which reflects the oil and gas recession following a dramatic price drop in the price of oil from $112pb in June 2014 to $36pb in January 2016. In Glasgow City region the number of HGFs decreased from 248 (2012-15) to 218 (2015-18) what represents a 12% reduction. On the other hand, the total population of enterprises with more than 10 employees was rising rapidly in both regions. It was also the case in Ayrshires, where combined with a relatively stable but decreasing number of HGFs, it resulted in a drop of the HGF incidence rate.

On a more positive note, after a drop in the number of HGFs in the middle of the period in South of Scotland, in Stirling, Clackmannan & Falkirk and in Highlands & Islands, we can observe a recovery of the number of HGFs recently what is also reflected in the slightly increasing HGF incidence rates (*Figure 10*).

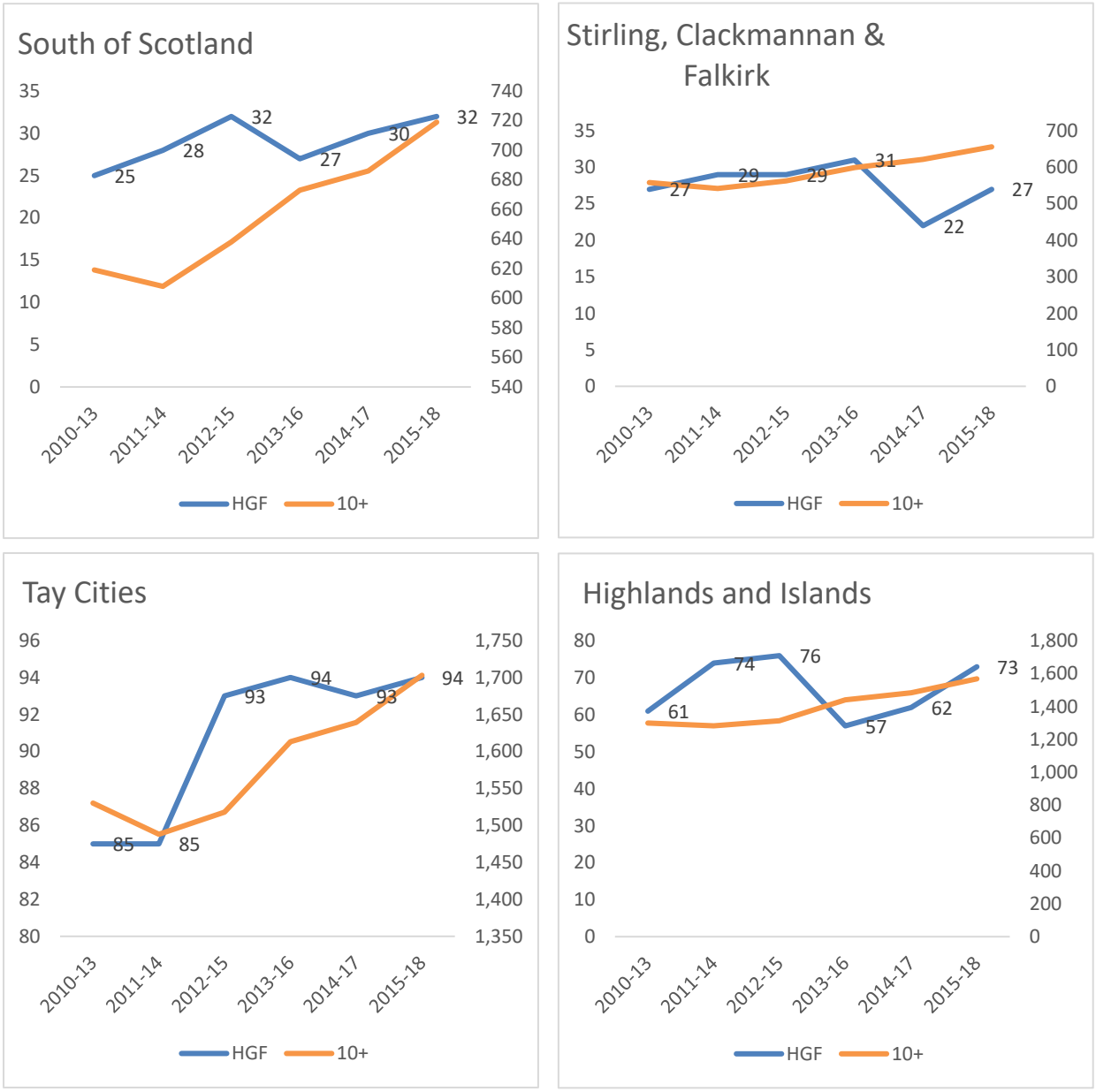
Figure 9a: Trend in the number of HGFs (lhs) and of the overall population of firms with more than 10 employees (rhs) in Scotland's sub-regions

(OECD employment definition: average 20%+ employment growth per year over 3 year period and 10+ employees in base year)



Source: ONS BSD (2010-2018)

Figure 9b: Trends in the number of HGFs (lhs) and of the overall population of firms with more than 10 employees (rhs) in Scottish sub-regions

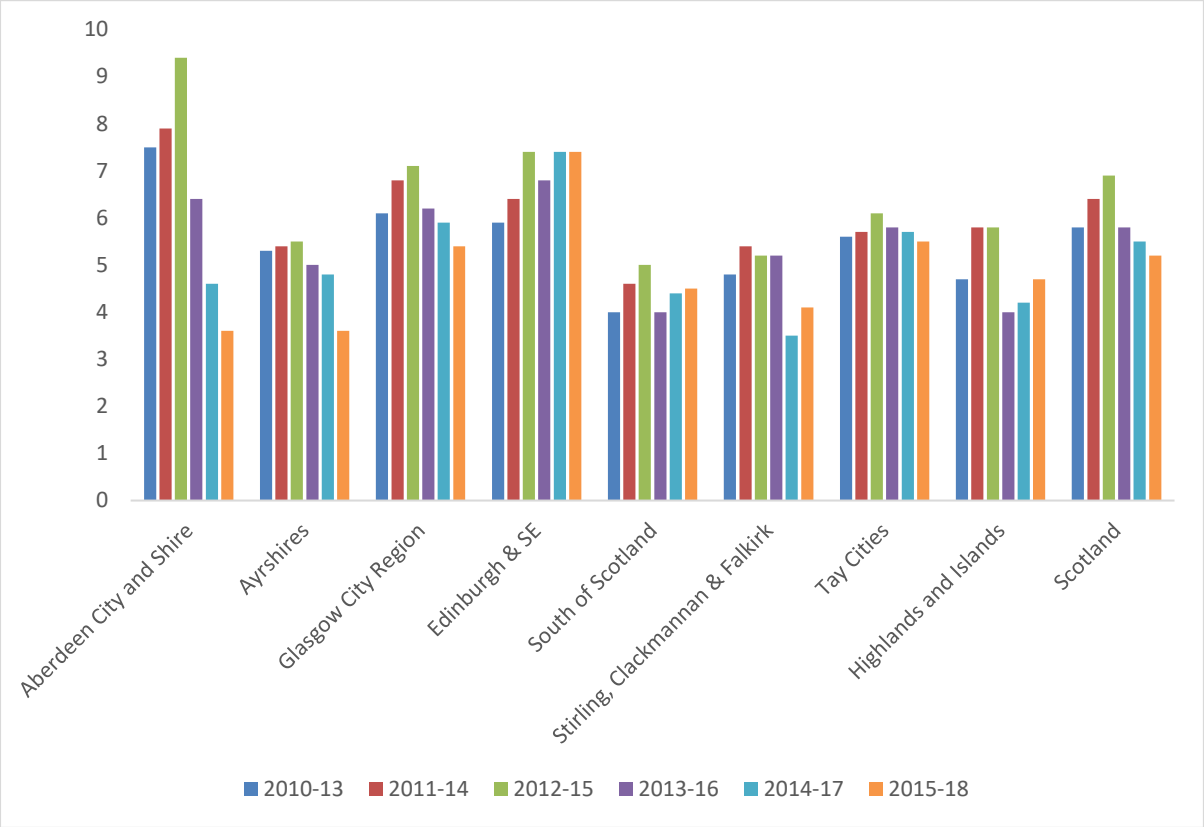


Source: ONS BSD (2010-2018)

The HGF incidence rate remained stable in Tay cities where an increase in the number of HGFs (from 85 to 94) was accompanied by a considerable increase in the business population. The HGF incidence rate for Edinburgh and South East sub-region stands out as it has maintained its 2015 level despite a rising business base of firms employing more than 10 employees. In fact, the number of the HGFs was rising almost during the whole period increasing from 108 in 2010-13 to 162 in 2015-18. This clearly illustrates the interconnection between the definition of the HGF metric and the size of the underlying business base and is another example of the less than optimal nature of using this metric to drive policy interventions.

Figure 10: HGFs incidence rate (%) in Scotland across time and sub-regions

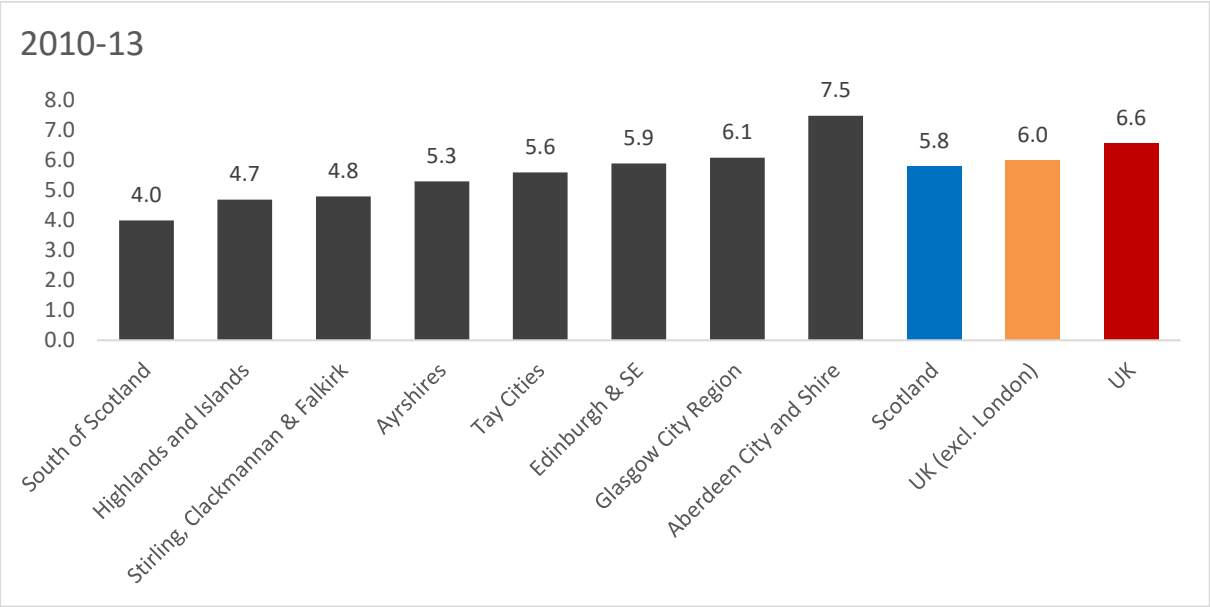
OECD employment definition: average 20%+ employment growth over 3 year period and 10+ employees in base year

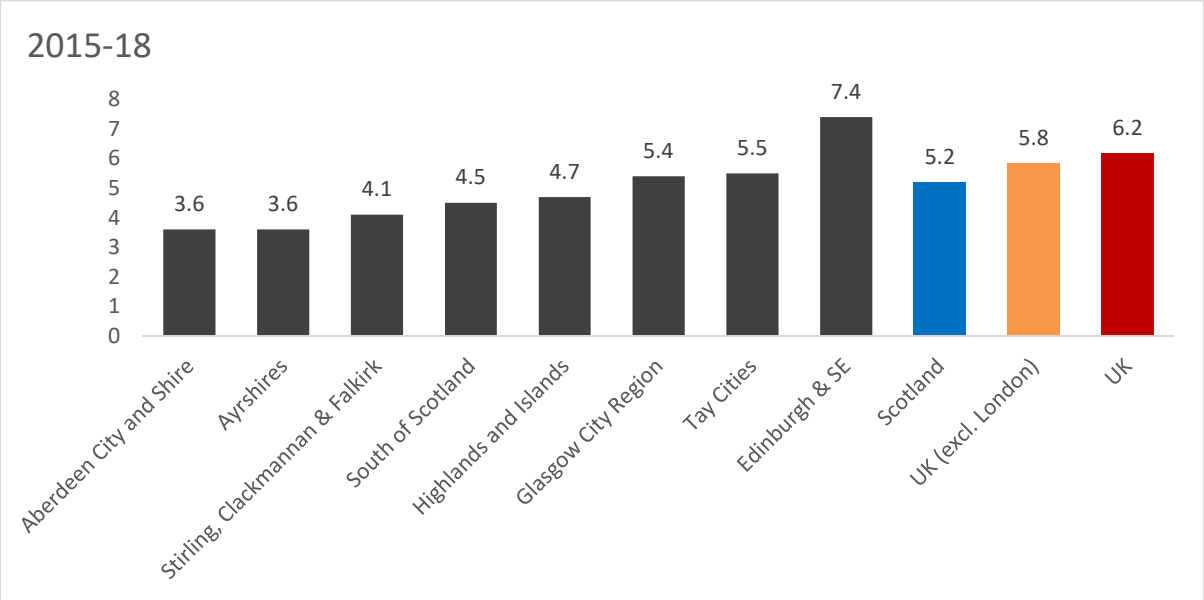


Source: ONS BSD (2010-2018)

Figure 11: HGFs incidence rate (%) in Scottish sub-regions, 2010-13 and 2015-18

OECD employment definition: average 20%+ employment growth per year over 3 year period and 10+ employees in base year

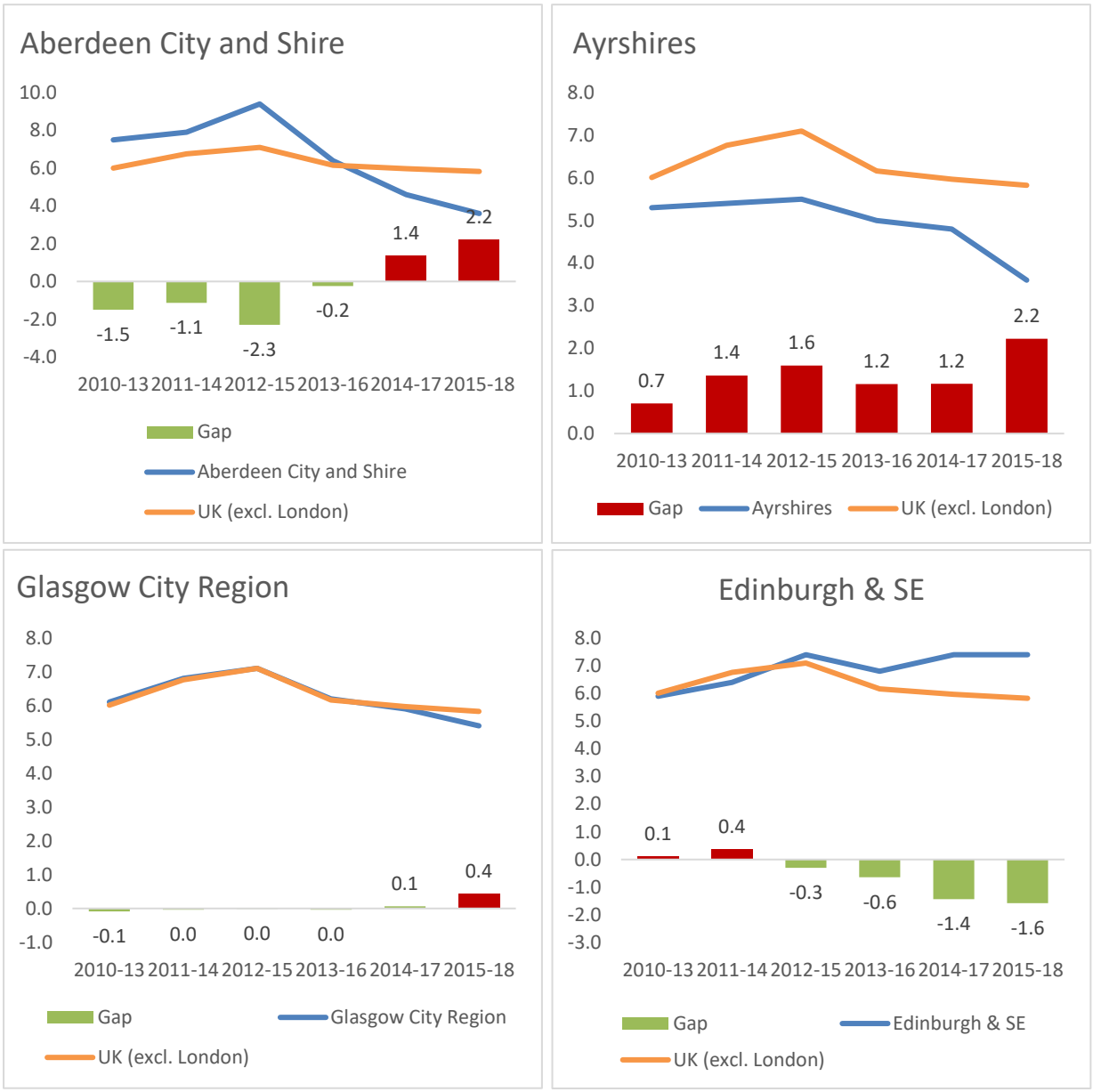




Source: ONS BSD (2010-2018)

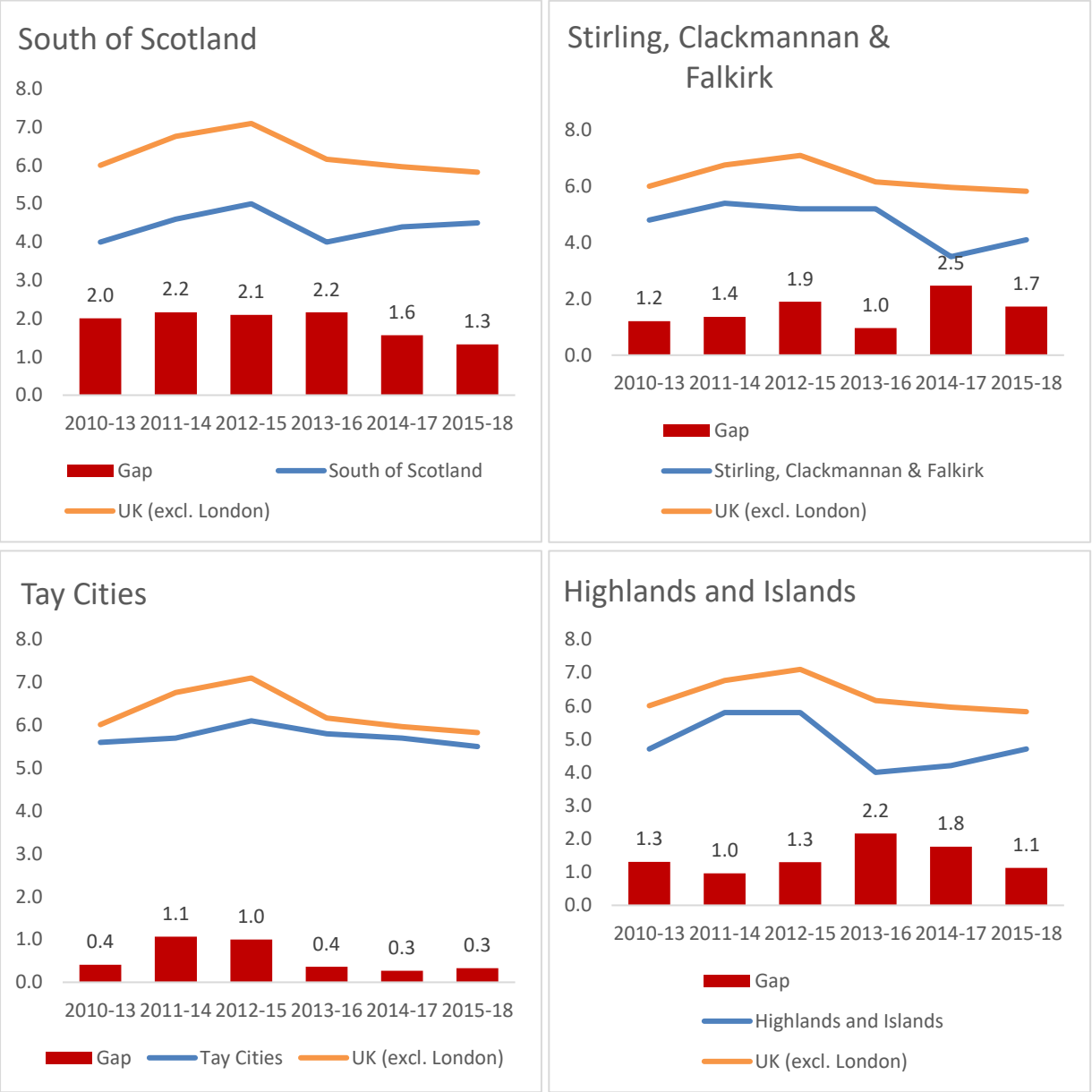
Figure 11 provides snapshots of HGF incidence rates across sub-regions of Scotland in the beginning of the decade and in the end. The changes in ranking of sub-regions depending on high-growth incidence rates are striking: Aberdeen City & Shire region moved from the first position with the highest HGF incidence (7.5%) to the poorest performance (3.6%) in Scotland. Tay Cities and especially Edinburgh and SE region, on the contrary, moved to the top of the sub-regions.

Figure 12a: HGFs incidence rate (%) in Scottish sub-regions and gap to UK average



Source: ONS BSD (2010-2018)

Figure 12b: HGFs incidence rate (%) in Scottish sub-regions and gap to UK average



When it comes to compare Scotland to the UK average, it becomes clear that the average HGF incidence rate for Scotland hides important divergences between sub-regions. Indeed, Edinburgh & SE as well as Aberdeen region before the oil recession outperform the UK average (excluding London); Glasgow region had very similar evolution and in Tay cities the gap is not so important and has been decreasing recently (*Figure 12*). The gap is more substantial in other Scottish regions, though decreasing recently in South of Scotland and Highlands & Islands. Interestingly, the incidence rate in the Highlands & Islands sub-regions is similar to large parts of rural Wales and the South West in England.

6. High-Growth Firms in Scotland by Sector

Table 4 clearly indicates that the overall trend of the rise and fall of the HGF incidence rate in Scotland is broadly consistent across all sectors of the economy and indeed the overall Scottish average except Wholesale and Retail which has remained broadly similar in the 2010-2018 period.

Table 4: Number and Incidence Rate of High-Growth Firms by Scottish Sector

(OECD employment definition: 20%+ employment growth per year over 3 year period and 10+ employees in base year)

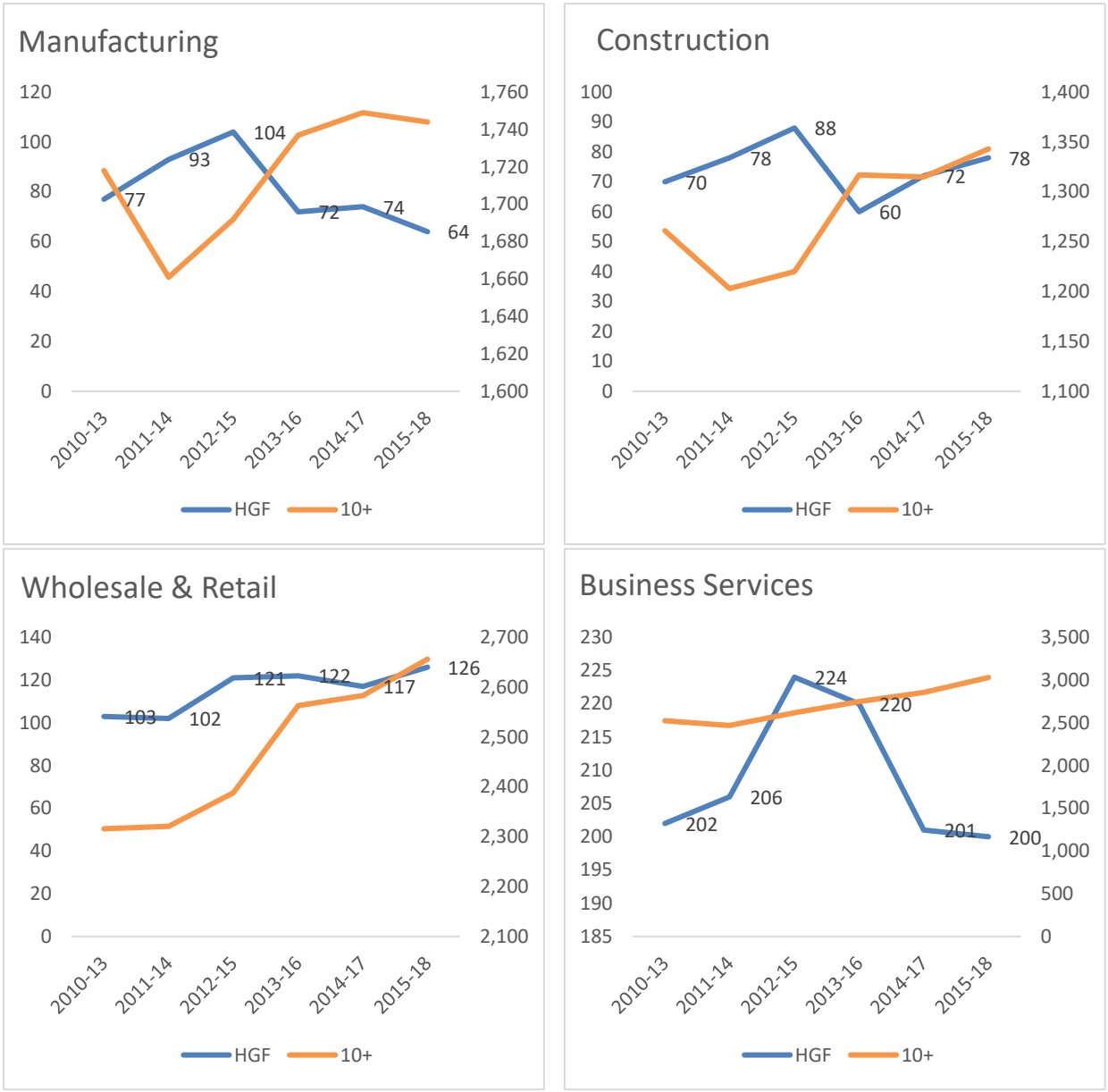
	2010-13			2011-14			2012-15		
Sector	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
Manufacturing	77	1,718	4.5	93	1,661	5.6	104	1,692	6.1
Construction	70	1,261	5.6	78	1,203	6.5	88	1,220	7.2
Wholesale & Retail	103	2,316	4.4	102	2,321	4.4	121	2,388	5.1
Business Services	202	2,524	8.0	206	2,468	8.3	224	2,618	8.6
Other	215	3720	5.8	237	3651	6.5	270	3789	7.1
Total	**667**	**11,539**	**5.8**	**716**	**11,304**	**6.3**	**807**	**11,707**	**6.9**
	2013-16			**2014-17**			**2015-18**		
Sector	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
Manufacturing	72	1,737	4.1	74	1,749	4.2	64	1,744	3.7
Construction	60	1,317	4.6	72	1,315	5.5	78	1,343	5.8
Wholesale & Retail	122	2,563	4.8	117	2,583	4.5	126	2,656	4.7
Business Services	220	2,746	8.0	201	2,854	7.0	200	3,029	6.6
Other	251	4,133	6.1	237	4,332	5.5	229	4,575	5.0
Total	**725**	**12,496**	**5.8**	**701**	**12,833**	**5.5**	**697**	**13,347**	**5.2**

Source: ONS BSD (2010-2018)

In the manufacturing sector the number of HGFs grew rapidly in the first three periods (from 77 to 104) then sharply declined to 64 in the following years affected most certainly by oil and gas prices (*Figure 13*). Arguably, the business services trends were also indirectly impacted by the situation in oil and gas industry: after a rise from 202 to 224 HGFs in 2016 they are back to 200 in the last period. The construction sector saw an increase in both HGF metrics: the number of HGFs and incidence rate slightly improved starting from 2014. In the wholesale and retail sector, despite a slight increase in the number of HGFs, the incidence rate remained stable because of the rise of the total number firms with more than 10 employees (*Figure 13, 14*).

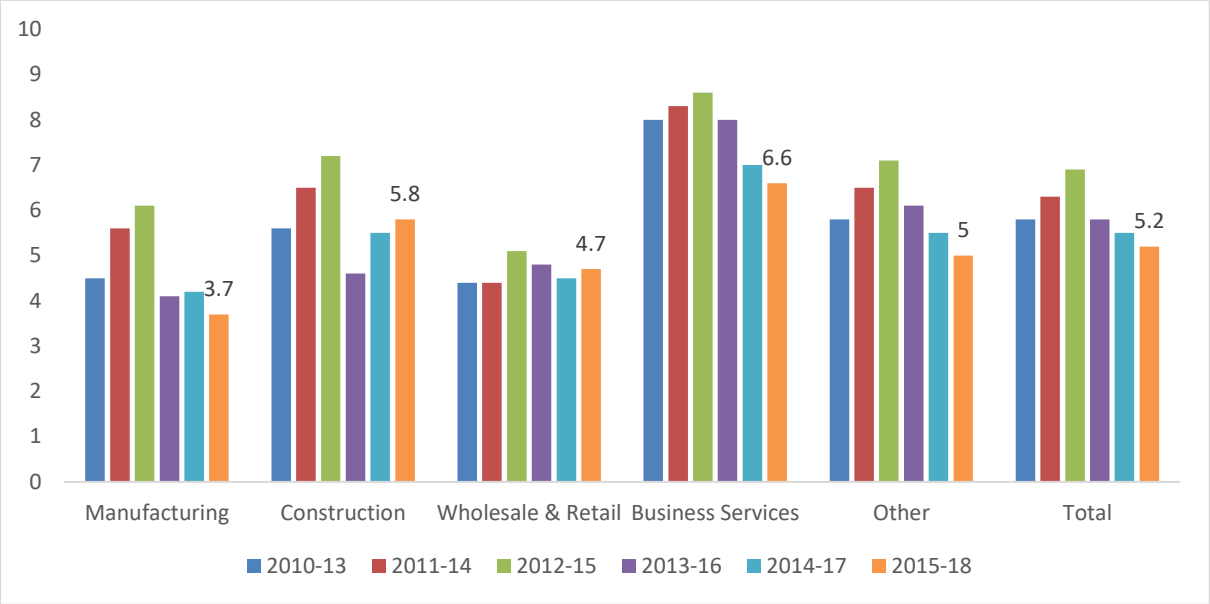
Figure 13: Trend in the number of HGFs (lhs) and of the overall population of firms with more than 10 employees (rhs) in Scotland by sector

(OECD employment definition: average 20%+ employment growth per year over 3 year period and 10+ employees in base year)



Source: ONS BSD (2010-2018)

Figure 14: HGFs incidence rate (%) in Scotland across time and sectors



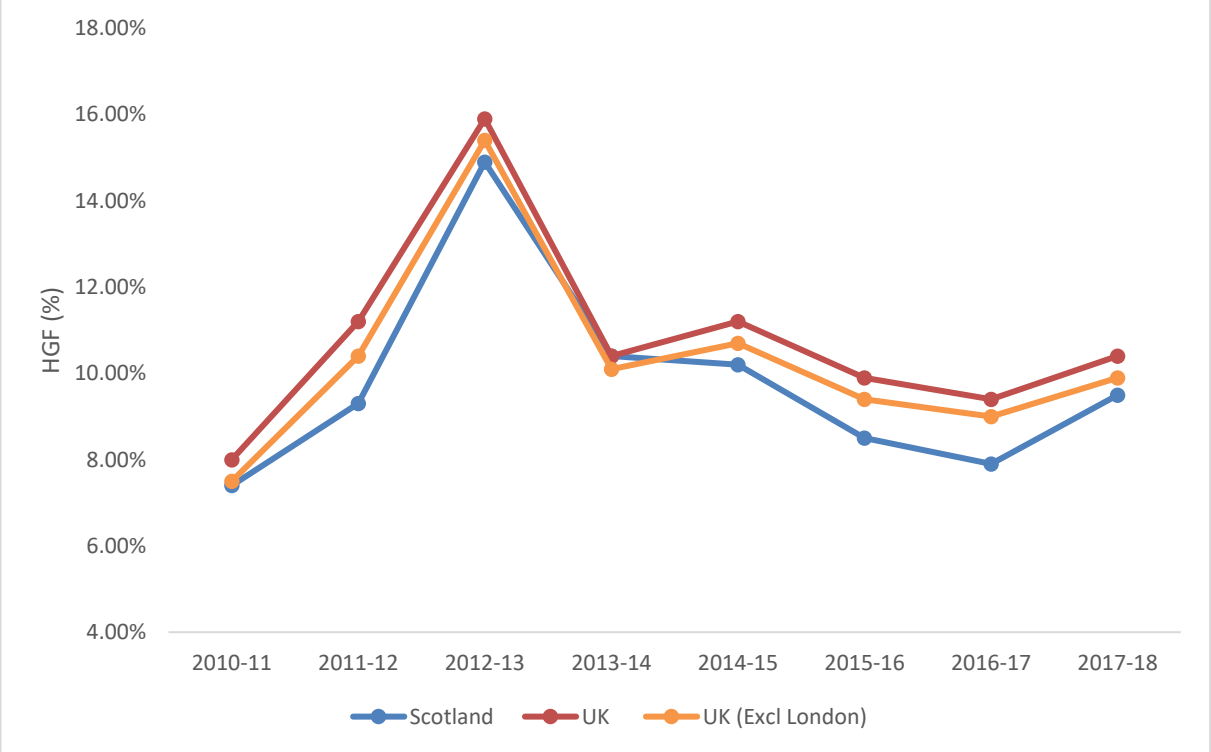
Source: ONS BSD (2010-2018)

7. High-Growth Firms – relaxing the OECD definition

Relaxing the Time-Period

Relaxing the traditional OECD measure, and measuring high-growth over a one-year period rather than three (*Table 5*), clearly shows the effects of the recovery after the Great Recession. During 2012-13 15% of firms in Scotland experienced growth of 20% or more; up from 9% the previous year and falling to 10% or less in later years. The trend in Scotland mirrored that of the UK, with rates similar to those in the UK when London in excluded. In 2017-18 the one year HGF rate in Scotland was equal to that in the South West and Wales, although the performance was relatively poor with only the West Midlands and Northern Ireland lagging. In the majority of years, Scotland's performance is within the bottom three. *Figure 15* illustrates this graphically and shows Scotland consistently lagging behind the rest of the UK since 2014-15.

Figure 15: HGFs incidence rate (20%, 1-year period) in Scotland, the UK and the UK excluding London (2010-11 to 2017-18)



Source: ONS BSD (2010-2018)

Table 5: Number and % of High Growth Firms (20% annual avg growth in employment over 1 year period and min. of 10 employees)

	2010-11			2011-12			2012-13			2013-14		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	386	5,469	7.1	562	5,201	10.8	845	5,313	15.9	575	5,545	10.4
North West	1345	17,678	7.6	1931	17,065	11.3	2860	17,895	16.0	1985	18,744	10.6
Yorkshire and The Humber	956	13,550	7.1	1358	13,090	10.4	2061	13,395	15.4	1467	13,991	10.5
East Midlands	836	12,004	7.0	1220	11,681	10.4	1866	12,124	15.4	1261	12,573	10.0
West Midlands	993	14,176	7.0	1429	13,695	10.4	2257	14,175	15.9	1428	14,945	9.6
East of England	1206	16,000	7.5	1639	15,602	10.5	2513	16,258	15.5	1647	16,970	9.7
London	2639	25,334	10.4	3975	25,307	15.7	5254	27,640	19.0	3622	29,301	12.4
South East	1902	24,553	7.7	2740	23,998	11.4	3931	24,930	15.8	2699	25,911	10.4
South West	1136	14,586	7.8	1496	14,279	10.5	2269	14,848	15.3	1584	15,525	10.2
Wales	480	6,641	7.2	592	6,494	9.1	896	6,560	13.7	590	6,866	8.6
Scotland	**957**	**12,886**	**7.4**	**1158**	**12,473**	**9.3**	**1914**	**12,828**	**14.9**	**1419**	**13,639**	**10.4**
Northern Ireland	585	5,679	10.3	288	4,974	5.8	563	4,816	11.7	391	4,790	8.2
UK	13421	168,559	8.0	18,390	163,862	11.2	27,230	170,786	15.9	18668	178,803	10.4
UK (Excl London)	10782	143222	7.5	14413	138552	10.4	21975	143142	15.4	15046	149499	10.1

	2014-15			2015-16			2016-17			2017-18		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	602	5,760	10.5	522	5,981	8.7	512	6,062	8.4	602	6,156	9.8
North West	2214	19,433	11.4	1999	20,237	9.9	1863	20,478	9.1	2,139	20,808	10.3
Yorkshire and The Humber	1547	14,482	10.7	1423	15,241	9.3	1355	15,396	8.8	1,547	15,598	9.9
East Midlands	1416	13,060	10.8	1274	13,624	9.4	1214	13,690	8.9	1,434	13,921	10.3
West Midlands	1459	15,419	9.5	1471	16,022	9.2	1455	16,199	9.0	1,536	16,469	9.3
East of England	1811	17,609	10.3	1769	18,375	9.6	1654	18,515	8.9	1,960	18,933	10.4
London	4045	30,015	13.5	3966	31,912	12.4	3729	32,930	11.3	4,339	34,121	12.7
South East	2958	26,734	11.1	2762	27,996	9.9	2651	28,378	9.3	3,027	28,834	10.5
South West	1826	16,186	11.3	1605	16,900	9.5	1483	17,044	8.7	1,659	17,450	9.5

Wales	707	7,109	9.9	633	7,475	8.5	618	7,581	8.2	731	7,730	9.5
Scotland	**1431**	**13,983**	**10.2**	**1231**	**14,547**	**8.5**	**1153**	**14,636**	**7.9**	**1,403**	**14,785**	**9.5**
Northern Ireland	586	4,780	12.3	409	4,882	8.4	716	4,898	14.6	460	5,359	8.6
UK	20,603	184,573	11.2	19,065	193,198	9.9	18,404	195,814	9.4	20,837	200,175	10.4
UK (Excl London)	16557	154555	10.7	15098	161280	9.4	14674	162877	9.0	16498	166043	9.9

Source: ONS BSD (2010-2018)

Table 6: Number and % of High Growth Firms (20% annual avg growth in employment over 2 year period and min. of 10 employees)

	2010-12			2011-13			2012-14			2013-15		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	338	5,143	6.6	510	4,898	10.4	537	5,036	10.7	447	5,312	8.4
North West	1245	16,652	7.5	1707	16,137	10.6	1814	16,980	10.7	1608	17,894	9.0
Yorkshire and The Humber	861	12,858	6.7	1228	12,413	9.9	1296	12,779	10.1	1137	13,417	8.5
East Midlands	759	11,414	6.6	1095	11,084	9.9	1167	11,560	10.1	1054	12,121	8.7
West Midlands	922	13,467	6.8	1348	13,049	10.3	1411	13,511	10.4	1103	14,366	7.7
East of England	1058	15,242	6.9	1498	14,858	10.1	1542	15,522	9.9	1306	16,296	8.0
London	2663	23,926	11.1	3411	23,897	14.3	3343	26,003	12.9	2916	27,849	10.5
South East	1761	23,276	7.6	2482	22,885	10.8	2474	23,744	10.4	2210	24,849	8.9
South West	936	13,918	6.7	1364	13,601	10.0	1382	14,164	9.8	1299	14,914	8.7
Wales	389	6,336	6.1	507	6,200	8.2	571	6,232	9.2	476	6,578	7.2
Scotland	**799**	**12,147**	**6.6**	**1098**	**11,841**	**9.3**	**1254**	**12,237**	**10.2**	**1060**	**13,034**	**8.1**
Northern Ireland	267	5,424	4.9	288	4,742	6.1	303	4,642	6.5	335	4,627	7.2
UK	11998	159803	7.5	16536	155605	10.6	17,094	162,410	10.5	14951	171257	8.7
UK (Excl London)	9335	135877	6.9	13125	131708	10.0	13751	136407	10.1	12035	143408	8.4

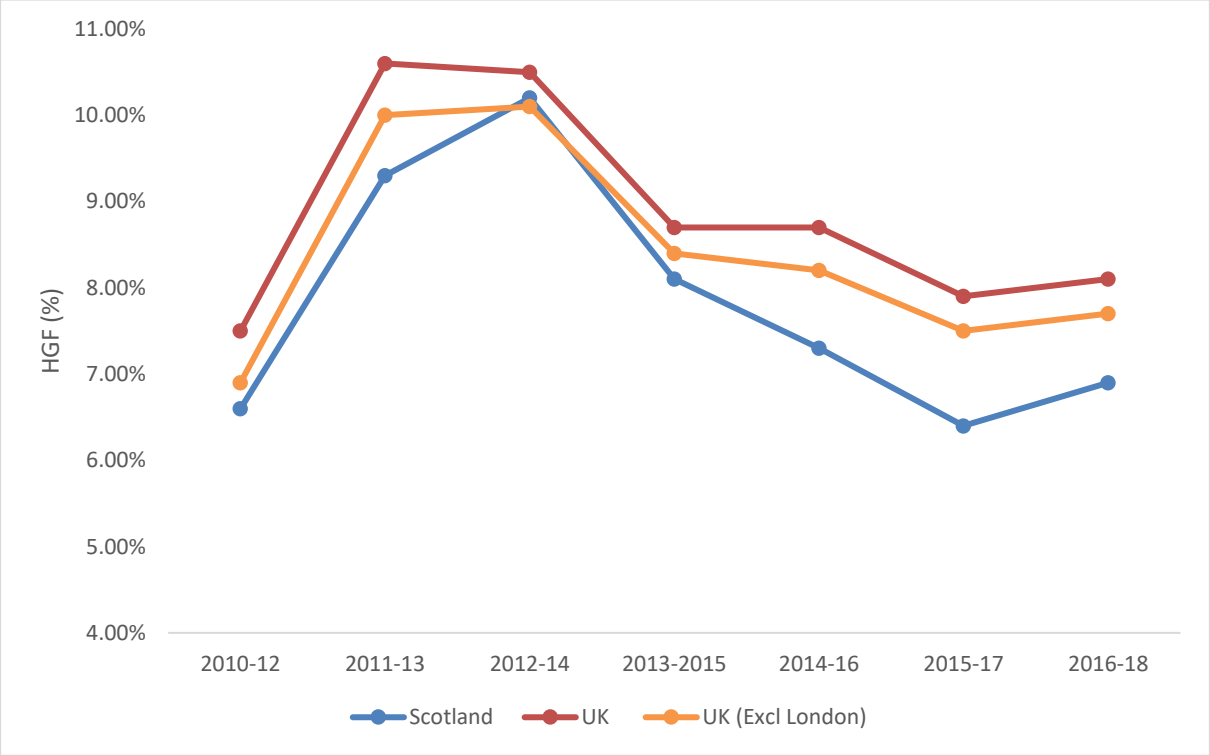
	2014-16			2015-17			2016-18		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	434	5,495	7.9	401	5,730	7.0	429	5,793	7.4

North West	1595	18,554	8.6	1491	19,315	7.7	1538	19,490	7.9
Yorkshire and The Humber	1182	13,910	8.5	1057	14,600	7.2	1096	14,757	7.4
East Midlands	1050	12,582	8.3	949	13,063	7.3	1037	13,131	7.9
West Midlands	1119	14,801	7.6	1153	15,359	7.5	1131	15,563	7.3
East of England	1418	16,932	8.4	1384	17,656	7.8	1462	17,765	8.2
London	3099	28,450	10.9	2943	30,333	9.7	3189	31,316	10.2
South East	2246	25,609	8.8	2110	26,899	7.8	2217	27,251	8.1
South West	1314	15,537	8.5	1258	16,244	7.7	1228	16,381	7.5
Wales	526	6,810	7.7	515	7,187	7.2	570	7,288	7.8
Scotland	**979**	**13,359**	**7.3**	**895**	**13,901**	**6.4**	**969**	**13,996**	**6.9**
Northern Ireland	340	4,624	7.4	399	4,725	8.4	378	4,751	8.0
UK	15,302	176,663	8.7	14,555	185,012	7.9	15,244	187,482	8.1
UK (Excl London)	12203	148213	8.2	11612	154679	7.5	12055	156166	7.7

Source: ONS BSD (2010-2018)

Table 6 further extends the definition to cover a two-year period of growth. In general, it is perhaps more difficult for firms to maintain their high growth over two years rather than one so it is important to explore the sensitivity of the HGF metric to time periods bearing in mind the original 3-year definitions was purely arbitrary. Here we begin to see, from 2014 onwards, Scotland's rate lagging behind that of the UK, even when London is excluded. On average, across all periods, around 8% of firms in Scotland maintained high growth over two years compared to 9% in the UK. From 2014 onwards Scotland typically had the lowest rate of all regions. *Figure 16* shows this graphically, where Scotland is clearly lagging behind the rest of the UK.

Figure 16: HGFs incidence rate (20%, 2-year periods) in Scotland, the UK and the UK excluding London (2010-12 to 2016-18)

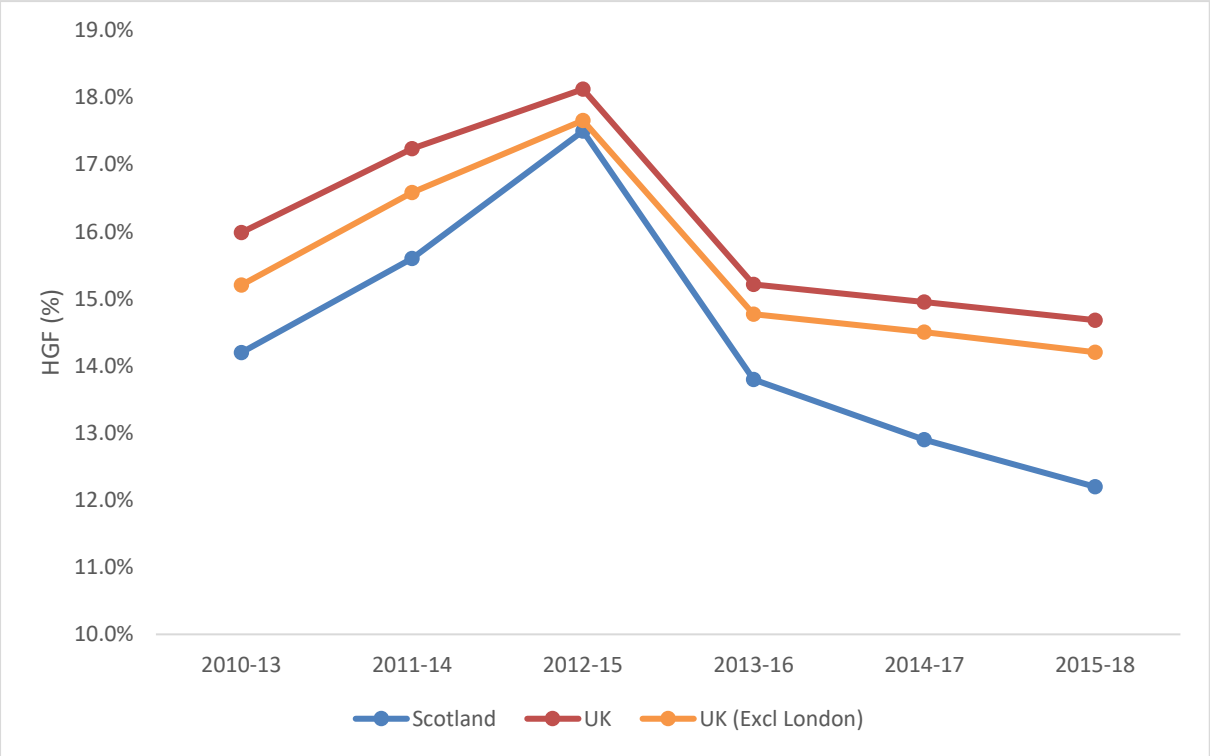


Source: ONS BSD (2010-2018)

Relaxing the High-Growth Threshold

The following tables relax the 20% high-growth threshold to 10% per year. *Table 7* looks at a 10% threshold over each 3 year period between 2010-13 and 2015-18. The pattern is the same as when looking at the 20% metric (*Table 1*), where there is an increase in incidences of high growth from 2010-13 to 2012-15 and then a steady decline to 2015-18. Looking at *Figure 17*, we can see that Scotland was converging on the UK percentage of HGFs until 2012-15, where it started to diverge and fall at a higher rate. Again, this may be due to the business uncertainty surrounding the 2014 referendum and the Oil & Gas sector slump .

Figure 17: HGFs incidence rate (10% per year, 3-year periods) in Scotland, the UK and the UK excluding London (2010-13 to 2015-18)



Source: ONS BSD (2010-2018)

Table 7: Number and % of High Growth Firms (10% annual avg growth in employment over 3 year period and min. of 10 employees)

	2010-13			2011-14			2012-15		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	737	4,826	15.3%	790	4,645	17.0%	862	4,828	17.9%
North West	2,520	15,745	16.0%	2,675	15,355	17.4%	2,935	16,251	18.1%
Yorkshire and The Humber	1,814	12,202	14.9%	2,008	11,863	16.9%	2,211	12,288	18.0%
East Midlands	1,672	10,849	15.4%	1,785	10,597	16.8%	1,994	11,140	17.9%
West Midlands	1,937	12,831	15.1%	2,119	12,467	17.0%	2,285	13,012	17.6%
East of England	2,299	14,514	15.8%	2,354	14,205	16.6%	2,617	14,899	17.6%
London	4,635	22,664	20.5%	4,711	22,577	20.9%	5,098	24,763	20.6%
South East	3,628	22,196	16.3%	3,874	21,836	17.7%	4,143	22,756	18.2%
South West	2,038	13,260	15.4%	2,168	12,996	16.7%	2,434	13,592	17.9%
Wales	820	6,049	13.6%	830	5,898	14.1%	963	5,976	16.1%
Scotland	**1,644**	**11,539**	**14.2%**	**1,769**	**11,304**	**15.6%**	**2,051**	**11,707**	**17.5%**
Northern Ireland	528	5,149	10.3%	480	4,569	10.5%	626	4,486	14.0%
UK	24,272	151,824	16.0%	25,563	148,312	17.2%	28,219	155,698	18.1%
UK (Excl London)	19,637	129,160	15.2%	20,852	125,735	16.6%	23,121	130,935	17.7%

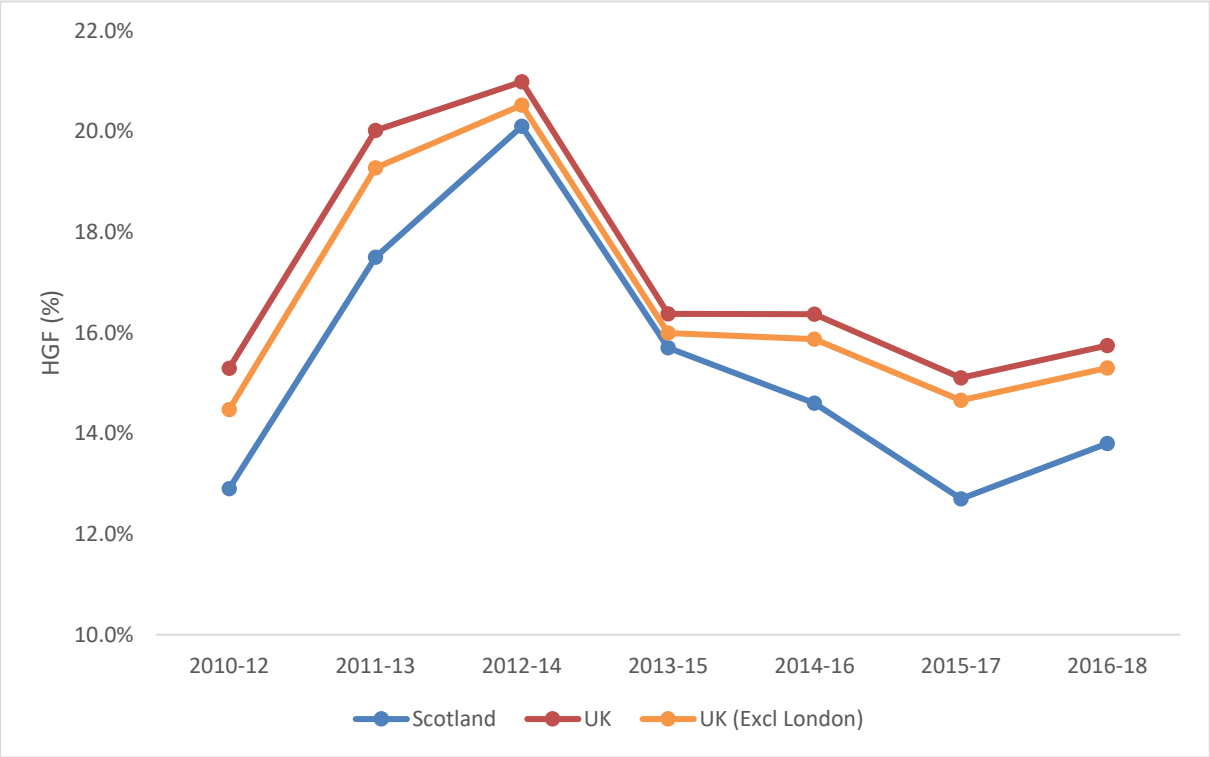
	2013-16			2014-17			2015-18		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	729	5,073	14.4%	705	5,276	13.4%	750	5,489	13.7%
North West	2,612	17,127	15.3%	2,572	17,788	14.5%	2,677	18,436	14.5%
Yorkshire and The Humber	1,938	12,906	15.0%	1,937	13,383	14.5%	1,941	14,004	13.9%
East Midlands	1,786	11,699	15.3%	1,769	12,072	14.7%	1,805	12,541	14.4%
West Midlands	1,954	13,826	14.1%	1,967	14,248	13.8%	2,113	14,809	14.3%
East of England	2,271	15,703	14.5%	2,409	16,310	14.8%	2,507	16,944	14.8%
London	4,633	26,445	17.5%	4,705	27,192	17.3%	4,953	28,901	17.1%
South East	3,739	23,866	15.7%	3,773	24,670	15.3%	3,852	25,836	14.9%
South West	2,164	14,332	15.1%	2,224	14,967	14.9%	2,221	15,612	14.2%

Wales	827	6,310	13.1%	898	6,565	13.7%	891	6,943	12.8%
Scotland	**1,728**	**12,496**	**13.8%**	**1,653**	**12,833**	**12.9%**	**1,629**	**13,347**	**12.2%**
Northern Ireland	607	4,476	13.6%	779	4,489	17.4%	716	4,596	15.6%
UK	24,988	164,259	15.2%	25,391	169,793	15.0%	26,055	177,458	14.7%
UK (Excl London)	20,355	137,814	14.8%	20,686	142,601	14.5%	21,102	148,557	14.2%

Source: ONS BSD (2010-2018)

Table 8 shows the incidences of high-growth using a 10% threshold and 2-year period (2010-12 to 2016-18). This is again very similar to the 20% definition, where we see an increase in high growth in Scotland from 2010-12 to 2012-14 but then a continuous decline to 2015-17. There is a slight increase in 2016-18 but overall Scotland still lags behind the rest of the UK, even when we exclude London from the analysis. This is also illustrated in *Figure 18*. So, irrespective of metric examined a similar story is emerging and perhaps the same set of reasons can be advance to explain it in – 2014 referendum effect and the decline in the Oil & Gas sector.

Figure 18: HGFs incidence rate (10% per year, 2-year periods) in Scotland, the UK and the UK excluding London (2010-12 to 2016-18)



Source: ONS BSD (2010-2018)

Table 8: Number and % of High Growth Firms (10% annual avg growth in employment over 2 year period and min. of 10 employees)

	2010-12			2011-13			2012-14			2013-15		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	727	5,143	14.1%	973	4,898	19.9%	1,065	5,036	21.1%	830	5,312	15.6%
North West	2,584	16,652	15.5%	3,227	16,137	20.0%	3,606	16,980	21.2%	2,949	17,894	16.5%
Yorkshire and The Humber	1,778	12,858	13.8%	2,380	12,413	19.2%	2,690	12,779	21.1%	2,171	13,417	16.2%
East Midlands	1,624	11,414	14.2%	2,172	11,084	19.6%	2,424	11,560	21.0%	2,002	12,121	16.5%
West Midlands	1,887	13,467	14.0%	2,623	13,049	20.1%	2,857	13,511	21.1%	2,163	14,366	15.1%
East of England	2,291	15,242	15.0%	2,898	14,858	19.5%	3,145	15,522	20.3%	2,533	16,296	15.5%
London	4,773	23,926	19.9%	5,773	23,897	24.2%	6,090	26,003	23.4%	5,104	27,849	18.3%
South East	3,665	23,276	15.7%	4,726	22,885	20.7%	5,014	23,744	21.1%	4,088	24,849	16.5%
South West	2,056	13,918	14.8%	2,655	13,601	19.5%	2,929	14,164	20.7%	2,473	14,914	16.6%
Wales	846	6,336	13.4%	1,013	6,200	16.3%	1,128	6,232	18.1%	896	6,578	13.6%
Scotland	**1,571**	**12,147**	**12.9%**	**2,078**	**11,841**	**17.5%**	**2,461**	**12,237**	**20.1%**	**2,051**	**13,034**	**15.7%**
Northern Ireland	636	5,424	11.7%	638	4,742	13.5%	675	4,642	14.5%	778	4,627	16.8%
UK	24,438	159,803	15.3%	31,156	155,605	20.0%	34,084	162,410	21.0%	28,038	171,257	16.4%
UK (Excl London)	19,665	135,877	14.5%	25,383	131,708	19.3%	27,994	136,407	20.5%	22,934	143,408	16.0%

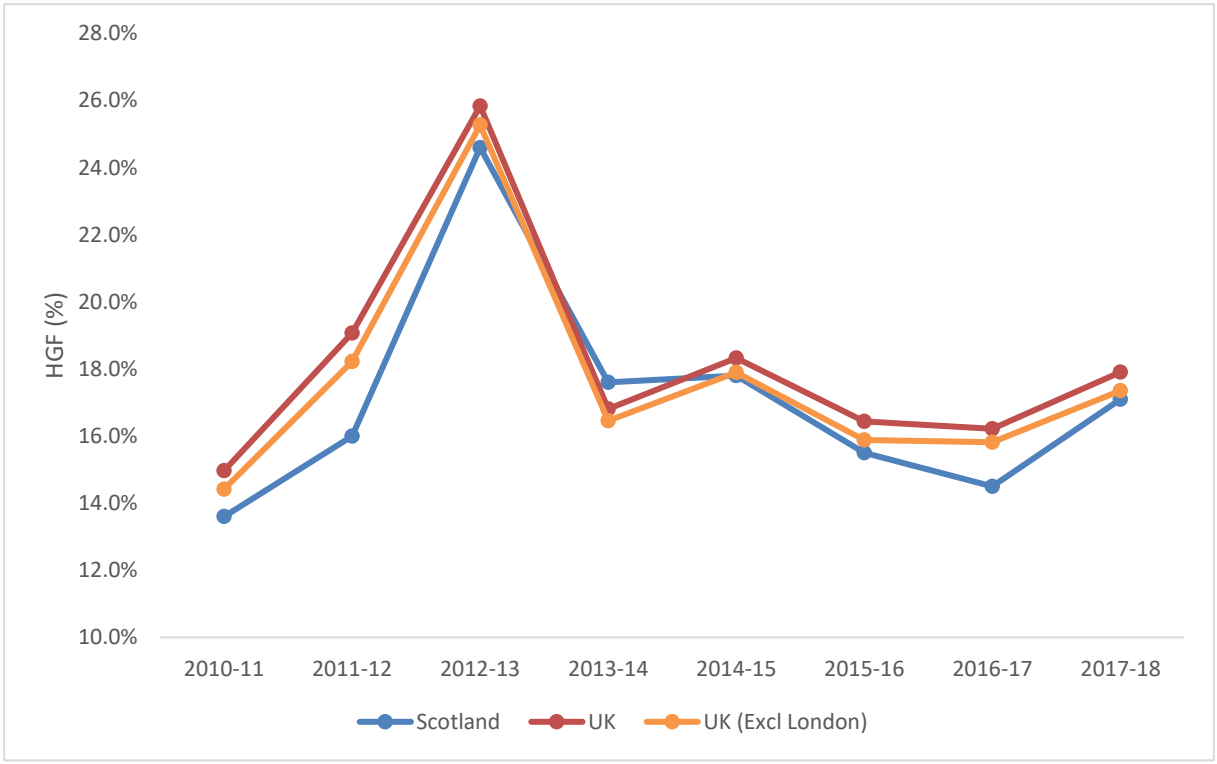
	2014-16			2015-17			2016-18		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	821	5,495	14.9%	792	5,730	13.8%	857	5,793	14.8%
North West	3,031	18,554	16.3%	2,835	19,315	14.7%	3,051	19,490	15.7%
Yorkshire and The Humber	2,232	13,910	16.0%	2,130	14,600	14.6%	2,215	14,757	15.0%
East Midlands	1,993	12,582	15.8%	1,925	13,063	14.7%	2,049	13,131	15.6%
West Midlands	2,248	14,801	15.2%	2,226	15,359	14.5%	2,295	15,563	14.7%
East of England	2,705	16,932	16.0%	2,602	17,656	14.7%	2,775	17,765	15.6%
London	5,391	28,450	18.9%	5,276	30,333	17.4%	5,633	31,316	18.0%
South East	4,245	25,609	16.6%	4,077	26,899	15.2%	4,331	27,251	15.9%
South West	2,517	15,537	16.2%	2,419	16,244	14.9%	2,448	16,381	14.9%

Wales	985	6,810	21.3%	935	7,187	13.0%	1,025	7,288	14.1%
Scotland	**1,949**	**13,359**	**14.6%**	**1,769**	**13,901**	**12.7%**	**1,930**	**13,996**	**13.8%**
Northern Ireland	795	4,624	11.7%	957	4,725	20.3%	912	4,751	19.2%
UK	28,912	176,663	16.4%	27,943	185,012	15.1%	29,521	187,482	15.7%
UK (Excl London)	23,521	148,213	15.9%	22,667	154,679	14.7%	23,888	156,166	15.3%

Source: ONS BSD (2010-2018)

Table 9 shows the incidences of high-growth in the UK using the 10% threshold over 1-year periods (2010-11 to 2017-18). This is also consistent with the 20% definition estimates where high growth incidence rates increase from 2010-11 to 2012-13 but then decline up to 2016-17 in Scotland. There is an increase in percentage of high growth firms in 2017-18 but Scotland still remains below the UK overall. This is also illustrated in *Figure 19*.The extent of this difference is not as wide as when looking at the 2-year and 3-year metrics and indicates that Scottish firms may be finding it difficult to maintain high-growth over longer periods of time compared with the rest of the UK. What might the explanation be for this? We will return to this later in the report when we present the results of an econometric model to explain the variation on one-year fast-growth episodes across the business population in Scotland.

Figure 19: HGFs incidence rate (10%, 1-year periods) in Scotland, the UK and the UK excluding London (2010-12 to 2016-18)



Source: ONS BSD (2010-2018)

Table 9: Number and % of High Growth Firms (10% annual avg growth in employment over 1 year period and min. of 10 employees)

	2010-11			2011-12			2012-13			2013-14		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	750	5,469	13.7%	924	5,201	17.8%	1,379	5,313	26.0%	906	5,545	16.3%
North West	2,518	17,678	14.2%	3,315	17,065	19.4%	4,658	17,895	26.0%	3,189	18,744	17.0%
Yorkshire and The Humber	1,820	13,550	13.4%	2,399	13,090	18.3%	3,358	13,395	25.1%	2,294	13,991	16.4%
East Midlands	1,683	12,004	14.0%	2,162	11,681	18.5%	3,081	12,124	25.4%	2,105	12,573	16.7%
West Midlands	1,893	14,176	13.4%	2,509	13,695	18.3%	3,669	14,175	25.9%	2,365	14,945	15.8%
East of England	2,366	16,000	14.8%	2,934	15,602	18.8%	4,215	16,258	25.9%	2,719	16,970	16.0%
London	4,578	25,334	18.1%	6,003	25,307	23.7%	7,954	27,640	28.8%	5,459	29,301	18.6%
South East	3,726	24,553	15.2%	4,724	23,998	19.7%	6,386	24,930	25.6%	4,315	25,911	16.7%
South West	2,196	14,586	15.1%	2,668	14,279	18.7%	3,729	14,848	25.1%	2,598	15,525	16.7%
Wales	884	6,641	13.3%	1,048	6,494	16.1%	1,479	6,560	22.5%	968	6,866	14.1%
Scotland	**1,755**	**12,886**	**13.6%**	**1,994**	**12,473**	**16.0%**	**3,155**	**12,828**	**24.6%**	**2,397**	**13,639**	**17.6%**
Northern Ireland	1,059	5,679	18.6%	567	4,974	11.4%	1,065	4,816	22.1%	745	4,790	15.6%
UK	25,228	168,556	15.0%	31,247	163,859	19.1%	44,128	170,782	25.8%	30,060	178,800	16.8%
UK (Excl London)	20,650	143,222	14.4%	25,244	138,552	18.2%	36,174	143,142	25.3%	24,601	149,499	16.5%

	2014-15			2015-16			2016-17			2017-18		
GOR Name	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**	**HGF**	**10+**	**%HGF**
North East	968	5,760	16.8%	872	5,981	14.6%	892	6,062	14.7%	1,040	6,156	16.9%
North West	3,544	19,433	18.2%	3,272	20,237	16.2%	3,227	20,478	15.8%	3,709	20,808	17.8%
Yorkshire and The Humber	2,565	14,482	17.7%	2,386	15,241	15.7%	2,412	15,396	15.7%	2,715	15,598	17.4%
East Midlands	2,319	13,060	17.8%	2,176	13,624	16.0%	2,145	13,690	15.7%	2,436	13,921	17.5%
West Midlands	2,555	15,419	16.6%	2,482	16,022	15.5%	2,480	16,199	15.3%	2,746	16,469	16.7%
East of England	3,093	17,609	17.6%	2,943	18,375	16.0%	2,847	18,515	15.4%	3,370	18,933	17.8%
London	6,153	30,015	20.5%	6,138	31,912	19.2%	6,002	32,930	18.2%	7,036	34,121	20.6%
South East	4,869	26,734	18.2%	4,663	27,996	16.7%	4,611	28,378	16.2%	5,140	28,834	17.8%
South West	3,016	16,186	18.6%	2,696	16,900	16.0%	2,672	17,044	15.7%	2,993	17,450	17.2%

Wales	1,091	7,109	15.3%	1,045	7,475	14.0%	1,010	7,581	13.3%	1,207	7,730	15.6%
Scotland	**2,488**	**13,983**	**17.8%**	**2,249**	**14,547**	**15.5%**	**2,123**	**14,636**	**14.5%**	**2,523**	**14,785**	**17.1%**
Northern Ireland	1,158	4,780	24.2%	835	4,882	17.1%	1,341	4,898	27.4%	932	5,359	17.4%
UK	33,819	184,570	18.3%	31,757	193,192	16.4%	31,762	195,807	16.2%	35,847	200,164	17.9%
UK (Excl London)	27,666	154,555	17.9%	25,619	161,280	15.9%	25,760	162,877	15.8%	28,811	166,043	17.4%

Source: ONS BSD (2010-2018)

8. High-Growth Episodes – a Cohort Perspective

Using the cohort of Scottish start-up firms in 2010, we track the number of High-Growth Episodes (HGE) they experience during the course of 2010-2018. A HGE is defined as firms with 10+ employees experiencing at least 20% or 10% growth in employment the following year. We compute the annual growth rate for each year (2010-11 to 2017-18) and place each year into three categories:

- 'High-growth': ten or more employees and growth of 20% or 10% in that year.
- Alive but not high-growth: Firms that don't meet the 'high-growth' threshold, which are growing more slowly, not growing at all or declining in that year and also firms that did grow by 20% or 10% but have fewer than 10 employees.
- Not active or no employment: When a firm has no employment or disappears from the database. This could be for a number of reasons that don't necessarily relate to the death or closure of a firm, such as, the firm could have been acquired and still be operating under another legal entity.

Tables 10 and *11* show the breakdown of these three categories for each period for 20% and 10% definitions respectively. Of 11,592 firms in the cohort at the start of the period, just 405 firms (3.49%) and 525 (4.53%) firms experienced at least one high-growth episode between 2010 and 2018. In both definitions, we can see more high-growth episodes occurred in 2012-13, 2013-14 and 2014-15 than in other years.[23]

Table 10: Number of 2010 Start-up Scottish firms coded either in HGEs, Alive but not HGEs or Not Active events (20% employment-based definition) 2010-11 to 2017-18 (n=405 firms in categorical size order)

	HGE	Alive but not HGE	Not Active
2010-11	78	327	0
2011-12	65	322	18
2012-13	102	270	33
2013-14	84	272	49
2014-15	99	237	69
2015-16	65	260	80
2016-17	62	246	97
2017-18	66	227	112

Source: ONS BSD (2010-2018)

[23] We have not yet undertaken this analysis for the rest of the UK but will make it available to Scottish Enterprise when this is completed.

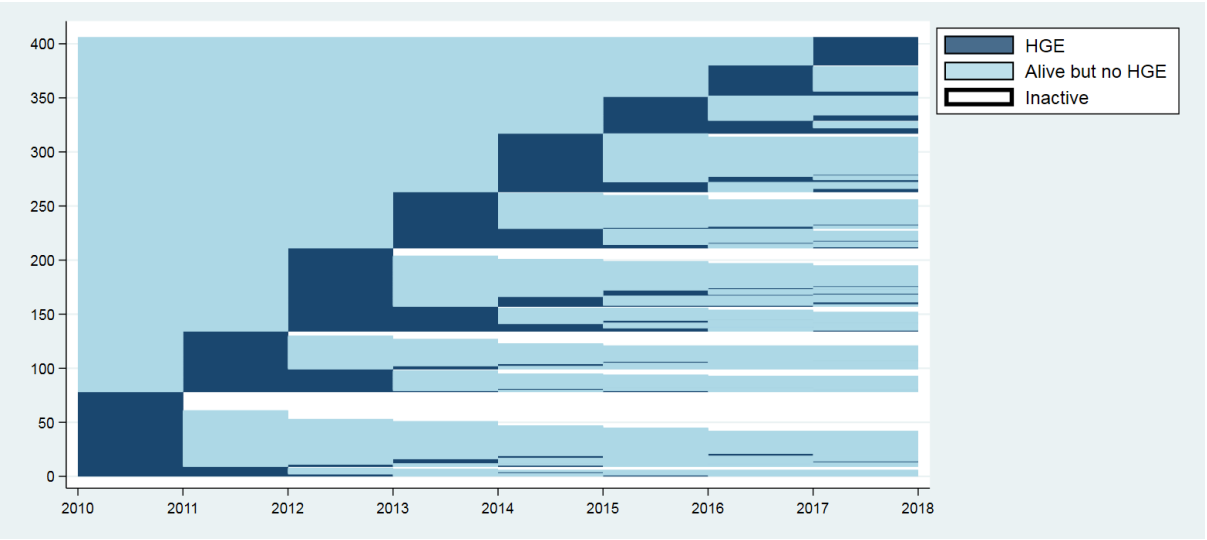
Table 11: Number of 2010 Start-up Scottish firms coded either in HGEs, Alive but not HGEs or Not Active events (10% employment-based definition) 2010-11 to 2017-18 (n=405 firms in categorical size order)

	HGE	Alive but not HGE	Not Active
2010-11	114	411	0
2011-12	91	408	26
2012-13	141	331	53
2013-14	132	321	72
2014-15	142	283	100
2015-16	113	292	120
2016-17	106	279	140
2017-18	119	246	160

Source: ONS BSD (2010-2018)

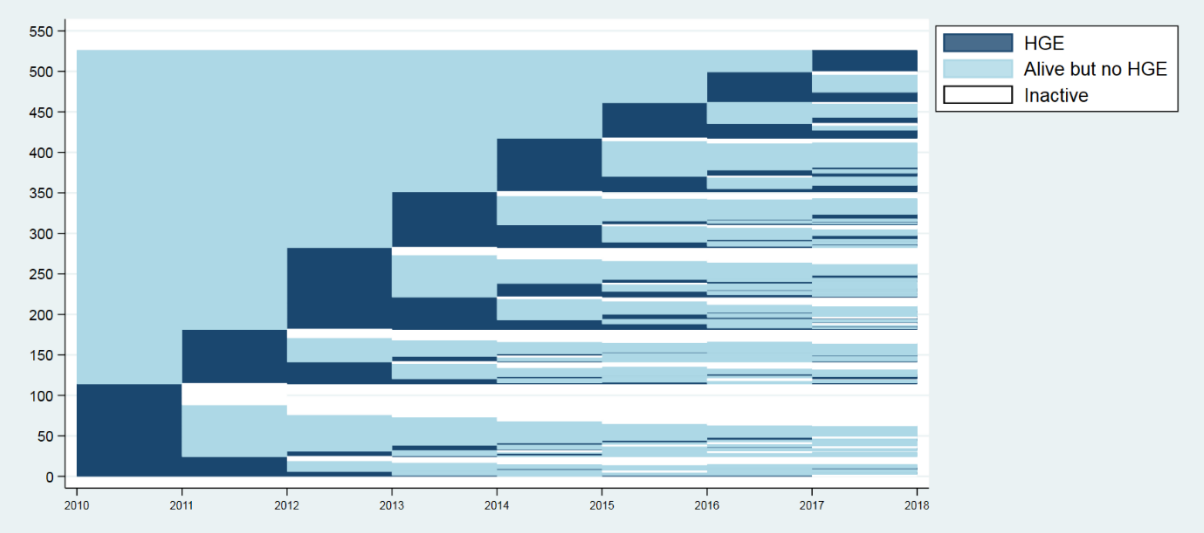
For a more visual look at the data, *Figures 20* and *21* shows sequence index plots for the 20% and 10% definition of high-growth respectively. Here, you can see the timeline of a single firm where it is represented with a single line across the chart. This has been put in categorical size order to show when HGEs occur in the cohort of firms. The plots show that there are a lot more firms that become inactive after an episode of high-growth in their first year (2010-11) compared with other periods (i.e. dark blue becoming white over time on the chart). When firms experience high-growth after 4 years (2014-15), they seem much less likely to become inactive in the 2 years after.

Figure 20: Start-ups in 2010: timing of 'high-growth' events (20% definition) 2010-11 to 2017-18 (n=405 firms in categorical size order)



Source: ONS BSD (2010-2018)

Figure 21: Start-ups in 2010: timing of 'high-growth' events (10% definition) 2010-11 to 2017-18 (n=525 firms in categorical size order)



Source: ONS BSD (2010-2018)

The importance of this analysis is to place the concept of 'high-growth' within the life cycle of the business and the next obvious step is to understand what the triggers are for these episodes whether initial or repeat and how they might differ with the age of the firm. An initial first step is to identify SE Account Managed firms in this sub-population of firms and to understand these high-growth episodes within the context of the support they have received from SE over the 2010-2018 period.

9. Why is there a Low Incidence Rate of High-Growth Firms in Scotland?

Though high-growth firms received a considerable amount of attention of the researchers lately, little is known about the determinants and predictors of high-growth incidence. It is now often argued - and the previous section confirms it – high-growth is episodic and discontinuous. Firm-specific, location-specific and macroeconomic explanations of high-growth should be addressed when attempting to explain relatively low HGF incidence rate in Scotland.

The results of these simple preliminary regressions at Government Office Region (GOR) level to understand what factors might affect the HGF incidence rate show that labour availability and education level exert a positive influence on the HGFs incidence rate. Other possible determinants, such as investment level, human capital estimates, R&D expenses by business and government do not appear to be significant at this level of analysis. We do not present these results here as for robustness issues the analysis should be extended to a more granular level (NUTS-2 and firm-level).

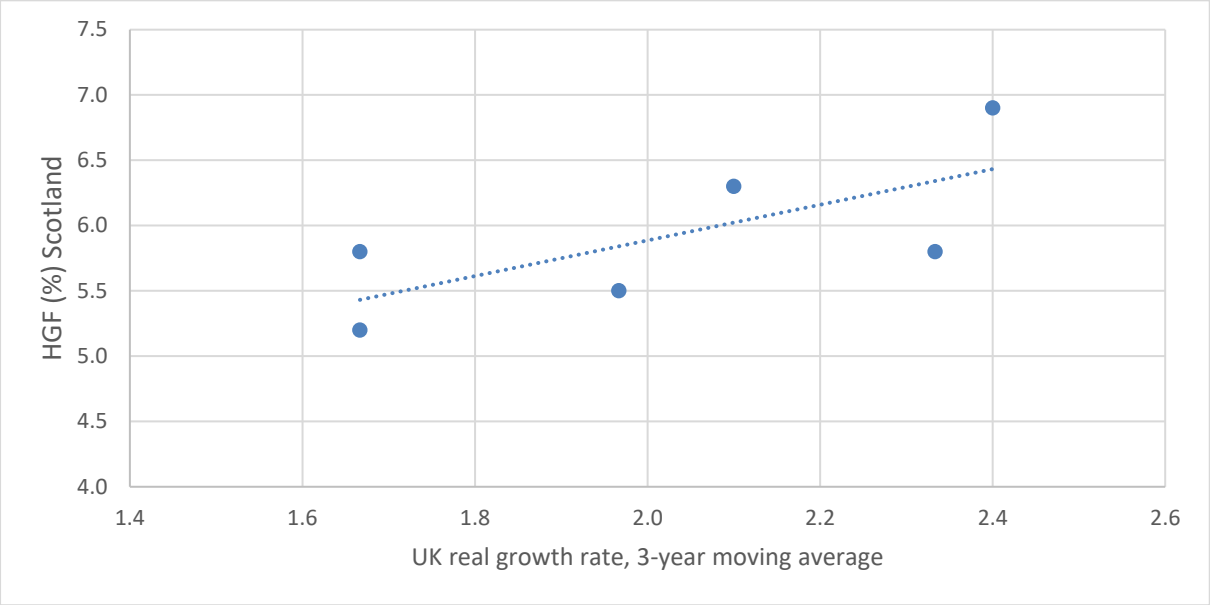
As an interim step we present a series of simple correlations between the Scottish HGF incidence rate and the range of variables that have been previously modeled to explain the spatial differences in small business growth[24].

As *Figures 22* and *23* show, HGF incidence in Scotland can be, at least in part, explained by macroeconomic conditions. Indeed, HGF incidence rate is correlated with real growth rate in the UK. It is also correlated with oil prices fluctuation (*Figure 23*) which arguably was one of the most important factors affecting business dynamics in the Aberdeen area during the last ten years. As it has been noticed before, the rise and fall of the number of HGFs in Scotland throughout 2010-2018 period is driven mostly by the trends of HGFs in Aberdeen City & Shire and Glasgow City regions.

[24] See, for example, Hart, M and McGuiness (2003) "Small Firm Growth in the UK Regions 1994-1997: Towards an Explanatory Framework", Regional Studies, 37,2 pp109-122
https://www.tandfonline.com/doi/abs/10.1080/0034340022000057523?journalCode=cres20

Figure 22: HGFs incidence rate in Scotland and UK real growth rate, 2010-2018

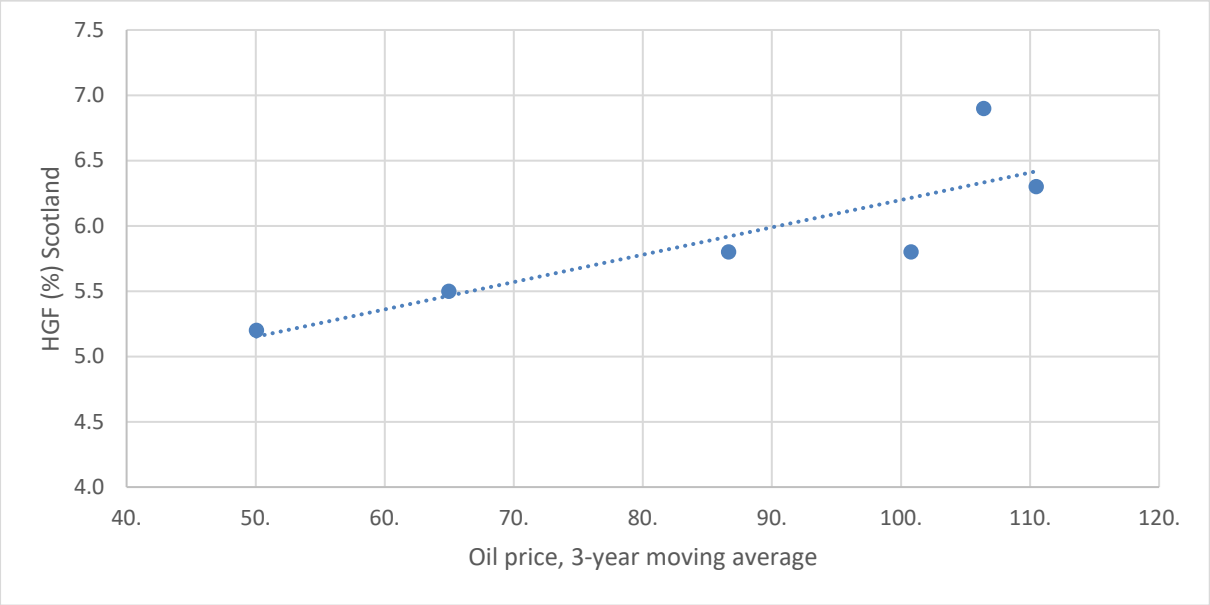
OECD employment definition (20%) and three-year moving average of the UK real growth rate



Source: ONS BSD (2010-2018), IMF (2019)

Figure 23: HGFs incidence rate in Scotland and Oil prices, 2010-2018

OECD employment definition (20%) and three-year moving average of annual average oil price

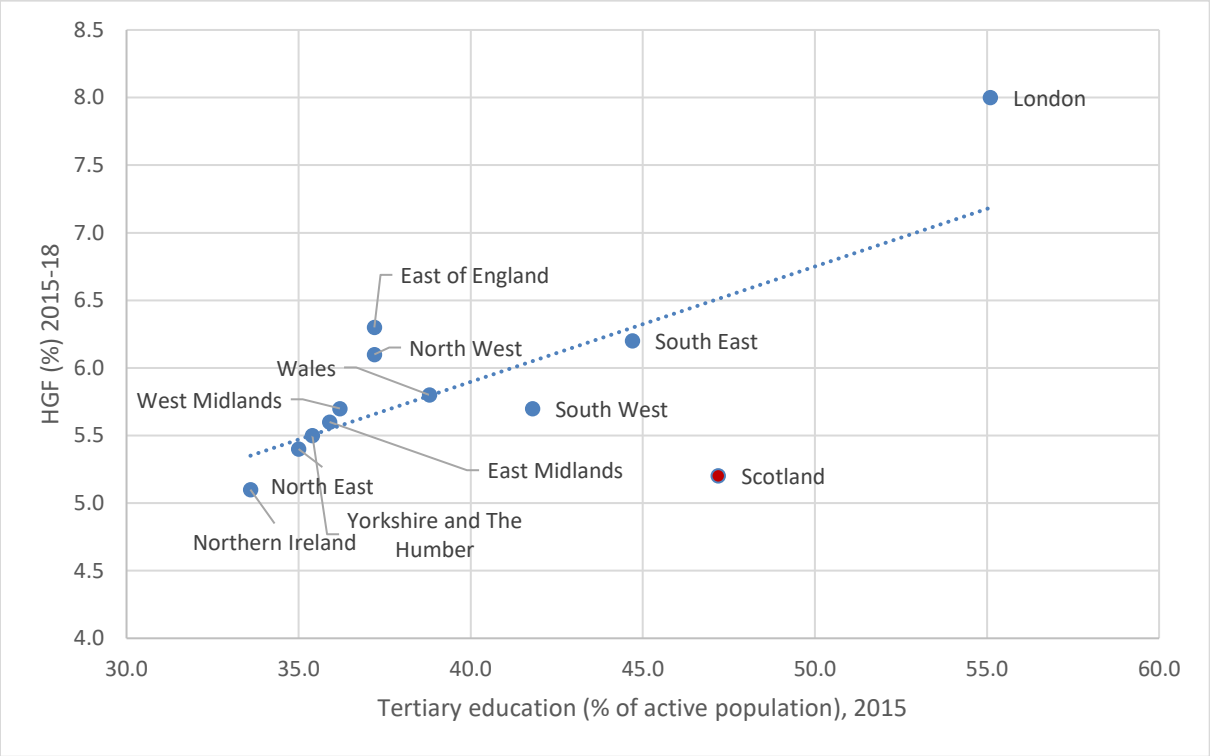


Source: ONS BSD (2010-2018), OPEC, IEA (2019)

There is a strong positive correlation between the share of active population (aged 16 to 64) with tertiary education (level 5 and higher) and HGF incidence rate. However, Scotland stands out as an exception: despite the large share of highly skilled labour (second-best after London) HGFs incidence are much lower than would be expected. Though we do not find, at this point, any strong relationship between other levels of education and the HGF incidence rate, the explanation mostly certainly lies in the availability of low and mid-skilled labour and in the short-term mismatches between demand and offer.

Figure 24: HGF incidence rate (2015-18) and share of active population with tertiary education (2015)

(OECD employment definition - 20%)



Source: ONS BSD (2010-2018), Eurostat (2019)

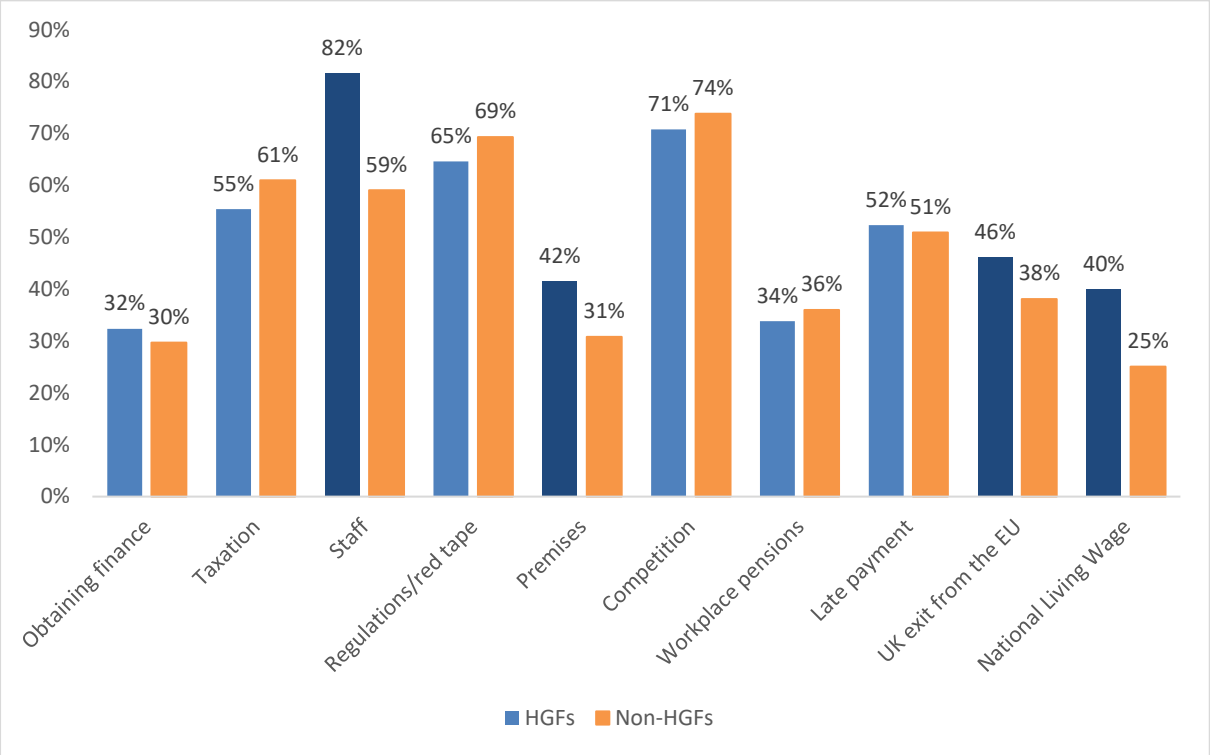
This is confirmed to some extent when we match BSD data with the Longitudinal Small Business Survey (LSBS)[25]. Indeed, 82% of the identified small and medium[26] HGFs (OECD 20% employment definition) report that one of the major obstacles or difficulties they face in achieving their business objectives is staff recruitment and skills (compared to 59% among non-HGF businesses) (*Figure 24*).

Other major differences between the perceived barriers between HGFs and non-HGFs concern the issues with premises (42% of HGFs report this as a major difficulty against 31% among non-HGFs), national living wage (40% against 25%) and uncertainty related to UK exit from the EU (46% against 38%).

[25] Department for Business, Innovation and Skills. (2018). *Longitudinal Small Business Survey, 2015-2017: Secure Access*. [data collection]. 2nd Edition. UK Data Service. SN: 8261 https://beta.ukdataservice.ac.uk/datacatalogue/doi/?id=8261#!#2

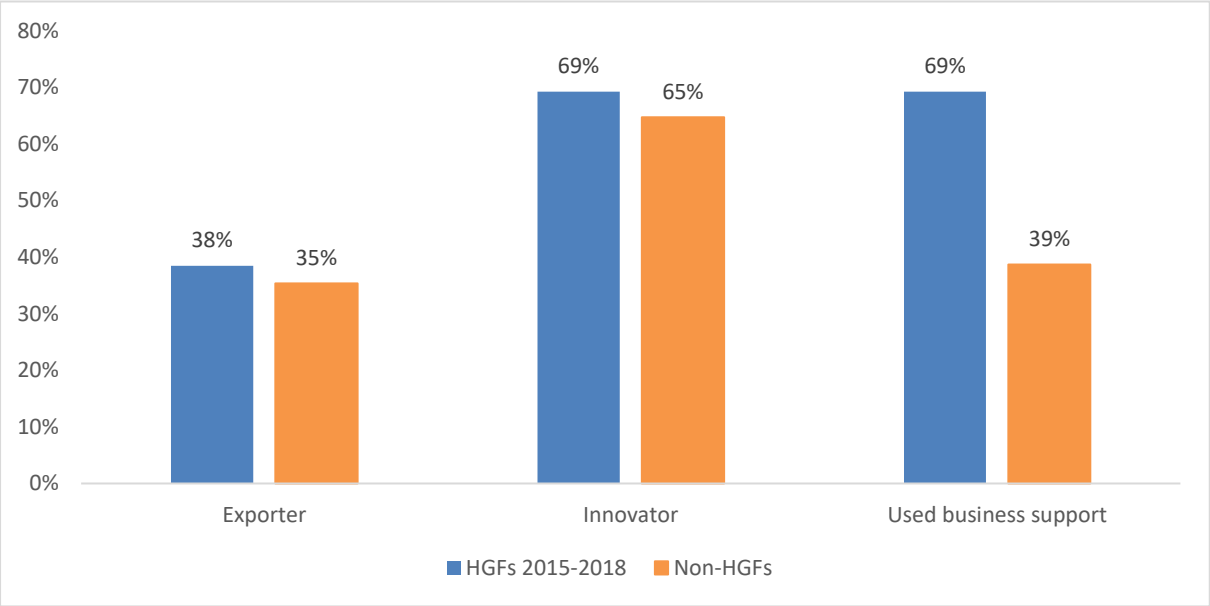
[26] LSBS sample cover businesses with less than 250 employees.

Figure 24: Major obstacles faced by HGFs and non-HGFs



Source: ONS BSD (2010-2018), LSBS (2018)

Figure 25: HGFs and non-HGFs: export, innovation and business support



Source: ONS BSD (2010-2018), LSBS (2018)

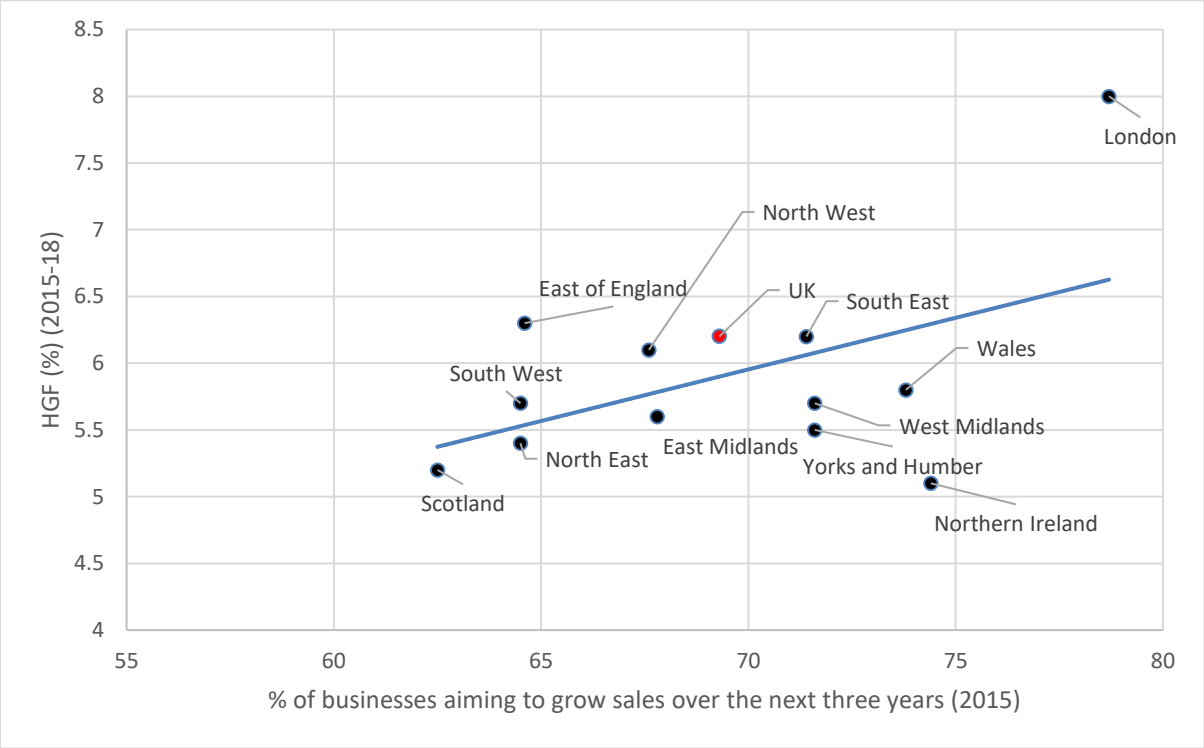
We also find that HGFs in the 2015-18 period are slightly more likely to be product or services exporters (38% against 35%) and product or process innovators (69% against 65%) in at least one of the three years (2015, 2016, 2017) (*Figure 25*). However, the substantial difference lies in the attitude towards business support: HGFs are more likely to seek any type of business support (69% of HGFs against 39% of non-HGFs). Thus, it appears, that ventures experiencing high-growth enhance their chances of success by seeking professional business support.

To better understand Scotland's high-growth puzzle we might also ask the following question: Is the relatively low HGF incidence rate in Scotland due mostly to some location-specific barriers and business environment or is it due to more firm-specific characteristics of Scottish entrepreneurs, such as their ambition to grow?

Figure 26 provides a first attempt to answer this question. It shows the relationship between growth ambition (which is measured as the percentage of small and medium businesses[27] aiming to grow sales over the next three years) and the high-growth firm incidence rate using the standard OECD definition (20% growth each year for three years).

There is a clear positive trend between growth ambition and the HGF incidence rate. In 2015, Scottish businesses showed the least ambition to grow sales and, as we discussed previously, it resulted in one of the lowest HGF incidence rate when compared with the rest of the UK (London being the clear outlier). Thus, a lack of ambition could directly impact the performance of firms and could help explain why we see low levels of HGFs in Scotland. This perhaps can be explained by a culturally embedded cautiousness of Scottish entrepreneurs or indeed a reluctance in recent years to grow their businesses as a result of external events such as the uncertainty surrounding Scottish independence and Brexit.

Figure 26: Percentage of businesses aiming to grow sales over the next three years (2015) and HGF incidence rates 2015-18)



Source: ONS BSD (2015-2018), LSBS (2015)

[27] As previously, businesses with less than 250 employees.

Building upon these simple associations a more detailed econometric model to provide a robust explanation of spatial differences in the HGF incidence rate across the UK was constructed at the level of the 9 English regions and 3 Home nations. The following tables are logistic regression models with random effects for the following estimation

Growth metric(t) = a + b(Age(t)) + c(size(t-1)) + d(sector(t))+ e(empgr(t-1)) + f(turngr(t-1)) + g(Average TEA(t)) + h(nonUKborn(t)) + i(ethnic(t)) + j(NVQ4+(t)) + k(net employment(t)) + l(GOR(t)) + m(year(t)) + error(t)

Where,

Growth metric is one of the following (Tables 12 to 16),

1. HGE – High growth episode (10% growth in employment over 1 year for firms with more than or equal to 10 employees) (Table 12)
2. HGE_20 – High growth episode (20% growth in employment over 1 year for firms with more than or equal to 10 employees) (Table 13)
3. sHGE – small high growth episode (growth in employment by at least 8 employees for firms with less than 10 employees) (Table 14)
4. allHGE - High growth episode (10% growth in employment over 1 year for firms with more than or equal to 10 employees) and sHGE (growth in employment by at least 8 employees for firms with less than 10 employees) together. (Table 15)
5. allHGE_20 - High growth episode (20% growth in employment over 1 year for firms with more than or equal to 10 employees) and sHGE (growth in employment by at least 8 employees for firms with less than 10 employees) together. (Table 16)

The control variables are as follows,

- Age = Death – Birth of a firm
- Size = size in terms of number of employees
- Sector = 1 digit SIC code classifications (not including Agriculture, mining and public sectors)
- Empgr = previous employment growth over one year (ie, for 2010, it would be the employment growth between 2008 and 2009)
- Turngr = previous turnover growth (similar to empgr)
- Average TEA = Total early stage entrepreneurial activity (GOR level for each year). This is taken from the Global Entrepreneurship Monitor UK.
- UKborn = percentage of working aged population (16-64) who are non –UK born (NUTS2 level for each year)
- Ethnic = percentage of working aged population (16-64) who are ethnic minority (NUTS2 level for each year)
- NVQ4+ = percentage of working aged population (16-64) who have qualification of NVQ4 or over
- Netemployment = calculated from job creation and destruction estimates as the number of jobs resulting from firm births + firm expansions – (firm deaths + firm contractions) at NUTS3 level for each year
- GOR = GOR level dummies

- Year = Year level dummies

This model uses data from the ONS Business Structure Database (Age size, sector, empgr, turngr), the Annual Population Survey (UKborn, ethnic, NVQ4+) and the Global Entrepreneurship Monitor (Average TEA) for the period 2009-2018 and only includes firms that are born before 2007 and still alive after 2018. Agriculture, mining and public sector firms are not included in the analysis.

For each of the following tables, there are 5 estimates calculated. In Model (1), we only include Age, size, sector, GOR dummies and Year dummies. For Model (2), we also include empgr and turngr. In Model (3) we add Average TEA. In Model (4), we then add nonUKborn, ethnic and NVQ4+. Finally, in Model (5), we add net employment to include all the variables. Log(sigma^2) is the logged variance of the random effect in our model. Number of ID is the number of firms used.

For each of the 5 growth metrics the results can be summarised as follows:

Significant determinants of a high-growth episode are:

6. Age (younger) and size (larger)
7. Prior growth (employment and turnover)
8. Higher levels of total early-stage entrepreneurial activity (TEA)
9. Sector (ICT; Business and Professional Services)
10. Time – i.e., early years after recession (i.e., 2011-13) and most recently in 2018

A closer look at the regional dummies in the model and particularly that for Scotland reveals only very weak evidence that it suffers from an overall ‘high-growth’ deficit. Only in the full model for the high-growth episode of 20% in one year dependent variable as well as the model which includes micro-businesses is the dummy for Scotland negative and significant. In all the other 3 models the dummy for Scotland is not significant.

In some of the reduced form models across all 5 variations on the dependent high-growth variable the Scottish dummy actually shows a small positive and significant effect on the likelihood of a business experiencing a high-growth episode. Overall, despite the compelling evidence throughout the descriptive analysis of Scotland having a lower proportion of high-growth firms as defined by the OECDs, this econometric analysis indicates that when we control for the nature of the business population (size, age, sector, prior growth), together with environmental variables such as education, ethnicity and other macro variables such as growth and new venture formation then the case for a ‘high-growth deficit’ in Scotland is severely weakened. This work is on-going as we seek to introduce other variables into the model but it does serve to provide a more robust view on the growth performance of Scottish businesses than the simple reliance on one rather sub-optimal HGF definition.

Table 12: HGE (10%) Logistic regression with random effects

VARIABLES	(1) HGE	(2) HGE	(3) HGE	(4) HGE	(5) HGE
Age	0.900***	0.906***	0.906***	0.906***	0.906***
	(0.000899)	(0.000904)	(0.000904)	(0.000909)	(0.000909)
Base = 10-14 employees					
15-19 employees	0.844***	0.846***	0.846***	0.846***	0.846***
	(0.00769)	(0.00765)	(0.00765)	(0.00769)	(0.00769)
20-49 employees	0.937***	0.940***	0.940***	0.939***	0.939***
	(0.00766)	(0.00760)	(0.00760)	(0.00764)	(0.00764)
50-249 employees	1.019*	1.017*	1.017*	1.016	1.016
	(0.0104)	(0.0102)	(0.0102)	(0.0103)	(0.0103)
250+ employees	1.187***	1.178***	1.178***	1.177***	1.177***
	(0.0204)	(0.0200)	(0.0200)	(0.0201)	(0.0201)
Base = Manufacturing					
Electricity	1.348**	1.275**	1.275**	1.268*	1.268*
	(0.167)	(0.156)	(0.156)	(0.157)	(0.157)
Water Supply	1.407***	1.390***	1.390***	1.382***	1.382***
	(0.0538)	(0.0522)	(0.0522)	(0.0523)	(0.0523)
Construction	0.806***	0.805***	0.805***	0.806***	0.806***
	(0.0116)	(0.0114)	(0.0114)	(0.0115)	(0.0115)
Wholesale and Retail Trade	0.993	0.992	0.992	0.991	0.991
	(0.0109)	(0.0108)	(0.0108)	(0.0108)	(0.0108)
Transport and Storage	1.180***	1.174***	1.173***	1.173***	1.173***
	(0.0202)	(0.0198)	(0.0198)	(0.0199)	(0.0199)
Accommodation	1.036**	1.041***	1.041***	1.038***	1.038***
	(0.0143)	(0.0141)	(0.0141)	(0.0142)	(0.0142)
Information and Communication	1.509***	1.489***	1.489***	1.477***	1.477***
	(0.0249)	(0.0241)	(0.0241)	(0.0241)	(0.0241)
Financial and Insurance	0.981	0.976	0.976	0.967	0.968
	(0.0242)	(0.0237)	(0.0237)	(0.0236)	(0.0236)
Real Estate	0.865***	0.848***	0.848***	0.844***	0.844***
	(0.0201)	(0.0194)	(0.0194)	(0.0195)	(0.0195)
Professional, Scientific and Tech. Act	1.109***	1.105***	1.105***	1.098***	1.098***
	(0.0145)	(0.0142)	(0.0142)	(0.0143)	(0.0143)
Admin, support services	1.188***	1.181***	1.181***	1.179***	1.179***
	(0.0170)	(0.0166)	(0.0166)	(0.0167)	(0.0167)
Arts, Entertainment and Recreation	1.163***	1.152***	1.152***	1.148***	1.148***
	(0.0223)	(0.0217)	(0.0217)	(0.0218)	(0.0218)
Other Service Activities	1.026	1.020	1.019	1.015	1.014
	(0.0185)	(0.0181)	(0.0181)	(0.0181)	(0.0181)
Employment growth (t-1)		1.204***	1.203***	1.203***	1.203***
		(0.0105)	(0.0105)	(0.0106)	(0.0106)
Turnover growth (t-1)		1.274***	1.274***	1.273***	1.273***
		(0.00845)	(0.00845)	(0.00849)	(0.00849)
Average TEA			1.657**	1.650**	1.690**
			(0.335)	(0.337)	(0.346)
% of working pop with NVQ4+				1.002**	1.002**
				(0.00114)	(0.00114)
% of working pop that are ethnic minorities				0.999	0.999
				(0.00166)	(0.00166)
% of working pop that are Non-UK Born				1.005*	1.004*
				(0.00258)	(0.00258)
netemployment					1.004***
					(0.000768)

Base = North East					
North West	1.080***	1.077***	1.071***	1.052**	1.050**
	(0.0239)	(0.0235)	(0.0235)	(0.0237)	(0.0236)
Yorkshire and the Humber	1.042*	1.041*	1.025	1.006	1.005
	(0.0239)	(0.0235)	(0.0239)	(0.0239)	(0.0238)
East Midlands	1.069***	1.066***	1.064***	1.034	1.034
	(0.0248)	(0.0243)	(0.0243)	(0.0251)	(0.0251)
West Midlands	1.040*	1.037	1.031	1.007	1.005
	(0.0236)	(0.0231)	(0.0231)	(0.0239)	(0.0238)
East of England	1.084***	1.078***	1.062***	1.020	1.019
	(0.0242)	(0.0236)	(0.0241)	(0.0255)	(0.0255)
London	1.190***	1.174***	1.152***	0.954	0.951
	(0.0255)	(0.0248)	(0.0258)	(0.0429)	(0.0428)
South East	1.084***	1.079***	1.064***	1.001	1.001
	(0.0232)	(0.0227)	(0.0232)	(0.0245)	(0.0246)
South West	1.083***	1.078***	1.063***	1.026	1.023
	(0.0244)	(0.0239)	(0.0244)	(0.0246)	(0.0245)
Wales	0.883***	0.882***	0.879***	0.871***	0.870***
	(0.0233)	(0.0229)	(0.0228)	(0.0229)	(0.0229)
Scotland	1.049**	1.049**	1.047**	1.004	1.004
	(0.0243)	(0.0238)	(0.0238)	(0.0248)	(0.0248)
Northern Ireland	1.321***	1.318***	1.316***	1.299***	1.306***
	(0.0353)	(0.0347)	(0.0346)	(0.0360)	(0.0362)
Base = 2010					
2011	0.760***	0.775***	0.771***	0.765***	0.767***
	(0.00890)	(0.00909)	(0.00919)	(0.00926)	(0.00929)
2012	1.129***	1.171***	1.152***	1.138***	1.121***
	(0.0128)	(0.0133)	(0.0152)	(0.0155)	(0.0156)
2013	1.884***	1.888***	1.880***	1.852***	1.828***
	(0.0206)	(0.0206)	(0.0208)	(0.0215)	(0.0216)
2014	0.916***	0.913***	0.903***	0.888***	0.869***
	(0.0111)	(0.0111)	(0.0116)	(0.0121)	(0.0123)
2015	1.056***	1.064***	1.060***	1.038***	1.014
	(0.0130)	(0.0131)	(0.0131)	(0.0138)	(0.0141)
2016	0.995	0.991	0.979	0.949***	0.936***
	(0.0128)	(0.0127)	(0.0134)	(0.0141)	(0.0141)
2017	0.946***	0.941***	0.930***	0.899***	0.885***
	(0.0129)	(0.0127)	(0.0133)	(0.0141)	(0.0141)
2018	1.205***	1.197***	1.189***	1.147***	1.129***
	(0.0166)	(0.0164)	(0.0166)	(0.0179)	(0.0179)
Constant	0.623***	0.553***	0.541***	0.501***	0.506***
	(0.0157)	(0.0138)	(0.0144)	(0.0179)	(0.0181)
log(sigma^2)	0.488***	0.442***	0.442***	0.442***	0.442***
	(0.00698)	(0.00679)	(0.00679)	(0.00684)	(0.00684)
Observations	1,108,837	1,108,837	1,108,837	1,095,858	1,095,858
Number of ID	161,318	161,318	161,318	160,657	160,657

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: HGE (20%) Logistic regression with random effects

VARIABLES	(1) HGE_20_	(2) HGE_20_	(3) HGE_20_	(4) HGE_20_	(5) HGE_20_
Age	0.897***	0.905***	0.905***	0.905***	0.905***
	(0.00104)	(0.00105)	(0.00105)	(0.00105)	(0.00105)
Base = 10- 14 employees					
15-19 employees	0.874***	0.878***	0.878***	0.877***	0.877***
	(0.00996)	(0.00994)	(0.00994)	(0.00999)	(0.00998)
20-49 employees	1.088***	1.094***	1.094***	1.092***	1.092***
	(0.0108)	(0.0107)	(0.0107)	(0.0108)	(0.0108)
50-249 employees	1.063***	1.064***	1.064***	1.060***	1.060***
	(0.0132)	(0.0130)	(0.0130)	(0.0130)	(0.0130)
250+ employees	1.083***	1.077***	1.077***	1.074***	1.074***
	(0.0229)	(0.0224)	(0.0224)	(0.0225)	(0.0225)
Base = Manufacturing					
Electricity	1.609***	1.490***	1.490***	1.498***	1.497***
	(0.222)	(0.203)	(0.203)	(0.205)	(0.205)
Water Supply	1.517***	1.490***	1.490***	1.494***	1.494***
	(0.0674)	(0.0650)	(0.0650)	(0.0656)	(0.0656)
Construction	0.940***	0.937***	0.937***	0.937***	0.937***
	(0.0163)	(0.0160)	(0.0160)	(0.0161)	(0.0161)
Wholesale and Retail Trade	0.977*	0.977*	0.977*	0.976*	0.976*
	(0.0133)	(0.0131)	(0.0131)	(0.0131)	(0.0131)
Transport and Storage	1.244***	1.236***	1.236***	1.240***	1.240***
	(0.0255)	(0.0249)	(0.0249)	(0.0251)	(0.0251)
Accommodation	1.219***	1.228***	1.228***	1.227***	1.227***
	(0.0198)	(0.0196)	(0.0196)	(0.0198)	(0.0198)
Information and Communication	1.645***	1.618***	1.618***	1.602***	1.602***
	(0.0315)	(0.0304)	(0.0304)	(0.0303)	(0.0303)
Financial and Insurance	1.093***	1.080***	1.080***	1.067**	1.067**
	(0.0317)	(0.0308)	(0.0308)	(0.0306)	(0.0307)
Real Estate	0.878***	0.854***	0.854***	0.847***	0.847***
	(0.0251)	(0.0240)	(0.0240)	(0.0240)	(0.0240)
Professional, Scientific and Tech. Act	1.111***	1.106***	1.106***	1.100***	1.100***
	(0.0177)	(0.0173)	(0.0173)	(0.0173)	(0.0173)
Admin, support services	1.398***	1.387***	1.386***	1.383***	1.383***
	(0.0234)	(0.0228)	(0.0228)	(0.0229)	(0.0229)
Arts, Entertainment and Recreation	1.433***	1.417***	1.417***	1.415***	1.415***
	(0.0319)	(0.0309)	(0.0309)	(0.0311)	(0.0311)
Other Service Activities	1.032	1.026	1.025	1.023	1.023
	(0.0227)	(0.0222)	(0.0222)	(0.0223)	(0.0223)
Employment growth (t-1)		1.222***	1.221***	1.221***	1.221***
		(0.0124)	(0.0124)	(0.0125)	(0.0125)
Turnover growth (t-1)		1.331***	1.331***	1.331***	1.331***
		(0.0104)	(0.0104)	(0.0104)	(0.0104)
Average TEA			2.900***	2.964***	3.013***
			(0.749)	(0.773)	(0.787)
% of working pop with NVQ4+				1.002	1.002
				(0.00138)	(0.00138)
% of working pop that are ethnic minorities				0.998	0.998
				(0.00203)	(0.00203)
% of working pop that are Non-UK Born				1.008***	1.008**
				(0.00317)	(0.00317)
netemployment					1.004***
					(0.000975)
Base = North East					
North West	1.061**	1.058**	1.046*	1.018	1.017
	(0.0281)	(0.0275)	(0.0273)	(0.0273)	(0.0273)

Yorkshire and the Humber	1.018	1.017	0.986	0.957	0.956
	(0.0279)	(0.0274)	(0.0276)	(0.0272)	(0.0272)
East Midlands	1.038	1.036	1.032	0.984	0.984
	(0.0288)	(0.0282)	(0.0281)	(0.0286)	(0.0286)
West Midlands	1.024	1.022	1.010	0.970	0.968
	(0.0278)	(0.0272)	(0.0271)	(0.0275)	(0.0275)
East of England	1.030	1.024	0.992	0.932**	0.931**
	(0.0275)	(0.0268)	(0.0271)	(0.0281)	(0.0281)
London	1.251***	1.231***	1.183***	0.886**	0.884**
	(0.0319)	(0.0308)	(0.0317)	(0.0480)	(0.0479)
South East	1.056**	1.050*	1.020	0.937**	0.938**
	(0.0270)	(0.0264)	(0.0266)	(0.0275)	(0.0276)
South West	1.041	1.037	1.007	0.961	0.959
	(0.0281)	(0.0275)	(0.0276)	(0.0276)	(0.0275)
Wales	0.919***	0.919***	0.913***	0.903***	0.903***
	(0.0289)	(0.0284)	(0.0283)	(0.0283)	(0.0283)
Scotland	0.998	0.998	0.995	0.948*	0.948*
	(0.0276)	(0.0271)	(0.0271)	(0.0280)	(0.0280)
Northern Ireland	1.136***	1.134***	1.130***	1.106***	1.111***
	(0.0368)	(0.0361)	(0.0360)	(0.0372)	(0.0374)
Base = 2010					
2011	0.706***	0.723***	0.715***	0.707***	0.708***
	(0.0108)	(0.0110)	(0.0111)	(0.0111)	(0.0112)
2012	1.147***	1.200***	1.159***	1.141***	1.127***
	(0.0164)	(0.0172)	(0.0193)	(0.0196)	(0.0198)
2013	1.970***	1.977***	1.961***	1.927***	1.907***
	(0.0265)	(0.0266)	(0.0266)	(0.0275)	(0.0278)
2014	1.015	1.014	0.992	0.969*	0.952***
	(0.0154)	(0.0154)	(0.0160)	(0.0165)	(0.0168)
2015	1.149***	1.161***	1.154***	1.122***	1.102***
	(0.0176)	(0.0178)	(0.0178)	(0.0186)	(0.0191)
2016	1.095***	1.090***	1.064***	1.024	1.012
	(0.0176)	(0.0175)	(0.0182)	(0.0190)	(0.0190)
2017	1.017	1.010	0.986	0.942***	0.930***
	(0.0174)	(0.0172)	(0.0178)	(0.0184)	(0.0185)
2018	1.318***	1.307***	1.290***	1.231***	1.216***
	(0.0225)	(0.0223)	(0.0223)	(0.0237)	(0.0238)
Constant	0.274***	0.239***	0.227***	0.209***	0.210***
	(0.00825)	(0.00712)	(0.00730)	(0.00901)	(0.00909)
log(sigma^2)	0.466***	0.401***	0.401***	0.403***	0.404***
	(0.00933)	(0.00899)	(0.00899)	(0.00908)	(0.00908)
Observations	1,108,837	1,108,837	1,108,837	1,095,858	1,095,858
Number of ID	161,318	161,318	161,318	160,657	160,657

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: sHGE Logistic regression with random effects

VARIABLES	(1) SHGE_	(3) SHGE_	(5) SHGE_	(7) SHGE_	(9) SHGE_
Age	0.949***	0.948***	0.948***	0.948***	0.948***
	(0.00242)	(0.00232)	(0.00232)	(0.00234)	(0.00234)
Base = 1- 4 employees					
5-9 employees	3.365***	3.565***	3.565***	3.554***	3.555***
	(0.0646)	(0.0674)	(0.0674)	(0.0676)	(0.0676)
Base = Manufacturing					
Electricity	12.26***	9.834***	9.837***	10.17***	10.13***
	(2.972)	(2.223)	(2.224)	(2.311)	(2.303)
Water Supply	2.101***	2.016***	2.016***	2.022***	2.022***
	(0.286)	(0.262)	(0.262)	(0.264)	(0.264)
Construction	0.889***	0.890***	0.889***	0.891***	0.891***
	(0.0407)	(0.0394)	(0.0394)	(0.0397)	(0.0397)
Wholesale and Retail Trade	0.875***	0.893***	0.893***	0.891***	0.891***
	(0.0365)	(0.0359)	(0.0359)	(0.0360)	(0.0360)
Transport and Storage	1.543***	1.523***	1.523***	1.547***	1.546***
	(0.0923)	(0.0874)	(0.0874)	(0.0891)	(0.0891)
Accommodation	3.241***	3.091***	3.092***	3.100***	3.099***
	(0.144)	(0.131)	(0.131)	(0.132)	(0.132)
Information and Communication	0.892**	0.913*	0.913*	0.897**	0.898**
	(0.0475)	(0.0470)	(0.0470)	(0.0464)	(0.0465)
Financial and Insurance	1.262***	1.244***	1.244***	1.218***	1.219***
	(0.0968)	(0.0919)	(0.0919)	(0.0905)	(0.0906)
Real Estate	1.658***	1.655***	1.655***	1.631***	1.631***
	(0.0854)	(0.0820)	(0.0820)	(0.0813)	(0.0813)
Professional, Scientific and Tech. Act	0.718***	0.736***	0.736***	0.720***	0.720***
	(0.0333)	(0.0330)	(0.0330)	(0.0325)	(0.0325)
Admin, support services	1.623***	1.582***	1.582***	1.558***	1.559***
	(0.0772)	(0.0725)	(0.0725)	(0.0718)	(0.0718)
Arts, Entertainment and Recreation	2.629***	2.564***	2.564***	2.521***	2.520***
	(0.142)	(0.132)	(0.132)	(0.131)	(0.131)
Other Service Activities	0.798***	0.824***	0.824***	0.824***	0.825***
	(0.0430)	(0.0430)	(0.0430)	(0.0431)	(0.0431)
Employment growth (t-1)		0.511***	0.511***	0.512***	0.512***
		(0.0107)	(0.0107)	(0.0107)	(0.0107)
Turnover growth (t-1)		1.427***	1.427***	1.425***	1.425***
		(0.0209)	(0.0209)	(0.0210)	(0.0210)
Average TEA			3.149*	3.083*	3.195*
			(2.088)	(2.070)	(2.149)
% of working pop with NVQ4+				1.008**	1.008**
				(0.00333)	(0.00333)
% of working pop that are ethnic minorities				0.991*	0.992
				(0.00495)	(0.00496)
% of working pop that are Non-UK Born				1.030***	1.029***
				(0.00792)	(0.00793)
netemployment					1.008***
					(0.00252)
Base = North East					
North West	1.030	1.034	1.022	0.929	0.924

	(0.0705)	(0.0681)	(0.0676)	(0.0631)	(0.0628)
Yorkshire and the Humber	1.046	1.049	1.016	0.922	0.918
	(0.0739)	(0.0713)	(0.0716)	(0.0659)	(0.0656)
East Midlands	0.989	0.995	0.994	0.847**	0.847**
	(0.0708)	(0.0685)	(0.0685)	(0.0622)	(0.0622)
West Midlands	0.913	0.923	0.912	0.809***	0.804***
	(0.0645)	(0.0628)	(0.0623)	(0.0580)	(0.0576)
East of England	1.080	1.083	1.050	0.840**	0.838**
	(0.0733)	(0.0707)	(0.0711)	(0.0623)	(0.0622)
London	1.646***	1.612***	1.544***	0.570***	0.566***
	(0.106)	(0.100)	(0.103)	(0.0740)	(0.0734)
South East	1.043	1.047	1.016	0.751***	0.751***
	(0.0684)	(0.0660)	(0.0664)	(0.0544)	(0.0544)
South West	1.043	1.047	1.015	0.866**	0.861**
	(0.0714)	(0.0690)	(0.0693)	(0.0614)	(0.0611)
Wales	1.122	1.128	1.121	1.082	1.079
	(0.0855)	(0.0825)	(0.0821)	(0.0801)	(0.0798)
Scotland	1.177**	1.181**	1.180**	0.979	0.976
	(0.0828)	(0.0798)	(0.0798)	(0.0711)	(0.0709)
Northern Ireland	1.425***	1.375***	1.373***	1.277***	1.290***
	(0.116)	(0.107)	(0.107)	(0.105)	(0.106)
Base = 2010					
2011	0.782***	0.761***	0.753***	0.722***	0.726***
	(0.0283)	(0.0273)	(0.0274)	(0.0267)	(0.0269)
2012	1.392***	1.351***	1.303***	1.233***	1.198***
	(0.0453)	(0.0435)	(0.0502)	(0.0491)	(0.0488)
2013	1.328***	1.291***	1.281***	1.201***	1.173***
	(0.0451)	(0.0432)	(0.0433)	(0.0425)	(0.0423)
2014	0.979	0.929**	0.908**	0.829***	0.796***
	(0.0370)	(0.0346)	(0.0358)	(0.0344)	(0.0345)
2015	1.031	0.987	0.980	0.882***	0.845***
	(0.0400)	(0.0376)	(0.0376)	(0.0360)	(0.0361)
2016	0.891***	0.835***	0.815***	0.710***	0.692***
	(0.0373)	(0.0343)	(0.0354)	(0.0328)	(0.0325)
2017	0.958	0.888***	0.866***	0.738***	0.717***
	(0.0411)	(0.0374)	(0.0385)	(0.0351)	(0.0347)
2018	0.992	0.936	0.925*	0.788***	0.767***
	(0.0441)	(0.0407)	(0.0407)	(0.0378)	(0.0373)
Constant	0.00124***	0.00172***	0.00163***	0.00120***	0.00122***
	(0.000111)	(0.000146)	(0.000147)	(0.000136)	(0.000139)
log(sigma^2)	2.187***	1.441***	1.442***	1.433***	1.434***
	(0.0965)	(0.0843)	(0.0844)	(0.0851)	(0.0851)
Observations	3,590,468	3,590,468	3,590,468	3,549,186	3,549,186
Number of ID	433,962	433,962	433,962	432,316	432,316

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: HGE (10%) and sHGE together Logistic regression with random effects

VARIABLES	(1) allHGE	(2) allHGE	(3) allHGE	(4) allHGE	(5) allHGE
Age	0.912***	0.915***	0.915***	0.916***	0.916***
	(0.000820)	(0.000825)	(0.000825)	(0.000829)	(0.000829)
Base = 1- 4 employees					
5-9 employees	3.739***	3.678***	3.678***	3.672***	3.672***
	(0.0650)	(0.0640)	(0.0640)	(0.0643)	(0.0643)
10-14 employees	111.1***	108.1***	108.1***	108.1***	108.1***
	(1.550)	(1.512)	(1.512)	(1.521)	(1.521)
15-19 employees	92.48***	90.21***	90.21***	90.15***	90.17***
	(1.368)	(1.336)	(1.336)	(1.344)	(1.344)
20-49 employees	103.3***	100.9***	100.9***	100.8***	100.8***
	(1.458)	(1.426)	(1.426)	(1.433)	(1.434)
50-249 employees	113.6***	110.6***	110.6***	110.3***	110.3***
	(1.730)	(1.684)	(1.684)	(1.690)	(1.691)
250+ employees	132.1***	128.0***	128.0***	127.5***	127.6***
	(2.689)	(2.595)	(2.595)	(2.601)	(2.603)
Base = Manufacturing					
Electricity	1.831***	1.769***	1.769***	1.774***	1.774***
	(0.204)	(0.195)	(0.195)	(0.198)	(0.198)
Water Supply	1.436***	1.425***	1.425***	1.419***	1.419***
	(0.0513)	(0.0504)	(0.0504)	(0.0505)	(0.0505)
Construction	0.807***	0.807***	0.807***	0.808***	0.808***
	(0.0106)	(0.0105)	(0.0105)	(0.0106)	(0.0106)
Wholesale and Retail Trade	0.974**	0.977**	0.977**	0.975**	0.975**
	(0.0100)	(0.00995)	(0.00995)	(0.00999)	(0.00999)
Transport and Storage	1.195***	1.193***	1.193***	1.195***	1.194***
	(0.0191)	(0.0188)	(0.0188)	(0.0190)	(0.0190)
Accommodation	1.165***	1.174***	1.174***	1.171***	1.171***
	(0.0148)	(0.0148)	(0.0148)	(0.0149)	(0.0149)
Information and Communication	1.387***	1.379***	1.379***	1.366***	1.365***
	(0.0207)	(0.0204)	(0.0204)	(0.0203)	(0.0203)
Financial and Insurance	0.994	0.991	0.991	0.979	0.979
	(0.0226)	(0.0223)	(0.0223)	(0.0222)	(0.0222)
Real Estate	0.987	0.980	0.980	0.974	0.974
	(0.0199)	(0.0196)	(0.0196)	(0.0196)	(0.0196)
Professional, Scientific and Tech. Act	1.040***	1.041***	1.041***	1.032***	1.032***
	(0.0126)	(0.0125)	(0.0125)	(0.0125)	(0.0125)
Admin, support services	1.215***	1.213***	1.212***	1.209***	1.209***
	(0.0161)	(0.0159)	(0.0159)	(0.0159)	(0.0159)
Arts, Entertainment and Recreation	1.264***	1.262***	1.262***	1.256***	1.256***
	(0.0221)	(0.0219)	(0.0219)	(0.0219)	(0.0219)
Other Service Activities	0.975	0.975	0.975	0.971*	0.971*
	(0.0159)	(0.0158)	(0.0158)	(0.0158)	(0.0158)
Employment growth (t-1)		1.024***	1.024***	1.024***	1.024***
		(0.00860)	(0.00860)	(0.00865)	(0.00864)
Turnover growth (t-1)		1.298***	1.298***	1.297***	1.297***
		(0.00788)	(0.00788)	(0.00792)	(0.00792)
Average TEA			1.825***	1.809***	1.855***
			(0.351)	(0.351)	(0.360)
% of working pop with NVQ4+				1.003***	1.003***

				(0.00105)	(0.00105)
% of working pop that are ethnic minorities				0.998	0.998
				(0.00154)	(0.00155)
% of working pop that are Non-UK Born				1.008***	1.007***
				(0.00241)	(0.00241)
netemployment					1.005***
					(0.000729)
Base = North East					
North West	1.075***	1.073***	1.066***	1.038*	1.036*
	(0.0219)	(0.0217)	(0.0217)	(0.0216)	(0.0216)
Yorkshire and the Humber	1.043**	1.043**	1.025	0.996	0.995
	(0.0220)	(0.0218)	(0.0222)	(0.0219)	(0.0219)
East Midlands	1.060***	1.059***	1.057***	1.010	1.010
	(0.0226)	(0.0224)	(0.0223)	(0.0227)	(0.0228)
West Midlands	1.029	1.028	1.021	0.985	0.982
	(0.0215)	(0.0213)	(0.0212)	(0.0216)	(0.0216)
East of England	1.079***	1.076***	1.057***	0.993	0.992
	(0.0221)	(0.0218)	(0.0223)	(0.0230)	(0.0230)
London	1.236***	1.226***	1.199***	0.895***	0.892***
	(0.0243)	(0.0239)	(0.0249)	(0.0372)	(0.0371)
South East	1.078***	1.075***	1.058***	0.965	0.966
	(0.0212)	(0.0210)	(0.0214)	(0.0219)	(0.0219)
South West	1.074***	1.072***	1.054**	1.002	0.999
	(0.0223)	(0.0220)	(0.0224)	(0.0222)	(0.0222)
Wales	0.910***	0.910***	0.906***	0.895***	0.894***
	(0.0220)	(0.0218)	(0.0217)	(0.0217)	(0.0217)
Scotland	1.061***	1.061***	1.059***	0.998	0.997
	(0.0226)	(0.0223)	(0.0223)	(0.0228)	(0.0228)
Northern Ireland	1.327***	1.330***	1.327***	1.300***	1.308***
	(0.0327)	(0.0324)	(0.0323)	(0.0334)	(0.0336)
Base = 2010					
2011	0.755***	0.767***	0.762***	0.753***	0.755***
	(0.00835)	(0.00849)	(0.00857)	(0.00860)	(0.00863)
2012	1.129***	1.167***	1.144***	1.124***	1.106***
	(0.0120)	(0.0124)	(0.0142)	(0.0144)	(0.0144)
2013	1.753***	1.765***	1.757***	1.721***	1.697***
	(0.0179)	(0.0181)	(0.0182)	(0.0187)	(0.0188)
2014	0.887***	0.892***	0.880***	0.858***	0.838***
	(0.0101)	(0.0102)	(0.0107)	(0.0110)	(0.0112)
2015	1.005	1.017	1.013	0.981	0.957***
	(0.0117)	(0.0118)	(0.0118)	(0.0123)	(0.0125)
2016	0.932***	0.934***	0.921***	0.882***	0.868***
	(0.0113)	(0.0113)	(0.0119)	(0.0124)	(0.0123)
2017	0.888***	0.888***	0.876***	0.834***	0.820***
	(0.0114)	(0.0114)	(0.0119)	(0.0123)	(0.0123)
2018	1.101***	1.103***	1.095***	1.040***	1.023
	(0.0143)	(0.0143)	(0.0144)	(0.0152)	(0.0152)
Constant	0.00480***	0.00461***	0.00448***	0.00403***	0.00407***
	(0.000122)	(0.000116)	(0.000120)	(0.000140)	(0.000141)
log(sigma^2)	0.417***	0.387***	0.387***	0.387***	0.388***
	(0.00593)	(0.00594)	(0.00594)	(0.00598)	(0.00598)
Observations	4,699,305	4,699,305	4,699,305	4,645,044	4,645,044

Number of ID	523,432	523,432	523,432	521,635	521,635

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: HGE (20%) and sHGE together Logistic regression with random effects

VARIABLES	(1) allHGE_20_	(2) allHGE_20_	(3) allHGE_20_	(4) allHGE_20_	(5) allHGE_20_
Age	0.912***	0.916***	0.916***	0.916***	0.916***
	(0.000945)	(0.000951)	(0.000951)	(0.000957)	(0.000957)
Base = 1- 4 employees					
5-9 employees	3.751***	3.698***	3.698***	3.689***	3.690***
	(0.0653)	(0.0645)	(0.0645)	(0.0648)	(0.0648)
10-14 employees	51.41***	50.12***	50.13***	50.09***	50.11***
	(0.748)	(0.732)	(0.732)	(0.736)	(0.737)
15-19 employees	43.88***	42.96***	42.97***	42.88***	42.88***
	(0.696)	(0.682)	(0.682)	(0.685)	(0.685)
20-49 employees	54.78***	53.70***	53.70***	53.51***	53.53***
	(0.805)	(0.790)	(0.790)	(0.792)	(0.793)
50-249 employees	53.88***	52.62***	52.63***	52.35***	52.37***
	(0.880)	(0.859)	(0.859)	(0.860)	(0.861)
250+ employees	54.69***	53.15***	53.15***	52.83***	52.86***
	(1.287)	(1.245)	(1.245)	(1.245)	(1.246)
Base = Manufacturing					
Electricity	2.322***	2.222***	2.223***	2.251***	2.251***
	(0.280)	(0.266)	(0.266)	(0.271)	(0.271)
Water Supply	1.553***	1.540***	1.540***	1.545***	1.545***
	(0.0646)	(0.0634)	(0.0634)	(0.0640)	(0.0640)
Construction	0.916***	0.916***	0.915***	0.916***	0.916***
	(0.0144)	(0.0143)	(0.0143)	(0.0144)	(0.0144)
Wholesale and Retail Trade	0.956***	0.960***	0.960***	0.959***	0.959***
	(0.0121)	(0.0121)	(0.0121)	(0.0121)	(0.0121)
Transport and Storage	1.264***	1.263***	1.263***	1.270***	1.270***
	(0.0241)	(0.0239)	(0.0239)	(0.0241)	(0.0241)
Accommodation	1.405***	1.419***	1.419***	1.419***	1.418***
	(0.0209)	(0.0209)	(0.0209)	(0.0211)	(0.0211)
Information and Communication	1.467***	1.458***	1.458***	1.440***	1.440***
	(0.0255)	(0.0251)	(0.0251)	(0.0250)	(0.0250)
Financial and Insurance	1.102***	1.094***	1.094***	1.076***	1.076***
	(0.0293)	(0.0288)	(0.0288)	(0.0286)	(0.0286)
Real Estate	1.061**	1.053**	1.053**	1.043*	1.043*
	(0.0251)	(0.0247)	(0.0247)	(0.0247)	(0.0247)
Professional, Scientific and Tech. Act	1.023	1.024	1.024	1.015	1.015
	(0.0150)	(0.0149)	(0.0149)	(0.0149)	(0.0149)
Admin, support services	1.417***	1.413***	1.413***	1.407***	1.407***
	(0.0219)	(0.0216)	(0.0216)	(0.0216)	(0.0216)
Arts, Entertainment and Recreation	1.561***	1.560***	1.560***	1.555***	1.554***
	(0.0313)	(0.0310)	(0.0310)	(0.0311)	(0.0311)
Other Service Activities	0.969	0.971	0.971	0.968*	0.968*
	(0.0191)	(0.0190)	(0.0190)	(0.0190)	(0.0190)
Employment growth (t-1)		0.993	0.992	0.992	0.992
		(0.00976)	(0.00976)	(0.00981)	(0.00981)
Turnover growth (t-1)		1.353***	1.353***	1.352***	1.352***
		(0.00935)	(0.00935)	(0.00939)	(0.00939)
Average TEA			3.041***	3.085***	3.145***
			(0.729)	(0.747)	(0.762)
% of working pop with NVQ4+				1.003***	1.003**
				(0.00126)	(0.00126)
% of working pop that are ethnic minorities				0.997*	0.997

				(0.00187)	(0.00187)
% of working pop that are Non-UK Born				1.012***	1.012***
				(0.00293)	(0.00293)
netemployment					1.004***
					(0.000906)
Base = North East					
North West	1.057**	1.056**	1.044*	1.003	1.002
	(0.0256)	(0.0253)	(0.0252)	(0.0248)	(0.0248)
Yorkshire and the Humber	1.024	1.024	0.992	0.950*	0.949**
	(0.0257)	(0.0255)	(0.0256)	(0.0249)	(0.0249)
East Midlands	1.031	1.030	1.027	0.959	0.959
	(0.0261)	(0.0259)	(0.0258)	(0.0257)	(0.0257)
West Midlands	1.010	1.010	0.998	0.943**	0.941**
	(0.0251)	(0.0248)	(0.0247)	(0.0246)	(0.0246)
East of England	1.034	1.031	0.999	0.910***	0.910***
	(0.0252)	(0.0249)	(0.0251)	(0.0252)	(0.0252)
London	1.309***	1.297***	1.244***	0.814***	0.811***
	(0.0304)	(0.0298)	(0.0307)	(0.0403)	(0.0402)
South East	1.053**	1.051**	1.019	0.899***	0.899***
	(0.0246)	(0.0243)	(0.0245)	(0.0243)	(0.0243)
South West	1.037	1.036	1.004	0.938**	0.936**
	(0.0255)	(0.0252)	(0.0254)	(0.0248)	(0.0247)
Wales	0.951*	0.952*	0.946**	0.931**	0.930**
	(0.0271)	(0.0269)	(0.0267)	(0.0266)	(0.0266)
Scotland	1.023	1.023	1.020	0.948**	0.947**
	(0.0258)	(0.0256)	(0.0256)	(0.0257)	(0.0257)
Northern Ireland	1.171***	1.174***	1.171***	1.135***	1.141***
	(0.0347)	(0.0344)	(0.0343)	(0.0351)	(0.0353)
Base = 2010					
2011	0.708***	0.719***	0.711***	0.699***	0.701***
	(0.00991)	(0.0101)	(0.0101)	(0.0101)	(0.0101)
2012	1.154***	1.197***	1.154***	1.129***	1.112***
	(0.0150)	(0.0156)	(0.0176)	(0.0177)	(0.0178)
2013	1.789***	1.805***	1.790***	1.744***	1.723***
	(0.0221)	(0.0223)	(0.0223)	(0.0228)	(0.0230)
2014	0.964***	0.973**	0.950***	0.917***	0.898***
	(0.0135)	(0.0136)	(0.0141)	(0.0144)	(0.0147)
2015	1.070***	1.085***	1.078***	1.033**	1.011
	(0.0152)	(0.0154)	(0.0154)	(0.0158)	(0.0162)
2016	0.997	0.999	0.974*	0.920***	0.908***
	(0.0148)	(0.0149)	(0.0154)	(0.0157)	(0.0158)
2017	0.934***	0.935***	0.911***	0.852***	0.840***
	(0.0147)	(0.0147)	(0.0152)	(0.0154)	(0.0154)
2018	1.164***	1.167***	1.152***	1.077***	1.061***
	(0.0184)	(0.0185)	(0.0185)	(0.0192)	(0.0192)
Constant	0.00444***	0.00425***	0.00403***	0.00355***	0.00358***
	(0.000130)	(0.000123)	(0.000125)	(0.000144)	(0.000146)
log(sigma^2)	0.433***	0.395***	0.396***	0.397***	0.397***
	(0.00807)	(0.00812)	(0.00813)	(0.00820)	(0.00820)
Observations	4,699,305	4,699,305	4,699,305	4,645,044	4,645,044
Number of ID	523,432	523,432	523,432	521,635	521,635

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1

10. Conclusions

Scotland has a 'high-growth deficit' according to the descriptive analysis presented in this report based on the OECD definition of a high-growth firm. We can crudely estimate this 'deficit' in Scotland by calculating the number of HGFs there would have been in 2015-18 if the UK incidence rate of 6.2% is applied. There would have been an additional 128 HGFs (20% employment definition) in Scotland (or 81 if London excluded from the analysis). We need to mindful of course that this simplistic 'closing the gap' type of analysis ignores the obvious fact that having more of these firms may well have negative effects on the performance of other established firms, including HGFs – a potential zero-sum game.

Further, irrespective of the HGF metric used it is clear that Scotland under-performs when compared to other parts of the UK in terms of the proportion of its business base that can be categorised as a high-growth. With a mature and effective business support policy in place the answer must surely lie in the following three areas: an 'entrepreneurial growth mindset', supply side constraints such as staff and premises sitting alongside external macroeconomic and political events. These potential explanations are, of course, intrinsically connected.

With respect to recent macroeconomic and political events or 'shocks' there are a number of plausible reasons why the Scottish HGF rate is relatively low:

- The Scottish independence referendum in 2014 which created some uncertainty and investment caution.

- The oil and gas recession following a dramatic price drop in the price of oil from $112pb in June 2014 to $36pb in January 2016[28] which affected economic activity in the Aberdeen area and Shetlands in particular, but which was also visible in a slower pace of growth in business starts in the east of Scotland than in the west of Scotland. Before this period, Aberdeen was a start-up hotspot in Scotland.

- The UK Brexit referendum in 2016 and the associated continuing uncertainty made Scots even more cautious than they otherwise would be, especially as 2 in 3 Scots voted to stay in and feared the consequences of Brexit rather than, as in England, the majority welcomed or ignored it.

There is some empirical evidence to support these possible reasons. Entrepreneurial growth is a function of overall business activity in a region and where this is subdued due to consumer and business caution, entrepreneurial growth will be lower[29]. The Scots were much slower to start and grow businesses than the English were after the great recession, and in the north-east and more rural areas of Scotland, start-up rates declined against the trend across the UK.

In the 2014 to 2017 period, Scottish production of scaling start-ups (start-ups that at least doubled sales to £1million or more in sales within 3 years of founding) was just under half (49%) the average production rate for the UK[30]. The North East and Highlands and Islands

[28] https://www.macrotrends.net/1369/crude-oil-price-history-chart

[29] Levie, J., Mwaura, S., Sahasranamam, S., Hart, M., Prashar, N. and Bonner, K. (2018). Entrepreneurial Ecosystem – Benchmark Research Final Report. Prepared for Entrepreneurship, Values-based Business and Small Business Policy, The Scottish Government. May. 70pp. [available from Scottish Government]

[30] Levie, J., Mwaura, S., Sahasranamam, S., Hart, M., Prashar, N. and Bonner, K. (2018). Entrepreneurial Ecosystem – Benchmark Research Final Report. Prepared for Entrepreneurship, Values-based Business and Small Business Policy, The Scottish Government. May. 70pp. [available from Scottish Government]

combined had around half the yield and production of scaling start-ups as South Western Scotland, despite a higher new firm birth rate than South West Scotland in 2014[31].

Entrepreneurs in their 50s are more likely to deliver on growth, but it is this demographic that shows the greatest disparity between the UK and Scotland. Scotland has similar rates of growth expectation to the UK among its younger entrepreneurs, but not among older entrepreneurs[32]. Unfortunately for Scotland, it has fewer young people in its population than the rest of the UK[33].

This caution is mirrored in consumer sentiment. In Scotland, consumer expectations on economic performance, though positive, began to decline after the independence referendum, turned negative in Q3 2016 (immediately after the Brexit referendum) and have remained negative ever since[34]. By contrast, Wales had relatively high rates of consumer confidence until recently[35]. It is notable that Wales had lower HGF rates in the first half of this period than Scotland but higher rates in the second half. Wales did not experience the independence referendum, the oil price drop, or vote against Brexit.

A further explanation of a relatively low high-growth incidence rates may lie in the domain of so called "growth-regimes". Audretsch and Fritsch (2002)[36] conceptualise four different growth regimes: entrepreneurial regime, routinized regime, revolving-door regime and downsizing regime. An *entrepreneurial regime* exists in a region where growth results from a high number of new firm-start-ups and a turbulent enterprise structure and innovative activity is implemented mostly by new ventures. A *routinized growth regime* exists in a region with a stable enterprise structure where start-ups play a less important role and growth is a manifestation of incumbent enterprises. A *revolving door regime* is characterized by a relatively low growth, high start-up rate but also a high exit rate, entries being relatively non-innovative. A *downsizing regime* exists in a low-growth regions with little start-up activity and downsizing and plant closures of incumbent enterprises.

One can argue that Scotland, due to historical factors, institutional and political organisation, demonstrates *routinized growth regime* characteristics. These particulars, far from making Scotland an "unsuccessful" region, should be taken into account when discussing a moderate performance of Scotland in terms of HGFs incidence rates.

However, the results of our econometric work, following on from our analysis of a cohort of start-ups in Scotland over 10 years, set out to explain the variation in annual high-growth episodes across ALL businesses in the UK since the Great Recession point to a more positive set of conclusions for the Scottish economy. As expected age and size and prior growth explain a large part of the likelihood a business will experience a high-growth episode in any one year and being located in Scotland would not appear to be a major disadvantage. Only in two of the models is there a very small negative and significant effect of being located in Scotland.

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[31] Levie, J., Mwaura, S., Sahasranamam, S., Hart, M., Prashar, N. and Bonner, K. (2018). Entrepreneurial Ecosystem – Benchmark Research Final Report. Prepared for Entrepreneurship, Values-based Business and Small Business Policy, The Scottish Government. May. 70pp. [available from Scottish Government]

[32] Levie, J., Mwaura, S., Sahasranamam, S., Hart, M., Prashar, N. and Bonner, K. (2018). Entrepreneurial Ecosystem – Benchmark Research Final Report. Prepared for Entrepreneurship, Values-based Business and Small Business Policy, The Scottish Government. May. 70pp. [available from Scottish Government]

[33] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/overviewoftheukpopulation/november2018

[34] https://www2.gov.scot/Resource/0054/00544947.pdf

[35] https://www.walesonline.co.uk/business/business-news/wales-highest-level-business-confidence-13236404

[36] Audretsch, D., and Fritsch, M. (2002) Growth Regimes over Time and Space, Regional Studies, 36:2, 113-124, https://www.tandfonline.com/doi/abs/10.1080/00343400220121909?journalCode=cres20

Finally, we would urge Scottish Enterprise to adopt a more nuanced view about business growth and high-growth in particular. Reliance upon a single definition (i.e., the OCED HGF) is less than optimal and as we have shown renders invisible much of the growth and indeed high-growth we observe in businesses across the Scottish economy. It is well past its sell-by date and there needs to be a move towards a more sensible understanding of growth and to recognize that it is episodic for the majority of businesses experiencing growth. Research into the triggers of these episodes and to examine the role of the various interventions associated with the Account Managed system in Scotland would be an invaluable next steps project.