




Job Creation in Northern Ireland Firms

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Executive Summary

Introduction

- It is acknowledged that a small number of firms are typically responsible for most jobs created in an economy. In fact, research stretching back to the late 1970s suggested that it was small rather than larger firms that were responsible for such job creation. More recently age rather than the size of firms has been recognised to be of greater importance with younger firms considered to be responsible for the largest share of job creation in an economy.

- Due to these recent debates and movement in policy terms towards scaling, attention has recently turned towards assessing how firms grow rather than why, analysing firms' growth history, or path, to better understand the growth process. Results to date have concluded that employment growth is relatively flat for the majority of firms and that growth is random with a variety of growth paths possible.

- In Northern Ireland job creation has been a policy lever to help grow the economy but to date we know little about the 'how' of firm job creation in terms of when and how often firms generate employment over their lifetime. To this end, this project seeks to understand both the extent of job creation in Northern Ireland since 2007 and the job creation history of businesses.

- Focusing on employer firm births[1], the analysis uses individual firm-level records to track job creation, job retention and job loss over time. The analysis allows us to identify how prevalent job creation is amongst new firms; the extent to which job creation is concentrated within a small group of firms; and how the pattern of job creation compares for firms of differing survival lengths.

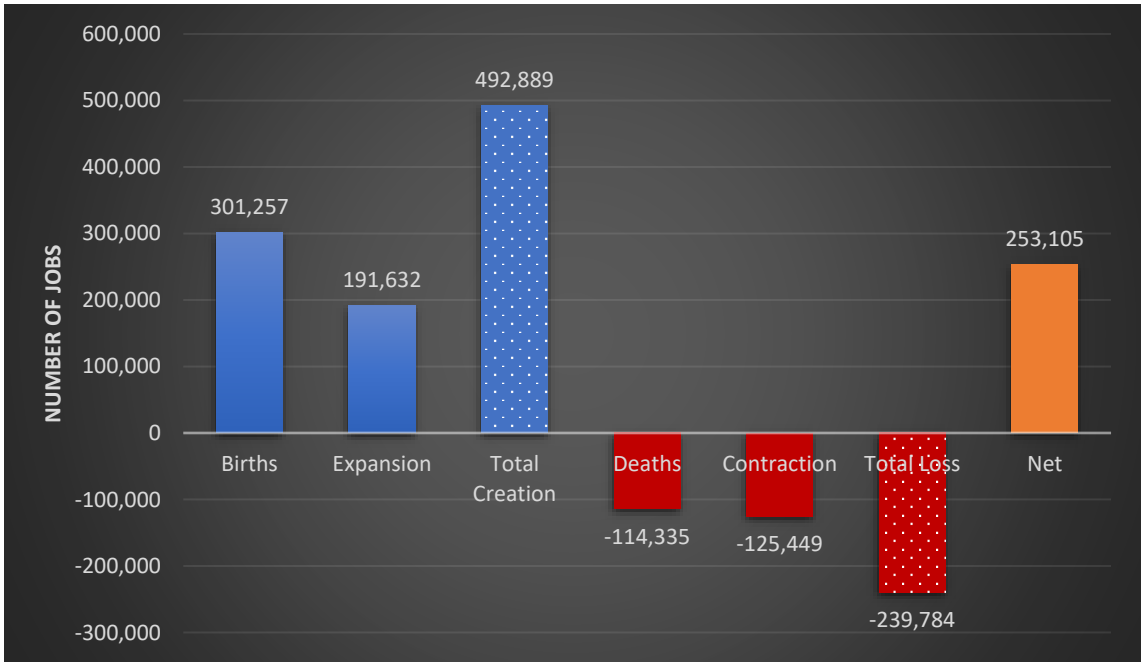
Gross and Net Job Creation

- In total there were 67,628 employer firms born in NI between 2007-21, the majority of which (64%) were in the service sector. Typically, employer businesses are born very small. When averaged across all years the median size at birth for all was 1 employee while the mean was 4.5 employees.

[1] Those with at least 1 employee in their birth year.

- Analysing the gross components of job creation and loss over the entire 2007-21 period for these employer births showed that:
  - Employer births created a total of 301k jobs in the year that they were born.
  - Those firms that survived created a further 192k jobs in total.
  - Those that subsequently died removed 114k, or just under one quarter, of those jobs.
  - Those that survived but contracted resulted in a further loss of 125k jobs.
  - **Overall employer births created just under half a million gross jobs between 2007-21.**
  - **Of those, a total of 240k jobs were lost through contraction or firm death resulting in a net job creation of 253k jobs**.

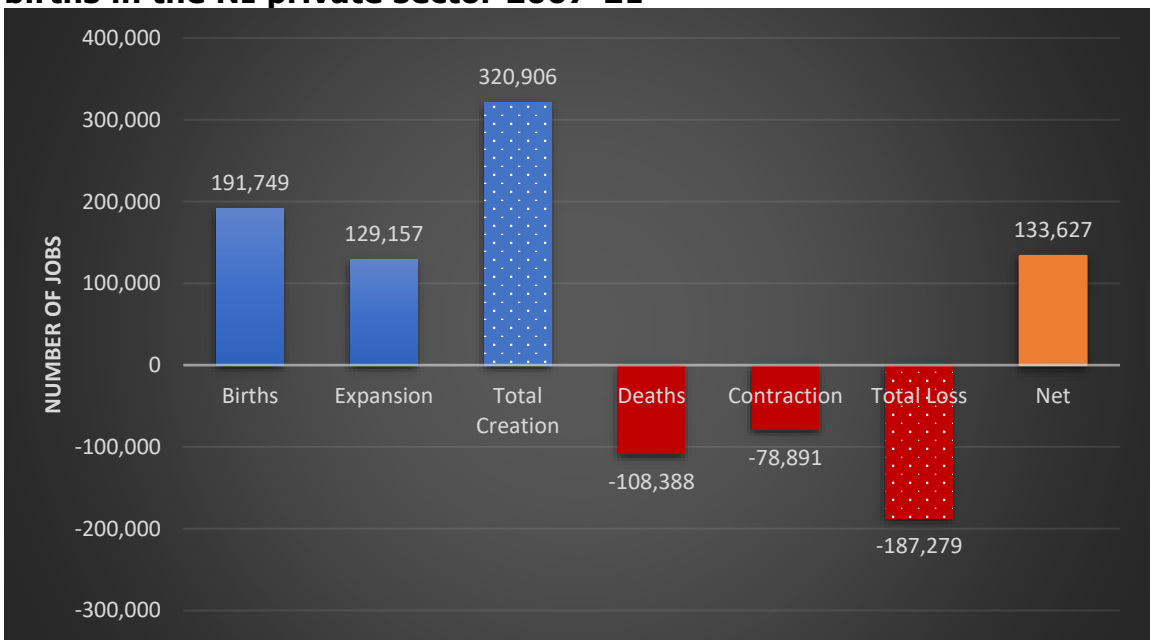
Figure 1: Components of gross job creation and loss in NI employer births 2007-21



Source: UUEPC estimates of the BSD

- When the analysis is restricted to the private sector the results show that:
  - Employer births created a total of 192k jobs in the year that they were born.
  - Those that survived created a further 129k jobs in total.
  - Those that subsequently died removed 108k, or one third, of those jobs.
  - Those that survived but contracted resulted in a further loss of 79k jobs.
  - **Overall employer births in the private sector created over 320k gross jobs between 2007-21.**
  - **Of those, a total of 188k jobs were lost through contraction or firm death resulting in a net job creation of 134k jobs.**

Figure 2: Components of gross job creation and loss in employer births in the NI private sector 2007-21



Source: UUEPC estimates of the BSD

Gross and Net Job Creation by Sector

- Of the net 253,105 jobs created in total in NI by employer births over the 2007-21 period almost half (47%) were created in the public sector, this was followed by private sector services[2] (41%). Combined net jobs created by both comprised 222,000 or 88% of the total[3].

- Analysing the components of gross job creation and loss for the sub—sectors within the broader service sector showed that Accommodation and Food created the largest number of jobs through births, at approx. 35,000 and had the largest gross number of jobs created at almost 52,000. But, due to the high number lost through death and contraction (30,000), it resulted in fewer net jobs created than in Wholesale and Retail. As a result, the largest net number of jobs created was in the Wholesale and Retail sector, at over 23,000.

- Both the Finance and Insurance, and Administration and Support, sectors created more jobs through expansion than they did initially at birth. In the former there were around 2,100 jobs created at birth and a further 2,900 through expansion. Administration and Support created around 13,000 jobs through birth and almost 19,000 in expansion, the largest expansion of all sectors.

- The Transport and Storage and Information and Communication sectors both had approx. 3,000 employer firm births over 2007-21. Their trajectories were also quite similar. The latter created 1,000 more jobs at birth, but both created the same number of jobs, approx. 5,000, through expansion. Although there were differences in gross job loss, overall, the net position was that Information and Communication created an additional 1,000 net jobs than Transport and Storage at 7,722 compared to 6,109 respectively. Despite the similarities it is likely that there are differences within the productivity contributions of these two sectors, with previous UUEPC research on business dynamism[4] indicating that although Transport and Storage had the highest business birth rate in 2021, the productivity of its firm births was lowest of all sectors.

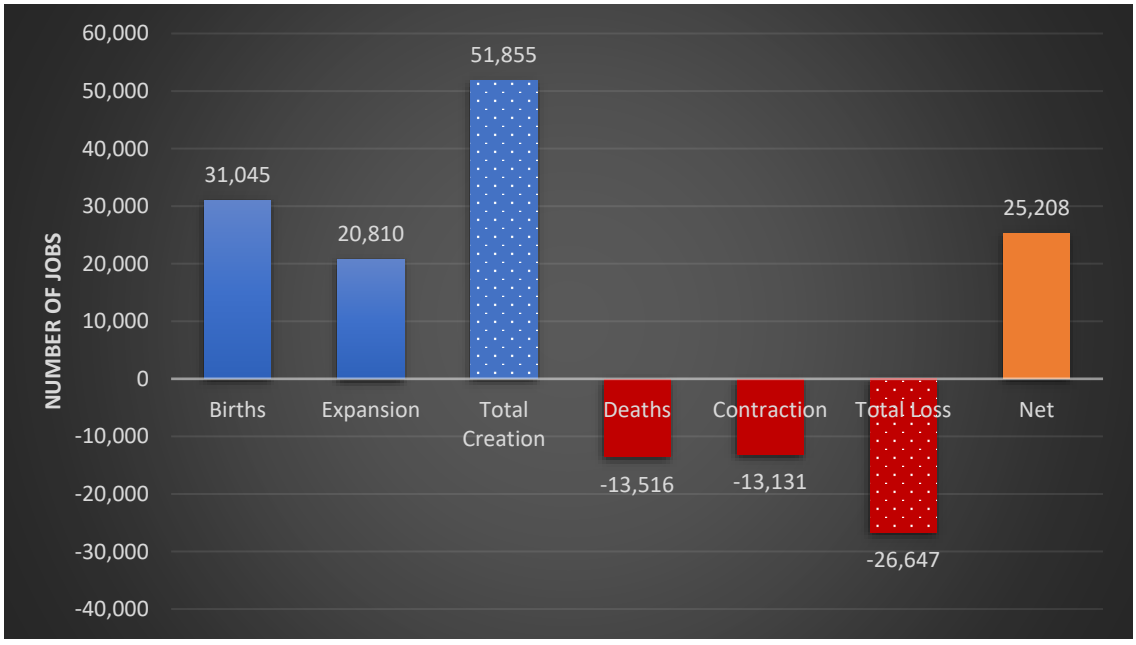
- Arts and Entertainment had an additional 200 employer births compared to Finance and Insurance (1,205 versus 997). But the Arts sector created more than twice as many jobs through those births (5,428

[2] This covers Sections D-N of SIC2007 and includes Electricity, Gas, Water Supply and Waste; Wholesale and Retail; Transport and Storage; Accommodation and Food; Information and Communication; Finance and Insurance; Real Estate; Professional, Scientific and Technical and Administration and Support services.
[3] With Agriculture and Mining, Manufacturing, and Construction comprising the remaining 12%.
[4] Bonner, K., Martin, G. and Donaldson, R. (2023). Business Dynamism in NI: Business births and deaths and implications for productivity, UUEPC.

versus 2,113) and also a higher number through expansion (3,529 versus 2,914). Net, the sector created around 1,000 more jobs overall (3,933 versus 2,945), due to a higher level of job loss through death and contraction.

- There were around 11,000 employer firm births in the 10X priority sectors between 2007-21, of which approximately 5,300 survived to 2021. The survival rate of firms in these sectors combined was higher than for those in the service sector in general, and for those in the wider economy. Combined, a total of almost 52,000 gross jobs were created in those sectors between 2007-21, 60% of which were created via firm births. Just over half of the gross jobs created were subsequently lost via either firm death or the contraction of firms. The result was a net job creation of 25,208 jobs in the 10X sectors by 2021, 10% of all net jobs created in the economy.

Figure 3: Components of gross job creation and loss in employer births in the 10X sectors combined 2007-21



Source: UUEPC estimates of BSD

- The Digital, ICT and Creative sector was the largest of the 10X sectors in terms of employer births and jobs created. With around 7,500 employer firm births in total the sector was responsible for almost 30,000 gross jobs created and 15,000 net jobs, 59% of the 10X total. Previous research on business dynamism by UUEPC[4] suggests that firm births in the ICT sector have higher productivity than the NI average while the sector also has a higher-than-average birth rate suggesting it will play a pivotal role in helping to deliver the 10X Strategy.

- Fintech and Life and Health Sciences were the only two of the 10X sectors whereby there were more jobs created through expansion than through firm births. This is particularly noteworthy for the Fintech sector as it had been noted in previous UUEPC research that the sector has a lower birth rate than average[4].
- The Fintech sector also had the highest job survival rate. Of the total 5,212 gross jobs created, less than half were lost through either contraction or firm death, resulting in a net job creation of just under 3,000 jobs by 2021. This is also important for the wider 10X strategy, and the economy in general, as it has been identified, in the UUEPC research, as having the highest productivity of the NI sectors.

Job Trajectory Analysis

- Analysis was undertaken to track the job trajectories of the employer births over time, splitting them into cohorts dependent on length of survival. Three cohorts of firms that survived and then died, after 3, 5 and 10 years respectively, were analysed along with a cohort of 14-year old survivors that were born in 2007 and still alive in 2021.

- For the majority of firms that survived 3 years, jobs remained static throughout the period i.e. there was no creation or loss and the number of employees that the firm started with is the same as the number throughout the period and in the year they died. Where job creation did occur it was largely between birth and the first year. For the majority of firms who had any job creation, it was a single yearly episode, rather than a continuous trend.

- Although few in number, those with multiple episodes of job creation created the highest average number of jobs in their birth year, at 10 per firm, and added an additional 11 on average by year 3. The analysis suggests that the larger the firm at birth the higher the number of job creation episodes and the higher the number of jobs created.

- For firms surviving five years those with static jobs throughout also accounted for a sizeable minority (38%). Job creation, where it happened, occurred early and most frequently in the year after birth. Where it happened later it was typically preceded, or succeeded, by static jobs. Similar to the previous findings, repeat episodes of job creation were rare.

- Analysing the employment generated by those surviving five years showed similar trends to those identified for the 3-year survivors. Two thirds of firms had no job creation at all over the period. Of those that

did create jobs one episode of job creation was most prevalent with just 4% of firms having 2-3 episodes of job creation over the 5 years. Those with these multiple episodes of job creation were larger in size on start-up, they also created a higher number of jobs on average, with a net 3 jobs per firm created by year 5. For those that created no jobs, there was a net loss of jobs every year before death. For those that had created jobs, there was a net job loss only in the years preceding death.

- Extending the analysis to those surviving ten years showed both a greater variety and permutation of job creation paths. The majority of 10-year survivors had at least one episode of job creation, with 57% experiencing all 3 elements of job creation, static and loss across the ten years. Notably, despite the longer survival period, 15% of firms only had static jobs throughout the whole ten years.

- Although job creation was more common amongst this cohort the largest share of firms (38%) still had only one episode of job creation. Approximately similar shares, of around 30%, had either no job creation at all over the period, or 2-3 episodes of job creation. As previously observed, those with these multiple episodes of job creation were larger in size on start-up, with an average of 4 employees in the birth year compared to 3 employees for those with 1 episode and 2 employees for those with no episodes of job creation. They also created more jobs on average.

- Turning to the cohort with the longest survival length (and who were still alive in 2021) the expectation was that job creation would be highest amongst this group and that they would also have the most frequent episodes of job creation. The majority (87%) of those surviving fourteen years, created jobs at some point over the entire period. Those with multiple episodes of job creation accounted for three fifths of the 14-year cohort of survivors, just over one quarter had one episode. The results affirm previous findings about the positive link between growth and survival. Notably, however, 13% of firms survived the entire period without any episodes of job creation.

- In line with the previously identified trends, repeat episodes of job creation were associated with those that were larger in size on start-up, with an average of 6 employees in the birth year compared to 3 employees for those with one episode and 2 employees for those with no episodes of job creation. They also created more jobs with an additional 12 jobs on average created over the period.

Conclusion and Policy Implications

- Analysis of the timing and consistency of job growth amongst employer firms showed some stable patterns, regardless of length of survival and whether the firms were part of a cohort that survived or that died. Typically, for those that survived up to 10 years, job creation was a rare one-off event which usually occurred early in the firm's lifecycle. Firms that recorded only static jobs represented a relatively large, although diminishing share, from 52% of firms with 3-year survival to 16% of those with 10-year survival. Firms with no episodes of job creation over their lifetime had a net loss of jobs regardless of survival length.

- Longer survival lengths were associated with more growth episodes although the growth trajectories were more idiosyncratic, with the most frequently observed pattern still that of static jobs (although in a minority of firms). Linear consistent growth was therefore a rare occurrence, for example even for those that survived 14 years, the highest number of job creation episodes per firm was six. Multiple episodes of job creation were associated with firms that were larger at birth, while the smallest firms typically had no episodes of job creation within their lifetime.

- Consistent with previous research the overall results point to growth occurring in younger firms with the results showing that the majority of jobs were created in the birth year and that subsequent job creation episodes were more prevalent in the first few years after birth. The results point to any potential policy interventions taking the age and size of firms into consideration rather than necessarily focusing on smaller firms. Indeed, although still meeting the definition of small, those born larger (findings suggested from 4-10 employees) typically had more repeat episodes of job creation and also created more jobs over their lifetime[5] suggesting that they are perhaps less in need of immediate policy intervention, unless it is to support growth at a faster or larger scale.

- The very smallest, those with an average size of 2 employees, were more likely to have no episodes of job creation and actually subsequently decline in size over their lifetime. Without further understanding it would be difficult to suggest any interventions to support job creation amongst this group without the potential for wasted effort and cost if they have been unable to implement job growth through market forces alone.

[5] These firms were found across sectors and were predominantly UK owned (NI ownership could not be distinguished from UK ownership).

- Any interventions may therefore be best focused on those that have static jobs over their lifetime but still manage to survive. Of course, the owners may be content with keeping the business at a constant size but given that for all cohorts those with static jobs throughout accounted for the most commonly observed sequence there may be interventions which could help support growth ambition for this group.

- Any programmes supporting job growth could therefore have entry criteria based on a combination of factors which include characteristics related to the business and its employment history, but also the growth mindset of the owner. This would avoid a strategy of trying to 'pick winners' but simply utilise a combination of criteria and evidence to ensure that, as far as possible, interventions are cost effective and addressing genuine market failure in the pursuit of firm growth.

- Overall the evidence from this and the previous Business Dynamism report should help towards identifying relative strengths and weaknesses in the wider NI entrepreneurial ecosystem. Combined with targeted interventions, such as that identified above, could support the delivery of NI's 10X Strategy which aims to have: *more businesses growing and expanding, more and better job opportunities for all our people, more people entering the labour market and more entrepreneurs taking a chance and starting a business.*

1. Introduction

1.1. It is acknowledged that a small number of firms are typically responsible for most jobs created in an economy. Stretching back to the work of Birch (1979, 1981) it was suggested that it was small rather than larger firms that were responsible for such job creation, with the term 'gazelles' introduced to represent the employment contribution of young fast-growing firms[6].

1.2. Based on this notion of gazelles, there has been a considerable policy focus concentrated on the promotion of such fast-growing firms, often referred to as high growth firms (HGFs) or more recently, scale-ups. This has particularly been the case since the mid-2000s as they were understood to best contribute to job creation in an economy, and even more so after the Great Recession[7]. Our current understanding of high growth firms, however, suggests that they are found across the business population and in fact most of those designated as 'high growth' have high growth episodes rather than a prolonged high growth experience[7]. Indeed, firm growth is thought to be erratic in nature with continuous growth seen as the exception rather than the rule[8].

1.3. To better understand job creation, research has typically focused on establishing the determinants of firm growth. This is usually performed using regression analysis however the explanatory power of such models is low[9]. This suggests that firm-level employment growth and by default, the creation of jobs, is quite complex and related to a range of factors including, amongst others, the business owner's ambition, the firm's resource base, demand for the firm's product/service and the supply of suitably qualified labour.

1.4. As a result of the difficulties in predicting firm growth, attention has recently turned towards analysing *how* firms grow rather than *why*, analysing firms' growth history, or path, to better understand the growth process. Recent studies focusing on either employment trajectories[10] or on sales growth paths[9] have concluded, amongst other findings, that employment growth is relatively flat for the majority of

[6] Birch, David L. (1981). Who Creates Jobs? *The Public Interest* 65, 3-14

[7] Hart, M., Prashar, N., & Ri, A. (2021). From the Cabinet of Curiosities: The misdirection of research and policy debates on small firm growth. *International Small Business Journa*l, 39(1), 3-17.

[8] Bosma, N., & Stam, E. (2012, March). Local policies for high-employment growth enterprises. In Report prepared for the OECD/DBA international workshop on high-growth firms: local policies and local determinants, Copenhagen.

[9] Coad, A., Frankish, J., Roberts, R. and Storey, D. (2013) Growth paths and survival chances: An application of Gambler's Ruin theory. *Journal of Business Venturing*, 28, 615–632.

[10] Anyadike-Danes, M., Hart, M. All grown up? (2018) The fate after 15 years of a quarter of a million UK firms born in 1998. *Journal of Evolutionary Economics*, 28, 45–76.

firms and that growth is 'random'[9]. In Northern Ireland (NI) job creation has been a central policy lever to help grow the economy but to date we know little about the 'how' of firm job creation in terms of when and how often firms generate employment over their lifetime.

1.5. To this end, along with understanding the scale of job creation, this project seeks to understand the job creation history of firms in NI. Assessing the jobs trajectory of cohorts of new businesses started in NI since 2007 enables us to identify the extent of job creation and loss; at what stage in firms' lifecycle job creation occurs and for how long it lasts. The analysis focuses on firms born each year as it enables tracking them through their period of survival, analysing job creation in the period from birth to death, or from birth to 2021 for those still alive at that point.

1.6. Using individual firm-level records, the analysis assesses businesses by birth cohort, to provide evidence on the pattern of job creation, job retention and job loss over time. The analysis allows us to identify how prevalent job creation is amongst new firms; the extent to which job creation is concentrated within a small group of firms; and how the pattern of job creation compares for firms of differing survival lengths.

1.7. The analysis will help close the gap in our understanding of when jobs are created and how often firms are in job creation mode. It will help policymakers understand at what point any policy interventions may be best placed to support firms to grow their employment and ultimately help to achieve the aims of the 10X Strategy.

1.8. Finally, whilst this research focuses on job creation, a previous study by UUEPC on Business Dynamism[11] focusing on those entering and exiting the market determined that NI's economy was less dynamic than other UK regions. NI has had an increasing business churn rate (birth rate plus death rate) since 2010, but it remains lower than other parts of the UK. NI's bottom pole position as a less dynamic economy will also have implications for job creation and so the results of the business dynamism research should be considered complimentary to this research when seeking to understand the broader job creation context.

[11] Bonner, K., Martin, G. and Donaldson, R. (2023). Business Dynamism in NI: Business births and deaths and implications for productivity, UUEPC.

2. Literature Review

Introduction

2.1. The evidence on job creation within firms can be traced back to Robert Gibrat's 1931 examination of French manufacturers which led to the creation of Gibrat's Law[12], suggesting that '…firm growth is a purely random effect and therefore should be independent of firm size' (in Daunfeldt and Elert, 2011). Early research on the topic continued to focus on *who* creates jobs, and despite modest progress on the issue there continues to be conflicting results (Coad et al, 2013). For instance, Birch's seminal research (1979, 1981, 1987) kickstarted the argument that small firms in the US create most employment. Later research by Davis et al. (1996) argued that smaller businesses do not create more net employment when statistical factors such as 'the size distribution fallacy, the confusion between net and gross job creation and the regression to the mean bias' are taken into account. More recent studies by Haltiwanger et al. (2013) and Coad and Karlsson (2022) stress that it is age rather than size that is the vital component, indicating that young firms create most employment, but that young firms are typically smaller.

Size versus age debate

2.2. Since Birch's initial contributions, the debate on job creation has increasingly focused on the statistical or methodological approach used, particularly when trying to identify the type of firms that create jobs. Traditional approaches analysing the size issue have been criticised on the basis that firms are typically allocated to a single size band, irrespective of their previous or subsequent growth (Neumark et al., 2008). Linked to that is the discussion about relative versus absolute growth, with initial size having a positive association with absolute growth and a negative association with relative growth (Davidsson et al. 2006).

2.3. Various approaches to overcome the size classification issue are summarised in de Wit and de Kok (2014) who suggest that a dynamic classification model can be best used to help determine how businesses contribute to net job creation. This model suggests that "job creation or loss should be attributed to the size class to which a firm belongs at the moment that this job creation or loss actually occurs, not a single size class" (pg.285). They suggest that this method is preferable as it can be completed without longitudinal data on employment levels of

[12] This has also become known as the Law of Proportionate Effect.

individual firms. They propose that they only need data on how many firms crossed over size class boundaries to correct the distribution fallacy. Applying this method to EU firms resulted in consensus with Birch's work, that smaller firms create more jobs than larger firms.

2.4. More recently, the age of a business when jobs are created, rather than its size, has emerged as a field of study (Coad and Karlsson, 2021). Haltiwanger et al. (2013) initially contributed to this debate by challenging the popular narrative that small US businesses create more jobs. To conduct their study they utilised data from the US Census Bureau, Longitudinal Business database (LBD)[13], employing Davis et al.'s (1996) size classification method, which calculates the average size of employment, to overcome the problematic regression to the mean issue experienced within other studies[14].

2.5. When assessing whether there is a group of firms that *disproportionately* create jobs, they concluded that it is young firms (births and those below 10 years of age) that play a pinnacle role in job creation and destruction[15]. Their results suggest that without controlling for age there is a 'strong' inverse relationship between firm size and net employment, with the average growth of the smallest firms being 15.2 percentage points above the largest firms (500+ employees). When the average size method is used and age is controlled for, a positive relationship is witnessed between growth and size across all firm size classifications up to 500 employees.

2.6. Overall, they suggest that when age is controlled for "…there is no systematic relationship between firm size and growth" (pg. 347), consequently it is young firms with the largest net job creation. They note that previous data sources did not include the age of a firm, and that young firms also tend to be small. They conclude that the findings of prior studies that attribute job creation to smaller firms may not have identified the link to the age of a firm due to data limitations and may therefore have confounded the issue of size with age.

2.7. Their study also identifies that the share of jobs created and destroyed by firms is roughly the share of their total employment[16] except for start-ups who account for 3% of employment (in a given year) but 20%

[13] LDB micro-data of private non-farm sector with at least one employee. Data is from March to March- this may neglect short lived firms but Haltiwanger et al. suggest that these firms are not vital to this analysis.
[14] To overcome any limitations of firms moving across size classifications a dynamic classification model was developed by the Bureau of Labour Statistics which attributes job gains and losses to each of the size classes that a firm passes through in growth/contraction.
[15] It is noted that business births only contribute to job creation.
[16] Giving the example that mature (aged 10 and over), large firms account for 45% of employment and most job creation and destruction.

of gross job creation. Their results highlight the role of start-ups within the economy suggesting that there is an 'up or out' pattern whereby each wave includes start-ups creating jobs, but due to the high exit rates of start-ups[17] 47% of these jobs are destroyed in the first five years. They suggest that if firms continue to survive it is the youngest that experience the highest net growth. Overall, they suggest that the fastest growing firms are under the age of five.

2.8. This notion that firms under the age of five have the fastest growth correlates with the concept of gazelles. Although Birch (1979) had previously identified gazelles as those firms that grow rapidly (achieving a minimum of 20% sales growth each year over the interval[18]), the OECD definition (Ahmad, 2006) specifically identifies them as HGFs under the age of five[19]. They suggest that high growth businesses will be typically young, partly as a function of the learning and expansion process that young businesses typically undergo before they reach some optimal size or die. Certainly, the evidence on gazelles supports the proposition that a few rapidly growing young firms generate a disproportionately large share of all net new jobs (Henrekson and Johansson, 2010). It is noted that these gazelles are of all sizes, with newness a more important factor than small size.

2.9. A more recent study by Coad and Karlsson (2022) focussing specifically on HGFs further supports the argument on the importance of the young age of the business. They utilise Swedish Register Based and Labor Market Statistics (RAMS) and Firm and Plant Dynamics data[20] from 1990-2016 covering 11 million firm-year observations. Their results indicate that the majority of HGFs are small, young firms and the lowest rate of HGFs are larger firms. Due to the low number of large firms within Sweden[21] they also tested for the share of firms that become HGFs across size and age groups. They conclude that while large firms can experience high growth it typically happens when they are young. In contrast it is old, small firms that experience low growth with old, micro firms in particular being an 'infertile region' for growth.

[17] Some spurious entry and exit may be attributable to legal and administrative actions.
[18] Birch (1995) pg. 46 specifically defines them as "a business establishment which has achieved a minimum of 20% sales growth each year over the interval, starting from a base-year revenue of at least $100,000."
[19] The OECD definition (Ahmad, 2006, pg. 60) is: All enterprises less than 5 years old with average annualised growth in employees greater than 20% per annum, over a three year period, and with 10 or more employees in the beginning of the observation period, should be considered as gazelles.
[20] With 1 employee or more.
[21] Coad and Karlsson (2022) note that according to the European Commission, 94.6% of Swedish firms are micro firms with 0–9 employees.

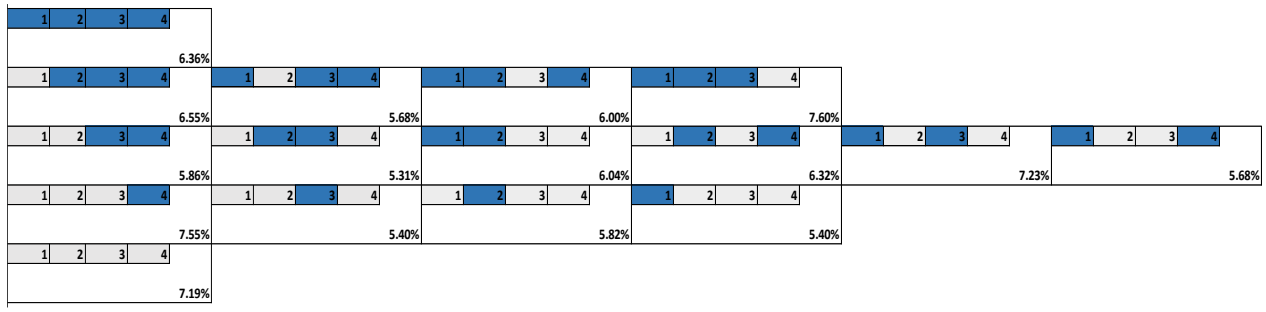
Growth trajectories

2.10. Amidst the continuing debate on job creation, much of the research has now progressed from simply trying to predict why firms grow and instead has focused on when and how firms grow. Coad et al. (2013) aim to understand the regularities of firm growth paths and the impact of firm's start-up size on survival by analysing 6,200 new businesses from 2004 to 2010. Their focus is on business sales, rather than jobs, which they tracked over six years, or until the firm exited[22]. The data was analysed using two theories, firstly the 'Resource Theory' which links resources and capabilities that are time-invariant, such as the education level of the owner or attitude to risk, to successful enterprise performance. The second theory is 'Gambler's Ruin' likening business growth and survival to gambling and chance in which a gambler, or entrepreneur in this case, needs resources from the beginning or 'wins' along the way to succeed. Coad et al. (2013) give the view that gamblers often overestimate their chances of succeeding, suggesting the same for entrepreneurs.

2.11. Within their results they show that sustained above-average growth is rare, with the probability of a new firm growing for four consecutive periods standing at just 7%. Figure 2.1 presents their results highlighting the unpredictable nature of annual growth, with increased sales (relative to the median) depicted in the grey boxes and decreased sales (relative to the median) depicted in the blue boxes. Their outcome emphasises '…the rarity of consistent and linear growth'. They suggest that chance is the dominant component of growth, giving support to the Gambler's Ruin theory. They also find that growth in itself has a positive impact on survival, with longer periods of growth increasing the likelihood of survival.

[22] Coad et al. noted this was beneficial data to understand the business performance before exiting.

Figure 2.1: Growth paths of firms surviving to the end of year 5



	Years in which sales decreased (relative to the median growth rate)
	Years in which sales increased (relative to the median growth rate)
%	Proportion of the sample that experienced each growth path

Source: Coad et al., 2013

Note: Frequencies are shown in each box, if there is no structure in growth rates (i.e a purely random process) each of the 16 growth paths should occur with probability 1/16=6.25%.

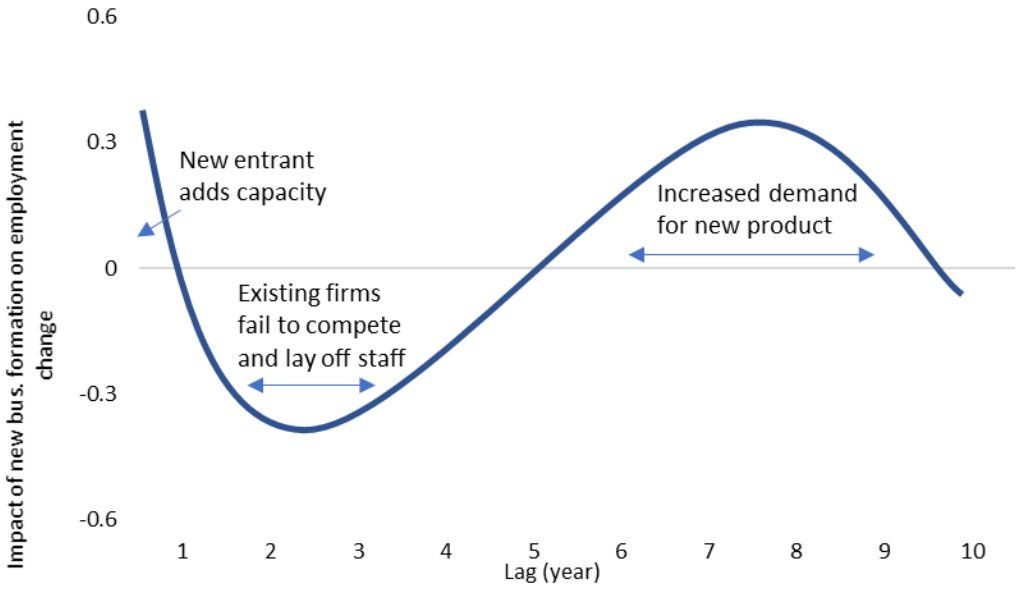
2.12. Tracking job creation over time, rather than sales, has been undertaken less frequently, particularly when using a birth cohort approach. Anyadike-Danes et al., 2015, is one such exception whereby (cross-country) cohorts of firms, born in 1998, are traced over time. Such an approach alleviates the need to categorise firms by either age or size as the cohort is followed from birth to maturity and therefore all firms are the same age, while the size distribution is tracked as the cohort matures.

2.13. Among the key findings, they report that new firms are typically born very small with around 90% of newly born firms having fewer than five employees. Furthermore, relatively few survive for at least ten years, with a survival rate of just 17% in the UK. However, those born in the smallest size-band (1-4 employees) that survive grow fastest with employment growth almost twice that of the largest firms (with 20+ employees). Their findings thus indicate that a very small group of the smallest firms make a disproportionate contribution to job growth, although the group varies in importance across countries and in the pace of growth.

2.14. Although these findings are supportive of earlier work on the importance of small firms as job creators, the authors disagree with the notion proposed earlier by Haltiwanger et al. (2013) of the 'up or out' characteristics of new firms. While only around 10-30% of the initial birth cohort are still in existence ten years later (depending on the country) very few of them are "up" in the sense of having grown in size. Instead, the majority of the survivors are born small and stay small even after 10 years. They refer to this dynamic as "not-up-nor-out" reflecting the lack of growth among the cohort that survive.

2.15. In a similar vein, focusing on the impact on the economy of such job creation among young firms, Fritsch (2008) suggests that ten years after starting, the impact of new business formation on employment ceases, outlining that those jobs generated from entrepreneurs have an 'S' shaped impact (Figure 2.2). Firstly, there is an immediate impact of the employment gain from new businesses in their year of inception. Based on evidence from wider research he then suggests that "employment in entry cohorts tends to be stagnant or decline from the second or the third year onward". This also coincides with the displacement of existing firms. These market selection effects result in increased competitiveness in years 6-10 leading to employment gain but after 10 years the effects on the region's employment fades.

Figure 2.2: New business formation impact on employment



Source: Fritsch (2008)

2.16. Given these recent advances in the debate on who creates jobs Haltiwanger et al. (2013) and Coad and Karlsson (2022) suggest that policy to promote employment growth must account for firm age, rather than solely target firms based on size. They indicate that the barriers young businesses face need to be more deeply understood to help reduce entry and exit volatility for start-ups. These barriers are often overlooked as policy aims to help support small business rather than young business. Coad and Karlsson (2022) consider that old, small firms do not become HGFs because of their routines and informal practices that are difficult to scale up. They also suggest the mature firms may 'game the system' to receive additional, possibly

unnecessary, policy support. As a result, they suggest that any policy on promoting HGFs should be conditional on firm age with support withdrawn from categories of firms where HGFs are least likely to be present.

Job Creation Policy

Enterprise policy, and its role in job creation, can really be seen to have begun in the 1930s as a response to the economic crisis of the time. Although confined to a single paragraph at the end of the 1931 MacMillan Report (MacMillan, 1931), this consideration showed recognition of market failure in terms of business finance, implying that this was, *"not only harming the daily operation of small businesses but also acting as a brake on their business growth: firms are not able to invest and thereby expand, for example, by developing new products, entering new markets or through hiring new employees"* (Mallett and Wapshott, 2020 p.40).

The MacMillan report recommended the need for Government intervention but in the UK focus remained on larger organisations with industrial strategies designed to support their growth and protect employment. It wasn't until the 1970s, when the UK and countries like the US began to see a sharp rise in unemployment, that the concept of small firms' role in job creation really came to prominence.

At that time David Birch (1979) reported his findings on job creation (in the USA). He identified a small group of businesses termed 'gazelles' to denote their fast-moving dynamic nature who had a disproportionate positive impact on job creation. In addition to creating new jobs, Birch argued that their impact was more systemic than just job creation; that is, in driving competitiveness, innovation and capacity through opportunities for other new businesses.

In the recession of the early 1980s the policy focus thus turned to the small business sector as a source of new jobs. In addition to the creation of wealth and net new jobs, the promotion of an enterprise culture was further seen as a way of tackling multiple disadvantage in communities, many of which had been badly hit by the demise of traditional large industries such as mining and ship building. This policy focus on small firms continued and by the late 1990s, in the UK and across advanced economies, entrepreneurship policy can be seen to be firmly embedded. Policy makers accepted the promotion of 'enterprise' and the promotion of 'enterprising culture' as beneficial to the economy and to society not least to generate increased prosperity, increase innovation and create jobs.

Throughout this period, there was a growing acceptance of the need to support small businesses and to focus on the creation of high-quality new businesses as a major contribution to economic growth. In particular 'high quality' new enterprises and 'potential growth firms' (Gavron et al., 1998, p24) were seen as major contributors to economic growth through job creation (in the context of high unemployment and areas of deprivation), innovation, exports (in the context of balance of trade challenges) and economic adaptation.

The Global Financial Crisis resulted in a resurgence of support for small firms and enterprise. The primary concerns were in ensuring access to finance as bank lending and other forms of finance became constrained along with a concern to effectively support new and small business who were viewed as central to economic recovery. Unlike the 1980 recession, however, the focus was now on HGFs as a strategy for creating new jobs and fostering economic recovery rather than the small firm sector in general (Mason et al., 2015). Although a focus on high growth prevails, the emphasis has shifted towards scaling up, with a recognition that high growth may be an isolated episode but that this small group of scalers plays an outsized role in job creation.

3. Data and Methodology

Data

3.1. The underlying dataset used for the analysis is the Business Structure Database (BSD). The BSD is derived primarily from the *Inter-Departmental Business Register* (IDBR), which is the UK's live business register. The IDBR is comprised of data collected by HM Revenue and Customs via VAT and Pay As You Earn (PAYE) records. The IDBR data are also complimented with data from Office of National Statistics (ONS) business surveys. If a business is liable for VAT (turnover exceeds the VAT threshold) and/or has at least one member of staff registered for the PAYE tax collection system, then the business will appear on the IDBR (and hence the BSD)[23,24].

3.2. The ONS created the BSD to provide a version of the IDBR for research purposes. They take an annual 'snapshot' of the IDBR around April each year and deposit that with the UK Data Service for approved researchers to access[25]. In 2004 it was estimated that the businesses listed on the IDBR accounted for almost 99 per cent of economic activity in the UK. Only very small businesses, such as the self-employed, are therefore not found on the IDBR/BSD.

3.3. Given that the BSD covers the full registered business population and is available on an annual basis, it represents the most comprehensive dataset on which to undertake this analysis. The data is anonymised however each firm is allocated a unique reference ID number which remains consistent over time. Combining all the annual datasets together to build a longitudinal database therefore enables the tracking of each individual firm's record across time.

3.4. The variables on the BSD dataset, for each firm, include turnover, employees, sector, ownership, birth, death, legal status and geographical indicators. The BSD data is available from 1997 onwards however for the purpose of this analysis, data from 2007-2021 has been utilised to provide a more timely assessment.

[23] https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=6697

[24] Note: the use of these data does not imply the endorsement of the data owner or the UK Data Service at the UK Data Archive in relation to the interpretation or analysis of the data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

[25] Researchers requiring to use the BSD for research purposes must first complete the training to become an 'approved researcher' and must separately make a project application to the ONS detailing the proposed objectives, methodology, outputs and public good aspect of the project.

3.5. As the research is focused on job creation the dataset has been restricted to those firms that are born with at least one employee (employer births) and who are located in the NI Government Office Region (GOR). Enterprises are assigned to a GOR based on the enterprise postcode which is typically the location of their UK head office. As a result of the regional allocation of enterprises there is a likelihood that some of the job creation in the subsequent analysis does not occur in NI (if the enterprise has sites elsewhere in the UK). Most enterprises, however, do not have multiple sites, with the ONS estimating that single-site businesses represent approximately 98% of all businesses in the UK[26].

Method

3.6. The first element of the analysis is to understand job creation and loss both in gross and net terms. Gross job creation occurs either through the birth of a firm (birth) or when an existing firm adds one or more employees (expansion). Similarly gross job loss occurs either through firm exit (death) or when an existing firm reduces the number of its employees (contraction). The net position reflects the overall difference between total gross job creation and total gross job loss. Accounting for the gross elements allows for a better understanding of how much job creation/loss is accounted for by firm births/deaths compared to expansion/contraction of existing firms.

3.7. Having analysed the total number of jobs created, the second element of the analysis is to understand the history, or path, of firms' job creation and loss over time. To do so we utilise a sequence analysis methodology. Sequence analysis was originally developed in the computer science field as a way to detect dissimilarities between long strings of codes and was subsequently adopted by biocomputing for gene analysis, comparing DNA strings and assessing their degree of dissimilarity (Blanchard, 2011). The methodology has been more recently adopted in the field of social sciences, for example, to analyse career trajectories, or the transition of individuals from education or joblessness to work.

3.8. Sequences are essentially a series of events or stages in the trajectory of statistical units. In our case the statistical unit is that of the firm and the sequences represent the categorical stages related to the jobs position in any year over a particular time period. We adopt 3 job-

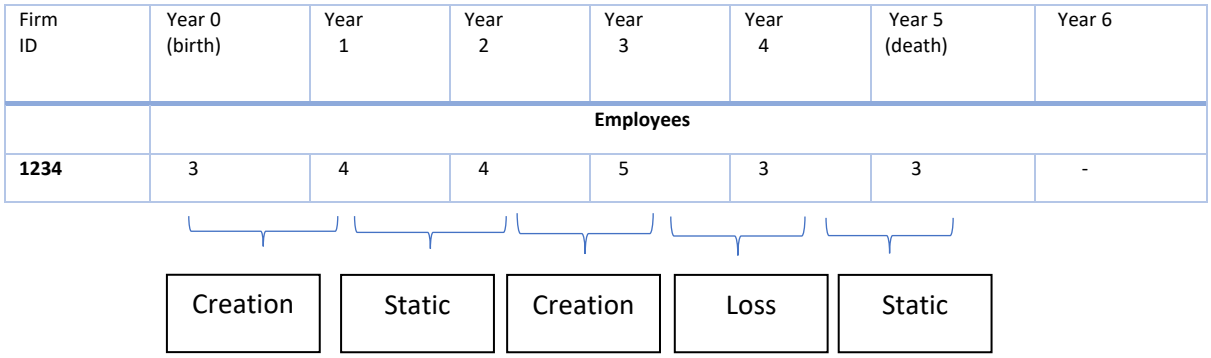
[26] https://www.ons.gov.uk/businessindustryandtrade/business/businessservices/articles/businessinsightsandimpactontheukandsubnationaleconomy/february2022

related states in which a firm can be present in, in any year, relative to the previous year: job creation (whereby the number of employees is higher than the previous year); job loss (whereby the number of employees is lower than the previous year) or jobs retained (whereby the number of employees remains static compared to the previous year). We denote each of these three states with an alphabetical representation, whereby:

- Job creation (denoted as C)
- Job retention/static (denoted as S)
- Job loss (denoted as L)

3.9. If we imagine a firm born in a particular year, surviving for 5 successive years, and exiting the market (dying) by end of year 5 we would have 6 years worth of employee figures and 5 individual annual states relating to the jobs position that the firm could have. Figure 3.1 shows an example, displaying the absolute number of employees in the firm each year of existence, and subsequently the job-related states. If the firm dies in year 5 it no longer appears on the dataset for year 6 and hence the jobs in year 5 also disappear.

Figure 3.1: Employees and associated annual job-related states



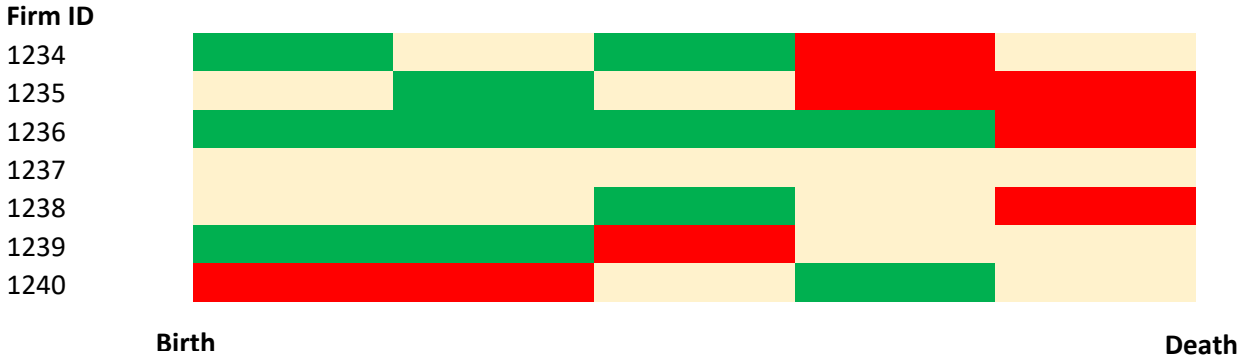
3.10. In the example from Figure 3.1, if we were to only analyse the birth and death year figures, we would conclude that no job creation had taken place as the number of employees was 3 in both years. This sequence analysis therefore allows us to see the underlying annual components across the firm's lifetime. The above sequence of creation–static–creation–loss–static would therefore be represented as C-S-C-L-S, to represent each of the annual states of job creation (C), static (S) and loss (L). Repeating that for each firm born in that year gives us the full range of job-related sequences for that cohort of firms, which we can represent graphically. Given the differing survival lengths for firms born in the same year it is better to group together those with the same survival lengths in order to best understand the patterns of job creation and loss. An example of how the employee numbers translate into their

respective sequences is shown in the example in Table 3.1 below. These can be then visually represented by colour coding the three job states, as per Figure 3.2 below, where green=job creation, beige=static, red=job loss. This helps to demonstrate when and how often each firm is in job creation, loss or static mode.

Table 3.1: Example of annual employee numbers by firm (left-hand side) and associated annual job-related states (right-hand side)

Firm ID	Birth	Year 1	Year 2	Year 3	Year 4	Death		Firm ID	Year 1	Year 2	Year 3	Year 4	Death
	Emp	Emp	Emp	Emp	Emp	Emp			State	State	State	State	State
1234	3	4	4	5	3	3		1234	C	S	C	L	S
1235	2	2	3	3	2	1		1235	S	C	S	L	L
1236	2	3	4	5	6	5		1236	C	C	C	C	L
1237	3	3	3	3	3	3		1237	S	S	S	S	S
1238	1	1	1	3	3	2		1238	S	S	C	S	L
1239	5	7	9	8	8	8		1239	C	C	L	S	S
1240	3	2	1	1	2	2		1240	L	L	S	C	S

Figure 3.2: Example of annual job-related states per firm



Where green=job creation, beige=static jobs, red=job loss

3.11. We repeat this type of sequencing for businesses within each cohort of firms born each year and undertake the analysis for those surviving different time periods e.g. 5 years, 10 years etc. Obviously as the survival period increases the sequences become longer, and the number of potential permutations increases.

3.12. By analysing the sequences some of the questions we can answer to gain a fuller understanding include:

- How prevalent job creation is amongst the cohort.
- What are the most dominant pattern of sequences.
- Whether job creation happens intermittingly over a firm's lifecycle.

- Whether job creation its more common at the start, middle or end of a firm’s lifecycle.
- Whether job creation typologies differ by length of survival.

4. Job Creation and Loss

4.1. Prior to analysing firms job creation sequences, or paths, it is important to understand the extent of job creation (and loss) amongst the cohorts of employer businesses born each year. As outlined earlier we focus on those born annually from 2007 onwards. Table 4.1 displays the annual number of employer births by broad sector upon which the subsequent analysis is based. In total there were 67,628 employer firms born altogether between 2007-21, the majority of which (64%) were in the (private) services[27] sector.

Table 4.1: No. of employer births by broad sector, NI, 2007-2021

	Agriculture & Mining	Manufacturing	Construction	Private Sector Services	Public Sector	Total
2007	353	277	1303	2,769	383	5,085
2008	969	206	1333	2,803	178	5,489
2009	572	200	850	2,544	151	4,317
2010	476	144	473	1,872	134	3,099
2011	312	217	545	2,572	194	3,840
2012	245	171	472	2,039	153	3,080
2013	271	216	493	2,708	163	3,851
2014	323	262	893	2,951	203	4,632
2015	290	288	652	2,936	224	4,390
2016	217	314	809	3,061	217	4,618
2017	227	412	908	3,697	244	5,488
2018	201	287	760	3,208	194	4,650
2019	264	381	903	3,415	153	5,116
2020	233	391	766	3,644	196	5,230
2021	258	319	695	3,266	205	4,743
Total	5,211	4,085	11,855	43,485	2,992	67,628

Source: UUEPC estimates of the BSD

4.2. Table 4.2 indicates that these employer businesses are born very small. When averaged across all years the median size at birth for all was 1 employee while the mean was 4.5 employees. The public sector is an outlier in that the mean size at birth was 36.6 employees however this category includes Health, Education and Public Administration, and

[27] The Private Services sector includes Electricity, Gas, Water Supply and Waste; Wholesale and Retail; Transport and Storage; Accommodation and Food; Information and Communication; Finance and Insurance; Real Estate; Professional, Scientific and Technical and Administration and Support. The Public Sector category includes the Public Administration, Education and Health sectors.

therefore it would be expected that the average size in the birth year would be larger than for private sector firms.

Table 4.2: Average size (employees) of employer births in birth year

	Agriculture & Mining	Manufacturing	Construction	Private Sector Services	Public Sector	Total
Mean	2.6	3.6	2.2	3.2	36.6	4.5
Median	1	1	1	1	1	1

Source: UUEPC estimates of the BSD

4.3. Of the total 67,628 employer births born between 2007-21, 56% or just under 38k had died by 2021 (Table 4.3). This left 29,700 (44%) of those firms still in existence in 2021. Of the broad sectors the survival rate was highest in the public sector, with half still alive in 2021, unsurprising given the nature of its activities[28]. Just under half of Manufacturing firms also survived to 2021. Agriculture and Mining had the lowest survival rate with less than one third of the employer births still in existence in 2021.

Table 4.3: Number of births, deaths, net entry and survival rates by sector 2007-21

	Agriculture & Mining	Manufacturing	Construction	Private Sector Services	Public Sector	Total
Births	5,211	4,085	11,855	43,485	2,992	67,628
Deaths	-3,570	-2,096	-7,206	-23,554	-1,502	-37,928
Net entry	1,641	1,989	4,649	19,931	1,490	29,700
Survival rate %	31.5	48.7	39.2	45.8	49.8	43.9

Source: UUEPC estimates of the BSD

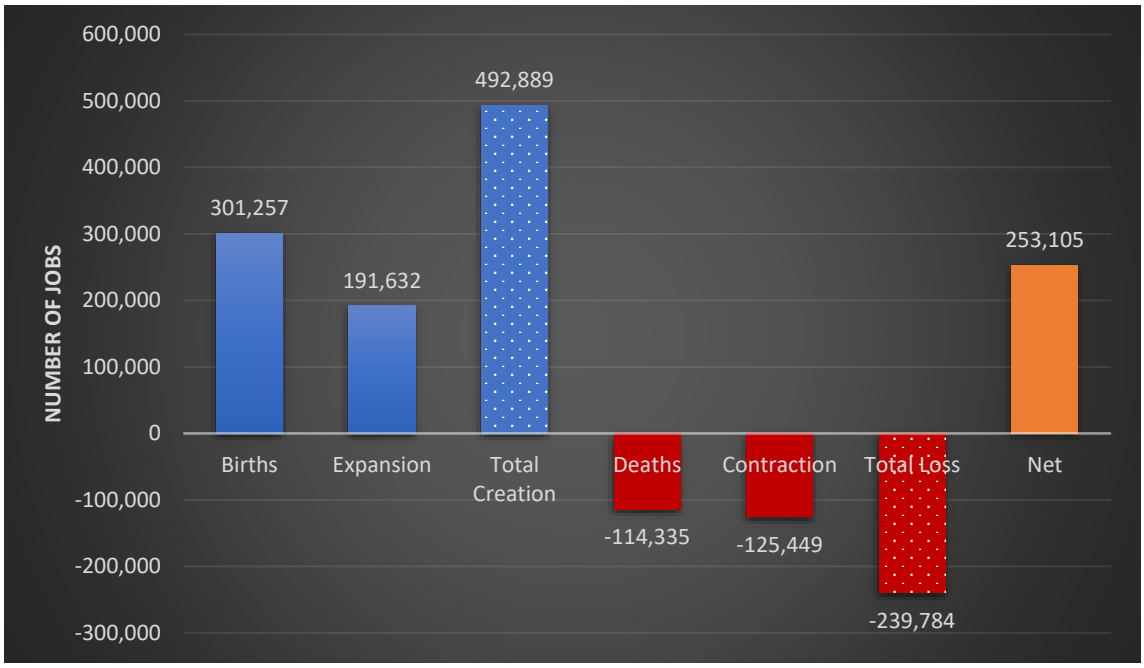
4.4. Figure 4.1 displays the gross components of job creation and destruction amongst those 67,628 firms that were born between 2007-21 (including during their period of survival). It shows that in total in NI:

- The employer births created a total of 301k jobs in the year that they were born (births).
- Those that survived created a further 192k jobs in total (expansion).
- Those that subsequently died removed 114,335, or just under one quarter, of those jobs (deaths).
- Those that survived but contracted resulted in a further loss of 125k jobs (contraction).
- ***Overall employer births created just under half a million gross jobs between 2007-21.***

[28] Previous UUEPC research analysing business dynamism also found that Health had the lowest business death rate in all bar one year from 2010-2021 supporting the idea that the public sector has higher survival rates.

- ***Of those, a total of 240k jobs were lost through contraction or firm death.***
- ***The net job creation by 2021 of those employer firms born since 2007 was 253k jobs.***

Figure 4.1: Components of gross job creation and loss in NI employer births 2007-21



Source: UUEPC estimates of the BSD

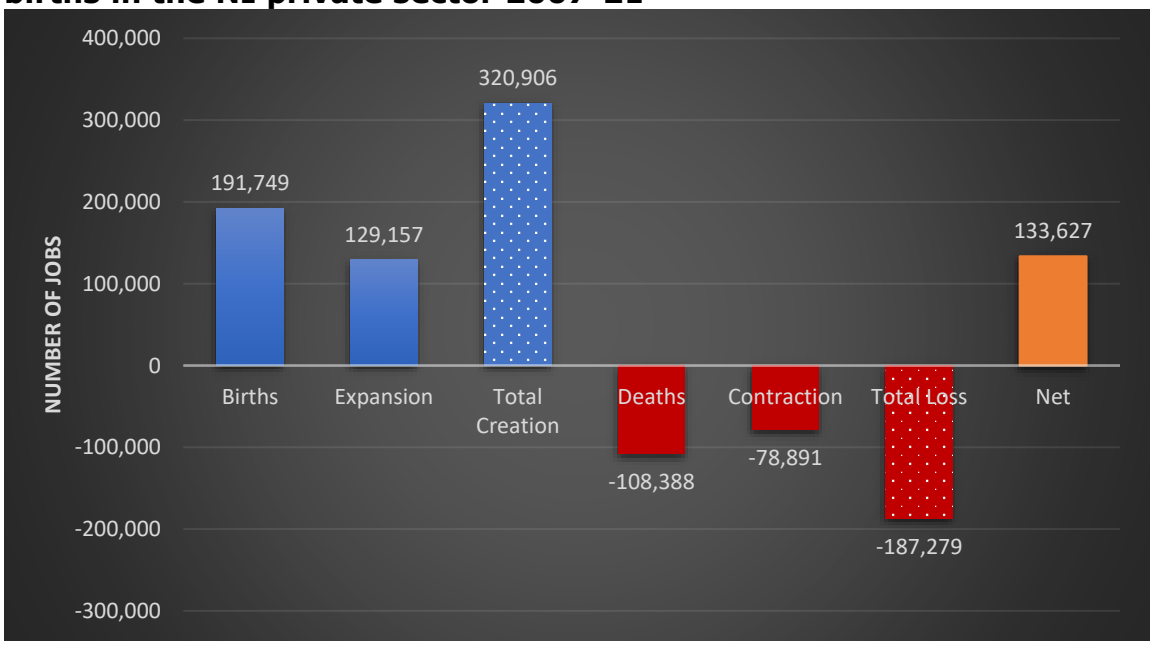
4.5. The results indicate that the majority of jobs created in new employer firms were during the year of start-up and although additional jobs were subsequently created via expansion this equated to only 64% of the number of jobs created at birth. Naturally, not all firms survive and although only 44% of those born since 2007 survived to 2021, the job losses via firm deaths represented the smallest component of the total job losses. In fact, job loss via the contraction of these firms accounted for 11,000 more losses than through firm deaths overall.

4.6. Recreating Figure 4.1 above with the public sector component excluded enables an analysis of job creation within the private sector. As was the case for the whole economy, jobs created by private sector firms in the year of their birth account for the largest component of total jobs created. Where the private sector differs, from the whole economy, is that the largest share of jobs lost is via firm death rather than contraction. Here 58% of the total jobs that were lost were due to death which compares to 48% when the entire economy is considered.

4.7. Figure 4.2 shows that employer births in the NI private sector:
- Created a total of 192k jobs in the year that they were born (births).

- Those that survived created a further 129k jobs in total (expansion).
- Those that subsequently died removed 108k, or one third, of those jobs (deaths).
- Those that survived but contracted resulted in a further loss of 79k jobs (contraction).
- ***Overall employer births in the private sector created over 320k gross jobs between 2007-21.***
- ***Of those, a total of 188k jobs were lost through contraction or firm death.***
- ***The net job creation by 2021 of those employer firms born in the private sector since 2007 was 134k jobs.***

Figure 4.2: Components of gross job creation and loss in employer births in the NI private sector 2007-21

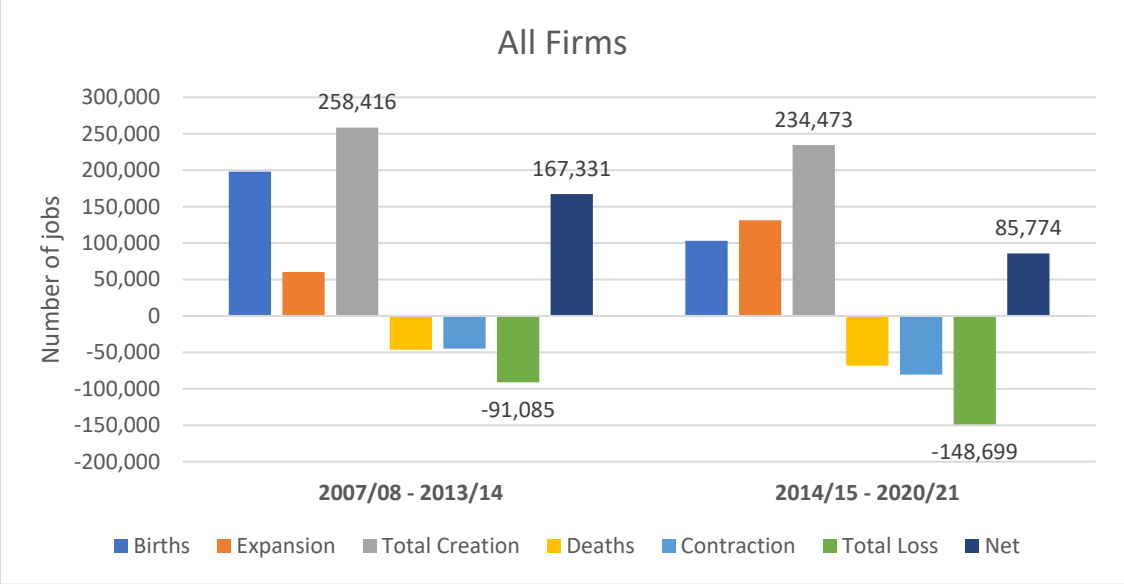


Source: UUEPC estimates of the BSD

Time-period Analysis

4.8. Splitting the analysis into two discrete 7-year time periods shows a difference in terms of the gross components of job creation, and between the private and public sector. For all firms, job creation, both gross and net, was higher during the 2007/08 – 2013/14 period than during 2014/15 – 2020/21 (Figure 4.3). There were almost 200,000 jobs created via births in the former period but only another 60,000 created via expansion. In contrast, in the latter period there were half as many jobs created via births, at around 100,000, with a higher number consequently created through expansion, around 134,000. Job losses through both contraction and death were also higher during 2014/15 – 2020/21. As a result, at 167,000, there were almost twice as many net jobs created in 2007/08 – 2013/14 compared to the latter period, at 86,000.

Figure 4.3: Components of gross job creation and loss in employer births 2007/08–2013/14 and 2014/15 – 2020/21



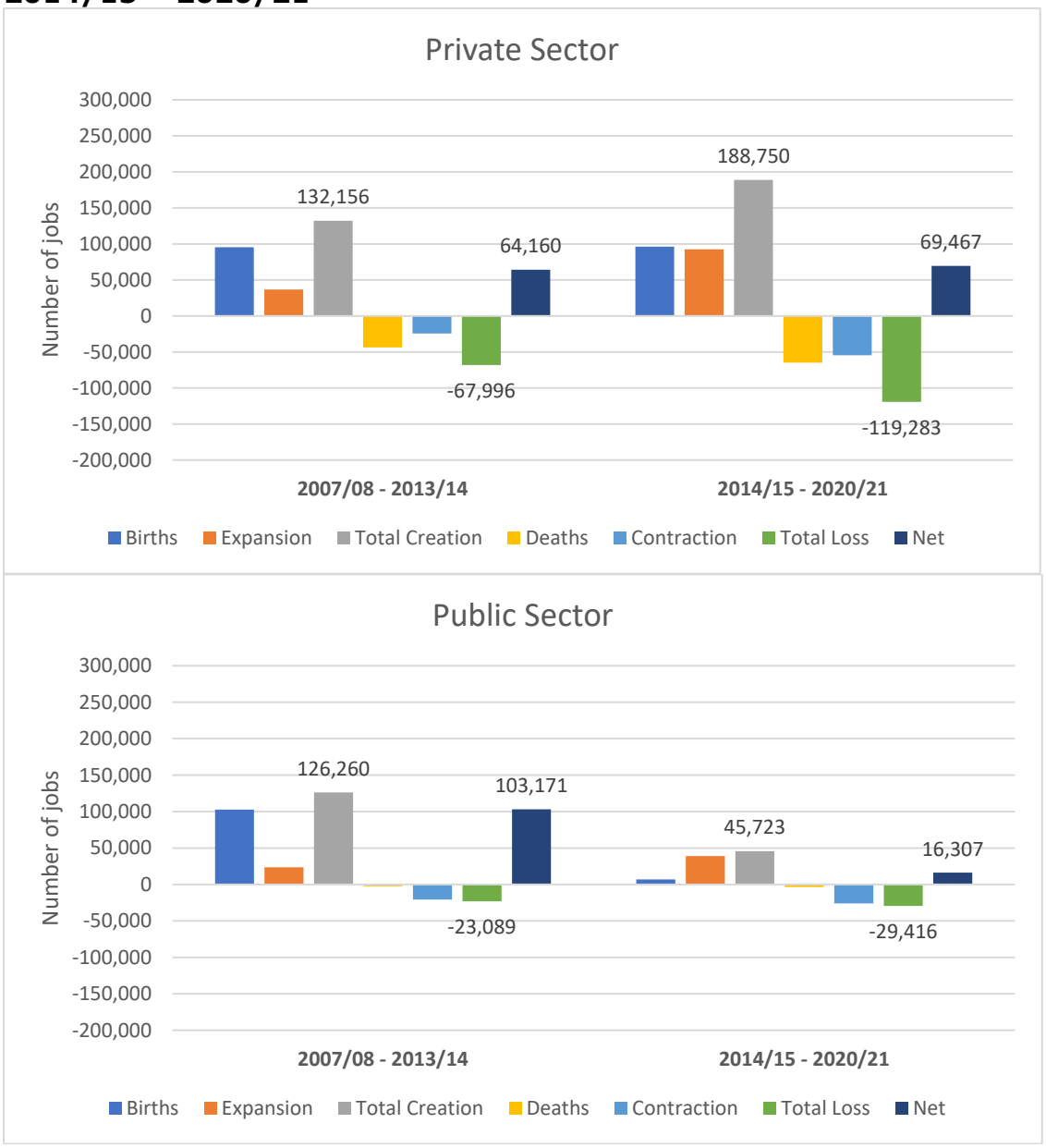
Source: UUEPC estimates of the BSD

4.9. The private sector and public sector operated quite differently during these two periods. For the private sector, and as before, there were a higher number of jobs created via births than expansion during 2007/08 – 2013/14, however jobs created via birth and expansion were more evenly balanced during the latter period, at just under 100,000 each (Figure 4.4). Despite the fact that job losses were higher during this 2014/15 – 2020/21 period the private sector created slightly more net jobs in this period (69,000) than in the previous (64,000).

4.10. Job creation in the public sector contrasted with that of the private sector quite significantly (Figure 4.4). In fact, there were over 100,000 net jobs created in the public sector during 2007/08 – 2013/14 but just 16,000 during 2014/15 – 2020/21. As with the private sector, jobs created via births were primarily responsible for the job creation in the earlier period. But between 2014/15 – 2020/21 the majority of the job creation was via expansion, with fewer than 7,000 jobs created via births.

4.11. Overall, the private sector created more gross jobs than the public sector during 2007/08 – 2013/14 but due to higher losses through death and contraction net job creation was lower. As a result, the public sector was responsible for the majority of job creation in the economy during 2007/08 – 2013/14 but the private sector drove job creation in the more recent period since 2014.

Figure 4.4: Components of gross job creation and loss in employer births in the private and public sector 2007/08–2013/14 and 2014/15 – 2020/21



Source: UUEPC estimates of the BSD

Sectoral Analysis

4.12. Replicating the job creation analysis for each broad sector shows some key differences to the overall picture, and also in the relative contributions of the gross components (Figure 4.5). Of the net 253,105 jobs created in NI by employer births over the 2007-21 period the largest share (47%) was created by the public sector, this was followed by the private *service* sector[29] (41%). Combined net jobs created by both comprised 222,000 or 88% of the total[30].

4.13. In all sectors the total jobs created outweighed those lost but this was particularly the case in the public sector. Here the number of jobs lost due to firm death was just 6,000 despite the fact that half the firms died, suggesting that those that died were smaller organisations.

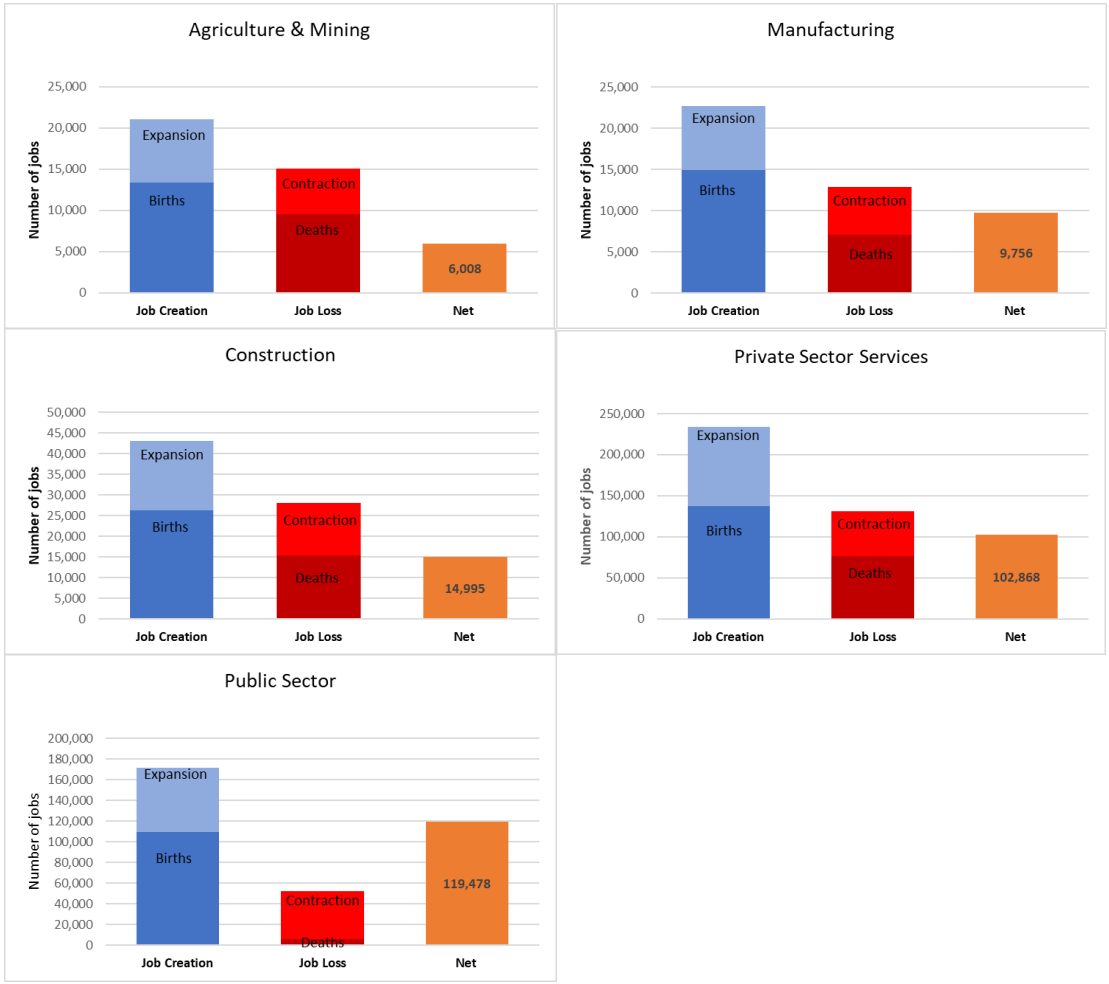
4.14. Relative to the total jobs created, job losses via contraction in the public sector were also relatively low, with total job losses in the sector less than one third of the total created. This sector was the only one in which job losses via contraction outweighed those lost through firm death. In absolute and relative terms this sector also had the highest net job creation over the period (Fig. 4.5).

4.15. Relatively speaking, the private services sector was most successful in creating jobs through expansion than any other sector. A total of 97,000 jobs were created via firms expanding which equated to around 70% of the number of jobs created at birth.

4.16. The Agriculture and Mining, and Construction sectors were the only two in which total job losses exceeded the number of jobs initially created by births. With an overall net job creation of 6,008, the Agriculture and Mining sector had the lowest ratio of net to gross job creation at just 29%. As previously outlined, the public sector had the highest ratio, with net jobs created equating to 69% of the gross figure.

[29] This covers Sections D-N of SIC2007 and includes Electricity, Gas, Water Supply and Waste; Wholesale and Retail; Transport and Storage; Accommodation and Food; Information and Communication; Finance and Insurance; Real Estate; Professional, Scientific and Technical and Administration and Support services.
[30] With Agriculture and Mining, Manufacturing, and Construction comprising the remaining 12%.

Figure 4.5: Components of gross job creation and loss in employer births by broad sector 2007-21



Source: UUEPC estimates of the BSD

4.17. Given that private sector services contributed over 100,000 net jobs, they can further be disaggregated into some of their key sub-sectors. Table 4.4 shows that Wholesale and Retail comprised the largest individual sectoral number of employer firm births, accounting for just under one quarter of the total but had a survival rate of just 45.3%. The highest survival rate was in the Professional and Scientific sector where half of all firms survived although they comprised just 7,098 or 16% of births in the private service sector.

Table 4.4: Number of births, deaths, net entry and survival rates within private sector services 2007-21

	Wholesale & Retail	Transport & Storage	Accomm & Food	Info & Comms	Finance & Insurance	Prof & Scientific	Admin & Support	Arts & Entertainment	Other[31]	Total
Births	10,466	2,952	5,716	3,252	997	7,098	4,153	1,205	7,646	43,485
Deaths	-5,724	-1,532	-3,390	-1,667	-516	-3,523	-2,193	-608	-4,401	-23,554
Net entry	4,742	1,420	2,326	1,585	481	3,575	1,960	597	3,245	19,931
Survival rate %	45.3	48.1	40.7	48.7	48.2	50.4	47.2	49.5	42.4	45.8

Source: UUEPC estimates of BSD

4.18. Analysing the components of gross job creation and loss for these sub—sectors (Figure 4.6) shows that Accommodation and Food created the largest number of jobs through births, at approx. 35,000 and had the largest gross number of jobs created at almost 52,000. But due to the high number lost through death and contraction (30,000) it resulted in fewer net jobs created than in Wholesale and Retail. As a result, the largest net number of jobs created was in the Wholesale and Retail sector, at over 23,000.

4.19. Notably, both the Finance and Insurance, and Administration and Support sectors created more jobs through expansion than they did initially at birth. In the former there were around 2,100 jobs created at birth and a further 2,900 through expansion. Administration and Support created around 13,000 jobs through birth and almost 19,000 in expansion, the largest expansion of all sectors.

4.20. The Transport and Storage and Information and Communication sectors both had approx. 3,000 employer firm births over 2007-21. Their trajectories were quite similar. The latter created 1,000 more jobs at birth, but both created the same number of jobs, approx. 5,000, through expansion. Transport and Storage lost more jobs through deaths, but fewer through contraction than Information and Communication. As a result, Information and Communication created an additional 1,000 net jobs than Transport and Storage at 7,722 compared to 6,109 respectively. Despite the similarities it is likely that there are differences within the productivity contributions of these two sectors, with previous UUEPC research on business dynamism indicating that although Transport and Storage had the highest business birth rate in 2021, the productivity of its firm births was lowest of all sectors[32].

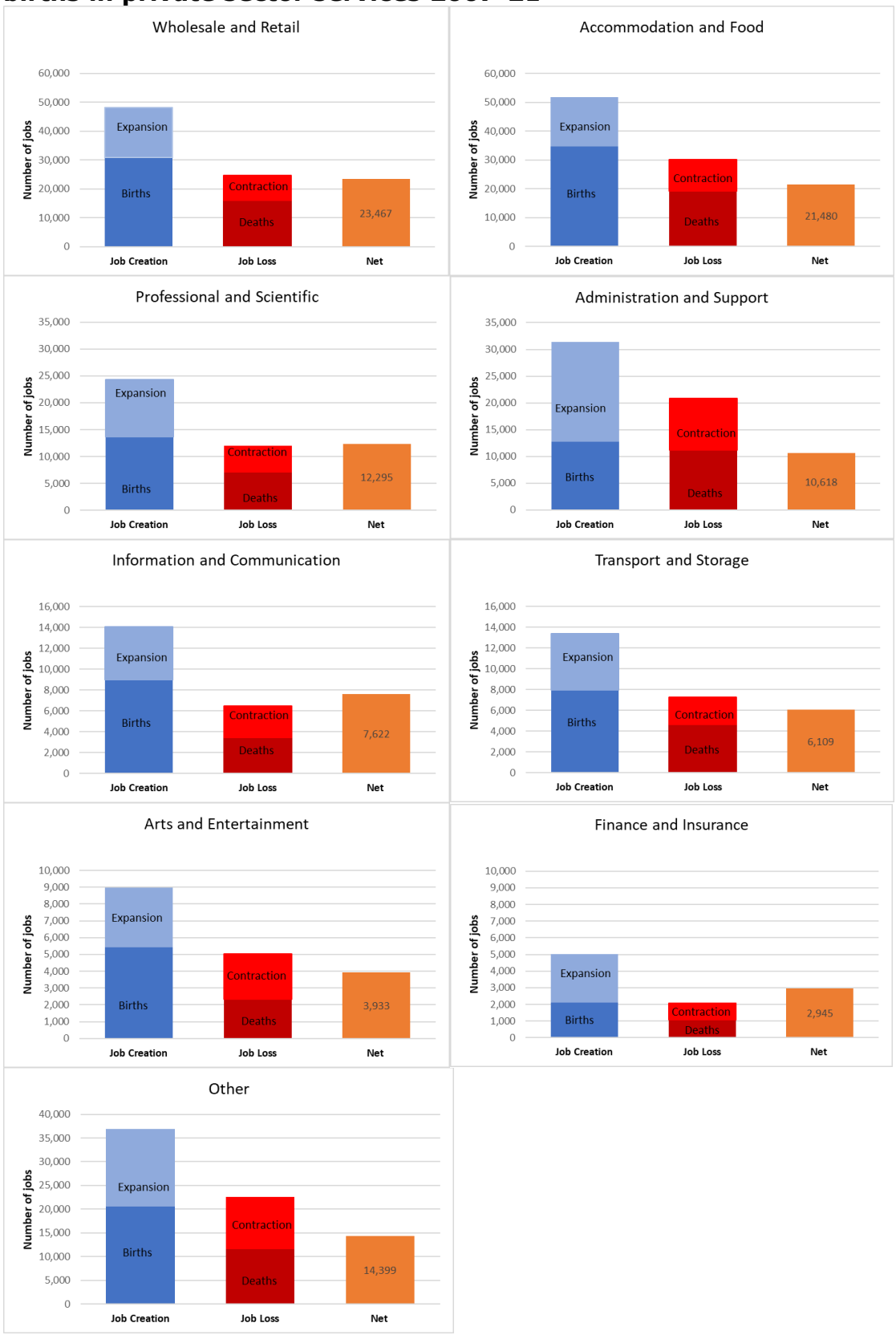
4.21. Arts and Entertainment had an additional 200 employer births compared to Finance and Insurance (1,205 versus 997). But the Arts sector

[31] The Other category contains Electricity, Gas, Steam and Water; Real Estate, Other Service Activities.

[32] Bonner, K., Martin, G. and Donaldson, R. (2023). Business Dynamism in NI: Business births and deaths and implications for productivity, UUEPC.

created more than twice as many jobs through those births (5,428 versus 2,113) and also a higher number through expansion (3,529 versus 2,914). Net, the sector created around 1,000 more jobs overall however (3,933 versus 2,945) due to a higher level of job loss through death and contraction.

Figure 4.6: Components of gross job creation and loss in employer births in private sector services 2007-21



Source: UUEPC estimates of the BSD

10X Sectoral Analysis

4.22. The 10X strategy[33] set out five priority clusters in which NI has seen capability and capacity emerge. These emerging specialisations include Digital, ICT and Creative industries; Agri-tech; Fintech/Financial Services; Advanced Manufacturing and Engineering, and Life and Health Sciences[34]. A separate analysis was run on these sectors to gauge the extent of job creation and loss since 2007. Classification of firms into these sectors was based on their 2-digit SIC2007 codes. Appendix one provides the SIC codes used as an approximation for these sectors which are based on the sectoral definitions as per the NI Skills Barometer[35].

4.23. Table 4.5 shows that there was a total of 11,023 employer firm births in the 10X sectors between 2007-21. Of those, just over half had died by 2021 with the remaining 5,317 representing a survival rate of 48.2%. This survival rate was higher than that previously identified for firms in private sector services (45.8%) and for all firms in the economy (43.9%). Digital, ICT and Creative comprised the largest individual sectoral grouping with almost 7,500 births, 68% of the total. The highest survival rate was in the Life and Health Sciences sector where almost 60% of firms survived, although this is the smallest of the 10X sectors.

Table 4.5: Number of births, deaths, net entry and survival rates within 10X priority sectors 2007-21

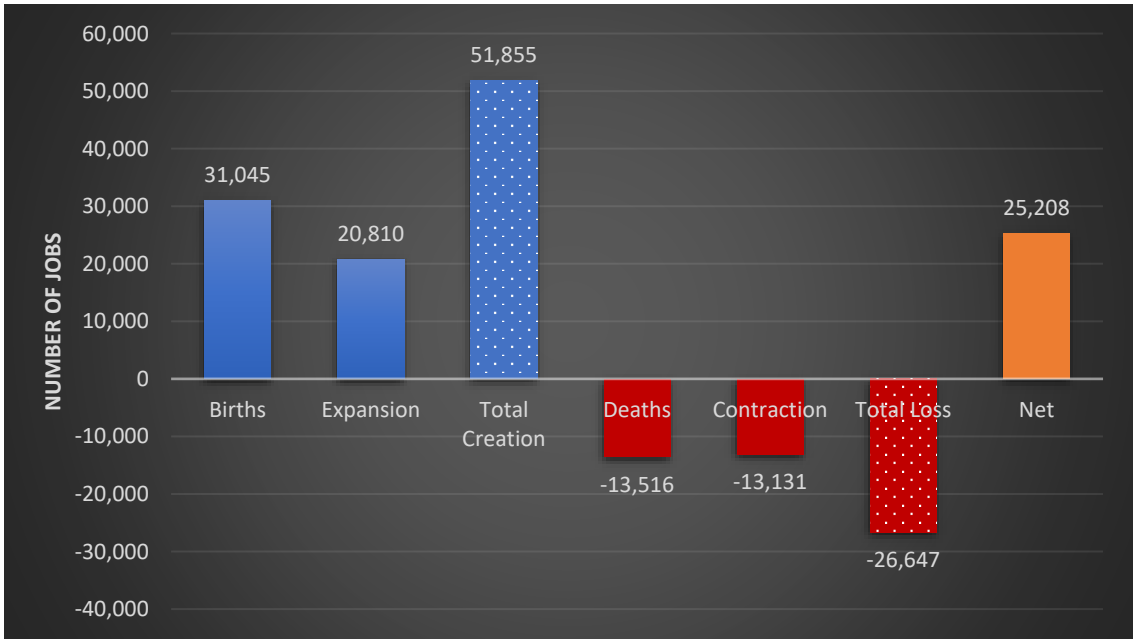
	Digital, ICT and Creative	Agri-tech	Fintech / Financial Services	Advanced Manufacturing & Engineering	Life and Health Sciences	10X Total
Births	7,485	433	1,047	1,925	133	11,023
Deaths	-3,895	-207	-558	-992	-54	-5,706
Net entry	3,590	226	489	933	79	5,317
Survival Rate %	48.0	52.2	46.7	48.5	59.4	48.2

Source: UUEPC estimates of BSD

[33] Department for the Economy (2021) A 10X Economy, Northern Ireland's Decade of Innovation.
[34] The subsequent report "10X Vision: Next Steps for Implementation" further identified Screen Industries and Low Carbon as separate priority sectors with Software (including cyber) replacing Digital, ICT and Creative. For the purpose of this analysis we report on the original five priority sectors.
[35] https://www.ulster.ac.uk/__data/assets/pdf_file/0009/1112985/Skills-Barometer-2021_INFORMATION-PACK_FINAL_web.pdf

4.24. Analysing the components of gross job creation and loss for the 10X sector as a whole (Figure 4.7) shows that there was a total of almost 52,000 gross jobs created in those sectors between 2007-21. Of those the majority (60%) were created by firm births, with the remaining 40% (21k jobs) created via expansion. Just over half of the gross jobs created were subsequently lost via either firm death or the contraction of firms, with the share lost spread equally between those two activities. As a result, there was a net job creation of 25,208 jobs in the 10X sectors by 2021 which is 10% of all net jobs created in the economy over the period.

Figure 4.7: Components of gross job creation and loss in employer births in the 10X sectors combined 2007-21



Source: UUEPC estimates of BSD

4.25. Figure 4.8 shows the gross components for the individual priority sectors within 10X. Given that it had the largest number of firm births, it is unsurprising that Digital, ICT and Creative created the largest number of jobs, both gross and net. At just under 15,000 net jobs, the sector contributed 59% of the total net 10X jobs although this was lower than its contribution to firms (68%). Previous research on business dynamism by UUEPC suggests that firm births in the ICT sector have higher productivity than the NI average while the sector also has a higher-than-average birth rate suggesting it will play a pivotal role in helping to deliver the 10X Strategy.

4.26. Fintech and Life and Health Sciences were the only two of the 10X sectors whereby there were more jobs created through expansion than through firm births. In Fintech almost 3,000 jobs were created through

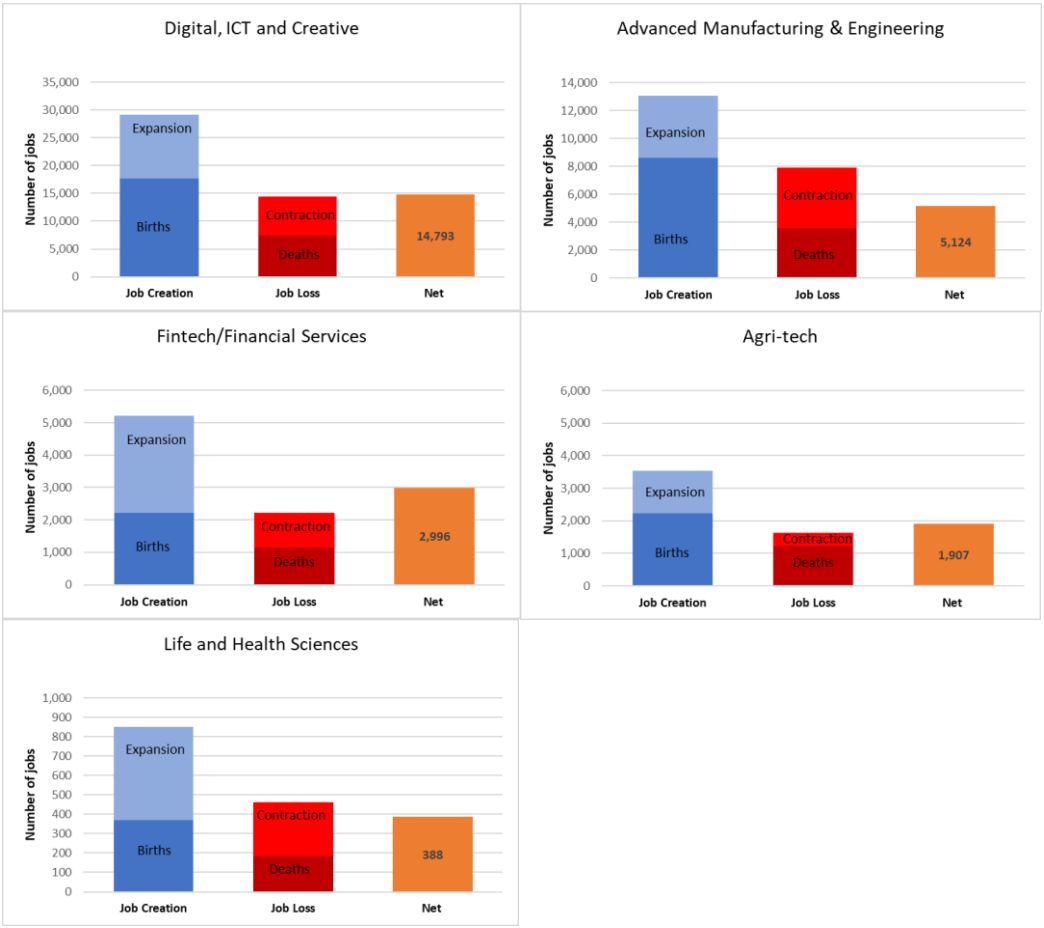
expansion, 35% more than created through births. In Life and Health Sciences the 483 jobs created through expansion were 31% higher than the number created via firm birth. In contrast, Advanced Manufacturing and Engineering had the lowest ratio of jobs created through expansion compared to births.

4.27. The Fintech sector also had the highest ratio of net to gross job creation. Of the total 5,212 gross jobs created, less than half were lost through either contraction or firm death. This resulted in a net job creation of just under 3,000 representing 57% of gross jobs created in that sector. This is also important for the wider 10X strategy, and the economy in general, as it had been identified in the Business Dynamism research as having the highest productivity of all sectors. In addition, despite having a lower than average business birth rate[36], its strength lies in the expansion of firms and durability of jobs.

4.28. Advanced Manufacturing and Engineering had the lowest ratio of net to gross job creation. Of the 13,035 gross jobs created just under 8,000 (61%) were lost through contraction or death. The net 5,124 jobs created accounted for just 39% of the gross total job creation in that sector.

[36] Bonner, K., Martin, G. and Donaldson, R. (2023). Business Dynamism in NI: Business births and deaths and implications for productivity, UUEPC.

Figure 4.8: Components of gross job creation and loss in employer births in 10X sectors 2007-21



Source: UUEPC estimates of BSD

5. Sequence Analysis

Now that we know the extent of job creation we can analyse when job creation and job loss occur. To do so we group together firms that have the same survival length, irrespective of year of birth. This provides a larger sample size than tracking annual cohorts individually and enables firms of the same survival length to be tracked from birth to death. Subsequently, by comparing cohorts of differing survival lengths an assessment can be made as to whether there are similar trends in the timing and length of job creation episodes[37].

3-year survival

5.1. Firstly, we analyse the extent to which each of the elements of job creation, static and loss occur at all throughout each firm's three-year survival period (in no particular order). Focusing on all 3-year survivors Table 5.1 shows that just over half of the firms only experienced static jobs and therefore were not engaged in any form of job creation or loss throughout the period of survival. A further 28% of firms only experienced static jobs and job loss, again with no job creation at all during the period, suggesting that in total around 80% of these 3-year surviving firms experienced no job creation over their lifetime.

5.2. Of those that did experience job creation, this was largely done in conjunction with static jobs, with one in ten firms experiencing only creation and static jobs. Only 7% experienced all three elements of job creation, static and loss. There were a number of firms who did experience only job creation throughout the period but the figure is too small to be disclosed.

[37] Due to the nature of the analysis, it was not possible to undertake further disaggregation by broad sector without disclosure issues. Results are only reported for the whole economy.

Table 5.1: All job sequence elements for those surviving 3 years (born between 2007-18)

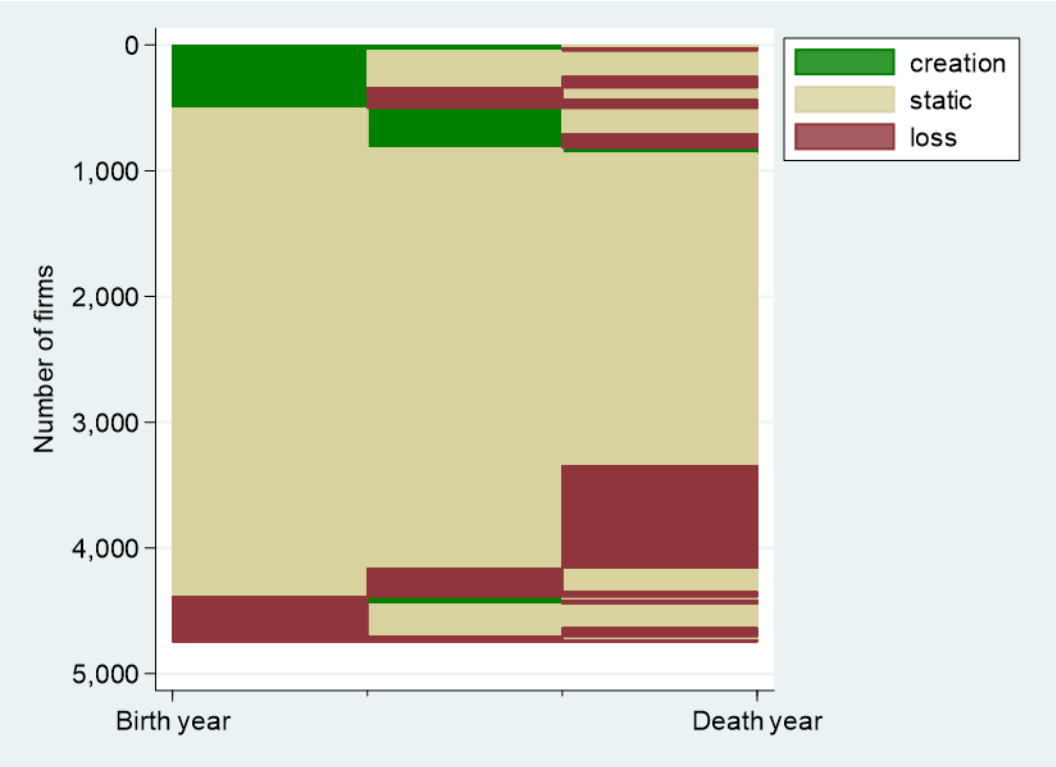
Elements	Freq.	Percent
static	2,484	52.3
static and loss	1,314	27.7
creation and static	469	9.9
creation and static and loss	328	6.9
creation and loss	133	2.8
loss	*	*
creation	*	*
Total	**4,746**	**100**

Source: UUEPC estimates of the BSD

5.3. Figure 5.1 displays the job sequence analysis for these 4,746 firms that were born between 2007-18[38] and survived for exactly 3 years. Each firm has its own row on the chart with each firm's trajectory, in terms of periods of job creation, static and loss, shown across the horizontal axis. The tick marks on the horizontal axis represents the years between birth and death.

[38] The latest data point available is 2021 therefore 2018 is the last year in which a 3-year survival period can be measured.

Figure 5.1: Job sequence analysis for those surviving 3 years (born between 2007-18)



N=4,746

Source: UUEPC estimates of the BSD

5.4. As indicated in Table 5.1 above, the chart shows that for the majority of firms that survived 3 years jobs remained static throughout the period i.e. there was no creation or loss and the number of employees that the firm started with is the same as the number throughout the period and in the year they died.

5.5. Where job creation does occur (shaded green), it mostly occurs between birth and the first year. There is also a group of a couple of hundred firms who have static job numbers between birth and year 1 and then create jobs between years 1 and 2. For the majority of firms job creation is a single yearly episode, rather than a continuous trend.

5.6. The largest chunk of job loss occurs in the year leading to the death of the firm, which is perhaps not surprising. There are, however, also a relatively large group of firms that lose employees between birth and the first year.

5.7. We can further delve into the most common individual sequences to get a better sense of the specifics of these episodes. Table 5.2 below

provides the top 10 most frequent sequences amongst those firms that survived 3 years[39].

5.8. As identified above in Figure 5.1 the most common pattern is that of no job creation or job loss, with static job episodes in each of the three years. Of the total 4,746 3-year survivors just over half had this static trend throughout. The next most commonly experienced (at 17% of firms) was two years of static jobs followed by job loss. These top two patterns account for almost 70% of all the observed sequences.

5.9. Job creation followed by two years of static jobs was the third most frequent pattern, although experienced by just 4% of firms. A similar share experienced job creation between years 1 and 2 with static jobs on either side. Within these top ten sequence patterns there were none where job creation happened more than once across the three years despite the fact that the top ten account for 95% of all the firms within the cohort.

Table 5.2: Top 10 job sequence patterns for those surviving 3 years (born between 2007-18)

Pattern	Freq.	Percent
static, static, static	2,484	52.3
static, static, loss	815	17.2
creation, static, static	200	4.2
static, creation, static	197	4.2
static, loss, static	185	3.9
loss, static, static	182	3.8
static, creation, loss	113	2.4
creation, static, loss	90	1.9
creation, loss, static	89	1.9
creation, loss, loss	69	1.5
loss, static, loss	69	1.5
Total top 10	**4,493**	**94.7**
Total number of 3-year survivors	**4,746**	

Source: UUEPC estimates of the BSD

[39] Due to disclosure issues the full range of sequences cannot be provided.

Job Creation

5.10. Analysing the specifics of job creation within these sequences shows that of the total 4,746 firms that survived for 3 years only, 80% or 3,813 had no episodes of job creation at all (Table 5.3), 19% (923) had one episode of job creation and less than 1%, or just 10 firms had 2-3 episodes. Those who had no episodes of job creation actually had a net loss of jobs to year 3, creating 9,110 in their birth year but losing almost 4,000 of those by year 3 (and subsequently the remainder once dead).

5.11. In contrast, those with one episode of job creation created 3,483 in their birth year and a net 870 to year 3, an average of an additional 1 employee per firm. Although few in number, those with multiple episodes of job creation created the highest average number of jobs in their birth year, at 10 per firm and added an additional 11 on average by year 3. The analysis suggests that the larger the firm at birth the higher the number of job creation episodes and the higher the number of jobs created[40].

Table 5.3: Net employment by job creation status for those surviving 3 years (born between 2007-18)

	0 episodes of job creation		1 episode of job creation		2-3 episodes of job creation	
	Employees	**Job creation/loss**	**Employees**	**Job creation/loss**	**Employees**	**Job creation/loss**
Birth year	9,110		3,483		96	
Year 1	7,496	-1,614	4,854	1,371	180	84
Year 2	6,826	-670	6,263	1,409	151	-29
Year 3	5,169	-1,657	4,353	-1,910	209	58
Net change	*-3,941*		*870*		*113*	
Avg size birth	2		4		10	
Avg size year 3	1		5		21	
Avg net addition/loss	-1		1		11	
N	**3,813**		**923**		**10**	

Source: UUEPC estimates of the BSD

5.12. Table 5.4 analyses episodes of job creation by sector[41]. It shows that of the five broad sectors Agriculture has the highest share of the 3-year survivors with 1 or more episodes of job creation at 31%. This is in contrast to Manufacturing at just 14%. Of the services sub-sectors, over one third of those in Accommodation and Food have more than 1

[40] Analysis of country of ownership of these firms suggested that they were UK-owned. Note that NI ownership is not separately distinguished from UK ownership.

[41] Due to disclosure rules those with 1 and 2 episodes were combined due to small numbers.

episode of job creation over the 3 years compared to just 10% of Finance and Insurance.

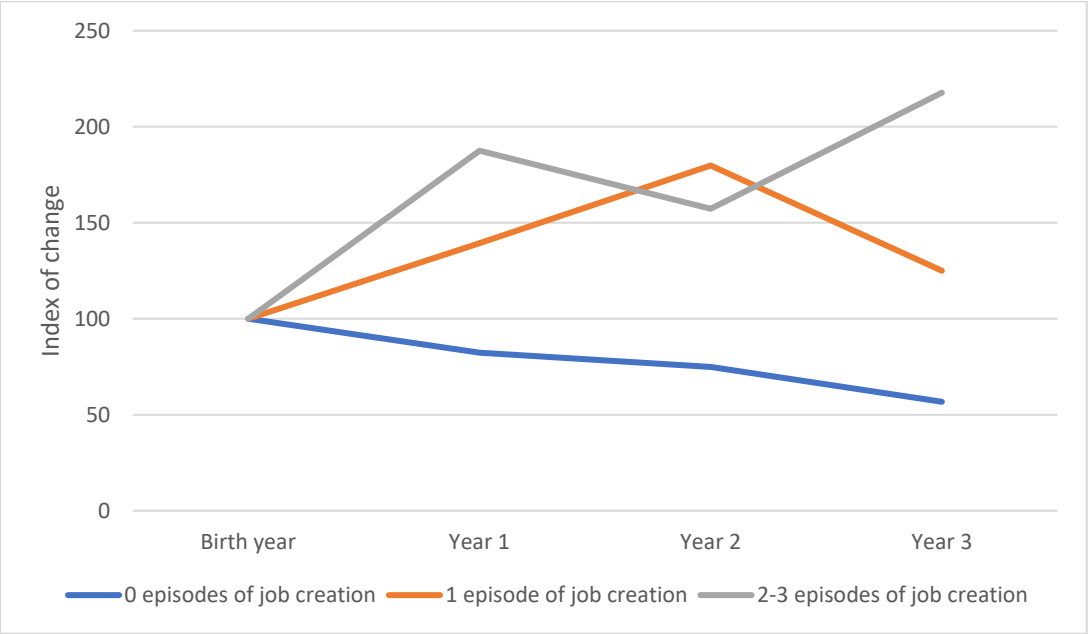
Table 5.4: Episodes of job creation for those surviving 3 years (born between 2007-18)

	0 episodes	1+ episodes	Total
	%	%	*N*
Agriculture & Mining	69	31	*331*
Manufacturing	86	14	*277*
Construction	84	16	*952*
Private Sector Services	80	20	*3,004*
Public Sector	80	20	*182*
Services sub-sectors			
Wholesale & Retail	83	17	*744*
Transport & Storage	82	18	*195*
Accommodation & Food	63	37	*407*
Information & Communication	83	17	*265*
Finance & Insurance	90	10	*97*
Professional & Scientific	86	14	*510*
Administration & Support	73	27	*257*
Arts, Entertainment & Recreation	85	15	*85*
Other Services	81	19	*444*
Total	80	20	*4,746*

Source: UUEPC estimates of the BSD

5.13. In terms of the timing of job creation and loss, Figure 5.2 represents the net data from Table 5.3 above. The employment figures, for the 3 categories of job creation status, have been indexed to that of their birth year. As indicated, those with 2-3 episodes of job creation more than doubled the number of jobs created at birth by year 3 with the largest share of job creation happening between birth and year 1. For those with one episode of job creation, the creation of jobs was split almost evenly between those who created jobs in the year between birth and year 1 and those who created jobs between years 1 and 2.

Figure 5.2: Index of net employment change by job creation status for those surviving 3 years (born between 2007-18) (birth year=100)



Source: UUEPC estimates of the BSD

5-year survival

5.14. We can repeat the exercise above for those firms surviving exactly 5 years, who were born between 2007-16[42]. Given their relatively short lifespan, again we would not expect to see extensive evidence of job creation.

5.15. Considering all job sequence elements experienced by those surviving 5 years (regardless of order) shows that two thirds had no job creation at all (Table 5.5), with 38% having only static jobs and 28% having static jobs with job loss. Of those that did create jobs a total of 441 combined this with static jobs and job loss over the 5-year period. There were no firms that only had job creation over the period.

[42] The latest data point available is 2021 therefore 2016 is the last year in which a 5-year survival period can be measured.

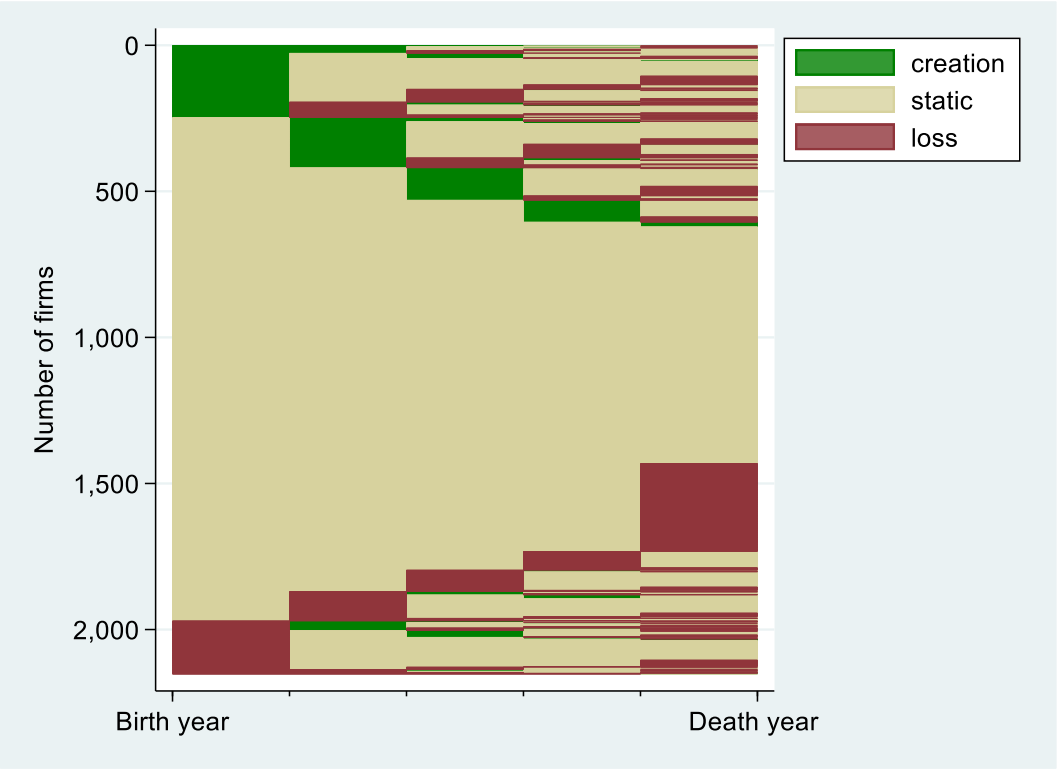
Table 5.5: All job sequence elements for those surviving 5 years (born between 2007-16)

Elements	Freq.	Percent
static	810	37.6
static and loss	610	28.4
creation and static and loss	441	20.5
creation and static	278	12.9
creation and loss	13	0.6
Total	2,152	100

Source: UUEPC estimates of the BSD

5.16. Figure 5.3 visualizes the individual sequences. For firms surviving five years those with static jobs accounted for a sizeable minority (810 firms or 38%) unlike the 3-year survivor firms the majority of whom had static jobs (52%). Job creation, where it happened, occurred early and most frequently in the year after birth. Where it happened later it was typically preceded, or succeeded, by static jobs. Similar to the previous findings, repeated episodes of job creation were rare. Job loss occurred across all years, but again was most common in the year before firm death potentially signaling the shedding of employees as a means to save costs for struggling firms, or as part of running down the business.

Figure 5.3: Sequence analysis for those surviving 5 years (born between 2007-16)



N=2,152

Source: UUEPC estimates of the BSD

5.17. Analysing the top ten sequence patterns for those surviving five years (Table 5.6) confirms that the pattern of static jobs throughout was the most commonly experienced scenario. In total 810 firms or 38% experienced only static job numbers throughout with no job creation or job loss. In fact, episodes of job creation were only found within four of the top ten sequences (highlighted in green) and the episodes were singular, occurring in only one year of the sequence.

5.18. In total the top ten sequences account for almost three quarters of all the sequences observed for 5-year survivors. Those outside the top ten were experienced by 2% of firms or less, highlighting the diversity of sequences that can occur as the length of survival increases but also the rarity of job creation episodes amongst the cohort.

Table 5.6: Top 10 job sequence patterns for those surviving 5 years (born between 2007-16)

Rank	Pattern	Freq.	Percent
1	static, static, static, static, static	810	37.6
2	static, static, static, static, loss	301	14.0
3	loss, static, static, static, static	67	3.1
4	static, static, creation, static, static	57	2.6
5	static, static, static, creation, static	56	2.6
6	static, static, static, loss, static	56	2.6
7	static, creation, static, static, static	52	2.4
8	creation, static, static, static, static	51	2.4
9	static, static, loss, static, static	51	2.4
10	static, loss, static, static, static	49	2.3
	Total top 10	**1,550**	**72.0**
	Total number of 5-year survivors	**2,152**	

Source: UUEPC estimates of the BSD

Job Creation

5.19. Analysing the employment generated by those surviving five years (Table 5.7) shows similar trends to those identified for the 3-year survivors. Two thirds of firms had no job creation at all over the period. Of those that did create jobs one episode of job creation was most prevalent with just 4% of firms having 2-3 episodes of job creation over the 5 years. Those with these multiple episodes of job creation were larger in size on start-up, with an average of 8 employees in the birth year compared to 4 employees for those with 1 episode of job creation and 2 employees for those with no episodes of job creation. They also created a higher number of jobs on average, with a net 3 jobs per firm created by year 5[43]. For those who created no jobs, there was a net loss of jobs every year before death. For those creating jobs, net job loss occurred in the years preceding death.

[43] As with the 3-year survivors, such firms were predominantly UK-owned.

Table 5.7: Net employment by job creation status for those surviving 5 years (born between 2007-16)

	0 episodes of job creation		1 episode of job creation		2-3 episodes of job creation	
	Employees	**Job creation/loss**	**Employees**	**Job creation/loss**	**Employees**	**Job creation/loss**
Birth year	3322		2301		752	
Year 1	2899	-423	2478	177	1028	276
Year 2	2649	-250	2845	367	1133	105
Year 3	2473	-176	3763	918	1134	1
Year 4	2325	-148	3544	-219	1358	224
Year 5	1768	-557	3144	-400	1004	-354
Net change	*-1554*		*843*		*252*	
Avg size birth year	2		4		8	
Avg size year 5	1		5		10	
Avg net addition/loss	-1		1		3	
N	**1,420**		**636**		**96**	

Source: UUEPC estimates of the BSD

5.20. Analysing episodes of job creation by sector[44] (Table 5.8) shows that, as before, of the five broad sectors Agriculture had the highest share of the 5-year survivors with 1 or more episodes of job creation at 44%. The public sector had the lowest share with just 29% having more than one episode. Of the services sub-sectors, Arts, Entertainment and Recreation, and Accommodation and Food, were most prevalent in terms of episodes of job creation with just over half of firms within each having 1 or more episodes of job creation over the 5 years.

[44] Due to disclosure rules those with 1+ episodes were combined due to small numbers.

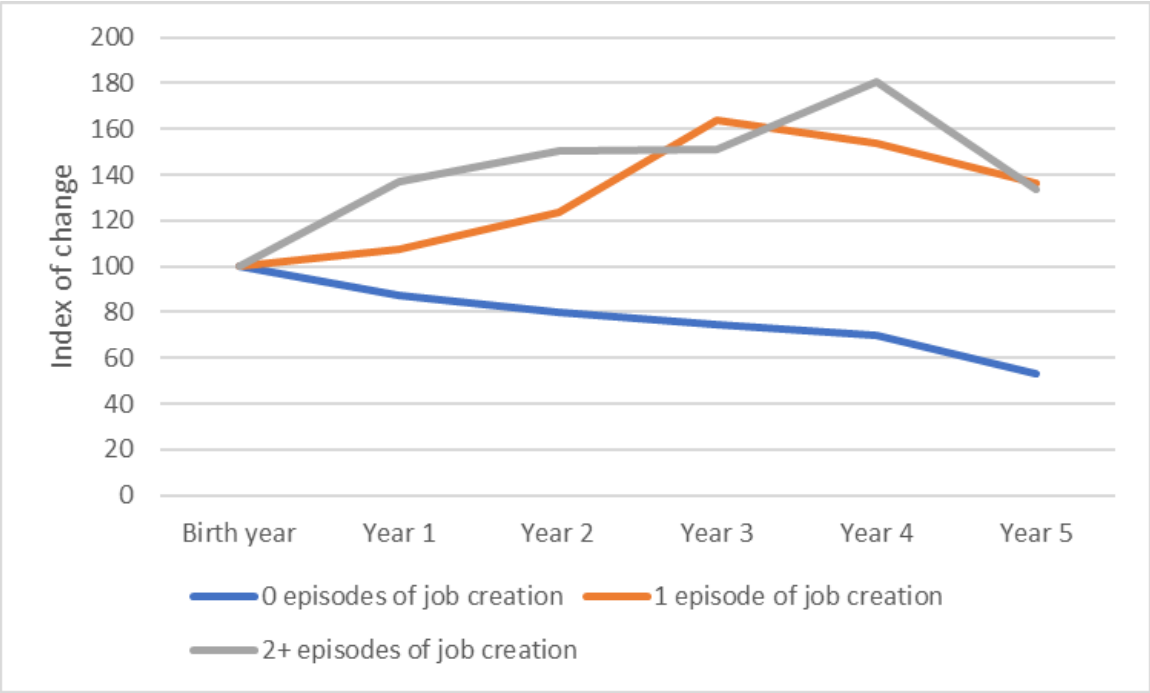
Table 5.8: Episodes of job creation for those surviving 5 years (born between 2007-16)

	0 episodes	1+ episodes	*Total*
	%	%	*N*
Agriculture & Mining	56	44	*105*
Manufacturing	66	34	*123*
Construction	68	32	*438*
Private Sector Services	66	34	*1396*
Public Sector	71	29	*90*
Services sub-sectors			
Wholesale & Retail	68	32	*369*
Transport & Storage	61	39	*84*
Accommodation & Food	49	51	*200*
Information & Communication	74	26	*122*
Finance & Insurance	67	33	*30*
Professional & Scientific	72	28	*236*
Administration & Support	72	28	*125*
Arts, Entertainment & Recreation	46	54	*24*
Other Services	67	33	*206*
Total	66	34	*2152*

Source: UUEPC estimates of the BSD

5.21. Figure 5.4 again represents the timing of these episodes of job creation and loss from Table 5.7 above. As indicated, those with no episodes of job creation over the whole 5 years had a net job loss annually. The fastest rate of job creation for those with one episode of job creation was in years 2-3, although net job creation was positive throughout the first 3 years. For those with multiple episodes of job creation the fastest rates of growth were between birth-year 1 and also in years 3-4 although this was followed by a decline in years 4-5 prior to death.

Figure 5.4: Index of net employment change by job creation status for those surviving 5 years (born between 2007-16) (birth year=100)



Source: UUEPC estimates of the BSD

10-year survival

5.22. We extend the analysis to those surviving 10 years (born between 2007-11[45]) on the basis that due to their longer survival they will have been more successful than those only surviving for 3 or 5 years and therefore will have had more episodes of job creation. Similarly, they are likely to have experienced more varied trends in job growth and loss over their lifecycle not least due to the fact that the number of permutations of job creation, static and loss increases with the length of time.

5.23. Table 5.9 shows all job sequence elements to enable a sense of the extent to which firms were creating jobs at any point during the ten years (regardless of order). As expected, the majority of 10-year survivors did have at least one episode of job creation, with 201 firms (57%) experiencing all 3 elements of creation, static and loss across the ten years and 34 (or 10%) having creation and static jobs (with no job loss). Notably, despite the longer survival period there were still 54 firms (16%) that only had static jobs throughout the whole ten years.

[45] The latest data point available is 2021 therefore 2011 is the last year in which a 10-year survival period can be measured.

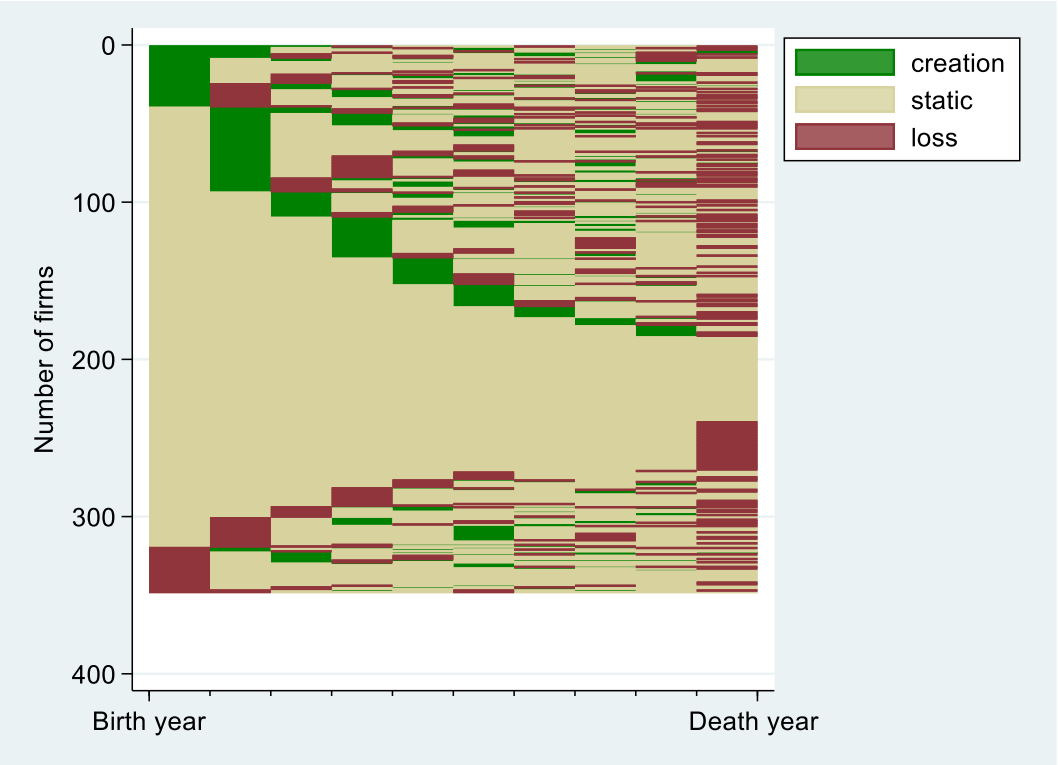
Table 5.9: All job sequence elements for those surviving 10 years (born between 2007-11)

Elements	Freq.	Percent
creation and static and loss	201	57.8
static and loss	59	17.0
static	54	15.5
creation and static	34	9.8
Total	348	100

Source: UUEPC estimates of the BSD

5.24. As detailed below Figure 5.5 shows the much reduced proportion of firms with static jobs only. Job creation was more prevalent throughout firms' lifecycles with more firms having repeat episodes. Job creation was, however, still sporadic with the most frequent periods still within the first two years. Job loss was also more frequently experienced throughout the ten years although, unsurprisingly, it was at its highest in the year leading to firm death.

Figure 5.5: Sequence analysis for those surviving 10 years (born between 2007-11)



N=348

Source: UUEPC estimates of the BSD

5.25. Due to the multitude of permutations of job creation, static and loss throughout the ten-year survival period, there are a much higher proportion of very unique sequences. As a result, it is not possible to provide the top ten sequence patterns due to disclosure rules, with only the top two meeting the threshold[46].

5.26. As Table 5.10 shows despite job creation being more prevalent amongst 10-year survivors the most commonly experienced sequence pattern was still that of static jobs throughout with 16% of firms having no creation or loss during the entire period. A further 9% had static jobs for 9 years followed by job loss in the year to death. Despite job creation being more prevalent throughout the ten years the heterogeneity of the sequences is apparent, given that only the two sequences shown in Table 5.10 were experienced by more than 10 firms.

Table 5.10: Top 2 job sequence patterns for those surviving 10 years (born between 2007-11)

Pattern	Freq.	Percent
static, static, static, static, static, static, static, static, static, static	54	15.5
static, static, static, static, static, static, static, static, static, loss	31	8.9
Total top 2	**85**	**24.4**
Total number of 10-year survivors	**348**	

Source: UUEPC estimates of the BSD

Job Creation

5.27. For those surviving ten years (Table 5.11), and as would be expected given the longer survival length, job creation was more common amongst this cohort but the largest share of firms (38%) still had only one episode of job creation. Approximately similar shares, of around 30%, had either no job creation at all over the period, or 2-4 episodes of job creation.

5.28. As previously observed, those with these multiple episodes of job creation were larger in size on start-up, with an average of 4 employees in the birth year compared to 3 employees for those with 1 episode and 2 employees for those with no episodes of job creation. They were the only group to have net job creation up to year 10 (albeit a small net increase). For those who created no jobs, there was again a net loss in almost all years before death. For those creating jobs, the net job loss

[46] Note that due to ONS disclosure rules cell counts of less than 10 are not permitted to be published.

occurred predominantly in the year preceding death resulting in no net change in average size between birth year and year 10.

Table 5.11: Net employment by job creation status for those surviving 10 years (born between 2007-11)

	0 episodes of job creation		1 episode of job creation		2-4 episodes of job creation	
	Employees	**Job creation/loss**	**Employees**	**Job creation/loss**	**Employees**	**Job creation/loss**
Birth year	187		407		402	
Year 1	171	-16	399	-8	494	92
Year 2	168	-3	406	7	476	-18
Year 3	167	-1	401	-5	467	-9
Year 4	157	-10	383	-18	584	117
Year 5	153	-4	416	33	630	46
Year 6	142	-11	617	201	693	63
Year 7	139	-3	536	-81	673	-20
Year 8	139	0	503	-33	827	154
Year 9	138	-1	518	15	832	5
Year 10	89	-49	402	-116	450	-382
Net change	*-98*		*-5*		*48*	
Avg size birth year	2		3		4	
Avg size year 10	1		3		4	
Avg net addition/loss	-1		0		0	
N	113		132		103	

Source: UUEPC estimates of the BSD

5.29. Due to the relatively small number of firms in total surviving ten years, analysis of job creation status by sector can only be undertaken by combining sectors[47]. Table 5.12 shows that the highest share with 0 episodes of job creation was the Construction and public sector combined, with over two fifths having no job creation over the 10-year period. Meanwhile only one quarter of those in Agriculture and Manufacturing combined had no job creation episodes, while 45% had 2-4 episodes of job creation. Of the services sub-sectors Wholesale and Retail and Transport and Storage combined had the lowest share with repeat episodes of job creation.

[47] Due to disclosure rules cell counts of <10 are not permitted.

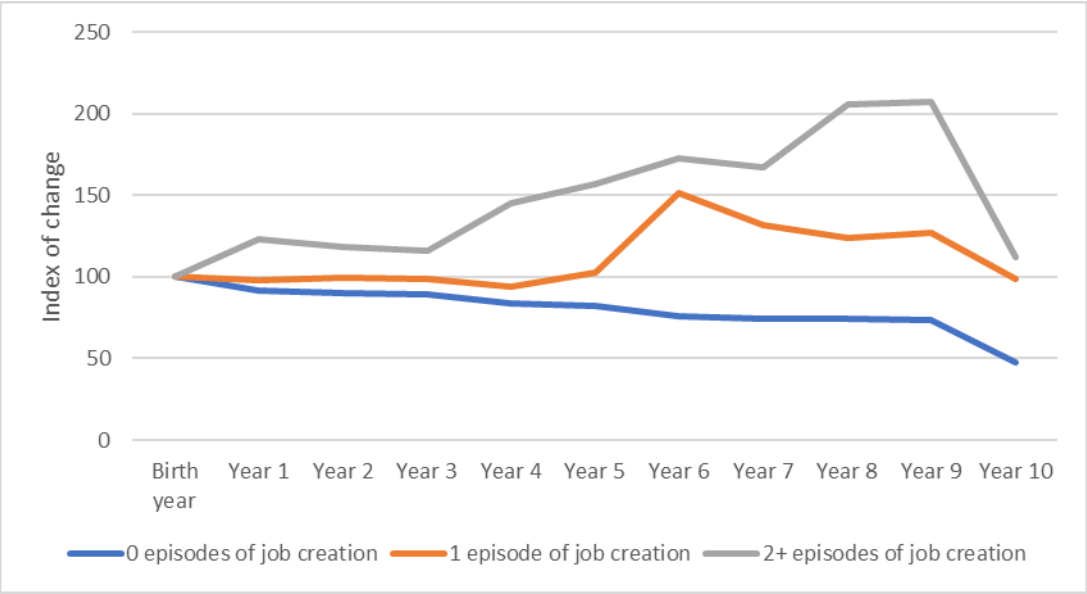
Table 5.12: Episodes of job creation for those surviving 10 years (born between 2007-11)

	0 episodes	1 episode	2-4 episodes	*Total*
	%	%	%	
Agriculture and Manufacturing	26	29	45	*58*
Construction and Public Sector	43	39	18	*67*
Private Sector Services	31	40	29	*223*
Services sub-sectors				
Wholesale and Transport	34	46	21	*68*
Info & Comms and Finance and Admin	45	27	27	*44*
Professional & Scientific	32	37	32	*38*
Other services	19	44	37	*73*
Total	32	38	30	*348*

Source: UUEPC estimates of the BSD

5.30. Displaying the net change in employment in terms of timing and scale, Figure 5.6 show the continual decrease in employment for those with no episodes of job creation. For those with one episode of job creation, the largest net increase was around the 5-6 year point, with the number of jobs created at the peak 52% higher than those created in the birth year. For those with multiple episodes, job creation was sporadic throughout the period, with the fastest rates of growth in years 3-4 and 7-8. Peak employment in year 8 was more than double that in the birth year, equating to an average net 4 additional jobs per firm. For all three categories there was a sharp loss of jobs in the year before closure.

Figure 5.6: Index of net employment change by job creation status for those surviving 10 years (born between 2007-11) (birth year=100)



Source: UUEPC estimates of the BSD

14-year survival

5.31. The previous analysis has focused on firms with a specific survival period until death. Here we turn to analyse firms that at the data endpoint were still alive to ascertain whether the observed previous trends still hold. To get the longest possible run of survivors we focus on those firms born at our data starting point (2007) that were still alive in 2021, giving 14 years of survival.

5.32. Given that these firms have not died we would expect that job creation would be highest amongst this group and that they would also have the most frequent episodes of job creation.

5.33. Table 5.13 confirms that the majority of firms (73%) that survived 14 years and were still alive in 2021 experienced all three elements of job creation, static and loss. Notably, just over 20% in total experienced no job loss at all, with 14% of the overall total experiencing a combination of only job creation and static jobs and the other 8% having only static jobs throughout the entire period.

Table 5.13: All job sequence elements for those surviving 14 years (born 2007)

Elements	Freq.	Percent
creation and static and loss	593	73.12
creation and static	115	14.18
static	66	8.14
static and loss	30-40[48]	*
creation and loss	<10	*
Total	811	100

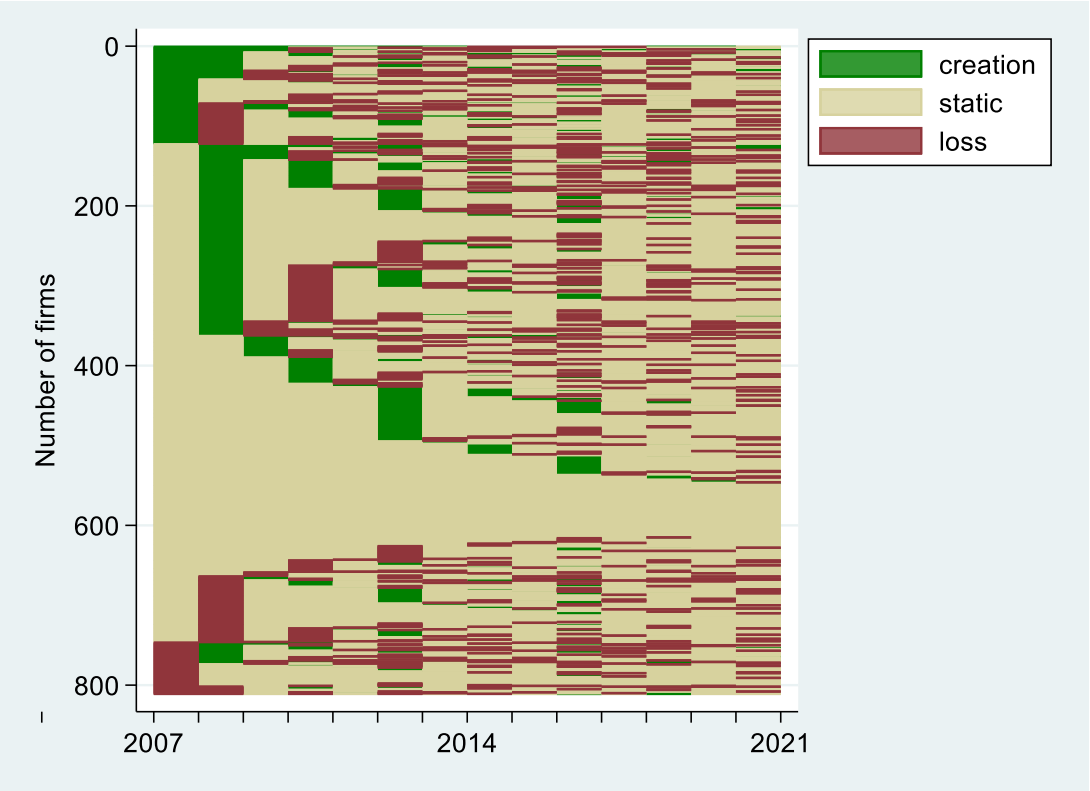
Source: UUEPC estimates of the BSD

5.34. Visualizing the individual firm sequences Figure 5.7 shows that job creation was still most prevalent in the early years[49], and there are also more repeat episodes. Despite this, job loss was also common across the 14-year period while the small group of firms with static jobs across the entire period is also apparent.

[48] Note that to prevent disclosure by subtraction a range of between 30-40 is given for the static and loss category as the creation and loss category has fewer than 10 observations and cannot be published.

[49] There are known to be lags in the BSD data due to the method by which it is updated, so although 2008-09 looks to have a relatively large number of firms creating jobs, it may be a reflection of the previous year's growth.

Figure 5.7: Sequence analysis for those surviving 14 years (born 2007)



N=811

Source: UUEPC estimates of the BSD

5.35. As identified with the previous 10-year survivors, due to the multitude of permutations of job creation, static and loss throughout the 14-year survival period, there are a much higher proportion of very unique sequences. Due to disclosure rules, only the top five meet the threshold[50].

5.36. Table 5.14 shows that even amongst those that survived, and were still alive in 2021, the most commonly experienced sequence pattern was still that of static jobs throughout, with 8% of firms having no creation or loss during the entire period. Where job creation did occur it was most frequently a one-off occurrence, typically followed by static jobs. Again, as per the 10-year survivors, the fact that only five sequence patterns were experienced by more than 10 firms indicates that job creation is a sporadic occurrence even for those with repeat episodes.

[50] Note that due to ONS disclosure rules cell counts of less than 10 are not permitted to be published.

Table 5.14: Top 5 job sequence patterns for those surviving 14 years (born 2007)

Sequence-Pattern	Freq.	Percent
static, static, static, static, static, static, static, static, static, static, static, static, static, static, static	66	8.1
static, static, static, static, static, static, static, static, static, creation, static, static, static, static	16	2.0
static, creation, static, loss, static, static, static, static, static, static, static, static, static, static, static	11	1.4
static, creation, static, static, static, static, static, static, static, static, static, static, static, static, static	11	1.4
static, static, static, static, static, creation, static, static, static, static, static, static, static, static, static	11	1.4
Total top 5	115	14.2
Total number of 14-year survivors	811	

Source: UUEPC estimates of the BSD

Job Creation

5.37. As previously identified the majority (87%) of those surviving fourteen years (Table 5.15), created jobs at some point over the entire period. Those with multiple episodes of job creation accounted for three fifths of the 14-year cohort of survivors, just over one quarter had one episode. Notably, 13% of firms survived the entire period without any episodes of job creation.

5.38. In line with the previously identified trends, repeat episodes of job creation were associated with those that were larger in size on start-up, with an average of 6 employees in the birth year compared to 3 employees for those with one episode and 2 employees for those with no episodes of job creation. They also created more jobs with an additional 12 jobs on average created over the period[51].

5.39. Those with one episode of job creation typically created jobs within the first couple of years, with a net loss recorded for almost all years from year 3 onwards. As a result, the average size of firms in this group was smaller in year 14 than at birth. Again, as previously observed, those with no episodes of job creation also experienced a net loss annually and were also on average smaller in year 14 than at birth.

[51] Analysis by country of ownership showed a mixture of foreign-owned and UK-owned firms in this group however they were predominantly UK-owned. Note that NI ownership cannot be distinguished from UK ownership.

Table 5.15: Net employment by job creation status for those surviving 14 years (born 2007)

	0 episodes of job creation		1 episode of job creation		2-6 episodes of job creation	
	Employees	**Job creation/loss**	**Employees**	**Job creation/loss**	**Employees**	**Job creation/loss**
Birth year	222		572		2974	
Year 1	205	-17	623	51	2962	-12
Year 2	186	-19	639	16	3603	641
Year 3	185	-1	627	-12	3717	114
Year 4	173	-12	541	-86	4245	528
Year 5	172	-1	533	-8	4629	384
Year 6	158	-14	503	-30	5212	583
Year 7	152	-6	498	-5	5206	-6
Year 8	151	-1	506	8	5522	316
Year 9	147	-4	486	-20	5668	146
Year 10	143	-4	497	11	7729	2061
Year 11	142	-1	499	2	8070	341
Year 12	140	-2	568	69	8460	390
Year 13	140	0	577	9	8488	28
Year 14	140	0	521	-56	9045	557
Net change	-82		-51		6071	
Avg size start	2		3		6	
Avg size end	1		2		18	
Net addition/loss	-1		0		12	
N	102		213		496	

Source: UUEPC estimates of the BSD

5.40. Combining sectors to analyse episodes of job creation shows relatively little variation for those surviving 14 years (Table 5.16). Agriculture and Manufacturing combined again had the highest share of firms, 68%, with multiple episodes of job creation compared to 58% for the total service sector. Of the services sub-sectors, there was little difference in the share with 2 or more episodes of job creation, with over half of all firms having these multiple episodes.

Table 5.16: Episodes of job creation for those surviving 14 years (born 2007)

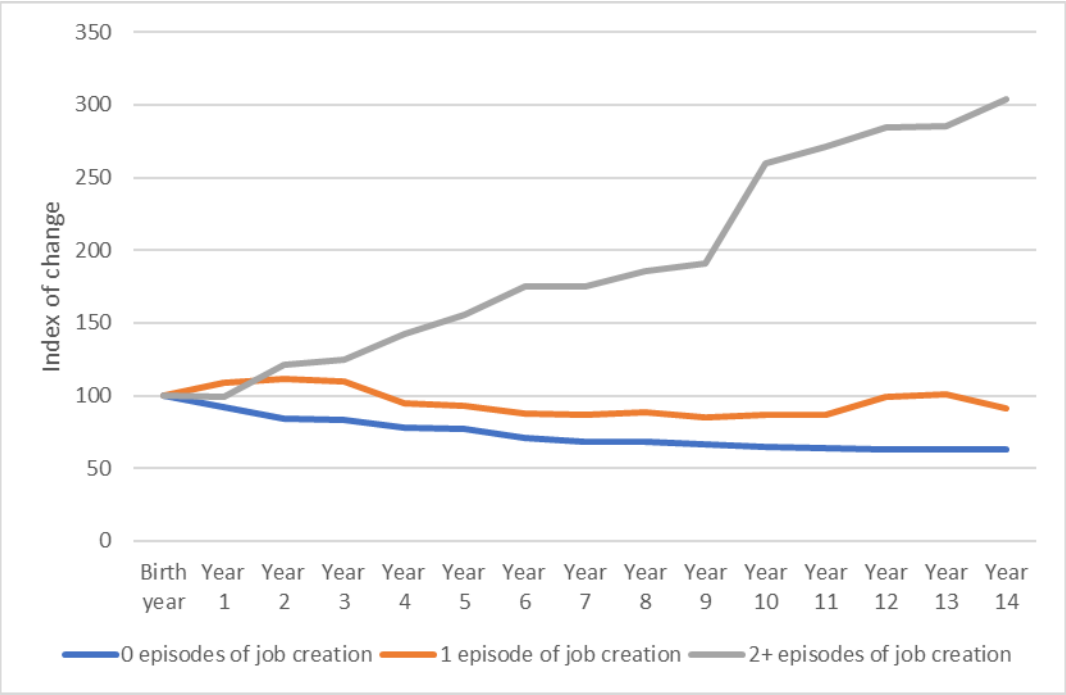
	0 episodes	1 episode	2-6 episodes	*Total*
	%	%	%	
Agriculture and Manufacturing	11	22	68	*133*
Construction and Public Sector	12	25	64	*182*
Private Sector Services	14	28	58	*496*
Services sub-sectors				
Wholesale and Transport	12	32	56	*197*
Info & Comms and Finance & Admin	19	24	57	*91*
Professional & Scientific	15	27	57	*91*
Other services	10	25	65	*117*
Total	13	26	61	*811*

Source: UUEPC estimates of the BSD

5.41. As these firms were still alive in 2021 we would not expect to see a decline in employment towards the end of the period, unlike the previous analysis which focused on those that had only survived for 3, 5 and 10 years respectively. Figure 5.8 shows the diverging trends in employment change for each of the three groups. Those with no job creation experienced an early decline in employment followed by a relatively steady state thereafter. Those with one episode of job creation had an initial increase within the first three years, and after a decline in year 4 stayed relatively stable until year 12. Those with multiple episodes of job creation created jobs almost continuously from year 1 onwards, again suggesting the heterogenous nature of job creation throughout the period.

5.42. Unlike the previous cohorts whereby those with multiple episodes of job creation were in the minority, the group with repeat episodes of job creation accounted for 61% of the total 14-year survivors. By the end of the period employment within these firms was over three times higher than the number created in the birth year. The analysis aligns with previous research indicating a link between growth and survival (Coad et al., 2013).

Figure 5.8: Index of net employment change by job creation status for those surviving 14 years (born 2007) (birth year=100)



Source: UUEPC estimates of the BSD

6. Conclusion and Policy Implications

6.1. This report sought to primarily analyse job creation within NI employer firms. The aim was to fill a knowledge gap with regards to the extent of job creation within firms and to analyse trends to identify when and how often firms are typically in job creation mode. Recent advances within the job creation literature have suggested that it is younger firms that create most jobs – and that these younger firms are typically smaller. Previous findings within the literature suggested that it was smaller firms that were responsible for most job creation but these studies either failed to, or were unable to, account for age and therefore confounded age with size when reporting that job creation was disproportionately undertaken by smaller firms.

6.2. More recently, when analysing the 'how' and 'when' of firm growth, research has reported a number of other consistent findings:

- That job creation by new firms typically happens early in their life-cycle.
- That a very small group make a disproportionate contribution to job growth.
- That consistent and linear growth is rare.
- That growth follows a random path.

6.3. The analysis within this report, which focuses on employer firms born in NI from 2007 onwards, confirms that such businesses are born very small. When averaged across all years the median size at birth for all was 1 employee while the mean was 4.5 employees. Those born from 2007-21, accounting for almost 68,000 firms, created over 300,000 jobs in total in the year that they were born. Those that survived until 2021 created a further 192,000 jobs – equating to almost half a million gross jobs created in the fourteen-year period.

6.4. Notably, this indicates that the majority of jobs created in new employer firms were during their year of start-up and although additional jobs were subsequently created via expansion this equated to only 64% of the number of jobs created at birth. Furthermore, not all these firms survived and of those gross jobs created, 240,000 were subsequently lost either through closure or contraction of survivors. The net result was that these employer firms created 253,000 net jobs between 2007-21.

6.5. Of these net jobs created almost half (47%) were created in the public sector. Excluding these from the analysis to focus only on the private sector, finds that employer births in the private sector created over 320,000 gross jobs of which 192,000 (60%) were created in their birth year and 129,000 by the expansion of survivors. Of the total created,

188,000 were lost either through firm death or the contraction of survivors. The net result was that new employer firms in the private sector created 134,000 net jobs between 2007-21.

6.6. Private sector services accounted for over three quarters of that net job creation. Of the main individual sub-sectors within that category the contribution to births was broadly similar to the contribution to jobs. Wholesale and Retail accounted for 24% of the births and 23% of the net jobs created. Information and Communication and Transport and Storage both accounted for 7% of the births respectively. The former also accounted for 7% of the net jobs created, and the latter 6%. The one sector which had a disproportionately lower share of jobs created was the Professional and Scientific sector which accounted for 16% of births in the Services sector but just 12% of the net jobs created. In contrast, Accommodation and Food accounted for 13% of service sector births but 21% of the net jobs created.

6.7. There were around 11,000 employer firm births in the 10X priority sectors between 2007-21, of which approximately 5,300 survived to 2021. The survival rate of firms in these sectors combined was higher than for those in the service sector in general, and for those in the wider economy. Combined, a total of almost 52,000 gross jobs were created in those sectors between 2007-21, 60% of which were created via firm births. Just over half of the gross jobs created were subsequently lost via either firm death or the contraction of firms. The result was a net job creation of 25,208 jobs in the 10X sectors by 2021, 10% of all net jobs created in the economy.

6.8. The largest of the 10X sectors in terms of employer births, and jobs created, was the Digital, ICT and Creative sector. With around 3,500 net firms created by 2021 the sector was responsible for almost 15,000 net jobs created, 59% of the 10X total. Previous research on business dynamism by UUEPC suggests that firm births in the ICT sector have higher productivity than the NI average while the sector also has a higher-than-average birth rate suggesting it will play a pivotal role in helping to deliver the 10X Strategy.

6.9. Fintech and Life and Health Sciences were the only two of the 10X sectors whereby there were more jobs created through expansion than through firm births. The Fintech sector also had the highest job survival rate. Of the total 5,212 gross jobs created, less than half were lost through either contraction or firm death, resulting in a net job creation of just under 3,000 jobs by 2021. This is also important for the wider 10X strategy, and the economy in general, as it has been identified, in

the UUEPC research, as having the highest productivity of the NI sectors.

6.10. Overall, analysis of the timing and consistency of job growth amongst all employer firms showed some stable patterns regardless of length of survival and whether the firms were part of a cohort that survived or that died. Typically, for those that survived up to 10 years, job creation was a rare one-off event which usually occurred early in the firm's lifecycle. Firms that recorded only static jobs represented a relatively large, although diminishing share, from 52% of firms with 3-year survival to 16% of those with 10-year survival. Firms with no episodes of job creation over their lifetime had a net loss of jobs regardless of survival length. Finally, longer survival lengths were associated with more growth episodes although the growth trajectories were more idiosyncratic, with the most frequently observed pattern still that of static jobs (although in a minority of firms). Linear consistent growth was therefore a rare occurrence, for example even for those that survived 14 years, the highest number of job creation episodes per firm was 6. Multiple episodes of job creation were associated with firms that were larger at birth, while the smallest firms typically had no episodes of job creation within their lifetime.

Policy Implications

6.11. Consistent with previous research the overall results point to growth occurring in younger firms with the results showing that the majority of jobs were created in the birth year and that subsequent job creation episodes were more prevalent in the first few years after birth. The results point to any potential policy interventions taking the age of firms into consideration rather than necessarily focusing on smaller firms. Indeed, although still meeting the definition of small, those born larger (findings suggested from 4-10 employees) typically had more repeat episodes of job creation and also created more jobs over their lifetime. For example, those surviving 14 years (from 2007-21) who had repeat episodes of job creation had 6 employees on average at birth and grew by 200% over the 14 years. This suggests that they are perhaps less in need of immediate policy intervention, unless it is to support growth at a faster or larger scale.

6.12. This is consistent with previous research which identifies that firms that are bigger at start-up are more likely to have growth intentions[52]. Furthermore, the business owners may be part of a "growth inclined" group (BIS, 2015) that are receptive to business support. Indeed, the

[52] Levie, J. and Autio, E. (2013) Growth and Growth Intentions. ERC White Paper No. 1. April 2013.

BIS research suggests that such owners are open to a more diverse range of funding options, suggesting that the facilitation of access to this variety of funding may be most beneficial for this group.

6.13. The very smallest, those with an average size of 2 employees, were more likely to have no episodes of job creation and actually subsequently decline in size over their lifetime. Without further understanding it would be difficult to suggest any interventions to support job creation amongst this group without the potential for wasted effort and cost if they have been unable to implement job growth through market forces alone.

6.14. Any interventions may therefore be best focused on those that have static jobs over their lifetime but still manage to survive. Of course, the owners may be content with keeping the business at a constant size, the so-called "growth resistant" (BIS, 2015) but given that for all cohorts those with static jobs throughout accounted for the most commonly observed sequence there may be interventions which could help support growth for this group. For example, interventions targeted post the age of five to support growth for those who have managed to maintain a market presence for five years and have not lost jobs but have not grown either.

6.15. This group may also have owners willing or ambitious for further growth but who have to date not yet been able to do so, perhaps as Coad and Karlsson (2022) suggest because they have informal routines and tacit knowledge that are difficult to scale up, or they lack the experience and knowledge in terms of how to do so or how to acquire finance to do so. Alternatively, they may form what have been termed the "growth ambivalent" (BIS, 2015), those who are not actively seeking growth and do not pro-actively seek opportunities but may do so if those opportunities are perceived as low risk. The BIS research suggests that exposing business owners to their peers who have more positive growth dispositions can be of benefit, resulting in communities of business owners for whom the pursuit of growth is the norm.

6.16. Any programmes supporting job growth could therefore have entry criteria based on a combination of factors which include characteristics related to the business and its employment history, but also the mindset of the owner[53]. These criteria could include business activity, firm age,

[53] Growth ambition could be assessed, for example, by asking about motivation for programme entry and expected size/growth of the business within a specific time frame.

prior employment trajectories and growth disposition of the owner[54]. The latter is particularly important as previous research has shown that growth intentions directly affect subsequent growth, and that entrepreneurs who are risk-taking, achievement oriented and innovative all more likely to be growth-oriented[55].

6.17. Using such a combination of criteria based on the owner and the business would help to ensure that there is an existing market for the product/service and potential for expansion; that there has not been a significant decline in employee numbers to date and that the owner(s) is willing, or at least disposed, to grow the business further. This would avoid a strategy of trying to 'pick winners' but simply utilise a combination of criteria and evidence to ensure that, as far as possible, interventions are cost effective and addressing genuine market failure in the pursuit of firm growth.

[54] A similar approach has already undertaken by Invest NI for programmes supporting job growth whereby they consider historic growth trends, current and projected sales, export sales performance and management team capability within their eligibility criteria.

[55] Levie, J. and Autio, E. (2013) Growth and Growth Intentions. ERC White Paper No. 1. April 2013.

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Appendix One

10X sector 2-digit SIC codes:

Digital and Creative Industries (SIC 58-63; 71, 73-74; 90-91) : Telecommunications (61); Computer programming, consultancy and related activities (62); Information service activities (63); Publishing activities (58); Motion picture, video and television programme production, sound recording and music publishing activities (59); Programming and broadcasting activities (60); Architectural and engineering activities; technical testing and analysis (71); Advertising and market research (73); Other professional, scientific and technical activities (74); Creative, arts and entertainment activities (90); Libraries, archives, museums and other cultural activities (91).

Agri-tech (SIC 10-12): Manufacture of food products (10); and Manufacture of beverages (11) and tobacco products (12).

Fintech/ Financial Services (SIC 64-66): Financial service activities, except insurance and pension funding (64) ; Insurance, reinsurance and pension funding, except compulsory social security (65); and activities auxiliary to financial services and insurance activities (66).

Note that in the UUEPC Skills Barometer this definition also includes 20% of the following Tech sectors: Telecommunications; Computer programming, consultancy and related activities; and Information service activities. They have not been included here due to working with firm-level records.

Advanced Manufacturing and Engineering (SIC 20, 22-23; 25-30, 32): Manufacture of chemicals and chemical products (20); Manufacture of rubber and plastic products (22); Manufacture of other non-metallic mineral products (23); Manufacture of fabricated metal products, except machinery and equipment (25); Manufacture of computer, electronic and optical products (26); Manufacture of electrical equipment (27); Manufacture of machinery and equipment n.e.c. (28); Manufacture of motor vehicles, trailers and semi-trailers (29); Manufacture of other transport equipment (30); and Other manufacturing (32).

Life and Health Sciences (SIC 21, 72): Manufacture of basic pharmaceutical products and pharmaceutical preparations (21); and Scientific research and development (72).

About UUEPC

UUEPC is an independent research centre focused on producing evidence-based research to inform policy development and implementation. It engages with all organisations that have an interest in enhancing the Northern Ireland economy. The UUEPC's work is relevant to Government, business and the wider public with the aim of engaging those who may previously have been disengaged from economic debate.

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