Too fast to live? Effects of growth on survival across the growth distribution

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ABSTRACT

Do moderate growth new firms have higher survival rates than fast-growing new firms? To address this question the customer bank records of 6578 new ventures are tracked over their first 10 years, and survival is measured either in terms of continued use of the bank account, or by entry into financial default. Simple bar charts show that it is the 7th or 8th decile of the growth distribution that has the highest survival chances. Although growth enhances survival on average, nevertheless the highest decile of the growth distribution never has the highest survival rates.

KEYWORDS: Firm growth; survival; failure; Penrose effects; high-growth firms; post-entry growth; scale-up

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1. INTRODUCTION

This paper addresses a key dilemma facing both the owners of a new venture (NV) and those funding it. The dilemma is whether faster growth consistently increases the likelihood of new venture survival, or whether survivors are likely to have more moderate growth rates. We show that, on average, growth does enhance survival, but that NVs with exceptionally fast rates of growth have lower survival rates than those with moderate growth. We provide a theoretical underpinning for this somewhat surprising finding and then sketch out its implications for owners, finance providers, governments and the research community.

Investigating the relationship between enterprise growth and survival has a long history (Audretsch 1995; Cosh et al., 1998), no doubt fuelled by concerns about the low survival rates of NVs (see e.g. the pioneering study by Mayer and Goldstein, 1961). The evidence, clearly documented by Dunne and Hughes (1994), points to no link for large enterprises, whereas for SMEs slower growth is associated with lower survival rates.

Primarily because of data limitations, there have been considerably fewer empirical studies examining the sub-group of SMEs that are new. The most notable early exception was the work by Phillips and Kirchhoff (1989). Using US data, and using employment as their growth metric, they found:

> *"[N]ew small firms show an average survival rate of 39.8 percent after six years... If an entry firm adds only one employee, its survival rate more than doubles to 65.0 percent. And, as the extent of growth increases, the survival rate increases as well, ultimately reaching 77.5 percent for high growth firms" p69*

The above quotation points to growth enhancing survival amongst NVs, so confirming the Dunne and Hughes result for SMEs. Most importantly, for the current paper, it finds this relationship is positive for all growth rates. Positive effects of growth on survival were also confirmed in later work (Headd and Kirchhoff, 2009; Coad et al., 2013; Geurts and Van Biesebroeck, 2016). Growth is then seen as "the very essence of entrepreneurship" (Sexton and Smilor, 1997; Pierce and Aguinis 2013: p321), and "rapid growth is seen as the business equivalent of a birdie, a touchdown, or a home run on the field of dreams" (Nicholls-Nixon, 2005, p77). Much excitement surrounds the success stories: Murmann et al. (2014) report that

Cisco had an average annual sales growth of 88% over the period 1990-1998, and an average annual employment growth rate of 66% over the period 1991-1998. Google was founded by two individuals in 1997, added a third in 1998, and jumped to 40 in 1999. High-growth firms have recently generated much excitement among policy-makers (European Commission, 2010) and academics (Henrekson and Johansson, 2010, Coad et al., 2014a; Brown and Mason, 2014; Megaravalli and Sampagnaro, 2018; Moschella et al., 2018; Pereira and Temouri, 2018; Rice et al., 2018; Weinblat, 2018). For some, more growth is clearly better.

The alternative case is that exceptionally fast growth, as with many other business phenomena, can be “too much of a good thing” (Pierce and Aguinis, 2013; Haans et al., 2016) and decrease, rather than increase, a new venture’s chance of survival. Evidence of the dangers of exceptional fast growth is provided by Gjerløv-Juel and Guenther (2012) and Delmar, McKelvie and Wennberg (2013) who claim that growth – *on average* – is negatively associated with a firm’s survival.[1]

We begin by setting out the theory- based case for seeing growth as enhancing, lowering, or having no effect on NV survival. We then argue that the survival-enhancing case is more persuasive for NVs with low to medium growth rates, whereas the survival-lowering case is more persuasive for NVs with exceptionally high growth rates. This implies the relationship between growth and survival is of an inverted U-shape.

Our empirical contribution is to analyse a large, rich and novel database of NVs in the United Kingdom over a 10 year period that enables us to equate non-survival with business death. Using a range of non-parametric and parametric techniques a consistent story emerges. It is that NVs with moderate growth rates have higher survival chances than those with low growth rates, but also higher survival rates than the very fastest-growers. Our third contribution is to provide some guidance on the implications of our findings for business owners, financial institutions, policy makers, and the research community.

[1] Nevertheless there could be doubts about the interpretation of these results because of the regression specifications. Gjerløv-Juel and Guenther (2012) look at the effect of early growth on survival, while holding constant initial size and also final size. Controlling for final size is a 'bad control', because final size lies on the causal path from growth to survival. Delmar, McKelvie and Wennberg (2013) look at the effect of sales growth on survival, holding constant ROA. Controlling for ROA could also be a 'bad control', because ROA lies on the causal path from sales growth to survival. As an example of the 'bad control' problem, one would probably find no significant effects of drinking beer on driving performance if you *ceteris paribus* control for blood alcohol levels. The bad control problem is discussed in Angrist and Pischke (2009) and Pearl (2009).

The paper is organised as follows. Section 2 formulates our underlying theory. Section 3 reports the results of prior work. Section 4 presents our dataset. Section 5 contains our non-parametric and parametric analysis. Section 6 concludes.

2. THEORY

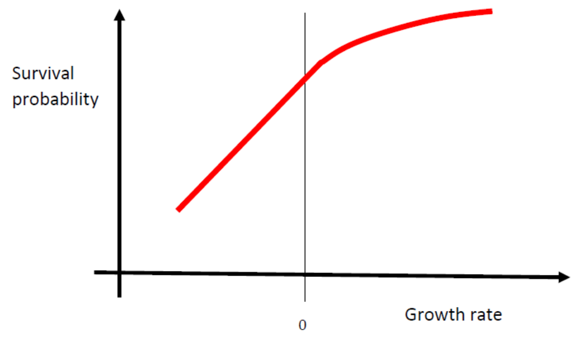
2.1 Benefits of growth

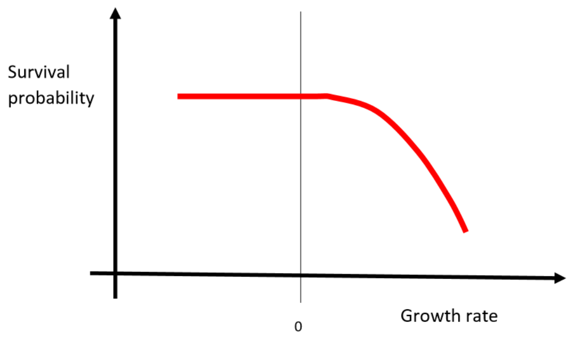
The traditional perspective holds that growth improves the survival chances (Phillips and Kirchhoff, 1989) of a new venture (NV) because it creates a stream of funds (Coad et al., 2013), and because growth itself is a positive signal to employees, investors and stakeholders regarding the firm's viability and future prospects. Wiklund (2007) writes that, for new small firms, 'growth and survival go hand in hand' (p. 145), and growth and survival are often taken as alternative indicators of the same underlying concept: 'performance' (Miller et al., 2013). Garnsey et al. (2006) acknowledge that, although growth creates problems, these are less dangerous to a firm's survival than the absence of growth.

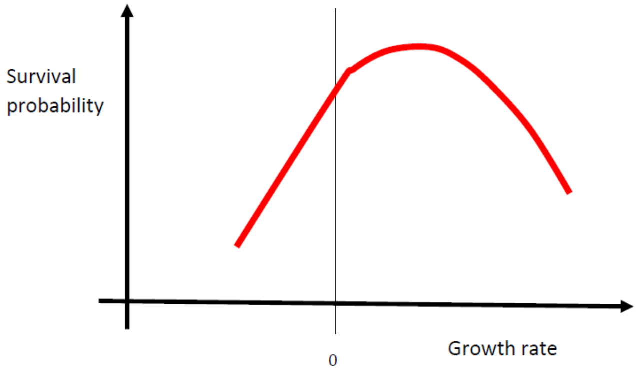
In the opaque finance marketplace in which NVs operate, suppliers of finance seek positive signals from the NV, with the clearest evidence of success being sales income; it becomes the core constituent of a "track record" enhancing access to, and possibly lowering the cost of, finance (Cressy and Bonnet, 2018). This explains Belghitar and Khan's (2013) finding that cash holdings are higher in SMEs than in larger firms, with this being clearest amongst SMEs with volatile cash flows. The point is emphasised in the review of the cash-conversion cycle in SMEs by Mazzarol (2014) which points to the critical role played by working capital within a small business. It particularly emphasises issues relating to creditor strain (i.e. time taken to pay creditors beyond normal limits), plus debtor and creditor days – time taken to collect from debtors and pay creditors. In short, sales growth is expected to relax financial constraints and so lower the likelihood of exit. Declining sales, in contrast, leads to difficulties in covering fixed costs, thus raising concerns about the NV's viability.

There are also non-financial factors which imply the presence of a positive link between sales growth and survival. Dahl and Klepper (2015) argue that a growing new firm becomes more credible with, and attractive to, potential employees. The firm benefits from having a wider pool of applicants from which to choose, so further accelerating growth by being able to employ more productive workers.

Figure 1: Hypothesizing an inverted U-shaped effect of growth on survival. Inspired by Haans et al. (2016).







BENEFITS OF GROWTH:	COSTS OF GROWTH:	NET EFFECT: INVERTED U-SHAPE
Growth provides legitimacy to a new venture, and is a positive signal to stakeholders regarding the firm's viability. Growth of resources helps resolve disputes between employees and offers them promotion opportunities. Beyond a certain point, however, the marginal benefits of growth decrease because the credibility and legitimacy benefits are established.	Costs of growth are low to begin with, but as growth rates become positive, they increase at an increasing rate, for reasons such as financial problems related to the cash cycle, up-front costs of investments in infrastructure, higher interest rates for high-growth firms' loans, time compression diseconomies, and adverse effects of time pressure on quality of decisions and quality of hires.	While growth improves survival up to a certain point, nevertheless there exists a positive growth rate beyond which the costs of growth exceed the benefits of growth, and beyond this growth rate further growth reduces survival chances.

2.2 Costs of growth

There are, however, several reasons why, as a firm grows, it may incur higher costs and so endangering survival. The first reflects the financial pressures of maintaining a balance between costs and incoming cash-flow: “Rapid-growth firms are typically cash-starved” (Hambrick and Crozier, 1985, p32). The accounting literature has suggested that fast growth may lead to cash-flow problems and disrupt the balance between cash consumption and cash generation (Higgins, 1977; Churchill and Mullins, 2001). Firms need cash for working capital, facilities and equipment, operating expenses, and so on. Furthermore, firms with ambitious growth plans need to make up-front investments in capacity and infrastructure. Fast growth may lead to failure if these costs cannot be compensated for by commensurate increases in revenue. In particular, delays between the completion of an order and receipt of payment – often around 90 days – impose major strains upon the resources of a new firm. We noted earlier that access to external credit is likely to be easier for “credible” firms that are growing quickly, but the ability to manage this access to credit without incurring penal costs is not always found. Furthermore, the skills required to achieve rapid sales growth are likely to be different from those of achieving prudent cash management, making it less likely that both skills will be present in an NV with only one or two owners. This has led some to warn that firms should only seek ‘profitable growth’ which comes by first ensuring a satisfactory financial performance – otherwise excessive growth may harm the firm by decreasing its profits (Davidsson et al, 2009; Brännback et al, 2014). Finally, these problems are magnified when growth is volatile rather than continuous over time, since greater volatility requires access to more buffer resources[2].

Second, the costs faced by a firm may increase directly as a function of its growth rate, with fast growth firms paying higher interest rates for their bank loans (Rostamkalaei and Freel, 2016). More generally, Dierickx and Cool (1989, p1507) highlight how ‘time compression diseconomies’ (also known among economists as “convex adjustment costs”) may cause costs to increase if there is a need to finish a task in a shorter time frame. For example,

[2] Storey (2011) shows that only one third of new firms surviving until the end of Year 3 grew their sales in both Year 2 and Year 3. The link between volatility and survival is more formally examined by Coad et al (2018)

‘crash’ R&D programs that spend twice as much on R&D over half the time period tend to be less effective (Dierickx and Cool, 1989, p1507).

Third, the quality of decisions may decrease under the time pressure that is introduced by high growth. Many firms fail after a period of rapid growth, because of a lack of suitable management to coordinate the growing organization’s increasing complexity (Probst and Raisch, 2005). Penrose effects (Penrose, 1959) arise when managers in fast-growing firms struggle to internalise and train-up new employees, such that they can focus less attention on their operational efficiency. Rapid growth in terms of employees may hinder knowledge transfer, create problems for a firm's internal structure, and affect the firm's culture and entrepreneurial spirit (Markman and Gartner, 2002). With regards to hiring employees in labour markets, Shane (1996) made the case that fast growth firms were more likely to encounter adverse selection problems in recruiting workers. This was confirmed by Coad et al (2014b) who find evidence that fast-growth firms hire marginal employees, presumably because they need to make hasty hires of less desirable individuals instead of waiting for a better match. Firms that experience rapid growth face the additional pressures of managing new customer relationships, which is especially problematic if these new customers are found in different geographical or sectoral markets.

Fourth, rapid growth is not necessarily a signal of superior skills and capabilities, but instead may reflect a willingness to engage in risky behaviour (Upton et al., 2001; Denrell & Liu 2012). Hence, the factors associated with high growth might also be associated with higher failure rates, if the underlying cause for both is higher risk-taking (such as an over-reliance on one customer).

The perils of fast growth become more serious if recent expansion cannot be reversed by a decline in size in the following period. Asymmetries exist in the sense that, while it may be relatively easy to grow, it may be more difficult to revert to the previous size. Firms may find it easier to hire, but more costly to fire, employees. New machines that were bought because of optimistic growth projections fetch considerably lower prices if sold on the second-hand asset markets. Investments in R&D cannot be easily sold off if the firm changes its mind.

2.3 The Inverted U-shape

In summary, a moderate rate of growth clearly alleviates financial stress by providing a buffer of slack resources and external stakeholders with a credible signal of growth performance. However, beyond this moderate rate of growth, the returns to additional growth may decrease for the reasons set out above. If that is the case then the relationship between sales growth and survival would be expected to be broadly positive but then flatten and even decline when growth rates are exceptionally high. This implies that the overall relationship would be expected to be of an inverted U-shape as shown in Figure 1.

To date, there has been little empirical testing of the inverted-U hypothesis for new ventures. In a large firm context, Ramezani et al. (2002) find that, although sales growth boosts profitability on average, beyond a certain point, further growth destroys shareholder value and negatively affects profitability. To undertake this testing for new ventures requires examination of the full distribution of growth rates (Zhou et al., 2012; Pe'er et al., 2016; Choi et al., 2017)[3] in order to assess whether sales growth, above a certain point, starts to have detrimental effects on NV survival.

3. PRIOR EMPIRICS

This section reviews the empirical evidence linking survival and growth, particularly in NVs, and it draws the reader's attention to three important considerations in this work.

The first is that different metrics of growth are used in the empirical work. The pioneering study by Phillips and Kirchhoff (1989) used employment as its growth metric. However this metric has important limitations when the focus is the new venture. This is because most NVs do not have employees when they start, and those that do are likely to be larger, so introducing a potentially important source of bias into the results. A second issue is that taking on its first employee is a major – even seismic – decision for the NV, and integer

[3] See also Zhou and Van der Zwan (2019).

restrictions for headcounts mean that it cannot be considered to be incremental, implying that in this context employment is a "clunky" metric. For these reasons we side with Olson et al. (2010, p5) who write, "revenue growth, more than any other metric, is the primary driver of long-term company performance." Relatedly, different time periods have been used in the literature to measure growth, usually measuring growth over either 1-year or 3-year periods. For comparability with previous work, we report results for both 1-year and 3-year growth periods.

A second empirical issue is the extent to which the issue of potential nonlinearities is addressed. These have been investigated in only a small number of studies by including quadratic terms for growth in survival regressions. Pe'er et al. (2016) find a significant curvilinear relationship between employment growth and failure, and warn of the potential negative effects of rapid growth.[4] Choi et al. (2017) observe a statistically significant U-shaped relationship between employment growth (measured over a three-year period) and the exit hazard. However, Zhou et al. (2012) investigate how employment growth over a three-year period affects survival chances, when growth rates are ordered into discrete growth classes, and observe no statistically significant effect of rapid growth on survival. They write (p9):

> *"We therefore conclude that there is no empirical support for our assumption that high growth rates have a negative impact on the survival rates of enterprises. From a policy perspective, we thus find no evidence that policies stimulating fast-growing enterprise may result in more firm deaths."*

The third issue that requires highlighting is the use of the term survival. This is both a very technically complex area to define – see Storey and Greene (2011) – and also for some, but not others, has negative connotations. This is because non-survival is sometimes equated with failure and incompetent management.[5] It is therefore important to note that our core

[4] Coad and Guenther (2013) investigate the effects of growth through diversification (i.e. entry into new product submarkets) on survival, and observe that while diversification enhances survival, these benefits are somewhat offset by an opposite-signed quadratic effect, although the relationship between diversification and survival only occurs if a firm more than doubles its product lines in a given year.

[5] Bruno and Leidecker (1988) for example made the case that "incompetent management was responsible for nearly 90% of these failures." However more recently there have been efforts to "rehabilitate" business failure on three grounds: first that some exits are successful, second that many owners view the closed business as a success and third that exit is a learning experience (Josefy et al., 2017).

definition of survival is whether the business bank account continues. No judgement is made, or required, about whether the business was a success. A second, tighter definition of non-survival is that of financial default. This is an indicator of extreme financial failure (i.e. if the firm is unable to keep up with its debt repayments) and is obtained from the bank's records regarding whether a firm enters default during its exit year.

Overall, our view is that both the theoretical perspectives and the empirical work thus far have produced mixed, even contradictory, evidence whether faster growth consistently increases the likelihood of new venture survival. These contradictions stem from the use of different theoretical perspectives, definitions, data sources and analytical techniques.

4. DATA

4.1 Database description

We analyse a cohort of 6578 new ventures observed from their first sales onwards, using customer records at Barclays Bank. In 2004 Barclays provided the main current (checking) account for over 20% of all businesses in England and Wales with sales of up to £1 million and their active customer base in this market was approximately 500,000 firms. We sought to take a representative sample of these businesses.

Our database was constructed by including all new ventures that started trading between March and May 2004, and then tracking them for up to 10 years (i.e. our data spans the period 2004-2014). We ensure that our ventures genuinely commence their operations at the time of birth by removing those that showed no trading activity in the period immediately after entry, i.e. during April-June 2004. Although some of these firms obtained term loans and overdraft facilities, it is important to note that being included in the dataset is NOT conditional on the use of other banking services beyond the business' basic current account. Unlike other countries, the UK is not characterized by 'multiple banking', and this is especially true for young firms (Ongena and Smith, 2000). For this reason the business bank account(s) are viewed to fully capture the financial transactions of the enterprise.

Bank-based archival data has several advantages over other frequently-used data sources on small businesses (Barnes et al., 2017). First accidental, or non-accidental, misreporting may lead to inaccurate data on the performance of entrepreneurs' businesses, whereas in our data the amount of money coming into the business account is observed with accuracy. Second, given the pressures to reduce bureaucratic requirements for small firms, administrative datasets often have little information on small new firms. In the UK, for example, firms below the Value Added Tax threshold are not required to provide details of their business operations. Third, questionnaire data often has small samples, and is vulnerable to biases (such as self-report bias, survivor bias, and other inaccuracies). In contrast, our dataset comprises information from a questionnaire taken immediately prior to start-up and where there is a strong incentive to respond truthfully. All financial transactions passing through that account, either for ten years or until the account closes, are accurately recorded.

A firm's size is measured in terms of the total funds entering the entrepreneur's bank account (i.e. credit turnover) over a 12-month period. This corresponds to its total sales.[6] Annual growth rates are calculated in the usual way by taking log-differences of sales (Tornqvist et al., 1985; Coad, 2009; Brenner and Schimke, 2015) for firm *i* in year *t*:

$$\text{Growth}_{it} = \text{Log}\ (\text{Sales}_{it}) - \text{Log}\ (\text{Sales}_{i,t-1}) \qquad (1)$$

Penrose famously observed that "there is no way of measuring an amount of expansion, or even size of a firm, that is not open to serious conceptual objection" (Penrose, 1959: p199). However we noted earlier that, in the case of new ventures, sales growth has advantages over other metrics – most notably employment – and so facilitates comparisons with work that focuses on employment growth (Zhou et al., 2012; Pe'er et al., 2016; Geurts and van Biesebroeck, 2016).

Given that only about 50% of new firms in our sample survive their first 3 years, we prefer to measure growth over a 1-year period (following e.g. Delmar et al., 2013; Capasso et al., 2014; Brenner and Schimke, 2015) instead of a 3-year period (Zhou et al., 2012; Holzl, 2014, Choi et al., 2017) to avoid possible survivor bias (e.g. firms that grew too fast in the first period and exit in the second period), and to better investigate the consequences of an intense

[6] The metric captures real sales and not financial account transfers.

burst of potentially excessive growth as opposed to sustained longer-run growth. However, considering that the literature on high-growth firms has often measured growth over a three-year period (e.g. Zhou et al., 2012; Holzl, 2014; Choi et al., 2017), we also present results for three-year growth, to reconcile previous conflicting evidence and to better contribute to the accumulation of knowledge in the broader field of firm growth.

4.2 Survival

As noted in Section 3 we are keenly aware that our findings are likely to be sensitive to the definition used for survival and non-survival. We therefore repeat that our core definition of non-survival is when the business bank account is discontinued.

This core definition does not distinguish between the types of non-surviving NVs. Some, for example, are “successful” exits - such as where the owner sells the business and these could vary in scale from modest trade sales to, in the extreme case, being listed as an Initial Public Offering (IPO). There is concern that successful entrepreneur exit events may appear in datasets as firm disappearances, and thus complicate the interpretation of firm-level exit events (Wennberg et al., 2010; Arora and Nandkumar, 2011; Coad, 2014; Kato and Honjo, 2015; Kato et al, 2017).[7]

For this reason we identify the sub-group of non-survivors which are clearly not successful – which we call defaulters. These are defined by using information on whether there is “a material incidence of lending arrears,” and whether the account is moved to a recovery unit with the bank seeking to recover the arrears. We use this metric in our robustness analysis, with 3.49% of our observations corresponding to cases of financial default.

A third issue with using a closed bank account as a measure of non-survival is that of transferring bank account activity to a rival bank. Our dataset enables us to see, when the account closes, if the NV switches to another bank, and these cases of ‘switchers’ have been excluded from the analysis.[8] Our dataset therefore also allows us to see whether a firm

[7] In practice, there are no IPOs in our sample.
[8] Firms are coded as "switchers" if there is an 'explicit' closure of the account and a record of exit to another provider. A (small) number of other firms may have moved 'below the radar', however, which means that it is possible that not all ‘switchers’ may have been identified.

continues to use the same business bank account (i.e. a continuing firm) or whether it ceases to use its bank account altogether and does not even transfer it to a different bank (i.e. an exiting firm). Firms that continue using the same business bank account under a different name, or switch their business bank account to a different bank, are not counted as cases of business exit. Finally we once again emphasise that multiple banking, common in several southern European countries, is extremely rare amongst firms in the UK that are young and small (Ongena and Smith, 2000), and so the assumption that the bank account(s) validly and fully capture the financial flows in the NV is valid.[9]

4.3 Control variables

Our dataset also includes a number of pre-start variables taken from a questionnaire administered at the time of seeking a business bank account. This rich set of control variables is, in itself, an important contribution, considering that previous authors commented on the need for information on founder characteristics (Zhou et al., 2012; Pe'er et al., 2016).[10] These variables are the age of the business owner (or the mean age in those cases where there is more than one business owner), the educational attainment, the gender, prior business experience (whether personal or family business experience), and the sources of advice/support approached prior to start-up. We also have information on characteristics of the business once it begins to trade, i.e. sector, location and choice of legal form. Finally, the unique asset of our data is that it includes time-varying business-specific variables that come from monitoring the bank account in the years after entry (i.e. bank account volatility and also information on the use, and extent of use, of authorized or unauthorized overdraft behaviour). This is particularly useful in our context, because it sheds some light on the financial difficulties faced by rapid growth firms. Appendix 1 presents the variables in more detail.

4.4 Descriptives

[9] There is of course the likelihood that some financial transactions take place with proceeds being placed "under the mattress."
[10] Zhou et al (2012, p6) write that: "The number of control variables in our dataset is very limited; we can only control for size, industry and age." Pe'er et al., (2016, p.36) explain that: "A third limitation of our study stems from the lack of information on the characteristics of the founders."

Table 1 presents summary statistics on firm size and growth rates, for different years. The median firm size (annual sales) is just under £40,000 in year 1, highlighting the small scale of most of these NVs.[11] The mean and the standard deviation of firm size increase over time, as they become larger and the size distribution shifts outwards in the years after entry (Cabral and Mata, 2003; Angelini and Generale, 2008). Perhaps surprisingly to some, the mean growth rate is slightly negative in each year, which implies that the average firm decreases slightly in sales from one year to the next. (The median growth rate is usually slightly positive, however.) The standard deviation of the growth rate distribution decreases over time, indicating that extreme growth events become less common in the years after entry. Table 1 also indicates the low survival of these businesses – out of 6578 NVs that start at the beginning of year 1, only about 50% (3211) remain in business at the end of year 3 (in line with Anyadike-Danes and Hart, 2018, on UK census data).

[11] The threshold for VAT registration was £58,000 annual turnover for the year starting 1 April 2004, and £73,000 annual turnover from April 2011 onwards. Hence, many of the firms in our dataset are below this threshold and would not appear in standard administrative datasets.

Table 1: summary statistics for size (sales) and growth rates, for the cohort's first ten years. There are 6578 firms at the start of year 1, although only 5524 survive until the end of year 1.

	Mean	Std Dev	10%	25%	Median	75%	90%	N
	Sales							
year 1	114095	508678	5475	14687	38712	103658	260652	5,524
year 2	144319	546146	5547	16529	44524	124414	323178	4,162
year 3	168352	645409	5222	17253	47855	138347	373255	3,211
year 4	183939	542018	5438	18532	51964	158026	428499	2,593
year 5	190217	552839	5945	17996	51168	152264	451445	2,152
year 6	192157	706588	5239	17517	47924	147866	453727	1,823
year 7	213050	938730	5700	18475	53019	161941	512618	1,604
year 8	253250	1333538	6668	19516	58134	177112	577178	1,424
year 9	277643	1640798	6533	19274	57258	180390	595597	1,311
year 10	300699	2046271	6860	22673	64989	196821	592880	1,208
	Sales gr.							
year 1	-	-	-	-	-	-	-	-
year 2	-0.055	0.940	-0.964	-0.270	0.053	0.356	0.753	4,162
year 3	-0.133	0.946	-1.001	-0.303	0.022	0.240	0.566	3,211
year 4	-0.110	0.864	-0.873	-0.280	0.013	0.226	0.503	2,593
year 5	-0.189	0.907	-0.991	-0.378	-0.067	0.135	0.427	2,152
year 6	-0.221	0.833	-0.864	-0.368	-0.080	0.086	0.359	1,823
year 7	-0.089	0.772	-0.696	-0.207	0.005	0.185	0.475	1,604
year 8	-0.055	0.698	-0.593	-0.198	0.000	0.184	0.458	1,424
year 9	-0.078	0.731	-0.592	-0.222	-0.022	0.147	0.436	1,311
year 10	-0.037	0.678	-0.518	-0.175	0.020	0.203	0.484	1,208

5. ANALYSIS

5.1 Non-parametric analysis

We begin our analysis with an *unconditional* exploration of survival across growth rate deciles, i.e. taking an initial look at the relationship between growth and survival without controlling for other influences. Figure 2 focuses on a cross-sectional analysis the earliest possible year of observation: growth from year 1 to year 2 and its effects on survival to year 3. The growth rate distribution is split into equipopulated deciles (from the 10% of firms with fastest decline to the 10% of firms with fastest growth). Considering that membership of the top decile in one year is not equivalent to membership of the top decile in another year (because decile thresholds change over years, and the sample size changes over years), we do not pool observations together, but focus only on growth in year 2.[12]

Overall, growth enhances survival. The lowest survival rates are found among firms having the fastest decline in year 2. For the 10% of firms experiencing the lowest growth rates in year 2, their survival rates going into year 3 are only 47%, and their survival rates into year 10 are just 10%. However, the highest survival rates are not observed for those firms enjoying the fastest growth rates in year 2. Instead, the relationship is non-monotonic. Exceptional growth, beyond a certain threshold, actually reduces a firm's survival prospects. This important finding of a nonlinear relationship could not have been detected by empirical methodologies that focus on the average effects growth on survival.[13] The highest survival rates are observed for firms in the 7th or 8th deciles.[14] In other words, for the top 20%-30% fastest-growing firms, additional growth carries no survival benefits. The confidence intervals are relatively large, however, suggesting that further analysis is needed to investigate whether the survival rates for the fastest growing firms are approximately the same as those for moderate-growth firms, or whether the survival rates are statistically significantly lower than those for moderate growth firms. To this end, we now turn to regressions.

[12] Since the cohort starts in 2004, and year 2 corresponds to 2006, then a focus on growth deciles in year 2 means that the analysis focuses on the years before the Great Recession. To investigate whether the relationship between growth and survival is a regularity that holds irrespective of the business cycle, we repeat the analysis in Figure 2 by measuring growth in year 5 (which corresponds to 2009), and the results (not shown here) confirm the non-monotone relationship between growth and survival. We conclude that the financial crisis did not lead to a change in the patterns observed between growth rates and survival.

[13] See e.g. Dunne and Hughes (1994), Headd and Kirchhoff (2009), and Delmar et al., (2013).

[14] Further bar charts for different years and for different survival horizons, presents similar results.

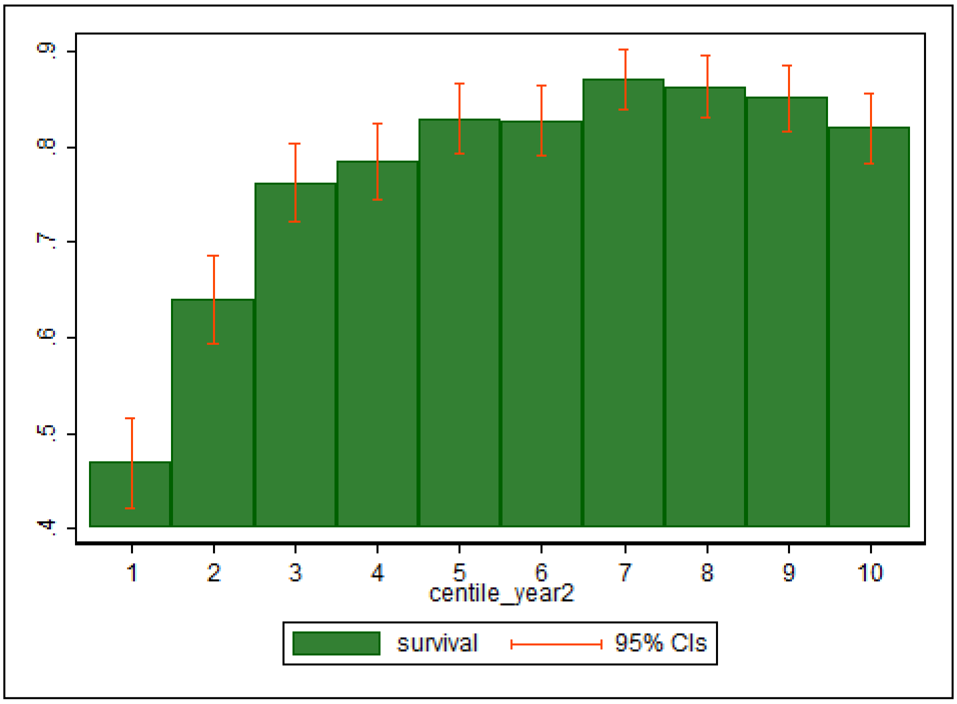


Figure 2: Firms are placed into equipopulated deciles (horizontal axis) according to their growth rates in year 2. Survival rates (vertical axis) to year 3. Bars overlaid with 95% confidence intervals.

5.2 Parametric analysis

5.2.1 Polynomial specifications

Regression models can investigate the statistical significance of the relationship between growth and survival, while also taking into account the potentially confounding role of other explanatory variables. Our basic regression equation focuses on the effects of growth at *t* on survival at *t+1*:

$$\text{Survival}_{i,t+1} = \alpha_0 + \beta_1 \text{Growth}_{it} + \beta_2 X_{it} + \varepsilon_{it} \qquad (2)$$

Given the preceding discussion, we expect nonlinear effects of growth on survival. These nonlinear effects could be investigated using a quadratic growth term in the regression equation for the effects of growth on survival (Pe'er et al., 2016), but this quadratic representation would be limited if the empirical relationship does not closely follow the quadratic functional form (Haans et al., 2016). We therefore augment our regression equation to include higher order polynomials, to give our regression model more flexibility in finding the best-fitting nonlinear relationship.[15] We therefore estimate the following regression equation:

$$\text{Survival}_{i,t+1} = \alpha_0 + \Sigma_{k=1:n}\, \beta_{1,k}(\text{Growth}_{it})^k + \beta_2 X_{it} + \varepsilon_{it} \qquad (2a)$$

where the polynomial (indexed by k) varies from the first to the n^{th} power. With regard to the choice of number of powers, we opt for a maximum of n=5.[16] To the extent that excessive growth may be an indication that the firm is already experiencing problems that could lead to exit, a conservative stance would be to interpret our results as associations rather than causal effects.

Table 2 shows our main regression results, coming from a discrete-time logit survival model (Jenkins, 1995; Wiklund et al., 2010; Coad et al., 2013), where the binary dependent variable is whether a firm survives until the end of the year. Section 5.1 analyzed a single cross-section (growth in year 2 and survival into year 3) but now our regressions pool together the years in a longitudinal data context. Discrete-time logit survival models have a number of advantages in our case, because explanatory variables are not fixed in time, but are allowed to vary across years (i.e. we have time-varying covariates), and this estimator takes each firm-year as a separate observation (unlike Cox proportional hazard models), hence making full use of the available data (Wiklund et al., 2010). Control variables are included in the computations, but not reported in detail in the results table (see notes to Table 2).

Column (1) of Table 2 shows that, on average, lagged growth improves survival chances, in line with the seminal paper by Phillips and Kirchhoff (1989). The coefficient on lagged

[15] Our polynomial regression specification has the advantages of being continuous and parsimonious; it permits the pooling together of observations across years and is fairly comparable with other studies on the same topic. However, an alternative to the polynomial regression specification involves the use of dummy variables for each growth decile. In further analysis, we fix the omitted baseline case as the 10th decile, and observe that the deciles corresponding to moderate growth have significantly higher survival rates than the dummy corresponding to the fastest growth decile.

[16] Inspection of the Akaike Information Criteria (AIC) and the Bayesian Information Criteria (BIC), as well as an inspection of how model fit statistics (Cox-Snell and Nagelkerke R^2 statistics as well as the percentage of cases correctly classified) improve with the inclusion of higher-order polynomials, show that the specification improves steadily when up to the 10^{th}-order polynomial is included. For simplicity, however, our preferred specification is a polynomial model that includes the quintic term (5^{th} power).

growth is positive and strongly significant. Column (2) shows that adding a quadratic term improves the model fit, in terms of the Nagelkerke R^2 goodness-of-fit statistic, and the linear and quadratic terms are both statistically significant. This is in line with previous work (e.g. Pe'er et al., 2016). Column (3) includes higher order polynomial terms, which are also statistically significant and improve the model fit. The linear term is positive, the quadratic and cubic terms are negative and the quartic and quantic terms are positive. This suggests that the practice of taking only quadratic powers (e.g. Pe'er et al., 2016; Coad and Guenther, 2013), when investigating the role of growth on survival, is perhaps arbitrary and overly simplistic, because the true relationship is more complex than the quadratic.

In order to verify that the relationship between growth and survival is indeed an inverted-U-shaped relation, we check that the slope is significant and opposite signed on either side of the optimum (Haans et al. 2016, p1182). Figure 2 suggested that the optimum lays in the 7th or 8th decile. We therefore distinguish between firms on the basis of whether or not they are in the region of rapid growth (i.e. above the 75th percentile) in their growth year, and examine the effects of growth on survival. Column (4) shows that, for firms in the bottom 75% of the growth rates distribution, the effect of growth on survival is significantly positive. Column (5), however, shows that growth is significantly negatively associated with survival for firms in the top 25% of the growth rates distribution. Hence, growth enhances survival up to a point, but at the upper end of the growth rates distribution (i.e. for the fastest-growing firms) the effect of growth is significantly negative.

Columns (6)-(9) take our alternative dependent variable: entry into financial default. The results in columns (6) hint that growth is linked to higher performance (i.e. lower default rates), although the linear term is not statistically significant. Column (7) points towards a U-shaped effect: the quadratic term is statistically significant, although the linear term is not statistically significant here either. Columns (8) and (9) are more conclusive, however, because they show that growth is significantly negatively associated with the probability of financial default at the bottom 75% of the growth distribution, while being significantly positively associated with the probability of financial default at the top 25% of the growth distribution. This shows that, for the top 25% fastest growers, additional growth no longer enhances survival, but instead it makes financial default more likely. The higher exit rates of the fastest-growing firms therefore do not seem to correspond to cases of successful exits, but rather to unsuccessful exits.[17]

Columns (10) to (13) measure firm growth over a three year period, to investigate whether the distinction between short bursts of growth (over one year) or sustained growth trajectories (over a three-year period) moderates the relationship between growth and survival. A focus on 3-year growth is in keeping with some previous investigations of the effect of rapid growth on survival (Zhou et al., 2012; Holzl, 2014; Choi et al., 2017). Column (10) shows that growth enhances survival chances, on average. Therefore, repeating our analysis using three-year growth (in addition to our results for one-year growth) may help to reconcile previous conflicting empirical evidence, and also can help to better contribute to knowledge accumulation in the broader field of firm growth.

Column (11) shows that the quadratic term is not significant. This contrasts with Choi et al. (2016), who report a significant quadratic term, in their analysis of employment growth and survival of US establishments. Columns (12) and (13) further investigate the matter using an analysis of subsamples, and show that growth has benefits for survival for the lower 75% of the growth rates distribution, although rapid growth (at the top 25% of the growth rates distribution) is not significantly related to survival chances.

The results in Table 2 suggest that growth enhances survival chances overall and also reduces the chances of entry into financial default. However, at the upper quartile of the growth rates distribution, growth has detrimental effects for survival. When growth is measured over three years, though, the negative effects of rapid growth are no longer detected (in line with Zhou et al., 2012). We suggest that this is because a three-year period is a relatively long time for new firms, and that restricting the sample to those firms that survive for the full three year period will censor many firms that grow fast in one year and exit in the next. Furthermore, it may be that it is sudden bursts of growth, visible over a one year horizon – in contrast to

[17] To further verify that business exit is due to poor performance (rather than being cases of successful 'entrepreneurial exit' such as IPO or acquisition, as in e.g. Wennberg et al., 2010), we ran 10 logistic regressions for each of the 10 deciles of growth in year 2, regarding survival into year 3. Indeed, exit events in the fastest-growth decile appear to be associated with poor performance (e.g. high revenue volatility, unauthorized overdraft activity, sole trader legal form). These extra results are available from the corresponding author upon request.

longer-term growth trajectories unfolding over a three year horizon – that are hazardous for fast-growing firms.

Table 2: logit duration model (Jenkins, 1995), for the effects of growth (t) on survival (t+1). All years pooled together. Growth rates >|2.3206|, corresponding to tenfold growth or tenfold decline, are considered to be outliers and are removed.

Dep. Var.: Surv. into t+1	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
	Growth	**Growth**	**Growth**	**Growth**	**Growth**	**DV: Fin.Def**	**DV: Fin.Def**	**DV: Fin.Def**	**DV: Fin.Def**	**3yr growth**	**3yr growth**	**3yr growth**	**3yr growth**
	Pooled	**Pooled**	**Pooled**	**Bottom 75%**	**Top 25%**	**Pooled**	**Pooled**	**Bottom 75%**	**Top 25%**	**Pooled**	**Pooled**	**Bottom 75%**	**Top 25%**
gr_sales	0.486***	0.418***	0.834***	0.659***	-0.367***	-0.0626	0.0371	-0.261**	1.304***				
	(0.0397)	(0.0424)	(0.0852)	(0.0543)	(0.122)	(0.0904)	(0.0945)	(0.120)	(0.234)				
gr_sales sqrd		-0.118***	-0.513***				0.156**						
		(0.0315)	(0.0807)				(0.0663)						
gr_sales^3			-0.419***										
			(0.0828)										
gr_sales^4			0.0921***										
			(0.0228)										
gr_sales^5			0.0667***										
			(0.0169)										
gr_sales										0.316***	0.334***	0.360***	-0.106
(3 years)										(0.0370)	(0.0489)	(0.0457)	(0.106)
gr_sales sqrd											0.00811		
(3 years)											(0.0141)		
Observations	17,649	17,649	17,649	13,201	4,448	17,649	17,649	13,201	4,358	10,592	10,592	7,909	2,683
Nagelkerke R2	0.170	0.171	0.176	0.185	0.130	0.245	0.246	0.268	0.213	0.166	0.166	0.178	0.131

Control variables: lagged sales and lagged sales squared (lagged 3 periods when growth is measured over 3 periods), age and age squared, education dummies, business experience dummies, sources of advice dummies, volatility, overdraft excess dummy, overdraft excess duration, unauthorized overdraft excess (dummy and duration), number of owners, male owner(s), legal form dummies, sector dummies region dummies, and constant term. Robust standard errors in parentheses. Key to significance levels. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3: logit survival model, for survival in individual years.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	surv. yr 3	surv. yr 4	surv. yr 5	surv. yr 6	surv. yr 7	surv. yr 8	surv. yr 9	surv. yr 10
gr_sales	0.799***	0.852***	0.735***	1.020***	0.818***	0.789***	0.546**	1.143***
	(0.0912)	(0.105)	(0.113)	(0.166)	(0.203)	(0.214)	(0.230)	(0.330)
gr_sales (squared)	-0.352***	-0.230***	-0.287***	0.0195	-0.394***	-0.430**	-0.330**	-0.234
	(0.0776)	(0.0732)	(0.0694)	(0.0561)	(0.143)	(0.178)	(0.164)	(0.247)
gr_sales^3	-0.114***	-0.0760***	-0.0547***	-0.0143	-0.0814***	-0.0496*	-0.0306	-0.0765**
	(0.0322)	(0.0146)	(0.0151)	(0.0101)	(0.0297)	(0.0274)	(0.0286)	(0.0388)
gr_sales^4	0.0293***	0.0103	0.0130***	-0.00102	0.0260*	0.0267**	0.0234*	0.0242
	(0.00947)	(0.00635)	(0.00408)	(0.00121)	(0.0138)	(0.0119)	(0.0138)	(0.0278)
gr_sales^5	0.00756***	0.00222***	0.00185***	0.000145	0.00462**	0.00337**	0.00274*	0.00443
	(0.00263)	(0.000854)	(0.000637)	(0.000157)	(0.00204)	(0.00172)	(0.00161)	(0.00365)
Observations	4,147	3,201	2,557	2,146	1,819	1,562	1,393	1,302
Nagelkerke R2	0.143	0.170	0.175	0.188	0.215	0.227	0.170	0.240

NOTES: Control variables: lagged sales and lagged sales squared, age and age squared, education dummies, business experience dummies, sources of advice dummies, volatility, overdraft excess dummy, overdraft excess duration, unauthorized overdraft excess (dummy and duration), number of owners, male owner(s), legal form dummies, sector dummies region dummies, and constant term. Robust standard errors in parentheses. Key to significance levels. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

5.2.2 Disaggregating by year

Following on from our aggregate analysis, where observations for all years were pooled together, we now investigate whether the perils of rapid growth decrease in the years after entry. This is important because growth rates are higher in the years immediately after entry, and then slow down (Haltiwanger et al., 2013; Lawless, 2014). Furthermore, survival challenges may be particularly acute for younger firms. The exit hazard is relatively high in the years immediately after entry, but afterwards stabilizes at a lower value, perhaps due to the liability of newness that affects young firms (Lundmark et al., 2019). Indeed, previous work has suggested that firms undergo significant changes in their first 5-7 years after entry (Anyadike-Danes and Hart, 2018; Coad, 2018).

Table 3 contains regression results for individual years. 8 regressions are reported in 8 columns (survival in each year from year 3 to year 10), with specifications including not only quadratic terms, but also 5th-order polynomials in firm growth rates. Overall, the growth rate is positively associated with survival, since the quadratic and cubic terms are always negative (and usually significant), and the quartic and quantic terms are usually positive and significant.

5.2.3 Predicted survival across the growth rate distribution

Regression models impose restrictions on the possible forms taken by the line of best fit, while semi-parametric graphs depict smoothed best-fit lines that closely follow the patterns in the data, thus providing rich descriptive graphs of the empirical relationship between growth and survival. In this section, we remove the influence of the control variables on survival, to obtain predicted survival probabilities (i.e. predictions from a fitted regression line), and then examine how these predicted probabilities vary over the growth rate distribution, to obtain a semi-parametric representation of the relationship between growth and survival. In a first stage, we estimate the following regression equation using a logit duration model:

$$\text{Survival}_{i,t+1} = \alpha_0 + \beta_2 X_{it} + \varepsilon_{it} \qquad (3)$$

X_{it} includes our full set of controls: founder characteristics, venture characteristics, and bank account activity variables.[18] Note that we do not include growth as an explanatory variable in (3), because we seek to examine how the expected survival rates, conditional on other variables, vary across the growth rate distribution. In a second stage, we show the predicted survival rates across the growth rate distribution, using a smoothed "lowess" nonparametric regression line for each year.

Figure 3 shows that the predicted survival probability is lowest for firms experiencing rapid decline. This confirms our earlier results in Figure 2, and resonates with previous research (e.g. Zhou et al., 2012). Closer analysis reveals that it is the bank account activity variables that help to predict the lower survival probabilities for these rapid-decline firms, consistent with the explanation that rapid decline leads to financial distress.

Overall, for all years, predicted survival rates peak when growth is slightly positive, with fast growth firms having lower predicted survival rates. The only modest exception is for the very youngest firms (growth in year 2 linked to survival in year 3) where the non-survival penalty for fast growth is small. The lower survival chances of rapid-growth firms, in our data, are not due to 'successful exits' but are due to the same factors that predict exit among rapid-decline firms.

[18] Bank account activity variables – use of (un-authorized) overdraft and bank account volatility – might be endogenous to failure (i.e. these variables may lie on the causal path between rapid growth and survival, making them 'bad controls'; Angrist and Pischke, 2009). However, our results for rapid-growth firms did not change noticeably whether or not these variables were included here.

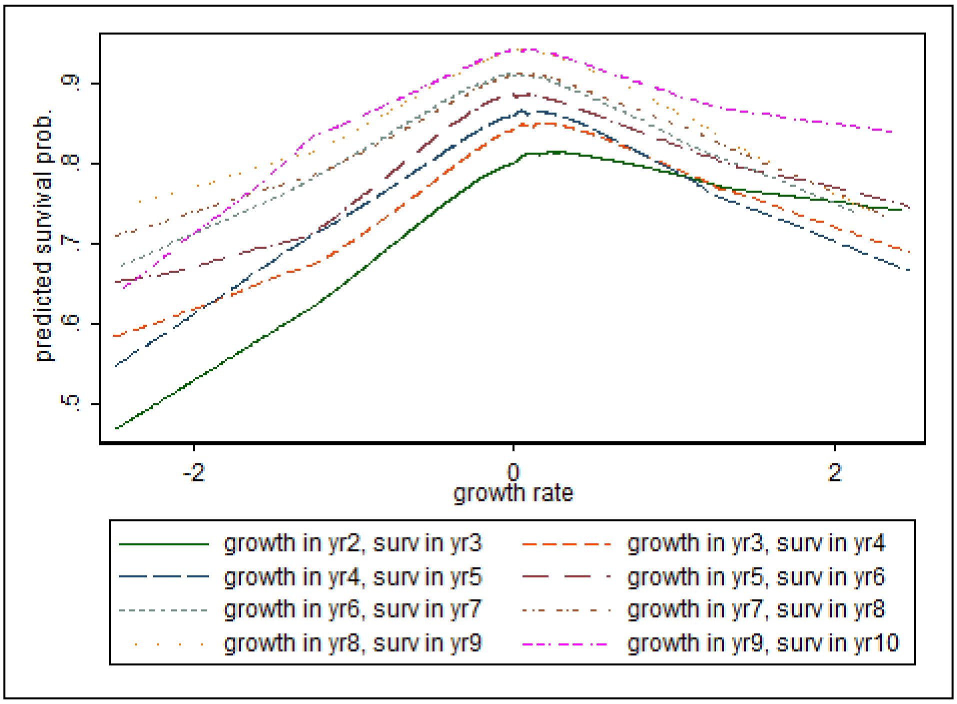


Figure 3: predicted survival probabilities across the growth rate distribution, obtained from a logit duration model estimated using equation (3) for individual years. A 'lowess' smoother summarizes how the predicted survival probabilities change across the growth rate distribution.

6. CONCLUSIONS

New ventures (NVs) have notoriously high failure rates, and a standard recommendation is that they can enhance their survival chances if they grow (Phillips and Kirchhoff, 1989). While it is generally recognized that firms should pursue growth, there are a number of theoretical reasons why too much growth might be harmful. For example, fast growth may decrease survival chances if the benefits of growth are overwhelmed by costs of growth that increase rapidly and contribute to financial difficulties. These might be reflected in cash-flow problems.

In this paper, we shed new light on the relationship between growth and survival, by looking at the benefits of growth across the growth rates distribution. We contribute to the literature by providing novel and conclusive results on the relationship between rapid growth and failure. Furthermore, we analyse a rich data source that allows us to remove the possibility of successful exits (an issue that has dogged previous research on the matter), and to confidently assert that the exits of high-growth firms are genuine cases of failure.

We find that, overall, growth enhances survival. However the highest survival rates are found amongst NVs with moderate growth – those in the 7th and 8th deciles of the growth distribution. Those experiencing the fastest growth – in the 9th and 10th deciles – have survival rates that are above the average for new firms as a whole, but below those with moderate growth. The relationship is therefore significantly nonlinear.

A popular indicator of firm growth combines growth and survival together onto the same continuous scale, where survival corresponds to a growth rate of -100% (known as the DHS indicator after Davis, Haltiwanger and Schuh, 1996). The DHS indicator has become a 'standard' indicator of firm growth (Haltiwanger et al., 2013). This makes intuitive sense if survival chances are a linear increasing function of growth rate. However, our results suggest that the fastest-growing firms have higher exit rates than their moderate growth counterparts. We therefore agree with other scholars (e.g. Huber et al., 2017, Delmar and Wallin, 2018) who suggest that it would be better to view survival and growth as two distinct processes, rather than trying to combine them together into one indicator.

Previous work that has investigated the nonlinear effects of growth on survival has restricted itself to only including quadratic terms (e.g. Pe'er et al., 2016), However, we show the benefit of higher powers being included in survival regressions. We also complement previous work (Zhou et al., 2012; Pe'er et al., 2016; Choi et al., 2017) by exploiting a rich dataset on the sales growth (instead of employment growth) of new ventures, and controlling for founder characteristics.

Our results suggest why previous evidence on the matter was inconclusive and sometimes conflicting. Although rapid growth measured over the period of one year can be detrimental to survival, nevertheless growth has no detectable harmful effects, even at the upper quantiles of the growth distribution, when growth is measured instead over a three year period. Hence, it seems to be short intense bursts of growth that are harmful, rather than prolonged rapid growth trajectories. Policy-makers that are interested in the job creation prowess of high-growth firms are therefore encouraged to focus on three-year growth (or perhaps five-year growth) rather than annual growth, because firms that create many jobs through rapid growth over a 1-year period appear to be more likely to shed jobs (via exit) than moderate-growth firms.

We think that our findings are highly relevant to those managing and funding NVs. For finance providers, exceptional fast growth over a year is a signal for alerting bank attention. The bank could look at the take-up and usage of loan and overdraft facilities to examine if these are being used to excess, implying weak cash management. The bank is in a position to assess the reasons for this take-up. It might be expected to view the provision of funding for an acquisition differently from receiving a high-profile order from a large firm which perhaps has a track record of slow payment. The closeness of the relationship between the bank and its new venture client is therefore a key component of both parties managing growth.

From the viewpoint of the NV our results clearly emphasise the merits of moderate rather than extreme growth, unless it is also clear that such rates can be sustained into the medium term. They are a justification for the NV to look closely at the payment terms and conditions associated with an apparently attractive large order from a large enterprise. Importantly, these lessons are not ones that can be ignored in buoyant macro-economic conditions. This is because, although our first analysis was against the backdrop of a recession, our findings robustly continue as economic conditions generally improved.

From a research perspective we see three possible directions. The first is to see if sales growth links to other outcome variables such as profits. Second we need to better understand whether the dangers of excessive growth fade in the years after entry. Third, as we noted earlier, we need to better understand the nature of the threshold amount of positive growth, below which managers can comfortably manage growth and assimilate the newly-added resources without incurring excessive organizational stresses and financial strains. It points to the need to investigate the most powerful causal mechanisms underpinning the “too fast to live” effect. These include cash flow problems, cost increases, decreases in decision quality, and growth as an outcome of risk-taking.

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Appendix 1: Data description

Table A1: Variables used in the regressions

Dependent variable	
Open	Binary variable. A business bank account can either continue (survival, takes value 1) or be transferred to a rival bank (these 'switchers' are identified and dropped) or be closed down without being transferred elsewhere (failure, takes value 0).
Default (used in robustness analysis)	Binary variable. Takes value 1 if the firm is recorded as entering default at any point in the year, otherwise takes value 0
Main independent variables: Size and growth:	
log sales	log of annual credit turnover of the current account
gr sales	Growth of annual credit turnover. Growth rates calculated by taking log-differences (Tornqvist et al., 1985)
startup size	Sales in the first year
Structural variables observed at start-up:	
age	(mean) age of start-up owner-manager(s)
age sq	quadratic function of age
Education dummies	Highest educational attainment of owner-manager(s): none, GCSE, A-level, Degree or higher, according to the UK National Vocational Qualification scale.
bexp	dummy variable equal to 1 if: the owner has no previous business experience (bexp_none); or the owner, personally, has previous business experience (bexp_self); or the owner's parents have business experience (bexp_fam). If there are multiple owners, this latter variable corresponds to the situation of the respondent.
adv x	sources of advice and support sought prior to start up: enterprise agency/business link (entbl), accountant (acc), solicitor (sol), college (coll), (Barclays) start right seminar (srs), the princes trust (pybt), family (fam), other (oth) (recoded into dummy variables)
own xs	Dummy variable, = 1 if the number of owners is in excess of the minimum number for the legal form: company 2+, partnership/LLP 3+
own male inv	= 1 if there is at least one male owner-manager of the start-up, 0 otherwise
legformx	legal form of start-up, recoded into dummy variables. legform2: partnership; legform3: sole trader. Omitted category is legform1: company (including LLP).
Trading variables:	
vol	ratio of the standard deviation of monthly turnover to the mean monthly turnover, summed over two six-month periods to obtain an annual volatility indicator
odxs	= 1 if in excess of authorised overdraft limit at any time
odxs pc	proportion of period in excess of authorised overdraft limit
odlim use	= 1 if authorised overdraft used at any time
odlim pc	mean proportion of authorised overdraft limit used
Industry and Region dummies:	
Industry	business sector of firm at start-up, recoded into dummy variables: 1 = Agriculture, 2 = Manufacturing, 3 = Construction, 4 = Retail, 5 = Transport, 6 = Accommodation, 7 = Information, 8 = Real Estate, 9 = Professional, 10 = Administrative, 11 = Education, 12 = Health, 13 = Arts, 14 = Other
Region	Region: 1 = East Midlands, 2 = East of England, 3 = London, 4 = North East, 5 = North West, 6 = South East, 7 = South West, 8 = West Midlands, 9 = Yorkshire and The Humber, 10 = Wales