An Investigation of UK SME Access to Finance, Growth and Productivity, 2015-2017

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EXECUTIVE SUMMARY

The study investigates UK SME access to external finance and its relationship to growth and productivity. Three research questions are addressed:

RQ1 – What are the characteristics of SMEs that determine their funding and discouragement?

RQ2 – What are the impacts of external finance on SME performance and productivity?

RQ3 – What are the implications for theory and policy?

Findings relate to a two-stage approach:

(i) Quantitative analysis of a panel of 4,165 surviving SMEs responding to the UK Longitudinal Small Business Survey (LSBS) baseline wave in 2015 and through two succeeding annual survey waves in 2016 and 2017;

(ii) Follow-up qualitative interviews to test the quantitative data findings with 6 expert business finance advisors working with innovative potential high growth SMEs in England, supplemented by 3 interviews with senior strategic managers from two business support organisations.

RQ1 – What are the characteristics of SMEs that determine their funding and discouragement?

Key characteristics of access to finance success

- The most successful SMEs applied every year and were significantly (<.001 level) larger SMEs (50-249 employees), more likely to use general business support and specialist access to finance advice and (<.05) to have more partner/directors, and better perceived ability to access finance.

- The smallest (self-employed) and youngest SMEs established up to 5 years were significantly (<.001) less successful in their applications.

- SME resource base is influential; fewer partner/directors and perceived poor finance access capabilities were significantly (<.01) associated with less success.

- Lower level innovative firms (referring to firm, rather than market level innovation) were less successful in accessing external finance (<.05).

Characteristics of Non-financed groups

- Happy non seekers were significantly (<.001) more likely to be self-employed, not seeking business advice, not having a business plan and not innovative.

- Discouraged non finance seeking SMEs were significantly (<.001) less likely to be large (50-249 employees) and more likely to possess poor perceived capabilities to access finance, have no business plan and be younger (5 years or less established; <.01).

- Those that sought finance, but did not receive any (2015-17) were significantly (<.01) more likely to be younger (up to 5 years established), innovative and have used specialist access to finance advice and general business support, but have no business plan.

- Known closures (n=552) were significantly (<.001 level) more likely to be established up to 5 years, family led with 1-2 directors/partners, possess poor capabilities to access finance, have no business plan and have declining employment, and (<.1) declining sales turnover and not be innovative.

RQ2 – What are the impacts of external finance on SME performance and productivity?

A caveat is that productivity data is constrained to a crude calculation of sales turnover divided by overall employment change between Autumn 2015 and Autumn 2017 for 2,896 SMEs.

Growth and Productivity

- There was no significant difference in the employment and sales growth of externally financed and non-financed SMEs. A high proportion of external finance was for premises, equipment, working capital and R&D unlikely to render shorter term changes. Productivity improvement (i.e. sales turnover per employee), for example from investment in more efficient machinery and working practices, may not result in shorter term employment increase.

- Half (50.8%) of all panel SMEs increased productivity between 2015-17; 8.9% remained static and 40.3% declined; median percentage growth was highest amongst successful finance seekers (5%) and lowest for contented non seekers (0%).

- Successful access to finance is correlated (<.1) to productivity growth, relating more to larger, more frequent applications by larger SMEs. Younger established SMEs (<10 years) exhibit higher productivity growth, notably aged 6-9 years.

- A crucial finding appears to be the overall indication that the smaller self-employed and micro SMEs struggle to exhibit productivity increase when externally financed, whilst older SMEs (20+ years) exhibit least impact where finance is received and externally financed larger SMEs (50-249) do not increase their productivity as much as their non-financed larger SME counterparts.

Productivity regression analysis

Overall, whilst the descriptive analysis demonstrated that access to external finance can lead to improved productivity and that access to regular and substantial amounts of external finance was associated with higher productivity, and conversely poor management resources such as fewer managers and poorer perceptions about

accessing external finance are associated with lack of external finance and poorer productivity growth, these factors are overridden by three main factors: establishment age, size and the balance between employment and sales growth. SME resource issues such as business planning, use of specialist finance advice and better perceptions of ability to access finance are associated with improved productivity performance (or at least with mitigating against poorer performance).

RQ3 – What are the implications for theory and policy?

- Whilst external finance can assist SME growth and productivity growth, such impacts are highly nuanced, appear strongly related to the employment size (larger SMEs perform better), establishment age (younger SMEs perform better), and the lag between employment growth and productivity growth. Ongoing, more frequent use of external business/finance support services can improve performance.

- Policymakers should be cognisant of the difference in objectives between employment and productivity growth, given that shorter-term changes – captured in the current study – demonstrate that smaller SMEs struggle to deliver productivity change (as they may have to take on more staff to undertake R&D and develop new skills) whilst larger firms may offer more rapid productivity change through equipment and work practice efficiencies, but at the expense (at least in the shorter term) of job creation and permanent job status.

- The study demonstrates that business finance advice is a key to SME development and is a significant factor in enabling timely access to appropriate types of finance. However, SME finance advice is likely to be most effective when it is ongoing, regular and integrated with mentoring and management skills development. This can enable optimal financial investment and management activities. In turn, this will provide greater access to follow-on funding, growth and business sustainability.

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CONTENTS

1. INTRODUCTION

The findings of this study relate to a two-stage approach:

(iii) Quantitative analysis of the UK Longitudinal Small Business Survey (LSBS) from the Baseline wave in 2015 and through two succeeding annual survey waves in 2016 and 2017;

(iv) Follow-up qualitative interviews to test the quantitative data findings with 6 expert business finance advisors working with innovative potential high growth SMEs in England.

The study focuses on three research questions (RQs):

RQ1 – What are the characteristics of SMEs that determine their funding and discouragement?

RQ2 – What are the impacts of external finance on SME performance and productivity?

RQ3 – What are the implications for theory and policy?

1.1 Background

The relationship between SME [1] external financing requirements and their growth performance is a potentially critical factor in economic development. Nesta's vital 6% study (2009) and more recent empirical work (e.g. Hart and Anyadyke-Daynes, 2014) demonstrates that the majority of employment growth is generated by a small select group of high growth SMEs (n.b. OECD 2007; 10+ employee enterprises with 3 consecutive years of 20%+ sales growth). Other studies suggest that potential high growth (PHG) SMEs suffer from access to finance barriers, due to a variety of demand and supply-side factors such as information asymmetries between innovative businesses and financiers, pecking order preferences, knowledge deficiencies of SME managers and advisors and the suitability and cost of available finance (BEIS, 2017; Baldock, 2016; Baldock and Mason, 2015; Lee at al, 2015; Cowling et al, 2012). The

[1] Small and medium-sized enterprises (SMEs) broadly defined in the UK as having less than 250 employees.

broader context is set by the readjustments in the UK's SME finance markets post the Global Financial Crisis (GFC) and which are continuing today. These include: the withdrawal of bank debt finance from early stage SME financing; further withdrawal (following the Dotcom crisis of the early 2000s) of private VC from early stage financing; increasing financial scale and reach of business angel groups and networks; the growth of specialist seed VC and accelerator finance, notably in London investing in digitech; the rise of crowd funding (CF) and asset-based lending in the UK's business financing escalator (Mason and Baldock, 2015; Mason and Harrison, 2015; Davis, 2013). Additionally, economic uncertainties exist with Brexit (since the UK vote to leave the EU on 23/06/2016) and the currently unstable UK coalition government.

Furthermore, the UK government has become increasingly concerned with SME productivity. In an era of relatively high employment, there are major concerns that the focus of public policy supporting businesses should be on the creation of higher quality jobs and instrumental to raising productivity and competitiveness (Henley, 2018; SQW, 2018[2]). Debates remain as to how best to calculate productivity – standard approaches typically record the relationship between sales turnover and employment within the SME over a fixed time period (e.g. month or year) as a unit of measurement. Questions arise over the appropriateness of measures and the time period measured, given the time lags for the impacts of assistance and business change to take place (i.e. external financing and the financed project). Clearly for a long horizon R&D investment, this could take considerably longer to lead to outcomes such as sales turnover (studies such as BEIS, 2017, suggest five years or more).

This longitudinal study seeks to add to the evidence on what is known about the characteristics, capabilities and behaviours of SMEs with growth aims, and the resultant impacts of access (or not) to required external finance on business growth and productivity over time. It is acknowledged that this is a pilot study and that part of the study is to explore the limitations of the LSBS data and make recommendations for future improvements to this data set.

[2] We note the ongoing work of the ESRC Productivity Insights Network

1.2 Building on prior LSBS research

A previous study (Owen et al, 2017) of the 2015 Longitudinal SBS (un-weighted) found sufficiently robust data collection to establish a baseline of research to analyse UK SME external financing requirements.

The study found that 2,865 (19%) sought external finance in the last year, with sufficient numbers of finance seekers for different types of finance to undertake more fine-grained analysis: 43% bank loans; 42% overdrafts, 36% leasing, 9% factoring, 6.5% equity, 7% grants and 4% peer-to-peer (P2P) debt finance.

Borrower discouragement (Brown et al, 2018) data indicated 9% had external financing needs but did not apply, including 3% that applied for some but not all of their needs.

Key binary logit regression findings are summarised in Owen et al. (2017) *ERC Working Paper 53,* notably revealing:

- Seeking and accessing formal external finance, along with borrower discouragement is highly associated with the resource base of the firm, with larger, longer established SMEs with larger management teams and better perceived access to finance skills and experience being significantly more likely to be successful in accessing the finance that they required.

- There is a strong correlation between successful access to finance and current and future positive growth orientation.

These findings are generalisable across the finance seeker and discouraged borrower sample. However, this study's further longitudinal research aims to improve our understanding of the relationship between SMEs' access to external finance and business growth and productivity change, and how business demand-side failings are associated with lack of success and discouragement from accessing external finance. We therefore aim to:

- Develop a greater understanding of the relationship between access to finance and growth and productivity - notably relating to sales turnover, employment, innovation/R&D - over time and in relation to the amounts and types of finance accessed.

- Understand more about the relationship between business resources, the use of different types of external assistance – e.g. specialist and strategic - and access to finance.

2 METHODOLOGY

2.1 Stage 1 – LSBS longitudinal quantitative data analysis

Stage 1 quantitative data was analysed using the panel data initially collected in the 2015 baseline survey of 15,502 UK SMEs, undertaken via telephone CATI interviews in the Autumn that year. SMEs are defined as independent UK-based enterprises with less than 250 employees. The baseline survey represents the largest and most robust contemporary survey of UK SMEs to include detailed questions on business finance (Section H).

Details of the LSBS baseline survey sampling procedure are set out in Owen et al (2017), suffice to state that this is a robust UK-wide survey which is broadly representative of the UK SME population (estimates) by region (the 9 English governance regions and 3 devolved nations) and broad sectoral activity (at SIC, 2007, first digit). It should be noted that the survey is under represented by start-ups and very young businesses trading less than 6 years (12% of 2015 baseline survey and 11% of the remaining panel in 2017), but does include sampling from unregistered sole traders captured by Dun and Bradstreet data.

Building on initial findings from the 2015 baseline survey, we adopt a longitudinal approach, focusing on succeeding annual panel member SMEs surveyed in 2016 (wave 2) and 2017 (wave 3). It should be noted here that the succeeding wave 2 and 3 data does exhibit considerable drop-out of panel members: this study focuses on the 4,165 SMEs (27% of the original baseline) that provided data for 2015, 2016 and 2017. This provides the most robust longitudinal data in relation to access to external finance (defined as that which is outside of the internal resources of the business and also that of original founder, family and friend investors – the '3 Fs').

Focusing on the remaining panel of 4,165 surviving UK SMEs a series of descriptive analyses are undertaken to address RQ1 – What are the characteristics of SMEs that determine their funding and discouragement? And then RQ2 – What are the impacts of external finance on SME performance and productivity? This process reveals a classification framework of finance seekers and non finance seekers for the period and

enables deeper analysis into the characteristics of these types of SMEs and their performance during the period 2015-17. Key variables drawn from the descriptive analysis then form the independent variables (listed in Annex 1) which are tested against the selected dependant variables for productivity change for the period. Productivity change was derived as sales turnover per employee change between Autumn 2015 and Autumn 2017. This is a relatively simple crude measure, since for example it was not possible to obtain accurate full-time equivalent (FTE) employee data to differentiate between full and part-time employees. As such, arguably, it supports a grouped, rather than continuous variable regression approach as the main concern is with the characteristics of higher or lower level productivity change. Therefore, three dependant binary variables are analysed; (i) upper median percentage change, (ii) upper quartile percentage change and (iii) lower quartile percentage change. Percentage change is adopted in order to mitigate against larger SME performance skew in relation to the actual size of productivity change taking place. A series of binary logit sifting models are then undertaken in order to find the most significant associations between external finance, business and management characteristics and productivity change.

We note that data on the drop-out SMEs from the baseline survey in 2015 in succeeding waves has been collected (although it appears to be incomplete). It is therefore an aim of further research (currently not available) to undertake data linking – at least for the registered businesses that would be captured by IDBR (i.e. Inter Departmental Business Register of PAYE and VAT registered businesses). It is recognized that not all of the LSBS sample comes from the IDBR and, therefore, that some of the Dun and Bradstreet sample of early stage SMEs, may not be captured by linking data. This further data linking research will examine the survival rates and how surviving drop-out SMEs performed in the period from Autumn 2015 to Autumn 2017.

2.2 Stage 2 – Qualitative In-depth interviews with Oxford Innovation SME finance advisors

Following a similar approach to the mixed methodology of the previous baseline study of the LSBS, 2015 (Owen et al, 2017), we undertook 6 in-depth qualitative interviews with key SME finance and business support advisor staff from Oxford Innovation. These were supplemented by 2 strategic oversight interviews with senior directors of Oxford Innovation and St John's Innovation Centre (Cambridge). The Oxford Innovation advisor interviews were with Business Advisers and Coaches who help to provide diagnostics, business planning and financing advice alongside a network of assistance including

access to mentors and business angels. For 30 years, Oxford Innovation has been providing coaching and training to high growth businesses. Specialising in investment and finance; business development; innovation; sales and marketing; business leadership and internationalisation – they support businesses on the key areas which will enable them to accelerate their growth and create sustainable, meaningful entities.

The Oxford Innovation advisors offer support to a range of SMEs, including start-ups and more established businesses. The three main strands of access to finance work undertaken by Oxford Innovation relate to access to alternative finance networks, notably business angels and smaller VC funding up to £2m (including Thames Valley Investment Network), early stage seed investment (up to £250k) and building skills and management training. Many of the surveyed advisors are engaged in the ERDF funded SME Access to Finance (A2F) £3.75m (80% EU funded) programme for SMEs in Cornwall and Isles of Scilly, established in 2017. This offers grants (typically up to 50% of costs and in the range of £500-£10k) and assistance to facilitate improved resourcing skills to manage and access finance, including hiring and training finance staff, recruiting experienced NEDs, developing pitches for alternative (non-bank) sources of online crowdfunding and angel pitches.

Interviews were undertaken in order to provide validation and insight into the quantitative LSBS data findings (a standard mixed methods approach advocated in Creswell, 2008). An exploratory topic guide approach was adopted in which key (significant) findings were presented to the interviewees for interpretation and explanation. The interviews were undertaken face to face or via skype, typically lasting one and a half hours. The interviews were recorded and transcribed and analysed using a standard Excel spreadsheet case by key response variable grid analysis. Double-blind inductive techniques were used to avoid individual analyst data interpretational skew (Yin, 2003). The interviews were primarily used to test the findings of the LSBS quantitative analysis and provide greater insight into how they may be interpreted. The interviews consisted of five elements:

1. Respondent profiling information

2. The Oxford Innovation service offer to SMEs

3. An assessment of the changes that have been made in relation to our previous findings – and what impacts these have made

4. Testing our latest findings against the advisor's experiences

5. Verbal Protocol Analysis (VPA) to assess clients' suitability for equity funding

2.3 Protocol analysis

In further detail the study adopts a similar VPA approach to that of Mason and Botelho (2016), which presented a protocol investment opportunity to 30 business angel investors and asked them to screen the business plan and to decide whether or not to invest. It was developed to enable business angels to undertake a formalised assessment approach to their investment decision making criteria. Here we seek to develop this as a tool which can assist business finance advisors to assess their client business cases in terms of their suitability for business angel or seed VC investment. Arguably, SME business finance advisors should be aware of the selection criteria of investors (such as business angels and seed VCs) in order to appropriately advise and prepare their clients (Costa et al, 2018).

VPA is rooted in cognitive sciences and intends to analyse the thought process and ultimately the behaviour of participants. By collecting multiple units of verbal reports on such thought processes (ideally collected every 10-15 seconds), the goal of this approach is to gain insights into what factors matter the most in a decision-making process. We use a VPA as part of semi-structured interviews with finance advisors of early stage SMEs and seek to understand the initial screening process of such advisors, as they select potential clients to be assisted in seeking external finance.

The VPA utilises an anonymised business case[3] which is presented to the advisors shortly before their assessment. This is to reduce selection bias and pre-set answers. The interviewee is asked to screen the business case according to their regular criteria and share their thoughts while doing so. In addition, the interviewer regularly prompts questions such as: 'What are your thoughts on this case? 'How would you advise the entrepreneur of this venture?' By doing so, the interviewee is encouraged to share thoughts imminently without presenting a pre-set answer, but instead sharing initial unadjusted thoughts. For example, with regard to the entrepreneurial team constitution

[3] For this study one typical early stage digitech business case was taken from a major UK crowdfunding site. Since the case was in the early stages of funding, the researchers have no preconceived notions or biases on whether the case is ultimately fundable, based on the presentation of its crowdfunding offer.

a potential answer might be "Oh, the team seems quite young". It is crucial that the interviewer provides prompts (but not specific options), therefore taking a neutral observer position. Hence, the VPA represents a powerful tool to understand individual cognitive decision making. By increasing the sample size, a VPA is likely to provide the most crucial, yet generally applicable factors of the decision-making criteria.

Put simply, by revealing the cognitive decision-making criteria of the advisor, we are able to see whether this in fact matches that demonstrated by investors and develop a useful assessment tool for the advisors.

2.4 Conclusions

The paper concludes by summarising the study findings and addressing RQ3 – What are the implications for theory and policy?

3. STAGE 1 LONGITUDINAL ANALYSIS OF THE LSBS

3.1 Introduction

The data presented refers to the 4,165 businesses remaining in the LSBS panel that responded fully to the 2015, 2016 and 2017 survey waves, conducted in the Autumn of each year. This represents 26.9% of the original baseline wave of 15,502 SMEs.

Those SMEs remaining in the panel of 4,165 were slightly more likely to have sought finance 20.4% than those in the original baseline survey (18.6%). However, their success rate in obtaining at least some finance was only marginally higher (84% of the remaining panel, compared with 83.3% of the original baseline survey). There appears to be little evidence of survivor bias in this respect, although success rates overall across the three-year period were higher (87.4%), which is more reflective of the core of 181 highly successful SME finance seekers that sought in each year (96.7%).

Initial statistical tests of difference (Mann-Whitney two-tailed) suggest that, although there are some minor changes in the proportional characteristics of the remaining panel, the proportions of those seeking finance in 2015 and in those remaining in the 2017 panel of 4,165 are broadly similar by key characteristics (e.g. employment size, establishment age, sector, location, management characteristics/capabilities).

Data for finance seeking is based on n=4,107, representing 2015 SME cases remaining in the panel surveys for both 2016 and 2017 which provided valid responses.

3.2 RQ1: Characteristics of Finance Seeking SMEs

3.2.1 Finance seeking trends 2015-17

Table 1: Longitudinal finance seeking trends 2015-17

Finance seeker category	Seeker N=	Col. %	some fin	Median £	Row **n=
Sought finance at some stage between 2015-17	1313	31.5	87.4	100,000	761
Sought finance in 2015	849	20.4	84.0	100,000	609
Sought finance in 2016	589	14.3	79.5	100,000	406
Sought finance in 2017	599	14.5	83.5	100,000	427
Sought finance in all three years	181	4.3	96.7	200,000	88
Only sought finance in 2015 (not after)	379	9.1	84.7	50,000	267
Only sought finance only in 2016	160	3.8	78.1	36,000	105
Only sought finance only in 2017	211	5.1	81.5	45,000	147
Only sought in one year (from 15-17)	750	18.0	82.4	45,000	519
Did not seek/apply finance 2015-17	2762	*66.3	n/a	n/a	n/a
Total n= (panel remainers)	4165	100	n/a	n/a	n/a

Note: *only 4,107 provided valid responses for seeking finance (2.2% non-response); **n= valid responses to total amount of finance received

We first present an overview classification of finance seeking activity in the period covering the three annual LSBS surveys 2015-2017. This provides the basis for the succeeding analysis and reveals (Table 1):

- Almost one third (31.5%) sought finance at some stage between 2015-17 (within the remaining panel n=4165).
- One fifth sought finance in 2015, whilst lower proportions of the remaining panel sought finance in 2016 (14.3%) and 2017 (14.5%).
- 18% only sought finance in one year, whilst 9.2% sought finance in two years and 3.8% sought finance in every year.
- The median amount received was £100k, this was lower for those SMEs only applying in one year (£45k) and highest amongst those applying every year (median £250k in 2015, £200k in 2016 and £185k in 2017).

- Success rates of applicants based on the proportions applying that received at least some funding were highest amongst those applying every year (96.7%) and lowest where finance was sought only in one year (82.4% overall).

- Those seeking finance in 2016 exhibit the lowest proportional success rates at 79.5%. This may relate to the onset of Brexit arrangements (from 23/06/2016) and ensuing market uncertainties. This situation appears to have then improved in 2017, with success rates returning to similar levels recorded in 2015.

Table 2 presents data from the full baseline survey (n=15,502) where 2,883 SMEs applied for external finance and compares this with the remaining panel survey (n=4,165) where 1,313 SMEs applied for external finance at some stage between Autumn 2015 and Autumn 2017.

- Overall 83.3% of SMEs applying for finance obtained at least some finance in the original 2015 baseline survey. By contrast, overall a slightly higher proportion of applicants between 2015-17 (87.4%) were successful amongst the remaining panel survey. Since the success rate for the remaining panel members seeking finance in 2015 was similar (84%), this finding appears more related to the higher success rates of multiple applicants (i.e. those applying in all three years had 96.7% success rate).

Table 2: Characteristics of Successful Applicants 2015 Baseline and Remaining Panel where applied between 2015-17 (* sig <.05; ** sig <.01; *** sig <.001)

Characteristic (n=2883) Row %	Baseline Obtained	Not	Other	N=	Remaining Obtained	n=1313
Employment size:						
Self employed/zero employee	72***	14	15	446	79.2***	207
1-9 employees (micro)	79	9	12	699	83.5	351
10-49 employees (small)	86	4	10	909	90	419
50-249 employees (medium)	91	1	8	829	93.5	336
Broad sector (SIC2007)						
product	86.1	4.7	9.2	763	89.3	345
transport	83.5	5.3	11.2	732	89.8	293
BS	83.4	7.5**	9.2	764	85.3	360
Other services	79.6**	5.8	14.6	624	85.7	315
Establishment age of business						
0-5 years	77***	10	13	379	80**	145
6-10 years	78	9	13	357	82.1	145
11-20 years	84	6	11	457	90.8	207
20+ years	86	4	10	1685	89.1	813
Government Office Regions						
north	83.4	5.5	11.1	548	85.3	265
south	82.7	6.9	10.4	1111	87.6	468
mid	85.4	5	9.7	787	88.2	382
devolved	81	5	14	437	88.4	198
Urban/Rural/Deprived location						
Urban	83	6	11	2027	86.9	925
Rural	85	5	11	849	88.9	387
15% most deprived areas	83	7	11	372	89	163
Management characteristics/capabilities						
Family led	84	7	10	1747	87.3	786
Women led	80	7	12	547	79.5	44
Minority Ethnic led	81	8	11	150	84	257
No partners/directors	79**	5	16	325	86.5	171
1-2 partners/directors	82	7	11	1505	84.9	677
3+ partners/directors	88	3	9	1018	91.4*	440
Capabilities access finance good+	90***	2	8	1515	93.8***	624
Capabilities access finance average	83	4	13	656	86.6	306
Capabilities access finance poor-	67	15	18	542	77.4	270
time specific factors						
Finance advice/support used 2015	78*	8	14	167	85	140
Used generic business advice 2015	85.1*	4.6	10.3	1412	87.3	921
No business plan 2015	82.7	6.9	10.4	1134	85.6	230
Innovative 2015	83.5	6	10.5	1451	86.2*	800
Not innovative 2015	83.2	5.7	11.2	1432	90.4	385
Total	**83.3**	**5.8**	**10.9**	**2883**	**87.4**	**1313**

- The smallest self-employed/zero employee businesses were significantly (<.001 level) less successful in both samples, but with a higher proportion being successful in the remaining panel. Similarly, the youngest SMEs established under 5 years were significantly less successful, although the degree of significance was greater in the 2015 baseline survey (<.001), compared to the remaining panel (<.01 level). Suggesting that as the youngest businesses mature, they become more fundable.

- 'Other services' were significantly (<.01 level) less successful in the baseline survey, but broad sector analysis revealed no significant difference in the remaining panel survey.

- There are no clear locational factors in relation to broad regions, urban or rural areas or deprived neighbourhoods.

- SME resource factors appear to be critical to success rates: SMEs with no partners/directors were significantly (<.01 level) less successful in the baseline survey, whilst those with 3+ partners/directors were significantly (<.05 level) most successful in the remaining panel survey; In both survey samples the SMEs with perceived greatest capabilities to apply for finance were highly significantly (<.001 level) most successful[4].

- Intriguingly, those using business advice in 2015 were significantly (<.05 level) more successful in the baseline survey, but conversely those using specialist access to finance advice were significantly (<.05 level) less successful. These factors were not significant in the remaining panel survey group. Previous studies (e.g. Mole et al, 2017) suggest that more successful SMEs are typically regular users of external advisory services (often paid for). The reduction in significance over time within the panel might well represent the wider use of such services by surviving SMEs (general advice rising from 50% in the baseline finance seekers to 70.1% in 2017; from 2.9% to 10.7% for specialist finance seeking advice in the same period).

[4] Subsequent feedback from OIS and St John's Innovation supports the view that SME development requires a range of management skills e.g. financial management and marketing, which young, small SMEs lack and require assistance to upskill and recruit.

- Those indicating innovation (in terms of introducing new products/services or processes) were significantly (<.05 level) less successful in obtaining finance. However, deeper analysis indicates that using successful application for R&D tax credits[5] as a proxy for the adoption of higher market level innovation (rather than simply change within the firm), only one in ten innovators were R&D tax credit recipients. Of these, around half (134) applied for external finance between 2015-17 and they were significantly (<.001 level) more likely to obtain some finance (122, representing 91%) than other applicants. From this, it would appear that it is '*lesser innovative*' firms seeking to change products, services and processes that have access to finance difficulties (a proposition which is supported by the high success rates of SMEs seeking external finance for 'significantly improved' goods, services and processes; consistently around 90%).

3.3 Key characteristics of those applying every year (n=181)

The highly successful group of SMEs that sought finance every year between 2015 and 2017 exhibits some striking characteristics. They typically sought and received more finance than other SMEs (median received £200k, with 97% success rate). They were also significantly (<.001 level) more likely to be larger medium sized enterprises (50-249 employees) and to have used business advice, including specialist advice on accessing finance, have an up to date business plan and to be innovative in some way. There were also significant (<.05 level) tendencies for these businesses to have 3 or more partners/directors, have perceived better capabilities to access external finance and to be in the primary, productive and construction sectors.

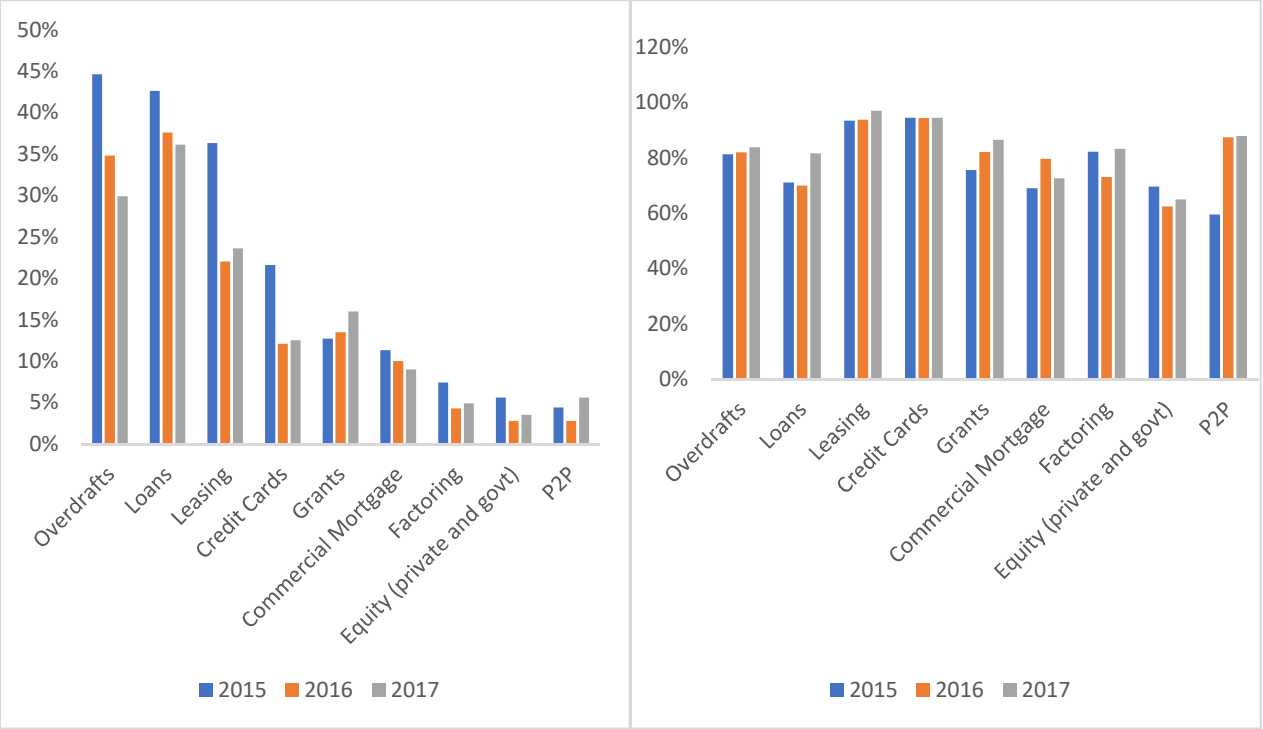
[5] UK R&D tax credits relate to up to 33% reclaim on the cost of qualifying R&D investment

3.3.1 Types of finance sought

Table 3: Types of finance sought and received 2015, 2016 and 2017 by panel (n=4165)

2015	Applied	% in Panel	% of Seekers	Successful	% success
Overdrafts	380	9.1	44.6	309	81.3
Loans	363	8.7	42.6	258	71.1
Leasing	308	7.4	36.3	288	93.5
Credit Cards	183	4.4	21.6	173	94.5
Grants	107	2.6	12.7	81	75.7
Commercial Mortgage	97	2.3	11.3	67	69.1
Factoring	62	1.5	7.4	51	82.3
Equity (private and govt)	46	1.1	5.6	32	69.6
P2P	37	0.9	4.4	22	59.5
Total	849	20.4	100	713	84.0
2016					
Overdrafts	205	4.9	34.8	168	82.0
Loans	220	5.3	37.6	154	70.0
Leasing	129	3.1	22.0	121	93.8
Credit Cards	71	1.7	12.1	67	94.4
Grants	78	1.9	13.5	64	82.1
Commercial Mortgage	59	1.4	10.0	47	79.7
Factoring	26	0.6	4.3	19	73.1
Equity (private and govt)	16	0.4	2.8	10	62.5
P2P	16	0.4	2.8	14	87.5
Total	589	14.1	100	468	79.5
2017					
Overdrafts	180	4.3	29.9	151	83.9
Loans	218	5.2	36.1	178	81.7
Leasing	140	3.4	23.6	136	97.1
Credit Cards	73	1.8	12.5	69	94.5
Grants	96	2.3	16.0	83	86.5
Commercial Mortgage	55	1.3	9.0	40	72.7
Factoring	30	0.7	4.9	25	83.3
Equity (private and govt)	20	0.5	3.5	13	65.0
P2P	33	0.8	5.6	29	87.9
Total	599	14.4	100	500	83.5

Figure 1: Annual Applications and Success Rates (2015-17) by Finance Type (n=4165)



Examining the types of finance sought by the panel (n=4165; Table 3) for each of the three survey waves (2015, 2016 and 2017), debt finance in the form of bank loans, overdrafts and leasing predominates in each wave. Loans become more common than overdraft applications in the succeeding waves – declining at a lesser rate as a proportion of those seeking external finance in each succeeding wave. Commercial mortgages also consistently represent around one in ten SME applicants. Business credit cards represented over one fifth of finance seekers in 2015, but only around one in eight seekers in succeeding years. The preponderance of use of debt finance is typical of SMEs with established trading track records (circa 9 out of 10 of the LSBS panel are established over five years).

Alternative (non-bank) finance such as equity and P2P debt finance remains a relatively small proportion of finance seekers, ranging from 2.8% to 5.6%. Notably, grant finance becomes proportionally greater within the finance seeker group in each succeeding wave.

Analysis of the success rates of applicants, where they receive at least some (and in the majority of cases all) of the finance that they apply for, credit cards and leasing consistently in each panel survey wave represent the highest proportional success rates.

Bank debt finance typically reveals a four fifths success rate, although overdrafts consistently exhibit higher success rates than loans.

Amongst alternative non-bank sources, equity finance is consistently amongst the most difficult to access with success rates ranging between 62.5% and 70%, which is indicative of this type of risk finance and the degree of information asymmetry barriers that inhibit access to this type of finance. P2P lending on the other hand, which typically requires applicant businesses to demonstrate trading track records of at least 18-24 months exhibits proportionally high success rates in 2016 (87.5%) and 2017 (87.9%).

Overall, the findings demonstrate decreasing year on year applications for finance for almost all types of finance (except for grants and P2P). They also demonstrate that applicants are becoming more successful in each year (except in the case of equity). The suggestion is that as the remaining (surviving) panel survey become more mature and experienced, they become more successful – exhibiting absorptive learning (Teece et al, 1997; BEIS, 2017) - the exception being for equity finance which is more typically sought by younger, less established, higher risk SMEs. Another interpretation (supported in subsequent sections) is that it is the more successful businesses that are applying over time, with the less successful being discouraged.

3.3.2 Amounts of finance received

Table 4: Types of finance received overall between 2015-17 by the panel (n=4165)

2015-2017	Success	% of Panel	% of Seekers	Median 2015	Median 2016	Median 2017
Overdrafts	490	11.8	37.3	100,000	150,000	170,000
Loans	452	10.9	34.4	90,000	100,000	115,000
Leasing	417	10	31.8	137,500	170,000	156,000
Grants	161	3.7	12.3	98,500	100,000	121,000
Mortgage	136	3.3	10.4	300,000	322,000	250,000
Factoring	79	1.9	6	160,000	175,000	150,000
P2P	58	1.4	4.4	100,000	80,000	38,000
Equity (private and govt)	45	1.1	3.4	130,000	500,000	500,000
Total	1148	27.5	1313	100,000	100,000	100,000

Examining the typical median levels of finance received by successful applicants in the period 2015-17 (Table 4), commercial mortgages (with median levels ranging between £250k in 2017 to £322k in 2016; representing 10.4% of external finance seekers in the period and 3.3% of the panel survey) and equity (ranging from £130k in 215 to £500k in

2016 and 2017) exhibit the highest amounts of funding per successful applicant. The median value of overdrafts was consistently higher than that for bank loans during the period, whilst P2P represented the smallest median level financing in 2016 (£80k) and 2017 (£38k).

3.3.3 Reasons for seeking finance

Table 5: Main Reasons for Seeking External Finance 2015, 2016 and 2017 by panel (n=4165)

2015	No	% of panel	% seekers
Working capital	447	10.7	52.7
Land & premises	195	4.7	23
Capital equipment & vehicles	374	9	44.1
R&D	31	0.7	3.7
Staff hire & training	24	0.6	2.8
Marketing	15	0.4	1.8
Total	849	20.4	100
2016			
Working capital	365	8.8	62
Land & premises	122	2.9	20.7
Capital equipment & vehicles	153	3.7	26
R&D	88	2.1	14.9
Staff hire & training	29	0.7	4.9
Marketing	22	0.5	3.7
Total	589	14.1	100
2017			
Working capital	341	8.2	56.9
Land & premises	115	2.8	19.2
Capital equipment & vehicles	149	3.6	24.9
R&D	83	2	13.9
Staff hire & training	54	1.3	9
Marketing	29	0.7	4.8
Total	599	14.4	100

Figure 2: Annual Percentage of Main Reasons for External Finance Amongst Seekers (2015-2017)

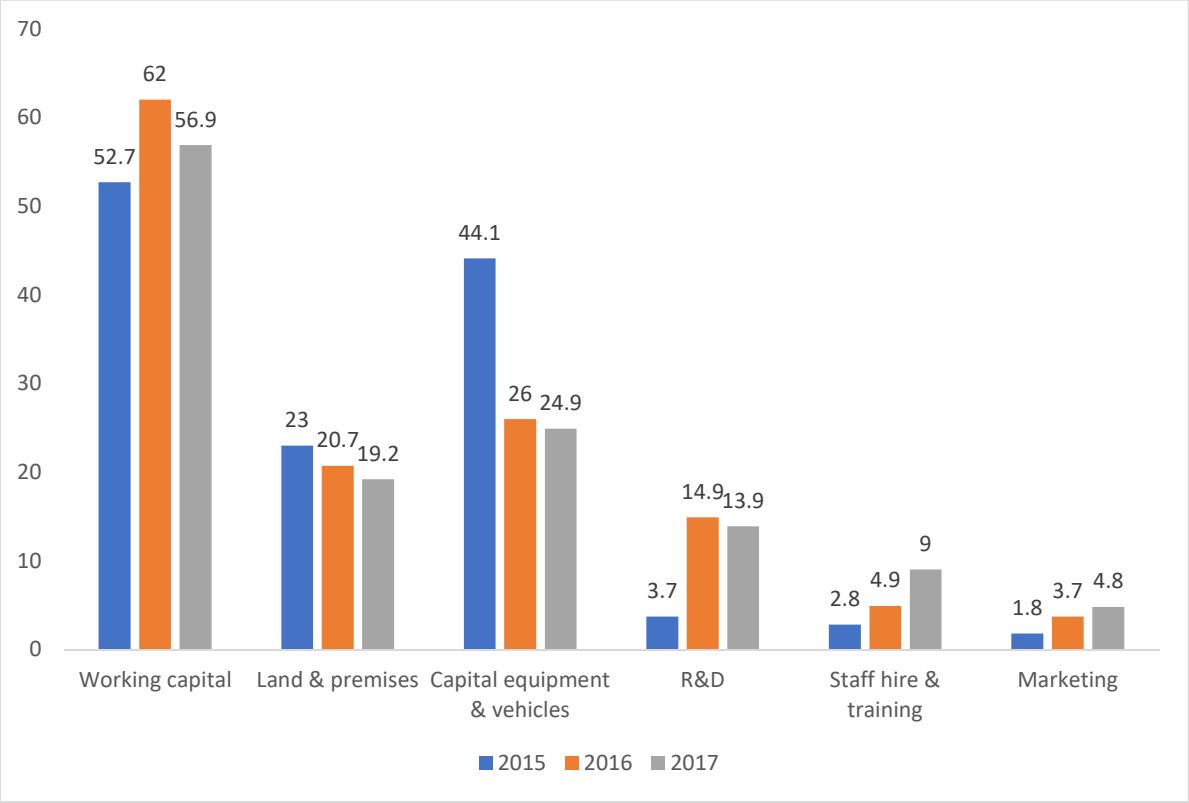


Table 5 and Figure 2 demonstrate that working capital was by far the most common reason for seeking external finance by the remaining panel member SMEs in each year; ranging from 52.7% in 2015 up to 62% in 2016. This confirms previous findings (Owen et al, 2017) that the majority of SMEs that seek finance require funds to overcome shortfalls in cash-flow to assist with the day to day running of their businesses. In 2015, those seeking working capital were most likely to apply for overdrafts (68%), 44% applied for loans (but with far less success; 75% obtained some loan finance, compared with 85% for overdrafts), whilst one third applied for credit card finance and one in ten used factoring.

Capital equipment and vehicle purchase was the second most common reason in each year. This is typically associated with leasing and HP finance and exhibits similar proportions and trends within the panel survey in each year.

Land and premises purchase and refurbishment work represented the third most common reason, relating to circa one fifth of seekers in each year, with around half of this requirement relating to commercial mortgage applications.

Notably R&D (including IP acquisition and protection) only represented 3.7% of panel SMEs seeking external finance in 2015. A change of definition more closely associating R&D with requiring funding to introduce firm level innovations in products, services or processes provided higher proportions of finance seekers in 2016 (14.9%) and 2017 (13.9%). Taking the period 2015-17 as a whole, the most common forms of finance for R&D and innovation activities were grants (36%), loans (34%) and leasing (25%), followed by credit card (13%), equity (9%) and P2P (4%) finance.

3.3.4 Characteristics of SMEs by finance types

Examining the main types of external finance accessed by the panel SMEs during the 2015-17 period (Table 6), smaller self-employed businesses are significantly (<.001 level) underrepresented in accessing loans, overdrafts, lease/HP finance and commercial mortgages. To some extent this is unsurprising, since many self-employed businesses operate from home-based locations and may operate relatively low overhead services – for example Business Services were significantly (<.05 level) less likely to access commercial mortgage finance. Perhaps more surprising, given that innovative young SMEs rely heavily on grants funding (North et al, 2013), larger SMEs are significantly more likely to access grants. This finding is indicative of both the small numbers of very young early stage SMEs in the sample and also the BEIS (2017) finding that larger, longer established innovative SMEs make considerable use of R&D grants.

Younger SMEs established up to 5 years were significantly (<.01 level) more likely to access equity finance, as were those in the 10-49 employment size group. This is indicative of the greater requirement for risk finance amongst younger SMEs, and they are generally (but not significantly) less represented across other forms of finance, including P2P (which, like bank debt finance, requires at least 18-24 months trading track record). Indeed, the oldest established businesses were significantly (<.05 level) more likely to access overdraft finance and also lease/HP finance (<.01 level).

Table 6: SME characteristics by access to external finance types 2015-2017 within panel

	Loan	OD	Lease	Grant	Com Mortgage	P2P	Equity	
Employment	Row %	Row%	Row %	Row %	Row%	Row %	Row %	N=
zero	6***	5.3***	3.5***	1.6	0.8***	0.9	0.6	1063
1 to 9	10.5	9.3	7.1	2.9	2.2	1.4	0.7	1205
10 to 49	14.5	12.1	13.8	5.3	4.3	1.7	1.8*	1118
50 to 249	17.7	19.1	18.1	6.4***	6.7	1.5	1.4	779
Region								
North	11.6	12.1	11.3	5.5	3.3	0.9	0.6	782
London & SE/East	9.9*	9.5	8.5	2.7	2.8	1.8	1.6	1621
Midlands & SW	13.3	11.2	11.1	3.2	4.1	1.3	0.8	1183
Devolved	14	12.1	10.4	6.4	2.9	1.2	0.7	579
Established Age								
0 to 5 years	9.5	8.6	7.2	3.4	2.5	0.9	2.9**	406
6 to 10 years	10.1	9.3	6.8	2.1	2.9	1.4	0.8	439
11 to 20 years	11.6	9.2	8.8	3.1	2.1	1.1	0.7	648
20+ years	12.6	12*	11.5**	4.5	3.8	1.6	0.9	2212
Broad Sector								
Primary/Manu/Const	16.7	13.5***	13.9	1.9	5.1	1.2	1	786
Transport/Ret/Whole	12.3	13	11.5	1.9	3.1	1.7	0.5	820
Business Services	10.1	8.9	8.4	2	1.9*	1.5	1.5	1294
Other Services	8.7	9	7.2***	11***	3.8	1.1	1	813
Total	490	452	417	161	136	58	45	4165
Row % of panel	11.8	10.9	10	3.7	3.3	1.4	1.1	100

Note: *** significant <.001 level; ** significant <.01 level; * significant<.05 level

Examining the main types of external finance accessed by the panel SMEs during the 2015-17 period (Table 6), smaller self-employed businesses are significantly (<.001 level) underrepresented in accessing loans, overdrafts, lease/HP finance and commercial mortgages. To some extent this is unsurprising, since many self-employed businesses operate from home-based locations and may operate relatively low overhead services – for example Business Services were significantly (<.05 level) less likely to access commercial mortgage finance. Perhaps more surprising, given that innovative

Broad sectoral analysis also reveals some significant patterns in accessing different types of finance in this period. Primary, manufacturing and construction sector SMEs were significantly (<.001 level) more likely to access overdrafts, whilst Other Services -

which include personal and community services – were significantly (<.001 level) more likely to access grants and less likely to access lease/HP finance.

3.4 RQ2: The Relationship between finance, growth and productivity change

3.4.1 Growth performance 2015-17

Table 7: Longitudinal employment and sales turnover performance where sought and received finance

change 2015-17	No. (Col.%)	Row % sought fin	Row % some fin	N= (base from which % calculated)
emp up 2015 to 17	1556 (37.9)	24.2	86.7	367
emp same	1422 (34.6)	14.6	76.4	208
emp down	1129 (27.5)	23.4	86	264
total	4107			839
sales up 2015 to 17	1419 (49.3)	24.2	88.1	344
sales same	566 (19.6)	20.7	86.3	117
sales down	901 (31.1)	21.2	78*	191
total	2886			652

Note: N= base for sales turnover is 2,886 valid responses; * sig at <.05 level

Overall (Table 7), there is only limited evidence of access to external finance contributing to increased employment and sales turnover during the 2015-17 period. Significant findings (<.05 level) relate to sales turnover, with those seeking finance being less likely to experience falling sales and those seeking finance being more likely to experience increasing sales, when compared to non-seekers. The findings reflect the nuances of the SMEs examined, which include both a large proportion of SMEs that are happy non seekers (able to self-fund investment and not in their perceptions in need of external financing) and also larger proportions of SMEs obtaining funds for working capital or investments in land, equipment and R&D which might not necessarily lead to growth in the shorter term.

- Nearly two fifths of SMEs increased employment and almost half increase sales, whilst less than one fifth reduced employment, but nearly a third experienced declining sales turnover between Autumn 2015 and Autumn 2017 (where valid data was provided for the remaining panel sample).

- Those SMEs seeking finance were just as likely to experience increasing or decreasing employment, with a slightly smaller proportion of those experiencing

declining sales being finance seekers (when compared with those increasing their sales in the period).

- Those receiving at least some external finance in the period were just as likely to experience increased or decreased employment, whilst those receiving finance were significantly less likely (<.05 level) to experience declining sales.

- When non finance seekers are analysed, whilst all categories (including happy non seekers and discouraged non seekers) exhibit lower proportions of SMEs with employment growth, there are no significant differences. Indeed, finance seekers exhibit slightly higher proportions of SMEs with declining sales turnover in the review period (32.1% of seekers compared to 25.6% of all non-seekers).

- However, non-seekers were significantly (<.05 level) less likely to exhibit sales growth (47.1% of all non-seekers, compared to 53% of seekers).

Table 8: Employment Change for All, Externally Funded and Non funded Panel

All	Total emp	mean	n=	Temp	mean	n=	Contract	mean	n=
2015	97627	23.44	4165	10182	2.46	4145	27932	6.76	4135
2017	103537	24.86	4165	12138	3.37	3244	12372	2.99	4137
change	5910			1956			-15560		
Funded									
2015	37318	32.51	1148	3826	3.35	1143	12738	11.24	1022
2017	39556	34.46	1148	4687	4.59	1022	5364	4.72	1133
change	2238			861			-7374		
Not fund									
2015	60309	19.99	3017	6356	2.12	3002	15194	5.06	3002
2017	63981	21.21	3017	7451	3.36	2222	7008	2.34	3001
change	3672			1095			-8186		

A critical concern when examining employment generation is the quality of employment created. The LSBS data allows only limited insight into the structure of the types of jobs involved in employment change between 2015 and 2017. This relates to whether jobs are temporary (rather than permanent employee status) and also whether additional contractor/agency based jobs are created (not on the payroll).

What is most striking about the limited data available (Table 8) is, first, that overall employment change was proportionally similar across externally funded and non-funded

(both 6%), but that the average size of funded SMEs was far larger (circa 50% more employees).

Second, it is also notable that the increase in employment amongst externally funded SMEs in the panel contained a slightly higher proportional growth of temporary jobs (22.5% growth of temporary jobs amongst funded and 17.2% amongst non-funded). These funded businesses are larger employers with larger numbers of temporary staff, but contained proportionally similar levels of temporary staff in 2015 (10.3% of funded and 10.6% of non-funded). What is less clear is whether temporary jobs which might relate to seasonality and economic up-cycles in demand, or marketing and R&D activities, lead to more permanent roles. The seasonality issue is at least addressed in terms of the annual survey taking place at the same time each year.

Third, there has been a sharp decline in the use of external contractors in the period. This was slightly higher amongst funded SMEs (-58%) when compared to non-funded (-54%). To some extent this might reflect a period of retrenchment and reduced investment, due to the uncertainties of global markets and Brexit and could be one of the reasons why larger funded SMEs have increased their temporary staffing – thereby reducing external contracting costs and developing more flexible employee status.

3.4.2 A note on Profitability

One potentially useful source of data relates to profit (trading surplus), since, in the absence of internal investment data, this might provide an indication of ability to invest. Analysis of the remaining panel survey with regard to profit data collected in each wave indicates that almost identical proportions in each wave were profitable (82.5% in 2015, 82.4% in 2016 and 83.6% in 2017) and that these also tend to be the same core of SMEs - around 90% of the profitable are profitable in every year. The percentage with profit increases with employment size; for example, in 2015 81.7% of zeros/self-employed, rising to 84.7% for the medium sized SMEs, with the most profitable age in the 6-10 years established category (84.9%).

Using profitability as a proxy indicator for ability to internally invest, it is not surprising that happy non seekers of external finance were more likely to exhibit a higher proportion with profit (87% in each wave), whilst those receiving external finance typically were around four-fifths of the group and those seeking external finance, but not receiving external finance, exhibit the lowest proportion with profit (for example, 70.3% in 2015 and 71.5% in 2016).

Overall, the profitability data provides findings which are expected, but this cannot be considered a strong or reliable indicator, given that there is not clear evidence of the total amount of capital investment made by these SMEs (whether finance seekers or not) year on year.

3.4.3 Productivity change associated with external financing 2015-17

Productivity is typically considered to be the relationship between inputs such as the numbers of employees engaged in work operations and outputs in relation to sales turnover generated by the SME. Since we do not have an accurate breakdown of employee hours worked, data is provided based upon the simple ratio of annual sales turnover divided by the total number of employees at the fixed point of annual survey in Autumn 2015 and Autumn 2017[6]. It is acknowledged that part time working proportions (which were not available in the LSBS data[7]) and seasonality can impact the data, but taking a fixed point in time annually and overall employment, provides a basis for calculations.

[6] Productivity change 2015 to 2017 = Sales/Emp 2017 - Sales/Emp 2015
[7] We have noted that temporary employment increases were slightly greater amongst funded SMEs.

Table 9: Relationship between amount of finance received and productivity change 2015-17

Productivity change group by: Amount received 2015	%<£100k	%£100k+	n=	Col %
<-50k	44.2	55.8	43	8
-10 to -49.9k	52.5	47.5	80	14.8
-1 to -9.9k	51.2	48.8	86	16
No change	52.2	47.8	23	4.3
1 to 9.9k	47.3	52.7	112	20.8
10 to 49.9k	50	50	132	24.5
50k+	50.8	49.2	63	11.7
Overall increased productivity	49.2	50.8	307	60
Total n= (2015)	268	271	539	100
Amount received 2016				
<-50k	53.6	46.4	28	8
-10 to -49.9k	51.9	48.1	54	15.4
-1 to -9.9k	55.6	44.4	54	15.4
No change	63.2	36.8	19	5.4
1 to 9.9k	46.5	53.5	71	20.2
10 to 49.9k	43.4	56.4	76	21.7
50k+	40.8	59.2*	49	14
Overall increased productivity	43.9	56.1*	196	55.9
Total n= (2016)	171	180	351	100
Amount received 2017				
<-50k	60.5	39.5	38	10.2
-10 to -49.9k	47.2	52.8	53	14.2
-1 to -9.9k	41.8	58.2	67	18
No change	52.9	47.1	17	4.6
1 to 9.9k	42.4	57.6	66	17.7
10 to 49.9k	47.7	52.3	86	23.1
50k+	47.8	52.2	46	12.3
Overall increased productivity	49.2	50.8	198	53.1
Total n= (2017)	176	197	373	100

Note: sig <.1

Table 9 presents the proportion of surveyed panel SMEs in each productivity category (calculated as average sales turnover change per employee between 2015 and 2017) amongst those receiving external finance, focusing on the proportion receiving more or less than the median (£100k) level received during this period. The findings demonstrate

improved productivity with higher levels of external finance annually, but only a significant relationship in 2016[8].

- Where data was provided, overall half (50.8%) of panel businesses receiving external finance have improved their overall aggregate annual productivity (sales turnover per employee), whilst 8.9% remained static and 40.3% declined.

- Significantly (<.1) the size of external finance, when above the median level of £100k financing was associated with increased productivity in 2016, and significantly (<.1) for the highest turnover increase group (£50k+).

Table 10: Productivity by finance received status (n=2896)

Productivity change group 2015-2017	No Finance	Some finance 2015-17	Finance in one year only	Finance in all 3 years
<-50k	72.4	27.6	15.4	3.4
-10 to -49.9k	72.4	27.6	14.4	3.3
-1 to -9.9k	65.6	34.4	17.2	6.9
No change	83.3	16.7	10.1	3.9
1 to 9.9k	65.8	34.2	19.2	5.5
10 to 49.9k	67.8	32.2	17	5.2
50k+	69.9	30.1	13.8	6.6
Overall increased productivity	67.6	32.4*	17	5.6*

Note: sig<.1

Table 10 demonstrates a significant relationship between receiving at least some external finance, and where this has occurred annually, with improved productivity change for the period (2015-17).

- There is a significant (<.l) relationship between receiving at least some external finance and improved productivity, and this is related to where external finance was received on a regular annual basis between 2015-17.

[8] A point raised here by business support providers is that a key failing of UK SMEs is lack of investment in equipment and related skilled labour, which in combination can achieve higher productivity.

3.4.4 Relationship between productivity and SME employment size and key characteristics

Table 11: Productivity Change by Employment Size Group

Employment Size group	Overall		Some Finance		Not Financed		N=
	Median £	Median %	Median £	Median %	Median £	Median %	
zero	0	0	0	0	0	0	734
1-9	0	0	0	0	0	0	840
10-49	1828.21	4.89	2500	6.67	1538.46	4.16	770
50-249	3164.26	8.12	3024.49	7.57	3397.44	8.56	552
overall	445	1.84	2000	5	0	0	2896

Table 11 examines the median level of £ value and percentage change in productivity per employee (between 2015-2017) for all panel SMEs (where data is available) and also compares the performance of externally funded by those not funded in the period. The table also disaggregates data by employee size categories (based on the 2015 base year).

Overall, there is considerably better productivity growth amongst externally financed SMEs for the period 2015-2017 (in terms of median £ value increase per employee and % change per employee). However, productivity growth is also strongly related to employment size, with larger SMEs (with 10 or more employees) exhibiting higher overall value and percentage productivity growth per employee than smaller SMEs.

Furthermore, when employee size bands are examined, it is the externally finance SMEs with 10-49 employees that demonstrate higher median levels of £ value change. No change is recorded in median performance for smaller zero (self employed) and micro SMEs (1-9 employees). Furthermore, in proportionate terms, median growth of externally financed SMEs is only higher in the 10-49 group, and slightly lower in the largest SMEs (50-249 employees).

Examining the amount of external investment per employee reveals an inverse relationship with employment size. Whilst the amount of external investment increases by the employment size – amongst those obtaining finance (rising from a median of £30k for zero employee firms to £49k in micros, £100k in small and £350k in medium-sized SMEs) – the investment per member of staff (using 2015 base) falls from £30k in zeros to £12.5k in micros, £5.5k in small and £4.6k in medium-sized firms. This suggests

economies of scale for larger firm investments, since for the largest firms the lowest investment delivers the highest employee productivity rise. However, when externally finance and non-funded SMEs are compared, it is only in the 10-49 (small SME) employee group that productivity improvements are notably higher amongst externally finance firms.

Further analysis of productivity change by broad sector, UK broad regions and establishment age reveals that in every category, those SMEs receiving external finance exhibit superior increases in median productivity to those that are not funded, with the exception of the North of England region, where no difference is identified. Younger aged SMEs (under 10 years established) exhibit considerably higher productivity change overall, but those established between 6-9 years exhibit the highest proportional rise.

A crucial finding appears to be the overall indication that the smaller self-employed and micro SMEs struggle to exhibit productivity increase when externally financed, whilst older (20+ years) exhibit least impact where finance is received and larger firms (50-249) do not increase their productivity as much as their non-financed large SME counterparts.

3.4.5 Productivity and Growth for Non-Financed

Table 12: Classification of non-financed 2015-17 (n=2896)

Where no finance received or discouraged	n=	Med £ rise productivity	Med % rise productivity
(i) Did not seek 2015-17	1895	0	0
(ii) Happy non-seekers (did not seek) or require	1644	0	0
(iii) Unsuccessful seekers (no finance in period)	116	1027	4.46
(iv) Overall discouraged, required finance, but all or some not applied	578	1428.57	5
(v) Discouraged, require external finance, but did not apply at all in period 2015-17	251	705.13	2.86

Table 12 presents the productivity performance in terms of median percentage change 2015-2017 by different categories of non-finance panel SMEs.

Taking forward Fraser's (2009, 2014) classification of those SMEs that are discouraged or contented 'happy' non seeking. Overall, whilst two thirds of SMEs did not seek finance in the period and the vast majority are happy non-seekers:

- 8.7% (n=4165) of SMEs required finance in the period 2015-17 but did not seek finance during this period.

- A further one in ten SMEs (10.5%) had applied for some finance in the period, but were discouraged to apply for all of the funding that they required in the period.

- Only 4% of SMEs had applied for finance during the period and had been completely unsuccessful – receiving no finance in the period.

- The median percentage level that productivity increased in the period (2015-17) across all of these categories (0%) is below that for external finance seekers (all seekers 4.74%; 4.46% for unsuccessful seekers) and those receiving external finance (5%).

Table 13: Non-Seeking, Discouraged and Failed Seekers Productivity Change 2015-17 (n=2896)

Productivity change group	All Non Seekers	Discouraged All	Discouraged non seek	Happy Non seek	Failed Seekers
<-50k	68.9	20.1	8.5	60.4	3.1
-10 to -49.9k	65.6	19.6	7.8	57.7	5.4
-1 to -9.9k	62.3	19.7	9.2	53.1	2.8
No change	79.8	15.6	9.7	70*	3.1
1 to 9.9k	61.3	21.5	8.2	53	4.1
10 to 49.9k	63.4	20.3	9.2	54.2	4.1
50k+	64.8	20.9	8.3	56.4	4.6
Overall increased productivity	63	20.9	8.6	54.3	4.2
%n	65.4	20	8.7	56.7	4

Note: *sig<.1

Table 13 examines the non-funded SME classifications (from Table 12) by average productivity change per employee between 2015-2017 groups (see Tables 9 and 10).

- Happy non seekers have significantly (<.1 level) higher representation amongst those with static productivity during the 2015-17 period.

- Across the wider discouraged group – which will include some that applied and may have received some funding – there is no significant finding.

3.4.6 Antecedents of financed, non-financed and non-seekers

Table 14: Antecedent use of external finance (2010-15) by seeker/non seeker category

2015-17	Used external finance up to 5 years before 2015	n=
Successful seeker	43.8***	1148
Non seeker	33.7***	2762
Failed seeker unfunded	34.5	165
Discouraged (in seekers)	37.5	822
Discouraged non seeker	32.3*	365
Happy non seeker	33.9***	2397
Overall	36.7	1529

Note: *significant <.1 level; ***significant <.001 level

Antecedent assessment of prior use of external finance indicates that 36.7% of the remaining panel SMEs had done so during the 5 years prior to the survey (Table 14). The main types of finance used in this period were credit cards (18%), overdrafts (16%), leasing (15.1%) and bank loans (13.5%), with equity finance only relating to 2.6% of the baseline survey SMEs (data from the full baseline survey n=15,502).

Table 14 examines the proportions of SMEs in the remaining panel that had used external finance in the five years prior to the 2015 baseline survey by their 2015-17 external financing category.

- Successful seekers of external finance in the 2015-17 period were significantly (<.001) more likely to have prior use of external finance.

- Non seekers were significantly (<.001) less likely to have prior use of external finance, whilst discouraged non seekers were significantly less likely to have done so (<.1 level).

- Happy non seekers were significantly (<.001) less likely to have prior use of external finance, suggesting that around two thirds of these SMEs are completely self-funded, whilst the remainder have used external funding, with this being sufficient to see them through the ensuing study period (2015-17).

- It is notable that happy non seekers that had previously used external finance (2010-2015) exhibited slightly higher percentage productivity increase than those

that had not (0% compared to 1%), suggesting some potential impact from previous financing.

3.4.7 Characteristics of non-financed/discouraged groups

The previous study by Owen et al (2017) clearly demonstrated the characteristics of SME finance seekers, indicating that they were significantly less likely to be small, self-employed and located in deprived neighbourhoods, and more likely to use business finance support and to have perceived capabilities to access external finance (particularly more established finance seekers). Finance seekers were also more likely to apply if they were younger – established up to five years – and in the primary, manufacturing and transport sectors. The study also found that discouragement from seeking external finance was significantly associated with younger established and smaller SMEs, notably with poor capabilities to access external finance, and also among women and ethnic minority led SMEs.

Here we are able to take a more detailed and nuanced longitudinal analysis which can account for differences between happy non seekers and those that were discouraged or applied and failed to obtain external finance during the period 2015-17.

Our findings in relation to non-finance businesses are revealing and significant (Table 15, presents the key findings for three non-finance classifications). Unsurprisingly, those businesses that were not seeking external finance in the period – 'happy non-finance seekers' were either self-employed or micro business, likely to be undertaking business services, family owned and less innovative. Perhaps more interesting are the discouraged non seekers and unsuccessful seekers groups. These are also more likely to be smaller SMEs, but are younger and innovative, but with poor capabilities and with unsuccessful seekers being highly likely to use specialist finance advice.

Table 15: Non-financed Group Key Characteristics 2015-2017 (n=4,165)

Happy non-seekers	% in group
Zero emp	70.6***
50-249 emp	47.1
Business service	64.8*
London/SE/EE	61.1*
Devolved	52.7
Deprived 15%	52*
Family business	59.4
Ethnic minority owned	50*
3+ partners	50.2***
No business advice	65.4***
Finance advice	34.8***
No business plan	66.7***
Not innovative	65.5***
Total	57.6
Discouraged non seeking	
1-9 emp	11
50-249 emp	5***
Devolved	11.1
0-5 years	11.7**
20+ years	7.5
3+ partners	6.3*
Poor capabilities	15***
No business plan	10.5**
Innovative	9.4*
Total	8.8
Sought non-financed	
1-9 emp	4.8
50-249 emp	2.8
0-5 years	6.5**
Women led	5.2*
Poor capabilities	7.4***
Business advice	4.7**
Finance advice	8.6***
No business plan	4.7**
Innovative	4.8**
Total	4

Note: *** significant at <.001 level; ** significant at <.01 level; * significant at <.05 level

3.4.8 Discouraged non seekers

The group of discouraged non seekers represent a little over one in twelve (8.8%) of the panel, and refer to those that expressed a need for finance at some stage between 2015 and 2017, but did not seek any external finance in this period. These might therefore be considered to be the most discouraged. They are characterised as highly significantly (<.001 level) less likely to be larger SMEs with 50-249 employees (particularly when compared to micro businesses with 1-9 employees), and far more likely to perceive poor capabilities for accessing external finance. They are also significantly (<.01 level) more likely to be less than 5 years established (particularly when compared with those longest established for 20 years or more) and have no business plan. Furthermore, they are significantly (<.05 level) less likely to have 3 or more partner/directors, but more likely to be innovative (at least in terms of introducing new products, services or processes to their business).

3.4.9 Non-financed Seekers

One in twenty-five (4%, representing panel 165 SMEs) had sought external finance during the 2015-17 period, but not received any funding. These SMEs are characterised as highly significantly (<.001 level) innovative (at least in terms of introducing new products, services or processes to the firm level), using specialist assistance to access external finance and perceiving themselves to have poor capabilities of accessing external finance. They significantly (at <.01 level) more likely to be using generic business advice and established for five or less years and significantly (<.05 level) more likely to be women led businesses. Unsurprisingly, as finance seekers, they were more likely to have business plans (but this was only significant at <.1 level).

3.4.10 Happy non seekers

This group are highly significantly (<.001 level) characterised as; zero employee/self-employed businesses, or micro businesses with just one or two partner/directors, most likely to be business services, and not using business or specialist finance advice or having business plans. They are also more likely to be located in London and least likely to be in the devolved nations (<.01 level), also more likely to be family businesses, but less likely (<.05 level) to be ethnic minority owned and in the most deprived areas.

3.4.11 A Note on Business Performance and Closures

Table 16: Business Performance and Access to Finance (Baseline survey)

	Obtained	Not	Other	N=
sales 2014-15 up	86.2**	4.6	9.1	1279
sales 2014-15 down	81.3	6.8	11.8	498
emp 2014-15 up	88.1***	3.4	8.4	962
emp 2014-15 down	82	5.3	12.7	417
exp sales 2015-16 up	85.4**	4.7	9.9	1545
expect sales 2015-16 down	78.8	7.6	13.6	250
exp emp 2015-16 up	84.7	4	11.2	219
exp emp 2015-16 down	83.1	6.8	10	1121
no longer trading	75.8	10.5	13.7	95
total	83.3	5.8	10.9	2883

Note: ** significant <.01; *** significant <.001

Table 16 presents findings from the baseline 2015 survey's external finance seekers (n=2,883) which provided sales turnover and employment change data for the year prior to survey and forecast data for the following year. More successful businesses (with track records) were significantly more likely to obtain external finance, whilst those that ceased trading exhibit higher proportions of applicants that failed to access funding and faced delays with decisions on finance applications:

- Those SME finance applicants with employment (<.001 level) and sales turnover growth (<.01 level) in the previous year, were significantly more likely to access finance, whilst future forecast sales turnover increase was significantly (<.01 level) associated with greater success in accessing finance.

- Those baseline survey SMEs that applied for finance in 2015 and subsequently ceased trading were less successful and demonstrate a high proportion of 'other' instances where finance applications decisions were still pending at the time of survey in 2015.

3.5 Characteristics of Closures

There is relatively little data available for SME closures. The combined 2015-17 data set presents 552 recorded closures relating to the 2015 baseline survey. Of these 337 closed in 2016 and 215 in 2017. 17.5% of closed SMEs applied for finance in 2015, of which 75.8% were successful in receiving at least some finance (slightly below the overall proportion of 83.3% success in the baseline survey). Only 151 closed SMEs provided

data for the reason for closure, which reveals retirement (28%) and taking up another job (20%) as the main factors, with access to finance only relating to 15%.

The most significant (<.001 level) business characteristics associated with closure were:

- Self-employment, young SMEs under 5 years established, family-led, 1-2 partner/directors, poor capabilities to access finance, no business plan and declining employment.

- Not innovative and declining sales were both significant (<.01 level).

3.6 Summary of Descriptive Findings

- The focus of the analysis is the 4,165 SMEs that provided valid responses to all three annual Autumn LSBS waves from 2015 to 2017. This reveals little difference with the broad characteristics of the original 15,502 SMEs in the 2015 baseline survey.

- Almost a third (31.5%) were external finance seekers; a higher proportion in 2015 (20%) compared to 2016 and 2017 (14%).

- Success rates amongst finance seekers are much higher amongst those seeking external finance every year (97%) compared to the remainder of finance seekers (83%).

- A small core of SMEs (3.8%) successfully accessed external finance in every year, their median funding (£200k) being twice that of the remaining successful finance seekers (£100k).

- There is evidence of increasing use of general business support and specialist access to business finance advice amongst the panel over time; those with multiple applications (every year) were significantly (<.001 level) more likely to use general and specialist access to finance advice and to be successful.

3.6.1 Key characteristics of access to finance success

- The panel results confirm the baseline survey findings (Owen et al, 2017); the smallest (self-employed) and youngest SMEs established up to 5 years were significantly (<.001 level) less successful.

- Resource base is influential; having fewer partner/directors and perceived poor capabilities to access finance were significantly (<.01 level) associated with being less successful.

- Lower level innovative firms (where innovation referred to the product, service or process change at the firm, rather than market level) were less successful in accessing external finance (<.05 level).

- The most successful applicants were those applying every year and these were; significantly (<.001 level) larger SMEs (50-249 employees), more likely to use general business support and specialist access to finance advice and (<.05 level) to have more partner/directors and better perceived ability to access finance.

3.6.2 Types of finance and reasons for seeking finance

- Bank debt finance predominates, underlining the mature SME sample (only one in ten are established 5 years or less). Leasing debt finance is also very commonly sought, whilst alternative non-bank finance in the form of equity and P2P consistently represents less than 10% of finance seekers.

- Working capital (60%) is the main reason for seeking finance, followed by plant (circa 20%) and equipment (ranging from 24-44% in the period), whilst R&D represents between 4-15%, with R&D tax credits representing around 7%.

- Younger SMEs are significantly (<.01 level) more likely to access equity finance and particularly those in the 10-49 employee size group, whereas younger SMEs are significantly (<.001 level) less likely to access debt finance.

- Grant finance was particularly associated (<.001 level) with the other services sector, which includes many personal and community services, whilst overdrafts were significantly (<.001 level) related to larger primary, manufacturing and construction sector SMEs.

3.6.3 Characteristics of Non-financed groups

- Happy non seekers were significantly (<.001 level) more likely to be self-employed, not seeking business advice, not having a business plan and not innovative.

- Discouraged non finance seeking SMEs were significantly (<.001 level) less likely to be large SMEs (50-249 employees) and more likely to possess poor perceived capabilities to access finance, have no business plan and younger (5 years or less established; <.01 level).

- Those that sought finance, but did not receive any (between 2015-17) were significantly (<.01 level) more likely to be younger (up to 5 years established), innovative (to some degree) and have used specialist access to finance advice and general business support, but have no business plan.

- Closures (limited data n=552) were significantly (<.001 level) more likely to be established up to 5 years, family led with 1-2 directors/partners, possess poor capabilities to access finance, have no business plan and have declining employment. They were also significantly (<.01 level) likely to have declining sales turnover and not be innovative.

3.6.4 Growth and Productivity

- There was no significant difference in the employment and sales growth of externally financed and non-financed surviving panel SMEs. This may be determined by the high proportion of finance for premises, equipment, working capital and R&D not leading to shorter term changes. Furthermore, productivity improvement, for example from investment in more efficient machinery and working practices, may well not result in shorter term employment increase.

- Half (50.8%) of all panel SMEs increased productivity (i.e. sales turnover output per employee) between 2015-17; 8.9% remained static and 40.3% declined.

- The median percentage level that productivity increased in the period (2015-17) is highest amongst successful finance seekers (5%), followed by unsuccessful seekers (4.46%) and lowest amongst contented happy non seekers (0%).

- Access to external finance is significantly (<.1) related to increased productivity, notably where this is annually accessed (in each year 2015, 2016 and 2017).

- Significantly (<.1) the size of external finance, when above the median level of £100k financing was associated with increased productivity in 2016, and significantly (<.1) for the highest turnover increase group (£50k+).

- Conversely, the happy non seekers were significantly (<.1 level) more likely to experience no change in their productivity.

- Whilst larger SMEs exhibit overall higher productivity increase, only small SMEs (10-49 employees) exhibit higher median productivity growth where externally financed.

- Younger SMEs (<10 years established) exhibit higher productivity change overall, with those established 6-9 years exhibiting the highest rise in median productivity.

- A crucial finding appears to be the overall indication that the smaller self-employed and micro SMEs struggle to exhibit productivity increase when externally financed, whilst older SMEs (20+ years) exhibit least impact where finance is received and larger SMEs (50-249) do not increase their productivity as much as their non-financed larger SME counterparts.

- Happy non seekers that had previously used external finance (2010-2015) exhibited slightly higher percentage productivity increase than those that had not (0% compared to 1%), suggesting some potential impact from previous financing.

4. MULTIVARIATE ANALYSIS OF PRODUCTIVITY GROWTH AND FINANCE CHARACTERISTICS

4.1 Introduction

This section examines more closely the interrelationships between SME access to finance and associated characteristics and their productivity change performance in the period 2015-2017. The dependent variable adopted is the median percentage change in production (calculated, as previously, as the percentage change between 2015 and 2017 of annual sales turnover divided by total employment at the time of survey). We select median percentage change as a key determinant of above average performance (UM = >2% rise) as it provides a robust measure which is less discriminatory (than median £ value change) against smaller SMEs. In order to capture the nuances of higher and lower level performance, we also conduct a parallel series of tests with the dependent variable as the upper (UQ = >+33% rise) and lower quartile (LQ = <-25% decline) productivity performers to see if the trends are similar and confirmatory.

The multivariate tests are operated using a binary logit sifting technique (similar to Owen et al, 2017, see also Annex 3) which examines the key independent variables (all listed and explained in the meta data Annex 1) explored in the descriptive analysis in three broad categories: (i) **business characteristics**, including employment size, establishment age, location and broad sector (all definitions are tied to the baseline, 2015 classification of each case); (ii) **management characteristics** relating to ownership and number of managers (also tied to the original baseline 2015 data) and **business resource characteristics** relating to use of external advice, business planning and perceptions of capabilities to access external finance and **innovation characteristics** relating adopting new products, services or processes and receipt of innovation tax credits - the latter two sets are reflective of what took place throughout the period 2015-17; (iii) access to **external finance characteristics** which examine the finance seeking categories alongside the amount of external finance raised, and types of finance – these variables are all representative of the entire period 2015-17.

Finally, we conduct a complete model which explores the interactions between all of the key independent variables to which are the most powerful explanators for higher levels of productivity growth in the sample.

4.2 Summary findings

4.2.1 Business characteristics (Table A)

Exploring the business characteristics, three parallel models were run for (i) the upper median (UM) performers, (ii) the upper quartile (UQ) and lower quartile (LQ) performers. The models are weak in respect of the lack area-based correlation (R square of .028 to .043) with 56.3% for UM and 75% for UQ and LQ. However, they demonstrate that whilst area factors such as region, deprivation and rurality and broad sectors are not significant, firm employee and establishment age are highly significant:

- [9]Controlling for employment size by the largest medium-sized employers, all smaller categories are significantly (<.01 level) less likely to exhibit above median level productivity growth – the degree of likelihood decreases with employment size in both the UM and UQ models (although only zero employee remains significant <.01 level in UQ), and conversely increasingly highly significantly (<.001 level) more likely to be smaller SMEs in the LQ model.

- Younger establishment age (when controlled against the oldest established 21+ years SMEs) is significantly (<.01 level) associated with higher productivity growth at UM level and highly significantly (<.001 level) at UQ level for those <10 years established[10] (age is not significant in the LQ model).

4.2.2 Management, resource and innovation characteristics (Table B)

Exploring management, resource and innovation characteristics within the three models, we again find some consistent results, although the only significantly positive characteristic associated with UQ productivity growth is increased sales turnover. The

[9] Smaller SMEs are less likely to have an increase in productivity when compared with larger (50 to 249 employees) which is the reference class. E.g. a zero employee SME has 0.66 chances to show productivity increase when compared with one with 50 to 249 at the UQ level

[10] For example, firms established <6 years have 1.926 and those 6-9 years 2.051 more odds to show productivity increase than reference class SMEs with 20+ years establishment.

models are more powerful (R square ranging from .626 (78.1% correct) for UM to .365 (78.6%) for LQ and .312 (80.9%) for UQ). Key findings are:

- Sales turnover and employment growth are the most highly significant predictors (<.001 level) across all three models, with sales turnover growth associated with productivity rise and employment growth negatively correlated with productivity rise.

- R&D tax credits are also positively associated (<.05 level) with productivity growth, but only at UM level.

- Lack of a business plan is highly significantly negatively correlated (<.001 level) with UM and UQ level productivity performance and conversely, highly significantly correlated (<.001 level) with LQ level performance.

- Family owned and women-led SMEs and possessing average access to finance capabilities (as opposed to good capabilities) are significantly (<.05 level) negatively associated with UM level productivity performance. Conversely, average access to finance capabilities are highly significantly (<.001 level) correlated with LQ productivity, whilst possessing 1-2 managers (<.01 level) and women-led firms (<.05 level) are also correlated with LQ performance.

4.2.3 Financing characteristics (Table C)

The three financing characteristics models for UM, UQ and LQ examine whether the panel SMEs sought and received external finance, or did not seek and were discouraged, as well as the level of external finance received (focusing on 2016 descriptive variable correlation with productivity growth) and the types of finance received. The models are relatively weak, suggesting the lack of correlation of access to finance with productivity growth (R square ranges from .007 (52.6% correct) for UQ to .011 (75%) for UM and .018 (75.3%) for LQ. Key findings suggest that access to finance is more correlated with avoiding the LQ:

- Leasing finance is the only significant (<.05 level) factor associated with UM performance. The suggestion here is that improved equipment can lead to efficiencies and improved productivity more rapidly than other types of finance.

- The LQ model demonstrates that access to finance in relation to either a single year transaction, or where access is annually, are both negatively significantly (<.05 level) associated with LQ performance. Conversely discouraged borrowers (<.1 level) are significantly associated with LQ performance.

- Access to grant and commercial mortgage finance are both negatively significantly (<.05 level) related to LQ performance. The former potentially being associated with higher level innovation (R&D tax credits were significantly (<.1 level) negatively correlated with LQ performance), the latter perhaps indicative of the (at least) stable performance requirements of patient capital lenders.

- No financing factors are significantly correlated with UQ performance.

4.2.4 Summary model with all key variables (Table D)

Thus far the individual models demonstrate that the most significant findings relate to positive correlations with improved productivity for younger establishments, notably those established 6-9 years and larger SMEs, with sales growth being a key positive correlation, whilst employment growth is (at least in the shorter term of this survey period) a significantly negative correlation. Management characteristics indicate a high correlation between lack of a business plan and poor performance, allied to average access to finance capabilities (i.e. less than good capabilities), whilst R&D tax credit innovation activities are positively correlated with growth. Access to finance in itself does not appear to be strongly associated with improved productivity, although leasing finance is and more regular successful access to finance is less associated with lower quartile (LQ) performance.

Putting these key independent variable findings into one complete model, we are able to control (for example) for size and age of establishment to see which variables appear most strongly related to higher or lower order productivity improvements.

The three models are reasonably robust (R squares of .663 (80.2% correct) for UM, .34 (79.4%) for UQ and .416 (81.5%) for LQ).

Key findings are broadly supportive of the main findings from the earlier model sifts, with particular emphasis on sales turnover increase and younger age SMEs as highly significant positive correlations with productivity growth and employment increase and

smaller employee size – particularly self-employment – as negative correlations with productivity growth:

- Sales turnover increase is highly significantly (<.001 level) correlated with productivity growth in all three models.

- Employment growth is highly significantly (<.001 level) negatively correlated with productivity growth in all three models.

- Smaller SMEs with less than ten employees are highly significantly (<.001 level) negatively correlated at the UM level, with self-employed also negatively correlated (<.001 level) at the UQ level, whilst all SMEs with less than 50 employees are highly significantly (<.001 level) correlated at the LQ level.

- Younger firms (established 20 years or less) are significantly (<.1 level) more likely to exhibit UM growth, with those established 6-9 years significantly (<.01 level) correlated with UQ growth, alongside the youngest firms established under 6 years (<.05 level).

- SMEs that lacked a business plan were significantly (<.01 level) less likely to achieve UQ productivity performance.

- Average capability (as opposed to good capability) to access external finance was significantly (<.01 level) associated with LQ performance, whilst access to specialist finance advice was significantly negatively (<.1 level) correlated with the LQ.

- Women-led (<.05 level), family owned and broadly innovative (management self-defined as at least introducing new innovations to the firm) SMEs were significantly (both at <.1 level) less likely to achieve UM productivity performance.

- Financing characteristics were not highly significant factors in better performance (UM and UQ) SMEs, the exception being leasing finance being significantly corelated (<.05 level) with UM performance. This may relate to equipment enabling improved efficiencies and productivity (perhaps, as noted earlier, at the expense of labour).

- Access to finance factors were more significantly correlated in the LQ model, with some success in accessing finance, and successful access when only applying in a single year negatively significant (<.05 level). However, not seeking finance and seeking and failing to secure external finance were also significantly (<.01 level) negative correlations with LQ performance.

Overall, whilst the study has previously demonstrated that access to external finance can lead to improved productivity and that access to substantial amounts of external finance at above £100k in 2016 was associated with higher productivity, and conversely poor management resources such as fewer managers and poorer perceptions about accessing external finance are associated with lack of external finance and poorer productivity growth, these factors are overridden by three main factors:

- First, that sales turnover growth is a highly significant factor in productivity increase, whilst (at least in the shorter term), employment growth is a significantly negative factor.
- Second, the smallest firms with less than 50 employees – and particularly the self-employed - are less likely to exhibit productivity growth.
- Third, the youngest firm – particularly those under 10 years established – are more likely to exhibit productivity growth.

Additionally, whilst a good deal of the access to external finance correlation data is inconclusive, access to leasing finance for equipment does correlate with improved productivity, whilst access to finance can reduce incidence of lower level (LQ) productivity. There is also evidence to support the business resource-based view, with lack of business planning less associated with UQ performance and average (as opposed to good) perceived capabilities to access external finance being more associated with poor LQ productivity performance. Conversely, specialist access to finance advice was less likely to be associated with LQ performance.

Finally, to check for external economic factors, an instrumental binary variable relating to whether Brexit would reduce business investment (2017-18) was added to the summary model. This had no impact on prior findings, but was negatively correlated (<.1 level) with UM suggesting such economic uncertainty may result in poorer productivity.

Table A: Multivariate of Business Characteristics: (i) Upper Median (UM), (ii) Upper Quartile (UQ), and (iii) Lower Quartile (LQ)

	UM B	Sig.	UQ B	Sig.	LQ B	Sig.
Northern Region	-0.094	0.486	-0.158	0.307	0.196	0.218
South, East and London	0.018	0.879	-0.036	0.791	0.130	0.365
Midlands and South West	-0.057	0.646	-0.185	0.194	0.142	0.335
Rural in 2015	-0.018	0.836	0.049	0.626	-0.083	0.418
Deprived 15% location 2015	-0.095	0.458	-0.118	0.437	0.109	0.460
Primary, manu, construct 2015	0.041	0.732	-0.050	0.716	-0.019	0.891
Transport, retail, wholesale 2015	0.053	0.659	-0.003	0.983	-0.087	0.539
Business Services 2015	-0.030	0.785	0.039	0.757	-0.037	0.771
Zero employees 2015	-0.826	0.000	-0.421	0.002	1.033	0.000
Micro 1-9 emp 2015	-0.720	0.000	-0.116	0.373	1.222	0.000
Small emp 10-49 2015	-0.325	0.005	-0.195	0.139	0.681	0.000
Young age 1-5 years (2015)	0.513	0.000	0.645	0.000	-0.221	0.134
Age 6-10 (2015)	0.595	0.000	0.708	0.000	-0.224	0.114
Age 10-20 (2015)	0.318	0.002	0.117	0.341	-0.129	0.283
Constant	0.350	0.018	-1.015	0.000	-1.969	0.000

Note: Yellow marks most significant findings (<.05 level)

Table B: Multivariate of Management, Resource and Innovation Characteristics: (i) Upper Median (UM), (ii) Upper Quartile (UQ), and (iii) Lower Quartile (LQ)

	UM B	Sig.	UQ B	Sig.	LQ B	Sig.
Family led 2015	-0.392	0.009	-0.178	0.215	0.293	0.061
Women led 2015	-0.321	0.047	0.123	0.404	0.310	0.047
MEG led 2015	0.007	0.982	-0.011	0.972	0.163	0.598
zero managers 2015	-0.104	0.632	-0.030	0.888	0.050	0.829
1-2 managers 2015	-0.191	0.185	0.185	0.194	0.388	0.009
Poor perceived access to finance capabilities	-0.076	0.597	0.191	0.157	0.225	0.119
Average access to finance capabilities	-0.290	0.050	-0.003	0.981	0.546	0.000
received business advice in period 2015-17	0.167	0.211	-0.103	0.405	0.083	0.521
received financial access advice	0.173	0.440	0.109	0.623	-0.317	0.206
no business plane 2015-17	-0.469	0.001	-0.485	0.000	0.212	0.115
if innovation took place in products or services in period 2015-17	-0.206	0.119	0.038	0.755	0.224	0.088
R&D tax credit used in 2015-17 period	0.432	0.047	-0.105	0.633	-0.442	0.057
External R&D investment 2015-17	0.376	0.121	0.039	0.878	-0.201	0.449
Employment rise 2015 to 2017	-6.733	0.000	-1.909	0.000	2.344	0.000
Sales turnover rise 2015 to 2017	7.435	0.000	2.116	0.000	-2.462	0.000
Constant	0.030	0.883	-1.542	0.000	-2.181	0.000

Note: Yellow marks most significant findings (<.05 level)

Table C: Multivariate of Finance Characteristics: (i) Upper Median (UM), (ii) Upper Quartile (UQ), and (iii) Lower Quartile (LQ)

	UM B	Sig.	UQ B	Sig.	LQ B	Sig.
some success accessing finance between 2015 and 17	0.452	0.402	1.006	0.197	0.067	0.904
some success where applying in one year only across 2015 2016 2017	0.150	0.364	-0.039	0.836	-0.416	0.030
some success obtaining fin where applying every year	0.007	0.973	0.030	0.903	-0.577	0.040
did not seek finance at all 2015-17	0.550	0.283	0.928	0.220	-0.386	0.453
discouraged borrower at some stage 2015-17	0.114	0.413	0.257	0.096	0.267	0.097
did not seek but was discouraged at some stage 2015-17	0.008	0.966	-0.014	0.949	-0.304	0.177
sought at some stage 2015-17 but failed to get any finance	0.739	0.172	1.165	0.135	-0.331	0.546
obtained bank loan 2015-17	-0.034	0.812	-0.181	0.272	-0.334	0.058
obtained OD 2015-17	0.047	0.773	0.065	0.727	-0.138	0.487
obtained P2P 2015-17	-0.087	0.778	-0.055	0.877	0.200	0.576
obtained grant 2015-17	0.170	0.423	-0.165	0.503	-0.638	0.019
obtained leasing 2015-17	0.346	0.038	0.162	0.387	-0.185	0.358
obtained factoring 2015-17	-0.047	0.861	0.124	0.675	-0.111	0.738
obtained equity 2015-17	-0.337	0.353	0.085	0.834	0.580	0.140
obtained commercial mortgage 2015-17	0.289	0.195	0.056	0.820	-0.762	0.020
Finance received 2016 over 100k	0.253	0.186	-0.144	0.508	-0.164	0.493
Constant	-0.640	0.209	-2.096	0.006	-0.687	0.179

Note: Yellow marks most significant findings (<.05 level)

Table D: Multivariate of All Characteristics: (i) Upper Median (UM), (ii) Upper Quartile (UQ), and (iii) Lower Quartile (LQ)

	UM B	Sig.	UQ B	Sig.	LQ B	Sig.
some success accessing finance between 2015 and 17	3.233	0.095	1.736	0.130	-1.711	0.040
some success where applying in one year only across 2015 2016 2017	0.280	0.257	-0.009	0.968	-0.504	0.044
some success obtaining fin where applying every year	-0.379	0.234	-0.169	0.567	-0.594	0.083
did not seek finance at all 2015-17	3.513	0.067	1.659	0.141	-2.325	0.003
discouraged borrower at some stage 2015-17	0.405	0.054	0.460	0.017	0.322	0.127
did not seek but was discouraged at some stage 2015-17	-0.079	0.792	-0.093	0.737	-0.244	0.409
sought at some stage 2015-17 but failed to get any finance	3.665	0.058	1.863	0.105	-2.335	0.005
obtained bank loan 2015-17	0.009	0.966	-0.139	0.483	-0.417	0.069
obtained OD 2015-17	0.193	0.445	0.038	0.868	-0.394	0.128
obtained P2P 2015-17	-0.116	0.798	-0.019	0.964	0.052	0.913
obtained grant 2015-17	-0.041	0.897	-0.250	0.425	-0.699	0.057
obtained leasing 2015-17	0.511	0.046	0.151	0.520	-0.057	0.825
obtained factoring 2015-17	-1.040	0.008	0.007	0.984	0.288	0.514
obtained equity 2015-17	-0.191	0.725	0.176	0.724	0.256	0.601
obtained commercial mortgage 2015-17	0.300	0.325	0.191	0.520	-0.722	0.067
Finance received 2016 over 100k	0.629	0.023	0.063	0.812	-0.234	0.432
Northern Region	-0.052	0.813	-0.025	0.903	0.165	0.448
South, East and London	0.225	0.262	0.092	0.607	-0.020	0.918
Midlands and South West	0.119	0.567	-0.113	0.546	-0.043	0.835
Zero employees 2015	-1.686	0.000	-0.806	0.000	1.392	0.000
Micro 1-9 emp 2015	-0.793	0.000	-0.116	0.539	1.444	0.000
Small emp 10-49 2015	-0.216	0.238	-0.266	0.130	0.820	0.000
Primary, manu, construct 2015	0.171	0.437	-0.093	0.646	-0.015	0.946
Transport, retail, wholesale 2015	0.053	0.801	-0.020	0.916	-0.049	0.820
Business Services 2015	0.061	0.758	0.150	0.404	0.082	0.680
Young age 1-5 years (2015)	0.422	0.055	0.431	0.023	-0.161	0.449
Age 6-10 (2015)	0.396	0.054	0.496	0.005	-0.027	0.893
Age 10-20 (2015)	0.322	0.064	-0.067	0.678	-0.124	0.471
Rural in 2015	-0.128	0.385	0.050	0.710	-0.072	0.616
Deprived 15% location 2015	-0.038	0.856	-0.062	0.753	-0.024	0.908
Family led 2015	-0.299	0.068	-0.061	0.689	0.277	0.108

Women led 2015	-0.381	0.027	0.146	0.348	0.312	0.059
MEG led 2015	-0.147	0.682	-0.244	0.469	0.082	0.805
zero managers 2015	0.154	0.516	0.043	0.851	-0.055	0.829
1-2 managers 2015	0.104	0.517	0.220	0.149	0.100	0.544
Poor perceived access to finance capabilities	0.094	0.554	0.123	0.394	-0.023	0.883
Average access to finance capabilities	-0.168	0.290	-0.010	0.948	0.391	0.010
R&D tax credit used in 2015-17 period	0.303	0.215	-0.149	0.527	-0.186	0.462
Employment rise 2015 to 2017	-7.271	0.000	-2.050	0.000	2.487	0.000
Sales turnover rise 2015 to 2017	7.930	0.000	2.207	0.000	-2.529	0.000
External R&D investment 2015-17	0.225	0.438	0.019	0.948	-0.028	0.931
if innovation took place in products or services in period 2015-17	-0.234	0.100	-0.007	0.958	0.207	0.133
received business advice in period 2015-17	-0.031	0.828	-0.181	0.157	0.185	0.172
received financial access advice	0.172	0.471	0.005	0.983	-0.479	0.078
no business plane 2015-17	-0.242	0.112	-0.364	0.008	0.039	0.783
Constant	-3.526	0.068	-3.215	0.005	-0.582	0.486

Note: Yellow marks most significant findings (<.05 level)

5. STAGE 2 QUALITATIVE INTERVIEWS WITH OXFORD INNOVATION SME FINANCE ADVISORS

5.1 Introduction

This section presents the findings from a series of 6 in-depth interviews with Oxford Innovation business finance advisors (Table 17). These were supplemented by an oversight interview with the strategic head of Oxford Innovation Opportunities Network (interviewee V) and the CEO of St John's Innovation Centre, Cambridge.

5.1.1 Background of advisors and their service offer

The service offered by Oxford Innovation - operating in Oxford and Swindon through Oxford Investment Opportunities Network ('OION') and the Access to Finance (A2F) team operating in Cornwall and Isles of Scilly - focus on general workshops for start-ups and early stage businesses. Workshops usually comprise of 20-25 people, with one-to-one coaching provided to more established businesses.

- For start-ups and early stage businesses: workshops cover (i) funding options available (the current landscape of financing in the UK, updates on relevant areas, grants etc.); (ii) business modelling (how to start a business and set up a salient business model); (iii) financial forecasting. Subsequently, if necessary one-to-one meetings/coaching and hands-on support is provided, including for writing funding applications.

- More established businesses: one-to-one meetings typically cover: (i) what funding options are suitable; (ii) business plan and forecasting.

Support is provided for networking and pitching for external finance and then, where required, through the funding negotiation process (notably for earlier stage, less experienced ventures). For A2F, this is very hands-on, whereas more typically for OION in Swindon and Oxford it is through lighter touch guidance, expert advice and pitch development. The engagement period with a business is typically 6-8 months, but up to a year for A2F. Details of the advisors' backgrounds and experience are presented in Table (below), suggesting that these are highly experienced advisors in SME finance with backgrounds also in SME financing and managing SMEs.

5.2 Key findings

10 key findings from the stage 1 quantitative study were presented to the advisors to test for validation from the advisors' perspective and also explanatory and potential business support policy insights.

Table 17: Oxford Innovation (OI) Business Finance Advisor Interviewees' Role and Experience

Interviewee I	OION	Access to Finance Specialist / Investment Network Manager	Set up, developed and advised Software Companies in England and Australia
Interviewee II	OION	Investment Network Manager at OI (Investment Networks)	Investment Training; Managed Investment Networks for early stage companies; led due diligence negotiations to establish the BoS Investment Programme, EEN
Interviewee III	A2F	High Growth Specialist / Stakeholder & Project Director	Management Positions in National Press; launched a publishing company; working in Angel and VC Investment; Project Management
Interviewee IV	OION/ A2F	Debt Funding Lead and Strategic Finance and Funding Specialist	Accredited Funding/Financial Solutions Advisor and Coach; Growth Accelerator Program with Grant Thornton; Background in banking and developmental finance; set up and owned companies
Interviewee V	OION	Managing Director of OION	Investor events, various management and advisory board positions, background in investment banking in London and Tokyo
Interviewee VI	A2F	Finance Director/Business Finance Specialist	Brokered deals sold companies; Finance director of international groups; coaching positions within OI and program manager and conducted pilot programs
Interviewee VII	A2F	Business Finance Specialist	Various projects within OI and JP Morgan; education about types of finance, market and access to finance; business owner and underwriter; multiple alternative finance positions with finance houses and banks

5.2.1 Resource base deficit

(1) There is a resource-based (management capabilities) deficit amongst SMEs – notably young, early stage businesses seeking external finance.

There is general consensus that the biggest barrier for SMEs accessing external finance is the lack of knowledge that they demonstrate. This aligns well with previous findings of the study and was supported by all interviewees. The need to deliver clear, concise, relevant up-to-date information in order to obtain the best results was also evident.

Interviewee V "*The main finance gap in the UK is for early stage innovation investment.*"

Interviewee II "… *equity investment is strongly knowledge-based given the high R&D efforts before revenue and profit. Debt is mostly for later stage companies for scale ups*".

Interviewee I "*Startups will still progress with a business idea regardless of their knowledge of finance … there can be an information overload for business owners.*"

5.2.2 Relationship between external finance and productivity

(2) SME productivity is significantly correlated with obtaining external finance and increased (in 2016) with increased levels of - and regular access to - external financing. For example, those businesses not seeking external finance (either contented non-seekers, discouraged non-seekers, or completely unsuccessful seekers) all perform worse in terms of productivity improvements per employee (2015-17). This was significant in the descriptive data, but not in the regression tests.

As there are no specific productivity measures in place (pre or post assistance) and OI/A2F does not track all of the SMEs that they assist, there is no reliable evidence supporting this statement. What interviewees pointed out, however, was that those who had undergone their training and support were made aware of how to manage resources effectively. Such resources could be financial and non-financial in nature. The impact was thus made in educating entrepreneurs to forecast reliably, identify and evaluate options and hence manage resources accordingly. What emerges, as summarised by the interviewee comment below, is that most SMEs are not strategic and use advice and support intermittently – only when absolutely required, but there are clearly benefits from developing longer relationships with advisors.

Interviewee VII "*Funding depends on risk: what risk are they prepared to take? We specifically elaborate on personal circumstances, personality, etc. Then people come back when they need help anyway.*"

5.2.3 Relationship between external finance and sales and employment growth

(3) Where SMEs received external finance they were just as likely to increase or decrease employment, but significantly less likely to experience declining sales (it should be noted that the study relates here to SMEs that are already trading).

This was mentioned to be true, as employment numbers usually get adjusted in terms of efficiency (based on the training provided by OI advisors) and hence are more likely to

lead to stable sales. It is worth mentioning here that the study examined predominately established SMEs and therefore external financing (notably for equipment) could lead to greater automation and some job skills training. The employee number is perceived as the only metric that can easily be tracked reliably by advisors. However, again, there are no specific protocols or metrics in place to record the impact of advisory support.

5.2.4 Relationship between amount of external finance and productivity growth

(4) Where SMEs received external finance, those businesses receiving above the median level of £100k (in 2016) and those receiving multiple rounds of annual funding were significantly more likely to increase growth and productivity (note: again not substantiated by the regression tests).

Whilst the interviewees did not have any specific metrics or qualitative evidence to support the statement it was suggested that mature SMEs that had already received financing once, were more effective and productive due to two reasons: first, they almost exclusively receive one-to-one coaching and hence more detailed feedback and insights. Second, the reason why these SMEs turn to Oxford Innovation advisors is less because they are not aware of the options but, rather, because they lack the resources to address these options accordingly.

Interviewee III "*An important service are the options available when a business needs money, A2F suggests where to turn to.*"

Discussions with St John's Innovation Centre, also indicate that "*building the business in the round*" through ongoing coaching and mentoring can be very beneficial to enhancing management skills (e.g. upskilling or recruiting in specialist functions such as financial management, marketing) for growth and facilitating ongoing financing round success.

5.2.5 Relationship between multiple external financing ad productivity

(5) Those SMEs receiving external finance in every wave were more successful in applying, receiving larger sums of finance annually, and appeared more productive.

Interviewees pointed out that SMEs are typically more successful in the second or third funding round, because they had undergone their training. There is support here for dynamic capabilities, whereby entrepreneurs learn from experience and develop their

SME resource base (Teece et al, 1997). For Oxford Innovation it holds true that those who receive funding are more successful, both in obtaining more funding and performance, as the investors choose the best in class (based on recommendations mostly):

Interviewee I "*The credibility is higher when they had already raised funding. It reflects on the expectation of funders.*"

The impact of the workshops (*this is only confirmatory based on qualitative experience*) is likely to lead to productivity improvements in assisted ventures. Ventures are more successful it seems, as the coaching and individual work addresses the most important knowledge gaps and market requirements. However, productivity measures are not in place – so for OIS the evidence often comes back via occasional talks with ventures and the development of these into a case study for the workshops.

Interviewee V *"…We are working on their collective experience.*"

Interviewee I+II "… *we even have to collect reviews, that's required for Europe.*"

Interviewee VI "*Our hands-on result is getting funded.*"

Interviewee VII "*A2F keeps track by building case studies."*

Interviewee III "… *Oxford Innovation monitor scale and growth, however there is potential [for more] in the geographical region of London and the South East where more high growth companies are situated.*"

Interviewee II *"…for example the Global Innovation Program where many different sectors and regions are coming together – you cannot keep close ties to everyone.*"

"*I'm not sure if there was any Benchmarking in place and how useful such reviews were to compare services. Also, the reviews are predominantly excellent – which points at the high demand of our support!*"

5.2.6 Impact of Brexit

(6) 2016, with the onset of Brexit appears to have been a worse year for SME financing, although this improved in 2017.

It was confirmed that Brexit is currently a major driver for insecurity in the market which might prevent venture expansion (especially internationally). It was also confirmed that 2017 saw a generally more positive outlook, however this is expected to deteriorate with the exit deadline approaching fast.

Interviewee I "*Brexit is a big issue for sure*. *Lack of investor confidence will see less money going into early stage investment."*

5.2.7 Relationship between resource base and external finance

(7) SME resource factors are confirmed as critical to accessing finance. Factors such as increased numbers of managers/directors and increased perceived competence to apply for external finance are significantly associated with improved success rates in applications.

It was also confirmed that the venture team is an important factor, especially for later equity investors. Besides a solid business model, it seems important that the team reflects a broad variety of key management skills/departments in a business (i.e. R&D/technology/service, sales and marketing, finance). This indicates that it is more important to present consistency and credibility to potential investors rather than innovation.

While it was agreed that knowledge resource factors, such as perceived competence are highly important for equity funding it was added that especially for debt funding it appears significantly more important to provide and show the necessary financial resources, in terms of securities and collateral.

Interviewee IV: "*In teams (specifically for equity funding) structure and management strengths are important – are there any holes? They focus less on product. For debt funding securities matter the most.*"

Interviewee III: "… *an ideal team consists of maybe three members. Solo entrepreneurs tend to miss out on things. You know, they tend to be more concerned with the dream rather than the delivery*."

An intriguing addition from advisors in the Cornwall area was the lack of expertise in grant writing, while grant is to provide funding for further expertise, businesses require expertise to write the grant applications in the first place.

Interviewee III "*What's missing are resources that do the work […] those who write R&D related grant applications, those who know the language*."

Interviewee IV "*Grants require a special language and needs experts to get yourself as an SME ahead of others. There is a gap there as grants are to help businesses, yet businesses need help to write those applications*". "*In Cornwall people are used to receiving grants, less so in London and the SE."*

The interviewees highlighted that Innovate UK programmes such as the Investment Accelerator Programme (IAP) are supportive. However, it could be useful to see grant/angel co-investments (to supplement the British Business Bank Angel Co-fund for earlier stage proof of concept investing) also.

Interviewee IV "*We do projects with Innovate UK – Enterprise M3 which is a local enterprise partnership*".

5.2.8 Relationship between innovation and external finance

(8) Intriguingly, the longitudinal panel survey found that remaining panel members describing themselves as in some way innovative (in terms of introducing products, services or processes) were significantly (<.05 level) less successful in obtaining finance.

What Oxford Innovation advisors hear from the feedback of investors is that high innovation levels are often a sign of very outstandingly creative and driven entrepreneurs. Such characteristics hence might be an indicator of a potential danger that finance received is not spent accordingly.

Interviewee IV: "*… banks are distrusting anything new. You know, spending overdrafts on innovation is not always putting SMEs in a good light. Also, funders mostly distrust the ability of management.*"

Interviewee III: "*Mostly they focus on sales, acceleration and scale. It would be important to look at determinants such as how and when to pay back, retire, the shareholder and stakeholder structure but entrepreneurs lack knowledge*"

5.2.9 Relationship between external finance and business closures

(9) Known business closures (from the original 2015 baseline survey) are associated with poorer success records in obtaining external finance and also more instances of decision pending/unresolved applications.

Oxford Innovation advisors barely see any business closures as they concentrate on assisting business growth. However, it is acknowledged that coaching younger SMEs in particular, helps towards ensuring business survival.

Interviewee III "*We share the mantra: education before intervention – even if not funded. A good day in the office is stopping someone from losing their house due to poor investment decisions.*"

5.2.10 Characteristics of business closures

(10) Business closures were most significantly associated with: Self-employed, young SMEs under 5 years established, family-led, less managers/directors, perceived poor capabilities to access finance, no business plan, declining employment and sales turnover and lack of innovation.

This seems to hold especially true for SMEs supported in regions such as Cornwall.

Interviewee IV: "*It is crucial to find out why they are doing it (grow or for living – can we help them to get some clients in regions, sectors, age group etc.). Many businesses underestimate the amount of time it takes to raise finance. They often turn to us when funding is required quickly. Let's say Eric can't pay salaries etc – Oxford Innovation finds funders that fund quickly – unsecured borrowing; not adequately prepared then, lack of planning.*"

Interviewee I: "*Raising money is especially difficult because they lack whole market knowledge (which also is very regionally specific).*"

5.3 Verbal Protocol Analysis (VPA)

The Verbal Protocol Analysis (VPA) was conducted with four interviewees. Two of them are mainly working with SMEs in the Oxford/Swindon area, whereas the other two are specialising in the Cornwall/South Western Area. The presented Business Case was selected as an early stage tech venture, as this is the main sector Oxford Innovation

advisors operate in, regardless of the region. The anonymised case is adapted from a real-life example of a venture funded on an equity crowdfunding platform (as such, it would not have been known to the interviewees). The case was assessed for suitability by an expert in this emerging form of VPA and piloted by a group of final year undergraduate students studying on an entrepreneurship module at Middlesex University. This demonstrated that the case was readily understandable and provided a useful contextual benchmark for the findings from the Oxford Innovation expert advisors.

The Oxford Innovation interviewees were asked to evaluate the Case (as it appears in Annex 2) according to its credibility and whether it was worth taking into consideration for support. Ultimately, it should be assessed according to its potential for funding.

The findings of the analysis underline the consistency of the prior observations of the advisors on their Oxford Innovation approach assisting young ventures to access finance. Some advisors mentioned the lengthy and intensive selection process of Oxford Innovation, which involves telephone calls, early meetings and later stage meetings – with each step increasing the scrutiny of the business model and the capability of the entrepreneurs. They highlight that in the case presented, the entrepreneurs would have been invited for calls and detailed assessment.

Our approach was to code the respondents' thought units and calculate the frequency counts. This helped to identify the most important issues being raised by participants. Since there were only a small number of respondents and we are just interested in understanding if the findings at stage 2 match those for stage 1 we do not report rankings here.

From the evaluation of the most crucial funding factors the following results appear to be the most important ones:

- **Market**: The potential customer base – notably, is the market narrow enough to tap the interest of the customer base?

- **Management Team**: The spread of the funding team – notably, a broad set of qualifications, especially in the sector, sales and finance.

- **Finance**: Does the valuation seem solid - are the numbers credible, does it reflect the market capacity, do they know the sources of income and expenses etc.?

Most of the advisors would not have supported the venture to approach potential investors as presented, due to the reason that they think the market is relatively saturated. Despite that the product seems clearly defined and the team knowledgeable and trustworthy, the lack of detail in the market research/testing phase appears weak and leaves room for interpretation – and would therefore need improvement. It is worth mentioning at this point that the student group queried the product cost and whether the target 'pensioner' group market could afford such monthly payments. The Oxford Innovation advisors also repeatedly pointed at the lack of clarity where numbers in the forecast and rollout phases would come from. Hence, they all had difficulties in understanding the valuation and the required investment amount.

Corroborating earlier findings, expertise and credibility appear to be the most important factors for obtaining external funding. In addition, the interviewees highlight the customer-base as an important factor. This could be a potential barrier for geographically narrow companies and reflects on some earlier Oxford Innovation interviewee comments about the nature of innovation, target markets and scalability:

Interviewee II "*… they [the entrepreneurs] often have not done basic market research – for example it is not always the case that they are innovative, rather lots of the same product or service already exist, but in different regions.*"

5.4 Summary of qualitative analysis

- There is general consensus that the main barrier to SME access to finance is a demand failure relating to their lack of knowledge about how and where to access external finance.

- Business support providers such as Oxford Innovation do not keep metrics on business development, growth and productivity. Funders do not ask for this and any relevant data held is not analysed and reported. Evidence of productivity change is therefore anecdotal at best.

- Ventures receiving Oxford Innovation guidance are more likely to use external finance to improve efficiency and this may result in sales growth or stability, but also may result in employment loss.

- Most SMEs are not strategic and only use external assistance and advice when required – as a last resort. However, where longer term relationships develop

with particular advisors, this may be beneficial to strategic development and accessing finance.

- SMEs increase their capabilities to access external finance through experience, hence over time they are more able to access the finance that they require.

- External macro-economic and political factors such as Brexit can have considerable impact on SME demand for finance. The poor demand for SME finance in 2016 reflected Brexit uncertainties – and the prevailing Brexit uncertainties in early 2019 will likely reduce demand for SME finance.

- Knowledge based resources (e.g. management skills and capabilities) are crucial for accessing equity finance, but for debt finances security and collateral are the key.

- Young, early stage SMEs require assistance with grant writing to access this type of finance. This was very evident from the A2F programme in Cornwall and Isles of Scilly.

- Innovation is a nebulous term. High level innovation can be a concern for potential investors where early stage management teams have little prior management knowledge and may not have the financial management skills to use finance efficiently. Conversely, many ventures do not undertake sufficient market research to understand and justify whether their innovations are localised or more widely scalable.

- There is a perennial problem with lack of business planning leading to business failure and poor use of finance where received. Lack of planning leads to preparation for failure.

- SME markets are differentiated; e.g. sub-regions of the South West of England vary considerably from high tech M4 corridor ventures to tourism in Cornwall, with business support needing to address these different financing needs.

6. RQ3 CONCLUDING SYNTHESIS OF KEY FINDINGS AND POLICY IMPLICATIONS

6.1 Summary of key findings

It is important that the findings presented are understood as representative of typically established UK SMEs, since less than one in eight were under 6 years old at the time of the baseline survey in 2015 and the findings relate to surviving SMEs that responded to all three annual survey waves between Autumn 2015 and Autumn 2017. It must also be conceded that the measure of productivity change; i.e. as the change in sales turnover generated per employee in each SME between 2015 and 2017, is crude. That said, there is a clear and powerful emerging message for academics, business support policymakers, business finance advisor practitioners and SME managers:

- Whilst external finance can assist SME growth and productivity growth (a key focus of the study), such impacts are highly nuanced and appear strongly related to the employment size (larger SMEs perform better), establishment age (younger SMEs perform better) and whether sales turnover growth outweighs employment growth. Management resource-based deficiencies such as lack of business planning, poorer perceived management capabilities to access external finance and lack of use of specialist access to finance support are associated with poorer productivity performance. There is also a suggestion that where external finance is received, lack of on-going assistance can lead to sub-optimal investment and performance (or at least lagged sales turnover improvement).

The suggestion here is that whilst the LSBS baseline survey (2015) analysis of access to finance by UK SMEs by Owen et al (2017) provided strong recommendations for improved access to business finance services in order to improve access to finance and reduce discouragement, there is also a need for ongoing business support to facilitate the optimal use of external finance investment received. Our findings suggest that SME sustainability and growth in productivity requires "*building the business in the round*" by upskilling and recruiting specialist management functions such as financial management and marketing to facilitate optimal investment and follow-on funding potential[11].

[11] See BIS (2012) for a detailed account

The original findings of Owen et al (2017) highlighted that smaller, younger SMEs that lack experience in sourcing external finance and particularly alternative non-bank finance options, require greater access to appropriate, specialist business finance support services. These findings are further supported and confirmed in the current longitudinal study. However, this follow-up longitudinal analysis also highlights that business growth, and particularly higher-level productivity growth is associated with larger SMEs and younger SMEs that are likely to be more regular users of business support (and significantly less likely to be poorer performers).

Crucially, the finding from our regression analysis (Tables C and D), that external finance alone is not associated with higher level productivity growth (at above the median change percentage, or above the upper quartile percentage change for 2015-17 – the only exceptions being for leasing finance and receipt of over £100k in 2016 at UM) is a salient lesson for policymakers. Numerous studies have previously indicated that the most successful SMEs are typically those that access external business support services (see Mole et al, 2017) and suggested that young and growth phase SMEs can benefit immensely from ongoing mentoring and business support to ensure that external funds are wisely invested, management team structures and skills are developed, and financial management practices are improved (see Owen et al, 2019a in relation to mentoring and external finance; Owen and Mason, 2016 in relation to business angel and seed investor management assistance - so-called non-financial investor benefits to investees; Owen et al, 2019 on the absorptive capacity of SME management teams).

Furthermore, there is evidence from the longitudinal study that surviving SMEs are absorbing and learning financing practices, through increased use of external business support services and demonstrably improved access to external finance, with those that regularly access finance generating higher levels of productivity improvement. This finding is strongly supported by the experience of Oxford Innovation's specialist access to finance advisors and by the CEO of St John's Innovation Centre. The Oxford Innovation A2F scheme in Cornwall and Isles of Scilly, has implemented a well promoted access to finance advice scheme that has encouraged SMEs to seek assistance earlier in the process of considering business financing options and seeking external finance. The result is improved access to finance, or remedial management support where the business is not investment ready, improved selection and application procedures and fewer business closures. Furthermore, where SMEs are more established and more regularly seeking external finance they will continue to use external advice to improve their chances of funding (e.g. improving grant bid writing and application materials).

However, there is still insufficient follow-up and support, suggesting that SME sustainability and improved productivity could benefit from further development of these services to provide 'support in the round', include ongoing mentoring, coaching and monitoring advisory services (e.g. business health checks).

6.2 Advancing Academic knowledge and Policy recommendations

Bhaumik et al (2015)[12] provide a strong academic basis for the framework of this study and an understanding of how it takes forward current academic knowledge in the post GFC and now Brexit era of uncertainty that surrounds SME financing in the UK. Bhaumik et al (2015) and Fraser (2014) advance the argument that examining SME finance gaps is useful, but that their causes are highly nuanced and likely to result from combinations of supply-side (finance provider failures) and demand-side (SME finance seeker failures) and combinations of interaction failures between SMEs and financiers. To this, Owen et al (2017) suggest including the role and interaction of intermediary finance advisors – all of which broadly fall under the ambit of agency failures and information asymmetries. Furthermore, Fraser (2014), recognising the need for greater understanding of cognitive reasoning and decision making of SMEs as a key explanator of demand failure, developed Kon and Storey's (2003) discouraged borrower concept, to provide a typology of SME borrowers, establishing that non borrowers may be discouraged (with an acknowledged need, but not applying for external finance), but that others are simply contented or happy non borrowers (not wishing to invest, or are able to invest sufficiently from their own internal – or informal network – resources).

As such, this body of knowledge is helpful, but limited. It increasingly recognizes that demand failure is an important element of the SME finance gap – or SME under investment puzzle. It also recognises a link between access to (debt) finance and improved business growth (Bhaumik et al, 2015). However, it does not consider the relationship between external finance and productivity change, or the extent of impact of intermediaries pre investment (addressing Mason and Kwok's, 2010, investment readiness) and post investment (addressing Baldock's, 1998, ongoing investment support requirement, also suggested in equity investment studies of business angels (e.g. Mason and Harrison, 2015) and VC investment (Baldock, 2016). Nor, whilst

[12] It should be noted that this paper draws on UKSMEF data 2004-09 which is largely bank debt finance related and pre-dating the GFC.

acknowledging the crucial role of entrepreneurial cognitive behavior, does it explore entrepreneurial team absorptive capacity in accessing and managing external finance (BEIS, 2017; Owen et al, 2019).

Collectively, the current study addresses all of these academic deficits in a practical and exploratory way. It develops a more nuanced understanding of SME finance seeking and non-seeking. Crucially, we reveal categories such as multiple annual successful seekers (role models that also make regular use of external generic business and specific business finance advice) and demonstrate (albeit limited) evidence of absorptive capacity building behaviour (supported by qualitative business finance advisor evidence), alongside a clearer understanding of discouragement, which differentiates between partial (seeking some but not all external financing needs) and totally discouraged (do not seek any external finance, despite acknowledged need) groups. We also attempt (with limited data) to differentiate between self-investing and non-investing happy non-borrowers and to build up greater knowledge of antecedent investing, prior to the study period (again with limited data).

Our findings, particularly in relation to the poor productivity performance of smaller businesses and less frequent, lower level finance seekers (when compared to regular, successful finance seekers), have strong implications for policymakers.

- Primarily, policymakers should be cognisant of the difference in objectives between employment and productivity growth, given that shorter-term changes – captured in the current study – demonstrate that smaller SMEs struggle to deliver productivity change (as they may have to take on more staff to undertake R&D and develop new skills), whilst larger firms may offer more rapid productivity change through equipment and work practice efficiencies, but at the expense (at least in the shorter term) of job creation and permanent job status.

- An important take-out from this study is that business finance advice is a key to SME development and is a significant factor in enabling timely access to appropriate types of finance. However, SME finance advice is likely to be most effective when it is ongoing, regular and integrated with mentoring and management skills development. This can enable optimal financial investment and management activities. In turn, this will provide greater access to follow-on funding, growth and businesses sustainability.

What is now required is for these type of services to be more effectively delivered (i.e. the Start-Up Loans Company report[13] demonstrated exactly why mentoring, which is poorly and unevenly delivered, fails to make a discernible impact) and monitored over a sufficient time period to demonstrate a difference (such as that mentioned in Owen et al, 2019a in e.g. Sweden's start-up mentoring scheme). A view strongly presented by Oxford Innovation is that government programme funders need to take greater account of the value of rounded business support service delivery which funds ongoing support, post-finance, and entails appropriate monitoring periods and data collection. This could provide greater evidence base and facilitate programme adjustments to fine tune for improved outcomes such as productivity (Lerner, 2010).

Here we present a 'blueprint' for policy table and figure (Table 18 and Figure 3[14]) which summarises the complementarity ladder requirements of business support and specialist financial advice alongside the stages of SME financing, structured within the contemporary UK SME finance escalator framework (drawing on input from Oxford Innovation, SQW and developing Owen et al, 2019).

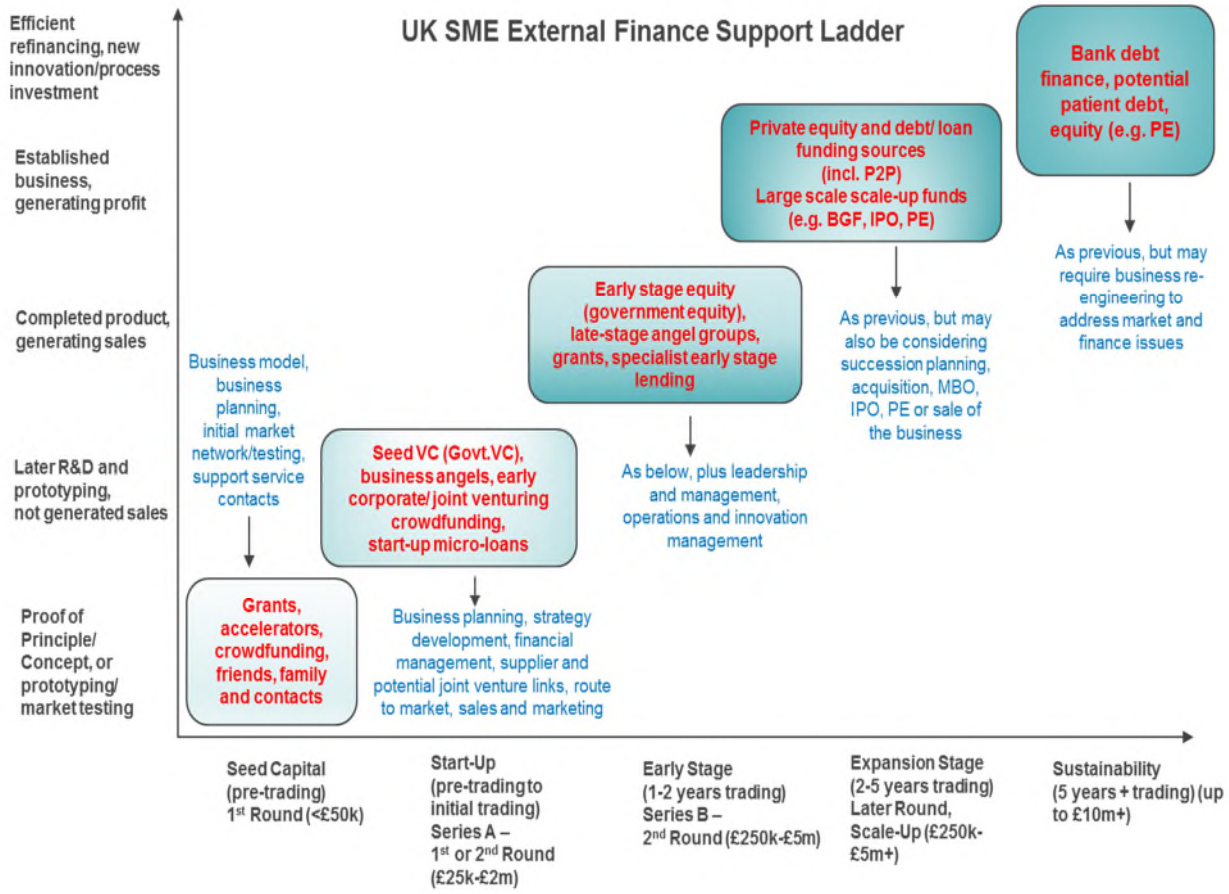
[13] British Business Bank (2017)
[14] Note the predominance of equity finance types relates to only a small, but growing proportion of SMEs (<5%), but is highly relevant to higher risk innovative potential high growth SMEs.

Table 18: UK SME External Finance Support Ladder

Company Stage	Business Support Need	SME Status	Potential Finance Source
Seed Capital (pre-trading) (1st Round) <£50k	Business model and business planning, initial market network/testing, support service contacts	Great idea. Proof of Principle/Concept initiated. Need finance for additional research for PoC or prototyping/market testing	Ideas too early for most formal investment. Grants for innovations and special interest activities (e.g. socio-enviro), accelerators, crowdfunding, friends, family and contacts.
Start-Up (pre trading to initial trading) (Series A: 1st Round or 2nd Round) £25k-£2m	Business planning, strategy development, financial management, supplier and potential joint venture links, route to market, sales and marketing.	Researched market and established PoC. Later R&D and prototyping to reach market. Not generated sales (unless consulting) Finance needed for working capital i.e. initial marketing, salaries, product testing.	Small amounts of early stage funding from Seed VC (government VC), business angels, early corporate/joint venturing and crowd funding. Specialist start-up micro-loans from government or local specialist providers (e.g. credit unions, enterprise agencies).
Early Stage (1-2 years trading) (Series B: 2nd Round) £250k-£5m	As above, plus leadership and management, operations and innovation management	Completed product and generating sales. Finance needed for marketing and operations to make business take-off.	Early stage equity (government equity) and late stage angel groups, grants, specialist early stage lending (loan pilots).
Expansion Stage (2-5 years trading) (Later Round scale-up) £250k-£5m+	As above, but may also be considering succession planning, acquisition, MBO, IPO, PE or sale of the business	Established business and generating profit. Finance needed for developing new products or exploring new markets, or more efficient debt refinancing.	Most private equity and debt/loan funding sources including P2P. Large scale scale-up funds such as Business Growth Fund and from IPO or PE.
Sustainability (5 years + trading) Up to £10m+	As above, but may require business re-engineering to address market and finance issues	Overcoming issues of over gearing for more efficient refinancing, or new innovation/process investment.	Bank debt finance, potential patient debt or equity capital e.g. PE.

Sources: Oxford Innovation and Owen et al (2019), adapted by SQW and CEEDR

Figure 3: UK External Finance Support Ladder



Sources: Oxford Innovation and Owen et al (2019), adapted by SQW and CEEDR

6.3 Ongoing research and limitations of the study

It should be re-stated that the LSBS represents the largest and most comprehensive panel of UK SME data on external finance in recent times. Other studies such as the British Business Bank Finance Survey are smaller and not panel based. We believe that our current study points the way for further, more comprehensive research in this field and in order to build on this a number of LSBS survey deficiencies need to be taken into account. Here we provide a list for further consideration:

6.3.1 The size of the original 2015 panel of 15,502 SMEs was not sufficient to capture robust data on the growth and diversity of alternative non-bank finance for SMEs in the UK. The diminished size of the pure longitudinal panel (4,165 SMEs responded to all three annual waves) has also made it difficult to provide robust data for key types of alternative (non-bank) finance, notably equity investment.

6.3.2 The survey bias (common amongst UK SME surveys) towards established ventures is problematic. The survey is highly representative of established UK SMEs more than 6 years of age. However, given that a high proportion of ventures in the UK which require external financing are very young, often under two years established, the LSBS does not provide robust data for early stage venture financing.

6.3.3 Data during the three year period (November, 2015-17) has been collected during a turbulent time of uncertainty around Brexit; either due to anticipation of a Brexit election, or subsequent to June, 2016 the uncertainty of what Brexit might look like. Such uncertainties have led to a relatively depressed period of SME borrowing and investment. The relatively small – declining - proportions of SMEs seeking external finance annually since 2010 (Owen et al, 2018) may represent a 'new norm', but also present challenges to analysts in terms of generating sufficient data on finance seekers and also to policy makers in terms of stimulating new investment.

6.3.4 The lack of data on the internal investment amounts and characteristics of the surveyed SMEs has proved problematic, since we would ideally like to know whether non finance seeking UK SMEs are investing sufficiently and more about why they do not seek external finance (particularly if they do not declare themselves as 'discouraged').

6.3.5 The LSBS does contain data on prior external financing behavior, but this is limited. It would be helpful to gain a longer period of panel understanding on the cycles of

investment taking place – particularly as it is widely understood that SME growth is typically discontinuous and non-linear – and therefore likely to occur in phases.

6.3.6 Three years remains a relatively short period for a panel survey and some of the time-lag effects of investment will not be captured in this study. This includes the development of longer horizon investment projects which may take place through a number of funding rounds and over many years (BEIS, 2017 study suggests that longer horizon R&D projects can take well over 5 years).

6.3.7 The restricted employment and sales data has meant that the productivity change calculations for this study (whilst undoubtedly useful) are broad-brush and crude. Gaining better valid data response coverage on sales turnover performance would be very helpful. Furthermore, greater detail in relation to the full-time and part-time balance in the workforce to provide full-time-equivalent (FTE) employee data would provide a more accurate metric.

6.3.8 Since the Owen et al (2017) baseline LSBS 2015 study of SME access to finance demonstrated a lack of data connectivity between different types of business support provider and nature of services offered/received and the specific outcomes of SME finance applicants, unsurprisingly the current longitudinal study suffers from the same limitations. This is particularly unfortunate as a key finding of the current study is that the SME resource base is important to accessing finance and to productivity increase and may potentially hold the key to more effective use of external financing – which results in higher level productivity. *This would appear to be the key finding which requires further study*.

6.3.9 The drop-out rate of SMEs from the original baseline in the subsequent 2 annual waves is particularly high. Not enough is known about business closures, sustainability and growth. Some of this may be corrected with effective data linking to other regular IDBR linked micro data sets which may hold important performance data (i.e. sales turnover, employment, innovation, closure or business transformation through merger or sale).

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APPENDIX

Annex 1: Multivariate Metadata Table

Variable name	Description
	Dependent variables
Upper Median	Median or above productivity change % (2015-17) =1
Upper Quartile	Upper quartile productivity change % (2015-17) = 1
Lower Quartile	Lower quartile productivity change % (2015-17) = 1
	Independent variables
Region	*Business characteristics*
North	North of England =1
South	South and East of England and London =1
Mid_West	Midlands and South West of England =1
Devolved	Devolved Nations =1
Rural_2015	Rural location 2015 =1
Dep15perc_2015	Deprived 15% location 2015 =1
Sector	
Primary Manu Const	Primary, construction and manufacturing = 1
Transport Ret Whole	Wholesale, retail, and distribution = 1
Business Services	Business, finance, IT and professional services = 1
Other Services	Personal services =1
Employment Size	
Zero_2015	zero employees in 2015 = 1
Micro_2015	micro employees (1-9) 2015 =1
Small_2015	small employees (10-49) 2015 = 1
Medium_2015	Medium employees (50-249)2015 =1
Age of establishment	
Young_2015	Young 1-5 years established (2015) =1
Age6-10_2015	Aged 6-10 (2015) =1
Age11-20_2015	Aged 11-20 (2015) =1
Age_Older	Older, aged 21+ (2015) =1
	Management
Family_2015	Family led 2015 =1
Women_2015	women led 2015 =1
MEG_2015	MEG led 2015 = 1
Manage0_2015	Zero managers 2015 =1
Manager1to2_2015	1-2 managers 2015 =1
Manager3_2015	3+ managers 2015 =1
Fincap_poor	Capability to access finance poor 2015=1
Fincap_average	Capability to access finance average 2015 = 1
Fincap_good	Capability to access finance 2015 good =1
Busadvice_20151617	received gen business advice 2015-17 =1

Finadvice_20151617	received finance access advice 2015-17 =1
Busplan_20151617	no business plan 2015-17 = 1
	Innovation
Innov_20151617	Any form of innovation 2015-17 =1
Rdcredit_20151617	R&D tax credit used 2015-17 =1
Rdinvest_20151617	R&D external investment made 2015-17 =1
	Growth
Salesup_201517	Sales turnover rise 2015-17 =1
Empup_201517	Employment increase 2015-17 = 1
	Finance Groups
somefin20151617	received finance during 2015-17 period =1
someonly20151617	some success where applied only in one year =1
some2015all	received some finance in each year 2015-17 =1
nonseekall	did not seek finance 2015-17 =1
discourageall	discouraged at some stage 2015-17 =1
disnonseek	discouraged and non seeking 2015-17 =1
hapnonseek	happy non seeking 2015-17 =1
failseek	failed seekers (no finance) 2015-17 =1
Fingroup_201517	finance received £100k+ 2015-17 =1
	Finance type
BankLoan_201517	bank loan received 2015-17 =1
BankOD_201517	overdraft received 2015-17 =1
PtoPCF_201517	P2P received 2015-17 =1
Grant_201517	grant received 2015-17 =1
Leasing_201517	Leasing received 2015-17 =1
Factoring_201517	Factoring received 2015-17 =1
Equity_201517	equity received 2015-17 =1
CMorg_201517	Commercial mortgage received 2015-17 =1

Annex 2: Verbal Protocol Analysis (VPA) Business Case

"Wall-E"

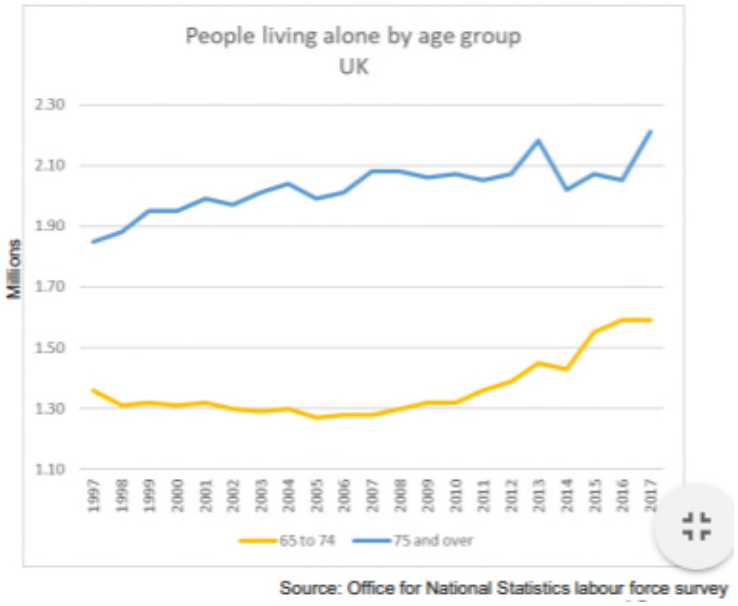
Overview:

- High growth market in independent living and loneliness alleviation
- Proven robotics/AI technology and memory stimulation software
- Mass market-accessible monthly subscription without capital outlay
- Targeting an exit by trade sale in year 2 to year 4

Robotics company X will be launching Wall-E®, an intelligent, personalised, robot companion service supporting extended independent living with companionship & memory stimulation software for older adults. Its prospective features include Realtime video calls connect the user to a dedicated 24x7 Service Centre with a voice command.

Wall-E is a subscription-based companion robot service that uses voice enabled robotic technology to offer connectivity and support to the UK's older adults.

We live in an ageing society, where the needs of the older adults of the UK are increasingly unmet by our health & care systems. Wall-E® strives to be an intelligent, personalised, robot companion service that supports extended independent living for older adults. We are looking to offer Wall-E to users at an affordable all-inclusive monthly subscription & is completely voice enabled.



Source: Office for National Statistics labour force survey

The prospective features of the Wall-E robot include an interactive companion, offering reminders, video calling to family & friends and smart home management, as well as monitoring of the user environment remotely by family and a real-time video support-function that connects the user to a dedicated 24x7 Care Centre. The friendly service agent, with their knowledge of the user's likes & dislikes, routines & needs, will answer their queries. We will integrate Wall-E with RemindMeCare, a partner software solution that promotes cognitive retention with memory stimulation. Once loaded with the user's brief life story, Wall E's AI engine will offer reminiscence with family photos and videos, nostalgic articles, music and news.

The Wall-E® solution will be piloted with 150 users from Q1 Y1, with the goal of a commercial launch in late-Y1. Our ambition is to achieve 40,000 subscribers within 3 years, representing just 1.1% of the number of over 65s who live alone.

The Business Model:

- A subscription service with repeat business
- Low subscriber churn due to deep personalisation
- Subscription revenue initially from resellers and pilot partners, B2C from Y2
- Revenue stream will be expanded with data monetisation & third party services
- Operating profit in Y2 £1.7M on a £7.4M forecasted turnover (23%)

	FY 0	FY 1	FY 2	FY 3	FY 4
Subscribers	146	3,278	16,674	42,978	95,682
Revenue	£ -	£1,101,647.00	£7,389,042.00	£21,689,719.00	£46,719,424.00
Direct Costs	£36,377.00	£292,573.00	£1,678,811.00	£4,892,356.00	£11,385,152.00
Gross Profit	£88,623.00	£1,039,073.00	£6,082,231.00	£16,997,363.00	£35,334,272.00
Gross Margin		73.44%	77.28%	77.44%	75.63%
Indirect Costs	£164,640.00	£1,281,190.00	£4,411,566.00	£10,118,557.00	£19,470,305.00
EBITDA	-£76,017.00	-£242,117.00	£1,670,665.00	£6,878,806.00	£15,863,967.00
EBITDA margin		-22%	23%	32%	34%

Funding:

- Previous investments value us at approximately £1.7M
- EIS advanced authorisation granted
- The business will be built to deliver strong investor returns in the medium term
- Institutional investment later in Y1
- Preferred model is external financing for hardware
- Pilot phase investment will come from both private funding and match funded grants

Phase 1 base funding requirement is £120k, with an opportunity to overfund

Exit Strategy:

Our intention is to exit by trade sale between years 2 and 4.

The business is already getting attention from the following segments:

- Smart Home technology providers
- Health Insurance companies
- Lifestyle Complex/care facility groups

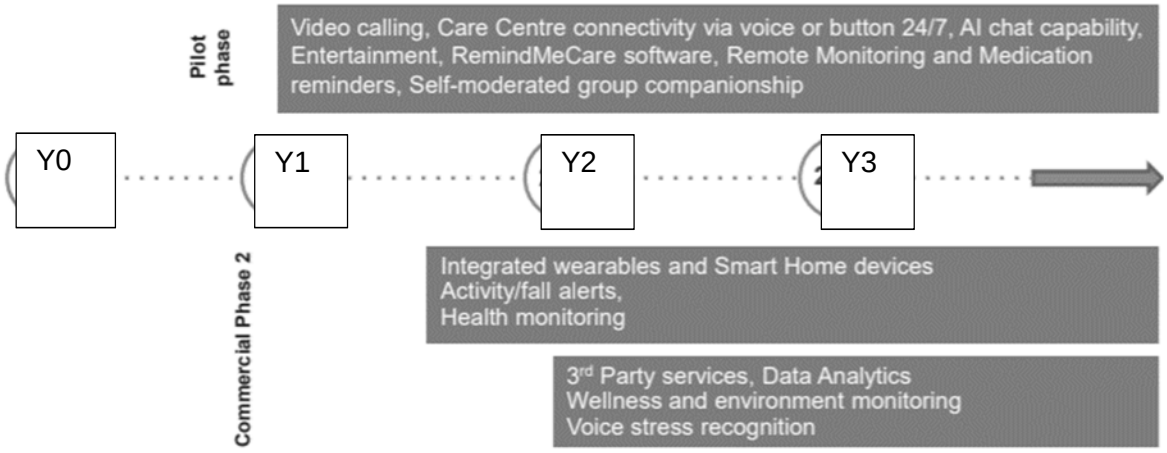
- Digital Health providers
- Care service providers
- Older adult product and service specialists

Services to be launched:

Cost/month per subscription: £49 (for full set of launch services)

Estimated Breakeven: 5,300 subscribers

Target 1 Year: 40,000 subscribers



Phase 1 B2B (Y1/Y2):

We will work with large businesses who have customers and subscribers in the following sectors:

- Utility providers
- Smart Home providers
- Care Service providers
- Social landlords and charities
- Age related charities
- Resellers in independent living technology

Phase 2 B2C (Y2 onward):

At solution maturity, we will sell directly to the consumer using the following process:

- Demand creation activities with
- Government and major public stakeholders
- Market segmentation for tight focus
- Regional rollout strategy
- Targeted advertising
- Franchising considered

The Team:

An Engineer and Sales and Marketing professional in Robotics Consulting, with Leadership experience in a FTSE250 hi-tech British company

As our COO is an experienced entrepreneur with 28 years experience launching services with the worlds biggest Telcos and infrastructure providers

As Academic Course leader at the University in Digital Media and Web Technologies, Zayd has joined the team as our software strategy consultar

An experienced software project leader at home and abroad, has joined the team as software development team leader

With 20 years of experience managing and working with partners in project environments brings business management skills to the team

The CEO set up Robotics Company X to bring the benefits of the robotics revolution to ordinary people. Having spent his career in service development and launch, it was a short step to conceive the Wall-E® “robotics-help” concept.

The COO joined Robotics Company X in the first few months of its birth when he saw what a difference it could make to the lives of ordinary people. His experience in launching services is invaluable to the business. He worked for X Technologies, where he was a consultant, advising on the introduction of new products and services.

The CEO and COO have conceived Wall-E® due to a combination of their own experiences in the transition of elderly parents into enforced independence, and their passion for the development of technology-based services. With this investment their dream is to deploy a Wall-E® pilot project that will usher in a new and disruptive commercial service, delivering real value to ordinary people.

The Wall-E project is supported by the X Robotics Laboratory, the University of X and other consultants with expertise in cyber security, telecare services and bio-sensing technologies.

We’re seeking investment of £400,000 to run a pilot scheme in early Y1, before the official launch in mid-Y1. The scheme will involve 150 Wall-Es. Wall-E® will launch later in Y1 as a subscription service with a monthly fee of just £49.
This is a ground-breaking opportunity with massive potential to help address the UK’s unmet care needs. And it’s a scheme that’s attracting interest… The impact of Wall-E® has already been recognised by a number of high profile investors and organisations.

Supporters currently include XYCare, X Robotics Laboratory, XY UK, University of X and other consultants with expertise in cyber security, telecare services and bio-sensing technologies.

Investing in Wall-E® is your opportunity to get involved in a business with massive potential to improve the lives of thousands of older and vulnerable people around the UK. Early bird investors have the chance to buy shares in Wall-E® for just £100 each while we raise the initial £400,000 we need to take the project to phase two.

Annex 3: Binary Logistic Technical Note

Since our dependent variable is a binary variable, we use binary probability models to analyse the factors influencing the performance of SMEs, adopting a logit model for mathematical simplicity (Stock and Watson, 2003). We use the median percentage change in production (representing the percentage change between 2015 and 2017 of annual sales turnover divided by total employment at the time of each survey) to measure our dependent variable – and repeat this for the upper quartile performance as a robustness check. Specifically, the dependent variable (i.e. 'upper median') is 1 if the productivity percentage change (2015-17) is equal or above the median value, and 0 otherwise. Our empirical model is described as below:

Let us assume that, P_i is the probability that an SME performs equal to or above the median value of productivity of all SMEs in our sample and (1- P_i) is the probability that an SME does not. Following Gujrati (2004), the performance of an SME can be written as:

$$P_{it} = \frac{e^{\beta_i X_{it}}}{1 + e^{\beta_i X_{it}}}$$

$$(1 - P_{it}) = \frac{1}{1 + e^{\beta_i X_{it}}}$$

Where, β_i is the vector of coefficients to be estimated, and X_i is the vector of independent variables. Combining these two equations, we get

$\left(\frac{P_{it}}{1-P_{it}}\right) = e^{\beta_i X_{it}}$, which represents the odds ratio in favour of SMEs that are performing equal or above the median value of the productivity. Taking the natural logarithms on both sides we get,

$Y_{it} = \ln\left(\frac{P_{it}}{1-P_{it}}\right) = \beta_i X_{it} \ldots\ldots\ldots\ldots (1).$

This equation represents our logit model that shows the log of odds ratio in favor of SMEs that are performing equal or above the median value of the productivity.

In particular, the Equation (1) can be written as

$Y_{it} = \beta_i F_i(BC_i, MC_i, BRC_i, IC_i, EFC_i) + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$

$t = 2015, 2016 \; and \; 2017 \; \& \; i = 1, 2, \ldots N$

Where, BC_i = Business Characteristics, MC_i = Management Characteristics, BRC_i = Business Resource Characteristics, IC_i = Innovation Characteristics, EFC_i = External Finance Characteristics.

These variables are defined in Annex 1. ε_{it} is the error terms.

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