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Skills, management practices and productivity in SMEs

ERC Research Paper 75

April 2019

www.enterpriseresearch.ac.uk

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The Enterprise Research Centre is an independent research centre which focusses on SME growth and productivity. ERC is a partnership between Warwick Business School, Aston Business School, Queen's University School of Management, Leeds University Business School and University College Cork. The Centre is funded by the Economic and Social Research Council (ESRC); Department for Business, Energy & Industrial Strategy (BEIS); Innovate UK, the British Business Bank and the Intellectual Property Office. The support of the funders is acknowledged. The views expressed in this report are those of the authors and do not necessarily represent those of the funders.

ABSTRACT

In this paper we match survey data on management skills and practices in a large group of SMEs with longitudinal data on productivity to examine the causal links between skills and management practices in 2014 and productivity performance in 2017. Our focus is on a group of firms led by a single entrepreneur or owner-manager. Three key conclusions emerge. First, we affirm the important of management practices for productivity such that an additional HR practice adds around 2% to productivity over three years. Second, we show that management skills relate strongly to management practices. Third, we show that Strategic Practices are most important for firms with fewer than 50 employees and that HR practices are more important for the performance of larger firms. Overall our research suggests a symbiotic relationship between management skills and management practices. Supporting productivity growth requires a dual approach combining training and mentoring to build managerial skills and ensure these are embedded in Management Practices.

ACKNOWLEDGEMENTS

This work has been supported by the Enterprise Research Centre (ERC), ESRC grant ES/K006614/1. We are grateful to Prof James Hayton (Warwick Business School) for providing access to the survey data on management skills and practices on which this analysis is based. The statistical data used here is from the Office of National Statistics (ONS) and is Crown copyright and reproduced with the permission of the controller of HMSO and Queens Printer for Scotland. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. The analysis upon which this paper is based uses research datasets which may not exactly reproduce National Statistics aggregates.

CONTENTS

1. INTRODUCTION

Public policy related to the performance and growth of existing small firms has focused on improving access to finance (Bolton Committee 1971), and more recently on reducing regulatory burdens (Djankov et al. 2002). However, there has also been an increasing recognition of the importance of management knowledge, skills and the adoption of best management practices (Bloom and Van Reenen 2010). These arguments have been linked to long-standing discussion of a 'long tail' of under-performing firms UK firms (Commission on Public Policy and British Business 1997) who also have a lower rate of adoption of best management practices (Bloom et al. 2012). In the recent Industrial Strategy we therefore find the assertion that 'management skills could account for a quarter of the productivity gap between the UK and US' (BEIS 2017 p. 169).

The quality of management has been related to firm size (Lucas 1978). Smaller firms may experience greater constraints on their managerial capability (Terziovski 2010) Consequently, fewer management practices are likely to be employed in small firms and also those firms that are closely held (i.e., those owned by just one or a few individuals, including family firms) (Awano et al. 2017). Existing evidence using education and experience shows the importance of managerial human capital for performance (Unger et al. 2011).

Whilst most existing research demonstrates the relationship between management practices and performance in large firms (Bloom and Van Reenen 2010; Guest and Conway 2011), we have less understanding of how specific leadership and management skills relate to management practices and which practices improve firm performance in small firms. We contribute to this body of evidence by matching data from a large-scale survey of firms' management skills and practices conducted in 2014 (Hayton 2015) with longitudinal data on business performance from the Business Structure Database (BSD) in 2017. Based on PAYE and VAT data the BSD provides information on the turnover and employment of all UK firms. This allows us to identify causal links between skills, management practices and firms' subsequent performance.

2. CONCEPTUAL CONTEXT

The understanding of managerial skills, knowledge and behaviour and its implications for business performance has been a long-standing interest (e.g. Pavett and Lau 1983, Katz 1974, Boyatzis 1982). In the identification of firm growth, Edith Penrose (1959) suggested managers have 'opportunity sets' where they identify opportunities to grow implying firm growth is constrained by managerial cognition. In smaller firms the managerial skills of founders are seen as central to performance (Dutta 2008, Chandler and Jansen 1992). However, there is a significant lack of research on leadership and management (L&M) skills in the context of SMEs and in the nature of the relationships and mechanisms through which skills improve performance. In a comprehensive discussion of the mediators of HR practices with performance, Jiang et al. (2012) suggest that the research is sparse on the relationship between the skills, involvement of organization members and performance.

2.1 Leadership and Management Skills

A skill is an ability to execute a task proficiently, although it may involve a series of specific behaviours to achieve an outcome. A complex task such as management may encompass up to fifty different skills covering managing activities and people (Armstrong 2002). In a widely accepted typology of management skills Katz (1974) highlighted three aspects of managerial skills: technical, human and conceptual. Technical skills are those required to perform those tasks related to the business, such as coding ability in an IT firm. Technical skills are useful even when managers no longer perform the technical task because they enable the manager to procure, organize and develop the people needed to accomplish the technical task. Human skills are clearly important because the management challenge is to complete activities through the efforts of other people (Armstrong 2002). Conceptual skills involve understanding the context of the wider organization, its strategy and structure. With conceptual skills, managers ensure their actions conform to organizational goals, resource availability and are appropriate within the organizational structure. Katz (1974) believed these sets of skills varied according to managerial level, yet all are required in small firms. These categories are consistent with other attempts to classify management skills (e.g. Boyatzis 1982) and have been refined into sub-dimensions (Peterson and Van Fleet 2004). Consequently, even though management skills are complex, most management skills can be grouped into: technical, human and

conceptual skills.

2.2 Leadership and Management Skills in SMEs

Much of the attention on leadership and management (L&M) skills in SMEs has been on those possessed by new firm founders. Founders of firms not only have to operate and manage a new firm from scratch but also have to recognise and develop opportunities. Founders often fall back on the model of organization derived from their previous employment (Burton 2001). In a US study, Gaylen Chandler and colleagues assessed three sets of founders' skills. The first two, technical-functional and managerial skills, derived from Katz but due to new firm founders' need to develop opportunities they added a third labelled 'Entrepreneurial Skills' (Chandler and Jansen 1992, Chandler and Hanks 1994). Whilst this was cross-sectional data, Chandler and Jansen (1992) found Managerial and Technical Skills to be closely associated with profitability while Entrepreneurial Skills were closely associated with growth, which is what we might expect if we take a Penrosian view of growth.

Evidence also links managerial skills indirectly to firm performance through their impact on goal setting, and the communication of vision – both of which might be considered management practices. In a series of studies, Joel Baum, Edwin Locke and colleagues investigated how CEO competencies influence venture growth finding a series of direct and indirect impacts (see Baum, Locke and Kirkpatrick 1998, Baum, Locke and Smith 2001, Baum and Locke 2004). Directly related to growth were technical and industry specific competencies and the communication of vision. General CEO competencies were related indirectly through goal setting, although performance goals can be overly ambitious (Baron, Mueller and Wolfe 2016). Growth was found to be both directly and indirectly linked to 'new resource skills' that operationalised the capacity to acquire and systemize operating resources. The related indirect link was through motivating employees and communicating vision. Taken together these studies show the need to understand the indirect links between management skills and performance and the potential for management practices to play a mediating role between skills and performance.

These studies also suggest the need to augment Katz's (1974) typology. Since there were effects from 'new resource skill', the communication of vision and the need to spot new opportunities, this suggests a role for Entrepreneurial Skills. Entrepreneurial skills include identifying and developing opportunities, communicating entrepreneurial vision, and acquiring and orchestrating the necessary resources for growth.

Consequently, Hayton (2015) extended Katz's (1974) typology to four sets of skills: Technical skills; Human/interpersonal skills; Conceptual/organisational skills; and, Entrepreneurial skills, see table 1.

Table 1: Scale Items for skills and practices

Scale Items	Cronbach's alpha
Entrepreneurial skills	.734
Relative to others, I accurately perceive gaps in the marketplace	
One of my greatest strengths is identifying the goods or services people want	
I am skilled at taking advantage of high quality business opportunities	
I am skilled at identifying those products or services that provide real benefit to customers	
Leadership Skills	.808
Relative to others, one of my greatest strengths is achieving results by organising and motivating people	
I am highly skilled at delegating work to others effectively	
One of my greatest strengths is my ability to supervise, lead and influence people in my organisation	
Organisational Skills	.758
Relative to others, I am skilled at making decisions about how to allocate limited resources most effectively	
One of my greatest strengths is organising resources and coordinating tasks	
Relative to others, I am skilled at keeping my organisation running smoothly	
Technical skills	.744
One of my greatest strengths is my expertise in a technical or functional area	
Relative to others, I am skilled at developing goods or services that are technically superior	
HRM Practices	.670
What percentage of employees received formal training in company-specific skills (i.e. task or firm specific training)?	
What percentage of employees received formal training in generic skills (e.g. problem solving, communication skills)	
What percentage of employees received a regular (e.g. annual) formal performance appraisal?	
Ignoring entry-level jobs, what percentage of employees has been promoted from within?	
What percentage of employees had structured interviews, using standardised questions and scoring of answers	
What percentage of employees were given one or more employment tests prior to hiring (e.g. skills or aptitude tests)	
What percentage of your workforce shared in the financial ownership of the firm (e.g. stock, options, profit sharing or other means)?	
What percentage of non-managerial employees received variable pay: by which I mean some of their pay is contingent upon individual, team or firm performance)?	
Centralised strategy	.561
Strategy for this company is primarily set up by myself as the Managing Director/Chief Executive	

I primarily define our firm's 'vision' - its basic purpose and general direction	
I primarily determine and execute the strategy based upon my analysis of the business situation	
Formal strategy	.782
Our company adopts a written strategic plan each year to guide our operating activities	
Strategic planning in our firm is a formal procedure occurring in a regular cycle	
We have a written mission statement that is communicated to employees	
Responsive strategy	.781
Strategy is the result of an on-going dialogue between managers, staff and executives	
Business planning in our company is on-going, involving everyone in the process to some degree	
Most people in this company have input into decisions that affect them	

Source: SME Leadership and Management survey 2014

2.3 Leadership and Management Skills and the Link with Performance

Good leaders and managers are expected to create efficient businesses, which grow. However, since leadership and management is unevenly distributed this results in a positively skewed firm size distribution (e.g. Lucas 1978). A meta-analysis showed a modest but significant correlation (r=.098) between human capital and entrepreneurial success (Unger et al. 2011) although when human capital measures captured knowledge and skills rather than general years of education this boosted the strength of the correlation (r=.204) to a more encouraging level (Unger et al. 2011). Consistent correlations of small magnitudes lead the research community to posit that there are important mediators and moderators of a relationship. Moreover, consistent with Lucas (1978), Unger et al. (2011) found skills to predict firm size better than performance.

Several arguments suggest that the relationship between L&M skills and performance is mediated through practices. Studies have suggested an indirect link between L&M skills and performance as we have alluded to already (see Baum et al. 1998, Baum et al. 2001, Baum and Locke 2004). The development of goal-setting and the capacity to acquire and deploy resources may be classified under the broad umbrella of practices. The relationship between skills and practices is often assumed to be given, i.e. when people train and gain competencies, we expect that they use that competence in practice. For example, studies of Finnish pupils use of ICT showed that competence led to increased practice (Hakkarainen et al. 2000); yet the connection may not always be realised. The literature on leadership training and performance in small firms has found only a weak link (Westhead and Storey 1996, Storey 2004). The problem was

well-known, that training in a practice on a training course would fail to be executed back in the workplace. Un-utilised or under-utilised skills will yield no performance benefits. Hence skills alone cannot drive productivity, only when skills drive practical actions, strategy or practices, they can drive performance.

To summarize whilst the existing literature suggests a positive association between L&M skills and performance, i.e. that management skills matter, empirical investigations suggest an indirect association, through the development of more effective management practices. This suggests:

> *Hypothesis 1: Higher managerial skill levels will be associated with the adoption of more structured managerial practices.*

2.4 Management Practices in SMEs

Within the resource-based view, researchers identified organizational processes and management decisions that develop substantive growth capabilities (Teece, Pisano and Shuen 1997, Koryak et al. 2015). These capabilities may evolve through experimentation and improvisation (Nelson and Winter 1982) and the more effective are repeated becoming routinized, where a core definition of routine is 'repetitive, recognizable patterns of interdependent actions, carried out by multiple actors' (Feldman and Pentland 2003, p.95). This approach creates firm heterogeneity as the individual firm evolves an idiosyncratic set of routines (Hoopes and Madsen 2008). Nevertheless common and best practices are evident making practices substitutable from firm to firm (Eisenhardt and Martin 2000). For example, in the case of firms driving organic growth through market penetration focusing on continuous improvement can boost effectiveness (Koryak et al. 2018).

The issue for measuring these practices is to identify those standardized management practices that have general applicability and value. Two sets of practices have been seen as candidates because they apply across industry sectors: HRM practices and strategic management practices [1]. Substantial evidence attests to the positive relationship between HRM practices and firm performance (Huselid 1995, Ichniowski, Shaw and Prennushi 1997, Combs et al. 2006). Following on from the early studies

[1] Other practices may also be important of course such as financial management or marketing that may impact performance and some of the practices may be more challenging in small firms with their more informal, personalized management style (Storey et al. 2010).

which stressed the requirement of a bundle of HRM practices rather than an isolated key 'silver bullet' this work has established the important of a set of High Performance Work Practices, high performance work systems or high commitment HRM (Jackson, Schuler and Jiang 2014). Although these practices may actually increase labour costs (Sels et al. 2006) they boost productivity and performance through influences on employee motivation and commitment. These practices also have benefits for entrepreneurial behaviour and innovation in organisations (Patel and Cardon 2010, Patel, Messersmith and Lepak 2013). Furthermore, there is evidence that the performance benefits of HRM practices also apply to SMEs where adopting HRM practices may be facilitated by the level of skills of employees and business characteristics (Way 2002, Wu, Bacon and Hoque 2014, Bacon and Hoque 2005).

Strategic management capabilities drive performance but vary across firms (Hart and Banbury 1994). Strategy enables CEOs to choose from a number of styles from directing, inspiring, controlling, empowering and/or endorsing (Hart and Banbury 1994). When firms develop capabilities in strategic management, including SMEs, we expect higher performance, moreover combinations of strategic management practices might encourage greater output (Hart and Banbury 1994). We consider three forms of strategic management practice: centralization, formalisation, and responsiveness to external and internal information. First, centralization refers to the CEO monopolizing strategic decisions, which has been a feature of some arguments for the role of the entrepreneur (Casson 1982), while other research links centralization with directive behaviour of the firm (Baron, Hannan and Burton 1999). Within the strategic management literature, Shepherd and Rudd (2014) place centralization as an element concerned with firm characteristics. Secondly, the formalization of strategic management suggests a more rational approach to strategic decision making (Shepherd and Rudd 2014), often resulting in a top team of individuals involved in making strategic decisions (Ashmos, Duchon and McDaniel 1998). Consequently, the formal, rational approach may spread the strategic function of the business beyond the CEO to her advisers (McDonald, Khanna and Westphal 2008). Moreover, firms with formal, rational strategic management procedures may be more likely to adopt formal processes more generally (Miller 1987). Thirdly, responsiveness was labeled by Hart and Banbury (1994) as a transactive strategic management process. This spreads strategic management wider still throughout the organization with wider feedback on

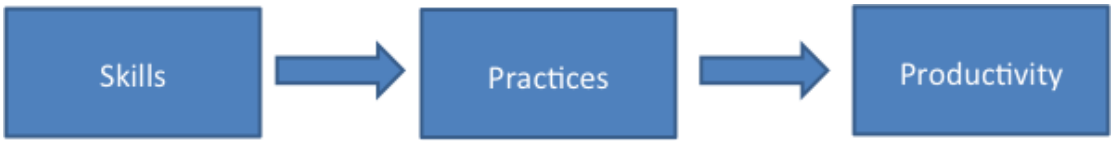
the existing plans of the business[2], see table 1.

Strategic management is associated with performance (Teece 2007). These three strategic management practices, along with HRM, are mechanisms through which the conceptual and entrepreneurial skills of a firms' leader can be exercised. They generalize across sectors and reflect the potential for competitive advantage requiring purposeful design, reflecting the skills of the managers, and their attention to the task (Hart and Banbury 1994). This leads to our second hypothesis:

> *Hypothesis 2: Adoption of more structured managerial practices will lead to higher productivity.*

The conceptual model in Figure 1 suggests that the impact of skills on productivity is fully mediated by HR and strategic practices.

Figure 1: Conceptual model – skills, practices and productivity



3. DATA AND METHODS

3.1 Measurement Issues

Measuring management and leadership skills is challenging for several reasons. First, survey data may include self-evaluations which may lead to self-enhancement bias although studies have shown that relatively minor adjustments such as developing questions that are 'relative' to others ameliorates bias (Mabe and West 1982). The surprising conclusion is that self-reports are often as reliable as any other source (see Shrauger and Osberg 1981). Self-assessments are more valid when they are independent of any rewards, when anonymity is guaranteed, and when performance is easily observed (Shore, Shore and Thornton 1992). Ratings are more valid with relative scales using a structured existing assessment instrument, when the skills are

[2] In this sense the three measures represent a widening of those involved in the firm's strategic management from one in centralization to a cabal in formalization to a wider group in responsiveness. Within the strategic literature all these three aspects reflect the strategic processes and can be classified as the influence of firm characteristics on strategy (Shepherd and Rudd 2014).

complex and difficult to observe and when the purpose is to understand differences across skill dimensions (Chandler and Jansen 1992). Moreover, individuals may have the most knowledge of their own complex skills (Levine 1980). The current study measured self-reported skills of the individual CEO/Managing Director on leadership, entrepreneurial skills, organizational skills and technical skills (see Hayton 2015).

3.2 Data sources

Independent English SMEs with between 5 and 250 employees sampled from the UK Government's Inter-Departmental Business Register (IDBR) were surveyed in 2014 (Hayton, 2015). Excluded from the sample were multi-site workplaces with greater than 250 employees, and subsidiary businesses. Given that the distribution of businesses is heavily skewed towards the smallest firms, purely random sampling yields too few medium-sized firms. Therefore, the sample was stratified by employee numbers and industry sector to oversample enterprises with greater than 50 employees. Five firm size bands were sampled with roughly equal numbers: 5-9 employees, 10-19 employees, 20-49, 50-99 and 100-249. Manufacturing was also oversampled. Here, we focus our analysis on those firms in which the survey respondent was the solo lead manager, solo founder or solo owner-manager of the enterprise. We use a dependent variable derived from matching survey data on skills and practices with longitudinal data on performance which should minimise any risk of common method variance.

3.3 Variables and Measures

Dependent variable

We measured the productivity of businesses in 2014 and 2017 using data from the Business Structure Database. We match this with the leadership and management survey data using common reference numbers included in both databases [3]. Productivity was measured as turnover per employee. Whilst this has the disadvantage of not accounting for differences in capital per worker, we might expect better practices to increase the productivity of businesses. Moreover, we use the 2017 measure as the dependent variable conditional on the 2014 measure so any firm differences in capital per worker should be accounted for in the conditional 2014 measure.

[3] The original Management Practices questionnaire sought explicit permission from respondents to allow matching of their survey responses with data from other administrative data sources.

Independent variables

Our data and measures of skills and management practices draw on those used in Hayton (2015), which also reports related confirmatory factor analysis for each scale used.

Leadership and Management Skills

These items addressed the four dimensions identified earlier - Entrepreneurial skills, Leadership, Organizational Skills and Technical Skills - adapted from Chandler and Jansen (1992). For single managers the referent is their own skills. An exploratory factor analysis of all the leadership and management skills established a four-factor solution with 'Entrepreneurial Skills,' 'Leadership Skills,' 'Organisational Skills,' and 'Technical Skills' best representing the data. The individual items were averaged to estimate a score on each dimension for each respondent reflecting their skill levels.

Adapted from Chandler and Jansen (1992), we measure Entrepreneurial Skills using a four-item scale with a Cronbach alpha of α=.734 including questions such as **"**Relative to others, I accurately perceive gaps in the marketplace" and "One of my greatest strengths is identifying the goods or services people want". Also adapted from Chandler and Jansen (1992), we measure Leadership Skills using a three item scale with a Cronbach alpha of α=.808 including questions such as "One of my greatest strengths is the ability to supervise, lead and influence people in my organisation" and "Relative to others, one of my greatest strengths is achieving results by organising and motivating people". Organisational Skills are measured using a three-item scale with a Cronbach alpha of α=.758. Example questions included "One of my greatest strengths is organising resources and coordinating tasks" and "Relative to others I am skilled at keeping my organisation running smoothly". Finally, Technical Skills was measured using a two-item scale with a Cronbach alpha of α=.744. The questions were "One of my greatest strengths is my expertise in a technical or functional area" and "Relative to others I am skilled at developing goods or services that are technically superior", for all the questions see table 1.

Our measure of HRM practices was adapted from Messersmith and Guthrie (2010) who developed a cogent formative index scale from previous work to encompass those HRM elements that relate to firm performance (Combs et al. 2006) including staffing, training, compensation, performance management, information sharing and participation in decision making. As individual items are assessed as percentages of

employees in receipt of a particular HR practice, z-scores were calculated for each item and the scale was the average of item scores (see Jiang et al. 2012). The overall scale Cronbach alpha α=.670 was on the low side; yet as a formative indicator this is to be expected (Bollen and Diamantopoulos 2017).

We derived three sub-scales within Strategic Management Practices to capture the dimensions of strategy formation identified in prior research (Hart and Banbury 1994). A principal components analysis of these items identified a three-factor solution. Three variables were constructed based upon the mean of the scale scores, labelled 'Centralised', 'Formalised', and 'Responsive' to represent distinctive qualities of the firm's strategy formulation and are treated as reflective indicators (Bollen and Diamantopoulos 2017). Strategy Centralisation was a three- item scale with a Cronbach alpha of α=.561 with questions included "I primarily define our firm's 'vision' - its basic purpose and general direction" and "I primarily determine and execute the strategy based upon my analysis of the business situation". The Cronbach alpha was quite low for this reflective indicator suggesting perhaps that there were subtle differences in the questions that undermined the unidimensional nature of the construct. Strategy Formalisation was measured using a three-item scale with a Cronbach alpha of α=.782. Items included "Our company adopts a written strategic plan each year to guide our operating activities" and "We have a written mission statement that is communicated to employees". The Cronbach alpha was reasonably high for this reflective indicator suggesting the unidimensional nature of the construct. Finally, Strategy Responsiveness was measured using a three-item scale with a Cronbach alpha of α=.781 with questions including "Strategy is the result of an on-going dialogue between managers, staff and executives" and "Business planning in our company is on-going, involving everyone in the process to some degree". The Cronbach alpha was reasonably high for this reflective indicator suggesting the unidimensional nature of the construct, see table 1.

Control measures

We controlled for the presence of the founder in the business because founders exert a dominant presence in the business (Fauchart and Gruber 2011). We control for whether the business manager was educated to degree level as previous work has suggested a correlation between education and business practices (McKenzie and Woodruff 2017). In a similar vein we control for the experience of the manager in industry years and the number of years of international experience. Better managers

might have another business as a portfolio entrepreneur (Westhead, Ucbasaran and Wright 2005), although this may divert the focus of management attention (Ocasio 1997). We further control for whether the business is anticipating growth since this may reflect a higher performance in the business (Lucas 1978). We controlled for being a member of a minority ethnic group because this may influence the position of the firm within the industry (Aldrich and Waldinger 1990). The age of the business was measured because young businesses can improve their productivity as they mature (Huergo and Jaumandreu 2004). Family ownership has been associated with not adopting management practices and therefore is included. To be classed as a family firm depended on two positive answers from three standard questions (see Westhead and Cowling 1998). First, does the respondent consider their firm a family firm, with majority family ownership? Second, is more than one family member involved in day-to-day management? Third, is the future Chief Executive Officer a member of the owning family? Finally, given the longstanding recognition of increasing formality of business practices in larger firms (Kotey and Slade 2005) we included the measure of firm size as the log of employment in the firm from the BSD database. Table 2 shows the descriptive data for the variables in the estimation sample. Correlations are included in Table 3.

Firms in the estimation sample were selected where there was a single lead entrepreneur or owner-manager. Questions around skills and practices were asked through Likert scales, which showed high levels of strategy centralization and HR practices; and comparatively low levels of Strategy Formalization and Technical Skills. 42% of respondents were founders with just 5% ethnic minority businesses. Family businesses accounted for 68% of the sampled businesses (Table 2).

Table 2: Sample Descriptives for the estimation sample

Variable	Mean	Std.
Productivity 2017 (log)	4.04	0.84
Productivity 2014 (log)	3.97	0.89
Strategy Centralisation	5.00	1.21
Strategy Formalisation	1.51	1.19
Strategy Responsiveness	3.26	1.58
HR Practices	4.28	2.29
Entrepreneurial skills	3.11	1.07
Leadership skills	2.20	1.03
Organisational skills	2.52	0.82
Technical skills	1.44	0.77
Founder (0/1)	0.42	0.49
Degree level qual. (0/1)	0.49	0.50
Industry exp. (years)	22.31	12.08
Internat. exp. (0/1)	0.24	0.43
Another business? (0/1)	1.57	1.71
Anticipating growth (0/1)	0.67	0.47
Ethnic minority group (0/1)	0.05	0.23
Age of business (years)	2.86	0.60
Family business (0/1)	0.68	0.47
Employment (log)	3.30	0.97

Source: SME Leadership and Management survey 2014, Business Structures Database.

3.4 Empirical Approach

We estimate two sets of equations. First, we estimate the impact of the four skills separately on the four Practices. Given that the correlation matrix shows that there are few high correlations and the factor analysis had suggested separate dimensions for each set of skills (see Table 3). Consequently, this enables us to estimate whether higher levels of leadership and management skills lead to more practices through OLS. Secondly, we estimate the impact of the strategic and HR practices on the measure of 2017 labour productivity conditional on the estimate for labour productivity in 2014.

Table 3: Correlation matrix (N=1682)

Productivity 2017 (log)	1.00																			
Productivity 2014 (log)	0.80	1.00																		
Strategy Centralisation	-0.03	-0.05	1.00																	
Strategy Formalisation	0.01	-0.04	0.33	1.00																
Strategy Responsiveness	-0.01	-0.04	0.40	0.45	1.00															
HR Practices	0.03	0.01	0.19	0.37	0.34	1.00														
Entrepreneurial skills	0.06	0.03	0.32	0.27	0.32	0.22	1.00													
Leadership skills	-0.05	-0.07	0.28	0.24	0.28	0.16	0.33	1.00												
Organisational skills	0.01	-0.02	0.27	0.18	0.25	0.11	0.34	0.49	1.00											
Technical skills	0.13	0.10	0.18	0.21	0.21	0.13	0.31	0.22	0.23	1.00										
Founder (0/1)	-0.06	-0.09	0.05	0.02	0.05	0.03	0.02	0.04	0.03	0.08	1.00									
Degree level qual. (0/1)	0.04	0.01	-0.03	-0.03	-0.01	0.09	0.03	-0.08	-0.05	0.01	-0.11	1.00								
Industry exp. (years)	0.06	0.07	-0.02	0.00	0.01	-0.08	-0.05	0.04	0.05	0.08	0.29	-0.17	1.00							
Internat. exp. (0/1)	0.01	-0.01	0.04	0.07	0.04	0.05	0.01	0.01	0.01	-0.02	0.05	0.11	-0.01	1.00						
Another business? (0/1)	-0.02	0.01	0.01	0.04	0.04	0.03	0.01	-0.03	0.01	0.01	0.25	-0.06	0.14	0.06	1.00					
Anticipating growth (0/1)	-0.03	-0.06	0.10	0.03	0.08	0.07	0.10	0.05	0.04	-0.03	0.02	0.04	-0.09	0.10	0.04	1.00				
Minority ethnic group (0/1)	-0.07	-0.08	0.01	0.03	0.03	-0.01	0.01	0.03	-0.03	-0.03	0.02	0.08	-0.13	0.02	0.03	-0.01	1.00			
Age of business (years)	0.12	0.16	-0.09	-0.09	-0.07	-0.14	-0.10	-0.06	0.01	-0.02	-0.27	0.01	0.28	-0.05	-0.09	-0.11	-0.14	1.00		
Family business (0/1)	-0.04	-0.01	-0.01	-0.06	-0.03	-0.13	-0.02	-0.03	0.02	-0.06	-0.11	-0.04	0.00	0.01	-0.03	-0.03	0.01	0.21	1.00	
Employment (log)	-0.08	-0.16	0.01	0.10	-0.04	0.01	0.02	-0.04	0.00	-0.09	-0.20	0.07	-0.06	0.04	-0.07	0.04	0.04	0.14	0.01	1.00

To use OLS in this instance requires us to establish that our explanatory variables are exogenous. The problem of endogeneity arises in the main in three ways: omitted variables, measurement error and simultaneity (Wooldridge 2002). Omitted variables bias would arise if there were some unobserved variable for which we would like to control, such as when wage equations omit ability where years of schooling are correlated with ability (Wooldridge 2002). In these equations we are trying to estimate ability, and it is not obvious that there is a key unobservable measure that we would require. Moreover, measuring 2017 labour productivity conditional on that of 2014 is helpful in this respect. Measurement error is dealt with by the use of the scales, which in psychometric theory are intended to reduce measurement error and therefore our use of validated scales should attenuate measurement error. The use of the matched dependent variable from the BSD for 2017 when the survey data was collected in 2014 also rules out any simultaneity.

4. RESULTS

The results are a series of estimation tables modelling the effect of skills on the adoption of management practices and management practices on the productivity of businesses. Tables 4 and 5 report the effect of Skills on Management Practices. Table 6 reports the impact of management practices measured in 2014 on productivity in 2017 for all SMEs in the sample. Subsequent tables repeat the analysis for small firms with less than 50 employees and medium-sized firms with 50-249 employees.

4.1 SME analysis

Table 4 shows the relationship between Skills and Practices. The first column labels the variables including independent, Skills and control variables that relate to the various Management Practices. The second column examines Strategy Centralization showing significant correlations with all of the Skills: Entrepreneurial, Organizational, Leadership and Technical. The third column examines Strategy Formalization with significant correlations with three Skills: Entrepreneurial, Technical and Leadership. The fourth column examines Strategy Responsiveness which proves strongly linked to all of the Skills: Entrepreneurial, Leadership, Technical and Organizational. The fifth column examines HR Practices with two of the Skills variables proving significant (Entrepreneurial and Leadership). Overall, each set of Skills strongly impacts on Practices with a greater variety of skills leading to more practices.

Table 4: From skills to practices: all firms

	Strategy Centralisation	Strategy Formalisation	Strategy Responsiveness	HR Practices
Entrepreneurial skills	0.211***	0.187***	0.319***	0.317***
	(0.034)	(0.029)	(0.038)	(0.058)
Leadership skills	0.161***	0.178***	0.217***	0.216***
	(0.035)	(0.032)	(0.044)	(0.065)
Organisational skills	0.189***	0.024	0.193***	-0.038
	(0.048)	(0.040)	(0.057)	(0.076)
Technical skills	0.094**	0.181***	0.198***	0.114
	(0.042)	(0.040)	(0.052)	(0.078)
Founder (0/1)	0.071	-0.039	0.102	0.043
	(0.064)	(0.065)	(0.086)	(0.130)
Degree level qual. (0/1)	-0.076	-0.094	-0.002	0.278**
	(0.056)	(0.058)	(0.073)	(0.115)
Industry experience (years)	-0.001	0.001	0	-0.007
	(0.003)	(0.003)	(0.004)	(0.005)
International experience (0/1)	0.07	0.130*	0.104	0.172
	(0.063)	(0.067)	(0.084)	(0.133)
Another business? (0/1)	0.001	0.032*	0.03	0.052
	(0.015)	(0.017)	(0.022)	(0.034)
Anticipating growth (0/1)	0.119*	-0.022	0.166**	0.227*
	(0.066)	(0.060)	(0.079)	(0.118)
Minority ethnic group (0/1)	0.01	0.135	0.068	-0.465*
	(0.124)	(0.120)	(0.155)	(0.241)
Age of the business (years)	-0.004	-0.004	-0.001	-0.012*
	(0.003)	(0.003)	(0.004)	(0.006)
Family business (0/1)	-0.015	-0.109*	-0.096	-0.381***
	(0.061)	(0.061)	(0.080)	(0.124)
Employment	0.001	0.003***	0	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
N	1,883	1,880	1,888	1,901
F(24,	10.64	14.88	16.46	9.64
Prob	0	0	0	0
R-squared	0.1633	0.1568	0.1837	0.1152
bic	5868.862	5854.86	6881.769	8521.428

Source: SME Leadership and Management survey 2014, Business Structures Database. Significance levels * denotes p<.1. ** p<.05, *** p<.001

Table 5 shows the relationship between Skills and Practices allowing for complementarities between Practices. Again, the first column shows the variables, both for independent Skills variables and control variables that relate to the various management practices but also add each of the Management Practices. The second column examines Strategy Centralization showing significant correlations with Entrepreneurial, Organizational, and Leadership Skills and complementarities with Strategy Formalization and Strategy Responsiveness Practices. The third column examines Strategy Formalization which (as in Table 4) has significant correlations with Entrepreneurial, Technical and Leadership skills and complementarities with Strategy Centralization, Strategy Responsiveness and HR practices. The fourth column examines Strategy Responsiveness which has significant correlations with a; four skills variables as well as Strategy Centralization, Strategy Formalization and HR practices. The fifth column examines HR Practices, which has significant correlations with Entrepreneurial Skills, and complementarities with Strategy Formalization and Strategy Responsiveness Practices. These results emphasise the strong complementarities between the different practices allowing for the impact of Skills. Consequently, for example, the impact of Entrepreneurial Skills can be seen in Strategy Centralization and this effect will be amplified because it will then indirectly impact Strategy Formalization and Strategy Responsiveness.

Table 6 turns to the impact of practices on productivity in 2017 conditional on productivity in 2014. This is a hierarchical OLS model showing the values of the different Practices as they are added. Column 1 presents the variables in the models with the first variable being lagged productivity in 2014 followed by a number of other controls. Below that are the Practices. In column (1) we estimate the base model with all the controls. The influence of productivity in 2014 on productivity in 2017 is clearly strong. Other positive influences are from the CEO possessing a degree level qualification and two negative values from the firm identifying themselves as a family business and an older business. Column (2) adds in Strategy Centralisation which has a very small and insignificant effect. Column (3) adds Strategy Formalisation which has a positive effect but is only weakly significant. Column (4) adds Strategy Responsiveness which has a positive and significant effect. Column (5) adds HR Practices which also has a positive and significant effect. HR Practices have the most consistent productivity impacts (Column 6); impacts from Strategy Formalisation and Responsiveness prove less robust.

Table 5: From skills to practices: all firms, with complementarities

	Strategy Centralisation.	Strategy Formalisation	Strategy Responsiveness	HR Practices
Entrepreneurial skills	0.125***	0.053**	0.156***	0.155***
	(0.033)	(0.027)	(0.036)	(0.055)
Leadership skills	0.094***	0.088***	0.086**	0.075
	(0.034)	(0.029)	(0.039)	(0.060)
Organisational skills	0.148***	-0.032	0.139***	-0.113
	(0.046)	(0.035)	(0.051)	(0.071)
Technical skills	0.031	0.115***	0.092**	-0.044
	(0.040)	(0.036)	(0.046)	(0.074)
Strategy Centralisation		0.127***	0.280***	0.002
		(0.023)	(0.033)	(0.050)
Strategy Formalisation	0.144***		0.351***	0.526***
	(0.027)		(0.033)	(0.050)
Strategy Responsiveness	0.187***	0.206***		0.255***
	(0.022)	(0.019)		(0.041)
HR Practices	0.001	0.123***	0.102***	
	(0.013)	(0.012)	(0.016)	
Founder (0/1)	0.064	-0.071	0.086	0.035
	(0.061)	(0.058)	(0.077)	(0.122)
Degree level qual. (0/1)	-0.06	-0.123**	0.027	0.335***
	(0.054)	(0.052)	(0.066)	(0.108)
Industry experience (years)	-0.001	0.002	0.001	-0.007
	(0.003)	(0.002)	(0.003)	(0.005)
International experience (0/1)	0.031	0.084	0.026	0.055
	(0.060)	(0.060)	(0.077)	(0.127)
Another business? (0/1)	-0.008	0.019	0.012	0.033
	(0.014)	(0.016)	(0.020)	(0.032)
Anticipating growth (0/1)	0.086	-0.091*	0.119*	0.148
	(0.062)	(0.054)	(0.071)	(0.111)
Minority ethnic group (0/1)	-0.019	0.172	0.055	-0.519**
	(0.117)	(0.107)	(0.140)	(0.223)
Age of the business (years)	-0.003	-0.002	0.003	-0.011*
	(0.003)	(0.003)	(0.004)	(0.006)
Family business (0/1)	0.015	-0.032	-0.021	-0.306***
	(0.060)	(0.055)	(0.072)	(0.115)
Employment	0	0.002***	-0.001*	0
	(0.001)	(0.001)	(0.001)	(0.001)
n	1,861	1,861	1,861	1,861
F(27,	17.36	42.59	38.57	20.18
Prob	0	0	0	0
R-squared	0.2495	0.3327	0.349	0.2345
bic	5630.125	5388.616	6379.346	8086.204

Source: SME Leadership and Management survey 2014, Business Structures Database. Significance levels * denotes p<.1. ** p<.05, *** p<.001

Table 6: From strategy to productivity: all firms

	(1)	(2)	(3)	(4)	(5)	(6)
Productivity lag (log)	0.738***	0.735***	0.736***	0.736***	0.733***	0.729***
	'(0.055)	'(0.056)	'(0.056)	'(0.056)	'(0.056)	'(0.057)
Founder (0/1)	0.01	0.012	0.013	0.01	0.01	0.012
	'(0.031)	'(0.031)	'(0.031)	'(0.031)	'(0.030)	'(0.031)
Degree level qual. (0/1)	0.061**	0.065**	0.062**	0.061**	0.055**	0.059**
	'(0.028)	'(0.029)	'(0.029)	'(0.028)	'(0.028)	'(0.029)
Industry experience (years)	0.001	0.002	0.001	0.001	0.002	0.002
	'(0.001)	'(0.001)	'(0.001)	'(0.001)	'(0.001)	'(0.001)
International experience (0/1)	0.026	0.03	0.022	0.025	0.024	0.027
	'(0.029)	'(0.030)	'(0.030)	'(0.029)	'(0.029)	'(0.030)
Another business? (0/1)	-0.011	-0.012	-0.012	-0.012	-0.012	-0.013
	'(0.008)	'(0.008)	'(0.009)	'(0.009)	'(0.008)	'(0.009)
Anticipating growth (0/1)	0.024	0.022	0.024	0.02	0.018	0.018
	'(0.021)	'(0.022)	'(0.021)	'(0.021)	'(0.021)	'(0.021)
Minority Ethnic Group (0/1)	0.004	0.002	0.001	0.001	0.009	0.004
	'(0.083)	'(0.083)	'(0.084)	'(0.083)	'(0.082)	'(0.084)
Age of business (years)	-0.061*	-0.059*	-0.056*	-0.059*	-0.054*	-0.052
	'(0.032)	'(0.033)	'(0.032)	'(0.032)	'(0.031)	'(0.033)
Family business (0/1)	-0.067**	-0.069**	-0.065**	-0.067**	-0.062**	-0.065**
	'(0.030)	'(0.031)	'(0.030)	'(0.030)	'(0.030)	'(0.031)
Employment (log)	0.028	0.026	0.027	0.028	0.024	0.025
	'(0.018)	'(0.019)	'(0.020)	'(0.019)	'(0.019)	'(0.020)
Strategy Centralisation		0.01				-0.001
		'(0.008)				'(0.009)
Strategy Formalisation			0.022*			0.005
			'(0.012)			'(0.015)
Strategy Responsiveness				0.017**		0.006
				'(0.007)		'(0.010)
HR Practices					0.020***	0.018***
					'(0.005)	'(0.006)
N	1,801	1,769	1,774	1,780	1,801	1,744
F'(24,	93.74	86.99	87.16	87.59	93.26	79.18
Prob	0	0	0	0	0	0
R-squared	0.6854	0.6819	0.683	0.6825	0.6878	0.6818
bic	2713.219	2693.281	2694.432	2695.876	2706.911	2676.579

4.2 Sub-sample estimates – small and medium-sized firms

Small firms are defined as those with fewer than 50 employees while medium-sized firms have 50-249 employees. Tables 7 and 8 explore the relationship between Skills and Practices for each group of firms. Relationships between Skills and Practices in small firms (Table 7) prove very similar to those for all firms (Table 4) with Entrepreneurial Skills, Leadership Skills and Technical Skills strongly related to each of the Management Practices. In medium-sized firms (with more than 50 employees) the links from Skills to Practices are again strong and consistently positive (Table 8). Note, however, in these larger firms we find a strong negative relationship between family businesses and the adoption of HR practices. This is consistent with more general evidence that family businesses are less likely to be employing large numbers of management practices (ONS, 2018).

Turning to the link between management practices and productivity in smaller firms, we find the strongest productivity effects are evident from Strategy Formalization (Table 9). In medium-sized firms HR practice effects on productivity are most pronounced (Table 10).

Table 7: From skills to practices, small firms (<50 employees)

	Strategy Centralisation.	Strategy Formalisation	Strategy Responsiveness	HR Practices
Entrepreneurial skills	0.208***	0.231***	0.385***	0.338***
	(0.041)	(0.033)	(0.046)	(0.066)
Leadership skills	0.197***	0.119***	0.161***	0.219***
	(0.044)	(0.039)	(0.053)	(0.075)
Organisational skills	0.138**	0.025	0.155**	-0.064
	(0.059)	(0.046)	(0.067)	(0.091)
Technical skills	0.124**	0.217***	0.211***	0.220**
	(0.058)	(0.050)	(0.066)	(0.093)
Founder (0/1)	0.170**	0.038	0.134	0.198
	(0.077)	(0.079)	(0.102)	(0.153)
Degree level qual. (0/1)	-0.006	-0.09	-0.023	0.230*
	(0.071)	(0.071)	(0.092)	(0.138)
Industry experience (years)	-0.002	0.001	0	-0.009
	(0.003)	(0.003)	(0.004)	(0.006)
International experience (0/1)	0.109	0.180**	0.162	0.377**
	(0.080)	(0.082)	(0.106)	(0.162)
Another business? (0/1)	0.014	0.018	0.014	0.014
	(0.019)	(0.019)	(0.029)	(0.040)
Anticipating growth (0/1)	0.135*	-0.013	0.158	0.157
	(0.079)	(0.073)	(0.098)	(0.141)
Minority ethnic group (0/1)	-0.012	0.11	0.077	-0.474
	(0.164)	(0.151)	(0.226)	(0.359)
Age of the business (years)	-0.002	-0.003	-0.002	-0.012
	(0.004)	(0.004)	(0.005)	(0.007)
Family business (0/1)	0.013	-0.048	-0.024	-0.171
	(0.075)	(0.076)	(0.102)	(0.148)
Employment	0.004	0.004	-0.001	0.008
	(0.003)	(0.003)	(0.004)	(0.006)
N	1,269	1,266	1,270	1,280
F(24,	8.03	10.7	12.64	9.14
Prob	0	0	0	0
R-squared	0.1729	0.1533	0.1906	0.1492
bic	4048.612	3978.067	4701.098	5764.862

Source: SME Leadership and Management survey 2014, Business Structures Database. Significance levels * denotes p<.1. ** p<.05, *** p<.001

Table 8: From skills to practices, medium-sized firms (>50 employees)

	Strategy Centralisation.	Strategy Formalisation	Strategy Responsiveness	HR Practices
Entrepreneurial skills	0.210***	0.131***	0.247***	0.317***
	(0.056)	(0.049)	(0.064)	(0.101)
Leadership skills	0.124**	0.252***	0.266***	0.210*
	(0.056)	(0.054)	(0.074)	(0.113)
Organisational skills	0.261***	0.011	0.246**	0.004
	(0.080)	(0.069)	(0.099)	(0.129)
Technical skills	0.078	0.149**	0.183**	-0.03
	(0.060)	(0.064)	(0.081)	(0.123)
Founder (0/1)	-0.054	-0.124	0.047	-0.093
	(0.111)	(0.113)	(0.151)	(0.227)
Degree level qual. (0/1)	-0.136	-0.116	0.035	0.322
	(0.096)	(0.099)	(0.125)	(0.199)
Industry experience (years)	0.003	0.001	0.002	-0.007
	(0.004)	(0.005)	(0.006)	(0.009)
International experience (0/1)	-0.011	0.067	0.034	-0.014
	(0.099)	(0.107)	(0.132)	(0.216)
Another business? (0/1)	-0.018	0.049*	0.059*	0.098*
	(0.023)	(0.028)	(0.033)	(0.055)
Anticipating growth (0/1)	0.097	0.011	0.14	0.315
	(0.108)	(0.103)	(0.132)	(0.200)
Minority ethnic group (0/1)	-0.007	0.114	0.037	-0.482
	(0.185)	(0.175)	(0.216)	(0.328)
Age of the business (years)	-0.006	-0.007	0.003	-0.016
	(0.005)	(0.005)	(0.007)	(0.010)
Family business (0/1)	-0.049	-0.173*	-0.204	-0.561***
	(0.101)	(0.100)	(0.130)	(0.206)
Employment	-0.001	0.001	-0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.002)
N	593	593	597	600
chi2	4.17	5.71	6.64	3.45
P	0	0	0	0
r2_p	0.1863	0.1633	0.1993	0.1202
Bic	1905.831	1933.176	2248.081	2781

Source: SME Leadership and Management survey 2014, Business Structures Database. Significance levels * denotes p<.1. ** p<.05, *** p<.001

Table 9: From practices to productivity, small firms (<50 employees)

	(1)	(2)	(3)	(4)	(5)	(6)
Productivity lag (log)	0.686***	0.682***	0.684***	0.682***	0.685***	0.678***
	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)
Founder (0/1)	0.013	0.012	0.016	0.011	0.011	0.012
	(0.033)	(0.034)	(0.034)	(0.034)	(0.033)	(0.034)
Degree level qual. (0/1)	0.054*	0.055*	0.054*	0.051*	0.051	0.051
	(0.031)	(0.032)	(0.031)	(0.031)	(0.031)	(0.032)
Industry experience (years)	0	0	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
International experience (0/1)	0.059*	0.063*	0.053	0.056*	0.055*	0.057*
	(0.033)	(0.034)	(0.033)	(0.033)	(0.033)	(0.034)
Another business? (0/1)	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Anticipating growth (0/1)	0.036	0.031	0.034	0.033	0.033	0.03
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)
Minority ethnic group (0/1)	0.116	0.115	0.117	0.112	0.116*	0.113
	(0.072)	(0.072)	(0.071)	(0.073)	(0.070)	(0.072)
Age of business (years)	-0.034	-0.034	-0.028	-0.035	-0.031	-0.03
	(0.033)	(0.034)	(0.033)	(0.033)	(0.032)	(0.033)
Family business (0/1)	-0.054*	-0.053	-0.055*	-0.056*	-0.053*	-0.057*
	(0.032)	(0.033)	(0.033)	(0.033)	(0.032)	(0.033)
Employment (log)	0.108***	0.103***	0.107***	0.109***	0.105***	0.103***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Strategy Centralisation		0.012				0.004
		(0.012)				(0.013)
Strategy Formalisation			0.023*			0.013
			(0.013)			(0.016)
Strategy Responsiveness				0.014*		0.005
				(0.008)		(0.010)
HR Practices					0.011*	0.006
					(0.006)	(0.007)
N	1,218	1,197	1,200	1,203	1,218	1,179
chi2	75.35	69.64	70.71	70.28	72.51	60.35
p	0	0	0	0	0	0
r2_p	0.6507	0.6474	0.6495	0.6466	0.6516	0.6455
bic	1715.309	1706.107	1704.079	1704.548	1719.187	1704.92

Source: SME Leadership and Management survey 2014, Business Structures Database. Significance levels * denotes p<.1. ** p<.05, *** p<.001

Table 10: From practices to productivity, larger firms (>50 employees)

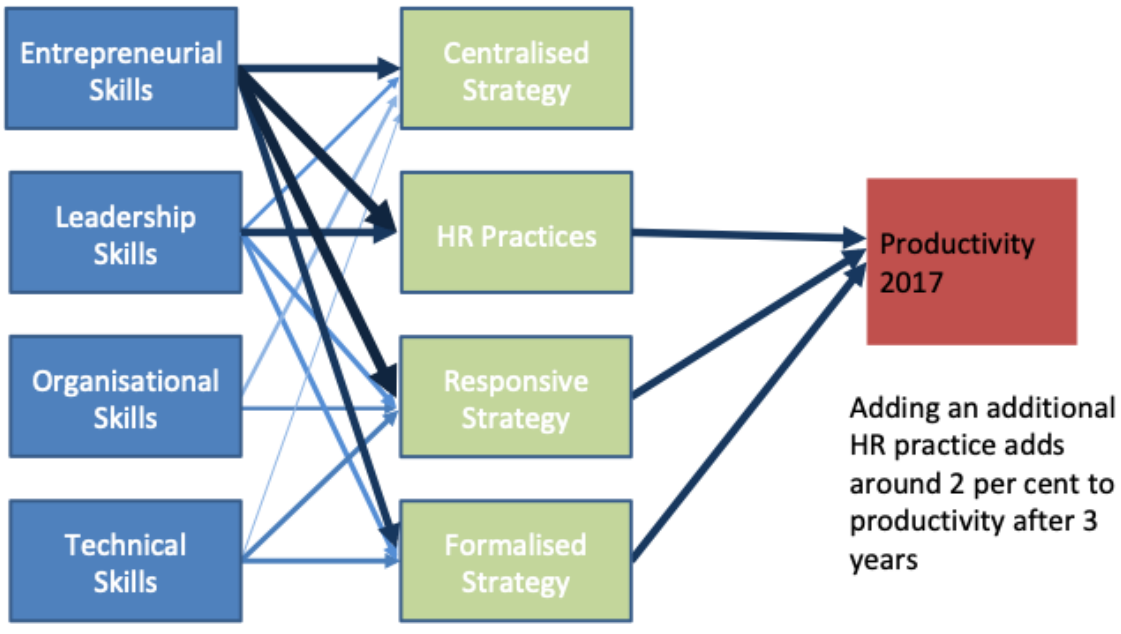
	(1)	(2)	(3)	(4)	(5)	(6)
Productivity lag (log)	0.764***	0.763***	0.764***	0.765***	0.755***	0.754***
	(0.078)	(0.079)	(0.079)	(0.078)	(0.079)	(0.082)
Founder (0/1)	0.032	0.035	0.035	0.035	0.034	0.037
	(0.056)	(0.058)	(0.057)	(0.057)	(0.056)	(0.059)
Degree level qual. (0/1)	0.066	0.077	0.069	0.069	0.057	0.066
	(0.047)	(0.048)	(0.048)	(0.047)	(0.046)	(0.049)
Industry experience (years)	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
International experience (0/1)	0.016	0.021	0.013	0.016	0.019	0.023
	(0.050)	(0.050)	(0.050)	(0.050)	(0.049)	(0.050)
Another business? (0/1)	-0.018	-0.019	-0.020*	-0.021*	-0.021*	-0.023*
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Anticipating growth (0/1)	0.028	0.027	0.028	0.023	0.018	0.016
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Minority ethnic group (0/1)	-0.028	-0.031	-0.033	-0.033	-0.018	-0.024
	(0.137)	(0.137)	(0.139)	(0.137)	(0.138)	(0.138)
Age of business (years)	-0.098**	-0.095**	-0.097**	-0.097**	-0.089**	-0.089*
	(0.047)	(0.047)	(0.047)	(0.047)	(0.045)	(0.047)
Family business (0/1)	-0.062	-0.067	-0.058	-0.059	-0.052	-0.052
	(0.052)	(0.053)	(0.052)	(0.052)	(0.051)	(0.053)
Employment (log)	0.063	0.059	0.066	0.069	0.053	0.06
	(0.058)	(0.060)	(0.061)	(0.059)	(0.058)	(0.062)
Strategy Centralisation		0.013				-0.002
		(0.014)				(0.016)
Strategy Formalisation			0.021			-0.002
			(0.020)			(0.025)
Strategy Responsiveness				0.023*		0.014
				(0.013)		(0.017)
HR Practices					0.023**	0.023**
					(0.009)	(0.011)
N	562	551	553	556	562	544
chi2	49.86	47.06	46.42	48.31	54.96	49.03
p	0	0	0	0	0	0
r2_p	0.7238	0.7198	0.7207	0.7221	0.7265	0.721
bic	969.365	965.642	967.905	967.733	970.201	971.842

Source: SME Leadership and Management survey 2014, Business Structures Database. Significance levels * denotes p<.1. ** p<.05, *** p<.001

5. DISCUSSION

Our two hypotheses were confirmed. First, higher L&M skill levels are strongly associated with the adoption of more structured managerial practices. In particular, Entrepreneurial and Leadership Skills were associated with all four of the business practices, which also exhibit strong and positive complementarities. For smaller firms there were particularly strong links between the Technical Skills of the CEO and Management Practices. Second, the adoption of more structured Management Practices contributes to higher productivity in both larger and smaller firms. The results confirm other evidence of the relationship between Management Practices and productivity for large and small employers (Huselid 1995, Bloom and Van Reenen 2010). For large firms our data suggests the strongest relationship is between HR Practices and productivity (Ichniowski et al. 1997; Wood and de Menezes 1998; Guest and Conway 2011; Hayton 2015; Awano et al. 2017). Figure 2 shows the significant links with the impacts approximated by the line weight and colour, for example the strongest effects were between entrepreneurial skills and HR practices which has the darkest line with the most weight.

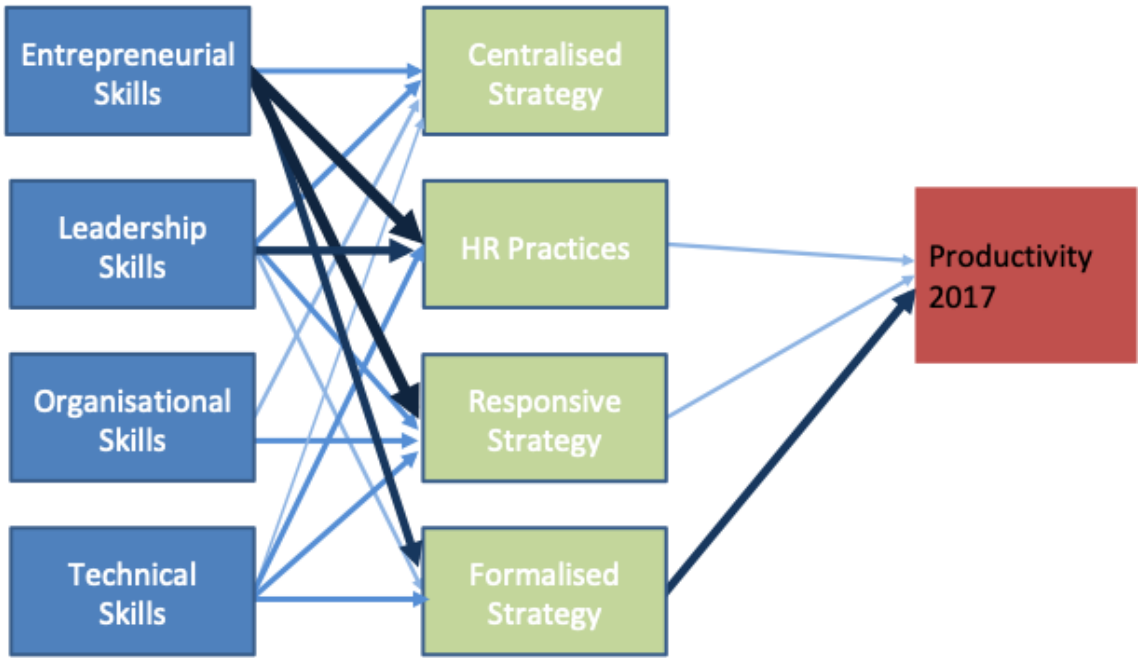
Figure 2: Significant links identified in full sample estimation



For small firms Strategic Management Practices have a greater impact on productivity than HR practices, although these effects are inconsistent with only weak levels of significance see figure 3, which uses the darker and weightier lines to indicate the influence. In particular, we find that Strategy Formalisation proves the most important

driver or productivity among small firms with fewer than 50 employees. This is consistent with other evidence of the value of business planning in smaller firms (Burke, Fraser and Greene 2010). It also suggests the potentially valuable role of business advice in helping firms implement more structured approaches to strategic planning and development (Davidsson and Klofsten 2003; Wu et al. 2014).

Figure 3: Significant links identified in the small firm estimation



Not all types of practices yield productivity benefits, however. For example, Strategy Centralization has little productivity benefit. Strategy Centralization describes a process where strategic decisions are made by the individual CEO and is strongly associated with the presence of the founder in the business. Paradoxically, this type of Practice also seems to restrict the impact of the individual's Entrepreneurial, Leadership and Organizational skills. This result runs counter to arguments which stress the effectiveness of entrepreneurial decision making (Casson, 2003) in favour of the benefits of more distributed decision-making involving a leadership or top management team (Eisenhardt 2013).

In policy terms the mediating role of practices in the link between skills and productivity is also potentially important. The implication is that improving skills in isolation will not transfer directly to improvements in productivity. It is only where upgraded skills enable or inform influence practice that productivity benefits will be realised. This suggests the need for a dual focus in business support which aims to drive productivity growth:

training to develop skills alongside mentoring/advisory support to help firms' embed and implement practices. The combination of the two may be mutually reinforcing.

Our evidence on Strategic Management Practices and productivity also suggests the influence of other organisational members on the link between the skills of founders and productivity. Future research might explore more potential mediation and moderation effects.

6. CONCLUSION

CEO skills matter for the adoption of management practices and in turn these have an impact on productivity over a three-year period; adding one additional HR practice adds around 2 per cent to productivity over three years. This relationship is strongest larger firms (with more than 50 employees) where HR practices show a strong link to productivity. For smaller firms, productivity benefits are associated with less centralised decision-making even in firms led by a single business leader such as those considered here. Our research suggests a symbiotic link between management skills and management practices, where managers use their skills to develop and adopt management practices. Understanding why entrepreneurial firms adopt management practices necessitates an understanding of the manager as well as the practice.

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