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High-performance work practices and labour productivity: a six wave longitudinal study of UK manufacturing and service SMEs

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ABSTRACT

This study utilises both evolutionary resource-based view (EBRV) and open systems theory to investigate the long term impact of high-performance work practices (HPWPs) on labour productivity in UK manufacturing and service sector SMEs. We investigate both forward and reverse causality and the moderating role of owner-manager strategic orientation, and whether such relationships are influenced by firm size and age. Utilising a longitudinal data set (a balanced panel) comprising 284 UK SMEs and six waves of data collection over a ten-year time period (2007–2017), we found support for both forward and reverse causality. Prior investments in HPWPs were positively associated with subsequent firm labour productivity and prior labour productivity was positively associated with future investment in HPWPs. The size of the estimated coefficients for these relationships were consistently larger for small firms than for medium sized firms, however there were not significant for firm age. We additionally found that owner-manager strategic orientation towards HR moderated both forward and reverse causality relationships and that this relationship increased over time. The size of the estimated coefficients was larger in small firms compared to medium-sized firms. Overall, our findings support calls to investigate both forward and reverse causality and to better understand potential differences between small and medium sized firms.

KEYWORDS

High performance work practices (HPWPs); small and medium-sized firms (SMEs); evolutionary resource-based view (ERBV); open systems theory; owner-manager strategic orientation (S-O); firm age; labour productivity; forward and reverse causality

Introduction

Over the last few decades, scholarly and practitioner interest in high performance work practices (HPWPs) has grown considerably (Allen et al., 2013; Messersmith et al., 2011; Shin & Konrad, 2017; Subramony, 2009; Saridakis et al., 2017). Despite the significant accumulation of

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knowledge on these practices, research has primarily focused on large firms. This is a significant deficiency in the literature given that the adoption of HPWPs among small and medium sized firm is modest at best (Harney & Dundon, 2006) with one study in the UK identifying an adoption rate as low as 5–15% (Gilman & Raby, 2013). The accumulated research reveals that SMEs are likely to utilise less than 50% of HPWPs (Chadwick et al., 2013; Teo et al., 2011) with explanations for this low take-up including the lack of financial and specialist HR resources and the low level of interest by owner-managers in these practices. Therefore, considering the constraints that SMEs experience compared to larger firms (Harney & Alkhalaf, 2021) there are questions concerning whether these practice are of value to SMEs in the long term.

We highlight a number of additional issues with the literature as a motivation for this study. First, studies in the SME context do not generally investigate the potential differences between small and medium sized firms. The majority of studies of HPWPs consider SMEs to be a single category or primarily focus on small firms (e.g. Chadwick et al., 2013; Patel & Conklin, 2012). Studies that have investigated HPWPs in medium sized firms are rare and few make comparisons between small and medium sized firm (three exceptions are Della Torre and Solari, 2013; Lai et al., 2017; Wu et al., 2015). Rauch and Hatak (2016) in their meta-analysis and Harney and Alkhalaf (2021) in their systematic review both acknowledged that HRM in small and medium sized firms will likely be very different. It is possible that the greater levels of formalisation found in medium sized firms many be conducive to greater use of HPWPs because these firms are more likely to have a HR specialist or department (Garavan et al., 2016; Wu et al., 2015).

Second, most studies have not investigated the impact of HPWPs on organisational performance using longitudinal research designs, therefore we have limited insights concerning forward and reverse casualty. A small number of studies have utilised longitudinal designs and generated contrasting findings. For example, Kim et al. (2021) and Garmendia et al. (2021) and Sheehan (2014) collected data over two time waves with the former finding a negative relationships and the latter finding a positive relationship between HPWPs and organisational performance. The lack of longitudinal research leaves many unanswered questions concerning whether investment in HPWPs are sustained over time in SMEs given the resource deficiencies they experience, the returns to these firms from investments in HPWPs on firm performance and the role of performance feedback on future investments in HPWPs.

Third, research to date has given insufficient attention to understanding characteristics of the owner- manager as an important contingency in the context of investment in HPWPs and SME performance

(Garavan et al., 2016). The owner-manager is a unique feature of the operation of SMEs and researchers have highlighted owner-managers' attributes including their HR philosophy and perceptions of HR effectiveness (Klaas et al., 2012; Kroon et al., 2013) to be important. One under researched dimension concerns the owner-manager's strategic orientation towards HR (Collings et al., 2010) defined as the extent to which the owner-manager prioritises investment in people and attached importance to HR practices in the context of achieving SME performance goals. We therefore have significant scope to understand the influence over time of owner-manager strategic orientation towards HR in sustaining investment in HPWP and the impact of feedback on SME performance on this orientation. Harney and Alkhalaf (2021) for example, highlight that we know very little about the long-term impact of the decisions of owner-managers on investment in HPWPs.

Finally, another defining feature of SMEs that has received less attention in the context of HPWPs in SME concerns the impact of firm age. Rauch and Hatak (2016) for example, argue that firm age is an important moderator variable because younger SMEs may experience more challenges in implementing HPWPs than older SMEs. Younger SMEs are less likely to have developed HR implementation expertise (Cardon & Stevens, 2004) or to have a HR specialist or an effective organisation structure (Kotey & Folker, 2007). In contrast, older firms likely face fewer of these challenges yet the meta-analytic evidence indicates that the relationship is stronger in younger firms especially for motivating enhancing HPWPs (Rauch & Hatak, 2016). We therefore lack clarity as to whether SMEs benefit from being older when it comes to HPWPs.

This paper makes a number of important contributions to the literature. First, it addresses the long-term, forward and reverse causal relationship between HPWPs and firm productivity in small compared to medium sized firms and younger compared to older firms. Investigation of these important nuances in SMEs significantly advances understanding of the impact of the impact of HPWPs on productivity in SMEs. We have relatively few insights concerning whether investments in HPWPs are beneficial for SMEs in the long term which we define as more than five years. In addition, most studies to date have focused on forward causality rather than reverse causality (Garmendia et al., 2021; Shin & Konrad, 2017). Our study differs from the Shin and Konrad (2017) study in a number of important respects. First, these authors included three waves of data compared to the six reported in this study; second they did not analyse SMEs explicitly and they conducted their study in Canada which potentially has a significantly different institutional context compared to the UK. To advance understanding of forward and revere causality in the context of HPWPs and firm productivity we utilise evolutionary

resource-based theory (ERBT) (Boxall & Steeneveld, 1999; Mueller, 1996) and open systems theory (Garavan et al. 2021a, 2021b; Shin & Konrad, 2017). These theories are a particularly good fit within the SME context where extant theoretical and empirical evidence is lacking.

Second, by focusing on two important and - as of yet not - fully understood contextual dimensions of SMEs (firm size and age) we acknowledge that the long–term relationship between HPWPs and firm productivity may depend on the demographic characteristics of SMEs (Rauch & Hatak, 2016). We therefore respond to calls for a more nuanced understanding of the impact of SME demographic characteristics on the HPWPs- organisational performance relationship (Garavan et al., 2021b; Nguyen & Bryant, 2004). Third, we address a significant void in the literature by investigating the moderating influence of owner-manager strategic orientation towards HR on long-term forward and reverse causal relationships. The strategic intent proposition of ERBT suggest that owner-managers influence firm performance because environmental factors, SME structures, processes and adjustments in HR practices are highly interdependent of each other and they will make decisions on HR based in part on their strategic orientation towards HR. For example, Sels et al. (2006) highlights that the decision to invest or not in HR comes down to the owner- manager, therefore we provide important insights into one important characteristic of the owner-manager on both forward and reverse causal relationships concerning HPWPs and firm productivity over time.

Finally, this study focuses on firm labour productivity as the intended outcome of HPWPs (Guest & Conway, 2011). Reviews of the SME literature (e.g. Dhawan, 2001; Owalla et al., 2021) highlight the importance of productivity as an organisational performance measure to SMEs and that SMEs face significant challenges which make productivity gains more challenging than is the case for larger firms. Labour productivity is one of the most proximal financial indicators of how effective HR practices are in organisations (Kim et al. 2021) and it is an appropriate fit in the context of the feedback loop, where it will signal to owner-managers the value or not of investment in HPWPs (Shin & Konrad, 2017).

Theoretical background and hypotheses

HPWPs and long-term SME labour productivity

We first propose that investment by SMEs in HPWP over time is positively associated with firm labour productivity. To anchor this hypothesis theoretically we utilise ERBT, as set out by Mueller (1996) because theoretically it envisages that the performance impacts of investment in

HPWPs will take time to accrue in addition to becoming stronger over time due to these practices becoming embedded within the SME. ERBT theory envisages that the introduction and subsequent implementation of HPWPs in SMEs will occur in an evolutionary, incremental and sometimes piecemeal way. It will therefore take time for the performance benefits of HPWPs to emerge. ERBT gives primacy to the benefits of systemic and persistent introduction and implementation of HPWPs which over time become embedded into the distinctive routines and practices found in SMEs (Boxall & Steeneveld, 1999). It gives emphasis to the processes of integration and the fit of practices with the SME context. Because HPWPs have the potential to become deeply embedded within the SME they are not easily replicated by competitors thus conferring significant performance advantages.

The HRM literature provides insights concerning the incremental implementation of HRM in SMEs and its benefits for organisational performance. For example, Nolan et al. (2020) found that tourism SMEs customised the implementation of HRD practices to match their context and that the implementation process was progressive, informal and highly systemic in nature. Other studies have highlighted that SMEs usually have a lower degree of complexity which is valuable when embedding HPWPs and that they may take more of co-creation approach to the implementation of HR practices involving employees thus ensuring that they are more accepted and a better fit with the SME context (Ulvenblad & Barth, 2021). There is also evidence that long-term implementation of HPWPs is beneficial for SME performance. For example, Sheehan (2014) found a positive relationship between these practices and organisational performance after controlling for past performance. Razouk (2011) likewise found both simultaneous and longitudinal correlations between HPWPs and organisational performance while controlling for past performance. In contrast, Garmendia et al. (2021) found a negative relationship between what they called 'high involvement practices' and organisational performance many of which are similar to those included in this study.

Given the diversity within the SME category with significant differences between small and medium firms (Harney & Alkhalaf, 2021) it is important to investigate whether these relationships between HPWPs and productivity differ in small compared to medium sized SMEs. Research highlights important differences between small and medium sized firms which potentially may be relevant (Chadwick & Li, 2018; Wu et al. 2015). Consistent with ERBT theory small firms potentially offer greater advantages when it comes to the introduction and long-term implementation of HPWPs because of greater flexibility, informality, the importance of interpersonal relationships, teamwork and tacit knowledge.

While some of these features likely do exist in medium sized firms (Della Torre & Solari, 2013) there will be greater formalisation, complex and diffused decision making thus slowing down the process of implementation of HPWPs in medium-sized firms. Therefore, the processes of implementation and embedding HPWPs in medium sized firms may be more challenging.

In a similar view we would expect differences between younger and older firms when it comes to the productivity benefits of HPWPs. Consistent with ERBT theory we would expect older firms to gain more productivity benefits from the introduction and implementation of HPWPs. This occurs because these practices take time to became embedded within the social fabric of the firm and to translate into performance benefits. Therefore, older SMEs will have developed deeper insights into their implementation and have built up skills in effective implementation (Rauch & Hatak, 2016). In contrast, younger firms will have developed fewer tacit insights on implementation and therefore will reap fewer benefits in terms of productivity. Based in this reasoning we propose the following hypotheses.

Hypothesis 1a: HPWPs at an earlier time point will be positively related to subsequent labour productivity when labour productivity at the earlier time point is controlled.

Hypothesis 1b: The relationship between HPWPs at an earlier time point and subsequent labour productivity when labour productivity at the earlier time point is controlled will be stronger for small compared to medium sized firms.

Hypothesis 1c: The relationship between HPWPs at an earlier time point will be positively related to subsequent labour productivity when labour productivity at the earlier time point is controlled will be stronger for older compared to younger firms.

SME productivity and investment in HPWPs

We now turn to reverse causality where labour productivity is conceptualised as the cause of investment in HPWPs. To make arguments for this relationship we draw on open systems theory and, in particular, the concept of the feedback loop (Garavan et al., 2021b; Kast & Rosenzweig, 1972). There is support for the feedback loop principle in a meta-analysis of the training –firm performance relationship (Garavan et al. 2021a) and in an empirical study by Shin and Konrad (2017) concerning the link between organisational performance and future investment in HPWPs. Shin and Konrad (2017) found that past HPWPs positively contributed to later labour productivity, as well as the reverse.

The feedback loop, as proposed by open systems theory (Kast & Rosenzweig, 1972; Von Bertalanffy, 1968), proposes that feedback can

be either positive or negative. Therefore, feedback on SME performance will impact future investments in HPWPs and where firms receive positive feedback on performance they will invest in future in these practices. Over time, continual investment in HPWPs will contribute to increased performance thus fuelling the cycle. Without positive feedback loops SMEs will make fewer investments in HPWPs due to the non-availability of slack resources and will be less subject to organisational inertia where they simply continue to invest in these practices regardless of the productivity gains accrued (Yoo et al., 2021). There is evidence that a firm's general resource investment decisions are impacted by its previous performance (Kaufman & Miller, 2011; Nadler & Tushman, 1980). In the context of SMEs, Shin and Konrad (2017) found that productivity contributed to future implementation of HPWPs.

However, we also argue that the positive long term relationship between firm productivity and investment in HPWPs may differ depending on the size and age of the firm. We propose that these relationships will be stronger in small firms because these firms are traditionally very resource scarce (Wu et al. 2015) and unless they make productivity gains, are less likely to make future investments in HPWPs. Medium sized firms on the other hand, potentially have more resources and are better able to navigate productivity variances. In addition, medium sized firms may be subject to greater organisational inertia and scholars have pointed to the stability of HR (Wright et al. 2005) to the effect that they will be more bound by what was done previously. When it comes to the age of the SME, we propose that the relationship will be stronger for younger SMEs because given high levels of resource scarcity, such firms will need significant gains in productivity in order to justify future investments in HPWPs. We therefore propose the following hypotheses:

Hypothesis 2a: Labour productivity at an earlier time point is positively associated related to subsequent HPWPs when earlier HPWPs are controlled.

Hypothesis 2b: The relationship between labour productivity at an earlier time point is positively associated related to subsequent HPWPs when earlier HPWPs are controlled will be stronger for small compared to medium sized firms

Hypothesis 2c: The relationship between labour productivity at an earlier time point is positively associated related to subsequent HPWPs when earlier HPWPs are controlled will be stronger for younger compared to older SMEs

The moderating role of owner-manager strategic orientation towards HRM

Existing research on the HPWPs-firm performance relationship reveals significant heterogeneity suggesting significant moderators of this relationship. To that end, the strategic orientation of the owner-manager

may play an important role in determining the extent and effectiveness with which HPWPs will be implemented (Sung & Choi, 2018; Wood & Vilkinas, 2007). We propose that the strategic orientation of the owner-manager towards HR is particularly important in the SME context for both forward and reverse causality relationships over time. SMEs will be heavily influenced by the beliefs and perceptions of the owner-manager about HR (Ahmadi et al., 2020). The strategic intent proposition of ERBT suggests that where owner-managers has a strong intent or vision for HR this will be instrumental in the initial decision to invest in HPWPs and to continue this investment into the future.

Strategic orientation towards HR represents an appropriate operationalisation of the strategic intent proposition of ERBT in that it captures the idea that the owner-manager has both vision and intent for the role of HR in the SME (Mueller, 1996). In terms of the long term forward causal relationship between HPWPs and firm performance a strong strategic orientation towards HR will lead the owner-manager to make the initial decision to invest in these practices and to sustain that investment over time (Kim & Bae, 2005). In addition, where the feedback on the productivity effects of investment in HPWPs is positive, this will sustain the owner-manager's positive perceptions of the value of HR. Indeed, EBRT theory envisages that strategic orientation becomes stronger over time in influencing the embedding of HRM within an organisation. Continuous positive feedback on the productivity effects of HPWPs provides the owner-manager with knowledge that strengthens his/her strategic orientation towards HR.

We do however argue that the impact of the owner-manager's strategic orientation towards HR will be stronger in small versus medium and in younger versus older SMEs. Small firms in comparison to medium firms will be better able to enjoy the benefits of the owner-manager's strategic orientation towards HR. This occurs because most decision making on HPWPs comes within the remit of the owner-manager providing greater opportunities for strategic orientation towards HR to influence decisions about investment in HPWPs (Ling et al., 2007). However, there will likely be increased complexity in decision making about HR issues in medium sized firms. For example, HR tasks are likely to become more complex and exceed the remit and attention of the owner-manager. In addition, HR decision making will often become more distributed and involve HR specialists (Garavan et al. 2016) thus providing less opportunity for the strategic orientation towards HR to impact HPWP investment decisions.

We would also expect that the impact of the strategic orientation towards HR to be more influential in younger versus older firms. Younger firms tend to be more entrepreneurial and to quickly respond to

opportunities (Choi & Shepherd, 2004) therefore the owner-manager will have greater influence on HR decision making. However, in older firms more managers and functional specialists will be involved which, may lead to differences and delays in decision making processes (Ling et al., 2007). Therefore, we would expect that the more distributed decision making in older firms will diminish the influence of owner-manager strategic orientation towards HR compared to younger firms.

Hypotheses 3(a): The HR strategic orientation (SO) of the MD/OM towards HRM will moderate both forward and reverse causal relationships between HPWPs and labour productivity.

Hypotheses 3(b): The moderating role of HR strategic orientation (SO) of the MD/OM towards HRM will be stronger in small compared to medium sized firms.

Hypotheses 3(c): The moderating effect of HR strategic orientation (SO) of the MD/OM towards HRM will be stronger in younger rather than older firms.

Our theoretical model is depicted in Figure 1.

Methods

Sample and data collection

Data for this study were obtained from 284 UK manufacturing and service SMEs, and all of these firms were small and medium-sized enterprises with a median employment level of average headcount of 75.3 employees. The data set derived from a stratified sample of SMEs from the UK Dun and Bradstreet databases was longitudinal and consisted of 6 waves of data (2007–2017) with a 2-year lag between each measurement wave. For the first wave ($t1$ = year 2007), we gathered 1580 (26.5% response rate) responses from Manager Directors (MDs)/Owner Manager (OMs); for the second wave ($t2$ = 2009) we collected 762 (48% non-attrition from previous period) responses; for the third wave ($t3$ = 2011) we collected 533 (70% non-attrition responses; for the fourth wave ($t4$ = 2013) we collected 389 ((73% non-attrition) responses; for

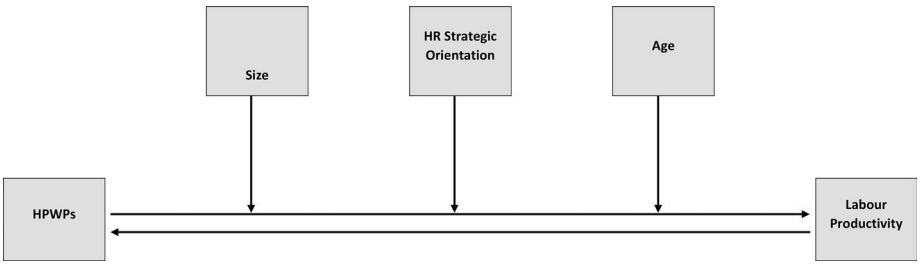

Figure 1. The research model.

the fifth wave ($t5 = 2015$)we collected 335 (86.1% non-attrition) responses and for the sixth wave ($t6 = 2017$) we collected 284 (85% non-attrition) responses. To compile a sample of SMEs the first author used four criteria for the purposes of stratification: organisational size; age; the primary sector of business activity; and independent ownership (i.e. not being part of another, usually larger, organisation). In respect of SME size, firms had to employ, following the EU 2005 definition of a SME, between 10 and 249 employees. In the case of age, we set the requirement that the SME had to be in operation for a minimum of 18 months, thus eliminating issues that may arise with start-ups, especially their high rate of failure within the first few months to 1 year of operation (Fuertes-Callén et al. 2020).

The data collection process involved the following steps and decisions. First, we made the decision to collect data from the SME MDs/OMs, given that very few SMEs would have a HR department or HR specialist (Garavan et al. 2016). Second, the first author emailed letters to the most senior person named on the Dun & Bradstreet (D&B) database. However, to make this process more efficient we undertook cross checks of contact details using a Google search. Third, data was collected using telephone surveys. We made the decision to use telephone surveys due to the very low response rate associated with the use of postal surveys (Dennis, 2003). Fourth, the data were collected using the services of a professional survey company, which worked closely with the first author for the duration of the study. Fifth, prior to administering the survey for the first time in 2007, the first author piloted it with 10 SME MDs/OMs and the survey company piloted it with 6 additional firms. We used this information to refine the survey instrument and it proved to be particularly useful in developing the list of HPWPs included in the study. All study questions remained the same for the six waves of data collection. Sixth, the telephone survey was administered with MDs/OMs over the duration of the study each telephone interview lasted approximately 30 minutes. Study participants were asked to answer honestly, we guaranteed absolute anonymity and the ethical requirements set out were met. At $t1$ we made study participants aware that the aim of the study was to collect data over a 10-year period. Finally, we sent all participating SMEs an executive summary of the findings, with bespoke benchmarking data, which helped to sustain their participation in the study.

Sample representativeness checks

We conducted checks for the representativeness of our sample. First we assessed response bias, utilising the D&B database to assess differences in net sales, employment levels and firm age between responding and non-responding firms in each time period. The Kolmogorov-Smirnov test (Kleinbaum et al., 1988) showed no significant differences in any

of these variables in any time period (at the $p < 0.10$ level). We also computed a two-stage Heckman Test to investigate response bias. No significant biases were found at the ($p < 0.10$ level).

Given the multiple-wave nature of our study, we paid particular attention to capturing significant changes that would inevitably occur in the intervening periods (e.g. change in ownership, change in strategy, change in products/services provided). There were significant changes in 26.8% of sample firms.[1] Dummy variables were used to control for significant changes in all of the estimations, but none of the change dummies were statistically significant at $p < 0.10$ and they were, therefore, not used in the estimations reported here.

The final sample reflects those firms that participated at all time periods ($n = 284$), representing 17.9% of the initial sample. Although a balanced panel design results in a substantial loss of observations through attrition, the balanced design helps to avoid conflating the importance of wave non-response with item non-response. However, the use of a balanced panel creates the potential for firm survival and survivor attrition bias. Both such biases may impede the ability to draw valid inference and to generalise findings from the analysis and are therefore examined but cannot be completely excluded and is therefore a limitation of the study.

Firm survival bias is widely recognised in longitudinal micro-level studies, especially in relation to SMEs. For example, the UK's Office of National Statistics (ONS) found that 42.4% of businesses that started in 2013 were still trading five years later in 2018 (Office of National Statistics (ONS), 2019 (Nov)). Analysing Companies House data and drawing upon the ONS's definition of firm survival and using a five-year tenure, we found that the 2007–2012 survival rates of companies in our sample was 37.5% and for the 2013–2017 it was 43.1%. The lower survival rate in the 2013–2012 period is likely to reflect the impact on the 2007–2008 banking crisis, which had a particularly adverse impact upon SMEs in the UK (Office of National Statistics (ONS), 2019).

We estimated hazard rates for the impact of the control variables and the dependent variable on firm survival on the unbalanced panel of Companies House Registered companies to test for the potential impact of survival bias. Only firm size was statistically significantly associated with survival with a hazard rate of 1.17 in 2009 (z-value at the 0.05 level) and 1.09 (z-value at the 0.05 level) in 20011, with size becoming statistically insignificant thereafter. This indicates that a 1% deviation below the trend level of employment increases the probability of non-survival by 17% over the 2007–2009 period and by 9% in 2009–2011.

We then analyse whether attrition bias is contained in the data by computing the means for each control, explanatory and dependent

variables in the six time periods. In 2007 and 2009, on average, non-attritor firms were likely to be larger and older compared to attritors. Specifically, in 2007 ($t = 2.25$, $p < 0.10$ (size) and $t = 2.05$, $p < 0.05$ (age) and in 2009: ($t = 2.09$, $p < 0.05$ (size) and $t = 1.92$, $p < 0.05$ (age)). The results are not surprising, as firm size and age are significantly correlated in this study ($r = 0.33$, $p < 0.01$ over the 10 years) and are consistent with other studies of SMEs (e.g. Cader & Leatherman, 2011). These differences become insignificant from 2011 onwards. No other variables were statistically significantly different between the survivors and non-survivors, attritors and non-attritors in any of the time periods. We, therefore, adapted the approach recommended by Certo et al. (2016) for applying the Heckman two-stage estimation technique and the reported results reflect these corrections.[2]

Measurements

HPWPs

We collected data from MDs/OMs over the six waves of data collection on the extent to which the SME had implemented 17 HPWPs. To develop the list of HPWPs included in our study we consulted the broader HPWPs-performance literature (e.g. Guest et al., 2003; Wright et al. 2005) and SME specific literature (de Kok & Uhlaner, 2001; Forth et al., 2011). The final survey included a list of HPWPs covering six areas: 1. recruitment and selection; 2. performance appraisal; 3. performance-based compensation pay; 4. training and development; 5. employee voice, consultation, participation and information sharing; and 6. strategic people management. As responses to these questions were measured on a binary scale, Kuder Richardson (K20) reliability measures for dichotomous item scales are reported (see Appendix, Table A1 for details of the individual practices and K20 results).

To ensure that the HPWPs measured were widely dispersed within the firm-that the particular practice was applied extensively among the firm's employees- we used Guest et al. (2003) cut-off point, whereby the item is counted only if it applied to 90 per cent or more of the workforce. Scores were standardized within the six HR practices since the number of items describing each of the practices varied. It is this standardized score that is used as the measure of HPWPs in each of the six time periods of the study. Cronbach's alphas: 2007 = 0.78; 2009 = 0.79; 2011 = 0.81; 2013 = 0.80; 2015 = 0.82; and 2017 = 0.82.

Labour productivity

To avoid the use of subjective measures of organisational performance we purchased data from D&B UK are reported (data source: D&B UK)

to create the SME-labour productivity dependent variable. Labour productivity is highlighted as an important measure of OP and is widely used in studies of HRM practices (Datta et al. 2005). We measured labour productivity as the ratio of firm sales to employees, which is consistent with other studies of HRM practices (Chadwick et al. 2013; Shin & Konrad, 2017).

Strategic orientation towards HRM (S-O HRM)

We measured the strategic orientation S-O towards HRM of the MD/OM utilising three items adapted from Bae and Lawler (2000) and Collings et al. (2010). Sample items: 'MD/OM give importance to investing in their employees as a key source of competitive advantage'; MD/OM considers human resource policies and practices to be important for company performance'. Cronbach's alphas: 2007 = 0.73; 2009 = 0.76; 2011 = 0.76; 2013 = 0.78; 2015 = 0.79; and 2017 = 0.80.

Control variables

The use of control valuables is highlighted in the literature (e.g. de Kok & Uhlaner, 2001; Jackson & Schuler, 1995; Patterson et al., 1997) so we collected data on a number of control variables using both D & B and the telephone surveys. These included: firm size (D&B) and age (D&B) (Rutherford et al. 2003). Given the importance of firm size and age in the context of SMEs, in addition to controlling for these factors, we also present disaggregated results for firm size and age. [3] While there is no consensus in the SME literature in relation to the definition of 'small' and 'medium-sized' firms we use the European Commission's definition (Commission Recommendation, 2003) and define 'small' as firms that employ 10–25 and 'medium' as firms that employ 26–249. Likewise, there is a lack of consensus about how to define 'young' and 'old' firms and we utilise the eight-year cut-off that is the most common cut-off within the SME literature (McDougall and Robinson, 1990; Rauch & Hatak, 2016; Zahra, 1996). The other control variables are as follows: whether the firm operated in the manufacturing or service sector (D&B); capital intensity (Capital) (the logarithm of the firm's book value to fixed capital stock) (Huselid, 1995; Way, 2002 (SME context)); R&D intensity (R&D) (the logarithm of the ratio of R&D expenditure to sales) (Huselid, 1995); and whether the firm primarily pursued a 'quality'. 'innovator' or 'cos]t-based' strategy (Sheehan, 2014). We also collected data on per unit labour costs, LBR cost (measured as, total labour costs/total employees) (D&B) to address issues related to the potential for HPWPs to result increased labour costs (Cappelli & Neumark, 2001). Given the potential for multicollinearity among the control variables,

the base model was first estimated by Lasso regression to perform variable selection. All of the proposed control variable coefficients were non-zero and are therefore retained (Thevaraja et al. (2019) (see the Appendix for tests for autocorrelation, heteroskedasticity; and measurement invariance (MI) (Table A2)).

Data analysis

Table 1 presents the means, standard deviations and correlations for the study variables. The result for the base model (control variables only) are reported in the Appendix (Table A3).[4]

To test our hypotheses, we analysed the data using a random intercepts cross-lagged panel model (RI-CLPM; Hamaker et al., 2015) and estimated it using structural equation modelling for longitudinal data in Mplus. The RI-CLPM is an extension of the traditional cross-lagged model and is a more reliable method compared to the traditional cross-lagged panel model (Bernardi et al., 2019). Our cross-lagged model was designed to meet the three principles of causality developed by Gollob and Reichardt (1991): considering the ordering of causes and outcomes, controlling autoregressive influences, and setting an appropriate time lag length. Autocorrelated errors were estimated by testing the longitudinal panel model (Little, 2013), reflecting systematic measurement error over-time (Gerhart et al. 2000). Following Shin and Konrad (2017) this approach allows for HPWPs at an earlier time point to predict performance at a later time point when performance at the earlier time point was controlled, and performance at an earlier time point predicts HPWPs at a later time point when HPWPs at the earlier time point are controlled. The 2-year time lag used was based on the 'implications-to-benefit lags' outlined by Huselid and Becker (1996). To test for the potential moderating role of the strategic orientation towards HRM of the MD/OM (hypotheses 3a–3c), we applied multiple group analysis implementing procedures and utilising Mplus syntax provided by Mulder and Hamaker (2021) (see also, van der Schuur et al. 2019). Specifically, to reduce the potential for multicollinearity, we mean-centred the individual proposed moderating variables before calculating the interaction terms.We followed standard guidelines on designing structural equation modelling with longitudinal data (MacCallum & Austin, 2000), and included cross-sectional relationships between HPWPs and performance with the hypothesised lagged effects. The 8 per annum control variables were added in at each time period and accumulated over time. In the estimations of hypothesis 3, previous S-O toward HRM is used as a control variable and accumulated over-time. We selected RI-CLPM

instead of a latent growth model, as we did not hypothesise systematic change in any of the variables as a function of time (Bernardi et al., 2019).

To test our hypotheses, we follow Mulder and Hamaker (2021) Mplus coding to estimate the RI-CLPM models (Muthén & Muthén, 1998–2012). Requirements for an acceptable model fit were a non-significant chi-square statistic, comparative fit indices (CFI) > .95, root mean square errors of approximation (RMSEA) < .06, and standardized root mean square residuals (SRMR) < .08 (West et al., 2012). The model and results testing the relationship between productivity and HPWPs presented in Table 1 yields a good fit: χ^2 ($df = 49$) = 14.221, $p = 0.224$; CFI = 0.985; RMSEA = 0.05; SRMR = 0.04 indicating that it was appropriate to proceed further with tests of the structural model (Byrne, 2001).

The path coefficients are reported in Table 1.[5] The paths from T1 HPWPs to T2 productivity ($\beta = 0.045$, $p < 0.01$); T2 HPWPs to T3 productivity ($\beta = 0.053$, $p < 0.01$); T3 HPWPs to T4 productivity ($\beta = 0.082$, $p < 0.001$); T4 HPWPs to T5 productivity ($\beta = 0.134$, $p < 0.001$); and T5 HPWPs to T6 productivity ($\beta = 0.223$, $p < 0.001$) (Column 1). The size of the path coefficients for small firms are consistently larger compared to that of medium sized firms (e.g. $\beta = 0.317$, $p < 0.001$ compared to $\beta = 0.108$, $p < 0.001$ for T5 HPWPs to T6 productivity in 2017 (Columns 2 and 3)).[6] None of the path coefficients for firm age are statistically significant (columns 4 and 5). These results demonstrate that HPWPs at an earlier time point are positively associated with labour productivity when labour productivity at the earlier time point is controlled and this relationship is particularly significant for small firms. We therefore find support for hypotheses 1a and 1b but not hypothesis 1c.

The paths from T1 productivity to T2 HPWPs ($\beta = 0.034$, $p < 0.01$); T2 productivity to T3 HPWPs ($\beta = 0.043$, $p < 0.01$); T3 productivity to T4 HPWPs ($\beta = 0.065$, $p < 0.01$); T4 productivity to T5 HPWPs ($\beta = 0.102$, $p < 0.001$); T5 productivity to T6 HPWPs ($\beta = 0.171$, $p < 0.001$) are all positive and significant. The size of the path coefficients for small firms are consistently larger compared to that of medium sized firms (e.g. $\beta = 0.233$, $p < 0.001$ compared to $\beta = 0.105$, $p < 0.001$ for T5 Productivity to T6 HPWPs in 2017). None of the path coefficients for firm age are statistically significant (columns 4 and 5). These results demonstrate that labour productivity at an earlier time period is positively associated with the level of HPWPS at a later time point, when earlier HPWPs is controlled and this relationship is particularly significant for small firms. We therefore find support for hypotheses 2a and 2b but not hypothesis 2c.

To test hypothesis 3a, we re-estimate hypotheses 1a and 2a using the moderated relationship (HPWPs*S-O). We find that the moderated paths from T1 HPWPs*S-O to T2 productivity are: ($\beta = 0.056$, $p < 0.01$); T2

Table 1. Means, Standard Deviations and Pearson's correlations of study variables.[a]

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
V1 ln (Size)	1.88	1.05																									
V2 ln (Age)	1.46	0.44	0.33**																								
V3 Industry (services)	0.61	0.19	−0.15	−0.19*																							
V4 ln (Capital intensity)	1.67	1.91	0.19*	0.15*	0.14*																						
V5 ln (R&D intensity)	1.32	1.11	0.11	0.19*	0.12	0.29**																					
V6 ln (LBR cost)	10.10	8.87	0.35**	0.33**	0.19*	0.15*	0.11																				
V7 Quality-strategy	0.35	0.18	0.21*	0.32**	0.07	0.26**	0.23**	0.25***																			
V8 Cost-strategy	0.26	0.25	0.19*	0.15*	0.06	−0.10	−0.25**	−0.23***	−0.25**																		
V9 S-0 HRM ($t=2007$)	3.72	1.52	0.11	0.11	0.03	0.20*	0.27**	0.12	0.26**	−0.11																	
V10 S-0 HRM ($t=2009$)	3.99	1.50	0.12	0.10	0.02	0.19*	0.29**	0.14*	0.27**	−0.12*	0.38**																
V11 S-0 HRM ($t=2011$)	4.08	1.51	0.13*	0.11	0.07	0.20*	0.30**	0.14*	0.28**	−0.13*	0.30**	0.36**															
V12 S-0 HRM ($t=2013$)	4.11	1.48	0.14*	0.12	0.05	0.21*	0.32**	0.15*	0.31**	−0.14*	0.21**	0.30**	0.33**														
V13 S-0 HRM ($t=2015$)	4.14	1.45	0.14*	0.12	0.03	0.21*	0.33**	0.21**	034**	−0.16*	0.16*	0.23**	0.28**	0.30**													
V14 S-0 HRM ($t=2017$)	4.23	1.40	0.15*	0.11	0.01	0.20*	0.36**	0.23**	0.41**	−0.21**	0.10	0.12	0.18*	0.24**	0.34**												
V15 HPWPs ($t=2007$)	9.36	3.23	0.30**	0.14	0.10	0.11	0.10	0.13*	0.40**	−0.25**	0.47**	0.40**	0.25**	0.11	0.10	0.05											
V16 HPWPs ($t=2009$)	9.43	3.26	0.28**	0.15	0.11	0.13	0.15*	0.14*	0.23**	−0.21**	0.41**	0.43**	0.29**	0.14*	0.12	0.08	0.72**										
V17 HPWPs ($t=2011$)	11.60	3.09	0.30**	0.14	0.10	0.15*	0.18*	0.14*	0.20**	−0.19*	0.30**	0.38**	0.42**	0.19*	0.10	0.11	0.58**	0.70**									
V18 HPWPs ($t=2013$)	13.37	3.08	0.31**	0.13	0.11	0.16*	0.21**	0.15*	0.19*	−0.20*	0.22**	0.30**	0.35**	0.39**	0.19*	0.20*	0.47**	0.59**	0.71**								
V19 HPWPs ($t=2015$)	13.71	3.06	0.32**	0.11	0.09	0.17*	0.27**	0.16*	0.17*	−0.16*	0.15*	0.17*	0.23**	0.32**	0.35**	0.28***	0.40**	0.41**	0.60**	0.68**							
V20 HPWPs ($t=2017$)	13.96	3.03	0.33**	0.12	0.08	0.18*	0.38**	0.17*	0.03	−0.15*	0.14*	0.09	0.17*	0.23**	0.24**	0.32**	0.30**	0.33**	0.48**	0.55**	0.70**						
V21 ln (labour productivity) ($t=2007$)	8.32	1.02	0.27**	0.11	0.03	0.19*	0.23**	0.10	0.28**	−0.31**	0.25**	0.18*	0.16*	0.18*	0.17*	0.21**	0.32**	0.25**	0.19*	0.15*	0.02	0.01					
V22 ln (labour productivity) ($t=2009$)	8.35	1.15	0.28**	0.10	0.04	0.20*	0.25**	0.09	0.22**	−0.29**	0.19*	0.28**	0.17*	0.19*	0.18*	0.23**	0.29**	0.33**	0.16*	0.17*	0.05	0.04	0.92**				
V23 ln (labour productivity) ($t=2011$)	9.46	0.99	0.30**	0.08	0.03	0.23**	0.26**	0.04	0.20**	−0.26**	0.18*	0.24**	0.22**	0.21**	0.20**	0.25**	0.22**	0.25**	0.27**	0.26**	0.06	0.12	0.85**	0.87**			
V24 ln (labour productivity) ($t=2013$)	9.64	0.94	0.31**	0.04	0.05	0.24**	0.28*	0.11	021**	−0.24**	0.15	0.19*	0.21**	0.28**	0.24**	0.29**	0.21**	0.23**	0.22**	0.31**	0.23**	0.17*	0.75**	0.85**	0.86**		
25 ln (labour productivity) ($t=2015$)	9.79	0.93	0.32**	0.06	0.05	0.26**	0.30**	0.16*	0.21**	−0.23**	0.14	0.16*	0.19*	0.24**	0.25**	0.31**	0.17*	0.19*	0.15*	0.25**	0.32**	0.33**	0.70**	0.72**	0.76**	0.85**	
26 ln (labour productivity) ($t=2017$)	10.29	0.91	0.35**	0.03	0.05	029**	0.34**	0.17*	0.20**	−0.24**	0.11	0.15*	0.16*	0.17*	0.28**	0.33**	0.13*	0.12*	0.13*	0.20*	0.25**	0.41**	0.36**	0.39**	0.43**	0.73**	0.82**

Note 1: $n=284$.
Note 2: $^{*}p<0.01$; $^{**}p<0.001$ and (two-tailed t-tests).
Note 3: Note 1: Intercorrelations for the control variables are averaged over the period 2007–2017. The matrix for the non-averaged control variables is available upon request.

HPWPs*S-O to T3 productivity ($\beta = 0.061$, $p < 0.01$); T3 HPWPs*S-0 to T4 productivity ($\beta = 0.090$, $p < 0.001$); T4 HPWPs*S-0 to T5 productivity ($\beta = 0.147$, $p < 0.001$); and T5 HPWPs*S-0 to T6 productivity ($\beta = 0.241$, $p < 0.001$). The moderated paths from T1 productivity to T2 HPWPs*S-0 are: ($\beta = 0.039$, $p < 0.01$); T2 productivity to T3 HPWPs*S-0 ($\beta = 0.048$, $p < 0.01$); T3 productivity to T4 HPWPs*S-0 ($\beta = 0.069$, $p < 0.01$); T4 productivity to T5 HPWPs*S-0 ($\beta = 0.111$, $p < 0.001$); T5 productivity to T6 HPWPs*S-0 ($\beta = 0.176$, $p < 0.001$) are all positive and significant. The size of the path coefficients for smaller firms are consistently larger compared to that of medium sized firms (e.g. $\beta = 0.325$, $p < 0.001$ compared to $\beta = 0.188$, $p < 0.001$ in 2017). The interaction between the MD's S-O towards HPWPs at an earlier time point are positively associated with labour productivity when labour productivity at the earlier time point is controlled, and this is especially significant for small firms. None of the interaction effects for firm age are statistically significant. We therefore find support for hypotheses 3a and 3b but not hypothesis 3c.

We present results for nested model tests in Table 2. Four competing models were considered to evaluate causality between HPWPs and performance. We compared a stability model without cross-lagged effects (P1) (baseline stable model), a standard causal model with paths from earlier HPWS to later performance (P2) (forward causation), a reverse causal model with paths from earlier performance to later HPWS (P3), and a reciprocal causal model with paths from earlier HPWS to later performance and from earlier performance to later HPWS (P4). The, chi-square difference tests results were as follows: P1-P2 ($\Delta\chi^2$ = 71.123; $p < 0.001$); P1-P3 ($\Delta\chi^2$= 20.022; $p < 0.001$); P1–P4 ($\Delta\chi^2$ = 142.921; $p < 0.001$); and P3–P4 ($\Delta\chi^2 = 122.987$; $p < 0.001$). The largest difference in the chi-square tests occur in the comparison between a stable model without cross-lagged effect (P1) and the reciprocal causal model (P4), therefore, support is found for the reciprocal model. This is consistent with the results reported by Shin and Konrad (2017) utilising the same test method.

Comparison of cross-lagged to cross-sectional models

Following prior research (Huselid & Becker, 1996; Shin & Konrad, 2017), we tested the cross-sectional models to compare the size of the path coefficients to those generated by the cross-lagged model. Findings indicated that the effect of HPWS on productivity in the cross-sectional model (without controlling for previous performance) was ($\beta = 0.332$) at T1, ($\beta = 0.387$) at T2, ($\beta = 0.402$) at T3, ($\beta = 0.415$) at T4, ($\beta = 0.425$) at T5, and ($\beta = 0.445$) at T6 (all $p < 0.001$), compared with the consistently smaller effect size of ($\beta = 0.045$, $p < 0.01$); T2 HPWPs to T3 productivity ($\beta = 0.053$, $p < 0.01$); T3 HPWPs to T4 productivity ($\beta = 0.082$, $p < 0.001$);

T4 HPWPs to T5 productivity ($\beta = 0.134$, $p < 0.001$); and T5 HPWPs to T6 productivity ($\beta = 0.223$, $p < 0.001$) in the cross-lagged model. Consistent with Gollob and Reichardt (1991) and Shin and Konrad (2017), these comparisons demonstrate that effect size estimates are exaggerated in cross-sectional studies.

In addition, a lagged model without controlling for previous performance produced larger effect sizes of ($\beta = 0.329$) at T1, ($\beta = 0.372$) at T2, ($\beta = 0.398$) at T3, ($\beta = 0.406$) at T4, ($\beta = 0.419$) at T5, and ($\beta = 0.423$) at T6 (all $p < 0.001$), compared to the effects when previous performance is controlled. These results highlight the importance of estimating the HPWP-performance relationship longitudinally and controlling for previous performance.

Discussion

Drawing on the HRM, HPWPs and SME literatures, this study contributes to an enhanced understanding of the relationships between HPWPs and labour productivity in SMEs. Overall, we found: (a) a significant long-term positive relationship between HPWPs and firm labour productivity; (b) a significant positive long term relationship between productivity and investment in HPWPs; (c) differences in the strength of these relationships for small compared to medium sized firms; (d) no differences in these relationships based on firm age and (e) significant moderation effects of owner manager strategic orientation on both sets of the statistically significant relationships. Regarding the direct relationships our findings are relatively consistent with the small body of literature investigating forward and reverse causality in the context of SMEs (Kim et al. 2021; Sheehan 2014). They are also consistent with ERBT (Mueller,1996) which proposes an incremental contribution of HPWPs as they become integrated into the social architecture of the SME. Therefore, over time the return from investments in HPWPs also increases. We indeed found that the HPWPs-firm productivity relationship increased in magnitude over time as did the productivity –HPWPs relationship. Our findings therefore provide evidence of the importance of HPWPs in SMEs when it comes to achieving productivity gains and they pave the way for more empirical investigation of the role of HRM practices in enhancing productivity in these organisations.

Interestingly, we found a number of additional findings that significantly extend the knowledge base on HPWPs and firm productivity in SMEs. First, we found that the magnitude of the positive relationship between HPWPs and productivity is significantly greater for small firms than for medium sized firms. This finding brings greater nuance

Table 2. RI-CLPM equation modelling results testing the causal relationships between HPWPs and labour productivity and the moderating role of strategic orientation (S-O) of HRM.

	All SMEs (1)	Small firms (2)	Medium- sized Firms (3)	'Young' firms[1] (4)	'Older' Firms (5)
Productivity 2007→2009	0.773***	0.887***	0.752***	−0.123	0.138
Productivity 2009→2011	0.881***	0.905***	0.852***	−0.114	0.127
Productivity 20011→2013	0.892***	0.940***	0.866***	−0.125	0.125
Productivity 2013→2015	0.903***	0.941***	0.892***	−0.122	0.120
Productivity 2015→2017	0.922***	0.955***	0.900***	−0.113	0.118
HPWPs 2007→2009	0.853***	0.892***	0.836***	−0.121	0.125
HPWPs 2009→2011	0.827***	0.876***	0.819***	−0.122	0.123
HPWPs 20011→2013	0.893***	0.913***	0.865***	−0.122	0.112
HPWPs 2013→2015	0.902***	0.944***	0.869***	−0.123	0.116
HPWPs 2015→2017	0.925***	0.946***	0.884***	−0.024	0.014
HPWPs 2007→Productivity 2009	0.045**	0.183***	0.031**	−0.110	0.120
HPWPs 2009→Productivity 2011	0.053**	0.219***	0.044**	−0.111	0.123
HPWPs 2011→Productivity 2013	0.082***	0.231***	0.067***	0.102	0.122
HPWPs 2013→Productivity 2015	0.134***	0.301***	0.103***	0.112	0.125
HPWPs 2015→Productivity 2017	0.223***	0.317***	0.108***	0.109	0.122
Productivity 2007→HPWPs 2009	0.034**	0.118***	0.022*	−0.121	0.122
Productivity 2009→HPWPs 2011	0.043**	0.124***	0.033**	−0.111	0.123
Productivity 2011→HPWPs 2013	0.065**	0.152***	0.049**	−0.112	0.119
Productivity 2013→HPWPs 2015	0.102***	0.207***	0.077***	0.092	0.115
Productivity 2015→HPWPs 2017	0.171***	0.233***	0.105***	0.109	0.101
HPWPs 2007*S-0 2007	0.336***	0.553***	0.293***	0.111	0.102
HPWPs 2009 *S-0 2009	0.325***	0.500***	0.290***	0.113	0.100
HPWPs 2011 *S-0 2011	0.298***	0.422***	0.234***	0.110	0.109
HPWPs 2013 *S-0 2013	0.235***	0.419***	0.200***	0.107	0.110
HPWPs 2015 *S-0 2015	0.114**	0.389***	0.108**	0.105	0.107
HPWPs 2017 *S-0 2017	0.111**	0.376***	0.107**	0.102	0.105
HPWPs 2007*S-0 2007→Productivity 2009	0.056**	0.192***	0.049**	−0.100	0.102
HPWPs 2009*S-0 2009→Productivity 2011	0.061**	0.226***	0.050**	−0.102	0.101
HPWPs 2011 *S-0 2011 →Productivity 2013	0.090**	0.240***	0.071**	−0.103	0.092
HPWPs 2013 *S-0 2013 →Productivity 2015	0.147***	0.319***	0.130***	0.092	0.100
HPWPs 2015 *S-0 2015 →Productivity 2017	0.241***	0.325***	0.188***	0.098	0.103
Productivity 2007→ HPWPs 2009*S-0 2009	0.039**	0.125***	0.024**	−0.102	0.092
Productivity 2009→HPWPs 2011*S-O 2011	0.048**	0.133***	0.037**	−0.105	0.101
Productivity 2011→HPWPs 2013 *S-0 2013	0.069**	0.167***	0.052**	−0.109	0.103
Productivity 2013→HPWPs 2015 *S-0 2015	0.111***	0.239***	0.090***	0.092	0.102
Productivity 2015 →HPWPs 2017 *S-0 2017	0.176***	0.241***	0.122***	0.95	0.104

Note 1: 'Young firms' = 18 months – 8 years; 'older' firms = 9 years or more.
Note 2: $*p < 0.05$; $**p < 0.01$ and $***p < 0.001$ (two-tailed *t*-tests).
Note 3: Robust standard errors.
Note 4: Dummy variables were added for firms who switched between size and age bands during the duration of the study. None of these dummy variables were statistically significant.

to the HRM in SMEs literature which has tended to treat SMEs as a homogeneous category. Our findings show that while both small and medium firms benefited from investment in HPWPs over time the magnitude of the relationship was significantly greater for small firms. This finding is consistent with our hypotheses based on EBRT theory

Table 3. Fit statistics for nested causal models.

	χ^2	*df*	CFI	RMSEA	TLI	Comparison	$\Delta\ \chi^2$
P1. Stability	2182.3	165	0.933	0.068	0.909		
P2. Forward Causation	2111.2	161	0.932	0.069	0.910	P1-P2	71.123***
P3. Reverse	2162.3	162	0.961	0.071	0.910	P1-P3	20.022***
P4. Reciprocal	2039.4	159	0.972	0.072	0.912	P1-P4	142.921***
						P3-P4	122.987***

Note. Adapted from Shin and Konrad (2017, p. 986).

(Mueller, 1996) that small firms have greater potential to embed HPWPs into their organisational routines due to lower levels of complexity, more collaborative and team based approach and greater informality (Ulvenblad & Barth, 2021). We therefore suggest that future studies could benefit from this theoretical lens to explore the HPWPs-productivity relationship in these contexts. These findings represent an important contribution to the development of the field by highlighting the need to better capture differences between small and medium sized firms when it comes to embedding HPWPs to achieve organisational performance outcomes.

We also make a significant contribution to the contingent role of the owner-manager in the context of the HPWPs-firm productivity relationship. We found that over time the moderating effect of the owner-manager's strategic orientation towards HR becomes more significant for both the forward and reverse causal relationships. Specifically, the results suggest that owner-managers will assess the initial and continuing impact of investing in HR based on their strategic orientation and they will continue to do so supported by positive returns for their SME. Where owner-managers have positive perceptions of the strategic value of HR they will make more significant investments to enhance firm human capital through HPWPs. This result holds over a 10-year period. This is an important theoretical contribution to the SME literature because to date much of the literature has focused on direct and mediated relationships between HPWPs and firm productivity (e.g. Chadwick et al. 2013; Sheehan, 2014) but paid less attention to understanding the contingencies of this relationship. What is important in the context of our findings is that is it suggests that owner-managers make decisions to invest in HPWPs are based on cognitive reasons. The finding also supports the theorizing of ERBT theory concerning the importance of strategic intent to embedding HPWPs in SMEs and that it is necessary to view this process in an evolutionary manner. (Mueller, 1996).

Theoretically, the study provides insights into the feedback and adaptation principles of systems theory (von Bertalanffy, 1968) in the context of SMEs. This theory envisages a dynamic relationship between HPWPs and performance and it gives particular primacy to the feedback loop (Garavan et al. 2021a, 2021b). It also shed light on the adaptation

principle and the alignment of HR practice with dimensions of context. It demonstrates that sustained and strategic investment in HPWPs provides significant returns for SMEs, directly in relation to labour productivity and for a sub-sample of respondents firms, where data was available, for profitability.

Practical implications

The present study provides important practical implications concerning investments by SMEs in HPWPs. First, our findings point to the benefits of SMEs investing in HPWPs over time. However, SMEs will need to be patient and take a long-term perspective on investment in HPWPs. This may be challenging for SME who typically have short-term time horizon. Second, it is important to understand the central role of the owner-manager's strategic orientation towards HR. The owner-manager is a key decision maker in SMEs, therefore whether a SME starts to invest in HPWPs will be influenced by the strength of the owner manager's strategic orientation towards HR. We also find that this strategic orientation towards HR has a long-term effect and is sustained in the context of positive feedback loops about both HPWPs and productivity. These findings have important implications for how we develop the skills of owner-manager to ensure that they think strategically about HRM/HPWPs. Practical ways to measure returns to HPWPs and feedback loops (positive and negative) would also be valuable to MDs/OMs. Indeed, such strategic and long-term views, enhanced by data, are likely to be critical for SME survival post the Covid-19 pandemic.

Strengths, limitations and future research directions

The study should be considered in the light of its strengths and limitations. In terms of strengths we use an objective measure of organisational performance (OP) (labour productivity) and we collected data over a longer time period than found in most previous studies. In addition, we also measured OP over a time period when the effects of investment in HPWPs will become apparent or not.

In terms of limitations, first this study was conducted in the context of a balanced panel of SMEs. We found survival bias in favour of larger firms in the sample over the 2007, 2009 and 2011 survey periods and attritor bias in relation to firm size and age in 2007 and 2009. We therefore acknowledge that the results are likely to be biased toward 'larger' and 'older' SMEs.[7] Therefore, our results must be interpreted with the usual caution - especially in relation to generalisability

– common with longitudinal firm-level studies and in the context of SMEs. Future research should interrogate the unbalanced panel and compare and contrast various response bias and firm survival estimation techniques to provide enhanced insight the complex dynamics examined. Future research should examine whether our results are sensitive to distal and proximal measures of firm performance and how HPWPs are measured (e.g. dichotomous (yes/no) or scaled) and whether rising wage costs may damper the relationships reported. Moreover, a larger sample size is needed to interrogate the magnitude of the cross-lagged effects reported.

Second, additional contingent factors need to be considered to understand the impact of performance on HPWPs. SHRM proposes that the value of firm investments in HPWPs depend on business strategy (Arthur, 1992; Youndt et al., 1996). While the business strategy control variables of quality and cost were positively and negatively associated with labour productivity in all time periods, we did not find any significant moderating effects on either performance or HPWPs in the models we estimated. The relationship between strategy, HPWPs and performance, and especially potential feedback loops and how these may evolve over time merits further investigation. We find that labour costs become positive and statistically significant in the last two time periods ($p < 0.05$ in 2015 and 2017). These results suggest that improved performance outcomes arising from greater investment in HPWPs may be at the expense of an increase in unit labour costs, potentially cancelling out the benefits gained and needs further investigation (Cappelli & Neumark, 2001).[8]

Third, we did not examine the potentially critical role of HPWPs' implementation and its effectiveness (Guest & Bos-Nehles, 2013) nor did we measure the 'strength' of HPWPs, especially from the perspective of employees (Bowen & Ostroff, 2004). Fourth, we did not explicitly measure slack resources (Singh, 1986; Waddock & Graves, 1997). Fifth, it is critical that future research examines mediating mechanisms that contribute to the HPWPs-performance relationship found here, in particular, the role of employees' psychological contracts and the evolution of these contracts, in response to HPWS over time. Future research needs to build upon Bryson and White (2019) and Lai et al. (2017) in terms of the micro (employee-level) analysis of how employees in SMEs respond to higher levels of investment in HPWPs. Finally, and perhaps, most significantly, we do not test for reciprocal causality, which has been found to be of particular importance in analysing dynamic relationships, especially in the strategy literature (e.g. Antonakis et al., 2014; Hamilton and Nickerson (2003) and this is an important area for future research.

Conclusions

The long-term forward and reverse causal relationships between investment in HPWPs and SME productivity represents an important gap in the literature. In addition, the investigation of differences between small and medium sized firms and the role of other contingencies such as owner-manager characteristics is in their infancy. The findings and insights generated in this study theoretically enhance the literature in addition to having important implications for practice. Our findings are supportive of the literature on the value of HPWPs in SMEs, however they bring to the fore the key role of an important contingency that of the strategic orientation of the owner manager towards HR. Their cognitions regarding the value of HR strategically influence investments in these practices in the long term.

Data sharing policy

Shared, upon reasonable request.

Notes

1. No statistically significant differences in net sales, employment levels and firm age were found between the 26.8% of sample firms where significant change had occurred compared to the 73.2% of firms with no significant change over the duration of the study.
2. All adjusted and non-adjusted results are available from the first author, on request.
3. We are grateful to an anonymous reviewer for making this important suggestion of analysing the results by firm size and age.
4. 'Innovation strategy' was the excluded dummy variable in the estimations.
5. We acknowledge that SEM results are commonly presented in a Figure(s), but the complexity of this analysis – longitudinal, moderation and disaggregation (by firm size and age) – the results are presented in a Table. The results discussed in the text are highlighted.
6. Firm age – "young" and "older" is not statistically significantly associated with the relationships examined. We are grateful to an anonymous referee for recommending reporting this disaggregated analysis (i.e. firm size and age).
7. For a sub-set of firms ($n = 81$) we calculated accounting-based measures of performance (net profitability) utilising Companies House data and following Rauch and Hatak's (2016) meta level approach. The overall relationships between HPWPs and net profitability remained significant, but the strength of the relationships was stronger for labour productivity – thereby potentially reflecting the impact of rising wage costs, associated with the introduction of HPWPs. We are grateful for Reviewers highlighting these issues (measures of performance and rising wage costs) and we recognise this as a limitation and an important area for future research.
8. Sensitivity analysis on a subset of $n = 81$ firms, where net profitability could be calculated using Companies House data, found that net profitability was sustained – and indeed increased – over the tenure of the study. This suggests that rising

labour costs do not off-set enhanced productivity and profitability but given the small size of this sub-sample, generalisations should be avoided, and caution must be used, in relation to this sub-sample analysis.

Disclosure statement

No potential conflict of interest was reported by the authors.

Additional data quality checks on collected data

We conducted several additional tests to evaluate the quality of the data from that reported in the main text. Specifically, checks for autocorrelation, heteroscedasticity and measurement invariance (MI).

Autocorrelation

Reflecting the balanced panel characteristics of the data, whereby variables are measured at two-year intervals, several correlations met or exceed the recommended 0.85 threshold (Kline, 2005) (e.g. the correlation between labour productivity in 2013 and 2015 was the highest at 0.91). However, none of the correlations between our two key variables of interest – HPWPs and labour productivity – exceeded 0.33 – in any time period. We followed Stata's recommended coding method for calculating variance inflation factors (VIFs) for panel data and the subsequent VIFs for each regression ranged between 1.11 to 2.37 over all time periods.

Heteroscedasticity

We conducted a Breusch-Pagan test for heteroscedasticity in the control model and the results reveal that this was an issue for these estimates [X^2 (49) = 124.55, $p < 0.001$]. Therefore, we corrected this using heteroscedasticity-consistent robust standard errors (reflected in the estimations).

Measurement invariance (MI)

Given that responses to HPWPs were collected over six time periods, it is critical to test whether there is measurement invariance (MI). To test for MI, we used four measurement invariance tests in Mplus (see Van de Schoot et al., 2012): chi-square, metric invariance, invariant uniqueness, and invariant factor variance (see Table A1). The chi-square difference tests, CFI and ΔCFI (less than or equal to 0.01), RMSEA and TLI measures all support measurement invariance for the HPWPs measure. Measurement invariance for the HPWPs measure was, therefore, supported (Byrne & Stewart, 2006; Cheung & Rensvold, 2002; Shek & Ma, 2011).

Base model (control variable) results, 2007–2017

Feedback analysis

Given the theoretical underpinnings of our study – specifically open systems theory - we examined the feedback effect from productivity to HPWPs and *vice versa* by testing for 8 possible mediated relationships (Shin & Konrad, 2017, pp. 987–988). Specifically, analysing T2 productivity as a mediator linking T1 HPWPs and T3 HPWPs; T3 productivity as a mediator linking T2 HPWPs and T4 HPWPs; T4 productivity as a mediator linking T3 HPWPs and T5 HPWPs; T5 productivity as a mediator linking T4 HPWPs and T6 HPWPs (Preacher & Hayes, 2008). These tests were repeated using the appropriate HPWPs year as mediators.

Before testing the potential mediation effects, we checked whether productivity and HPWPs are time-dependent processes. The correlations (r) between the productivity and HPWPs measures are higher among adjacent time points than among distant points. For productivity the correlations were as follows: the association between T1 and T2 productivity ($r = 0.75$); T1 with T3 productivity ($r = 0.61$); T1 with T4 productivity ($r = 0.58$); T1 with T5 productivity ($r = 0.51$); and T1 with T6 productivity ($r = 0.46$) (all $p < 0.001$). For HPWPs the correlations were as follows: the association between T1 and T2 HPWPs ($r = 0.72$); T1 HPWPs with T3 HPWPs ($r = 0.58$); T1 with T4 HPWPs ($r = 0.47$); T1 with T5 HPWPs ($r = 0.40$); and T1 HPWPs with T6 HPWPs ($r = 0.30$) (all $p < 0.001$).

The existence of feedback was tested by mediation analysis, following the method adapted by Shin and Konrad (2017). Sobel tests showed the following: T2 productivity significantly mediated the association between T1 HPWPs and T3 HPWPs ($z = 2.933$, $p < 0.001$); T3 productivity significantly mediated the association between T2 HPWPs and T4 HPWPs ($z = 3.123$, $p < 0.001$); T4 productivity significantly mediated the association between T3 HPWPs and T5 HPWPs ($z = 3.467$, $p < 0.001$); T5 productivity significantly mediated the association between T4 HPWPs and T6 HPWPs ($z = 3.578$, $p < 0.001$).

Sobel tests showed that T2 HPWPs significantly mediated the association between T1 productivity and T3 productivity ($z = 3.672$, $p < 0.001$); T3 HPWPs significantly mediated the association between T2 productivity and T4 productivity ($z = 3.554$, $p < 0.001$); T4 HPWPs significantly mediated the association between T3 productivity and T5 productivity ($z = 3.652$, $p < 0.001$); T5 HPWPs significantly mediated the association between T4 productivity and T6 productivity ($z = 3.465$, $p < 0.001$).

We then bootstrapped the indirect effects of the potential mediators using the PROCESS regression-based macro (v3.1) (2018) ran in SPSS version 22 (see Hayes, 2013). Results of the bootstrapping for the individual mediators further support the Sobel tests at the bootstrapped 95 per cent confidence intervals for each of the indirect effects tested. The examination of the

specific indirect effects using 5,000 bootstrapping samples with both 95 per cent bias-corrected and bias-corrected-accelerated confidence intervals also provides support for both productivity and HPWPs as mediators since none of the 95 per cent CIs contain zero (see Table A4 (columns 1–5 for HPWPs and columns 6–10 for productivity)).

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Appendix A

Table A1. Individual HPWPs used by sample firms, 2007–2017.

HR Explanatory variables	2007	2009	2011	2013	2015	2017
A. Recruitment and selection						
a. Use of at least one of the following formal recruitment channels (Job Centre/employment service office; careers service; private employment agency)	0.537	0.542	0.596	0.645	0.678	0.728
b. Use of at least one of the following selection methods: formal application form; formal interview; work sample; test of job skills; assessment of job skills	0.878	0.882	0.935	0.955	0.962	0.987
RK 20 =	0.591	0.601	0.600	0.601	0.602	0.601
B. Performance appraisal						
a. Formal appraisal of majority of core employees at least annually	0.587	0.579	0.672	0.715	0.786	0.812
RK 20 =	0.562	0.562	0.0.563	0.563	0.564	0.564
C. Performance Based Compensation						
a. Any performance-linked pay (merit pay or payment by results)	0.356	0.341	0.402	0.517	0.563	0.619
b. Employee share ownership schemes	0.022	0.019	0.045	0.039	0.048	0.053
c. Profit-related pay	0.192	0.172	0.252	0.299	0.316	0.376
RK 20 =	0.765	0.766	0.765	0.767	0.767	0.768
D. Training and development						
a. Formal induction programme for new core employees	0.912	0.919	0.921	0.938	0.940	0.943
b. The majority of core employees received formal (off- the-job) training in the past 12 months	0.586	0.571	0.634	0.659	0.682	0.721
c. The majority of core employees received informal (on-the-job) training in the past 12 months	0.783	0.796	0.842	0.871	0.894	0.903
RK 20 =	0.802	0.800′	0.801	0.802	0.802	0.801
E. Employee voice, consultation and participation and information sharing						
a. Standalone non-union representative	0.078	0.071	0.062	0.060	0.055	0.053
b. Joint consultative committees or some type of structured consultation process	0.102	0.100	0.114	0.118	0.139	0.143
c. Employees are formally surveyed on a regular basis, at least annually, about issues timely to the organization	0.188	0.181	0.215	0.243	0.227	0.266
d. Regular information sharing (about investment plans, financial position and/or staffing plans)	0.267	0.235	0.223	0.239	0.246	0.251
RK 20 =	0.634	0.634	0.633	0.634	0.632	0.634
F. Strategic people management						
a. Job title denoting specialisation in employment relations/ human resources	0.055	0.072	0.078	0.092	0.107	0.115
b. Formal strategic plan	0.356	0.377	0.429	0.483	0.528	0.538
c. Employment relations issues covered in plan	0.315	0.334	0.412	0.433	0.472	0.491
d. Investor in People status/ Investors in People Community Interest Company	0.157	0.142	0.190	0.182	0.165	0.132
RK 20 =	0.653	0.653	0.653	0.654	0.653	0.653

Note 1: Respondents were asked: 'Please indicate whether the following practices cover 90 percent or more of the firm's employees'.
Note 2: KR20 is the Kuder Richardson reliability measure for dichotomous variables (0–1).

Table A2. Tests of measurement invariance.

	χ^2	*Df*	$\Delta\ \chi^2$	CFI	Δ CFI	RMSEA	TLI
Initial	1147.2	73		0.976		0.070	0.957
Metric invariance	1305.6	81	158.4***	0.971	0.005	0.072	0.951
Equal error variance	1427.9	99	122.3***	0.967	0.004	0.073	0.958
Invariant factor variance	1453.8	101	25.9*	0.966	0.000	0.070	0.955

Table A3. Control variables and labour productivity.

Control variables	2007	2009	2011	2013	2015	2017
V1 ln (Size)	0.182**	0.170**	0.123*	0.119*	0.125*	0.126*
	(0.08)	(0.08)	(0.06)	(0.06)	(0.06)	(0.06)
V2 ln (Age)	0.052	0.041	0.043	0.042	0.042	0.041
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
V3 Industry (services)	0.044	0.052	0.051	0.062	0.051	0.50
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)
V4 ln (Capital intensity)	0.221**	0.202**	0.165*	0.163*	0.160*	0.153*
	(0.10)	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)
V5 ln (R&D intensity)	0.084	0.095	0.132	0.163*	0.201**	0.220**
	(0.05)	(0.06)	(0.08)	(0.08)	(0.08)	(0.10)
V6 ln (LBR cost)	0.052	0.072	0.081	0.102	0.194*	0.196*
	(0.03)	(0.04)	(0.05)	(0.06)	(0.09)	(0.09)
V7 Quality-strategy	0.232***	0.212**	0.203**	0.213**	0.193*	0.190*
	(0.10)	(0.10)	(0.09)	(0.097)	(0.10)	(0.10)
V8 Cost-strategy	−0.253***	−0.247***	−0.191**	−0.183**	−0.152*	−0.142*
	(0.09)	(0.09)	(0.10)	(0.10)	(0.08)	(0.07)

Table A4. Intertemporal mediation effects of HPWPs & labour productivity.

Mediator (1)	Bootstrapped BC 95% CIs Lower (2)	Bootstrapped BC 95% CIs Upper (3)	Bootstrapped BCa 95% CIs Lower (4)	Bootstrapped BCa 95% CIs Upper (5)	Mediator (6)	Bootstrapped BC 95% CIs Lower (7)	Bootstrapped BC 95% CIs Upper (8)	Bootstrapped BCa 95% CIs Lower (9)	Bootstrapped BCa 95% CIs Upper (9)
T2 HPWPs	0.0346	0.1238	0.0355	0.1241	T2 Productivity	0.0267	0.1003	0.0271	0.1012
T3 HPWPs	0.0351	0.1295	0.0362	0.1306	T3 Productivity	0.0271	0.1014	0.0282	0.1019
T4 HPWPs	0.0369	0.1337	0.0374	0.1342	T4 Productivity	0.0281	0.1133	0.0292	0.1134
T5 HPWPs	0.0382	0.1466	0.0389	0.1496	T5 Productivity	0.0293	0.1142	0.0302	0.1146
Total	0.1448	0.5336	0.1480	0.5385	Total	0.1112	0.4292	0.1147	0.4311

Note: BC = bias corrected; BCa = bias corrected and accelerated; 5,000 bootstrap samples (see Preacher & Hayes, 2008).