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Exploring the performance implications of precarious work

Frank Wiengarten[1] | **Mark Pagell**[2] | **Christian F. Durach**[3] | **Paul Humphreys**[4]

[1]Universitat Ramon Llull, ESADE, Barcelona, Spain

[2]Smurfit Graduate School of Business, University College Dublin, Dublin, Ireland

[3]ESCP Business School, Berlin, Germany

[4]University of Ulster, Jordanstown, Northern Ireland, UK

Correspondence
Frank Wiengarten, Universitat Ramon Llull, ESADE, Barcelona, Spain.
Email: frank.wiengarten@esade.edu

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Abstract

Precarious work, or employment that is associated with temporary contracts, low earnings and limited or no employee representation, is on the rise. From an operations perspective, these practices should enable flexibility and reduce costs. However, from the perspective of most other social sciences, precarious work harms workers and should harm firm performance. The objective of this research is to provide a comprehensive analysis of the performance implications of precarious work. We collected survey data in the UK from multiple respondents (operations and human resource managers) along with secondary data to explore how the use of precarious work affects a company's financial, operational and occupational health & safety performance. The results were mixed. Precarious work did not have a significant influence on occupational health & safety performance and had a negative relationship with cost performance. We also established an inverted u-shaped relationship between precarious work and flexibility and financial performance; low levels of precarious work improve flexibility and financial performance and high levels of precarious work harm both. Finally, we explored if high-performance work practices could moderate these relationships, but the results were mostly insignificant. The results suggest that firms only benefit from relatively low levels of adoption of precarious work.

KEYWORDS

occupational health & safety, operational performance, precarious work, sustainability

1 | INTRODUCTION

Firms are adopting a number of nonstandard or precarious forms of operational work such as using temporary or contractual workers, with low remuneration and limited opportunities for employee participation. These types of contractual arrangements prevail in service and manufacturing industries alike (McKay et al., 2012) and they are steadily becoming more prevalent (Sperman, 2013; TUC, 2019). OECD research conducted in 26 European countries showed that over half of the jobs created between 2007 and 2013 were precarious. In the US, the percentage of precarious workers rose from 10.7% in 2005 to 17.2% in 2015 (Kalleberg & Vallas, 2018). Similarly, in the UK, the level of precarious work rose by more than 27% between 2011 and 2019,

with 1 in 10 UK workers in precarious employment in 2019 (TUC, 2019). These are trends that the Covid-19 pandemic amplified globally (Matilla-Santander et al., 2021). This work is precarious, because the uncertain working hours translate into volatility in earnings and irregular schedules that negatively affect workers and their families.

Anecdotally, adopting these forms of work will increase flexibility, reduce costs, and shift some risks from the firm to the workers (e.g., ILO, 2011). Empirical operations management (OM) research has also typically concluded that precarious forms of work reduce costs and increase flexibility and thus ultimately improve financial performance (e.g., Kesavan et al., 2014). However, research in other disciplines such as human resource management, industrial relations and sociology indicates that jobs with these precarious characteristics can harm workers. Precarity reduces their job performance, which should in turn harm organizational performance (Benavides et al., 2000; Fisher & Connelly, 2017; Quinlan et al., 2001). As a result, there is an ongoing debate as to the true costs and benefits of adopting precarious work.

This is a critical but complicated debate. The conclusions from the OM literature that these forms of work benefit the firm are mainly based on analytical models that do not consider how workers' job characteristics, well-being and job performance are affected. In contrast, most of the worker-focused literature on precariousness investigates job characteristics and worker outcomes, such as income insecurity and health, without empirically exploring if the adoption of these forms of work is actually benefiting the firm. The result is that the performance implications of precarious work have been operationalized in numerous ways, at different levels of analysis and from multiple perspectives.

The objective of this research is to provide a comprehensive analysis of the performance implications of precarious work by integrating the OM literature with research on precarious job characteristics. Thus, we analyze the costs and benefits of precarious work for firms, including the implications for occupational health and safety (OHS). Specifically, we pose the following research question: *How does the use of precarious work affect a company's operational, financial and occupational health & safety performance?*

High-performance work practices (HPWP) can help to develop and leverage human capital through increasing the workforce's knowledge, skills, and autonomy. Hence, HPWP may mitigate the harm to workers from adopting precarious work and/or explain why research on the performance impact of precarious work finds mixed results. This leads to our second research question: *Does the use of high-performance work practices moderate the relationship between precarious work and a company's operational, financial and occupational health & safety performance?*

To answer these questions, we collected data from manufacturing firms located in the UK. While precarious work has increased in all sectors (McKay et al., 2012), we focus on manufacturing for three reasons. First, the service sector is highly diverse and many "gig economy" (e.g., Kaine & Josserand, 2019) workers in services have some but not all attributes of being in precarious employment. For instance, while food delivery drivers and freelance consultants both typically work on temporary contracts, the consultant is not deemed to be in precarious employment because of their high remuneration. Second, permanent manufacturing jobs have long been the benchmark for good employment without necessitating higher-level education, hence the focus in economics on the loss of these jobs in the USA and Europe (e.g., Pierce & Schott, 2016). Finally, the role of an engaged operational workforce to create competitive advantage (e.g., Flynn et al., 1995; Fynes & Voss, 2001) has long been studied in manufacturing settings; situating this study in both that literature as well as the literature on flexible workforces (e.g., Kesavan et al., 2014).

We combine survey data from multiple manufacturing firm informants (operations and human resource managers) with secondary data on firm financial performance. Overall, our results are mixed, presenting sample opportunities for future work to explore the implications of precarious working conditions at the individual, company and societal level.

Specifically, we find an inverted u-shaped relationship between the adoption of precarious work and flexibility and financial performance in the guise of return on assets; low levels of precarious work improve flexibility and return on assets and high levels of precarious work harm both. The relationship between precarious work and cost performance is linear and negative; increased adoption of precarious work leads to a reduction in cost performance. Additionally, we find that adopting precarious work does not affect a company's occupational health & safety performance. Finally, companies can shift the turning point between precarious work and flexibility performance through implementing HPWP in the form of employee empowerment practices, but not through skill enhancement. Due to the small sample size and potential endogeneity concerns, these results need to be taken and interpreted carefully. Nevertheless, this study is one of the first that provides a comprehensive assessment of the performance implications of adopting precarious work in the OM domain and the mixed results suggest that firms only benefit from low levels of adoption of these practices.

2 | LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The implications of precarious work have been extensively debated and studied outside of the operations domain (for a review see Kreshpaj et al., 2020). Terminology varies across disciplines with precarious conditions also being deemed contingent employment and nonstandard work (Kreshpaj et al., 2020). However, terms like contingent and nonstandard can also be applied to work arrangements that are potentially insecure, but highly remunerated (e.g., being a self-employed IT consultant). Hence, most disciplines describe work as precarious, where nonstandard working arrangements place the workers and their families at risk. We do the same, both to engage in the wider discourse outside OM and to be clear that we are studying forms of work that a great deal of previous research has already concluded lead to ill health, stress and insecurity (Campbell & Price, 2016; Ojala & Pyiöriä, 2019).

Precarious work is conceptualized as a multidimensional construct that captures the job characteristics of employment insecurity, inadequate income, and a lack of rights and protections (Campbell & Price, 2016; Kreshpaj et al., 2020). These characteristics result in economic and social insecurities, physiological and psychological stress, and possibly harmful conditions (Berry & Bell, 2018; Fisher & Connelly, 2017).

Ojala and Pyiöriä (2019) distinguish between subjective (fears of labor market risk, poor employability prospects and previous unemployment) and objective (temporary contract, low earnings and low representation) features when discussing the implications of precarious work. Subjective features relate to individual-level research and job characteristics, while objective features are related to company-level research (Petriglieri et al., 2019). The OM literature has traditionally focused on nonstandard forms of work, such as temporary contracts, but has not tended to investigate precarious work in relation to inadequate income and a lack of rights and protections (Kuruvilla & Li, 2021; Ojala & Pyiöriä, 2019).

This research is conducted at the firm level of analysis. Hence, we operationalize precariousness through objective forms of work (fixed-term contract workers on either a full- or part-time basis, self-employed workers and zero-hour workers[1]), as well as objective characteristics of the job; specifically, low remuneration and low collective bargaining power (Campbell & Price, 2016; Kreshpaj et al., 2020; Ojala & Pyiöriä, 2019).

Precariousness is therefore operationalized as a multidimensional construct with workers who have permanent employment, are well paid and have collective bargaining power being the least precarious and workers who have temporary employment, are poorly paid and have no collective bargaining power being the most precarious. For simplicity and clarity, we will refer to the least precarious jobs as secure work while other arrangements will be referred to as precarious work.

We also explore worker safety as a dependent variable because safety links what matters to individual workers with firm performance. Occupational health & safety is both a characteristic of an individual's job that is related to precariousness and is increasingly seen as a measure of operational performance (e.g., Pagell et al., 2015).

2.1 | Performance implications of precarious work

The use of precarious work represents a sizable portion of all work arrangements (Eurofound, 2018). These work arrangements are widely expected to decrease costs and increase flexibility, which should ultimately benefit the organization. However, there have been few, if any, empirical studies of these claims that explore the full range of potential costs and benefits to using precarious work (Fisher & Connelly, 2017). Shortening product life cycles, increasing product variety, fluctuating demand and heightened requirements for product availability, have made volume and variety flexibility a source of competitive advantage (Zhang et al., 2003). By adopting precarious work, companies can maximize their flexibility and shift certain risks such as the cost of accidents and fluctuation in demand onto the workforce (ILO, 2011). In addition, these contractual arrangements allow companies to hire and fire workers as needed with limited impact on costs. This shifting of operational risks to the workers is extensively discussed in the press (e.g., The Guardian, 2020a, 2020b). As far back as 2002, Kratzer (2002) argued that such a power shift results in exploitation and precarious job characteristics. These potential negative implications of precarious work on workers' health and safety have received little, if any, attention in the OM discipline.

2.1.1 | Flexibility, cost and financial performance

Achieving flexibility through resource allocation/management and operational and supply chain design has been extensively explored in modeling, analytical and empirical studies (Aksin et al., 2007; Barz & Kolisch, 2014; Hopp et al., 2004). From an operations manager's perspective, an increase in the use of precarious forms of work, such as temporary employees, could

be valuable in that a flexible workforce can be viewed as an enabler on which other competitive capabilities are built (Hallgren & Olhager, 2009). For example, Jack and Raturi (2002) reported that workforce flexibility is a key source of volume flexibility, whereas other researchers pointed towards greater financial success through a reduction in operational expenses (Valverde et al., 2000). Precarious forms of work enhance a company's ability to manage fluctuations in demand (Bonet et al., 2013; Hallgren & Olhager, 2009; Jack & Raturi, 2002) and turn some fixed costs into variable costs, by providing a mechanism for companies to alter employee numbers and hours on-demand (Dudbridge, 2011; Valverde et al., 2000).

The evidence from the OM literature appears to align with practice; increasing the use of precarious workers is a cost-effective way to deal with uncertainty through flexibility. However, the OM literature generally does not examine how these forms of work might impact precarious and nonprecarious workers, from a strategic human resource perspective. Fisher and Connelly (2017) noted that when all costs and benefits are considered and employers look beyond immediate savings, precarious workers may represent a false economy. While direct labor costs are typically lowered, it is unclear if these initial cost reductions ultimately translate into savings once the overall productivity and all potential indirect costs are taken into account from a human capital (HC) perspective (Fisher & Connelly, 2017; Kalleberg et al., 2000).

HC presents an important organizational resource to generate value or improve performance (Riley et al., 2017). HC can be characterized as the "*stock of individuals' knowledge, skills, and abilities in an organisation to generate an 'ideal' composition of employees that creates value*" (Methot & Allen, 2018, p. 723). HC in the form of knowledge can lead to sustainable competitive advantage (e.g., Kogut & Zander, 1992). It has been repeatedly noted that an organization's knowledge and capabilities are predominantly situated in their HC (Mayer et al., 2012). For example, Hatch and Dyer (2004), identified that HC selection, development, and deployment improves performance. In addition, Crook et al.'s (2011) meta-analysis found strong positive links between HC and performance, especially operational performance.

Many authors note that there are differences between firm specific and general HC. Firm specific HC refers to knowledge, skills and abilities that are unique to a firm (Mayer et al., 2012). Investments in firm specific HC are tied to the firm and are expected to confer competitive advantage. The typical explanation for why firm specific HC creates competitive advantage is based on the resource-based theory, resting on the premise that truly unique skills and knowledge are developed over time, are context dependent, and are only valuable for a company if aligned with its strategy (e.g., Barney, 1986; Coff, 1997; Kor & Mahoney, 2005).

General HC refers to HC that all firms in an industry need or can leverage (e.g., Crook et al., 2011). Investments in general HC have typically been associated with benefits to the workers, but not their employer (e.g., Morris et al., 2017). Investing in general HC does not build firm specific skills or knowledge and from the resource-based theory perspective would not confer long-term competitive advantage. Lepak and Snell (1999) note that when workers have skills that are easy to acquire or can be easily replaced, firms will not have an incentive to invest in them. In other words, precarious workers hired to reduce costs or provide a response to uncertainty are unlikely to acquire firm specific skills. Investing in these workers would be investing in general HC. Hence, firms are unlikely to make investments in precarious workers since this would increase costs and only benefit the workers.

The adoption of precarious work should lower costs, increase flexibility and ultimately improve firm financial performance. However, it does not create firm specific HC (Riley et al., 2017) and firms will not have incentives to develop these workers. This fits the general patterns seen in practice, where the adoption of precarious work is seen as good for the firm, but harmful to workers. However, from the HC perspective, it seems short-sighted to solely consider the benefits of adopting precarious work, without considering the potential downsides.

Working arrangements are reciprocal relationships between the employer and the employees. Employees work for companies primarily for the exchange of monetary rewards and other commonly expected work related social benefits. Akerlof (1982), who viewed labor contracts partially as gift exchanges, highlighted the reciprocal nature of the relationship when he noted that wages are determined and influenced by workers' effort and that this is partially determined by wages (Akerlof, 1984). Fehr et al. (1998) built on the notion of gift exchange in labor markets and concluded that reciprocal behavior in the labor market is a stable phenomenon (Gino & Flynn, 2011). Reciprocity is critical because secure work is used to set the level of expectations for the entire workforce (both secure and precarious) in terms of monetary rewards and security, as well as fostering a sense of belonging among workers towards their organization. Precarious work does not match with these expectations and workers may not perform as expected since they are likely to adjust their behavior to reciprocate for poor wages and low levels of security (Fehr et al., 1998).

The OM literature does not link decisions to increase operational flexibility or decrease costs via various forms

of work to worker outcomes. However, related research from the OM discipline has concluded that workers who are at risk, stressed and unhealthy, and whose jobs have precarious characteristics, do not develop or contribute to the organization, thus reducing financial performance (Das et al., 2008; Longoni et al., 2013; Pagell et al., 2014; Pagell & Gobeli, 2009; Veltri et al., 2013). These conclusions align with studies in the organizational psychology and safety literature that have researched the "human costs" of jobs that can be characterized as precarious (Ashford et al., 2007; Kreiner et al., 2006; Petriglieri et al., 2019; Piccoli et al., 2017).

In addition, introducing or increasing the adoption of precarious work, not only affects the workers in these precarious jobs, but also the secure workers in the company (Eldor & Cappelli, 2020). According to Kuvaas et al. (2013), "*a 'blended workforce,' where standard and nonstandard workers work together, may negatively affect the attitudes and behaviors of the standard employees*" (p. 94). Low levels of adoption of precarious work, such as hiring a few extra temporary workers for a short-term seasonal demand spike, should not have an impact on how the secure workforce views and does their jobs. Thus, the performance outcomes from low levels of adoption of precarious work should primarily increase volume flexibility and reduce fixed costs, improving financial performance (Dudbridge, 2011; Valverde et al., 2000). However, as the level of adoption of precarious work increases, the likelihood for negative spillovers also increases (Davis-Blake et al., 2003). When the secure workforce notices that management's treatment of the precarious workers is solely transactional, they may fear for their own long-term place in the company. This may affect all workers, as even the secure workforce worries about their benefits or status within the company. The secure workers might be afraid that they will be treated similarly in the future, or even lose their job, as their role may also be turned into a precarious position. They may conclude that there is a general strategic change by management to not invest in HC anymore. In other words, the workers perceive that management has altered the terms of the reciprocal agreement and the secure workers respond in kind. This response or spillover effect is very similar to the arguments made against outsourcing or downsizing. Cost driven outsourcing decisions have been shown to reduce worker motivation and performance. A large-scale study by Maertz Jr. et al. (2010) identified that survivors of layoffs, or combinations of outsourcing and layoffs, have lower perceived organizational performance, lower job security, lower affective and calculative attachments to the organization, and higher turnover intentions than a no layoffs comparison group.

To summarize, the literature on various forms of work offers conflicting predictions on the outcomes from adopting precarious practices. On the one hand, precarious work should increase operational flexibility, decrease costs and improve financial performance. On the other, it may reduce worker commitment and motivation which decreases individual motivation and by extension, operational and firm performance.

We suggest that with an increase in the employment of precarious workers a stressful workplace environment is created that can have negative implications for the performance of the existing secure workforce. Adopting precarious work can bring initial gains in terms of cost savings and matching supply and demand more effectively. However, these need to be considered alongside the potential longer-term losses in performance, which are associated with not building or even destroying existing HC. The implication is that as the degree of precarious work increases, the performance of a firm is also likely to decrease (Lisi, 2013; Orellana et al., 2019). Subsequently, we propose that there is a diminishing marginal effect of adopting precarious work on cost, flexibility and financial performance, with an increasingly negative relationship past the turning point. Thus, at high levels of precariousness, we expect there to be a negative impact on a firm's cost, flexibility and financial performance.

> **H1(abc).** There is a diminishing effect of adopting precarious work on (a) cost, (b) flexibility and (c) financial performance, resulting in a negative relationship past the turning point (i.e., inverted u-shaped).

2.1.2 | Occupational health and safety

Adopting precarious work could have a strong negative impact on the workers' psychological and physiological well-being (Fisher & Connelly, 2017). The negative psychological implications of precarious work have been extensively discussed in the literature (e.g., Camerman et al., 2007; De Cuyper & De Witte, 2008; Kraimer et al., 2005; Nollen & Axel, 1996). Lewchuck (2017) identified that precarious workers were significantly more likely to report that their general and mental health was worse than those in secure employment. Ojala and Pyiöriä (2019) found that precarious employees had an increased risk of receiving a disability pension.

In a review of 57 longitudinal studies on the association between job insecurity and health and well-being, De Witte et al. (2016, p. 18) found "*clear evidence [for] exhaustion (burnout), [with regard to] general mental/*

psychological well-being, self-rated health, and a variety of somatic complaints" caused by job insecurity. In addition to negative psychological effects, evidence also exists for increased coronary heart disease (Ferrie et al., 2013), increased morbidity (Ferrie et al., 2001), as well as high blood pressure and body mass indices (Ferrie et al., 1998) amongst precarious workers. In sum, there is empirical evidence of the negative consequences of precarious work on workers' psychological well-being and health (Cheng & Chan, 2008; De Witte et al., 2016).

To our knowledge, the specific link between precarious work and safety has not been tested (Fisher & Connelly, 2017) and the literature provides conflicting suggestions as to its direction and strength. Thus, we add OHS performance as a dependent variable. Workers that take on precarious work tend to have less training and experience (Ojala & Pyiöriä, 2019) and accident rates are higher for employees with less job proficiency (e.g., Breslin & Smith, 2006). Furthermore, precarious workers often do repetitive and labor intensive tasks. Repetition leads to boredom and boredom can lead to mistakes, which could result in accidents and injuries (Loukidou et al., 2009). Thus, in addition to the pressure of being in a precarious situation, the specific working environment could negatively affect precarious workers (Danna & Griffin, 1999) in the guise of an increased risk of accidents. This suggests that increased adoption of precarious work should lead to a decrease in OHS performance.

On the other hand, simple repetitive tasks might not require much training or experience and thus the effect on accidents could be null. In addition, workers in precarious jobs are often only in specific jobs for a short period of time, which should reduce the likelihood of boredom leading to accidents. Finally, there is evidence that because precarious workers are in an atypical contractual relationship, they are less likely to report an accident (e.g., Probst et al., 2013), which further complicates this issue in that absent worker data results in the measure of OHS at the organizational level being attenuated.

Our conceptualization of OHS is at the organizational level, but the measure does provide an indication of the workers' perspective in that poor safety is experienced first and foremost by the workers who are put at risk or injured. Despite the counterarguments, given the established link between precarious work and ill health, and the potential links between precarious work and safety we propose:

> **H2.** Higher levels of adoption of precarious work have a negative impact on occupational health and safety performance.

2.2 | Precarious work and high-performance work practices

Strategic human resource management research has identified that HPWP such as formal training, empowerment or reduced status differentials between employees enhance workers' job satisfaction, trust in management, and organizational commitment (Macky & Boxall, 2007). Alvesson and Willmott (2002) argue that training and promotion are a significant source of an individual's identification with and commitment to an organization. Raineri (2017) identified that training and empowerment practices lead to the development of HC and result in higher employee commitment.

The link between HPWP and organizational outcomes is indirect. Way (2002) found that while HPWP reduce employee turnover they do not directly impact productivity. Kehoe and Wright (2013) also propose that HPWP do not directly affect firm performance. In line with Macky and Boxall (2007), they identified that the employees' perceptions of HPWP affects their commitment. HPWP would then directly increase commitment and motivation and it is through this process that HPWP indirectly impacts organizational performance.

However, traditional resource-based theory arguments surrounding HC suggest these practices would not have the same impact with precarious workers since this would, in essence, be an investment in general HC (e.g. Lepak & Snell, 1999), which only benefits the workers. HPWP are generally viewed to be on the opposite end of the continuum in comparison to precarious work, in terms of human resource management strategies (Martini et al., 2021).

HPWP can also be viewed as a set of practices that develops "underdeveloped" HC; in this case precarious workers. Connelly and Gallagher (2004) concluded that contingent workers respond positively when employers invest in them, in terms of attitude, behavior and performance. Kuvaas et al. (2013) investigated the implications of investing in or developing both precarious and secure employees. They identified that both groups reacted positively to investment on multiple dimensions such as work effort, work quality and organizational citizenship behavior. Furthermore, employee empowerment is particularly important for precarious workers as it provides the vulnerable workforce with a sense of value and belonging, that they would otherwise lack in comparison with the secure workforce (Kuvaas et al., 2013).

In addition, there is empirical evidence linking investments in general HC to performance (e.g., Riley et al., 2017), though a meta-analysis suggests the effect is smaller than investing in firm specific HC (Crook et al., 2011). Riley et al. (2017) suggest this occurs because

investments in general HC signal intent on the part of the firm, in turn acting as an incentive for workers to develop new skills and capabilities.

The typical depiction of investments in HC as being made by the firm overlooks a critical fact, the workers themselves decide if they are actually going to acquire new skills, knowledge and abilities. A firm can offer training; it cannot make workers learn and therefore needs to provide workers with an incentive to acquire new skills. Riley et al. (2017) note that investing in general HC can be viewed as a signal of the firm's commitment to the workers. In other words, even though training and empowering precarious workers seems at odds with minimizing costs and traditional resource-based theory perspectives of investing in general HC, it is possible that these investments send a strong signal of intent, to both the precarious and secure workforce; with this signal being equally or more important to the secure workers (Eldor & Cappelli, 2020). A firm that is increasing its use of precarious workers and is not investing in the workforce is signaling to the secure workers that they might also lose their status. Hence, neither the precarious or secure workforce will be motivated or committed. However, the use of HPWP, especially when the precarious workers are also involved, sends a different signal. Specifically, that the firm does care and is willing to invest in all of its people. From this perspective investing in general HC, via HPWP, likely increases the motivation and commitment of both the secure and precarious workforces, which then leads to improved performance.

While HPWP cover a wide range of practice bundles, the use of empowerment and formal training are the most well-established practices (Gardner et al., 2001; Subramony, 2009; Sun et al., 2007). Empowerment enhancing bundles "*boost employee autonomy and responsibility levels*" (Subramony, 2009, 745–746). Skill enhancement bundles are geared towards augmenting the knowledge and skill levels of the workforce (Sun et al., 2007). The former shapes individuals' commitment to the organization through engaging workers in organizational participation, while the latter impacts commitment by showing an appreciation for employees' work and the need for work performance (Gardner et al., 2001).

Based on the traditional view of investing in general HC, HPWP would not moderate the relationship between precarious work and performance. However, more recent work shows that these investments have positive implications for the motivation and commitment of both precarious (e.g., Kuvaas et al., 2013) and secure workers (e.g., Riley et al., 2017). We propose that managers can increase the level of precarious work that can be adopted, before experiencing the negative impacts of precarious work, by also embracing the empowerment and training components of HPWP. In other words, by adopting HPWP, companies can shift the turning point of the predicted curvilinear relationship between precarious work and cost, flexibility and financial performance to the right:

> **H3(a).** Empowerment and skill enhancement moderate the relationship between precarious work and performance, so that relatively higher levels of precarious work can be adopted before they negatively affect operational (cost and flexibility) and financial performance.

The predicted relationship between precarious work and OHS in H2 is linear, not curvilinear, Hence, we also predict:

> **H3(b).** Empowerment and skill enhancement moderate the relationship between precarious work and OHS performance.

Figure 1 graphically illustrates our hypotheses. Based on the underpinnings of human capital theory and previous work, we hypothesize that the relationship between precarious work and performance is curvilinear ($H1_{(a,b,c)}$). In terms of managing precarious work, we propose that companies can potentially shift the turning point of the curvilinear relationship between precarious work and performance to the right by adopting HPWP ($H3_{(a)}$). With regard to $H3_{(b)}$ we propose that empowerment and skill enhancement can reduce the potentially negative implications of precarious work on OHS performance.

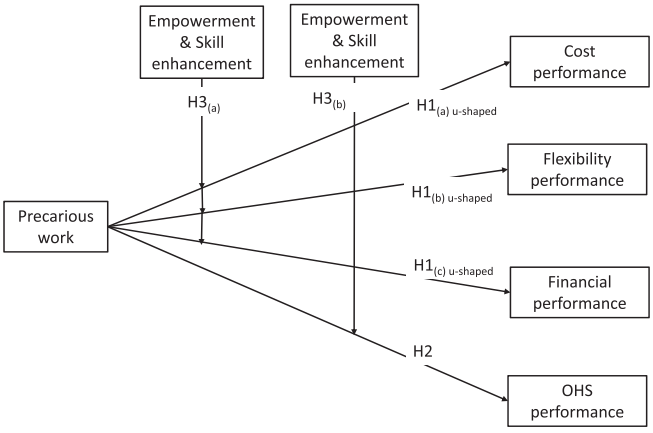

FIGURE 1 Research model

3 | METHOD

3.1 | Survey design, sample and data collection

Our primary method of data collection was through a survey administrated by a UK-based global market-research company to multiple respondents per firm. To increase objectivity and to allow triangulation of our findings we also collected data from secondary sources for control and dependent variables.

The population is all manufacturing firms (Standard Industrial Classification [SIC] 10-32) with primary trading addresses in the UK. The annual accounts of all UK-based companies (private and public) are available from the FAME[2] database. Firms listed therein were randomly contacted in 2017 to ask for their participation in this study. We obtained data from two informants per firm, along with publicly available secondary data on the number of employees, industrial classification, total assets, net income and cost of goods sold (COGS). To develop a secondary measure for occupational health & safety performance we followed Pagell et al. (2019) and collected data from the UK's Health & Safety Executive (HSE) database which is an open access data source[3] that lists health and safety-related information for all UK companies.

To establish our explanatory and moderating variables, we first randomly contacted firms from the population to solicit the participation of one of their human resource (HR) managers with senior decision-making authority (such as policy making and the hiring and firing of personnel). If the offered informant had no such senior decision-making authority, we asked for further referral or excluded the firm from the survey. We obtained 204 complete responses from the targeted group of HR managers. We took the referrals of these 204 HR managers to the person with responsibility for operations at their company, to retrieve information regarding cost and flexibility performance. Eventually, a total of 125 firms provided matched information from both HR and operations managers; of which 111 companies published the required data on FAME to calculate the secondary data control variables (see Table 1).

To assess whether this sample of 111 companies is representative of our population, key demographics between the sample of 111 firms and all 4914 manufacturing firms listed in the FAME database were compared for the financial year 2017. Potential differences in industry affiliation were checked by comparing the first digit of the UK 2007 SIC code ($\chi^2 = 10.792$; $p = .374$). Next, we compared the reported number of employees ($F = 0.221$, $p = .638$). We also compared the return on assets (ROA) for the 110 firms in the sample that reported their ROA ($F = 0.197$, $p = .586$). The homogeneity of variance assumption was not violated in the ANOVA tests ($p \geq .368$). We conclude that the sample is not significantly different from the population of UK-based manufacturing firms listed in FAME, mitigating selection bias concerns.

The purpose of the project was explained to all participants who were assured of the confidentiality of their responses, and that there were no right or wrong answers. Concerns over common method bias were largely alleviated due to two design approaches. First, information on the explanatory and dependent variables was retrieved from different informants (Podsakoff et al., 2003). The model to test H2 was the only exception. In this model, HR managers provided both the explanatory and dependent variables all of which were operationally defined (i.e., nonperceptual). Second, the measures of precarious work (i.e., temporary contracts, low earnings, employee representation) are nonperceptual (Chang et al., 2010).

3.2 | Measures

The HR respondents provided the responses to the items used to create the explanatory and moderating measures

TABLE 1 Sample demographics: Number of employees and SIC code

Number of employees 2017	Count	SIC	Count	SIC (cont.)	Count (cont.)
<10	1	10	9	24	3
11–50	42	11	2	25	12
51–250	61	13	2	26	8
251–500	5	14	1	27	5
>501	2	16	3	28	13
		17	4	29	8
		18	7	31	3
		20	10	32	12
		23	7	33	1

of precarious work, skill enhancing bundles, empowerment enhancing bundles and the occupational health & safety metrics of the firm's operational workers. The operations managers assessed our dependent variables of cost and flexibility performance. Please note, the operations managers also respond to the items that addressed precarious work. Their responses where used to check for endogeneity. The HR respondents' assessment of precarious work was used in the main analysis, given they likely knew the most about employees' contractual status. Appendix A depicts all of the survey measures. Secondary data from FAME was used to measure the firm's financial performance (ROA) and to calculate the control variables of dynamism, munificence, competitive intensity and firm size. Additional secondary data was collected from the UK HSE to triangulate our results regarding hypothesis two (OHS performance).

Precarious work was operationalized as an additive composite measure with three standardized and equally weighted dimensions (temporary contracts to proxy employment insecurity, low earnings to proxy inadequate income, and employee representation to proxy a lack of rights) based on Campbell and Price (2016), Ojala and Pyiöriä (2019) and Kreshpaj et al. (2020). While the literature agrees on the multidimensional nature of the construct; previous research has generally assessed precariousness from the standpoint of individual workers (e.g., Campbell & Price, 2016). Research at the firm level of analysis using managerial respondents to address all three dimensions of precarious work is lacking. While our research is generally of a confirmatory nature, the development of a composite measure for precarious work is one of the contributions of our research to the literature.

Respondents were asked to report average values on each of the precarious work dimensions for the preceding 12 months. Temporary contracts were assessed as the summed percentage of temporary workers, in terms of zero-hour contract workers, fixed-term workers, and self-employed workers relative to the firm's total employees (Chadwick & Flinchbaugh, 2016). Values of this standardized dimension range from −0.39 to 7.14. In line with prior literature, temporary workers supplied through a staffing agency were excluded from our proxy for employment insecurity as their contracts are with the agency (i.e., outsourced employment) and not the firm of interest (Chadwick & Flinchbaugh, 2016; Jokela, 2017; Petriglieri et al., 2019). Prior research operationalized low earnings as a binary variable, with workers whose pay was at or below a set threshold deemed as having low earnings (Kreshpaj et al., 2020). Therefore, we operationalize low earnings as a binary variable, with workers receiving the minimum wage (or below) deemed low earnings. Specifically, low earnings[4] were assessed as the weighted sum of binary variables for each employment category (permanent, fixed-term, zero hours, agency and self-employed), checking whether the majority of operational workers in the employment category are paid above the minimum wage and weighted for the employment category's representation in the firm's total employment. Values of this standardized dimension range from −1.97 to 3.99. Employee representation was measured as the share of permanent and fixed-term employees organized in trade-unions. We then weighted this share for the representation of permanent and fixed-term employees amongst the firm's total employees. This factor was then multiplied by −1, so that, in line with the other two dimensions, a higher score means less representation/more precarious employment among the operational workers. Values of this standardized dimension range from −4.52 to 0.41. It is important to note the values for temporary contracts, low earning, and employee representation fall outside the expected range of standardization (±3), as they are not normally distributed.

In summary, precarious work consists of three dimensions, each dimension was first standardized and then summed. As a result, a firm's precarious work score needs to be interpreted relative to the other firms in the sample. Figure 2a (cost performance) and Figure 2b (flexibility performance) highlight that precarious work is a multidimensional composite consisting of temporary contracts, earnings, and employee representation; a high degree of precarious work is a combination of a high share of temporary contracts, low earnings, and poor employee representation within a firm. In addition, the figure illustrates the distribution of precarious working practices across firms in our sample. For ease of interpretation, each datapoint was color-coded to indicate performance with respect to cost (Figure 2a) and flexibility (Figure 2b). Red coloring indicates best performance and cyan coloring indicates poorest performance.

Operational cost and *flexibility performance* were conceptualized using the measures reported in Ward and Duray (2000) and Wiengarten et al. (2014). All items were measured on a seven-point Likert scale and summed to assess the company's performance in relation to the firm's major competitors (Cronbach's α: cost performance $\alpha = .769$; flexibility performance $\alpha = .540$). The FAME database does not contain any readily accessible secondary measures for flexibility that incorporate the commonly considered dimensions of output volume, product mix, throughput time and new product introduction. Therefore, flexibility was only addressed using the survey measures.

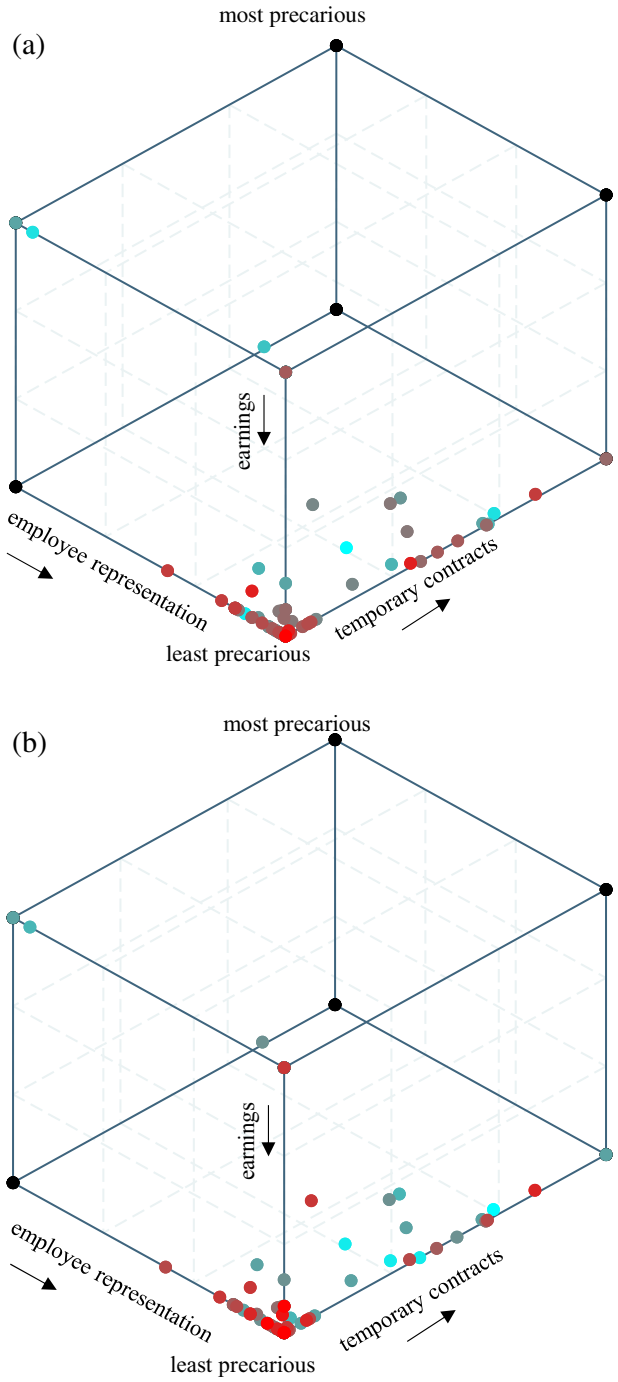

FIGURE 2 (a) Precarious work composites and sample spread ($N = 111$)—cost performance is represented by different colors, with red indicating best performance and cyan indicating poorest performance. Small colored circles within the cuboid indicate data points; small black circles on the edges span the surface of the cuboid, representing min and max values of the respective dimension. (b) Precarious work composites and sample spread ($N = 111$)—flexibility performance is represented by different colors, with red indicating best performance and cyan indicating poorest performance. Small colored circles within the cuboid indicate data points; small black circles on the edges span the surface of the cuboid, representing min and max values of the respective dimension

Financial performance was conceptualized through ROA which was calculated as a firm's operating income divided by total assets in the respective year (Eroglu & Hofer, 2014; Kovach et al., 2015). From an OM perspective ROA can be interpreted as a proxy for the profitability of a firm and the efficiency of asset utilization (Kovach et al., 2015). We obtained ROA data for the years 2014–2017 for 110 firms. No single extreme values were detected by visual inspection.

Occupational health and safety (OHS) was measured by two items reporting the number of occupational accidents and days of missed work resulting from occupational injury or illness amongst operational workers at the company in the last 12 months. The primary information on OHS was collected through the survey (additional secondary data was collected for triangulation purposes). Each item was weighted for the firm's total number of operational workers (Pagell et al., 2015) and standardized. The summed composite measure was multiplied by −1 so that lower values indicate worse OHS performance.

The *skill enhancing* measure was conceptualized through four items on a seven-point Likert scale measuring a company's efforts to augment the knowledge and skill levels of its workforce in terms of training programs (Sun et al., 2007). Responses were collected and weighted for the relative representation of each employment category (permanent worker, fixed-term worker, agency worker, self-employed, zero-hour contract) in the firm (Cronbach's $\alpha = .762$). The *empowerment* enhancing measure was also conceptualized through four items measuring a firm's practices to increase its employee's autonomy and responsibility levels (Subramony, 2009). Again, the responses were collected and weighted for each employment category relative to total employment (Cronbach's $\alpha = .850$).

We included multiple control variables to specify the relationship between precarious work and operational performance given other potentially important influences. For each firm we included the *number of manufacturing sites*, as all things being equal, more sites imply more complexity, which might affect company performance (Lu & Shang, 2017) and the need for flexible labor. *Firm size* was controlled for using the log transformed number of employees as reported in the FAME database in 2017. Firm size may be related to whether employees are organized in unions as well as to firm performance (Machin, 1991). Next, we included a dummy variable to indicate whether a firm is Investors In People (*IIP*) certified. IIP aims to help UK organizations improve the way they manage, develop and inspire their workforce, on the premise that focusing on skills training is crucial in achieving competitive advantage (Zadek, 1998).

IIP certification is held by over 14,000 organizations across 75 countries, with over 90% of these firms being in the UK (Waal, 2016). Being certified can boost organizational reputation and performance (Rose & Thomsen, 2004) and may be related to both the adoption of precarious work or the use of HPWP.

Finally, to account for industry level factors that might influence the use of precarious work or firm performance, we followed previous literature and included *competition*, *dynamism* and *munificence* (Dess & Beard, 1984). In industries which are more concentrated/have more competition we would expect more cost pressure and increased use of precarious workers while in industries which were munificent, we would expect the opposite. Dynamism would instead likely be related to the need for flexibility, with higher levels of dynamism being associated with increased flexibility needs and more precarious work. Competition was operationalized as the Herfindahl–Hirschman Index (HHI). The HHI is defined as the sum of the squares of the market shares of the firms within each industry sector in 2017 (we used UK 2007 four-digit SIC codes to define industry sectors). Increases in the HHI indicate a decrease in competition. Following Dess and Beard (1984), dynamism was operationalized by dividing the standard error of the regression slope coefficient of time against industry sector sales for the 5-year period (2013–2017) by the mean value of industry sales. Munificence was operationalized as industry sector sales growth over the 5-year period.

3.3 | Psychometric properties of multi-item scales

The psychometric properties for the moderating variables of empowerment and skill enhancing bundles were evaluated by conducting confirmatory factor analysis (CFA) for the items of these two constructs to test convergent validity using AMOS 25. Each item was assessed by HR managers for all employment categories (permanent, fixed-term, zero hours, agency and self-employed). We conducted the CFA on the responses for permanent employees, as every company in our sample employs permanent employees, while not every company employs the other categories of operational workers. The CFA failed the initial χ^2-test ($p = .017$). Thus, we conducted Bollen-Stine's nonparametric bootstrapping with 500 bootstrap samples using AMOS 25 (Bollen & Stine, 1992). Testing the null hypothesis that the model is correct, we obtained a p-value of .100. Given this test result, we felt more comfortable interpreting the obtained approximate fit indices (McIntosh, 2007): $\chi^2 = 36{,}680$; $\chi^2/\mathrm{df} = 1.981$; CFI = 0.954; GFI = 0.934; RMSEA = 0.094; SRMR = 0.0705; PClose = 0.063; IFI = 0.956. The indices indicate tolerable fit (Browne & Cudeck, 1992) given the sample size (Marsh et al., 1988), demonstrating some evidence of convergent validity.

We examined discriminant validity estimating the Heterotrait-Monotrait (HTMT) ratio for both constructs, as suggested in Henseler et al. (2014). The calculated score was 0.52 and thus well below the 0.85 cut-off, further supporting the assumption of unrelated construct measurements. In addition, the squared term of the correlation between the two constructs was lower than their average variance extracted (AVE). AVE was 0.593 for empowerment enhancing bundles and 0.679 for skill enhancing bundles. Given the relatively small variation in loadings we used Cronbach's α to assess reliability which was: $\alpha = .762$ for the empowerment enhancing bundles and $\alpha = .850$ for the skill enhancing bundles. Hence, we concluded that our moderation measures possess adequate reliability.

The obtained factor loadings were then used to create the two constructs across all employment categories of the firm. The assessment of the items per employment category was weighted relative to total employment.

Table 2 reports the means, min/max, standard deviations, and correlations of the studied variables in the sample firms. Correlations indicate that the ordinary least squares (OLS) assumption of no perfect collinearity is not violated.

Because the indicators of operational performance were responded to by the operations managers, and in line with prior literature that has treated the dimensions of operational performance as latent formative constructs (Ahmad & Schroeder, 2003; Samson & Terziovski, 1999), a separate CFA was conducted on the performance constructs of costs ($\alpha = .769$) and flexibility ($\alpha = .540$). The results, which are consistent with previous research using these indicators, are $\chi^2 = 22{,}318$; $\chi^2/\mathrm{df} = 1.313$; CFI = 0.975; GFI = 0.954; RMSEA = 0.0538; SRMR = 0.048; PClose = 0.422; IFI = 0.976; $p = .173$. However, the individual indicators for each dimension contain different content (see Appendix A). Thus, the indicators give rise to operational performance, as changes in the indicators will cause changes in the constructs. Therefore, each of the operational performance dimensions was constructed by summing their indicators.

4 | RESULTS

We conducted hierarchical regression and moderated hierarchical regression for each dependent variable, estimating our regression parameters by OLS. We used the heteroskedasticity-robust t-statistic, for all estimations to address concerns of heteroskedasticity of arbitrary and

TABLE 2 Descriptive statistics and correlations between the variables

		Mean	Min	Max	*SD*	1	2	3	4	5	6
1	Cost performance	4.86	2.75	7	0.86						
2	Flexibility Performance	5.36	3.5	7	0.81	0.573**					
3	Occupational Health & Safety	−0.001	−13.66	0.58	1.58	−0.001	0.137				
4	ROA 2017	0.08	−0.64	0.96	0.19	0.332**	0.214	−0.108			
5	Precarious work	−0.02	−5.22	11.29	2.05	−0.167	−0.022	0.071	−0.275*		
6	Empowerment	4.46	1.52	7	1.38	0.039	0.066	0.016	0.033	−0.006*	
7	Skill enhancement	5.10	1.15	7	1.41	0.198*	0.188*	−0.090	0.196	−0.045	0.495**
8	# of manufacturing sites	1.62	1	18	2.09	−0.035	−0.156	−0.009	−0.020	0.004	−0.104
9	Firm size	3.92	1.61	6.68	127.78	−0.048	−0.190*	−0.291**	−0.185	−0.277**	−0.060
10	Recognized for IIP	0.09	0	1	0.29	0.124	0.095	−0.196	−0.142	−0.141	0.166
11	HHI	0.09	0.01	0.45	0.09	0.095	0.030	0.050	−0.251*	−0.021	−0.072
12	Dynamism	0.05	0.00	0.40	0.07	−0.007	0.059	0.030	−0.202	0.092	0.018
13	Munificence	0.24	−0.73	2.86	0.44	0.176	0.102	0.025	0.077	−0.020	0.051
14	ROA 2016	0.06	−0.97	1.12	0.18	0.115	0.077	0.023	0.628**	−0.082	−0.030
15	ROA 2015	0.06	−1.29	1.19	0.19	0.220*	0.145	−0.014	0.791**	−0.136	−0.079
16	ROA 2014	0.05	−1.17	1.71	0.22	0.110	0.013	0.089	0.349**	−0.175	−0.113
		7	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	
8	# of manufacturing sites	0.009									
9	Firm size	0.009	0.154								
10	Recognized for IIP	0.189*	0.072	0.222*							
11	HHI	0.047	0.033	0.170	0.034						
12	Dynamism	0.027	0.056	0.059	0.164	0.460**					
13	Munificence	0.023	−0.048	−0.060	−0.048	0.331**	0.324**				
14	ROA 2016	0.082	0.043	−0.009	−0.025	−0.114	−0.076	−0.032			
15	ROA 2015	0.098	−0.016	−0.044	−0.108	−0.130	−0.124	0.008	0.646**		
16	ROA 2014	−0.019	0.138	0.001	−0.088	−0.042	0.005	0.066	0.241*	0.464**	

*Significance at .05 level.
**Significance at .01 level.

unknown forms. The average variance inflation factor (VIF) of the variables is 2.23. The maximum VIF is 4.51. Thus, increased variance of the estimated regression coefficients due to multicollinearity should not be a serious concern. We assessed the power of our models post-hoc to our estimations, using the G*Power 3.1 software. Based on the smallest effect size determined across the unrestricted regression models ($f^2 = 0.259$; f^2 was estimated by G*Power as a function of the *partial correlations* squared) our results indicated a power above 0.8.

4.1 | Effects of precarious work on performance

Tables 3–5 display the results of the regression analyses for cost, flexibility and financial performance ($H1_{(a,b,c)}$). Model 1 represents the restricted model and includes the control variables. We added the standardized term of precarious work into model 2 and its squared term into model 3. In model 4, we add the standardized moderators, before the interaction terms between the standardized moderators and the standardized linear terms of precarious work are added in model 5.

A significant negative effect could be determined between precarious work and cost performance ($\beta = -.088$, $t = -2.43$, model 2), however, the quadratic term was insignificant. In addition, the average marginal effects in model 5 were also insignificant at $p = .086$. Hence, instead of the curvilinear relationship predicted, we find a negative linear relationship indicating that as precarious work increases, cost performance decreases (i.e., costs increase). As a robustness check we developed an additional cost measure based on cost of goods sold

(COGS) with data collected from the FAME database. The estimates of interest when using this indicator of costs are nonsignificant (see Appendix B for more detail).

Next, the results show a positive effect of precarious work ($\beta = .106$, $t = 2.06$, model 5) and a negative effect of the quadratic term of precarious work ($\beta = -.025$, $t = -4.15$, model 5) on flexibility performance. This indicates a diminishing marginal effect of precarious work on flexibility performance. To further establish the suspected inverted u-shaped relationship between precarious work and flexibility performance, we followed Lind and Mehlum (2010). First, we found that the observed estimate for the quadratic term is significant and of the expected sign. Second, we estimated the turning point at 2.12 and found it to be located well within the data range of mean centered precarious work [−5.23; 11.29]. We then tested this condition by estimating the 95% Fieller interval for extreme points (Fieller, 1954). The interval was estimated at [−0.46; 3.00] with significant test results for the presence of an inverted u-shape ($p = .002$). To offer additional insight into how the estimated turning point relates to earnings, employee representation, and temporary contracts, we selected two companies from the sample that are closest to the identified turning point. See company IDs 1010110323 and 1010110405 in Appendix H, and their specific combinations of the dimensions of precarious work. For the two companies closest to the turning point, we observe that they both pay above the minimum wage with no workers in a

TABLE 3 Regression precarious work and cost performance ($N = 111$)

	Cost performance				
Variables	**Model 1** β **(SE)**	**Model 2** β **(SE)**	**Model 3** β **(SE)**	**Model 4** β **(SE)**	**Model 5** β **(SE)**
# of mfg. sites	−.010 (0.041)	−.008 (0.040)	−.011 (0.040)	−.016 (0.046)	.013 (0.040)
Firm size	−.048 (0.115)	−.120 (0.111)	−.102 (0.110)	−.093 (0.122)	−.119 (0.117)
Recognized for IIP	.475 (0.298)	.575* (0.269)	.597* (0.261)	.536* (0.258)	.589* (0.256)
HHI	.910 (1.017)	.935 (0.997)	1.040 (0.995)	.844 (0.986)	.836 (1.011)
Dynamism	−1.588 (1.405)	−1.266 (1.179)	−1.180 (1.175)	−1.083 (1.081)	−.975 (1.050)
Munificence	.365* (0.178)	.324* (0.162)	.312 (0.166)	.321* (0.160)	.301 (0.161)
Empowerment$^{\pm}$				−.066 (0.067)	−.067 (0.066)
Skill enhancement$^{\pm}$				.125 (0.081)	.122 (0.082)
Precarious work$^{\pm}$		−.088* (0.036)	−.052 (0.054)	−.045 (0.054)	−.012 (0.060)
Precarious work$^{\pm 2}$			−.006 (0.006)	−.007 (0.006)	−.013 (0.007)
Empowerment × precarious work					.054 (0.042)
Skill enhancement × precarious work					−.062 (0.061)
Intercept	4.959**	5. 243**	5.184**	5.172**	5.272**
R^2	0.066	0.105	0.112	0.139	0.153
ΔR^2	0.066	0.039*	0.007	0.027	0.014

Note: ±, mean-centered values.

*Significance at .05 level; values below .001 are shown as .001.

**Significance at .01 level; values below .001 are shown as .001.

TABLE 4 Regression precarious work and flexibility performance ($N = 111$)

	Flexibility performance				
Variables	**Model 1** β (*SE*)	**Model 2** β (*SE*)	**Model 3** β (*SE*)	**Model 4** β (*SE*)	**Model 5** β (*SE*)
# of mfg. sites	−.053 (0.049)	−.051 (0.049)	−.056 (0.049)	−.060 (0.054)	−.023 (0.042)
Firm size	−.182 (0.121)	−.216 (0.118)	−.183 (0.117)	−.173 (0.127)	−.228* (0.114)
Recognized for IIP	.357 (0.300)	.405 (0.292)	.446 (0.279)	.377 (0.275)	.488 (0.267)
HHI	.302 (1.000)	.314 (1.003)	.510 (0.969)	.334 (0.960)	.283 (0.966)
Dynamism	.366 (1.255)	.519 (1.148)	.681 (1.185)	.769 (1.085)	.996 (1.028)
Munificence	.103 (0.176)	.084 (0.170)	.060 (0.174)	.067 (0.163)	.026 (0.167)
Empowerment$^{\pm}$				−.055 (0.066)	−.057 (0.060)
Skill enhancement$^{\pm}$				.122* (0.060)	.115* (0.057)
Precarious work$^{\pm}$		−.042 (0.034)	.025 (0.051)	.034 (0.050)	.106* (0.051)
Precarious work$^{\pm 2}$			−.012* (0.006)	−.012* (0.006)	−.025** (0.006)
Empowerment × precarious work					.123** (0.038)
Skill enhancement × precarious work					−.134* (0.058)
Intercept	6.122**	6.257**	6.147**	6.131**	6.343**
R^2	0.078	0.088	0.117	0.146	0.223
ΔR^2	0.078	0.010	0.029*	0.029	0.077**

Note: ±, mean-centered values.

*Significance at .05 level; values below .001 are shown as .001.

**Significance at .01 level; values below .001 are shown as .001.

trade-union and have a turning point which is between 19 and 33% temporary workers.

Thus, we conclude that increasing precarious work has a larger effect on flexibility performance when starting with low values of precarious work than with higher values. Beyond the turning point, precarious work decreases flexibility performance.

We also conducted a robustness check for the functional form of the relationship between precarious work and flexibility. Following Haans et al. (2016), we included a cubic term of precarious work to test whether the relationship between precarious work and flexibility performance is perhaps S-shaped rather than inverted u-shaped. We find that the cubic term does not improve model fit. $R^2_{quadratic} = 0.223$; $R^2_{cubic} = 0.224$; change in $R^2 = 0.001$ ($p = .779$). This result provides additional support for the quadratic relationship.

These results provide support for $H1_{(b)}$ with respect to operational flexibility, but not with respect to cost performance ($H1_{(a)}$), which is linear and negative rather than curvilinear (Figure 3).

In $H1_{(c)}$ we explored the relationship between the adoption of precarious work and ROA, since ROA would capture the efficiency of the firm. ROA 2017 (the year of the survey data collection) and cost performance are correlated at 0.332 which suggests that they are capturing overlapping but not identical elements of being efficient.

The equation used to test ROA 2017 as the explained variable is identical to the flexibility and cost performance equations. In addition, we included lagged

TABLE 5 Regression precarious work and ROA 2017 ($N = 110$)

	ROA 2017				
Variables	**Model 1** β (*SE*)	**Model 2** β (*SE*)	**Model 3** β (*SE*)	**Model 4** β (*SE*)	**Model 5** β (*SE*)
ROA 2016	.303 (0.189)	.287 (0.184)	.287 (0.184)	.298 (0.186)	.289 (0.181)
ROA 2015	.519** (0.180)	.507** (0.178)	.507** (0.178)	.510** (0.178)	.525** (0.179)
ROA 2014	.129 (0.104)	.098 (0.091)	.098 (0.091)	.097 (0.092)	.080 (0.091)
# of mfg. sites	.003 (0.004)	.002 (0.003)	.002 (0.003)	.002 (0.003)	.002 (0.004)
Firm size	−.024 (0.014)	−.034* (0.013)	−.031* (0.014)	−.032 (0.014)	−.036** (0.013)
Recognized for IIP	.005 (0.034)	.007 (0.025)	.014 (0.022)	.015 (0.021)	.031 (0.023)
HHI	−.026 (0.077)	−.020 (0.073)	−.011 (0.067)	−.011 (0.066)	−.002 (0.069)
Dynamism	−.266 (0.213)	−.219 (0.154)	−.179 (0.122)	−.179 (0.125)	−.089 (0.095)
Munificence	.003 (0.023)	.001 (0.021)	−.006 (0.020)	.005 (0.020)	.004 (0.020)
Empowerment$^{\pm}$				.002 (0.009)	−.001 (0.008)
Skill enhancement $^{\pm}$				−.002 (0.009)	.002 (0.008)
Precarious work$^{\pm}$		−.016 (0.008)	−.010 (0.007)	−.010 (0.006)	−.009 (0.007)
Precarious work$^{\pm 2}$			−.002 (0.001)	−.002 (0.001)	−.003** (0.001)
Empowerment × precarious work					−.021 (0.008)
Skill enhancement × precarious work					−.012** (0.004)
Intercept	0.130*	0.171**	0.164**	0.165**	0.178**
R^2	0.624	0.658	0.668	0.668	0.710
ΔR^2	0.624**	0.034	0.010	0.000	0.042**

Note: ±, mean-centered values.

*Significance at .05 level; values below .001 are shown as .001.

**Significance at .01 level; values below .001 are shown as .001.

variables of ROA accounting for 2014–2016, the 3 years prior to the survey. In doing so, we can account for factors unobserved to us that affect ROA, helping to get a better estimate of the effect of precarious work on ROA in the same year. ROA data over four consecutive years could be obtained from 110 firms in the sample. The results are reported in Table 5.

With regard to model 5, the results support $H1_{(c)}$, indicating a negative effect of the quadratic term of precarious work ($\beta = -.003$, $t\text{-} = -2.84$) on ROA 2017. The turning point of the inverted u-shaped relationship is at precarious work equal to 0 and located within the data range of mean-centered precarious work [−5.23; 11.29] (see Figure 4). Yet the 95% Fieller interval for extreme points is [−12.18; 0.60] which does not allow us to reject the assumption of a monotone relationship ($p = .145$) between precarious work and a firm's same year ROA. Lastly, we also explored a potential lagged effect of

precarious work on ROA by using ROA 2018 data as the dependent variable with lagged values from 2014 to 2017 as controls. No significant relationship was discovered. We again selected companies from our sample that were close to the identified turning point, to offer insight on their combinations of earnings, employee representation, and temporary contracts. See company IDs 1010112265 and 1010110407 in Appendix H with mean-centered precarious work values close to 0. For the two companies closest to the turning point, we observe that they both pay above minimum wage with no workers in trade-unions, while both have 3% temporary workers.

Following Haans et al. (2016), we again included a cubic term of precarious work in model 5 to test for the presence of an S-shaped relationship with ROA. The cubic term did not improve model fit. $R^2_{quadratic} = 0.610$; $R^2_{cubic} = 0.711$; change in $R^2 = .001$ ($p = .418$).

Table 6 displays the results for occupational health & safety performance (H2). Model 1 represents the restricted model with controls. The standardized term of precarious work was added into model 2. H2 predicted linear effects so there are no squared terms in these models. Model 3 includes the standardized moderators, and model 4 the interaction effects. The results provide no support for H2.

In order to triangulate the results for H2, we also explored companies that received a notice or had been found in breach of the HSE's safety rules. Breaches are extremely rare; to be found in breach means the violation was considered serious enough for the HSE to pursue criminal prosecution of the firm and its management, and for the courts to have found the firm in breach. Prosecution is the least used of the HSE's tools (HSE, 2017). Notices, which are much more common, are divided into improvement and prohibition notices, with the latter being more severe. Companies issued an improvement notice have at least 21 days to make the changes required to be in compliance, while firms who are issued a prohibition notice must make improvements prior to reopening (HSE, 2017). In line with previous research which indicates that while accidents are relatively common, breaches and notices are rare (e.g., Pagell et al., 2019), only a small sub-set of firms in our sample were listed in the HSE database. Specifically, we identified four improvement notices (and no prohibition notices) and three breaches between 2014 and 2020 in our sample of firms. No firm received a notice or breached twice; seven firms in the sample had violated HSE regulations. Given the small subsample, we were limited in the analysis we could do and have to interpret the following with caution. Companies that received a notice or were found in breach had relatively higher levels of precarious work (mean value of 3.2) in comparison to companies that did not receive a notice or breached (mean value of −0.236) with a marginal level of significance at $p = .072$. These results suggest that our survey results may have been overly positive and that with a larger sample we could have observed the predicted negative relationship between precarious work and safety.

4.2 | Moderating effects of high-performance work practices

We next tested the potential moderating roles of empowerment and skill enhancement on operational and financial performance ($H3_{(a)}$), and on OHS performance ($H3_{(b)}$). The test of hypotheses $H3_{(a,b)}$, is presented in Tables 3–6.

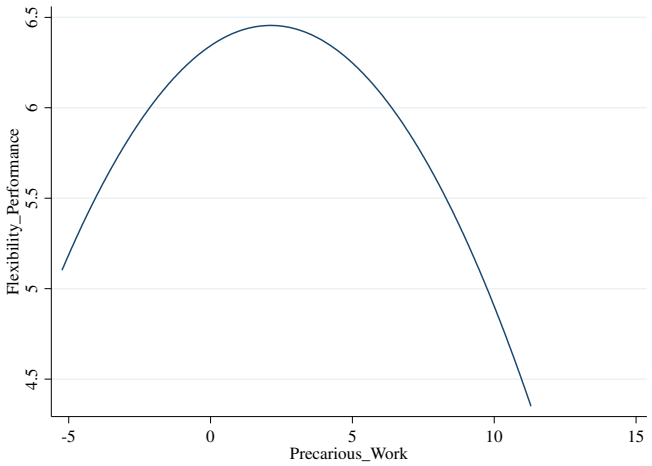

FIGURE 3 Estimated relationship between flexibility performance and precarious work

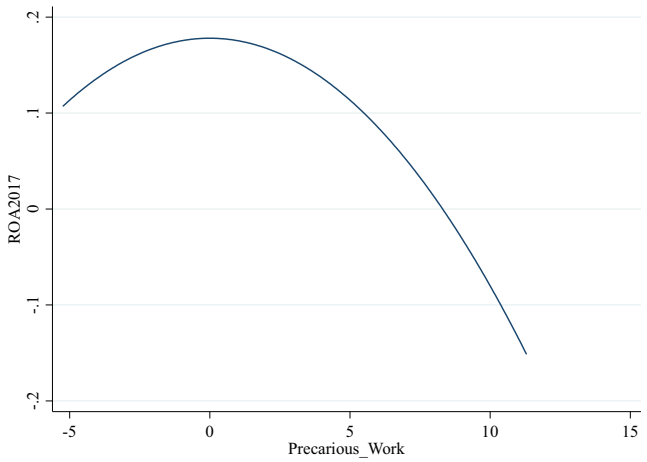

FIGURE 4 Estimated relationship between ROA and precarious work for 2017

TABLE 6 Regression precarious work and occupational health & safety ($N = 111$)

	Occupational health & safety performance			
Variables	**Model 1** β **(SE)**	**Model 2** β **(SE)**	**Model 3** β **(SE)**	**Model 4** β **(SE)**
# of mfg. sites	.032 (0.084)	.032 (0.084)	.042 (0.072)	.069 (0.071)
Firm size	−.614 (0.469)	−.614 (0.469)	−.618 (0.475)	−.655 (0.489)
Recognized for IIP	−1.006 (1.172)	−1.006 (1.172)	−.976 (1.148)	−.989 (1.149)
HHI	2.027 (2.106)	2.027 (2.105)	2.357 (2.012)	1.985 (1.832)
Dynamism	1.480 (2.016)	1.480 (2.157)	1.344 (2.212)	1.288 (2.171)
Munificence	−.300 (0.352)	−.300 (0.352)	−.325 (0.344)	−.305 (0.330)
Empowerment$^{\pm}$			.135 (0.158)	.136 (0.159)
Skill enhancement$^{\pm}$			−.155 (0.124)	−.155 (0.126)
Precarious work$^{\pm}$		−.003 (0.040)	−.001 (0.042)	−.001 (0.516)
Empowerment × precarious work				.093 (0.094)
Skill enhancement × precarious work				−.054 (0.072)
Intercept	2.488	2.477	2.456	2.600
R^2	0.130	0.1130	0.143	0.155
ΔR^2	0.130	0.000	0.013	0.012

Note: ±, mean-centered values.
*Significance at .05 level; values below .001 are shown as .001.
**Significance at .01 level; values below .001 are shown as .001.

We find no significant moderating effect of high-performance work practices on the relationship between precarious work and cost performance (Table 4). With regard to flexibility performance (Table 4), we find a significant interaction between both the linear term of precarious work and empowerment ($\beta = .123$, $t = 3.22$, model 5) and precarious work and skill enhancement ($\beta = -.134$ t-2.34, model 5). We conclude that for each value of the moderators a unique turning point exists. The obtained estimates indicate that the derivative of the equation in model 5 of flexibility performance, in terms of empowerment, is strictly greater than zero. This suggests that as empowerment increases, the turning point moves to the right (Figure 5). For skill enhancement, we find an opposing relationship, suggesting that as skill enhancement increases, the turning point moves to the left (Figure 6). The results provide support for $H3_{(a)}$ with respect to flexibility performance and empowerment and reject $H3_{(a)}$ with respect to skill enhancement.

Next, we find an analogous significant relationship between the interaction term of precarious work and skill enhancement on ROA 2017 ($\beta = -.013$ $t = -2.19$, Table 5, model 5) (Figure 7), with no effect regarding empowerment. Lastly, we find no significant interaction effect on OHS (Table 6).

Finally, given the small sample size and to aid future research on the subject, particularly with regards to functional forms, we graph the nonparametric relationships of our raw data using binned scatter plots in Appendix G (Starr & Goldfarb, 2020).

4.3 | Robustness checks on the precarious work composite

In our precarious work composite, we excluded employment via an agency in measuring the temporary work dimension since such employment may significantly

reduce job insecurity vis-à-vis other nonpermanent forms of employment (Bowman & Cole, 2014). However, given that agency workers made up the majority of all nonpermanent employees within our sample, for robustness, we re-estimated the key models using three different specifications of the composite and controls: (1) including agency workers in the temporary work dimension, as well as in the dimensions of wage and representation (Appendix E); 2) excluding agency workers from all three measures (temporary work, wages, and representation) (Appendix E); and (3) adding a control variable for the share of agency workers (Appendix F). We then compared the obtained estimates to what was estimated in the main analyses which excluded agency workers in the temporary work dimension, but included them in the dimension of wages and representation. The results remain qualitatively similar.

Because precarious work is a multidimensional construct, we also explored whether the use of this composite imposed overly strict constraints in our estimations (Edwards & Parry, 1993). The Edwards and Parry test is very similar to the assumption that if splitting up the dimensions explains more variance than the composite, it may be more reasonable to interpret the effect of each dimension individually. The differences in *R*-square values between the constrained and unconstrained equations using an *F*-test indicate no significant difference from zero, providing some support for the use of a composite. More details regarding the Edwards and Parry test are reported in Appendix C.

Additional insight might be found in exploring the individual effects of each precarious work dimension. Thus, we re-ran our models using the individual dimensions of precarious work (instead of the composite) in terms of low earnings, employee representation, and temporary contracts on performance. These results are reported in Appendix D. Based on the R-square values and significance levels, the individual dimensions explain a similar degree of variance in our data relative to the composite scores. Given that theory is clear on precarious work being a multidimensional construct, we feel the use of the composite results are most appropriate to discuss the implications of our results. We will, however, draw on some of the results for the individual dimensions to shed light on the nonsignificant and unexpected results.

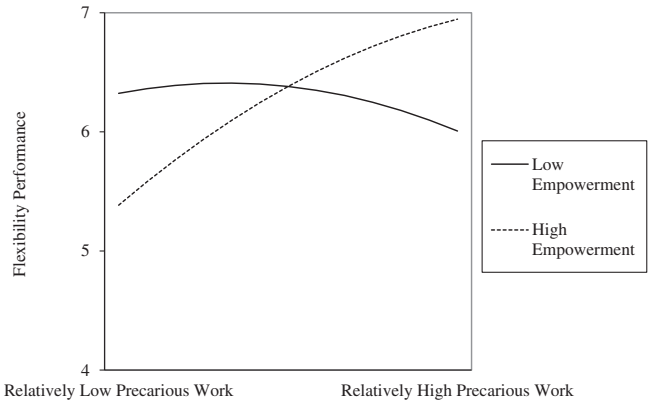

FIGURE 5 Two-way interaction effect between precarious work and empowerment-enhancing bundles

5 | ENDOGENEITY

Three mechanisms could cause endogeneity concerns in the present analysis. First, company performance and precarious work might be correlated because a common antecedent produces spurious correlation. For example, some industries may both use higher levels of precarious

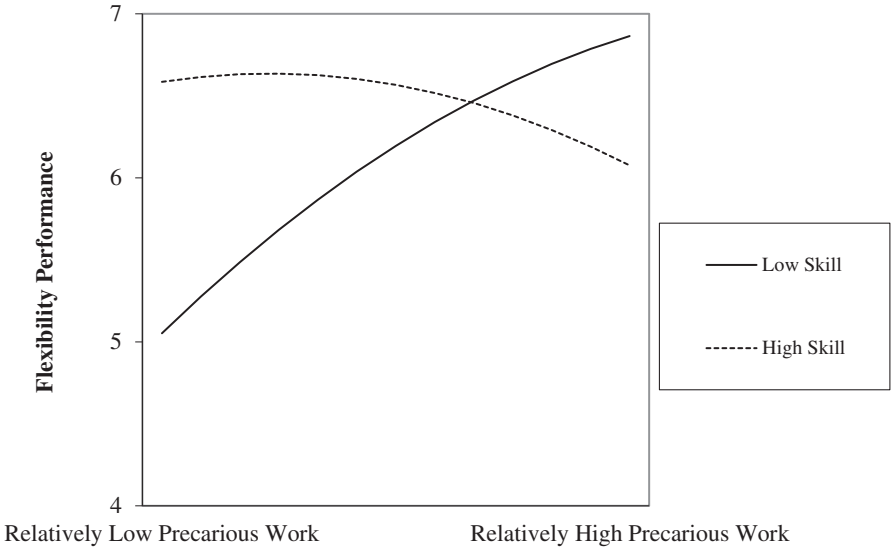

FIGURE 6 Two-way interaction effect between precarious work and skill-enhancement

work and show higher performance. More generally, precarious work might be correlated with unmodeled causes of performance creating omitted variable problems. For example, precarious work might depend on a firm's social sustainability focus (as expressed by its certification choice), which is also likely to have a direct effect on company performance. To partly address these concerns, we included several controls that are potentially correlated to both performance and precarious work. The literature suggests these controls are the most important. Hence, while one could certainly add additional controls, we were limited by the sample size. Second, precarious work and performance may have a reciprocal causal relationship (simultaneity). While we could not test for this, we believe that it is reasonable to assume that working arrangements are chosen in response to desired same-year performance outcomes and not vice versa. Third, to test for endogeneity that arises from measurement errors in precarious work—for example, through the use of survey measures and proxies—we used instrumental variable estimation (Lu et al., 2018).

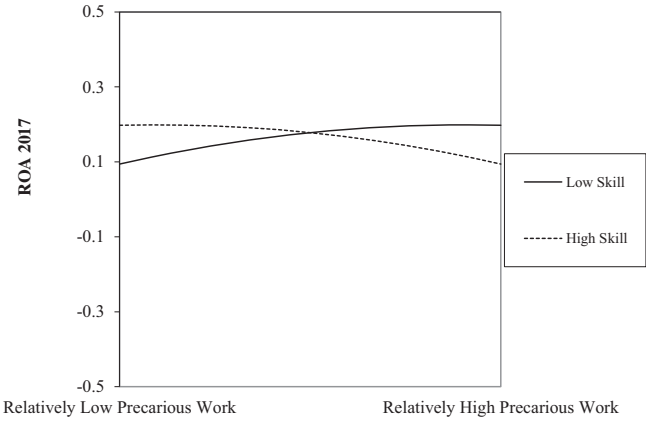

FIGURE 7 Two-way interaction effect between precarious work and skill-enhancement

Instrumental variable estimation required the identification of at least two instruments (Haans et al., 2016) that are uncorrelated with the disturbance term (instrument validity) and correlated with precarious work as well as with the quadratic term of precarious work (instrument relevance). Building on the idea of "model implied instrument variables," as proposed by Bollen (2018), we assessed our dataset to find potential candidate variables that are correlated with precarious work and uncorrelated with the equation's disturbance term. We found such a candidate in the assessment of precarious work made by operations managers. Our primary analysis uses the assessment of the HR managers who should be the best informants (e.g., Flynn et al., 2018). If we can assume that it is precarious work that affects operational performance, we can assume further that the observation of precarious work as obtained from the operations managers (precarious work*) is uncorrelated with the error term (Wooldridge, 2016). The same would hold for the squared term of precarious work*, which can be instrumented by (precarious work*)^2. Yet, for precarious work* to be a suitable candidate, we would also need to assume that measurement errors in both observations (HR and operations managers) are due to the different vantage points of the informants, and not due to cross-departmental biases

TABLE 7 Tests for endogeneity

Dependent variable	Test	Results	
Suspected endogenous variables: Precarious work and precarious work^2 as assessed by the human resource manager			
Instruments: Precarious work and precarious work*^{2} as assessed by the operations manager*			
Cost performance			
	Durbin–Wu–Hausman	$p = .427$	H_0 = The suspected endogenous variables are exogenous
	Davidson–MacKinnon	$p = .677$	
Flexibility performance			
	Durbin–Wu–Hausman	$p = .919$	H_0 = The suspected endogenous variables are exogenous
	Davidson–MacKinnon	$p = .654$	
Occupational health & safety performance			
	Durbin–Wu–Hausman	$p = .635$	H_0 = The suspected endogenous variables are exogenous
	Davidson–MacKinnon	$p = .471$	
ROA 2017			
	Durbin–Wu–Hausman	$p = .983$	H_0 = The suspected endogenous variables are exogenous
	Davidson–MacKinnon	$p = .875$	

regarding precarious work. To investigate this assumption further, we estimated the absolute deviations of both assessments within each firm and explored the correlation of this estimate with firm size. It seems reasonable to assume that HR and operations managers in smaller firms meet more often than in bigger firms, which may correlate their biases about precarious work. We tested this assumption by correlating firm size, average tenure of responding HR and operations managers as well as the number of production sites with the observed differences in assessments of precarious work and found no significant estimates ($p = .497–.903$). Hence, we find support for the assumption that both measurement errors are uncorrelated. These results provide some suggestive evidence for the validity of our instruments.

We next conducted multiple tests to explore whether our instruments are weak (Andrews et al., 2019). 2SLS estimators are biased towards the OLS estimator, and inferences based on the standard errors can be severely misleading if the proposed instruments are only weakly correlated with the endogenous regressors (Miller et al., 2020). Stock and Yogo (2005) suggest that the *F*-statistic for one endogenous variable, as is the case in our linear estimations, should exceed 10 to indicate a strong instrument. The test statistics in our estimations exceed 41.18. Cragg and Donald (1993) and Stock and Yogo (2005) both further suggest that the F-statistic for two instruments should exceed 11 for inferences based on the 2SLS estimator to be reliable. The test statistics in our quadratic estimations exceed 16.38. Additionally, accepting at most a rejection rate of 10% of a nominal 5% Wald test, we can reject the null hypothesis that the instruments are weak in our linear estimation, as the test statistic of 24.94 exceeds its critical value of 16.38. For our curvilinear estimations, the result is 16.38 and exceeds the critical value of 7.03.

As we found no evidence for weak instruments, we next used the respective instruments to conduct 2SLS estimations with the dependent variables. Post-estimation results on the tests for endogeneity of precarious work and its quadratic in the respective equations are reported in Table 7, separately for each dependent variable.

The Durbin–Wu–Hausman test for each equation indicates that precarious work is exogenous in all instances. To triangulate the Durbin–Wu–Hausman test, we also conduct the Davidson and MacKinnon (1993) augmented regression test. These test results further support the assumption of randomness in the measurement errors in precarious work and its quadratic term.

Based on the test results, we decided to apply OLS for estimating the parameters in our models (Antonakis, 2017). 2SLS estimation is generally less efficient than OLS when the explanatory variables are approximately exogenous, as 2SLS can have very large standard errors, because the standard error of beta is the square root of the estimated asymptotic variance (Wooldridge, 2016). Lastly, we were unable to retrieve strong and valid instruments for HPWP, which is a limitation of this study.

6 | DISCUSSION

The research set out to answer two broad questions. First: *How does the use of precarious work affect a company's operational, financial and occupational health & safety performance?* We identified an inverted u-shaped relationship between the adoption of precarious work and flexibility performance; low levels of precarious work improve flexibility performance and high levels of precarious work harm flexibility. The same relationship was found between precarious work and financial performance in the guise of ROA. The relationship between precarious work and operational cost performance appears to be negative and the relationship between precarious work and a company's OHS performance is non-significant. The results indicate that any benefits to the firm come at low levels of adoption of precarious working arrangements.

The second research question was: *Does the use of high-performance work practices moderate the relationship between precarious work and a company's operational, financial and occupational health & safety performance?* The results for cost and ROA are insignificant while the results for flexibility are mixed and suggest a complex relationship that needs further study. Specifically, for flexibility performance we find a significant interaction effect between both the linear term of precarious work and empowerment: as empowerment increases, the turning point moves to the right; as skill enhancement increases, the turning point moves to the left. The rightward shift for empowerment was predicted, but the leftward shift for skill enhancement was not.

The overall results suggest that precarious work only delivers the expected benefits to the firm when its adoption is at fairly low levels and that if HPWP have a role to play in mitigating the negative impacts of precarious work, this role is complicated and likely limited. The following sections detail these implications and explicate some of the questions that future research should address.

6.1 | Managerial implications

Adopting precarious work is expected to lead to increased flexibility, reduced costs and shifts some risks from the

firm to the workers (e.g., ILO, 2011; Kesavan et al., 2014). In the OM literature, the potential downsides from these working arrangements have generally not been explored and when they are considered it is typically from the firm's perspective. The only in depth empirical study in operations (Kesavan et al., 2014) was based on a service setting with multiple stores owned by a single retailer. Kesavan et al. (2014) conclude that there is a curvilinear relationship between performance and the adoption of part-time and temporary workers in this specific firm (our precarious work construct does not include part-time workers with a permanent contract). However, the authors generally view the adoption of precarious work as a "good thing" and their results indicate that in their specific service setting, the optimal levels of temporary and part-time workers are 13.48% and 44.03% respectively. A manager looking for guidance from the anecdotal, modeling and limited empirical evidence from OM would likely conclude that while there can be diminishing returns at very high levels of precarious work, precarious work is generally good for the firm.

The results suggest otherwise, we find that adopting precarious work is only beneficial in terms of flexibility to a certain extent. After a turning point precarious work harms flexibility performance. Having a small portion of the workforce in precarious jobs to increase flexibility would align with our results; but this proportion is limited, and the current practice of ever-increasing precarious workers would not align with this goal. The scores on the mean-centered composite measure range from −5.22 to 11.29 and the maximum flexibility performance (the turning point) in our study occurs when precarious work equals 2.12. Considering that this is a nonstandardized Likert scale, this is a relatively low value in terms of the optimal level of precariousness with regards to maximizing flexibility performance.

ROA is even more sensitive to higher degrees of precarious work than flexibility, with the maximum ROA performance occurring when the level of precarious work is 0. The effect of precarious work on ROA turns negative at relatively low levels of precarious work. The adoption of precarious work then seems to be mainly a false economy, with any savings in labor costs being likely lost elsewhere (Fisher & Connelly, 2017). The impact of precarious work on flexibility, cost and financial performance are important findings for managers whose present behavior indicates that they incorrectly expect the adoption of precarious work to be good for their firm.

The results from the moderation hypotheses raise more questions than they answer for operations managers with the intention to adopt these forms of work. However, previous research suggests a positive link between investing in HPWP and operational performance (e.g. Fynes & Voss, 2001; Longoni et al., 2013), as do the correlations between skill enhancement and both flexibility and cost performance in this research. In addition, recent research indicates that by investing in HPWP firms can reduce the negative implications of precarious work by signaling to both precarious and secure workers that they are valued and worth investing in Kuvaas et al. (2013) and Riley et al. (2017). In other words, these practices should still benefit the firm even if their role in mitigating the impact from adopting precarious work requires further study. Hence, we would not suggest firms already using these practices abandon them and we cautiously suggest they could still be of benefit for firms adopting precarious working arrangements.

Based on empirical work in multiple other disciplines that has provided a wealth of evidence that precarious work harms workers (e.g., De Witte et al., 2016; Ferrie et al., 2013; Ojala & Pyiöriä, 2019), more recent explorations of HC suggest that this ultimately could harm firm performance (e.g., Riley et al., 2017) and, on the basis of our results, we would recommend that the adoption of precarious work should be limited, at most. Going further we would suggest that managers might therefore refrain from adopting precarious working practices and instead consider more positive (from an employee perspective) ways to reduce costs or create flexibility. The automotive company BMW, for example, uses a practice called "*Arbeitszeitkonto*." This is a workload account, where employees can debit and credit up to 300 working hours (±) working hours (Focus Money Online, 2020). Thus, during slack periods, employees can take time off whereas, when there is a surge in demand (credited as extra hours), they may need to work overtime. In complex manufacturing processes such practices might be more beneficial in the long run than using precarious workers.

6.2 | Theoretical implications

Previous research is clear that firm specific HC is a source of competitive advantage (e.g., Crook et al., 2011). From the traditional HC perspective, precarious workers are considered general HC because they have skills that are easy to acquire or replace and that do not demand a wage premium. From this perspective, the adoption of precarious work may lower cost or increase flexibility, but the workers themselves are not a source of firm specific knowledge and by extension competitive advantage or disadvantage.

There is, however, an alternative perspective that links general HC to performance (e.g., Crook et al., 2011). In the context of precarious work, this

linkage would be explained by the commitment and motivation of both the precarious and secure workforces in their reciprocal relationship with the organization. Specifically, precarious workers will not perform as expected because they reciprocate for their poor wages and lack of security with low levels of commitment and motivation (Fehr et al., 1998). In addition, the adoption of precarious work has spillover effects on the secure workforce who view the adoption of precarious work as a signal that they too might be at future risk (Riley et al., 2017) in turn causing them to also reduce their commitment and motivation (Eldor & Cappelli, 2020; Riley et al., 2017). As a firm adopts more precarious workers both the precarious and secure workforce will reciprocate by reducing their motivation and commitment; in essence firm specific knowledge is not formed or even lost.

Our results are mostly in line with the alternative view of general HC. We find that anything beyond a low level of adoption of precarious work harms flexibility and financial performance and that any level of adoption harms cost performance. In other words, even if one assumes that precarious jobs can be designed via poka-yokes, and the like, to be pretty much fail safe and therefore that the precarious workers have no firm specific HC, we still see negative performance impacts from increased adoption. Our primary theoretical contribution is to provide evidence that general HC does play a role in competitive advantage and by extension disadvantage.

Our second theoretical contribution is to advance knowledge on the content and operationalization of the precarious work construct. The conceptualization and measurement of precarious work has always been difficult due to the multidimensional nature of the construct. In addition, previous research has generally addressed precariousness from the perspective of the worker. Hence, while there is previous research in management that has explored individual dimensions of precarious work at the firm level of analysis using managerial respondents (e.g., Chadwick & Flinchbaugh, 2016 explored part-time work), previous research using managerial respondents has not captured all three dimensions. Our results suggest that precarious work can be captured using managerial respondents and that the construct is indeed a composite.

7 | LIMITATIONS, FUTURE RESEARCH AND CONCLUSIONS

This research is an early attempt to bridge the divide between practice and (mainly analytical) operations management research which suggests precarious work is good for the firm, and the abundant evidence that suggests that precarious work harms workers, which should then have negative implications for employers. We combined a multiple respondent survey with secondary data to explore the research questions. By using separate HR and operations respondents we reduce potential problems with common method bias or respondent bias (Flynn et al., 2018). In addition, the secondary data provides additional insight and allowed us to triangulate the results for costs, OHS and ROA. Finally, the sample is a good representation of the population.

Previous research and HC theory allowed us to specify precise hypotheses with nonlinear and moderating effects, but the lack of developed measures of precarious work at the firm level makes the operationalization of this construct more exploratory. In addition, the sample is also relatively small and from a single sector in a single country. Hence, like many early studies that develop measures and link disciplines (e.g., Das et al., 2008), our study raises many questions for future research to answer.

Future research should explore these results in other contexts. For instance, future research should explore other forms of general HC, be they jobs such as accounting that have a high degree of general industry knowledge or investments in, for example, general education, which the worker could take with them to another employer if they left. Similarly, a single country study eliminated confounds that could have occurred with different regulatory regimes, but future research needs to explore if the results hold outside the UK. Finally, many of the recent discussions of precarious workers and gig economy workers have focused on service providers (e.g. Kesavan et al., 2014) and platforms (e.g., Kaine & Josserand, 2019), so future research needs to further explore the role of precarious workers in different contexts.

ROA, COGS and cost are all addressing different facets of efficiency and the constructs do share some variance (e.g., the correlation between cost and ROA is .332 and highly significant). However, the varying results based on the choice of efficiency measure also raise questions for future research. For instance, it is possible the results for the perceptual cost measure are due to operations managers perceiving the use of precarious workers as a sign of not being cost competitive. In other words, the use of precarious workers could be negatively impacting managers perceptions of cost competitiveness. It is also possible that the varying results for the different operationalizations of efficiency are because the balance sheet benefit of reduced wages is not recognized by operations managers who instead experience an increase in the amount of time spent monitoring and scheduling a

workforce that is not committed to the organization. To fully understand the flexibility, cost and financial performance implications of precarious work will then require future research to explore how adopting precarious work changes managerial roles. Equally, it will be necessary to explore how precarious work is captured in various operational and organizational performance metrics, because our results suggest that the choice of efficiency measure can change the results from adopting precarious work.

The operationalization of the precarious work construct will also need significant further development along at least two paths. First, the robustness checks suggest that the various dimensions of precarious work may not be equally impactful to the firm; with temporary contracts potentially impacting firm performance the most. These finding needs to be explored in future research with a much larger sample that can tease out these complexities. Second, future researchers will also need to explore if this conceptualization holds across industries and countries.

Our research design made an explicit trade-off in that in capturing the firm level of analysis, we lose the variance in how individuals experience their jobs and the outcomes of those experiences. Future research that captures both firm and worker perspectives simultaneously will be needed to more fully understand the precarious work construct as well as the impact of adopting precarious work on both worker and firm outcomes.

For instance, the inconsistent results for HPWP and the insignificant results for safety both deserve further exploration; especially since both could be a function of addressing precarious work using managerial respondents. Specifically, it is not clear if our mostly insignificant results regarding OHS and HPWP are because the theory is wrong, the sample is small, or because we collect data from managerial respondents not individual workers like most past research.

Addressing OHS adds to our research model, but we are missing the workers' perspective. We tried to mitigate this possibility by capturing the pressures of the working environment through secondary data on breaches and notices, but failed to get a sufficient sample size to come to reliable conclusions. However, the limited secondary data suggest that with a larger sample the predicted negative relationship between adopting precarious work and OHS might be seen; future research needs to explore this possibility. Future research should also explore if our results are mainly due to the underreporting of accidents by precarious workers (e.g., Probst et al., 2013). In addition, the results for OHS may also be because our measure of OHS performance assesses the potential physical implications of precarious work, but we do not capture psychological stress and strain; hence future research should explore if our results are because of differences in how we measured worker outcomes and how they have been addressed in previous research.

We face similar issues with the results surrounding HPWP. Given previous research on HPWP and the positive correlations between skill enhancement and both flexibility and cost performance, we would cautiously suggest that HPWP does deserve further study in the context of precarious work, even though our results are mainly insignificant. For instance, some percentage of workers may prefer this type of employment; hence, their experience and how the secure workforce responds to their presence is bound to be different. In addition, the workers' commitment and motivation are clearly unmeasured intervening variables in this study. Future research that directly measures how both precarious and secure workers respond to both increases in precarious work and the adoption of HPWP is needed. Similarly, we only measured objective characteristics of precarious work. However, it is likely that the more subjective characteristics are important when looking at worker motivation and commitment. For instance, it is possible that the influence of HPWP would be greater when workers themselves perceive their situation as precarious.

Previous research captures some or all of the above for individuals, at the expense of not exploring if precarious work was delivering the benefits firms expected. This research is an early attempt to explore the firm level outcomes. However, using only managerial respondents and secondary data could be a major reason for some of the results; especially those surrounding HPWP and OHS. Addressing the issues raised above requires future research that simultaneously explores precarious work's impact on both workers and firms. This will likely require future research to use designs that are multilevel or nested, to simultaneously collect either primary data from the workers themselves or secondary data on individual workers' performance at operational tasks and indicators of their wellbeing such as attendance, unplanned absences and the like.

Lastly, while we took all available precautions to address the potential confounding impact of endogeneity in our research and our analysis indicates that the variables are exogenous, we cannot rule out endogeneity entirely. The results should be interpreted carefully should endogeneity exist.

This research provides an exploration of what is a growing phenomenon, precarious work. Recent economic developments have resulted in an altered operational approach to contracting workers in a just-as-required mode. The switch from a full-time resource to a temporary on call resource has in many cases resulted in precarious working conditions, where the employers

seem to be reaping all the benefits. In this paper, we have investigated this phenomenon to explore if these benefits do really exist and if they impact on the OM domain. This paper is one of the first that introduces the growing societal practice of precarity into the OM domain.

We have identified that the assumed benefits of precarious work for the firm are at best overstated. At low levels of adoption, the expected improvements in flexibility and ROA are observed, though with an increase in costs. However, as the level of adoption increases, performance against these attributes diminishes. In addition, while the increased adoption of precarious work does not harm occupational health and safety, it also does not improve it. In conclusion, this suggests that the increase in these forms of work is not benefiting firms in the expected manner. Given the harm these forms of work cause to workers and society, this suggests that precariousness in the work environment is a somewhat misguided management trend.

ORCID

Frank Wiengarten https://orcid.org/0000-0003-3689-7254
Mark Pagell https://orcid.org/0000-0001-7053-6917
Christian F. Durach https://orcid.org/0000-0003-4818-0648

ENDNOTES

[1] The Advisory, Conciliation and Arbitration Service for businesses and employees in the UK states that zero hour contracts are employment contracts with no guaranteed hours. This means that employees are not guaranteed any work by their employers (and therefore no pay). Business leaders have supported the adoption of such contracts, since they provide a flexible labour market. Trade union groups have raised concerns about the potential exploitation of employees, as well as about how workers can adequately assert their employment rights (ACAS, 2020).

[2] https://www.bvdinfo.com/en-gb/our-products/data/national/fame.

[3] https://resources.hse.gov.uk/notices/default.asp.

[4] As indicated in Appendix A, we only included workers that were aged 25 years or over in order to exclude entry level or first-time workers such as students.

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APPENDIX A.: SURVEY QUESTIONS

Questions for HR managers
Number of manufacturing sites

At how many locations does your company have manufacturing sites?

Number of operational workers

Approximately, how many operational workers have worked at your company in the last 12 months?

Employment structure

Which of the following types of operational workers, if any, have worked at your company in the last 12 months?

1. Permanent workers on either a full or part-time basis
2. Fixed-term contract workers on either a full or part-time basis
3. Agency workers
4. Self-employed workers
5. Zero hour workers

Employees organized in trade-unions

What percentage of your company's permanent operational workers (i.e., full-time and part-time) are organized members in trade-unions?

What percentage of your company's fixed-term contract (i.e., full-time and part-time) operational workers are organized members in trade-unions?

Wage

For each of the following types of workers who are aged 25 and over that have worked at your company in the previous 12 months, **<insert types of works>**, are the majority paid above the legal minimum wage of £7.20? Firstly...

1. Permanent workers on either a full or part-time basis
2. Fixed-term contract workers on either a full or part-time basis
3. Agency workers
4. Self-employed workers
5. Zero hour workers

Investors in people standard

Does your company currently hold the following certification?

1. IIP (*If necessary – Investors in People Standard*)

Occupational health & safety

Thinking about all the occupational accidents amongst your **<INSERT # of operational workers>** operational workers at your company in the last 12 months, how many accidents occurred in that period?

Thinking about all the disabilities due to occupational injury or illness amongst your **<INSERT # of operational workers>** operational workers at your company in the last 12 months, how many days were spent due to this?

Empowerment enhancing bundles

Thinking about some specific practices, to what extent does your company allow or adopt to the following practices for each type of operational worker at your company, please answer using the following scale with 1 being not at all, 4 being to some extent and 7 being to a great extent, you can use any number in-between. Firstly...

	Permanent worker	Fixed-term worker	Agency worker	Self-employed	Zero-hour contract
Operational workers are involved in influencing work process/outcomes					
Self-managed or autonomous work groups					
Operational workers participation in decision making					
Systems to encourage feedback from our operational workers					

Please note, the following error terms were covaried: none.

Skill enhancing bundles

Thinking about skill enhancement amongst your workers, to what extent does your company practice the following initiatives for each type of operational worker at your company, please answer using the following scale with 1 being not at all, 4 being to some extent and 7 being to a great extent, you can use any number in-between. Firstly...

	Permanent worker	Fixed-term worker	Agency worker	Self-employed	Zero-hour contract
Extensive training programs are provided for our operational workers.					
Our operational workers will normally go through training programs every few years.					
There are formal training programs to teach our new operational workers the skills they need to perform their job.					
Formal training programs are offered to our operational workers in order to increase their opportunities to promotion in this facility.					

Please note, the following error terms were covaried: The error of item 4 was covaried with the errors of items 2 and 3.

Questions for operations managers

Operations managers also responded to the questions used to construct our precarious work measure: For such questions, please see questions for HR managers, regarding employment structure, employees organized in trade-unions, and wage.

Operational performance

For the following items, please rate your business' operational performance in comparison to your major competitors. On a scale of 1 to 7 (1 = far below competitors, 4 = on par, 7 far above competitors).

Cost performance

1. Direct manufacturing costs
2. Total product costs
3. Raw material costs
4. Labor unit costs

Please note, the following error terms were covaried: The errors of items 2 and 3.

Flexibility

1. Flexibility to change output volume
2. Flexibility to change product mix
3. Manufacturing throughput time
4. Number of new products introduced each year

Please note, the following error terms were covaried: The errors of items 7 and 8.

APPENDIX B.: SECONDARY DATA MEASURE FOR COST PERFORMANCE

We developed an alternative secondary measure for cost performance, which we call COGS performance. For this, we used a company's COGS divided by its same year sales and adjusted this measure by one-digit industry means (please note—the results are insensitive to whether we use one- or two-digit SIC codes). We then multiplied this measure by −1, so that a higher value indicates better COGS performance. One extreme maximum value was detected in the data. For consistency, we excluded the maximum and the minimum value before estimation. We note that cost performance and our measure of COGS

TABLE B1 Regression precarious work and COGS performance ($N = 91$)

	COGS performance 2017				
Variables	**Model 1** β (*SE*)	**Model 2** β (*SE*)	**Model 3** β (*SE*)	**Model 4** β (*SE*)	**Model 5** β (*SE*)
COGS performance 2016	.547** (0.195)	.548** (0.200)	.549** (0.105)	.566** (0.198)	.570** (0.199)
COGS performance 2015	.544* (0.2658)	.532* (0.259)	.523 (0.267)	.551 (0.291)	.539 (0.295)
COGS performance 2014	−.1171 (0.175)	−.162 (0.232)	−.157 (0.241)	−.193 (0.270)	−.174 (0.276)
# of mfg. sites	−.002 (0.002)	−.002 (0.002)	−.002 (0.002)	−.003 (0.002)	−.001 (0.002)
Firm size	−.005 (0.007)	−.007 (0.007)	−.007 (0.007)	−.007 (0.007)	−.010 (0.007)
Recognized for investors in people	−.001 (0.011)	.001 (0.012)	.002 (0.012)	.001 (0.014)	.008 (0.014)
HHI	−.030 (0.043)	−.032 (0.043)	−.037 (0.045)	−.028 (0.049)	−.038 (0.047)
Dynamism	−.098 (0.098)	−.1044 (0.100)	−.101 (0.100)	−.100 (0.103)	−.107 (0.106)
Munificence	.011 (0.013)	.012 (0.014)	.012 (0.015)	.011 (0.015)	.011 (0.016)
Empowerment$^{\pm}$				−.001 (0.006)	−.001 (0.006)
Skill enhancement$^{\pm}$				.004 (0.007)	.005 (0.007)
Precarious work$^{\pm}$		−.003 (0.002)	−.004 (0.003)	−.003 (0.004)	−.001 (0.004)
Precarious work$^{\pm 2}$			.001 (0.001)	.001 (0.001)	−.001 (0.001)
Empowerment × precarious work					.004 (0.003)
Skill enhancement × precarious work					−.006* (0.002)
Intercept	0.032	0.040	0.040	0.040	0.053
R^2	0.805	0.806	0.807	0.808	0.813
ΔR^2	0.805**	0.001	0.001	0.001	0.005*

Note: ±, mean-centered values.

*Significance at .05 level; values below .001 are shown as .001.

**Significance at .01 level; values below .001 are shown as .001.

performance are not significantly correlated (Table B1, $r = -.139$, $p = .256$). Results with respect to the estimates of interest are insignificant. For robustness, we included a cubic term of precarious work, yet we find that the cubic term does not significantly improve the model.

APPENDIX C.: IMPLICATIONS OF COMPOSITE IMPOSED CONSTRAINTS: IMPACT OF INDIVIDUAL DIMENSIONS OF PRECARIOUS WORK

Similar to the matter of difference scores, the use of (equally weighted) composite scores can suffer from some methodological problems (Edwards & Parry, 1993), as the dimensions are constrained to be equal in magnitude and sign. Subsequently, we followed the procedure suggested by Edwards and Parry (1993) that relaxes such constraints through the use of polynomial regression equation. The procedure considers the dimensions of the composite instead of the composite itself. It requires developing an unconstrained equation that includes all three dimensions separately as well as their squares and interaction products.

Table C2 below lists the estimates obtained from the constrained and unconstrained equations and compares R^2 values—please note, all control variables were included. We start by comparing the R^2 values of the constrained and unconstrained equations and find the R^2 values of the constraint equations predicting flexibility and occupational health & safety performance to be higher than the R^2 values obtained by the unconstrained equations. Yet, the R^2 of the unconstrained cost performance equations appears to be higher than for the constrained equation. We then conducted an F-test to test for the significance in R^2 differences, with nonsignificant results for cost performance. Next, given that some of the insignificant estimates of the linear terms point into different directions, we tested whether the differences between such estimates are significant. None of these differences were significantly different from zero at $p > .30$. These findings are corroborated by the insignificance of all linear predictor variables and their higher-order terms, with the exception of the interaction term of low earnings and employee representation predicting cost performance. Given these results, we conclude that the overall constraints imposed by the linear and squared composite score of precarious work represents the individual dimensions reasonably well.

TABLE C2 Results of constrained and unconstrained equations

Outcome performance variables	Constrained equation			Unconstrained equation										Differences in R^2s and between constraint and unconstraint equation
	(TC + LE − ER)	(TC + LE − ER)^2	R^2	TC	LE	ER	TC^2	LE^2	ER^2	TC × LE	TC × ER	LE × ER	R^2	
Flexibility	0.048	−0.012*	0.148	0.051	−0.177	−0.186	0.013	0.067	0.058	−0.081	0.320	−0.125	0.130	−0.018
	(0.050)	(0.006)		(0.211)	(0.537)	(.358)	(0.084)	(0.117)	(0.085)	(0.107)	(0.954)	(0.091)		
Cost	−0.050	−0.006	0.154	0.045	−0.567	−0.072	0.057	0.058	−0.037	−0.168	−0.564	−0.195*	0.169	0.015
	(0.053)	(0.006)		(0.245)	(0.507)	(0.351)	(0.096)	(0.127)	(0.078)	(0.118)	(0.922)	(0.95)		
OHS	0.041		0.118	−0.112	0.184	−0.067							0.124	0.006
	(0.044)			(0.159)	(0.128)	(0.206)								

Note: The four columns labeled "unconstrained equation" are standardized regression coefficients with all predictors entered simultaneously. Both equations included control variables but are reported without control variables.

Abbreviations: ER, employee representation; LE, low earnings; TC, temporary contracts.

Note: ±, mean-centered values.

*Significance at .05 level; values below .001 are shown as .001.

APPENDIX D.: RESULTS OBTAINED FOR THE INDIVIDUAL COMPOSITES OF PRECARIOUS WORK

Table D3

TABLE D3 Regressions individual composites of precarious work and performance measures

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
ROA 2016				.351* (0.158)
ROA 2015				.435* (0.182)
ROA 2014				.113 (0.107)
# of mfg. sites	−.006 (0.028)	−.0218 (0.043)	.163 (0.091)	.003 (0.005)
Firm size	−.089 (0.112)	−.104 (0.100)	−.305* (0.140)	−.024 (0.013)
Recognized for investors in people	.586* (0.276)	.538 (0.306)	−.553 (0.592)	.018 (0.026)
HHI	.939 (1.025)	−.581 (1.179)	.285 (1.430)	−.008 (0.077)
Dynamism	−1.402 (1.199)	.693 (1.121)	.111 (1.427)	−.139 (0.112)
Munificence	.327* (0.163)	.152 (0.165)	−.034 (0.264)	−.009 (0.019)
Empowerment$^{\pm}$		−.085 (0.065)	.001 (0.180)	−.006 (0.010)
Skill enhancement$^{\pm}$		.148* (0.068)	−.059 (0.129)	.006 (0.009)
Temporary contracts	−.034 (0.084)	−.362 (0.189)	.185 (0.169)	.005 (0.023)
Low earnings	−.193 (0.101)	−.394 (0.518)	.238 (0.192)	−.163 (0.098)
Employee representation	−.009 (0.009)	.247 (0.188)	−.293 (0.297)	−.005 (0.024)
Temporary contracts^2		−.086* (0.034)		−.010* (0.004)
Low earnings^2		.121 (0.154)		−.043 (0.028)
Employee representation^2		−.011 (0.053)		−.001 (0.007)
Empowerment × temporary contracts		−.035 (0.119)	−.837 (0.470)	.002 (0.014)
Empowerment × low earnings		.035 (0.119)	.172 (0.144)	−.002 (0.012)
Empowerment × employee representation		−.225* (0.069)	−.591* (0.294)	−.012 (0.009)

(Continues)

TABLE D3 (Continued)

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
Skill enhancement × temporary contracts		−.132 (0.098)	.034 (0.202)	−.002 (0.015)
Skill enhancement × low earnings		−.030 (0.045)	−.022 (0.070)	−.015 (0.008)
Skill enhancement × employee representation		.247* (0.092)	.272 (0.222)	.004 (0.011)
Intercept	5.053**	5.697**	0.925*	0.080**
R^2	0.121	0.247	0.351	0.702

Note: ±, mean-centered values.
*Significance at .05 level; values below .001 are shown as .001.
**Significance at .01 level; values below .001 are shown as .001.

APPENDIX E.: RESULTS OBTAINED FOR THE COMPOSITES OF PRECARIOUS WORK WITH AND WITHOUT AGENCY WORKERS IN ITS OPERATIONALIZATION

Tables E4 and E5

TABLE E4 Regressions precarious work and performance measures with agency workers in the operationalization of each dimension and moderators

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
ROA 2016				.295 (0.172)
ROA 2015				.514** (0.175)
ROA 2014				.095 (0.092)
# of mfg. sites	−.008 (0.037)	−.019 (0.046)	.071 (0.072)	.003 (0.004)
Firm size	−.104 (0.111)	−.245* (0.106)	−.679 (0.490)	−.037** (0.012)
Recognized for investors in people	.548 (0.269)	.478 (0.266)	−.918 (1.141)	.033 (0.023)
HHI	1.018 (0.994)	.552 (0.961)	2.347 (1.916)	−.001 (0.066)
Dynamism	−1.395 (1.231)	.901 (1.104)	1.305 (2.098)	−.120 (0.104)
Munificence	.325* (0.164)	.028 (0.174)	−.326 (0.323)	−.005 (0.020)
Empowerment±		−.033 (0.063)	.141 (0.162)	−.001 (0.009)

TABLE E4 (Continued)

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
Skill enhancement$^{\pm}$		.086 (0.060)	−.179 (0.131)	.001 (0.007)
Precarious work$^{\pm}$	−.088* (0.041)	.104* (0.048)	.014 (0.049)	−.009 (0.005)
Precarious work$^{\pm 2}$		−.032** (0.006)		−.004** (0.001)
Empowerment × precarious work		.073 (0.0411)	.064 (0.090)	−.002 (0.005)
Skill enhancement × precarious work		−.138* (0.056)	−.101 (0.186)	−.012** (0.003)
Intercept	5.178**	6.404**	2.671	0.185**
R^2	0.098	0.213	0.152	0.712

Note: ±, mean-centered values.
*Significance at .05 level; values below .001 are shown as .001.
**Significance at .01 level; values below .001 are shown as .001.

TABLE E5 Regressions precarious work and performance measures without agency workers in the operationalization of each dimension and moderators

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
ROA 2016				.284 (0.188)
ROA 2015				.535** (0.183)
ROA 2014				.071 (0.091)
# of mfg. sites	−.008 (0.042)	−.030 (0.043)	.066 (0.073)	.003 (0.004)
Firm size	−.122 (0.113)	−.204 (0.105)	−.642 (0.495)	−.035** (0.013)
Recognized for IIP	.566* (0.272)	.488 (0.271)	−1.060 (1.155)	.021 (0.023)
HHI	.895 (1.000)	.001 (0.967)	1.687 (1.798)	−.005 (0.071)
Dynamism	−1.226 (1.182)	.868 (0.991)	1.374 (2.230)	−.112 (0.099)
Munificence	.332* (0.163)	.041 (0.157)	−.296 (0.342)	.003 (0.020)
Empowerment$^{\pm}$		−.089 (0.062)	.170 (0.165)	−.001 (0.009)

(Continues)

TABLE E5 (Continued)

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
Skill enhancement $^{\pm}$		.123* (0.057)	−.155 (0.126)	.003 (0.009)
Precarious work$^{\pm}$	−.081* (0.036)	.068 (0.044)	−.005 (0.056)	−.009 (0.006)
Precarious work$^{\pm 2}$		−.021** (0.055)	.093 (0.096)	−.002* (0.001)
Empowerment × precarious work		.146** (0.048)	−.055 (0.072)	.003 (0.007)
Skill enhancement × precarious work		−.088* (0.044)		−.013* (0.006)
Intercept	5.254**	6.252**	2.540	0.176**
R^2	0.101	0.220	0.163	0.702

Note: $\pm$, mean-centered values.
*Significance at .05 level; values below .001 are shown as .001.
**Significance at .01 level; values below .001 are shown as .001.

APPENDIX F.: RESULTS OBTAINED WHEN CONTROLLING FOR A FIRM'S SHARE OF AGENCY WORKERS

Table F6

TABLE F6 Regressions precarious work and performance measures controlling for the share of agency workers

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
ROA 2016				.290 (0.182)
ROA 2015				.524** (0.180)
ROA 2014				.080 (0.093)
Agency workers	.003 (0.007)	.017* (0.007)	.005 (0.013)	−.001 (0.001)
# of mfg. sites	−.011 (0.043)	−.020 (0.020)	.069 (0.072)	.002 (0.004)
Firm size	−.057 (0.117)	−.266 (0.046)	−.665 (0.493)	−.036** (0.012)
Recognized for IIP	.476 (0.295)	.475 (0.270)	−.992 (1.154)	.031 (0.024)
HHI	.844 (1.018)	.128 (0.944)	1.946 (1.866)	−.001 (0.069)
Dynamism	−1.523 (1.399)	1.269 (1.047)	1.360 (2.200)	−.091 (0.098)

TABLE F6 (Continued)

Variables	Cost performance Model 2 β (*SE*)	Flexibility performance Model 5 β (*SE*)	Occupational health & safety Model 4 β (*SE*)	ROA 2017 Model 5 β (*SE*)
Munificence	.368 (0.178)	.029 (0.167)	−.304 (0.331)	−.004 (0.020)
Empowerment$^{\pm}$		−.013 (0.062)	.148 (0.174)	−.001 (0.010)
Skill enhancement$^{\pm}$		.097 (0.057)	−.160 (0.130)	.002 (0.008)
Precarious work$^{\pm}$		.114* (0.055)	.002 (0.051)	−.009 (0.007)
Precarious work$^{\pm 2}$		−.025** (0.007)		−.003** (0.001)
Empowerment × precarious work		.13** (0.042)	.091 (0.096)	−.001 (0.006)
Skill enhancement × precarious work		−.142* (0.059)	−.056 (0.073)	−.012** (0.004)
Intercept	4.973**	6.381**	2.610	0.178**
R^2	0.068	0.258	0.560	0.338

Note: ±, mean-centered values.
*Significance at .05 level; values below .001 are shown as .001.
**Significance at .01 level; values below .001 are shown as .001.

APPENDIX G.: BINNED SCATTERPLOTS OF THE RAW DATA WITH FITTED LINES

Figures G1–G4

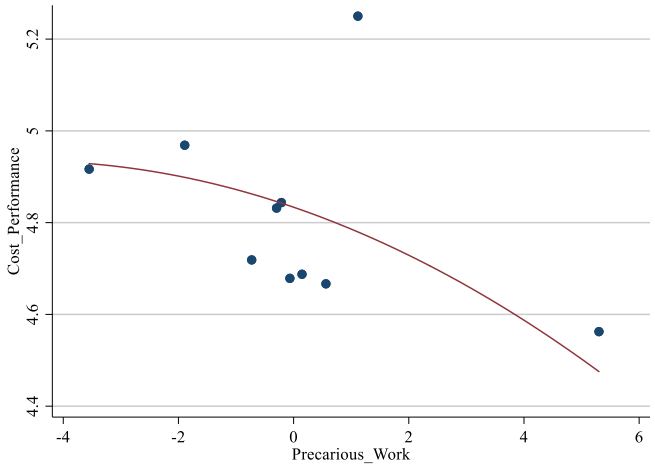

FIGURE G1 Binned scatterplot for cost performance and precarious work

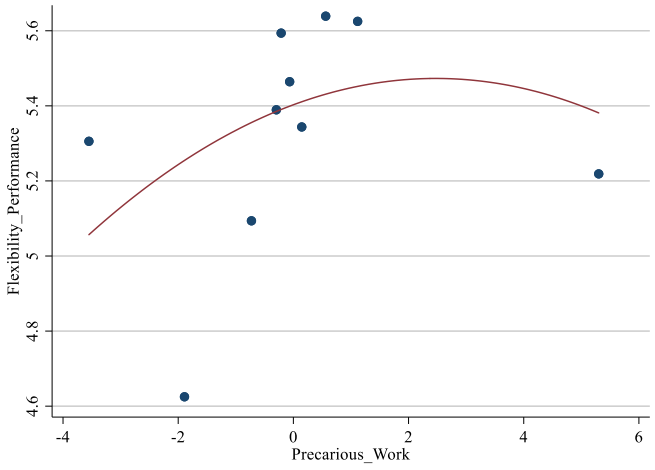

FIGURE G2 Binned scatterplot for flexibility performance and precarious work

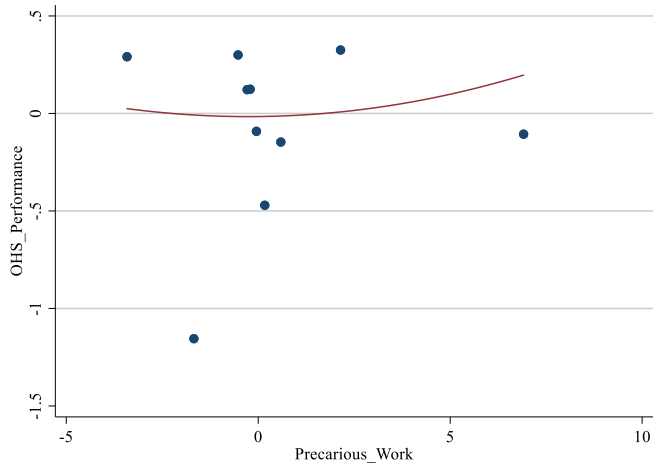

FIGURE G3 Binned scatterplot for OHS performance and precarious work

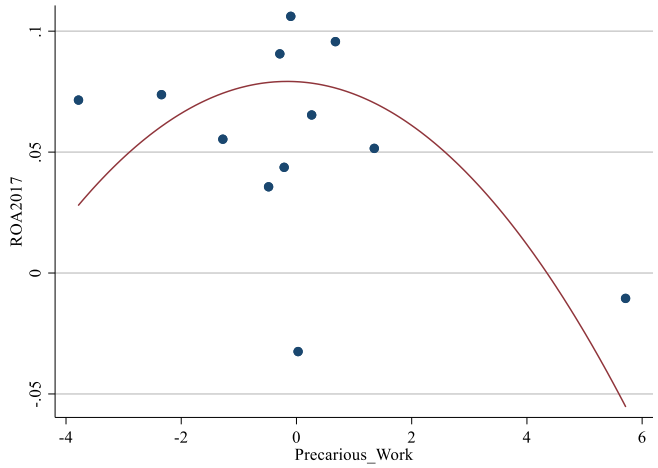

FIGURE G4 Binned scatterplot for ROA2017 and precarious work

APPENDIX H.: SELECTED COMPANY CASES WITH MEAN-CENTERED PRECARIOUS WORK VALUES CLOSEST TO THE TURNING POINT VALUES ESTIMATED ROA AND FLEXIBILITY PERFORMANCE

Table H7 is indicative of the large number of possible combinations of earnings, employee representation, and temporary contracts within firms of the same (or similar) precarious work values. For example, company 1,010,112,265 relies on relatively more zero-hour workers than company 1,010,110,407. However, due to company 1010112265's compensation of this worker category, it arrives at the same value of precarious work then company 1,010,110,407. Furthermore, it is interesting to observe that all four companies closest to the respective turning points have no permanent (sample average 9.02, min = 0; max = 100) or fixed term (sample average 2.18, min = 0; max = 100) employees organized in labor unions.

TABLE H7 Precarious work turning point cases for ROA and flexibility performance

	Percentage of...					Majority above the minimum wage? [Yes = 1; No = 0]					Percentage organized in labor unions		
Company ID	Fixed term workers	Self-employed workers	Zero-hour workers	Agency workers	Permanent workers	Fixed term workers	Self-employed workers	Zero-hour workers	Agency workers	Permanent workers	Fixed term worker	Permanent workers	Mean-centered precarious work value
Closest to ROA performance turning point													
1010112265	*2*	*0*	*1*	*2*	*95*	*1*	*0*	*1*	*1*	*1*	*0*	*0*	−0.004
1010110407	*3*	*0*	*0*	*1*	*96*	*1*	*0*	*0*	*1*	*1*	*0*	*0*	−0.004
Closest to flexibility performance turning point													
1010110323	*19*	*0*	*0*	*1*	*80*	*1*	*0*	*0*	*1*	*1*	*0*	*0*	1.502
1010110405	*33*	*0*	*0*	*33*	*34*	*1*	*0*	*0*	*1*	*1*	*0*	*0*	2.821