Information Technology, Business Strategy and the Reassignment of Work from In-House Employees to Agency Temps

Adam Seth Litwin and Sherry M. Tanious

Abstract

Though we now understand how information technology (IT) influences work, we know much less about how it reshapes the actual relationship between workers and their employers. That is, to what extent do employers deploy new technologies towards the erosion of traditional employment relationships? This study relies on a cross section of British workplaces to provide statistical evidence that IT actually facilitates managers’ reassignment of work once done by in-house employees to those working instead for a staffing agency, an effect that trebles in magnitude where managers have simultaneously cut employment. Furthermore, IT differentially serves opposing business strategies. While employers electing to compete on price rather than quality are more likely to reassign work, managers enacting quality-centred strategies are more likely to rely on IT to avert work reassignment. The findings demonstrate that new technologies may facilitate this form of externalization, but they do not unilaterally drive it. The estimates also illuminate IT’s indirect impact on workers via managers’ use of it as a tool for restructuring employment.

1. Introduction

The erosion of traditional employment relationships stands as the most pronounced change in the field and practice of employment relations of the last few decades, only comparable in impact to the decline of collective bargaining and the advancement and workplace diffusion of information technology (IT). The research ramifications for worker externalisation, while hard to overstate, are dwarfed by its consequences for the actual workers.
we study. ‘The most basic terms of employment — hiring, evaluation, pay, supervision, training, and coordination’ (Weil 2014b: 108), once the product of what Doeringer and Piore (1971) labelled internal labour markets (ILMs), are often no longer even set by the organization to which one ostensibly supplies their labour.

ILMs, the administrative units within a firm in which a set of norms, administrative rules and procedures govern the pricing and allocation of labour, have arguably given way to manifestations of externalization. Of all of them, growth in the use of temporary employment or staffing agencies — intermediary organizations that directly administer employment relations with their workers, but then cede the control of those workers to a client firm (Forde and Slater 2016) — has been the most injurious to the UK labour force. Aside from the UK having the largest temporary staffing industry in Europe and the sector’s growing reach across-occupational and sectoral spectra (Ferreira 2017), those employed by these agencies report having less job security (De Cuypere and De Witte 2007) and poorer health outcomes (Silla et al. 2005). These perceptions are magnified where client employers deploy these workers as pawns in a long-term scheme to cut labour costs (Trade Union Congress 2007). Håkansson and Isidorsson (2019) show that in Europe, those employed by temporary staffing agencies and assigned to client employers—‘temps’ — are deprived of employer investments in skill development, a penalty with long-term and far-reaching consequences for building a worker’s and an economy’s human capital stock. Moreover, what distinguishes agency temps from other non-standard workers, namely freelancers and independent contractors, is that a majority of agency temps would prefer standard employment (Golden and Appelbaum 1992; Osterman and Burton 2005), reminding us that it was not their choice to operate in a precarious state.

Exposing traditional, ILM-derived wage-setting mechanisms to the market has long put downwards pressure on pay, benefits and job security (Hyman 2018), effects that an employment-based welfare system, as in the United States, further exacerbates. Thus, one can reasonably infer that increased economic inequality (Piketty 2014), eroded job quality (Kalleberg 2011) and even inferior organizational performance (Broschak et al. 2008; Doellgast et al. 2015; Stirpe et al. 2014; Torka and Schyns 2010) stem in part from the proliferation of non-standard work arrangements, namely temporary agency jobs. These beliefs have spurred a wealth of rich case studies and other qualitative research theorizing what we might think of as the ‘opportunity structures’ (Heyes and Rainbird 2011; Kacperczyk 2012) facing strategic employers. Thus, determining which specific factors enable, drive or constrain employers to use agency temps has generated a host of economic, sociological and strategic explanations for the increased incidence of ‘flexible staffing’ arrangements. Nevertheless, despite the evolution of IT and the increased use of agency temps across nearly every sector in the economy — and even well-grounded speculation that one must drive the other (Rubery and Grimshaw 2001) — no study that we know of has attempted to generalize
from this meticulous, collective search for causality. That is, no study has tried to quantify the relationship between the above-referenced diffusion of new technologies and the overt reassignment of work once done in-house to those employed instead by a staffing agency — what we see as a quintessential signifier of eroding ILMs.

This article aims to break the silence. We employ the familiar Workplace Employment Relations Study (WERS), a representative sample of UK establishments. Controlling for observable and unobservable features of these establishments, we find that IT adoption is positively correlated with our concrete measure of work reassignment. More pointedly, we find that downsizing in the absence of technology adoption is essentially uncorrelated with the reassignment of work to agency labour, but that the initial effect of new or upgraded technology trebles in magnitude when adoption is done in parallel with reductions in employment. We then drill down to determine whether management’s choices around business strategy affect the ends to which they deploy IT; that is, towards reassigning work or towards keeping work in-house. We find that while employers electing to compete on price rather than quality are more likely to reassign work, quality-centred strategies actually rely on technology to avert work reassignment. Furthermore, those employers somehow managing to ‘go against the grain’ by enacting ‘high road’ employment models alongside price-focused business strategies are significantly less likely to reassign work to outsiders.

The following section looks to existing research and theory on ILMs as well as on the use of temporary agency workers. This helps us explain why and how IT, through its impact on the opportunity structures managers face, facilitates the reassignment of work to agency temps. Then, we detail our source data and the construction of the measures we will call upon for the multivariate analysis. The article proceeds with this analysis, followed by a discussion of its implications and a brief conclusion.

2. Theory and Research

To explain the link between IT and work reassignment, we must first understand the employment model from which employers deviate when they turn to temporary agency staff. Then, we can ask why and when we expect managers to make this pivot. Our answer points to first to technologically wrought changes in opportunity structures and then to business strategy.

The Evolution of Internal Labour Markets

In a world in which conventional wisdom defaults to markets as the most effective solution to most business problems, we cannot fault those who ask why traditional employment relationships — long-term, mutually obligatory and dyadic — exist at all. Sociological and institutional explanations centre on relative power disparities and the mitigation of market uncertainty (e.g. Grimshaw et al. 2001; Marchington et al. 2005). In short, employers garner
flexibility and mitigate risk by reducing their dependence on external resources or groups, the primary realization to emerge from what we now label the theory of resource dependence (Pfeffer and Salancik 1978). As noted above, managers historically translated the direct employment of labour into power and control via the construction and maintenance of so-called ILMs (Doeringer and Piore 1971).

Owing to its American roots, seminal ILM theory centres largely on the behaviour of and choices made by employers, not workers (Rubery 1978). From this perspective, ILMs clearly deliver useful benefits to the employers who build and maintain them, most notably for their husbandry of ‘functional flexibility’—‘enhancing employees’ ability to perform a variety of jobs and participate in decision-making’ (Kalleberg 2001: 479). Beyond that, the accumulated benefits of ILMs keep workers glued to the firm even when external labour market competition tightens (Abraham 1990). ILMs also serve as a deterrent to shirking or opportunism on the part of workers. Nonetheless, they are no panacea; ILMs tie the employer’s hands with respect to wage adjustments, promotion and hiring decisions. Still, from the perspective of resource dependence, these encumbrances pale in comparison to the incremental control ILMs wield over workers and the degree to which ILMs protect the organization from economic risk. Notwithstanding, anything that further tilts the balance of power towards employers or that creates new avenues for managers to mitigate external labour market uncertainties should enable both the erosion of ILMs and an increasing reliance on external sources of labour.

Technological Change That Alters the Power Structure

Temporary staffing agencies provide one such source of external labour. Most relevant to our analysis is the finding that over the last two decades, the use of agency temps has transcended the short term and the ad hoc to include a broader range of tasks, some of them even white collar or managerial in nature (Ward et al. 2001). In fact, in their mixed-method deep dive into employment practices in the construction sector, Forde et al. (2008) offer clear evidence in support of Burton and Osterman’s (2005) claim that employers now use temporary agency staff expressly to bypass the long-term employment arrangements attendant to ILMs. We believe that the explanation for these structural changes rests in employers’ increased access to IT and the business strategy context in which they deployed it.

Having considered the purpose and functions of ILMs as well as employers’ tendency towards subverting them via work reassignment, we can now make the case that recent technological advances facilitate employers’ partial transition from one state to the other. That is, technology substitutes for some aspects of ILMs, allowing employers to garner flexibility — numerical instead of functional — and mitigate risk without having to commit to the long-term obligations and to accept the constraints to their decision-making attendant to the maintenance of ILMs.

© 2020 John Wiley & Sons Ltd.
Rubery and Grimshaw (2001) were the first to posit that IT, in particular, might serve as a substitute for key aspects of ILMs. And since then, the cost of hardware and software as well as the services required for storing, transmitting and processing data have only fallen and continued to fall precipitously (Bresnahan et al. 2002; Goldfarb and Tucker 2019). Consequently, rather than relying on an employment model predicated on technologies from the mid-twentieth century, managers can now use IT as a tool to facilitate (1) supervision and monitoring (Baker and Hubbard 2003), (2) job segmentation and simplification (Brynjolfsson 2002; Doellgast 2012), and (3) the coordination of task-interdependent production and service delivery processes (Abramovský and Griffith 2006; Malone et al. 1987).

Scholars have traditionally defined IT as computers, hardware, software and peripherals, which Grimshaw et al. (2002) observed in their case study of a call centre mitigated the loss of control that employers would otherwise have suffered from outsourcing. More recently, IT has come to include all of those devices that themselves operate as computers, but also tap the Internet to connect computers and devices to one another and to the so-called ‘cloud’. When deployed for supervision and monitoring, IT, aided by barcoding, sensors, scanners, radio frequency identification and global positioning systems, allows employers to access real-time productivity and product-completion data. Depending on the nature of the work under study, one can argue that the information bosses glean digitally is far more textured and more actionable than anything they could learn even from standing directly behind a worker toiling at his or her workstation. With these agreements in place, managers have an attractive alternative to ILMs, one that forestalls worker opportunism without having to make long-term commitments to job security, skill investments or pay increases. Consequently, given IT’s potential as a tool for monitoring and supervising workers, managers who report having made recent investments in new or upgraded technology should be more likely to report that agency workers have now assumed work once undertaken by conventional employees.

Aside from facilitating monitoring and supervision, technology has become especially adept at performing repeated, routine tasks (Autor et al. 2003). Black and white images of caged, factory robots demonstrate that this has long been the case with respect to physical tasks. Likewise, robotic process automation (RPA) describes the sorts of software and algorithms that can take on repetitive cognitive tasks, evoking a metaphorical representation of a robot doing white-collar, administrative or service work (Jesuthasan and Boudreau 2018). In this way, IT threatens to replace labour altogether, along two lines. It can do so directly, literally assuming tasks once undertaken by workers. However, technological substitution or automation exemplifies IT’s effects on work itself, not on the employment relationship per se. For our purposes, IT’s ability to take on repetitive tasks facilitates the breaking up of jobs and the simplification of work, a phenomenon that Doellgast (2012) demonstrated in her comparative study of call centres. Thus, from the standpoint of research dependency theory, IT has facilitated a redistribution
of power between capital and labour that impinges upon the ways that these parties relate to one another in the employment context.

Finally and related to both supervision and segmentation, IT facilitates the coordination of the most highly interdependent tasks being undertaken by multiple people even when they are geographically dispersed. That is, managers can deploy technology to reduce the coordination costs once associated with moving production and service delivery activities outside the employer’s own organization (Abramovsky and Griffith 2006; Hitt 1999). To illustrate, Autor et al.’s (2002) analysis of the workforce impact of digital check imaging in a US retail bank shows that IT further aids management’s externalization efforts by allowing for the easy disaggregation of jobs into low- and high-value-added work (Brynjolfsson and Hitt 2000). The low-value-added work can then be re-assigned to external workers (Abraham and Taylor 1996). More critically and more recently, with the availability of globally networked computing, managers can easily communicate and coordinate with subordinates, and these subordinates can easily communicate and coordinate with one another, instantaneously or asynchronously. Furthermore, employers must realize that these co-workers can work interdependently without ever interacting with one another socially, rendering it especially unlikely that these workers will ever engage in concerted action as a means of recourse for managerial caprice. Consequently, technology’s ability to facilitate coordination offers another economic explanation as to why we should expect to find a positive relationship between the incidence of IT adoption or upgrading and management’s reassignment of work from conventional employees to temporary agency staff.

Information Technology and Business Strategy

Aside from deciding whether to adopt new technologies, managers also choose the strategic ends towards which they will deploy them (Piole and Sabel 1984). And, access to IT materially shapes the options available to them. Studies in work and employment typically evaluate this issue by calling on the business strategy archetypes first proffered by Porter (1980, 1985) and since relied upon by employment relations scholars (e.g. Arthur 1992; Kochan et al. 1986; Litwin 2015). That is, firms can work towards attaining a durable, competitive advantage through a strategy of either ‘cost leadership’ or ‘differentiation’. Under the former, the firm aims to become the lowest cost producer of a product or service, thereby allowing it to undercut its competitors on price. Conversely, the latter hinges on a firm’s ability to produce a product or deliver a service that is highly valued by customers and for which they would be willing to pay a premium price, for example, a product that fills a very specific market niche or one that is of impeccable quality.

Arthur (1992) showed that the cost leadership approach in the product market goes hand-in-hand with ‘an autocratic approach to HR in which supervisors seek to “drive” rather than to “motivate” workers’: under this ‘cost reduction’ model of employment, workers are a ‘necessary evil’ and a
cost to be minimized (Litwin 2011: 870). This contrasts with the ‘commitment maximizing’ employment model in which managers view workers as a long-term object of their investment that accordingly must be developed, rewarded and empowered. Researchers characterize the ‘commitment maximizing’ employment model subsumed within ILMs as inclusive of broadly defined jobs, high levels of employee involvement, substantial investments in skills training, high wages and benefits and a high percentage of skilled workers encouraged to work in self-managed teams. Indeed, Arthur linked this employment model theoretically and empirically to the product differentiation business strategy.¹

Since Arthur first promulgated this theory, investigators have substantiated it empirically. Grimshaw et al. (2006) note that trusting relationships prove difficult to establish and maintain under contracting relations, implying that one should be less likely to reassign work while implementing a quality or differentiation strategy in the product market. Similarly, controlling for economic and structural features of firms, Zhou et al. (2011) unearthed a negative association between an employer’s reliance on temporary contracts and sales of what they refer to as ‘innovative’ products, which they define on the basis of their novelty. In sum, received research both theoretical and empirical leads us to expect a negative correlation between the incidence of a quality or differentiation strategy and the reassignment of work.

Furthermore, since the differentiation business strategy pushes managers to implement the commitment maximizing employment model, we would not expect managers operating along this path to use technology as a tool for work reassignment. Instead, they will deploy new technologies towards the preservation of their ILMs by empowering workers who are long-term, well-trained and highly-skilled (Arthur 1992). Accordingly, while the incidence of new or upgraded technology may be positively correlated with work reassignment, this effect should be moderated in the context of a business strategy predicated on product or service quality.

Juxtaposed with its business strategy counterpart, price competition erodes the trust relations required to maintain the functionality of an ILM. Firms enacting a price-centred business strategy face especially tight margins and cannot easily bankroll production slack. Therefore, these employers will scrutinize their costs fearing the risk associated with even a short-term labour surplus, and thus are also more likely to pursue productivity increases through numerical flexibility rather than functional flexibility (Purcell and Cam 2002). When managers deploy technology in service to this strategy, one would have to expect it to intensify the reassignment effects that price competition already brings to bear. This effect would arise from the afore-theorized pathways by which IT can provide monitoring in place of the disciplinary functions of an ILM, not to mention IT’s facility in segmenting, simplifying and coordinating jobs that are task-interdependent.

Finally, to the extent that IT may be able to substitute for certain features of traditional employment, we can ask the question: what happens in the ‘off-diagonal’ case in which a price-competitive producer nonetheless maintains a
commitment-style employment model, one that imbues workers with influence and autonomy in their daily work? We should find a weakening of the positive relationship between the incidence of price competition and the reassignment of work. In other words, while managers enacting a price-focused business strategy are more likely to reassign work away from conventional employees, the effect will be reduced where workers improbably perceive themselves as having influence and autonomy in the course of their daily work. Interestingly, what this amounts to empirically is a parallel between the moderating effect of IT on work reassignment in the wake of quality-based strategies and the moderating effect that innovative employment approaches have when enacted in support of price competition.

3. Data

We will subject our theory to data collected through the 2011 Workplace Employment Relations Study (WERS6 or simply, WERS), the sixth in a series of establishment- or workplace-level surveys conducted in the United Kingdom since 1980 (Department for Business, Innovation and Skills 2013). We rely mainly on its Survey of Managers, as it canvasses the most senior manager with responsibility for employment relations, HR or personnel at each workplace (van Wanrooy et al. 2013) on the full range of objective and subjective matters germane to our analysis. The response rate was 46.3 per cent yielding a cross section of over 2,500 distinct workplaces from a survey population of all British workplaces with five or more employees across nearly all sectors of the economy. As we will explain below, we construct one of our variables instead from items on the WERS6 Survey of Employees. Those interviewing managers as part of the Survey of Managers distribute these questionnaires to a 25-person sample of the establishment’s workers, achieving a response rate of 39–54 per cent, depending on one’s assumptions in calculating it (van Wanrooy et al. 2013). The only sectors excluded from the WERS sampling frame are those containing agricultural, mining and otherwise-unclassified household work as well as activities of extraterritorial organizations. Thus, the population accounts for 90 per cent of all British employment.2

In addition to its coverage, a number of other features of the WERS data appeal to us. Two are especially salient. First, that the units-of-analysis are establishments or workplaces — ‘comprising “the activities of a single employer at a single set of premises”’ (van Wanrooy et al. 2013: 199) — makes us more confident in the validity of our measures and more comfortable speaking in causal terms about the relationships between variables. Second, researchers must often weigh the analytical straightforwardness of cross-sectional analysis against its inability to speak to temporal relationships between variables. Point-in-time or ‘snapshot’ data can also be prone to endogeneity if an uncontrolled confounder drives both the independent and dependent variables of a model. Were this to occur, any inferences made from our statistical models would be biased (Wooldridge 2010). Fortunately, the
developers of WERS6 took pre-emptive steps in the design of their instrument that largely forestall these challenges, at least for the items that concern us. The survey mitigates these issues by including aspects of timing in some key questions.

Dependent Variable

To operationalize the extent to which temporary agency staff are performing work formerly done by in-house employees — what we refer to as work reassignment, we first use a set of items to ascertain whether or not any activities or services are being carried out for the workplace by temporary agency staff. Indeed, this same item from the WERS Survey of Managers has been employed in previous empirical studies including those of Bryson (2013) and Böheim and Zweimüller (2013). However, we are able to sharpen this measure in a way that allows us to differentiate between the outsourcing of work to agency temps and the reassignment or transferring of work to agency temps from conventional employees. For those managers who answer the incidence question(s) affirmatively, we then use their responses to a follow-up question asking whether ‘any of these temporary agency staff [are] carrying out work which used to be done by permanent employees’. We set the resulting dummy variable equal to 1 where, in fact, temporary agency staff have been substituted in place of in-house employees. Otherwise, we set the value of this variable to 0. We detail the construction of this variable along with that of the others used in this study in Table 1.

Independent and Control Variables

A large-n, cross-sectoral, economy-wide analysis like this one requires we operationalize IT in a broad enough manner that it applies to all of the workplaces included in the study. Ideally, relative to the received case-study research that we prize for its carefully contextualized measures, we gain in generalizability what we lose in internal validity. Towards that goal, the primary independent variable in our study is a binary measure of whether or not the workplace has introduced new technology or upgraded technology, including computers, over the last two years.

That said, we took a number of steps to ensure that this all-encompassing variable measures what we intend it to. First, WERS asks managers what percentage of their employees use computers in their daily work. To the extent that the investments we are measuring include computers and related high-tech capital, we would expect computer use to be substantially greater in adopting workplaces than in non-adopting workplaces. Indeed, in non-adopting workplaces, 55.7 per cent of workers are computer users compared to 77.2 per cent of workers in adopting workplaces \(t = 6.33, \ p < 0.001\). Even within sectors, the substantial difference-in-means maintains \(t = 4.57, \ p < 0.001\).

Second, in the most recent previous iteration of WERS, that is, WERS2004, surveyors asked two separate questions regarding technological adoption:
<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Reassignment</td>
<td>Whether or not staff of a temporary employment agency are now undertaking work which used to be done by permanent employees of this workplace</td>
<td>Binary variable equal to 1 for ‘yes’ and 0 for ‘no’</td>
</tr>
<tr>
<td><strong>Independent &amp; Control Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Technology</td>
<td>Whether or not this workplace has introduced new technology or upgraded technology, including computers, over the last two years</td>
<td>Binary variable equal to 1 for ‘yes’ and 0 for ‘no’</td>
</tr>
<tr>
<td>Shrinking Employment Rolls</td>
<td>Whether or not the raw difference in the workplace size — as defined below — between this year and last year is negative</td>
<td>Binary variable equal to 1 for ‘yes’ and 0 for ‘no’</td>
</tr>
<tr>
<td>Quality-Based Competitive Strategy</td>
<td>The extent to which demand for their main product or service depends upon offering superior product quality</td>
<td>Ordered, discrete variable ranging from 0 to 4 in which 0 = ‘not at all’ and 4 = ‘heavily’</td>
</tr>
<tr>
<td>Price-Based Competitive Strategy</td>
<td>The extent to which demand for their main product or service depends upon offering lower product prices</td>
<td>Ordered, discrete variable ranging from 0 to 4 in which 0 = ‘not at all’ and 4 = ‘heavily’</td>
</tr>
<tr>
<td>Worker Influence &amp; Autonomy</td>
<td>Workers’ perceptions of influence and autonomy</td>
<td>Summative rating scale composed of five items (α = 0.82), averaged across all employee respondents of each workplace</td>
</tr>
<tr>
<td><strong>Workplace Size</strong></td>
<td>Number of workers on the establishment’s payroll excluding casual, freelance, self-employed and agency workers</td>
<td>Continuous count of the number of workers</td>
</tr>
<tr>
<td><strong>Union Presence</strong></td>
<td>Whether or not there is at least one union in this workplace recognized for the purposes of collective bargaining</td>
<td>Binary variable equal to 1 for ‘yes’ and 0 for ‘no’</td>
</tr>
<tr>
<td><strong>Foreign Ownership</strong></td>
<td>Establishment’s parent company is less than 51% UK-owned</td>
<td>Binary variable equal to 1 for ‘yes’ and 0 for ‘no’</td>
</tr>
<tr>
<td><strong>Independent Establishment</strong></td>
<td>Establishment is a single, independent establishment not belonging to another body</td>
<td>Binary variable equal to 1 for ‘yes’ and 0 for ‘no’</td>
</tr>
<tr>
<td><strong>Concentrated Ownership</strong></td>
<td>A single person or family owns at least 25% of the parent company of this establishment</td>
<td>Binary variable equal to 1 for ‘yes’ and 0 for ‘no’</td>
</tr>
</tbody>
</table>

In general, how much influence do you have over...  
...the tasks you do in your job?  
...the pace at which you work?  
...how you do your work?  
...the order in which you carry out tasks?  
...the time you start or finish your working day?  
Ordered, discrete item ranging from 1 to 4 in which 1 = ‘none’ and 4 = ‘a lot’  
Ordered, discrete item ranging from 1 to 4 in which 1 = ‘none’ and 4 = ‘a lot’  
Ordered, discrete item ranging from 1 to 4 in which 1 = ‘none’ and 4 = ‘a lot’  
Ordered, discrete item ranging from 1 to 4 in which 1 = ‘none’ and 4 = ‘a lot’  
Ordered, discrete item ranging from 1 to 4 in which 1 = ‘none’ and 4 = ‘a lot’
(1) whether management has introduced or upgraded computers in the last two years, and (2) whether management has introduced or upgraded new technology other than computers in the last two years. That provides us an opportunity to compare their distributions. As it turns out, a $\chi^2$-test allows us to soundly reject the null hypothesis that these variables are distributed independently ($\chi^2 = 110.9, \ p < 0.001$).

Finally, both the labour relations and economics literatures commonly measure technological adoption or upgrading in a binary manner in large-sample, cross-sectoral studies (e.g. Bartel et al. 2007; Keefe 1991), and a number of previous analyses including Latreille (1992), Litwin (2013) and Machin and Wadhawni (1991) have even done so using this same WERS survey item. In toto, while we cannot deny the broad mix of technologies netted by this operationalization, we are confident in the effectiveness of this measure for allowing us to assess the impact of IT across an entire, national economy.

In considering the impact of IT adoption on the use of temporary agency staff, we are also interested in changes in the size of the establishment’s workforce. In other words, has management externalized work while simultaneously reducing the headcount of conventional employees? We can measure this by taking the difference between the number of conventional employees on the payroll at the workplace and this same measure for one year earlier, each assessed with a separate question from the WERS interviewer. We then construct a dummy variable equal to 1 where this raw difference is negative, that is, where management has curtailed employment over the last year.

In addition to technology adoption and employment growth or decay, we are also interested in the strategies that managers enact in the product or service market. We have constructed two variables to capture this. In two separate questions, WERS canvasses managers on the extent to which demand for their main product or service depends upon offering lower prices and/or offering better quality than their competitors. In both cases, managers answer on a 5-point Likert-type scale. We have coded these from 0 to 4, anchored on one end by ‘Demand does not depend at all on price/quality’ and on the other end by ‘Demand depends heavily on offering lower prices/superior quality’.

Recall that we expect the positive impact of a price-competitive business strategy to be attenuated where management enacts it without its usual concomitant constriction of worker control. This requires that we account for workers’ perceptions of influence and autonomy. While we could glean this information from the Survey of Managers, when it comes to measuring the subjective perceptions of workers, we are more comfortable asking the workers themselves rather than their managers. A number of other empirical studies have used the WERS Survey of Employees in this way, taking the average of the (usually) 25 worker responses and assigning it to the workplace as a unit. For example, Jones et al. (2016) measured workers’ job anxiety in this manner, whereas Bryson et al. (2017) likewise assessed workers’ subjective well-being. Brown et al. (2015, 2011) also turned to the WERS Survey of Employees,
taking a cross-workplace average, to measure workers commitment, loyalty and trust in management. Consequently, we control for workers’ perceptions of influence and autonomy by relying on workers’ answers to five questions from the Survey of Employees regarding how much control they have over how they undertake their work. Each question is answered on 4-point, Likert-type scale in which 1 = ‘none’ and 4 = ‘a lot’. We fused these items into a summative rating scale of perceived worker influence ($\alpha = 0.82$). We then averaged these across all of the employee respondents for a given workplace.

Of course, attaining an unbiased estimate of the relationship between managers’ adoption of new technologies and their reassignment of work requires that we control for those variables that we might expect to be correlated with both. Some are straightforward characteristics of the establishment itself. First and foremost among these would be the size of the workplace, a common control in studies of technology adoption (Litwin 2013; Machin and Wadhawni 1991) and of employment externalization (Kalleberg et al. 2003; Mangum et al. 1985). Thus, we control for the number of workers on the establishment’s payroll, which we measure using a linear and a quadratic term, allowing us to account for curvilinearity. Though the data do not allow for a direct test of the relationship between collective bargaining and externalization, they do allow us to account for the presence of at least one union in the workplace being recognized for purposes of collective bargaining. Following the advice of Grimshaw et al. (2006), who note that some key decisions are often made far away — both geographically and organizationally — we also account for foreign ownership of the establishment as well as for whether or not the workplace is fully independent or instead a single branch of a larger organization. We also control for the extent to which ownership is concentrated or diffuse, as closely held companies may be more likely to defend their ILMs in the wake of hostile market forces.

Despite the care with which we selected and operationalized our control variables, additional, unobserved, sectoral characteristics could still simultaneously drive managers’ behaviour with respect to both the upgrading of technology and the externalization of work. Likewise, most of the potentially confounding effects that could arise from the economic slowdown that occurred during the data collection period likely accrue at the industry level. Consequently, some of our multivariate estimates will partial these out by including a vector of dummies capturing section-level standard industrial classifications (SICs) from the UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007).

4. Results

Descriptive Statistics

Table 2 shows the unweighted means, standard deviations and bivariate correlations for all of the variables we call on in the study. Note that across the entire sample, about one-fifth of the managers or workplaces sampled report
### TABLE 2
Means, Standard Deviations and Correlations for Study Sample of British Workplaces

<table>
<thead>
<tr>
<th></th>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work Reassignment</td>
<td>0.20</td>
<td>0.40</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Information Technology</td>
<td>0.61</td>
<td>0.49</td>
<td>0.14***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Shrinking Employment Rolls</td>
<td>0.40</td>
<td>0.49</td>
<td>0.13***</td>
<td>0.02</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Quality-Based Competitive Strategy</td>
<td>3.12</td>
<td>0.99</td>
<td>-0.05**</td>
<td>0.02</td>
<td>-0.05**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Price-Based Competitive Strategy</td>
<td>2.18</td>
<td>1.27</td>
<td>-0.03</td>
<td>-0.04*</td>
<td>0.10***</td>
<td>0.07***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Worker Influence &amp; Autonomy</td>
<td>3.09</td>
<td>0.37</td>
<td>0.04*</td>
<td>-0.02</td>
<td>-0.04*</td>
<td>-0.001</td>
<td>-0.07**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Workplace Size</td>
<td>449.3</td>
<td>1213.5</td>
<td>0.25***</td>
<td>0.13***</td>
<td>0.03*</td>
<td>0.05**</td>
<td>-0.08***</td>
<td>0.002</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Union Presence</td>
<td>0.56</td>
<td>0.50</td>
<td>0.24***</td>
<td>0.11***</td>
<td>0.11***</td>
<td>-0.08***</td>
<td>-0.05**</td>
<td>-0.19***</td>
<td>0.23***</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Foreign Ownership</td>
<td>0.14</td>
<td>0.35</td>
<td>0.09***</td>
<td>0.06***</td>
<td>0.06***</td>
<td>-0.02</td>
<td>0.09***</td>
<td>0.01</td>
<td>0.02</td>
<td>-0.04**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Independent Establishment Ownership</td>
<td>0.26</td>
<td>0.44</td>
<td>-0.09***</td>
<td>-0.07***</td>
<td>-0.05**</td>
<td>0.01</td>
<td>-0.06**</td>
<td>0.16***</td>
<td>-0.05***</td>
<td>-0.25***</td>
<td>-0.21***</td>
<td>1.00</td>
</tr>
<tr>
<td>11</td>
<td>Concentrated Ownership</td>
<td>0.29</td>
<td>0.46</td>
<td>-0.21***</td>
<td>-0.06***</td>
<td>-0.05**</td>
<td>0.02</td>
<td>0.14***</td>
<td>0.06***</td>
<td>-0.18***</td>
<td>-0.45***</td>
<td>-0.01</td>
<td>0.23***</td>
</tr>
</tbody>
</table>

**Source:** Authors’ analysis of data from the 2011 Workplace Employment Relations Study (WERS) Survey of Managers and Survey of Employees.

**Notes:** Table shows means, standard deviations and bivariate correlations (using pairwise deletion) based on the unweighted sample. Cell sizes range from \( n = 1,699 \) to \( n = 2,680 \) workplaces.

*\( p < 0.10 \), **\( p < 0.05 \), ***\( p < 0.01 \).
using agency labour for work once done in-house. This high proportion arises from the oversampling of large workplaces and workplaces in less-populated industries, a challenge we manage by relying on the weighted data for all other parts of our analysis (van Wanrooy et al. 2013). When we account for sample design, just 5.2 per cent of managerial respondents report having reassigned work as we define it.

With respect to the focal independent variable, just over 60 per cent of managers reported having introduced or upgraded technology, including computers, over the previous two years. When accounting for the survey design, this number falls to 48 per cent. At first glance, technology upgrading appears to be only weakly associated with work reassignment. However, when we estimate a $\chi^2$-type test-of-independence on the weighted data, the results contradict the Pearson correlations: those workplaces in which managers installed or upgraded new technology are, indeed, more likely to report having transferred work once done in-house to workers employed instead by an agency (i.e. $F = 28.87$, $p < 0.0001$). This stands to reason: without any controls whatsoever in place, one should expect to find such a positive relationship. The key question, of course, is whether or not this relationship maintains after controlling for other drivers of technological upgrading and work reassignment, including unobserved characteristics at the industry level.

A closer look at the control variables reveals a few interesting aspects of the unweighted sample. The mean workplace payroll is quite large at almost 450 workers, once again reflecting the non-random sampling. Similarly, 56 per cent of the managers sampled reported that their workplace recognizes as least one union for the purposes of collective bargaining. Most of the workplaces in the sample are domestically owned, and just over a quarter of them are standalone establishments. Less than a third report concentrated ownership as we define it. Forty per cent of respondents have contracted employment over the previous year, not surprising given these data were collected in the midst of the ‘Great Recession’. The mean managerial respondent perceives their workplace as competing rather intensely along the lines of a quality or differentiation strategy and somewhat less likely on the bases of low prices (3.12 vs 2.18 on a 0–4 scale). Finally, workers perceive themselves as having ‘some’ influence and autonomy — 3.09 on a scale of one to four, in which four represents ‘a lot’.

Multivariate Estimates

Determining whether the positive relationship between technological change and the reassignment of work to agency workers maintains in the presence of potentially confounding variables requires the use of multivariate statistical techniques. Technically, the prediction of a dichotomous dependent variable calls for a functional form intended for such limited dependent variables, namely logistic or probit regression (Aldrich and Nelson 1984; Wooldridge 2010). Unfortunately, these models generate inconsistent estimates for coefficients attached to two-way, multiplicative interaction terms (Ai and
Norton 2003), which are, indeed, our very focus. Consequently, we opt instead for the computational efficiency and the more transparent estimates that arise from linear probability models (LPMs). As a result, we must accept the possibility of non-conforming predicted probabilities. The other key concern associated with the use of OLS estimators for dichotomous dependent variables is that of heteroscedasticity (Aldrich and Nelson 1984). However, the efficiency issues that would normally arise from this are largely addressed when estimates account for the complex design of that sample; we accomplish this by relying on weighted data, as the survey designers advise (van Wanrooy et al. 2013).

In Table 3, we report our first set of multivariate estimates. Each of the six models displayed in the table are LPMs in which the dependent variable is whether or not agency workers are now undertaking work formerly done by the establishment’s in-house employees. In Model 1, the only variable on the right-hand side (RHS) is the IT dummy. The coefficient estimate associated with it, 0.07, implies that those managers reporting the introduction or upgrading of IT are 7 percentage points more likely than those that have not upgraded their technology to have turned to agency workers for services formerly performed by actual employees. As we work rightwards across the table, our goals are twofold. Aside from showing that a precisely measured differential maintains even in the presence of the control variables, we would also like to shed more light on the interplay of technology adoption and workforce contraction. Towards those ends, Model 2 incorporates a broad set of controls capturing organizational and structural features of the workplace. Nonetheless, the positive relationship between technological upgrading and work reassignment maintains. These estimates also reveal that the likelihood of contracting is increasing curvilinearly in workplace size. Interestingly, those workplaces with at least one union bargaining on behalf of some workers are more likely to have reassigned work to an employment agency than are ‘non-unionized’ workplaces: this implies inter alia that managers use temps to protect those already within the ILM ambit, a matter to which we will return in our larger discussion of the results. While neither foreign ownership nor the independence of an establishment appear to drive our measure of work reassignment, establishments with concentrated ownership are less likely to report the reassignment of work. This implies that employment ties that are more relational than contractual — bosses who actually know and work with their employees — are less likely to reassign their work to temps. Perhaps, the most revealing estimate is that attached to the employment contraction dummy. Its precisely estimated value of 0.05 indicates that controlling for all of the other variables on the RHS including technology adoption, those managers that have reduced employment over the previous year were also 5 percentage points more likely to have outsourced work once done in-house.

Having separately but simultaneously estimated the linear effects of both IT adoption and downsizing, we are now ready to consider their relationship to the use of agency workers more closely. Model 3 includes both of these linear or ‘main’ effects but adds a two-way, multiplicative interaction term, allowing
TABLE 3
Impact of Information Technology Adoption on the Likelihood That Management Has Reassigned Work from Conventional Employees to Employees of a Temporary Staffing Agency: Linear Probability Models with a Focus on Technological Substitution

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>0.07***</td>
<td>0.06***</td>
<td>0.03***</td>
<td>0.07***</td>
<td>0.06***</td>
<td>0.03***</td>
</tr>
<tr>
<td></td>
<td>(5.33)</td>
<td>(4.56)</td>
<td>(2.71)</td>
<td>(5.01)</td>
<td>(4.29)</td>
<td>(2.47)</td>
</tr>
<tr>
<td>Shrinking Employment Rolls</td>
<td>0.05***</td>
<td>0.01</td>
<td>0.05***</td>
<td>0.03***</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(3.05)</td>
<td>(1.05)</td>
<td>(3.07)</td>
<td>(1.12)</td>
<td>(3.07)</td>
<td>(1.12)</td>
</tr>
<tr>
<td>New Technology × Shrinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment Rolls</td>
<td>0.09***</td>
<td>0.09***</td>
<td>0.09***</td>
<td>0.09***</td>
<td>(2.64)</td>
<td>(2.59)</td>
</tr>
<tr>
<td>Workplace Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.32***</td>
<td>0.32***</td>
<td>0.32***</td>
<td>0.32***</td>
<td>(7.02)</td>
<td>(7.05)</td>
</tr>
<tr>
<td></td>
<td>(7.02)</td>
<td>(6.97)</td>
<td>(7.10)</td>
<td>(7.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workplace Size²</td>
<td>−0.02***</td>
<td>−0.02***</td>
<td>−0.02***</td>
<td>−0.02***</td>
<td>(−3.37)</td>
<td>(−3.36)</td>
</tr>
<tr>
<td></td>
<td>(−3.37)</td>
<td>(−3.37)</td>
<td>(−3.35)</td>
<td>(−3.36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Union Presence</td>
<td>0.04***</td>
<td>0.04***</td>
<td>0.04***</td>
<td>0.04***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.04)</td>
<td>(3.22)</td>
<td>(3.04)</td>
<td>(3.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign Ownership</td>
<td>0.03</td>
<td>0.03</td>
<td></td>
<td></td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.36)</td>
<td>(1.32)</td>
<td></td>
<td></td>
<td>(1.43)</td>
<td></td>
</tr>
<tr>
<td>Independent Establishment</td>
<td>−0.002</td>
<td>−0.001</td>
<td>−0.005</td>
<td>−0.004</td>
<td>(−0.17)</td>
<td>(−0.28)</td>
</tr>
<tr>
<td></td>
<td>(−0.17)</td>
<td>(−0.11)</td>
<td>(−0.30)</td>
<td>(−0.28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrated Ownership</td>
<td>−0.02*</td>
<td>−0.02*</td>
<td>−0.02*</td>
<td>−0.02*</td>
<td>(−2.19)</td>
<td>(−1.65)</td>
</tr>
<tr>
<td></td>
<td>(−2.08)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>includes industry controls</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>Yes</td>
</tr>
<tr>
<td>pseudo-R²</td>
<td>0.05</td>
<td>0.26</td>
<td>0.26</td>
<td>0.14</td>
<td>0.29</td>
<td>0.29</td>
</tr>
<tr>
<td>n</td>
<td>2,664</td>
<td>2,547</td>
<td>2,547</td>
<td>2,664</td>
<td>2,547</td>
<td>2,547</td>
</tr>
</tbody>
</table>

Notes: This table displays coefficients and statistical significance (with t-statistics in parentheses) for linear probability models estimated on survey-weighted data. The dependent variable is the binary measure of whether or not staff of a temporary employment agency are now undertaking work that used to be done by permanent employees of this workplace. The linear and quadratic measures of workplace size have been divided by 1,000 to render their associated coefficient estimates detectable at two decimal places. The pseudo-$R^2$ is derived by applying the McElveen and Zavoina (1975) technique to the unweighted probit version of the model estimate.

*p < 0.10 **p < 0.05, ***p < 0.01.
the effect of technology adoption to differ based on whether or not managers do it in conjunction with downsizing. What emerges is a much richer picture of the relationship between technology and the use of agency workers. The positive coefficient of 0.03 attached to the technology indicator now represents the effect of technology upgrading in the absence of downsizing, and it is just half of what was implied by Model 2. The most telling findings, however, arise from the coefficient estimates attached to the downsizing dummy and to the two-way, multiplicative interaction term linking IT adoption and downsizing. The insignificant partial slope associated with the downsizing dummy tells us that in the absence of technological upgrading, downsizing appears to be completely uncorrelated with the use of agency labour for work once done in-house. Moreover, the precisely measured, positive coefficient of 0.09 estimated for the two-way, multiplicative interaction term reveals that when managers deploy new or upgraded technology while they are also reducing employment, they are 9 percentage points more likely to be turning to agency workers for tasks once performed by conventional employees.

We should also note that establishment size positively predicts the likelihood of work reassignment, albeit at a decreasing rate — consistent with previous empirical studies (cf. Davis-Blake and Uzzi 1993; e.g. Kalleberg et al. 2003; Mangum et al. 1985). Moreover, even in the midst of the full vector of controls, the presence of a recognized union in the establishment maintains its positive association with work reassignment, suggesting that employers are finding numerical flexibility through their use of agency temps when they cannot do so with their conventional employees.

What Models 1–3 in Table 3 do not account for are myriad unobservable features at the sectoral level that could simultaneously drive both the independent and dependent variables, thereby generating a spurious relationship between these constructs. We take these unobservables up in Models 4–6. Note that the inclusion of sectoral-level controls has no material effect on the coefficients of interest. Thus, controlling for structural features of the establishment and unobserved ascriptions of broadly defined industries, those establishments that upgraded their technology are more likely to have outsourced work to employment agencies than otherwise ‘twin’ workplaces that did not upgrade their technology. Employers amplified this effect substantially when they simultaneously decided to shrink employment. And, in the absence of new technology, employers who shrank the workforce did not do so by reassigning work to agency temps.

Table 4 continues the analysis by estimating models similar in structure to those reported in the previous table. Once again, these are LPMs in which the dependent variable is whether or not staff of a temporary employment agency are now undertaking work which used to be done by permanent employees of this workplace. And the set of control variables closely resembles the one employed in the previous set of analyses. With these estimates, however, we zoom in on the interplay of IT adoption and business strategy. Furthermore, note that in this case, we bypass the initial set of estimates that do not account for sectoral-level effects.

© 2020 John Wiley & Sons Ltd.
TABLE 4
Impact of Information Technology Adoption on the Likelihood That Management Has Reassigned Work from Conventional Employees to Employees of a Temporary Staffing Agency: Linear Probability Models with a Focus on Business Strategy

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>0.05***</td>
<td>0.14***</td>
<td>0.05***</td>
<td>0.052</td>
<td>0.19**</td>
</tr>
<tr>
<td>Technology</td>
<td>(3.48)</td>
<td>(2.78)</td>
<td>(3.51)</td>
<td>(1.37)</td>
<td>(2.54)</td>
</tr>
<tr>
<td>Quality-Based</td>
<td>−0.01**</td>
<td>0.0003</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitive Strategy</td>
<td>(−2.11)</td>
<td>(0.08)</td>
<td></td>
<td></td>
<td>(0.93)</td>
</tr>
<tr>
<td>Price-Based</td>
<td>0.12*</td>
<td>0.0001</td>
<td>−0.0001</td>
<td>0.12*</td>
<td>(1.81)</td>
</tr>
<tr>
<td>Competitive Strategy</td>
<td>(0.01)</td>
<td>(−0.05)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Technology × Quality-Based</td>
<td>−0.03**</td>
<td></td>
<td>−0.04**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitive Strategy</td>
<td>(−2.08)</td>
<td></td>
<td>(−2.36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Technology × Price-Based</td>
<td>0.0004</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitive Strategy</td>
<td>(0.03)</td>
<td>(0.16)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker Influence &amp; Autonomy</td>
<td>0.13**</td>
<td></td>
<td></td>
<td></td>
<td>(2.06)</td>
</tr>
<tr>
<td>Worker Influence &amp; Autonomy × Price-Based</td>
<td>−0.04*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workplace Size</td>
<td>0.36***</td>
<td>0.36***</td>
<td>0.36***</td>
<td>0.36***</td>
<td>0.27***</td>
</tr>
<tr>
<td>Workplace Size²</td>
<td>−0.03***</td>
<td>−0.03***</td>
<td>−0.03***</td>
<td>−0.03***</td>
<td>−0.03***</td>
</tr>
<tr>
<td></td>
<td>(−5.06)</td>
<td>(−5.07)</td>
<td>(−4.99)</td>
<td>(−4.97)</td>
<td>(−4.16)</td>
</tr>
<tr>
<td>Union Presence</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.54)</td>
<td>(0.46)</td>
<td>(0.66)</td>
<td>(0.65)</td>
<td>(0.77)</td>
</tr>
<tr>
<td>Foreign Ownership</td>
<td>0.05</td>
<td>0.05*</td>
<td>0.05*</td>
<td>0.05*</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>(1.65)</td>
<td>(1.79)</td>
<td>(1.67)</td>
<td>(1.66)</td>
<td>(1.54)</td>
</tr>
<tr>
<td>Independent</td>
<td>−0.0003</td>
<td>−0.0002</td>
<td>−0.0001</td>
<td>−0.0001</td>
<td>−0.01</td>
</tr>
<tr>
<td>Establishment</td>
<td>(−0.02)</td>
<td>(−0.01)</td>
<td>(−0.05)</td>
<td>(−0.05)</td>
<td>(−0.51)</td>
</tr>
<tr>
<td>Concentrated</td>
<td>−0.02</td>
<td>−0.02</td>
<td>−0.02</td>
<td>−0.02</td>
<td>−0.01</td>
</tr>
<tr>
<td>Ownership</td>
<td>(−1.40)</td>
<td>(−1.43)</td>
<td>(−1.37)</td>
<td>(−1.36)</td>
<td>(−0.76)</td>
</tr>
<tr>
<td>includes industry controls</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>pseudo-R²</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.24</td>
<td>0.31</td>
</tr>
<tr>
<td>N</td>
<td>1,687</td>
<td>1,687</td>
<td>1,685</td>
<td>1,685</td>
<td>1,777</td>
</tr>
</tbody>
</table>

Notes: This table displays coefficients and statistical significance (with t-statistics in parentheses) for linear probability models estimated on survey-weighted data. The dependent variable is the binary measure of whether or not staff of a temporary employment agency are now undertaking work that used to be done by permanent employees of this workplace. The linear and quadratic measures of workplace size have been divided by 1,000 to render their associated coefficient estimates detectable at two decimal places. The pseudo-R² is derived by applying the McKelvey and Zavoina (1975) technique to the unweighted probit version of the model estimate.

*p < 0.10 **p < 0.05 ***p < 0.01.

Model 1 separately considers the impact of new technology and a quality-based or ‘differentiation’ business strategy on the likelihood management reassigns work to agency labour. Once again, with the control variables in place, those managers who report having upgraded their technology in the previous two years are 5 percentage points more likely to have transferred work to agency temps. Furthermore, consistent with our predictions, a
single-step increase (on the 0–4 scale) in the extent to which competition
is predicated on product or service quality reduces the likelihood of this
form of outsourcing by a single percentage point. By adding the two-way,
multiplicative interaction term, Model 2 allows us to tease out the impact
of IT adoption at different levels of a quality-based competitive strategy.
In the presence of the interaction term, that $\hat{\beta}_{\text{tech}} = 0.14$ indicates that
where competition is in no way predicated on quality, investments in new
technology increase the likelihood of work reassignment by 14 percentage
points. Contrary to what we would expect, that the coefficient associated
with the measure of quality-based competition is insignificantly different
from zero suggests that where managers do not invest in new or upgraded
technology, the impact of a quality-based business strategy on this form of
outsourcing is nil. The negatively signed, statistically significant coefficient
attached to the interaction term proves especially instructive and supportive
of our prediction: it implies that in the context of technological upgrading,
increases in the intensity of quality-based competition are associated with
reductions in the probability of work reassignment to temps.

Models 3–5 shift our focus from the adoption of technology under a
‘differentiation’ business strategy to its adoption where competition is instead
dicated on low costs and low prices. The insignificant point estimate
attached to the price-based competition variable in Model 3 implies that once
one accounts for IT adoption as well as the full set of control variables, the
intensity of price competition does not drive managers’ decision regarding
the use of agency workers for work formerly done in-house. This does not
comport with our predictions. Further evidence of the weakness of price-
based competition as a predictor comes from Model 4, where once again,
the inclusion of an interaction term allows for technological adoption to
influence our measure of work reassignment differently based on the nature
of the competitive environment. In this case, not only is the estimate on the
interaction term statistically insignificant, but the coefficient on the linear or
main effect of technology adoption has turned insignificant as well. Therefore,
this set of estimates points to the need to dig more deeply into the dynamics
by which different forms of competition — price competition, in particular —
interact with IT adoption to enable or constrain managers’ efforts to transfer
work from conventional employees to agency temps.

Model 5 responds to this call. It includes in a single estimate measures of
both ‘flavours’ of business strategy. It also includes the two-way, multiplicative
interaction between IT and quality-based competition shown to be so critical
in Model 2 as well as the analogous interaction for price-based competition.
What is most novel about this model is that it also adds for each workplace
a measure of workers’ perceptions of influence and autonomy in their work,
and it allows the effect of price competition to differ based on this frontline
worker perceptual measure. What this estimate reveals beyond the previous
ones is that price competition, indeed, influences managerial opportunity
structures with respect to work reassignment, in line with our predictions.
Beyond that, on the one hand, there remains no statistical support for the
theory that employers deploy new technologies towards the intensification of price competition’s positive effect on work reassignment. On the other hand, managers’ decisions to compete on price need not necessarily promote the erosion of ILMs: the work-reassigning application of IT diminishes as workers report higher levels of influence and autonomy. This supports our final prediction and implies that a consciously innovative approach to managing workers can shield them from the negative employment effects arising from price competitive business strategies. Note that this protection operates in a way that mimics the effects of IT on workers in the wake of a quality-driven business strategy.

5. Discussion

In the current context, we should be concerned if employers’ access to IT — by reshaping or reorienting the constraints facing managers — occasions the reassignment of work to agency temps, thus undermining ILMs. Conventional employment remains a fundamental conduit for training, recruitment, appraisals, pay (including sick pay), job security, paid maternity/paternity/adoption leave, redundancy protections and career progression (Doellgast et al. 2015; Forde and Slater 2016; Grimshaw et al. 2001; Hebson and Grugulis 2005; Toms and Biggs 2014). Thus, its erosion undercuts not only individual workers, but also the entire economy. From a distributional standpoint, temps themselves face strong cost pressures with few opportunities to bargain collectively to counter them. Moreover, through processes of benchmarking and concession bargaining, reliance on temps or any form of outsourcing exerts downward pressure on pay and conditions for temps and in-house employees alike (Doellgast and Pannini 2015). Hopkins (2017) shows that similar forces drive higher rates of occupational injury for temps relative to their in-house counterparts. Our analysis supports our theory that these potentially corrosive changes to ILMs can be ascribed in part to employers’ increased adoption of IT.

With this in mind, Figure 1 aims to make the first set of estimates, those appearing in Table 3, more transparent. It shows probabilities fitted from the estimates in Model 6, that is, accounting for all of the control variables including the sectoral dummies. It answers the question, ‘What is the probability that a manager will reassign work from in-house employees to agency temps?’, and it does so by holding all non-focal variables at their sample means. What the first bar reveals is that where managers neither upgrade their technology nor shrink employment, there is a 0.02 probability that they engage an employment agency for work once done in-house. The predicted probability increases only marginally where managers do shrink employment but do not upgrade their technology, the scenario illustrated by the second bar. The third bar shows the predicted probability for those workplaces in which managers upgrade their technology without shrinking employment. Note that the marginal effect of technological upgrading, 3
Fitted Probabilities That Management Has Reassigned Work from In-House Employees to Temporary Agency Staff as a Function of Information Technology Introduction or Upgrading.

Source: Authors’ analysis of data from the 2011 Workplace Employment Relations Study (WERS) Survey of Managers and Survey of Employees.

Notes: Bars were fitted from Model 6 in Table 3 with all non-focal independent variables held at their sample means. Bars convey the fitted probability that the management respondent reports staff of a temporary employment agency are now undertaking work which used to be done by permanent employees of this workplace as a function of whether or not the workplace has introduced or upgraded technology, including computers, in the last two years.

percentage points (i.e. $0.05 - 0.02 = 0.03$) is larger than the marginal effect of shrinking employment, 1 percentage point (that is, $0.03 - 0.02 = 0.01$). Furthermore, though not obvious from the figure, in the absence of technological upgrading, there is no apparent association between a manager’s decision to shrink the workforce and their likelihood to reassign work. This underscores the notion that an employer’s access to IT deeply influences the opportunity structures they face, and thus, the work reassignment decision. Also of great practical significance is the marginal impact of introducing or upgrading technology in the wake of downsizing, the conditions captured in the final bar in Figure 1. These workplaces have a .15 probability of redirecting work from conventional employees to agency-employed workers — $6 \frac{1}{2}$ times the likelihood that an otherwise ‘twin’ employer in the same sector would choose to reassign work in this manner.

In Figure 2, we undertake a similar exercise, translating the estimated coefficients from the final LPM in Table 4 into predicted probabilities. Once again, the probability of redirecting work to agency labour is just 0.02 where managers have not introduced or upgraded their technology and where all other covariates have been held at their sample means. Moving
rightwards, the second bar captures the effects of ‘turning the switch’ on the technology indicator from zero to one, effectively boosting the predicted probability fourfold. In generating the third bar, we have set the value for the quality-based competition variable to high, that is, 4, leading to an almost 40 per cent reduction in the predicted probability of work reassignment. The fourth and fifth bars speak to the effects of price competition on the probability of work reassignment. When workers report low levels of influence and autonomy — especially likely for employers competing on this basis — the likelihood of work reassignment soars relative to those employers relying on new technology to compete on quality (0.13 vs 0.05). However, when employers anomalously manage to provide workers a sense of influence and autonomy even while enacting a price competitive business strategy, the probability of work reassignment falls to 0.07 — only slightly higher than it is for employers using technology to compete on quality (0.05). This suggests that under a price competitive business strategy, an employer’s proactive effort to maintain this one aspect of traditional employment reduces the likelihood they will reassign work from conventional employees to agency temps. Technology enables and constrains via its impact on opportunity structures: it does not decide or determine anything on its own.
Technology’s Influence on the Employment Relationship Rather Than on the Work Per Se

A key takeaway from our analysis is the indirect effect that the managerial application of IT has on workers via the corrosion of ILMs, that is, conventional employment relationships. By contrast, labour economists have advanced very useful theories for understanding the direct connection between technological change and labour market outcomes. Autor et al. (2002, 2003), among others, zeroed-in on the capabilities of turn-of-the-century workplace technology, IT, in particular, concluding that it was adept at following rules-based logic, but incapable of tasks requiring visual and motor processing capabilities that could not be reduced to a set of programmable rules. But, aside from how technological change might influence the actual work that people do, how might it facilitate managerial alterations to the arrangements under which people undertake this work?

That few have explicitly examined the ways managements have deployed IT towards the erosion of ILMs or conventional employment strikes us as an important oversight. Yet, scholars of both labour and management have noted that ‘changes in technologies or technoeconomic paradigms’ (Littler 1993: 316) can engender changes in industrial relations systems, the classic example being the advent of industrial unionism — with its narrowly defined job classifications — in response to the exigencies of Taylorism and Fordism (Dubofsky and McCartin 2017; Slichter et al. 1960). More generally, one can argue that employers of the last century developed in ILMs an employment model predicated on the production technologies, communication technologies and coordinating mechanisms they had themselves nurtured or that they at least had at their disposal. Consequently, it follows that a precipitous drop in the cost of computing power, with its knock-on effect of reducing the costs associated with acquiring and transmitting production-related information, would alter the constellation of factors enabling or constraining employers’ key production-related decisions, that is, ‘opportunity structures’ (Heyes and Rainbird 2011; Kacperczyk 2012). In this way, technological change can lead employers to rethink the dominant arrangements under which they relate to their workers in this millennium.

Managerial Opportunity Structures

Aside from revealing this second or indirect path by which IT adoption drives labour market outcomes, our analysis also points to ways that technological change has redistributed the relative power of workers and employers, recasting the opportunity structures, and therefore, the choices employers face in deciding how to manage people. This view stands in stark contrast to putative notions of technology’s seemingly unstoppable, autonomous march forward. Yet, both with and without having introduced new technology, plenty of managers did not reassign work, and quite a few reassigned work from employees to agency temps without shrinking employment. More
Interestingly, managers who laboured to maintain a ‘high road’ employment model even while executing a price-focused business strategy refrained from reassigning work from conventional employees to agency temps. Nonetheless, the largest marginal increases in managers’ likelihood to reassign work arose where technological investment seemingly facilitated their ability to downsize.

Notwithstanding the factors that limited or empowered employers’ decisions around technological adoption and work reassignment, managers also decide how to compete in the product or service market — again, bolstered or constrained by opportunity structures. Labour relations and HR researchers have long claimed that business strategies predicated on product quality or differentiation enable or facilitate a ‘high road’ employment model. On the one hand, our addition of IT adoption into this framework only strengthens this relationship. We found that while managers investing in new or upgraded technology were more likely to reassign work to temps, the implementation of a quality strategy reduced the size of this effect by almost 40 per cent. Thus, when managers seize the opportunity to use technology to enact a quality-focused business strategy, they are less likely to be using the technology to facilitate work reassignment. Even where management does elect to compete on price, those managers insisting on maintaining a high road employment model, embodied by high levels of worker influence and autonomy, were about half as likely to deploy new or upgraded technology towards the goal of work reassignment as were those managing under a traditional, ‘low road’ model.

Limitations and Future Research

We can imagine a number of ways one might strengthen this study, some of which arise in our attempt to undertake a broader, more cross-sectoral analysis than received case-study research would allow. First, readers would be right to question our coarse measure of technological change. After all, ‘new…or upgraded technology, including computers’, could encompass a wide range of automation, machinery, robotics, mechanization and the like. Furthermore, different sectors could tend towards different sorts of technologies and deploy them in different ways. As we noted when we introduced this measure, a deeper analysis of the variable’s distribution as well as its sensible correlations with other technology-related variables in multiple rounds of WERS data collection lend it credence — at least enough for us to rely on it to draw conclusions about economy-wide, average effects. Nonetheless, we concede that technology should be measured with much more specificity whenever possible, and we applaud those qualitative researchers who have done so, thereby giving large-n studies like this one sturdier legs to stand on.

Second, our study relies on cross-sectional analyses, with all of its usual causal and inferential liabilities. As we noted earlier, WERS mitigates many of these issues through its careful design. Nonetheless, managers and workers responded to WERS surveyors in the midst of what had been the greatest
economic slowdown since the Great Depression. This could reasonably raise concerns regarding the unmeasured impact of austerity on employer behaviour and the extent to which these unique forces hinder our ability to generalize from our findings. While it remains possible that employers across-the-board were less willing to establish new, conventional employment relationships during this time, most of this ‘unobserved’ effect should be absorbed at the sectoral level, one of the reasons why we focus our analyses on those estimates that account for industry effects. Moreover, analyses undertaken after the recovery revealed that contrary to marginalist tropes around ‘wage stickiness’, UK employers actually adjusted wages rather than employment (Gregg et al. 2014; Levy 2013).

Finally, this audience, in particular, should be sensitive to the fact that while our analysis treated the presence of unions as a potential confounder to be controlled for, the estimates in Table 3 sent a surprisingly clear and somewhat counterintuitive message. Within a given sector and holding the other variables in place, those workplaces where at least one union is recognized for the purposes of collective bargaining are about 4 percentage points more likely than others to reassign work to temps. It could be that managers use temps to protect those already within the ILM ambit. Therefore, to the extent that unions drive the creation and preservation of ILMs, their presence could help to explain the reassignment of work away from permanent employees. Unfortunately, seminal ILM theory speaks little to this point, in part because its US-centric perspective underweighted the role played by workers and trade unions (Rubery 1978).6 Received analyses examining the employment relationship through both psychological (e.g. Toms and Biggs 2014) and sociological lenses (e.g. Benassi and Dorigatti 2015), however, suggest that unions’ ability to bolster job security for covered workers often comes at the expense of job security for those outside the bargaining unit. Our estimates suggest that this phenomenon plays out, at least in the aggregate, in our data. Likewise, according to Houseman (2001: 155), ‘A unionized company may pay above-market wages, and thereby have an incentive to use temporary agency workers or contract workers who are not its legal employees and are not covered by the terms of the collective agreement’. Suffice it to say that this finding begs for deeper analysis. Some of which researchers could undertake using the same data we use here.

6. Conclusion

Nearly two decades ago, Rubery and Grimshaw (2001: 165) postulated that

New technologies provide a basis for changes in the employment relationship through their effects on organizational forms…. None of these effects are predetermined, and it is the interaction between new technologies and other forces shaping employment which will determine the future of employment and job quality.

© 2020 John Wiley & Sons Ltd.
Our findings respond with statistical evidence that IT, aside from encroaching upon tasks once the exclusive province of human labour, has also contributed to a restructuring of the employment relationship that others have shown to be deleterious to workers. In addition to altering the nature and composition of the jobs workers do, new technologies are allowing but not forcing employers to alter the very foundation of the employment relationship itself. In the language of resource dependence, IT, in effect, makes some employers less reliant on the disciplinary functions of ILMs. With new technologies, employers can maintain the power and control they seek over their workers without having to accept the rigidities attendant to ILMs. Furthermore, to the extent one believes that managers still execute business strategy and make employment decisions, this article shows that IT, while facilitating the externalization trend, does not unilaterally drive it. It directly influences opportunity structures, but not outcomes.

This article sought to establish these points statistically by revealing the positive association between the introduction or upgrading of IT and the reassignment of work once done in-house to those working instead for a temporary staffing agency. In so doing, we intend this study to complement those that instead focus on the composition of tasks bundled into a job, occupation or profession (e.g. Autor et al. 2003; Chui et al. 2016; Frey and Osborne 2017). The work of these scholars is critically important and itself worked to fill a research void (Barley and Kunda 2001; Orlikowski and Barley 2001). However, it also largely assumed the persistence of a system in which an employer — generally, one who has invested in heavy capital as well as in direct production inputs — would then hire, control, supervise, coordinate and to some degree, train the worker. In other words, the employer’s relationship with his or her workers was probably more akin to their relationship with their machines than it was to their relationship with expendable production inputs. Indeed, Weil (2014a) has demonstrated that the structure of the employment relationship and the system in which it was ensconced can no longer be assumed. And, our findings provide the initial statistical evidence that recent technological change has, in fact, actually facilitated the erosion of the conventional, mutually-obligatory, dyadic model of employment.

Final version accepted on 27 November 2020

Acknowledgements

The authors thank Ariel Avgar, David Blatter, Lance Compa, Virginia Doellgast, Tom Kochan and Anne Sieverding for thoughts on an earlier draft. They also acknowledge the UK Department for Business, Innovation and Skills, the Economic and Social Research Council, the UK Commission for Employment and Skills, the Advisory, Conciliation and Arbitration Service (Acas) and the National Institute of Economic and Social Research as the originators of the 2011 Workplace Employment Relations Study data, and the
UK Data Archive at the University of Essex as the distributor of the data. The National Centre for Social Research was commissioned to conduct the survey field work on behalf of the sponsors. None of these organizations bear any responsibility for the authors’ analysis and interpretations of the data.

Notes

1. There are a number of advantages to assessing business strategy using more context-specific strategic types. For example, rely on an organization’s market entry timing mode, for example, ‘first mover’, ‘fast follower’ or ‘fence sitter’. However, these sorts of measures apply only to certain sectors, firms or aspects of firm behaviour. For example, Han et al.’s operationalization applies only to firms pursuing new product development.

2. The WERS is especially well documented. For detailed information, see or visit http://www.wers2011.info/. The website also includes a nearly exhaustive bibliography of empirical research conducted using these data.

3. We ‘stress tested’ this variable in a number of ways to insure that it was measuring the incidence of work reassignment per se as opposed to the mere use of temporary agency workers by the managers of the workplace. We experimented with an alternative, narrower operationalization in which all agency temps — not some or all — were undertaking work once done in-house. Similarly, we re-estimated our models on a simpler measure of whether or not an employer used temporary agency staff at all, irrespective of whether the work being undertaken by temps was formerly undertaken by permanent employees. These analyses are available as a supplement from the authors. All in all, we remain convinced that work reassignment, on the one hand, and the mere use of agency temps at all, on the other, are distinct constructs, both conceptually and operationally.

4. While the items used to construct an analogous measure of worker autonomy from the Survey of Managers do not align perfectly with those we use from the Survey of Employees, we can still construct a version of the worker autonomy index from management data (α = 0.72). Tellingly, when we do, the correlation at the workplace level between the two measures is only weakly positive (ρ ≃ 0.25). In fact, this discrepancy obtains with all sorts of subjective WERS measures in which managerial respondents have good reason to present to surveyors a more positive take on workplace climate than do the actual workers surveyed. Identified this same exact issue using WERS 2004 data when both managers and frontline workers were asked to describe the labour relations climate on a 5-point, Likert-type scale: the manager in charge of labour relations tended to describe the climate at least a bit more favourably than the frontline workers that were actually party to the same climate.

5. Note that for all of the multivariate results displayed in Tables 4 and 5, the linear and quadratic measures of workplace size have been divided by 1,000. This allows their associated coefficient estimates to be detectable at two decimal places.

6. Critiques of the narrowness and functionalism of early writing on ILMs, noting that researchers drew almost exclusively on their observations of US labour markets. As a result, they paid short shrift to other actors relevant to the shaping of ILMs in the UK — namely, workers via labour organizing.
References


IT and the Reassignment of Work  845


© 2020 John Wiley & Sons Ltd.